Bavarian Graduate Program in Economics

BGPE Discussion Paper

No. 221

Uncover your risk! Using Facebook to increase personal risk awareness and screening of type 2 diabetes in Indonesia

Manuela Fritz
Michael Grimm
Ingmar Weber
Elad Yom-Tov
Benedictus Praditya

October 2022

ISSN 1863-5733

Editor: Prof. Regina T. Riphahn, Ph.D.
Friedrich-Alexander-Universität Erlangen-Nürnberg

BGPE Discussion Paper Series

Uncover your risk! Using Facebook to increase personal risk awareness and screening of type 2 diabetes in Indonesia

Manuela Fritz[1,2*], Michael Grimm[1,3,4], Ingmar Weber[5†], Elad Yom-Tov[6,7], Benedictus Praditya[8]

[1]*School of Business, Economics and Information Systems, University of Passau, Passau, Germany*

[2]*Department of Economics, Econometrics and Finance, University of Groningen, Groningen, The Netherlands*

[3]*IZA Bonn, Germany*

[4]*RWI Research Network, Essen, Germany*

[5] *Department of Computer Science, Saarland University, Saarbrücken, Germany*

[6] *Microsoft Research, Herzliya, Israel*

[7] *Faculty of Industrial Engineering and Management, Technion, Israel Institute of Technology, Haifa, Israel*

[8] *Xiaomi Indonesia, DKI Jakarta, Indonesia*

THIS VERSION: September 2022

Abstract: We assess whether social media – in particular Facebook – can serve as an efficient and cost-effective instrument to increase type 2 diabetes awareness and encourage risk screening activities in Indonesia, where – as in the rest of Southeast Asia – the prevalence of the disease and with it the rates of undiagnosed cases have dramatically increased in the last decade. We use Facebook's advertisement function to randomly distribute graphical ads related to the risk and consequences of diabetes to Facebook users above the age of 35 in Jakarta and Yogyakarta. The ads differ in their message ("theme") and graphical design, but equally invite viewers to visit an information website on which they can participate in a diabetes self-screening activity. Depending on their determined risk score, participants receive a recommendation to contact their GP and ask for an in-depth screening. We find that the ad themes that we label "information" and "shock" outperform all other themes in terms of creating link clicks and completed screening questionnaires. A follow-up survey six weeks after the online screening suggests that approximately 28% of respondents that were found to have a high risk, plan to schedule (or already have scheduled) an appointment for a professional screening. The complementary cost-effectiveness analysis shows that such an online public health campaign can be very cost-effective with a cost of approximately US$9 per newly diagnosed person with type 2 diabetes.

JEL codes: I10, I12, I18, D83, D91.

Keywords: health, diabetes, Facebook, screening, cost-effectiveness, Indonesia.

---

* *Corresponding author:* Manuela Fritz, University of Passau, School of Business, Economics and Information Systems, Chair of Development Economics, Innstraße 29, 94032 Passau, Germany. Phone: ++49-851-5318, E-Mail: manuela.fritz@uni-passau.de. Orcid-ID: 0000-0002-6507-644X.

This study received ethical approval from the University of Passau Research Ethics Committee (15.03.2022, IRB Approval Number I-07.5090/2022) and was pre-registered at the AEA RCT Registry (0008781, https://doi.org/10.1257/rct.8781). The study has been conducted without any support from or connection to Facebook or the Meta group.

Acknowledgments: We sincerely thank Ferdyani Yulia Atikaputri, Ayu Paramudita and Mardha Tilla Septiani for their research assistance, Gerard van den Berg for his comments at the Groningen PhD conference 2022 and participants of the research seminar at the University of Passau for their valuable remarks.

† Part of this work was done while I.W. was at the Qatar Computing Research Institute, HBKU, Doha, Qatar.

1. Introduction

The global number of people living with diabetes has risen sharply in the last decades and has reached 537 million by 2021, with more than 90% being attributed to type 2 diabetes (International Diabetes Federation (IDF), 2021). Approximately 80% of affected individuals nowadays live in low-and middle-income countries, where not only the absolute number of cases but also prevalence rates have been rising more rapidly than in high-income countries (IDF, 2021; World Health Organization (WHO), 2021). To counteract this trend, the 2011 UN High-Level Meeting on Non-Communicable Diseases (NCDs) has set the global target to halt the increase in diabetes by 2025 (WHO, 2013; Zhou et al., 2016), which, however, is currently far away from being reached. Most low- and middle-income countries face a double burden of infectious diseases, that are still among the leading causes of death, and rising numbers of death due to non-communicable diseases, hence expenditures to curb the number of diabetes cases compete with many other priorities in the public health sector. Low cost and easy to implement interventions to prevent and control diabetes could therefore be of great help in many of these countries. When diabetes is sufficiently early detected, it can be effectively treated by medicinal, lifestyle and dietary changes. If undetected and untreated, however, it can have detrimental health consequences, such as eye and kidney damage, neuropathy and, in the most severe cases, stroke and death. The unawareness of the disease and its related risk factors and symptoms and the belated or never occurring diagnosis are therefore major obstacles in the fight against diabetes.

In this paper, we design and introduce an online awareness campaign implemented via the social media platform Facebook and analyze whether it can serve as a cost-effective solution to increase the risk awareness of type 2 diabetes and to encourage individuals to complete a self-screening risk test similar to the diabetes risk test of the American Diabetes Association (American Diabetes Association, 1993, 2019) and the diabetes FINDRISC questionnaire (Lindstrom and Tuomilehto, 2003). Specifically, we randomly distribute advertisements that differ in their message (“theme”), framing and graphical design via Facebook, which encourage viewers to click on the ad and thereby being directed toward a website. On this website, we provide informational material about diabetes, its risk factors, symptoms and consequences and individuals are invited to complete the self-screening questionnaire. After completion, participants received an assessment of their personal risk together with recommendations for keeping a low risk or how to encounter a medium or high risk, including the recommendation to contact their GP or a primary health care facility to undergo a professional diabetes screening.

