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Invitations, Incentives, and Conditions

A Randomized Evaluation of Demand-Side Interventions for Health Screenings in Armenia

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Abstract

The study is a randomized controlled trial that investigates the impact of four demand-side interventions on health screening for diabetes and hypertension among Armenian adults ages 35–68 who had not been tested in the last 12 months. The interventions are personal invitations from a physician (intervention group 1), personal invitations with information about peer screening behavior (intervention group 2), a labeled but unconditional cash transfer in the form of a pharmacy voucher (intervention group 3), and a conditional cash transfer in the form of a pharmacy voucher (intervention group 4). Compared with the control group in which only 3.5 percent of participants went for both screenings during the study period, interventions 1 to 3 led to a significant increase in the screening rate of about 15 percentage points among participants. The highest intervention impact was measured among recipients in intervention group 4, whose uptake of screening on both tests increased by 31.2 percentage points. The levels of cost-effectiveness of intervention groups 1, 2, and 4 are similar while for intervention group 3 it is about twice more expensive per additional person screened.

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1. Introduction

More than 15 million people between ages 30 and 69 years die annually around the world from noncommunicable disease (NCD). Up to 85 percent of these premature deaths occur in low- and middle-income countries (LMICs) (World Health Organization (WHO), 2020). This high burden of NCDs and premature mortality has a steep economic cost. A 2011 analysis estimated that NCDs would cost US$23 trillion globally by 2031, due to medical expenditure, productivity losses, disability, and death (Bloom et al. 2011). At the individual level, these exposures result in high blood pressure or hypertension, overweight and obesity, high blood glucose or diabetes mellitus, and hyperlipidemia, which also increase the risk of other NCDs, including stroke and heart disease.

Detecting hypertension and diabetes mellitus is essential to initiating treatment, achieving disease control and delaying the onset of other NCDs, with their attendant health and financial costs. However, a high proportion of people living with hypertension and diabetes mellitus have never been diagnosed, particularly in LMICs. Only half of the 1.4 billion people living with diabetes globally are aware of their diagnosis and 84.3 percent of undiagnosed cases live in LMICs (Saeedi et al. 2019). Furthermore, only 39.2 percent of people living with hypertension in LMICs have ever been diagnosed, contributing to the low proportion (10.3 percent) that achieve control of their blood pressure (Geldsetzer et al. 2019). Screening programs, through physical exams and tests, provide a means of diagnosing hypertension and diabetes even in individuals who are apparently healthy.

Financial incentives have been shown to be effective at increasing preventive health care use (Bright et al. 2017; Massavon et al. 2017). Making these incentives contingent on the desired behavioral change distinguishes conditional cash transfer (CCT) programs from traditional means-tested social protection interventions. Evaluations of CCT have shown that, in addition to increasing consumption, they can be effective at raising education (Fiszbein and Schady 2009), preventive health care use (Lagarde, Haines, Palmer 2007), and actual health outcomes (Gertler 2004; Fernald, Gertler and Neufeld 2008; de Walque, Fernald, Gertler and Hidrobo 2017). Recent studies have evaluated the impact of conditionality. Baird et al. 2011 and Akresh et al. 2016 suggest that CCTs outperform unconditional cash transfers (UCT). In contrast, Benhassine et al. 2015 compare labeled cash transfers to CCTs targeting primary school completion in rural Morocco. They document large gains from the labeled cash transfer program, with minimal added benefits of conditionality. Conditional payments may operate through several mechanisms. By distributing cash, they might remove resource constraints that may hinder the adoption of desirable behaviors by poor households. By subsidizing those desirable behaviors, they might resolve an externality for example when parents do not fully internalize the benefits to their children or to society of education or health care. They might also help overcome issues

of "bounded rationality, bounded willpower, and bounded self-interest" (Sunstein, Jolls and Thaler, 1998).

There is also empirical evidence on the effectiveness of informational interventions on health behavior change (Wakefield, Loken, and Hornik, 2010). Mass media campaigns have been associated with declines in smoking (National Cancer Institute, 2008) and increases in demand for cervical cancer screening (Comino et al., 2012; Shelley et al., 1991). Cohort studies of large-scale communication interventions have also reported increased awareness of healthy behaviors and improvements in diet and physical activity. There are, however, mixed findings on the impact of these interventions on cardiovascular disease risk (Shea and Basch, 1990; Atienza and King, 2002). References to social norms in messaging interventions have also been shown to change individual behaviors, including charitable giving (Frey and Meier, 2004), voting (Gerber and Rogers, 2009), retirement savings (Beshears et al., 2015), water and energy consumption (Allcott 2011; Allcott and Rogers 2014; Ferraro and Price, 2013), and tax compliance (Hallsworth et al., 2017).

In this study, we tested the effectiveness of financial and informational demand-side interventions to promote screening uptake for hypertension and diabetes in Armenia, a middle-income country. The study uses an experiment randomized at the individual level (N=2,000) to evaluate four demand-side interventions, including personal invitations (intervention group 1), personal invitations mentioning that peers have tested (intervention group 2), a personal invitation accompanied by a labeled but unconditional cash-like incentive, in the form of a pharmacy voucher (intervention group 3) and a personal invitation accompanied by a conditional cash-like incentive (intervention group 4).

The personal invitation was common to all four intervention groups, and gave information about the importance of screening, the fact that it was free and details on how and where to go for screening. As designed, the personal invitations may have provided a nudge or external cue to action and increased the individuals' sense of self-efficacy by clarifying how and where to screen. The invitations may also have led to re-evaluation of the perceived costs of screening, susceptibility to hypertension and diabetes, and the benefits of screening. By comparing the personal invitation (intervention group 1) and the personal invitation that mentions peers having been screened (intervention group 2), our experiment tested the impact of descriptive social norms on health prevention. In addition, by comparing the labeled, unconditional cash-like incentive (intervention group 3) and the conditional cash-like incentive (intervention group 4), we estimate the impact of conditionality on screening.

We show that compared to the control group in which only 3.5 percent of participants went for both screenings during the study period of approximately 6 months, intervention groups 1 to 3 led to a significant increase in the screening rate of about 15 percentage points among

participants. The highest intervention impact, however, is measured among recipients of intervention group 4, that is the personal invitation with a conditional cash-like incentive, among whom screening on both tests increased by 31.2 percentage points compared to the control group.

The rest of this paper is outlined as follows. Section 2 describes the Armenian context, the prevalence of hypertension and diabetes, and rationale for reforms to increase screening rates. Section 3 presents the methods including the intervention design and the experimental methods. Section 4 presents the evaluation results as well as a cost-effectiveness analysis. Section 5 discusses those results and concludes.

2. Context

Armenia is a landlocked country in Eurasia bounded by Georgia, Azerbaijan, Turkey and the Islamic Republic of Iran. NCDs now account for 93 percent of deaths in Armenia, including cardiovascular diseases (55.2 percent), cancers (20.2 percent), and diabetes mellitus (1.5 percent). Hypertension and diabetes mellitus are significant contributors to the burden of NCDs (Andreasyan et al. 2019; Institute of Health Metrics and Evaluation (IHME), 2020).

In Armenia, general practitioners and family physicians at the primary health care (PHC) level are responsible for health promotion, screening, treatment, monitoring, and referral to specialist care. PHC is provided in polyclinics in urban areas, ambulatory facilities in rural areas, and outpatient health centers. By law, since 2006, all Armenian citizens can access PHC without cost, as the basic benefits package covers PHC and emergency care for the entire population. However, public funding for PHC does not cover the cost of outpatient medicines or expensive diagnostic care, except for socially vulnerable and other selected groups (Lavado et al., 2018; GoA Decree, 2004). Hence, one in five Armenians reports that financial barriers are the reason for forgoing needed care. In addition to these financial barriers, the perception that PHC is of poor quality and gaps in regulation contribute to foregoing of PHC for specialist and emergency care (Andreasyan et al., 2016).

These gaps in service delivery contribute to challenges in detecting and managing NCDs in Armenia, including hypertension and diabetes. In a nationally representative survey, one out of three people above the age of 15 years has undiagnosed hypertension. In addition, only 43.5 percent of the population above 15 years have had their blood pressure measured by a health provider, screening for hypertension. There were higher rates of screening among women compared to men, and in Yerevan compared to the provinces (Andreasyan et al. 2016). Similarly, only 24 percent of individuals aged 15 years and above had their blood glucose levels measured in the past 12 months, of whom 20 percent had been measured by a physician (Andreasyan et al. 2016).