As a showcase of our campaign we use Indonesia, yet we argue that such a campaign can be equally well implemented in other low- and middle-income countries. In Indonesia, diabetes currently presents the third leading cause of death (Centers for Disease Control and Prevention, 2020) and the country ranks fifth in the list of absolute numbers of diabetes cases worldwide (IDF, 2021). More concerningly, Indonesia ranks third among the countries with the highest undiagnosed cases worldwide. By the end of

2019, more than 10 million individuals were estimated to live with the disease in Indonesia with more than 70% of the cases remaining undiagnosed (IDF, 2021).

With our campaign we target all Indonesian male and female Facebook users above the age of 35, which live either in the city Jakarta or in the Special Region of Yogyakarta (*Daerah Istimewa Yogyakarta*) – the two regions with the highest diabetes prevalence rates in the country (Kementerian Kesehatan Republik Indonesia, 2018). The population of the two regions amounts to 14.23 million and thereby represents 5.4% of the total Indonesian population and almost 10% of the urban population. In Indonesia's urban areas, which also have higher diabetes prevalence rates than rural areas, internet penetration rates and usage of social media platforms are high, suggesting that an online awareness campaign about diabetes could indeed be a very cost-effective instrument to increase diabetes awareness and encourage screening activities. As of January 2022, the internet penetration rate in Indonesia stood at 76.3%, with 94% of all users accessing the internet via smartphones (Internet World Stats, 2022; Kepios, 2022). The social medial platform Facebook is especially widely used in the country and therefore offers the great potential to serve as platform for information sharing and spreading. By mid-2021, Facebook had 176 million Indonesian users – corresponding to 64% of the entire population (Internet World Stats, 2022).

With this campaign and the accompanying study, we aim to answer the following research questions: First, can informational ads distributed via Facebook encourage viewers to visit an information website about diabetes and to conduct a self-screening diabetes risk test? Second, which type of ad (with respect to the graphical design and theme) is most effective in encouraging viewers to visit an information website about diabetes and to conduct a self-screening diabetes risk test? Third, what are the characteristics of those who participate in the screening questionnaire compared to the universe we target and what is their diabetes risk score? Fourth, what is the cost per view, per generated website visit and per completed screening questionnaire and can such a campaign be considered a cost-effective public health intervention? Fifth, what is the compliance rate with respect to the received recommendation to schedule an appointment for a professional screening?

We contribute to the literature in several ways. First, we contribute to the literature that focusses on awareness rising, prevention and uptake of screening for NCDs in low-and middle-income countries, especially in Southeast Asia (Dukpa et al., 2015; Capuno et al., 2021; de Vries Mecheva, 2021; Marcus et al., 2022). This literature is of special policy relevance, given that health care systems in low- and middle-income countries are still to a large extent focalized on infectious and transmittable diseases, despite an ever-increasing health burden due to NCDs (Dans et al., 2011; Kostova et al., 2017; Manne-Goehler et al., 2019). Second, we contribute to the growing literature that shows that Facebook is a promising tool for health-related information campaigns (e.g., Parackal et al., 2017; Pereira da Veiga et al., 2020), for health-related research study recruitment (Thornton et al. (2016) provide a comprehensive review) as well as an increasingly relevant tool for scientific research especially in terms of implementing randomized controlled trials (RCTs) and field experiments (Gordon et al., 2019; Orazi and Johnston, 2020; Breza et al., 2021; Levy, 2021). Our study, however, stands out as one of the very first to implement a health-related field experiment via Facebook in a middle-income country context. Lastly, we contribute to a literature mainly rooted in psychology that explores what kind of framings or pictorial contents drive health-related decisions (Rothman and Salovey, 1997; Krishnamurthy et al., 2001; Gallagher and Updegraff, 2012; Kuehnle, 2019; Hall et al., 2022) and whether exposure to information improves health preventive behavior (Slade, 2012; Dammert et al., 2014; Kim et al., 2019). We thereby provide evidence about which psychological channels can effectively incentivize individuals to learn about their risk of having or developing diabetes in a country where the general awareness of the disease is low.

The remainder of this paper is structured as follows. Section 2 summarizes the contextual background about diabetes in Indonesia. Section 3 presents the experimental design of the Facebook health campaign and the different ads in detail. Section 4 describes the data that we collected, while Section 5 presents the empirical strategy and results. Section 6 discusses cost-effectiveness and Section 7 concludes.

2. Contextual background

Indonesia currently faces a public health problem with diabetes that has reached epidemic proportions. The latest Indonesian Basic Health Research from 2018 (RISKESDAS) revealed that the diagnosed diabetes prevalence rate for individuals above the age of 35 was 3.5%, while the rate of individuals with diabetes according to blood sugar testing was 14%. These numbers imply that the prevalence rate increased by almost 25% since the previous RISKESDAS in 2013 and that about 75% of all cases remain undiagnosed. Additionally, the RISKESDAS data show that one in three adults (30.6%) suffers from impaired glucose tolerance, i.e., pre-diabetes, and therefore has an increased risk of developing type 2 diabetes in the future (Kementerian Kesehatan Republik Indonesia, 2018).