Since 2010, the government has introduced performance-based incentives that reward providers for better performance, including increasing screening rates for selected conditions, including hypertension and diabetes. In addition, clinical guidelines for these conditions have been developed and medical personnel have been trained to undertake screening tests. Furthermore, a national mass media campaign has educated the population on the benefits of screening. Nevertheless, the rates of early detection of hypertension and diabetes have remained low.

3. Methods

Intervention Design

This study evaluates the impact of demand-side interventions on screenings for hypertension and diabetes in PHC among adults between 35 and 68 years in Armenia who had not been screened in the preceding year.

Our study investigates the impact of four demand-side interventions on hypertension and diabetes screening, including personal invitations from a physician, personal invitations with information about peer screening behavior, a labeled but unconditional cash-like transfer in the form of a pharmacy voucher, and a conditional cash-like in the form of a pharmacy voucher (Table 1). These interventions were informed by feedback from stakeholders during focus group discussions on the barriers and facilitators to screening care use and refined in discussion with senior policy makers in the MOH. We describe these interventions below.

Table 1: Overview of demand-side interventions

Study groups	Description
Intervention group 1	Personal invitation to come to the health clinic for diabetes and hypertension screening.
Intervention group 2	Personal invitation to come to the health clinic for diabetes and hypertension screening with information on screening among peers.
Intervention group 3	Personal invitation to come to the health clinic for diabetes and hypertension screening and pharmacy voucher incentive, not conditioned on being screened.
Intervention group 4	Personal invitation to come to the health clinic for diabetes and hypertension screening and pharmacy voucher incentive conditional on being screened.
Control group	No personal invitation for screening or voucher. Exposure to general mass-media campaign to encourage health screenings that have been ongoing for several years.

Personal invitations (intervention group 1) were delivered in person by the study field workers and consisted of a verbal message and printed letters, signed by a physician, inviting the individual to be screened for diabetes and hypertension (Box 1). These invitations highlighted that the screening visit was important for the individual's health and that the required procedures were free-of-charge and not time consuming. Invitations also provided information on how to

screen, providing a phone number to schedule an appointment, naming the medical facility in the community, and providing an address. Invitations were signed by medical doctors in the designated facilities who were known in the community and recognized as credible sources of medical information. As designed, the personal invitations may have provided a nudge or external cue to action and increased the individuals' sense of self-efficacy by clarifying how and where to screen. The invitations may also have led to re-evaluation of the perceived time and monetary costs of screening, susceptibility to hypertension and diabetes, and the benefits of screening.

Box 1: Personal invitation (Intervention group 1)

Dear [Name, Surname],

We cordially invite you to visit [Name of the medical facility] of [Name of the community] at the following address [Address] to be screened for diabetes and hypertension.

According to official records in your personal medical card, in past 12 months you have not been screened for diabetes and hypertension at a medical facility. In terms of prevention and control of diseases, your visit to the medical facility is extremely important to ensure your personal healthcare.

Please, prior to the visit make a call to your doctor for a proper appointment, using the telephone number presented in the bottom of this invitation.

Note: for a credible measurement of diabetes you must visit the doctor fasting since midnight, which means you should not eat or drink anything except water. The screening is free-of-charge, painless and not time-consuming.

We highly recommend that you visit the medical facility soonest possible and to use the free-of-charge medical services of the primary healthcare facility.

Looking forward to seeing you,

DATE
DOCTOR
SIGNATURE

Personal invitations with peer group information (Intervention group 2) were delivered in person by study field workers and consisted of a verbal message and printed letters, signed by a physician, inviting an individual to be screened for hypertension and diabetes and included information on screening among peers (Box 2). These invitations included all the information in the personal invitations under Intervention group 1. In addition, each intervention included information on the number of men and women in the individual's peer group that had screened in their communities. Peer groups were defined within three age bands: 35-45 years, 46-55 years, and 56-68 years. Learning of the number of peers that had screened may lead to adjustments of perceived susceptibility to hypertension and the benefits of screening. Deviations from this social norm may be perceived as costly, changing assessments of the cost of screening. Akin to

Intervention group 1, the invitation may serve as a cue to act and increase the individual's sense of efficacy by clarifying how and where to screen.

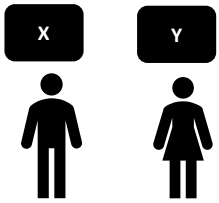
Box 2: Personal invitation with peer group information (Intervention group 2)

Dear [Name, Surname],

We cordially invite you to visit [Name of the medical facility] of [Name of the community] at the following address [Address] to be screened for diabetes and hypertension.

According to official records in your personal medical card, in past 12 months you have not been screened for diabetes and hypertension at a medical facility. In terms of prevention and control of diseases, your visit to the medical facility is extremely important to ensure your personal healthcare.

We would like to inform you that based on official statistics for your community among your peers, X men and Y women have already taken this screening, and what about you?



Please, prior to the visit make a call to your doctor for a proper appointment, using the telephone number presented in the bottom of this invitation.

Note: for a credible measurement of diabetes you must visit the doctor fasting since midnight, which means you should not eat or drink anything except water. The screening is free-of-charge, painless and not time-consuming.

We highly recommend that you visit the medical facility soonest possible and to use the free-of-charge medical services of the primary healthcare facility.

Looking forward to seeing you,

DATE
DOCTOR
SIGNATURE

Personal invitations with a labeled pharmacy voucher (Intervention group 3) were delivered in person by study field workers and consisted of a verbal message and printed letters, signed by a physician, inviting an individual to be screened for hypertension and diabetes and a pharmacy voucher that was offered unconditionally (Box 3). These invitations included all the information in the personal invitations under Intervention group 1. In addition, the intervention offered a pharmacy voucher, valued at AMD 5,000 (~US$10) which could be redeemed once for medicines and other supplies available in selected pharmacy chains, and was not conditioned on being screened. The letter identified the two pharmacy chains where the vouchers could be redeemed, the individual's choice of products, and the monetary value. A unique identification

number and a one-time use of each voucher was added to prevent fraud. Individuals could use the voucher for themselves or transfer it to another person. The offer of the voucher was labeled as an encouragement to screen for hypertension and diabetes. The income effect of the labeled vouchers may have increased the perception of benefits to screening and reduced the financial constraints of the participants. Furthermore, the invitation may have served as a nudge or external cue to act and may have increased the individual's sense of efficacy by clarifying how and where to screen.

Box 3: Personal invitation with a labeled pharmacy voucher (Intervention group 3)

Dear [Name, Surname],

We cordially invite you to visit [Name of the medical facility] of [Name of the community] at the following address [Address] to be screened for diabetes and hypertension.

According to official records in your personal medical card, in past 12 months you have not been screened for diabetes and hypertension at a medical facility. In terms of prevention and control of diseases, your visit to the medical facility is extremely important to ensure your personal healthcare.

To encourage your participation in screening, you will receive a single-usage voucher, which allows you to purchase free-of-charge medication or medical products for an amount equivalent to 5000 AMD. The voucher can be used at the below-mentioned pharmacies:

Natali Pharm Chain	Alfa Pharm Chain
Address	**Address**
Address	**Address**

In case of questions related to the utilization of the voucher, you can call the number mentioned on it. There is a unique ID on the voucher for verification. Again, if you present the voucher at any of above-mentioned pharmacies you can receive for free medicine or medical products that you prefer. The voucher is valid till [Date]. If lost, the voucher cannot be recovered.

We very much hope that the voucher will encourage you to visit our medical facility as soon as possible. Please, prior to the visit make a call to your doctor for a proper appointment, using the telephone number presented in the bottom of this invitation.

Note: for a credible measurement of diabetes you must visit the doctor fasting since midnight, which means you should not eat or drink anything except water. The screening is free-of-charge, painless and not time-consuming.

We highly recommend that you visit the medical facility soonest possible and to use the free-of-charge medical services of the primary healthcare facility.

Looking forward to seeing you,

DATE
DOCTOR
SIGNATURE

Personal invitations with a conditional pharmacy voucher (Intervention group 4) were delivered in person by study field workers and consisted of a verbal message and printed letters, signed by a physician, inviting an individual to screen for hypertension and diabetes and the offer

of a pharmacy voucher, conditioned on screening (Box 4). These invitations included all the information in the personal invitations under Intervention group 1. Verbal instructions clarified that the individual could report screening to a designated research assistant, who, following verification by the hospital facility of screening, would provide a pharmacy voucher, valued at AMD 5,000 (~US$10) which could be redeemed once for medicines and other supplies available in selected pharmacy chains. These instructions also identified the two pharmacy chains where the vouchers could be redeemed, the individual's choice of products, and the monetary value. A unique identification number and a one-time use of each voucher was added to prevent fraud. Individuals could use the voucher for themselves or transfer them to another person. The income effect of the labeled vouchers may have increased the perception of benefits to screening and reduced the financial constraints of the participants. In addition, conditioning receipt of the voucher on screening behavior would introduce a price effect that changed the perceived cost of screening. Furthermore, the invitation may have served as a nudge or external cue to act and may have increased the individual's sense of efficacy by clarifying how and where to screen.