The high numbers of undiagnosed cases are driven by a low awareness of diabetes in the general public as well as among health care workers and policy makers. With respect to the general population, several studies report that low levels of knowledge about diabetes symptoms, risk factors and treatment possibilities prevail. For example, Kristina et al. (2020) in their study in rural Yogyakarta find that 46% of respondents have poor knowledge of diabetes risk factors, and even worse knowledge in terms of diabetes management and treatment possibilities. Bakti et al. (2021) conducted a study on public knowledge of diabetes and hypertension in metropolitan cities in Indonesia and found that on average 35% of the knowledge questions regarding diabetes symptoms and risk factors were answered incorrectly. On the health care provider side, especially the awareness of and adherence with diabetes screening guidelines as well as knowledge about the disease seems to remain low. Widyahening et al. (2014) conducted a study with 400 general practitioners and found that even though health care professionals do know the risk factors and symptoms of the disease, a high share of them is unaware of the recommendation that patients at risk should regularly be screened for high blood sugar levels. Ligita et al. (2018) provide an extensive literature review on the profile of diabetes healthcare professionals in Indonesia and conclude that they often lack skills and knowledge in providing diabetes education and care. Further, Widyaningsih et al. (2022) present evidence that health workers in the national community-based screening program for diabetes and hypertension (*POSBINDU*) suffer from unsatisfactory knowledge about the disease and lack the required abilities for health screening and education. These findings imply that individuals need to be aware of their individual risk status to demand a professional screening. Hence, raising individual awareness of diabetes is an important first step in the process of disease prevention and treatment in the given context.

The high prevalence rate of diabetes comes not only with an immense health burden but also implies immense costs and substantial economic losses. A modelling study by Bloom et al. (2015) estimates that the expected economic output loss for Indonesia due to diabetes will amount to US$11 billion per year for the period 2012-2030. Additionally, in light of limited governmental health expenditure (less than 3% of GDP (World Bank, 2022)) and a national health insurance scheme (BPJS/JKN) that has suffered from financial deficiencies ever since its implementation (BPJS Kesehatan, 2015, 2016; Deloitte Indonesia, 2019; Prabhakaran et al., 2019), the government needs to strive for cost-effective health interventions to ensure the financial sustainability of the scheme. While Indonesia's current NCD policy encompasses preventive diabetes and hypertension screening activities at the community level, this policy has been found to suffer from suboptimal implementation and targeting, low participation rates, inadequate coverage and lack of human and financial resources (Rattanavipapong et al., 2016; Alfiyah and Pujiyanto, 2021; Widyaningsih et al., 2022), which undermine its cost-effectiveness.

With our campaign and study, we aim to address both aspects, awareness and cost-effectiveness, by assessing whether Facebook can serve as instrument to distribute health-related information on a large scale with limited financial resources.

3. Experimental design

From March 15 until April 5 2022, we ran a diabetes health campaign entitled "Ada Gula, Ada Diabetes"[1] via Facebook's advertisement function, which allows to distribute self-designed ads and videos to Facebook users while using specific demographic and geographic targeting criteria. This advertisement tool was originally developed for businesses to boost their customer base and increase

[1] The title of the campaign is related to the traditional Indonesian saying "Ada gula, ada semut", which literally means "When there is sugar, there must be ants". Figuratively, the saying means that for every action there is an equal and opposite reaction. Our adapted campaign name hence figuratively interprets diabetes as the reaction to too much sugar – also in relation to the fact that diabetes is known as "Sakit Gula" ("sugar disease" or "sugar sickness") in Indonesia. Several Facebook comments that were posted below our ads indicated that ad viewers understand this adaptation of the original saying.

sales, yet, it is increasingly also used by scientific researchers to recruit survey participants (Kosinkski et al., 2015; Thornton et al., 2016; Choi et al., 2017; Ananda and Bol, 2020; Grow et al., 2020). While using the tool for the recruitment of survey participants is indisputable practical, it does offer an even more sophisticated and scientifically valuable function that allows to implement randomized controlled trials. Facebook's A/B split test allows to randomly distribute two (or more) ads or ad sets to evenly split and statistically comparable audiences to test which ad performs best in terms of a pre-specified campaign target (Meta, 2022a). Hereby, the ads can differ in their design or placement, depending on which variable is sought to be tested. This A/B test design also ensures that the same budget is allocated to each ad and hence avoids that Facebook's algorithm determines the budget allocation which could generate unbalanced Facebook user exposure rates across ads.

We designed five different ads that each referred to a different theme and psychological channel to test which type of ad content performs best in the given context. We entitled these themes "family", "geography", "information", "religion" and "shock". The themes and ads are described in more detail below and all graphics are displayed in Figure A1 to Figure A6 in Appendix A.

1) Family: The family ad pictured an Indonesian family of three generations and contained the message that every family can be affected by diabetes.
2) Geography: One geography ad was designed for each of the two regions in our Study (Jakarta and Yogyakarta). The graphics showed a landmark of each of the two cities (the National Monument in Jakarta and the Yogyakarta Monument in Yogyakarta, respectively) covered in sweets. The message referred to the local prevalence rates of diabetes in each of the regions.
3) Information: The information ad contained a statement about the possible health consequences of diabetes. The graphic showed a wooden mannequin on which the body parts that can be affected by diabetes were marked.
4) Religion: The religion ad presented a cooking Indonesian woman with Hijab and contained a statement from the Quran that conveyed the message that one should not live a potentially self-harming life.
5) Shock: The shocking ad pictured a man in front of a tomb and contained the message that diabetes can have deadly consequences.

In addition to the messages outlined above, each ad carried the statement "Learn about your diabetes risk now" ("Pelajari tentang risiko diabetes Anda sekarang") to encourage the ad viewers to click on the ad and visit the campaign website.

Technically, we ran two different campaigns, one for each of the targeted regions, and then pooled the data for the analysis. Each ad received an equal budget of US$5 per day, summing to a total daily budget of US$50 for both cities together. In terms of the target population, we restricted the audience demographically to Facebook users above the age of 35 and geographically to users living in either Jakarta or Yogyakarta.