Box 4: Personal invitation with a conditional pharmacy voucher (Intervention group 4)

Dear [Name, Surname],

We cordially invite you to visit [Name of the medical facility] of [Name of the community] at the following address [Address] to be screened for diabetes and hypertension.

According to official records in your personal medical card, in past 12 months you have not been screened for diabetes and hypertension at a medical facility. In terms of prevention and control of diseases, your visit to the medical facility is extremely important to ensure your personal healthcare.

To encourage your participation in the screening, within one week after your visit to the medical facility and being screened for diabetes and hypertension by the medical staff, you will receive a single-use voucher, which allows you to receive free-of-charge medication or medical products for an amount equivalent to 5000 AMD. Any questions related to the utilization of the voucher will be explained to you individually.

We very much hope that the opportunity to receive free-of-charge medicine or medical products will encourage you to visit our medical facility soonest possible. Please, prior to the visit make a call to your doctor for a proper appointment, using the telephone number presented in the bottom of this invitation.

Note: for a credible measurement of diabetes you must visit the doctor fasting since midnight, which means you should not eat or drink anything except water. The screening is free-of-charge, painless and not time-consuming.

We highly recommend that you visit the medical facility soonest possible and to use the free-of-charge medical services of the primary healthcare facility.

Looking forward to seeing you,

DATE
DOCTOR
SIGNATURE

The control group did not receive any intervention under this study, including information and pharmacy vouchers. However, the ongoing mass media campaign funded through the MOH provided information on the prevalence of diabetes and hypertension and encouraged adults to screen for free for hypertension and diabetes in the local primary health care clinic. These campaigns involved broadcasts on public and private television stations, billboards on major roads, posters in health facilities and post offices, and text messages from the MOH.

Experimental Methods

A. ***Study sample and randomization***

The experimental sample drew on the administrative records of the PHC clinics in the public sector Armenia. Health clinic administrative records in Armenia are relatively complete and of high quality, as the e-health system is nationwide in scope and is updated following the patients' visits. The health sector is dominated by public health facilities, particularly outside Yerevan. In addition, 100 percent of the rural population and 85 percent of the urban population is registered for care at the PHC level. Hence, the e-health database is likely to have information on most of the diabetes and hypertension screenings conducted in Armenia, particularly at the PHC level.

After selecting public health facilities in 4 provinces (Ararat, Armavir, Kotayk and Lori) chosen on the basis of their infrastructure and NCD prevalence and local culture affecting behavior and screening rates and which were sufficient to reach the desired sample size of 2,000 individuals, the experimental sample was randomly drawn from the patient records, proportionally to the size of the catchment population of the health facilities. A total of 6,934 individuals were selected from the registered population of the selected PHC facilities. The inclusion criteria of subjects selected from the e-health database were individuals between the age of 35 and 68 years old, and who had not been screened for diabetes or hypertension in the last 12 months. From this sampling list, individuals were randomly assigned to the 5 study arms of the study.

After the randomization, potential study participants were contacted in two phases. The first phase, conducted by phone, was the eligibility verification. The second phase, conducted face-to-face, was the informed consent. These two phases took place between June and September 2019 for the 4 intervention groups and between January 10 and February 20, 2020, for the control group.

For the eligibility verification, the fieldworkers contacted by phone all 6,934 individuals to verify whether they could be reached, were available and eligible for the study. The results of the verification indicated that: 1,966 (28.4 percent) were out of reach, had the wrong contact information or could not be located, 1,893 (27.3 percent) were temporarily out of their residence, 386 (5.6 percent) had already been screened at one of the selected PHC facilities during the

previous 12 months, 255 (3.7 percent) had been screened at a non-selected PHC facility during the previous 12 months, 251 (3.6 percent) explicitly refuse to talk, 77 (1.1 percent) were planning to move temporarily in the next 6 months, 77 (1.1 percent) were planning on leaving their community in the upcoming 6 months, 39 (0.6 percent) were members of the same household, 18 (0.3 percent) had died, 1 individual did not meet the age group criteria for inclusion in the study, and there was 1 case of duplicated identification.

Table 2 further details how the eligibility verification outcomes were distributed across the 5 study groups. Table 2 reveals some differences in the eligibility verification results between the 4 intervention groups and the control group.[1] More people were temporarily out of the country in the control group (33.2 percent) than in the intervention groups (23.6 percent, 26.4 percent, 23.4 percent and 27.8 percent for respective intervention groups 1-4). This is likely driven by a difference in the timing of the eligibility verification in the control versus intervention groups. For the control group, eligibility verification was carried out in the 2019-2020 winter, when traditionally more people migrate for jobs out of the country, while for the intervention groups it was completed in the summer of 2019 when the agricultural season is active and there are more income possibilities inside the communities, and less migration.

As a result, a total of 2,047 individuals that had been randomly assigned to the different treatment arms were eligible to participate in the study. To assess the willingness of those 2,047 individuals to participate in the study, the fieldworkers contacted the 2,042 individuals for a face-to-face visit, until the target sample size of 400 individuals per study group was reached. Of these 2,042 individuals, 31 (1.5 percent) of the contacted participants refused to participate, 3 (0.1 percent) were temporarily out of the community and 8 (0.4 percent) were out of reach or could not be found. The participation rate across the four provinces was 97.9 percent for a total sample size of 2,000 participants, with 400 individuals in each of the study arms, including the control group. Table 3 further details how the response rate outcomes were distributed across the 5 study groups.[2] According to ex-ante power calculations presented in the research proposal, our sample size of 2,000 individuals would allow us to detect a 20 percent increase in the screening rate with a power of 0.8 for diabetes screening and a power of 0.9 for hypertension screening. The flow of study participants is further illustrated in Figure 1.

[1] We ran a test comparing the sample verification results across study groups: an F-test of equality of the proportions of individuals for which eligibility was confirmed ("OK") did not reject equality (p-value = 0.5) across groups 1-4, but rejected it when we added the control group (p-value <0.01 across all 5 groups).

[2] We ran a test comparing the response rate results across study groups: an F-test of equality of the proportions of individuals who granted consent did not reject equality (p-value = 0.478) across groups 1-4, but rejected it when we added the control group (p-value <0.01 across all 5 groups).

Table 2: Sample verification results by study groups

Sample Verification Code	Group One (%)	N	Group Two (%)	N	Group 3 (%)	N	Group four (%)	N	Control Group	N	Total
Ok	31.2%	410	31.50%	415	33.40%	411	30.80%	410	23.00%	401	2047(29.50%)
Temporarily out of the community/non-resident	23.6%	310	26.40%	348	23.40%	288	27.80%	370	33.20%	577	1893(27.30%)
Will temporarily leave the community during upcoming 6 months	1.10%	14	2.80%	37	1.00%	12	0.90%	12	0.10%	2	77(1.10%)
Member of the same HH	1.10%	15	0.40%	5	0.50%	6	1.00%	13	0.00%	0	39(0.60%)
Refused to talk	3.30%	44	3.90%	51	2.60%	32	4.50%	60	3.70%	64	251(3.60%)
Out of reach/wrong contact info/not located	30.70%	0	24.70%	325	29.80%	367	28.00%	373	28.60%	498	1966(28.40%)
Duplicate case/same ID, contacts	0.00%	0	0.00%	0	0.00%	0	0.10%	1	0.00%	0	1(0.00%)
Screened at selected PHC center during last 12 months	5.90%	78	4.50%	59	6.40%	79	4.20%	56	6.60%	114	386(5.60%)
Screened at another PHC center during last 12 months	2.40%	32	5.50%	73	2.60%	32	2.60%	35	4.80%	83	255(3.70%)
Died	0.60%	8	0.40%	5	0.20%	3	0.10%	1	0.10%	1	18(0.30%)
Wrong age group	0.00%	0	0.00%	0	0.00%	0	0.10%	1	0.00%	0	1(0.00%)
Total	**100.00%**	**1314**	**100.00%**	**1318**	**100.00%**	**1332**	**100.00%**	**1332**	**100.00%**	**1740**	**6934(100%)**