The campaign objective was chosen to optimize "conversions", with conversion being programmed to be equal to the completion of the screening questionnaire. Setting "conversions" as the campaign objective (instead of the other two possibilities "awareness" or "consideration") allowed us to focus on possible questionnaire completers which would thus gain from the campaign, while simultaneously preventing to show the ads to seemingly uninterested users. This conversion objective requires the generation of a so-called Facebook Pixel code, which needs to be embedded in the code of the landing website to which the ad viewers are redirected. Thereby, Facebook can track user actions that happen on our website and optimize accordingly. This implies that after a learning phase, Facebook's algorithm aims to show the ads to individuals more likely to complete the screening questionnaire, based on the characteristics of earlier completers. While this internal algorithm exaggerates the self-selection bias if the conversion objective is used in regular campaigns (Neundorf and Öztürk, 2021), the use of the A/B split test ensures that conditional on being in the target audience the ad version the user sees is random. This randomization procedure allows to compare the different ads in their effectiveness to generate clicks and conversions, i.e., completed screening questionnaires, and hence to test which kind of thematic approach would be well suited in the context of Indonesia to raise awareness about a health concern and which approach can effectively encourage individuals to search for more information.

After clicking on one of the ads in Facebook, individuals were redirected to the landing page of the campaign website (adagulaadadiabetes.com). Before being able to browse further on the website, the participants were informed about our privacy policy and that data generated on the website were used for an academic study. For both they then had to indicate their consent.

On this website, individuals were offered the opportunity to conduct a diabetes risk test similar to the diabetes risk test of the American Diabetes Association and the diabetes FINDRISC (Finnish Diabetes Risk Score) screening test.[2] The questionnaire version we used is an adapted and translated version specifically for the Indonesian population (the complete questionnaire and scoring system are presented in Appendix B).[3] It consisted of eleven questions which can be answered in approximately 90 seconds. Based on the individual answers, a risk score between 0 and 16 points was calculated and participants received an assessment of their personal risk in terms of low risk (0-3 points), medium risk (4-5 points),

[2]The original FINDRISC questionnaire was developed by Lindstrom and Tuomilehto (2003) to identify individuals at risk of diabetes using a Finnish population sample. Since then, the questionnaire has been evaluated and validated many times and has been adjusted to different population and country samples, e.g. the LA-FINDRISC for Latin America (e.g., Nieto-Martínez, 2017; Muñoz-González, 2019) or the ModAsian FINDRISC for Asia (e.g., Ku and Kegels, 2013; Lim et al., 2020). The original diabetes risk test of the American Diabetes Association dates back to 1993 and has likewise been adapted multiple times (e.g. Fauzi et al., 2022).
[3]The used version is based on the diabetes risk test of the American Diabetes Association (1993, 2019), the ModAsian FINDRISC for Asia, the FINDRISC Bahasa Indonesia (Rokhman et al., 2022) and the Malay version of the American Diabetes Association diabetes risk (Fauzi et al., 2022).

or high risk (6 or more points). Additionally, the assessment contained recommendations on how to keep the risk low, how the diabetes risk can be reduced and to visit a health center or a general practitioner in case the risk score was too high.

Moreover, the website contained a page with factual information on diabetes in Indonesia including the distribution of prevalence rates across the country and medical risk factors, as well as information about how diabetes can be diagnosed and how it can be treated. Further, we provided detailed information about the institutions involved in the research activities, the aim of the campaign and the notification that the campaign was purely educative and could not replace a professional health visit or screening activity.

We also asked participants to leave their email address so that they could get follow up information and further be involved in the study. Six weeks after the end of the campaign we sent to all these addresses a follow-up survey to elicit information about actual compliance with the recommendations received. Since providing the mail address was voluntary and hence the sub-sample of respondents is subject to a potential self-selection bias, we provide a description of the sample that completed this follow-up survey and contrast it with the profile of the entire sample. Yet, we believe it is not unlikely that among those who did not leave their email address or left their email address but did not respond to the survey, also a sizable share followed up on the recommendation. They may simply not have perceived a need to get follow-up information.

Our study was pre-registered at the AEA RCT Registry (0008781, https://doi.org/10.1257/rct.8781) and received ethical approval from the University of Passau Research Ethics Committee (15.03.2022, IRB Approval Number I-07.5090/2022).

4. Data

In the following we present and describe the data that we collected through Facebook, the summary statistics derived from the screening questionnaire, and the data we collected through the additional follow-up survey.

4.1 Facebook data and screening questionnaire

Table 1 presents the Facebook statistics by age, gender and location. This engagement data is provided directly by Facebook to the campaign implementer. With our campaign we reached in total 286,776 individuals, generated 758,977 impressions (distinct views of the ads) and generated 5,278 link clicks. This amounts to a click rate of 1.84% (relative to the reached individuals), which is higher than the rates achieved in studies with a similar set up as, for example, in Choi et al. (2017) (1.4%) or Orazi and Johnson (2020) (0.2%). Overall, we spent approximately US$1,060 and the campaign resulted in 2,052 started and 1,469 completed screening questionnaires ("conversions"; a conversion-to-reach rate of 0.51% (1,469/286,776) and a conversion-to-click rate of 27.83% (1,469/5,278)).

Table 1. Aggregate statistics of the Facebook campaign

	(1) Reach	(2) Impressions	(3) Link clicks	(4) Expenditure (in US$)	(5) Completed Questionnaires "Conversions"
Total	**286,776**	**758,977**	**5,278**	**1,066.04**	**1,469**
By Gender					
Male	160,560 (56%)	433,677 (57%)	2,725 (52%)	570.91 (54%)	754 (51%)
Female	126,216 (44%)	325,300 (43%)	2,549 (48%)	495.13 (46%)	715 (49%)
By Age					
Below 45	136,500 (48%)	342,729 (45%)	1,646 (31%)	372.01 (35%)	466 (32%)
45-54	98,060 (34%)	271,914 (36%)	2,091 (40%)	421.23 (40%)	686 (47%)
55-54	32,820 (11%)	90,314 (12%)	978 (19%)	188.42 (18%)	238 (16%)
Above 65	19,396 (7%)	54,020 (7%)	559 (11%)	84.37 (8%)	79 (5%)
By Location					
Jakarta	145,528 (51%)	321,154 (42%)	2,834 (54%)	526.75 (49%)	876 (60%)
Yogyakarta	141,248 (49%)	437,823 (58%)	2,440 (46%)	539.29 (51%)	567 (40%)

Notes: The number of completed screening questionnaires by location does add up to 1,443 and not to 1,469 since for 26 completed questionnaires tracking was restricted and the referring ad and thus the location could not be determined.

Due to changes in Apple's data policy, Facebook is unable to track users that opted out of tracking under iOS 14 or users that prohibit tracking in any other form and therefore relies on statistical modeling to estimate the total number of conversions (Meta, 2022b). Moreover, Facebook is unable to differentiate by age or gender, once the users leave the platform and thus only provides aggregated data on conversions. Hence, for the results in terms of conversions (Column (5)), we rely on the more accurate data that were collected directly on our campaign website from which we could extract – without any loss or modelling – the absolute number of completed (and started) screening questionnaires.

We used Facebook's dynamic URL parameters (Meta, 2022c) to generate ad specific referrer links, containing information about the ad id, ad name and ad placement. These URL parameters could then be read out on our campaign website whenever an individual started to fill out the screening questionnaire. However, for those individuals who opted out of tracking, the ad specific URL parameters within the referrer link would not be displayed. Yet, given that a vast majority of smartphone users in Indonesia relies on an Android system, only 26 (out of 1,469) completed screening questionnaires could not be linked to the ad from which users were re-directed to our campaign website.

We did not restrict the possibility to complete the screening questionnaire multiple times. We did so to allow for possible spillover effects, for example, when a user after completion of the screening questionnaire re-did the screening for another person. This, however, also implies that the same person could fill out the screening questionnaire multiple times with differing information, for example to check for related changes in the obtained risk score. The individual link id together with the IP address and browser information, however, allows us to identify repeated survey questionnaires that were completed from the same device. We therefore construct a data sample in which we drop the observations that stemmed from repeated questionnaires, i.e., for each link id × IP address combination, we keep only the first completed observation in our sample. We use this first observation based on the assumption that a person filling out the questionnaire multiple times would do this first for him- or herself and potentially only afterwards for another person. Similarly, we assume, if it is filled out multiple times out of curiosity, one would enter the true data the first time and hypothetical data only afterwards. This procedure led to a reduction from 1,533 completed questionnaires (with duplicates) to an individual sample containing the 1,469 completed screening questionnaires presented in the summary statistics.[4] We will use this reduced individual sample throughout the paper as the main sample. This is especially important for the analysis of ad performance – since a repeated questionnaire does not imply a repeated click on the viewed ad, and we thereby prevent to overestimate ad performance.

Table 2 presents the summary statistics of the completed screening questionnaires for the main sample. Summary statistics including the information for all started questionnaires as well as for the sample of all completed questionnaires including any duplicates are presented in Table C1 and C2, respectively, in Appendix C.

The average user completing the diabetes risk screening questionnaire on our campaign website is between 45 and 54 years old, has a BMI of about 26 and a high diabetes risk with an average risk score of 6. Men and women are almost equally represented. Half of the respondents report to have ever been told to have high blood sugar levels and one third has ever been diagnosed with high blood pressure levels. In terms of smoking, 34% of participants report to be ever-smokers, (i.e., either currently smoke or have smoked previously, but stopped now). This average smoking rate, however, obscures a strong gender heterogeneity, with 8% of women and 57% of men in our sample being ever-smokers; a trend that is also well in line with the tobacco consumption pattern in Indonesia observed in RISKESDAS 2018 (with 3.2% female and 65% male ever-smokers, respectively, for the total Indonesian population above the age of 10). Sixty percent of the respondents report to conduct at least 30 minutes of physical activity per day, while only 45% report to consume fruit or vegetables on a daily basis. Thirty percent of the respondents report to consume sugary beverages every day.

[4] We observe 45 link id × IP address combinations that completed the questionnaire twice, five link id × IP address combinations that completed the questionnaire three times and one link id × IP address combination that completed the questionnaire four times.

Table 2. Summary statistics of completed screening questionnaires

	(1) Mean	(2) SD	(3) Min	(4) Max
Age distribution				
35-45	0.32		0	1
45-54	0.47		0	1
55-54	0.16		0	1
Above 65	0.05		0	1
Female	0.49		0	1
Ever had high blood sugar levels	0.50		0	1
Ever diagnosed with high blood pressure	0.33		0	1
Family member with diagnosed diabetes	0.54		0	1
Weight	69.28	17.10	33	185
Height	162.43	7.84	140	195
BMI	26.15	5.61	11	70
Daily physical activity	0.60		0	1
Smoking				
Never smoked	0.66		0	1
Stopped smoking	0.20		0	1
Currently smoking	0.14		0	1
Daily fruit consumption	0.45		0	1
Daily sweet beverages consumption	0.30		0	1
Risk score	6.37	2.57	0	14
Low risk	0.14		0	1
Medium risk	0.25		0	1
High risk	0.61		0	1
Provided e-mail address	0.14		0	1
Number of observations	1,469			

Notes: Table 2 displays the summary statistics of the completed screening questionnaires for the main sample without repeated answers.

The summary statistics of the started screening questionnaires (Table C1 in Appendix C) reveal that a large share of survey starters dropped out after the first question (9%) and another large share before the question about participants' weight and height (10%). Overall, 75% of started screening questionnaires were completed. Of all completers, 205 (14%) left their e-mail address to be contacted for further study activities. To this sub-sample, we sent a follow-up survey six weeks after the end of the Facebook campaign. The full workflow together with the number of observations at each step is presented in Figure 1.