Table 3: Response rates by study groups

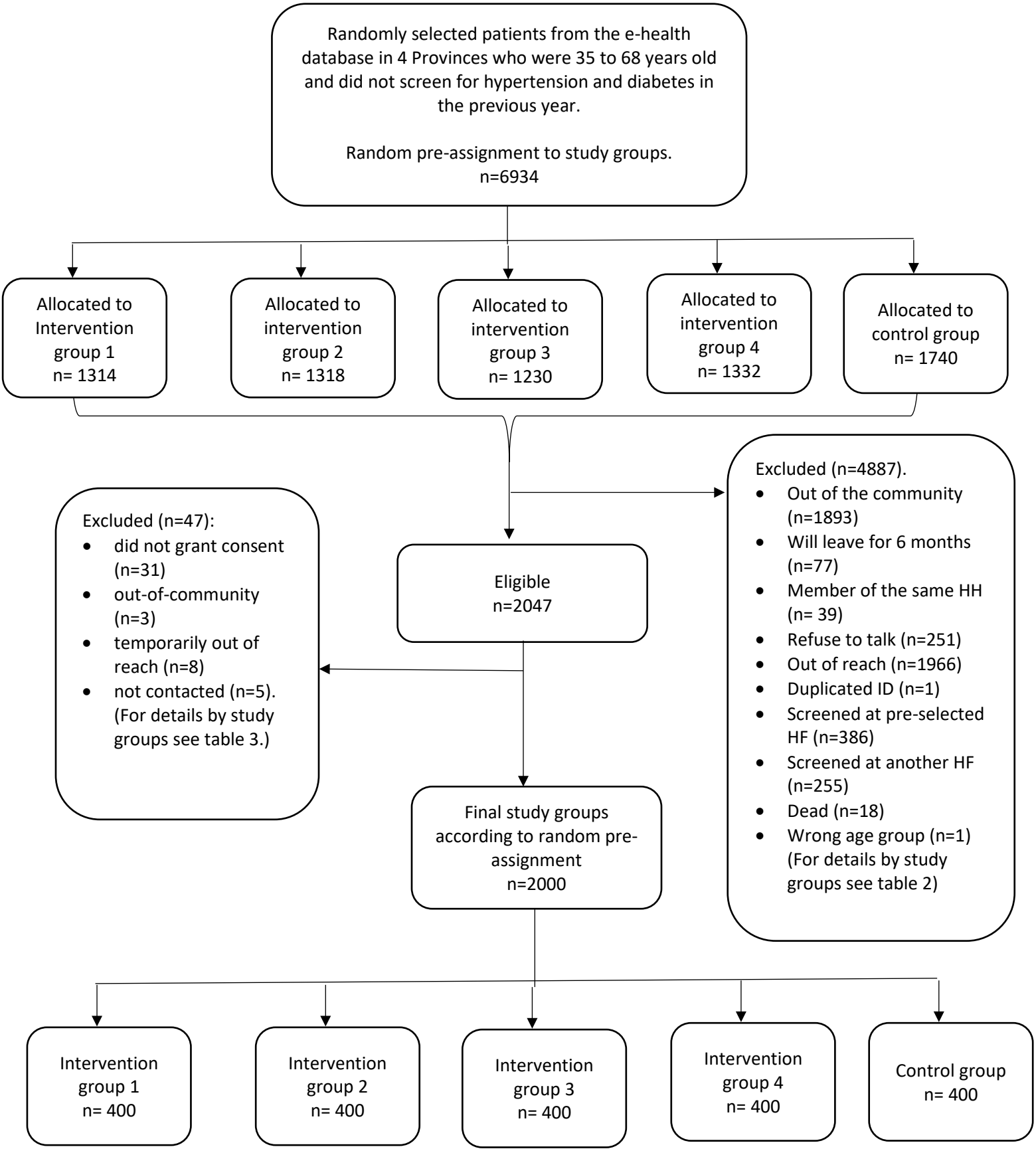
Study Group	Consent granted (%)	N	Refused to participate (%)	N	Temporarily out of the community (%)	N	Out of reach/not found (%)	N	Total
Group One	97.8%	400	1.00%	4	0.5%	2	0.07	3	409(100%)
Group Two	96.4%	400	3.4%	14	0.0%	0	0.02	1	415(100%)
Group Three	97.8%	400	1.2%	5	0.0%	0	0.01	4	409(100%)
Group Four	97.8%	400	2.0%	8	2.0%	1	0	0	409(100%)
Control Group	100.0%	400	0.0%	0	0.0%	0	0	0	400(100%)
Total	97.9%	2000	1.5%	31	0.1%	3	0.4%	8	2042(100%)

B. **Data collection**

Facility administrative records from the e-health database collected at the end of the study period serve as the primary data source on whether the study participants came for hypertension and diabetes screening. In addition, a baseline survey for the impact evaluation was administered face-to-face to study participants during the visits by the study fieldworkers. Its main objective was to collect socio-demographic variables not available in the e-health database to assess the balance across study groups at baseline and to serve as control variables in the estimation models. For intervention groups 1-4, the baseline survey took place between July 22, 2019, and September 2, 2019. It consisted of administering a short socio-demographic survey to the sample of 1,600 study participants. Fieldworkers administrated the baseline survey in the same visit that they distributed screening invitations (and vouchers for group 3).

To avoid contamination of the control group (n=400) from asking specific questions about diabetes and hypertension screening, the baseline survey was not administered to the control group between July and September 2019 but instead was administered in January 2020, at the end of the intervention period. This short time difference in administering a survey consisting of questions linked to fairly stable socio-demographic variables was deemed preferable to the risk of changing the behavior of the control group by asking them health specific questions and in particular, asking them why they had not screened in the last 12 months.

Figure 1: Participants flow diagram



C. **Estimation**

We ran ordinary-least squares (OLS) regressions estimating the impact of the interventions on four main outcome variables: 1) taking both hypertension and diabetes screening, 2) taking diabetes screening, 3) taking hypertension screening, and 4) taking at least one of the two screenings. As robustness checks, we further specified four regressions including an increasing number of control variables: only controls for facility and provincial fixed effects, further controls for the level of health facility, additional controls for age and gender of study participants and a final set of controls for a broader set of socio-economic variables collected during the baseline survey.

Implementation Fidelity

This study protocol was approved by the Institutional Review Board of the Center of Medical Genetics and Primary Health Care in Armenia (#02570094). A process evaluation was conducted, as part of the qualitative research, to ascertain that the intervention did not deviate from its predefined design. The study was implemented consistent with the approved protocol. All the invitations were delivered to the 1,600 study participants in the intervention groups. In addition, 100 percent of the study participants who were in intervention group 3 were offered the pharmacy vouchers with the invitation letters, and 100 percent of the study participants who received Intervention 4 that reported attending screenings received pharmacy vouchers. There were no reported challenges in redeeming the vouchers in the preidentified pharmacies.

4. Results

A. Baseline characteristics and balance

Table 4 presents the means and standard deviations for a range of baseline characteristics for the sample mean, 4 intervention groups and the control group. Appendix Table 1 reports the p-values of t-tests of whether the differences observed in the five groups are statistically significant at conventional levels indicated by the stars next to the p-value.

The mean age of our sample is 51 years old. Only 1 percent of the study participants do not have any education. More than 50 percent of our sample is unemployed, and most are married (86 percent). The average household size is 5 people. Our subjective measures on income revealed that 50 percent of participants responded that their income is sufficient for basic family needs, such as food, clothing, and utilities, but not enough for big purchases, such as equipment or a car, while 35 percent responded that their income is sufficient for everyday food but not for clothes and other basic needs. The majority of individuals are mapped to large-sized primary health care facilities (74 percent).

The balance tests for our set of variables indicate that the distribution of widowed, self-employed, and those who responded to our subjective welfare measures questions are not always similar across the different treatment arms and the control group. However, we find no statistically significant differences across

groups for all other variables at baseline. We control for those baseline characteristics in some of our regression specifications.

Table 4: Baseline characteristics by study groups

Variables	Sample Means	Intervention group 1	Intervention group 2	Intervention group 3	Intervention group 4	Control group
Male	0.5(0.5)	0.50(0.5)	0.50(0.50)	0.51(0.5)	0.50(0.5)	0.50(0.5)
Age	51(9.6)	51(9.6)	51(9.8)	50(9.5)	51(9.8)	51(9.3)
No Education	0.01(0.08)	0.013(0.1)	0.01(0.1)	0.00(0.1)	0.010(0.1)	0. (0)
Primary Education	0.57(0.5)	0.58(0.5)	0.53((0.5)	0.59(0.5)	0.58(0.5)	0.59(0.5)
Technical Education	0.27(0.4)	0.28(0.4)	0.30(0.5)	0.23(0.4)	0.3(0.4)	0.27(0.4)
Higher Education	0.16(0.4)	0.13(0.3)	0.17(0.4)	0.18(0.4)	0.15(0.4)	0.15(0.4)
Married	0.86(0.3)	0.83(0.4)	0.85(0.4)	0.86(0.3)	0.86(0.3)	0.88(0.3)
Divorced	0.03(0.2)	0.028(0.2)	0.030(0.2)	0.035(0.2)	0.030(0.2)	0.025(0.2)
Widowed	0.034(0.2)	0.065(0.2)	0.028(0.2)	0.035(0.2)	0.018(0.1)	0.025(0.3)
Single	0.079(0.3)	0.075(0.3)	0.093(0.3)	0.068(0.3)	0.093(0.3)	0.068(0.25)
Household Size	4.6(3)	4.6(2.0)	4.7(5.1)	4.6(1.8)	4.6(2.0)	4.6(2.1)
State Employee	0.16(0.4)	0.16(0.4)	0.17(0.4)	0.16(0.4)	0.14(0.3)	0.19 (0.4)
Private Sector Employee	0.2(0.4)	0.20(0.4)	0.18(0.4)	0.24(0.4)	0.20(0.4)	0.21(0.4)
Self-Employed	0.086(0.3)	0.09(0.3)	0.10(0.3)	0.095(0.3)	0.10(0.3)	0.043(0.2)
Unemployed	0.55(0.5)	0.55(0.5)	0.56(0.5)	0.51(0.5)	0.57(0.5)	0.57(0.5)
Our income is not sufficient for everyday food	0.056(2)	0.10(0.3)	0.083(0.3)	0.035(0.2)	0.050(0.2)	0.015(0.12)
Our income is sufficient for everyday food but not for clothes and other basic needs	0.35(0.5)	38(0.5)	0.32(0.5)	0.27(0.4)	0.38(0.5)	0.41(0.5)
Our income is sufficient for family basic needs, such as food, clothing, utilities, but not enough for big purchases, such as equipment or a car	0.50(0.5)	0.43(0.5)	0.49(0.5)	0.55(0.5)	0.48(0.5)	0.55(0.5)
Our income is sufficient to meet all family needs, make big purchases, but not enough for savings	0.078(0.3)	0.073(0.3)	0.07(0.3)	0.13(0.34)	0.090(0.3)	0.025(0.2)
Our income is sufficient to meet all family needs, make any kind of purchases and have some savings	0.014(0.1)	0.20(0.1)	0.03(0.2)	0.015(0.1)	0.005(0.1)	0.0025(0.1)
Small PHC (pop. <920)	0.10(0.3)	0.10(0.3)	0.10(0.3)	0.10(0.3)	0.10(0.3)	0.10(0.3)
Medium PHC (920>pop <1700)	0.16(0.4)	0.19(0.4)	0.19(0.4)	0.19(0.4)	0.19(0.4)	0.16(0.2)
Large PHC (pop. >1700)	0.74(0.4)	0.71(0.5)	0.71(0.5)	0.71(0.5)	0.71(0.5)	0.74(.4)
Urban PHC	0.51(0.5)	0.51(0.5)	0.51(0.5)	0.51(0.5)	0.51(0.5)	0.51(0.5)

Sample means with standard deviations in parentheses.

B. Main results and sensitivity analysis

Table 5 reports the screening status of study participants in the 5 study groups in the e-health database. From a baseline of no screening for all participants, 3.5 percent of participants in the control group went for both hypertension and diabetes screening during the study period (July

2019 to January 2020). In comparison, 18.5 percent, 18 percent and 17.7 percent of participants in intervention group 1 (personal invitation), in intervention group 2 (personal invitation with peer group information) and in intervention group 3 (personal invitation with a labeled pharmacy voucher) respectively received both screenings. Finally, 34.3 percent of participants in intervention group 4 (personal invitation with a conditional pharmacy voucher) obtained both screenings.

Table 5: Screening status by study groups

Screening Status	**Intervention group one**		**Intervention group two**		**Intervention group 3**		**Intervention group 4**		**Control Group**	
	Mean	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**
No Screening	74.8%	299	74.5%	298	74.3%	297	57.8%	231	91.2%	365
Diabetes only	1.3%	5	1.8%	7	2.5%	10	1.8%	7	0.7%	3
Hypertension only	5.5%	22	5.8%	23	5.5%	22	6.3%	25	4.5%	18
Both Hypertension and Diabetes	18.5%	74	18%	72	17.7%	71	34.3%	137	3.5%	14
Observations	400		400		400		400		400	

Table 6 reports the estimates of the study's impacts on the uptake of taking both screening tests using OLS regressions. The interventions had a statistically significant impact on the uptake of screening in all intervention groups. Column 1 only controls for facility and provincial fixed effects, column 2 further controls for the level of health facility, column 3 adds controls for age and gender of study participants, and column 4 controls for a broader of socio-economic variables collected during the endline survey. The results are similar across all four specifications and we therefore focus on the specification with the full set of controls. In Column 4, compared to the control group, intervention groups 1 to 3 led to an increase in the screening rate of about 15 percentage points (pp). The highest intervention impact, however, is measured among participants of intervention group 4 (personal invitation with a conditional pharmacy voucher). For them, the uptake of screening on both tests increased by 31.2 pp. Additionally, we conducted a test of equal treatment effects between the different intervention groups. In Column 4, the reported p-values at the bottom of the table indicate that the difference in effect sizes between intervention groups 1 to 3 was not significant, while the effect size in intervention group 4 was significantly different than in the other 3 intervention groups.[3]

In Table 7, we used the OLS specification with the full set of controls to estimate the study's impacts on the three other outcome variables: 1) taking the diabetes screening, 2) taking the hypertension screening, and 4) taking at least one of the two screenings. The results are quantitatively all similar for all outcomes. Therefore, in the remainder of the analysis, we focus on describing the program's effect on taking both tests.

[3] We ran the same analysis using logistic regressions: the marginal effects show very similar results to the coefficients (results available on request).

Table 6: Effects on taking both screening tests

	(1) Both tests	(2) Both tests	(3) Both tests	(4) Both tests
Intervention Group One	.15***	.15***	.15***	.156***
	(.022)	(.022)	(.022)	(.022)
Intervention Group Two	.145***	.145***	.145***	.157***
	(.021)	(.021)	(.021)	(.022)
Intervention Group Three	.143***	.143***	.143***	.15***
	(.021)	(.021)	(.021)	(.022)
Intervention Group Four	.308***	.308***	.307***	.312***
	(.025)	(.025)	(.025)	(.026)
Small Facility		.062	.062	-.162*
		(.064)	(.064)	(.097)
Medium Facility		.062	.063	.039
		(.102)	(.102)	(.089)
Age			0	0
			(.001)	(.001)
Male			-.035**	-.032*
			(.017)	(.017)
Urban				-.213*
				(.114)
No education				.096
				(.128)
Technical Vocation, College				-.04**
				(.02)
Higher Education				-.028
				(.025)
Single				-.063**
				(.028)
Divorced				-.005
				(.053)
Widowed				.016
				(.052)
State Employee				.004
				(.025)
Private Sector Employee				-.023
				(.022)
Self Employed				-.036
				(.031)
Income not sufficient for food				-.055
				(.036)
Income sufficient but not for clothes				.04**
				(.02)
Income sufficient but not for savings				.017
				(.034)
Income sufficient for everything				-.04
				(.061)
Y Mean Control	.035	-	-	-
SE Control	(.009)	-	-	-
Observations	2000	2000	2000	1997
R-squared	.076	.076	.078	.088
p ig1=ig2	0.855	0.855	0.862	0.955
p ig1=ig3	0.783	0.783	0.805	0.822
p ig1=ig4	0.000	0.000	0.000	0.000
p ig2=ig3	0.926	0.926	0.941	0.775
p ig2=ig4	0.000	0.000	0.000	0.000
p ig3=ig4	0.000	0.000	0.000	0.000

Standard errors are in parentheses; Facility and Province effects on all models (not shown) and robust standard errors
*** *p<.01,* ** *p<.05,* * *p<.1*

Table 7: Effects on taking diabetes, hypertension, and at least one screening test