4.2 Follow-up survey

Of the 205 participants who left their e-mail address and agreed to be recontacted again for further information and research activities, 53 participated in the follow-up survey. In this follow-up survey, we asked the respondents whether they remembered their risk level from the screening questionnaire and about their plans to comply with the received recommendations. Specifically, we asked whether they plan to schedule a professional medical screening (or have already done so), if yes, when and where they planned to go and if no, what their reasons were for not doing so. We also asked what types of activities (such as conducting more physcial activity or eating healthier) they planned to conduct to reduce the risk of diabetes. Moreover, the follow-up questionnaire included several knowledge questions about diabetes risk factors, symptoms and long-term health consequences, a question whether the respondent posesses a health insurance, whether it was the first time conducting a diabetes risk test, and, if they were already aware of their diabetes diagnosis, whether they were currently on medication.

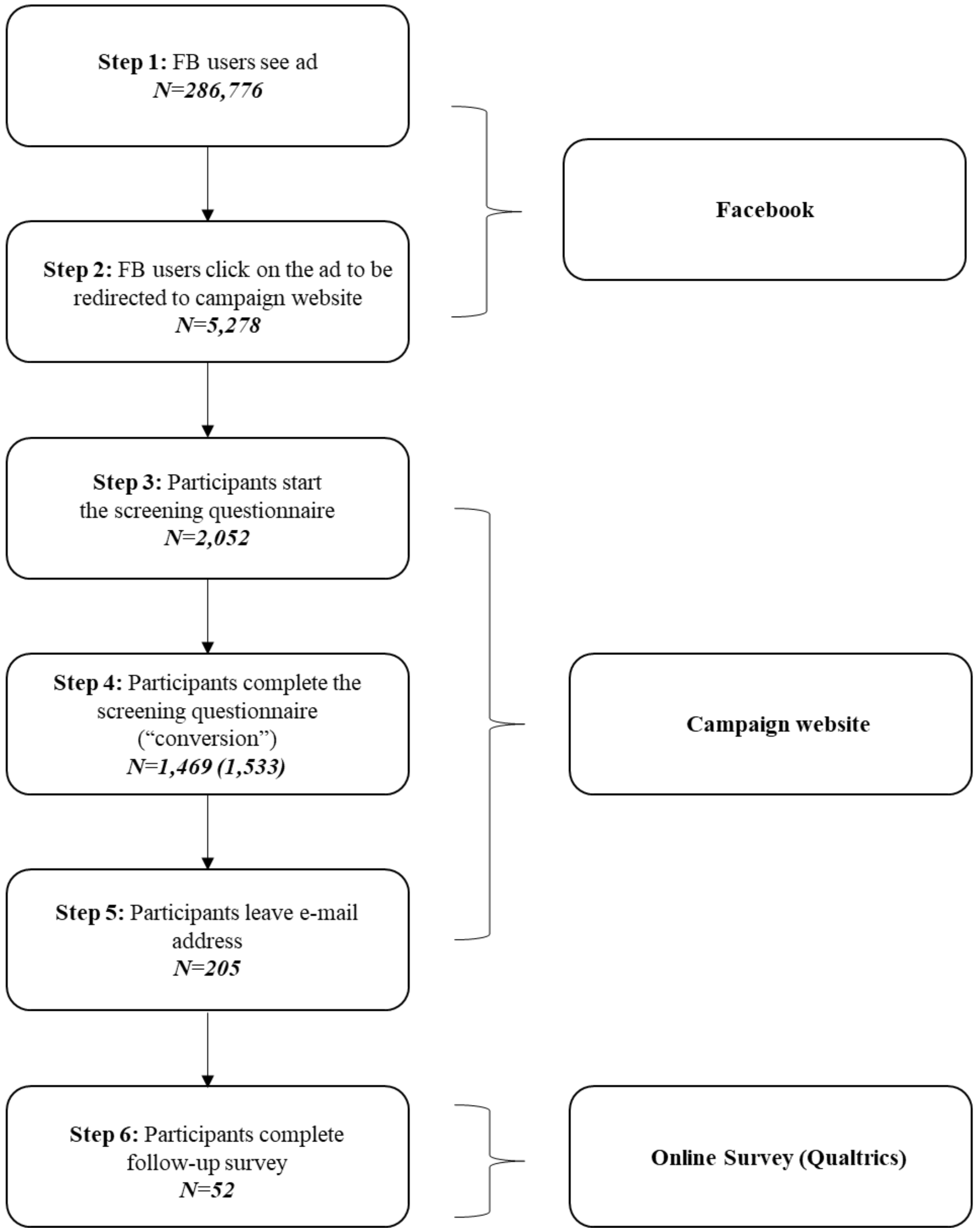

Figure 1. Workflow of the experiment. *Notes:* The number 1,533 in parenthesis refers to the number of completed questionnaires when duplicated questionnaires are also counted.

5. Empirical Strategy and Results

5.1 Empirical Specification

We start our empirical analysis with the evaluation of which of the five ad themes is most effective in generating link clicks and conversions. To do so, we estimate the following logistic regressions

$$P(Link\ click_i = 1 \mid Ad\ theme_i^j, \boldsymbol{Z_i}) = \lambda(\beta_0 + \sum_{j=1}^{4} \beta_j\ Ad\ theme_i^j + \beta \boldsymbol{Z_i} + u_i) \tag{1}$$

and

$$P(Conversion_i = 1 \mid Ad\ theme_i^j, \boldsymbol{Z_i}) = \lambda(\delta_0 + \sum_{j=1}^{4} \delta_j\ Ad\ theme_i^j + \delta \boldsymbol{Z_i} + e_i) \tag{2}$$

where λ is the logistic function, $\sum_{j=1}^{4} Ad\ theme_i^j$ is a set of four dummy variables that are equal to one whenever person *i* saw the ad theme *j* (the ad theme "family" serves as reference group), $\boldsymbol{Z_i}$ is a vector of control variables (age, gender, region), and u_i (e_i) is the error term. Note that the coefficients β_j and δ_j can be interpreted as causal effects since the ad themes were randomly assigned to Facebook users.