	(1) Diabetes test	(2) Hypertension test	(3) At least one test
Intervention Group One	.163***	.167***	.174***
	(.023)	(.026)	(.027)
Intervention Group Two	.169***	.17***	.182***
	(.023)	(.026)	(.026)
Intervention Group Three	.17***	.162***	.182***
	(.023)	(.025)	(.026)
Intervention Group Four	.324***	.331***	.343***
	(.026)	(.028)	(.029)
Small Facility	-.137	.001	.026
	(.099)	(.116)	(.117)
Medium Facility	.072	.086	.119
	(.092)	(.098)	(.099)
Age	0	.001	.001
	(.001)	(.001)	(.001)
Male	-.04**	-.07***	-.078***
	(.018)	(.019)	(.019)
Urban	-.166	-.056	-.009
	(.116)	(.132)	(.133)
No education	.081	.066	.051
	(.126)	(.134)	(.132)
Technical Vocation, College	-.045**	-.025	-.03
	(.02)	(.022)	(.023)
Higher Education	-.03	-.031	-.033
	(.026)	(.028)	(.028)
Single	-.065**	-.062*	-.063*
	(.029)	(.032)	(.033)
Divorced	-.021	-.036	-.052
	(.053)	(.056)	(.056)
Widowed	.015	0	-.002
	(.053)	(.058)	(.058)
State Employee	.019	.013	.028
	(.026)	(.028)	(.028)
Private Sector Employee	-.032	-.027	-.037
	(.023)	(.024)	(.024)
Self Employed	-.042	-.049	-.055*
	(.031)	(.033)	(.033)
Income not sufficient for food	-.055	-.044	-.044
	(.038)	(.043)	(.044)
Income sufficient but not for clothes	.038*	.027	.024
	(.02)	(.021)	(.022)
Income sufficient but not for savings	.004	.008	-.005
	(.034)	(.037)	(.038)
Income sufficient for everything	-.06	-.076	-.096
	(.063)	(.064)	(.066)
Y Control Mean	.043	.08	.061
SE Control	(.10)	(.14)	(.144)
Observations	1997	1997	1997
R-squared	.089	.086	.089
p ig1=ig2	0.824	0.911	0.791
p ig1=ig3	0.804	0.868	0.791
p ig1=ig4	0.000	0.000	0.000
p ig2=ig3	0.979	0.779	0.998
p ig2=ig4	0.000	0.000	0.000
p ig3=ig4	0.000	0.000	0.000

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
Facility and Province effects on all models (not shown) and robust standard errors

We also conducted a heterogeneity analysis to assess whether treatment effects varied by gender, by age groups (35 to 45 years old, 46 to 55 years old, and 56 to 68 years old), levels of education, marital status, and subjective perceptions of income. We ran interaction effects models to test for statistically significant differences. Our analysis indicates no statistical evidence that the treatment effects vary by gender, age group, and marital status (results available by request).

From our interaction analysis, there is some evidence that the financial incentives were less effective for more educated or higher income participants. In Appendix Table 2, the effect size within intervention group 3 among those who have a technical or college degree and those who have higher education is statistically significantly smaller compared to participants who have no education or have primary or secondary education, suggesting that more educated participants were less responsive to the unconditional voucher incentive. Similarly, the interaction results in Appendix Table 3 suggest that higher-income participants were less responsive to the conditional voucher incentive by 14 pp. Given that the amount of the vouchers was fixed, it is not surprising that they would relatively less attractive for more educated or richer individuals.

C. Cost-effectiveness analysis

We determine the cost-effectiveness of interventions in this study by comparing the cost per capita with the effect size for each intervention to inform the policy decision-making process. Our cost inputs only included costs directly related to the intervention and did not include research costs (Table 8). These included the costs of printing of the invitation letters to participants, the consent form, the infographics cards, the voucher publication, and a list of pharmacies of where to redeem the vouchers. We also added the cost of transportation for delivering the study and vouchers, per diem stipends to field workers, communication, and remuneration costs used to deliver materials and track participants.

Generally, the costs incurred for intervention group 4 are the highest because field workers needed to verify which participants in intervention group 4 (personal invitations with conditional pharmacy vouchers) had satisfied the screening condition and would then receive a voucher. This necessitated more visits and communication with participants. However, as shown in Table 8, the cost of printing of study documents and the voucher issuance was higher for intervention group 3. This is because all 400 participants in this group received the unconditional voucher regardless of their screening status, whereas in intervention group 4, only participants who took a test received the vouchers. In intervention group 2, the printing of study documents is slightly higher than that of intervention group 1 because of the added cost of printing the infographics.

In addition to the costs described, we included the cost of vouchers for doctors and operators. These vouchers were given as an incentive to doctors and operators from participating PHC to help with the extraction of data from the e-health system and track study participants for their screening status. In total, 60 vouchers were delivered to doctors and operators. The cost of this incentive was 350,000 Armenian dram (AMD). We assumed that half of this cost is research-related and, as such, should not be included in the cost-effective calculations.[4] Next, we distribute half of this cost (i.e. one 1/4th of the total cost of the doctor's vouchers) equally across the four intervention groups to account for the fact that the doctors had to help obtain information about each participant and verify their eligibility in the e-health system for all groups. The remaining costs (one 1/4th of the total) is assigned to intervention group 4 since the intervention in this group required tracking the screening status of participants in the e-health system to decide whether they could receive the conditional vouchers.

To estimate the average cost-effectiveness ratio of each intervention, we divide the average cost per person of each intervention by the effect size of each group compared to the control group in the regression with taking up both hypertension and diabetes screenings as the dependent variable (table 6). In Table 9, for each group, we present both dollars per additional person screened for both tests and the inverse ratio, i.e. additional person screened per dollar.

Table 8: Costs by intervention groups in AMD

Cost-Inputs	**Intervention Group 1**	**Intervention Group 2**	**Intervention Group3**	**Intervention Group 4**
Printing of Study Documents/packed envelopes	62,000	66,000	82,000	74,000
Voucher printing and 5000 AMD cash transfer	0	0	1,710,000	83,0000
Transportation	192,000	192,000	192,000	397,000
Per Diem	153,000	153,000	153,000	206,000
Communication	40,000	40,000	40,000	88,000
Remuneration to delivery agents	1,440,000	1,440,000	1,440,000	2,000,000
Doctors and operators' voucher	21,876	21,876	21,876	109,375
Total Cost in AMD	1,908,876	1,912,876	3,638,876	3,704,375
Total Cost in AMD /Person	4,772	4,782	9,097	9,261

All costs are in Armenian dram (AMD). The exchange rate used is 1 US$= 476.88 AMD

[4] We also calculated cost-effectiveness estimates where we assign all doctors' vouchers cost to the intervention. Results are similar and available on request.

Table 9: Cost-effectiveness (CE) Results when doctor's vouchers are assumed to be 50 percent intervention related

CE Ratio	Dollar/person screened	Person screened/dollar
Intervention Group 1	64.15	0.016
Intervention Group 2	63.87	0.016
Intervention Group 3	127.18	0.008
Intervention Group 4	62.24	0.016

The cost-effectiveness of intervention groups 1, 2 and 4 is very similar (between $62.2 and $64.2 per additional person screened for both tests), while for intervention group 3 it is about twice more expensive per additional person screened ($127.2). These findings are driven by the following facts: a) intervention groups 1 and 2, limited to a personal invitation, are about half as expensive per person than interventions 3 and 4 which include a pharmacy voucher of 5,000 AMD (about US$10), and b) intervention groups 1 to 3 have the same impact, increasing screening rates by about 15 pp, while intervention group 4 is about twice as effective (31.2 pp increase in screening rates).

5. Discussion

This study addresses a challenge common to many LMICs faced with a rising burden of NCDs and low levels of diagnosis of hypertension and diabetes. In Armenia, despite efforts on the supply-side (improving facility equipment and supplies, and financial incentives to providers) and on the demand-side (communication campaign including mass-media outreach), screening rates for diabetes and hypertension are still lagging. This study hypothesizes that simple financial and non-financial personalized incentives on the demand-side can lead to an increase in screening rates.

We used an experiment randomized at the individual level to evaluate four different types of demand-side incentives to increase the take-up of screenings for hypertension and diabetes among individuals ages 35-68 in Armenia. The experiment compares different incentives for patients to come for screenings, including personal invitations (intervention group 1), personal invitations mentioning that peers have been tested (intervention group 2), a personal invitation accompanied by a labeled but unconditional pharmacy voucher (intervention group 3) and a personal invitation accompanied by a conditional pharmacy voucher (intervention group 4).

The results show that compared to the control group in which only 3.5 percent of participants went for both screenings during the study period, intervention groups 1 to 3 led to a significant increase in the screening rate of about 15 pp among participants. The highest intervention

impact, however, was measured among recipients of intervention group 4, the personal invitation accompanied by a conditional pharmacy voucher. For them, the uptake of screening on both tests increased by 31.2 pp, which is significantly higher than in the three other intervention groups.

Our findings suggest that financial incentives and personalized invitations can significantly and substantially increase health screenings in an environment where such behaviors are low and resistant to usual mass communication campaigns and interventions to improve service delivery readiness. These findings are consistent with studies in other contexts. Personalized invitations have been used as a tool to increase attendance for predominantly preventive health care visits, including screening for cancer, HIV, and other diseases that benefit from early detection (Camilloni et al. 2013). Various messaging content and delivery methods have also been explored to further encourage screening attendance, from including provider signatures (Camilloni et al. 2013) in letters to sending SMS text follow-ups (Sallis et al. 2019).

The personal invitations delivered in intervention groups 1 and 2 were simple but cost-effective. They may have provided a nudge or external cue to action and increased the individuals' sense of self-efficacy by clarifying how and where to screen. The invitations may also have led to re-evaluation of the perceived costs of screening, susceptibility to hypertension and diabetes, and the benefits of screening (Gong et al. 2020). The similar impacts observed in intervention groups 1 and 2 suggest that the addition of information on screening among peers did not make a difference in this context. This is in contrast with recent literature in behavioral economics suggesting that descriptive social norms can influence individual behaviors in charitable giving (Frey and Meier 2004), voting (Gerber and Rogers 2009), and energy use (Allcott 2011).

Financial incentives in the form of cash transfers (specifically pharmacy vouchers) are also explored in this study. CCT programs provide payments to families or individuals in compliance with certain conditions, such as school attendance or child vaccinations (Wiysonge 2017). While research demonstrates efficacy, CCT programs may be costly to administer in part because of the need to verify compliance with the condition. In a labeled cash transfer program (LCT), cash transfers or vouchers contain information encouraging the desired behavior but are not conditional on compliance. Research in the context of primary school completion has suggested that LCTs may be similarly effective without the added monitoring cost of CCTs (Benhassine 2015). Our results however indicate that in this context CCTs are more effective and cost-effective than unconditional labeled cash transfers to incentivize health screenings among adults.

In addition to the usual concerns about external validity, our study has other limitations. Our sample was limited to individuals who had not screened in the last 12 months and might, therefore, not be representative of the overall population. Further, our interventions were not run by the government but by a well-organized and motivated organization. Beyond this pilot, scaling-up such incentives by the government might not necessarily yield the same results.

Similarly, from the perspective of extending the financial incentives (intervention groups 3 and 4) to a larger scale, some people might argue with the fairness of such incentives. They would say that paying people to take up screenings is unfair to individuals who are already regularly screening: why would people who have never screened be paid an incentive for testing, when someone who regularly screens never received anything? If, for fairness reasons, the financial incentives have to be extended to a larger segment of the population, they might be less cost-effective.

In the personal invitation containing statistics about screening among peers, we have used absolute numbers instead of percentages because those percentages were relatively low, and we were not sure whether communicating low rates of screenings would be perceived as encouraging. This feature of intervention group 2 is different from most behavioral economics interventions that convey social norms using percentages. This might have contributed to the absence of differences between intervention groups 1 and 2. This might be an interesting question to explore in further research.

While our study results contribute to the debate on the cost-effectiveness of conditional and unconditional financial incentives, they also shed interesting light on the contrast between financial and non-financial incentives (de Walque and Valente 2018). While the conditional voucher intervention in intervention group 4 is clearly the most effective intervention, our cost-effectiveness analysis indicates that intervention groups 1 and 2 are equally cost-effective even though they lead to a smaller increase in screenings.

Finally, our study uses an existing e-health database to identify eligible study participants, measure the main study outcomes, and verify compliance for the conditional intervention. This considerably reduced the intervention and data collection costs. As such databases become more common across the world, they could be used more often for such purposes, provided that, like in this study, patient privacy and confidentiality are guaranteed.

References

Akresh, Richard, Damien de Walque, and Harounan Kazianga. 2016. “Evidence from a randomized evaluation of the household welfare impacts of conditional and unconditional cash transfers given to mothers or fathers” World Bank Policy Research Working Paper 7730.

Allcott, Hunt. 2011. "Social Norms and Energy Conservation." *Journal of Public Economics* 95: 1082-1095.

Allcott, Hunt and Todd Rogers. 2014. "The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation." *American Economic Review*: 104(10): 3003-3037.

Andreasyan, D., Bazarchyan, A., Manukyan, S., Muradyan, G., Torosyan, A., Chamanyan, A., Bidzyan, L., Zelveyan, P. (2016). Armenia Health System Performance Assessment. NIH/MOH

Atienza AA, King AC. Community-based health intervention trials: an overview of methodological issues. Epidemiol Rev. 2002;24:72–79. [PubMed] [Google Scholar]

Baird, Sarah, Craig McIntosh, and Berk Özler. 2011. “Cash or Condition? Evidence from a Cash Transfer Experiment.” *Quarterly Journal of Economics*, 126(4): 1709-1753.

Benhassine, Najy, Florencia Devoto, Esther Duflo, Pascaline Dupas, and Victor Pouliquen. 2015. “Turning a Shove into a Nudge: A “Labeled Cash Transfer” for Education.” *American Economic Journal: Economic Policy*, 7(3): 86-125.

Beshears J, Choi JJ, Laibson D, Madrian BC, Milkman KL. 2015. The Effect of Providing Peer Information on Retirement Savings Decisions. *J Finance*. 2015;70(3):1161-120. doi:10.1111/jofi.12258

Bloom, D.E., Cafiero, E.T., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L.R., Fathima, S., Feigl, A.B., Gaziano, T., Mowafi, M., Pandya, A., Prettner, K., Rosenberg, L., Seligman, B., Stein, A.Z., & Weinstein, C. (2011). The Global Economic Burden of Noncommunicable Diseases. Geneva: World Economic Forum.

Bright, T., Felix, L., Kuper, H., Poack, S. (2017). A systematic review of strategies to increase access to health services among children in low- and middle-income countries. *BMC Health Services Research*: 17:252. DOI 10.1186/s12913-017-2180-9

Camilloni, L., Ferroni, E., Cendales, B.J. et al. Methods to increase participation in organised screening programs: a systematic review. *BMC Public Health* 13, 464 (2013). https://doi.org/10.1186/1471-2458-13-464

Comino EJ, Powell Davies G, Krastev Y, Haas M, Christl B, Furler J, Raymont A, Harris MF. A systematic review of interventions to enhance access to best practice primary health care for chronic disease management, prevention and episodic care. BMC Health Services Research 2012; 12: 415

de Walque, Damien, Lia Fernald, Paul Gertler and Melissa Hidrobo. 2017. Cash Transfers and Child and Adolescent Development. Chapter 23 in *DCP3, Disease Control Priorities 3, Economic Evaluation for Health*, *Child & Adolescent Development Volume*. World Bank. 325-40.

de Walque, Damien and Christine Valente. 2018. Incentivizing School Attendance in the Presence of Parent-Child Information Frictions" World Bank Policy Research Working Paper #8476.

Fernald LCH, Gertler PH, Neufeld LM. 2008. "Role of cash in conditional cash transfer programmes for child health, growth, and development: an analysis of Mexico's Oportunidades." *Lancet* 371: 827-37.

Ferraro Paul J and Michael K. Price, 2013. "Using Nonpecuniary Strategies to Influence Behavior: Evidence from a Large-Scale Field Experiment," The Review of Economics and Statistics, 95(1): 64-73.

Fiszbein A and NR Schady. 2009. "Conditional Cash Transfers for Attacking Present and Future Poverty." Policy Research Report, The World Bank, Washington, DC.

Frey and Meier. 2004. "Pro-Social Behavior in a Natural Setting." Journal of Economic Behavior & Organization, 54, 65–88.

Geldsetzer P, Manne-Goehler J, Marcus ME, et al. The state of hypertension care in 44 low-income and middle-income countries: a cross-sectional study of nationally representative individual-level data from 1·1 million adults. *Lancet*. 2019;394(10199):652-662. doi:10.1016/S0140-6736(19)30955-9

Gerber and Rogers. 2009. "Descriptive Social Norms and Motivation to Vote: Everybody's Voting and so Should You." *The Journal of Politics, 71*(1), 178–191. https://doi.org/10.1017/S0022381608090117

Gertler P. Do Conditional Cash Transfers Improve Child Health? Evidence from PROGRESA's Control Randomized Experiment. *American Economic Review* 2004; 94: 332-341.

Gong, Estelle; Chukwuma, Adanna; Ghazaryan, Emma; and de Walque, Damien. 2020. Invitations and incentives: a qualitative study of behavioral nudges for primary care screenings in Armenia. Unpublished manuscript.