5.2 Main results

Figures 2 and 3 together with Tables D1-D4 in Appendix D display the results for link clicks and conversions for the total sample and separately for men and women. Figures 2 and 3 show the relative increases in comparison to the "family ad", which implies a reference click-to-reach-ratio of 1.7% and a reference conversion-to-reach-ratio of 0.4%. Tables D1-D2 in the Appendix display the regression coefficients and marginal effects from the logit model; Tables D3-D4 present complementary results from an OLS model.

The top graph for the full sample in Figure 2 shows that we can establish a clear hierarchy in terms of ad effectiveness for generating link clicks. The ad themes "geography'" and "family" are the least performing, while the theme "information" outperforms all four other themes. In terms of the effect size, a user seeing the ad theme "information" was 24% and 25% more likely to click on the ad compared to someone who saw the theme "family" or "geography", respectively. The ad themes "shock" and "religion" are not significantly different from each other in their effectiveness to generate links, but both perform significantly better than the themes "geography" and "family" (results for pairwise t-tests are shown in Table D1).

In terms of the user characteristics, women were 24% more likely to click on an ad, and the two age groups 55-64 and 65+ were more likely than younger users to click on an ad (see regression results in Tables D1-D3). Differentiating the ad theme effectiveness by gender (graphs 2b and 2c) shows that the differential effectiveness is mainly driven by women, while men reacted to all themes in a more similar manner.

Turning to conversions, Figure 3 (graph a) shows a slightly different picture. While “information” is again the best performing theme in generating conversions, the performance of the “religion” theme is no longer significantly different from the “family” theme. Instead, the “geography” theme is now significantly more effective than the “family” and “religion” themes and equally effective as the “shock” theme in generating conversions. Differentiating by gender (graphs 3b and 3c) reveals, however, that the effectiveness of the “geography” ad is solely due to a female response to this theme, while for men the responsiveness to the “information” theme is greatest and the ad performs significantly better compared to all other themes with the exception of the “shock” theme (p-value 0.151).

Women are also more likely (+21%) to complete a screening questionnaire conditional on seeing one of the ads compared to their male counterparts. Yet, given that the number of women seeing an ad on Facebook was lower in absolute terms (since there are generally less female Facebook users than male users in Indonesia (Statista, 2022a)), the sample of completed questionnaires is balanced in the gender distribution. Although the oldest age group (65+) was more likely to click on the ads than users below 45, they are less likely to complete the questionnaire once being re-directed to the website. This is further confirmed when we regress the probability of attrition on participants’ characteristics (conditional on having started the screening questionnaire), where we find that elderly above the age of 65 are 34 percentage points more likely to drop out in the course of the questionnaire compared to the youngest age groups. This effect is larger for elderly men, though not statistically different from the female effect (results shown in Table D5 in Appendix D).

We also find a pronounced difference between the two cities in terms of conversions. While Facebook users in both cities were similarly likely to click on the ads, users based in Jakarta were significantly more likely to complete the screening questionnaire.