Government of Armenia: Decree on State Funded Health Care for Free and at Preferential Conditions. (2004) N 318-Ն. Retrieved May 30, 2020, from https://www.arlis.am/documentview.aspx?docid=12227

Hallsworth, M., List, J. A., Metcalfe, R. D., & Vlaev, I. 2017. The behavioralist as tax collector: Using natural field experiments to enhance tax compliance. Journal of Public Economics, 148, 14-31.

Institute of Health Metrics and Evaluation. Retrieved May 28, 2020, from http://www.healthdata.org/armenia

Lavado R., Hayrapetyan S. and Kharazyan S. (2018). Expansion of the Benefits Package: The Experience of Armenia. *Universal Health Coverage Study Series No27.* The World Bank.

Lagarde M, Haines A, Palmer N. Conditional Cash Transfers for Improving Uptake of Health Interventions in Low- and Middle-Income Countries: A Systematic Review. *JAMA* 2007; 298: 1900-10.

Massavon, W., Wilunda, C., Nannini, M.,Majwala, R. K., Agaro,C., De Vivo, E., Lochoro, P., Putoto, G., Criel, B. (2017). Effects of Demand-Side Incentives in Improving the Utilization of Delivery Services in

Oyam District in Northern Uganda: A Quasi-Experimental Study. *BMC Pregnancy and Childbirth*: 17:431. DOI 10.1186/s12884-017-1623-y

National Cancer Institute. Tobacco Control Monograph No 19. Bethesda, MD: US Department of Health and Human Services, National Institutes of Health, National Cancer Institute; 2008. The role of the media in promoting and reducing tobacco use. NIH Pub No 07-6242.

Saeedi P, Petersohn I, Salpea P, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Research and Clinical Practice*. 2019;157. doi:10.1016/j.diabres.2019.107843

Sallis, A., Sherlock, J., Bonus, A. et al. Pre-notification and reminder SMS text messages with behaviourally informed invitation letters to improve uptake of NHS Health Checks: a factorial randomised controlled trial. *BMC Public Health* 19, 1162 (2019). https://doi.org/10.1186/s12889-019-7476-8

Shea S, Basch CE. A review of five major community-based cardiovascular disease prevention programs. Part II: intervention strategies, evaluation methods, and results. Am J Health Promot. 1990;4:279–87. [PubMed] [Google Scholar]

Shelley JM, Irwig LM, Simpson JM, Macaskill P. Evaluation of a mass-media-led campaign to increase Pap smear screening. *Health Educ Res*. 1991;6(3):267-277. doi:10.1093/her/6.3.267

Sunstein Cass R., Christine Jolls and Richard H. Thaler. 1998. "A Behavioral Approach to Law and Economics," 50 Stanford Law Review 1471.

Wakefield MA, Loken B, Hornik RC. Use of mass media campaigns to change health behaviour. *Lancet*. 2010;376(9748):1261-1271. doi:10.1016/S0140-6736(10)60809-4

Wiysonge CS, Paulsen E, Lewin S, et al. Financial arrangements for health systems in low-income countries: an overview of systematic reviews. *Cochrane Database Syst Rev*. 2017;9(9):CD011084. Published 2017 Sep 11. doi:10.1002/14651858.CD011084.pub2

World Health Organization. Noncommunicable diseases. Retrieved May 28, 2020. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

Appendix Table 1: Balance test of variables in study groups

	P-Values									
Variables	**IG1-IG2**	**IG1-IG3**	**IG1-IG4**	**IG1-CG**	**IG2-IG3**	**IG2-IG4**	**IG2-CG**	**IG3-IG4**	**IG3-CG**	**IG4-CG**
Male	0.944	0.777	0.944	0.888	0.724	0.888	0.832	0.832	0.888	0.944
Age	0.279	0.187	0.671	0.597	0.826	0.52	0.565	0.383	0.418	0.930
No Education	0.477	0.255	0.737	0.025	0.654	0.704	0.083	0.412	0.157	0.045*
Primary Education	0.155	0.774	0.943	0.773	0.088	0.177	0.088	0.72	1.000	0.72
Technical Education	0.639	0.124	0.751	0.692	0.045*	0.432	0.387	0.221	0.253	0.936
Higher Education	0.116	0.079	0.541	0.541	0.852	0.335	0.35	0.25	0.25	1.000
Married	0.498	0.238	0.281	0.043	0.614	0.688	0.177	0.919	0.396	0.342
Divorced	0.832	0.542	0.832	0.825	0.69	1.000	0.665	0.69	0.407	0.665
Widowed	0.012**	0.052	0.001***	0.006***	0.542	0.34	0.825	0.122	0.407	0.462
Single	0.372	0.68	0.372	0.68	0.193	1.000	0.193	0.193	1.000	0.193
Household Size	0.603	0.971	0.773	1.000	0.611	0.706	0.603	0.79	0.97	0.772
State Employee	0.703	0.923	0.371	0.349	0.633	0.203	0.579	0.425	0.302	0.068
Private Sector Employee	0.365	0.172	1.000	0.792	0.023	0.365	0.243	0.172	0.27	0.792
Self-Employed	0.63	0.807	0.63	0.007***	0.812	1.000	0.002***	0.812	0.003***	0.002***
Unemployed	0.887	0.229	0.722	0.669	0.178	0.831	0.776	0.119	0.103	0.943
Our income is not sufficient for everyday food	0.459	0.000***	0.010**	0.000***	0.004***	0.065	0.000***	0.293	0.07	0.005***
Our income is sufficient for everyday food but not for clothes and other basic needs	0.088	0.001***	0.942	0.469	0.122	0.103	0.015**	0.002***	0.000***	0.426
Our income is sufficient for family basic needs, such as food, clothing, utilities, but not enough for big purchases, such as equipment or a car	0.065	0.001***	0.155	0.000***	0.119	0.671	0.089	0.048**	0.887	0.034**
Our income is sufficient to meet all family needs, make big purchases, but not enough for savings	0.891	0.007***	0.365	0.002***	0.005***	0.297	0.003***	0.071*	0.000***	0.000***
Our income is sufficient to meet all family needs, make any kind of purchases and have some savings	0.486	0.59	0.056	0.019**	0.22	0.012**	0.004***	0.155	0.058	0.563
Small PHC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

	P-Values									
Variables	**IG1-IG2**	**IG1-IG3**	**IG1-IG4**	**IG1-CG**	**IG2-IG3**	**IG2-IG4**	**IG2-CG**	**IG3-IG4**	**IG3-CG**	**IG4-CG**
Medium PHC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Large PHC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Urban PHC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Notes: ***: p<0.01; **: p<0.05; *: p<0.1; IG: Intervention group; CG: Control group; PHC: Primary health care

Appendix Table 4: Heterogeneity analysis by level of education

	(1) Both tests
1.Group	.149***
	(.029)
2.Group	.152***
	(.029)
3.Group	.215***
	(.031)
4.Group	.314***
	(.034)
3.Education (Technical/College)	-.012
	(.082)
4.Education (Higher Education)	-.147*
	(.088)
1.GroupXTechnical/College	.002
	(.053)
1.GroupX Higher Education	-.013
	(.061)
2.GroupX Technical/College	-.048
	(.05)
2.GroupX Higher Education	.037
	(.062)
3.GroupX Technical/College	-.172***
	(.048)
3.GroupX Higher Education	-.142***
	(.052)
4.GroupX Technical/College	-.05
	(.06)
4.GroupX Higher Education	.047
	(.076)
Y Control Mean (Group 5 & Primary Education/ Secondary/No Education)	0.034
	(0.012)
Observations	1997
R-squared	.101
p g1=g3:Education 3	0.004
p g2=g3:Education 3	0.032
p g2=g3:Education4	0.015
p g3=g4:Education4	0.029

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
The omitted interaction term is 5.Group X Primary Education/Secondary/No Education
Facility and Province effects on all models (not shown) and robust standard errors
Interactions with all control variables on model (not shown)

Appendix Table 3: Heterogeneity analysis by perceived income

	(1) Both tests
1.Group	.168***
	(.032)
2.Group	.19***
	(.036)
3.Group	.193***
	(.039)
4.Group	.392***
	(.041)
1. Medium/High Income	-.028
	(.067)
1.GroupX Medium/High Income	-.019
	(.044)
2.GroupX Medium/High Income	-.064
	(.046)
3.GroupX Medium/High Income	-.072
	(.047)
4.GroupX Medium/High Income	-.14***
	(.053)
Y Control Mean (Group 5 & Low Income)	0.030
	(0.013)
Observations	1997
R-squared	.091

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*
The omitted interaction term is 5.GroupX Low Income
Facility and Province effects on all models (not shown) and robust standard errors
Interactions with all control variables on model (not shown)
None of the p-values between groups are significant at the 0.05 level (not shown)