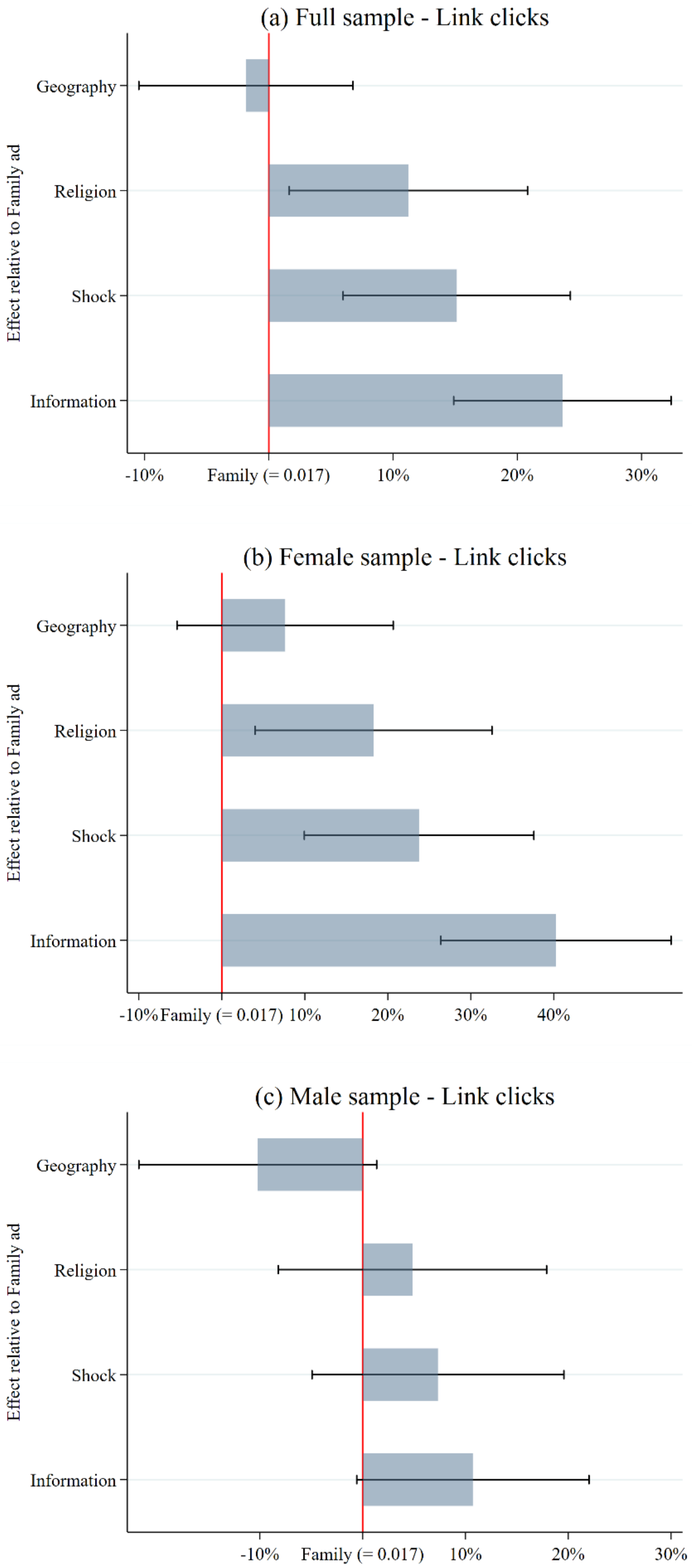

Figure 2. Ad effectiveness – Link clicks. *Notes:* Figure 2 shows the effectiveness of the different ad themes in terms of link clicks. The effects are presented as relative effect to the "family ad", which serves as reference category. The regression results of the logistic function (and OLS regressions) are presented in Appendix D.

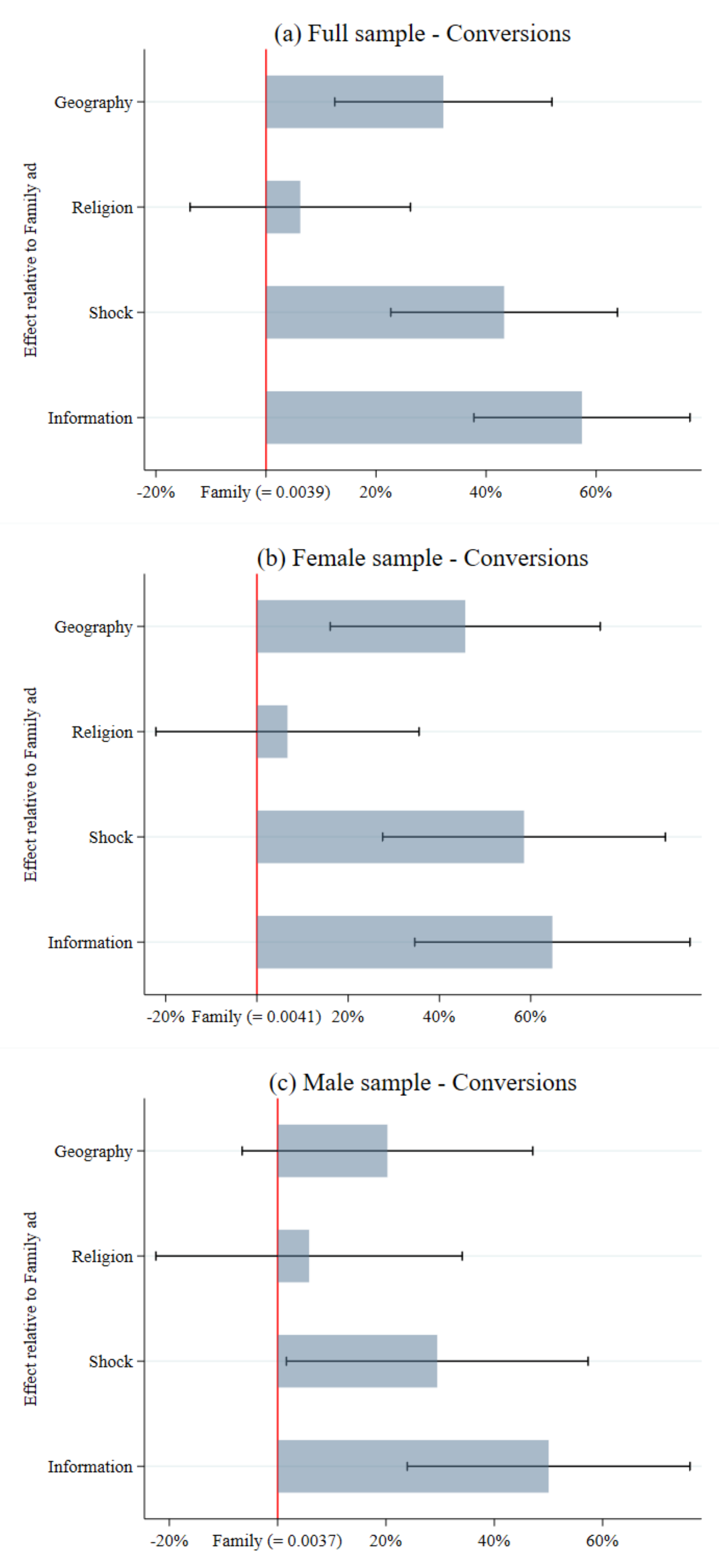

Figure 3. Ad effectiveness – Conversions. *Notes:* Figure 3 shows the effectiveness of the different ad themes in terms of conversions. The effects are presented as relative effect to the "family ad", which serves as reference category. The regression results of the logistic function (and OLS regressions) are presented in Appendix D.

5.3 Gender and age heterogeneity

To get a clearer picture of the heterogenous impacts among the different population groups by age and gender, we calculate the predicted probability of clicking on the different ads for eight distinct population subgroups by interacting the treatment dummies with the age and gender variables. The most effective ad for each of the eight population subgroups together with the resulting predicted clicking probabilities are presented in Figure 4 (predicted probabilities for all ad themes by age and gender are presented in Figure D1 in the Appendix).

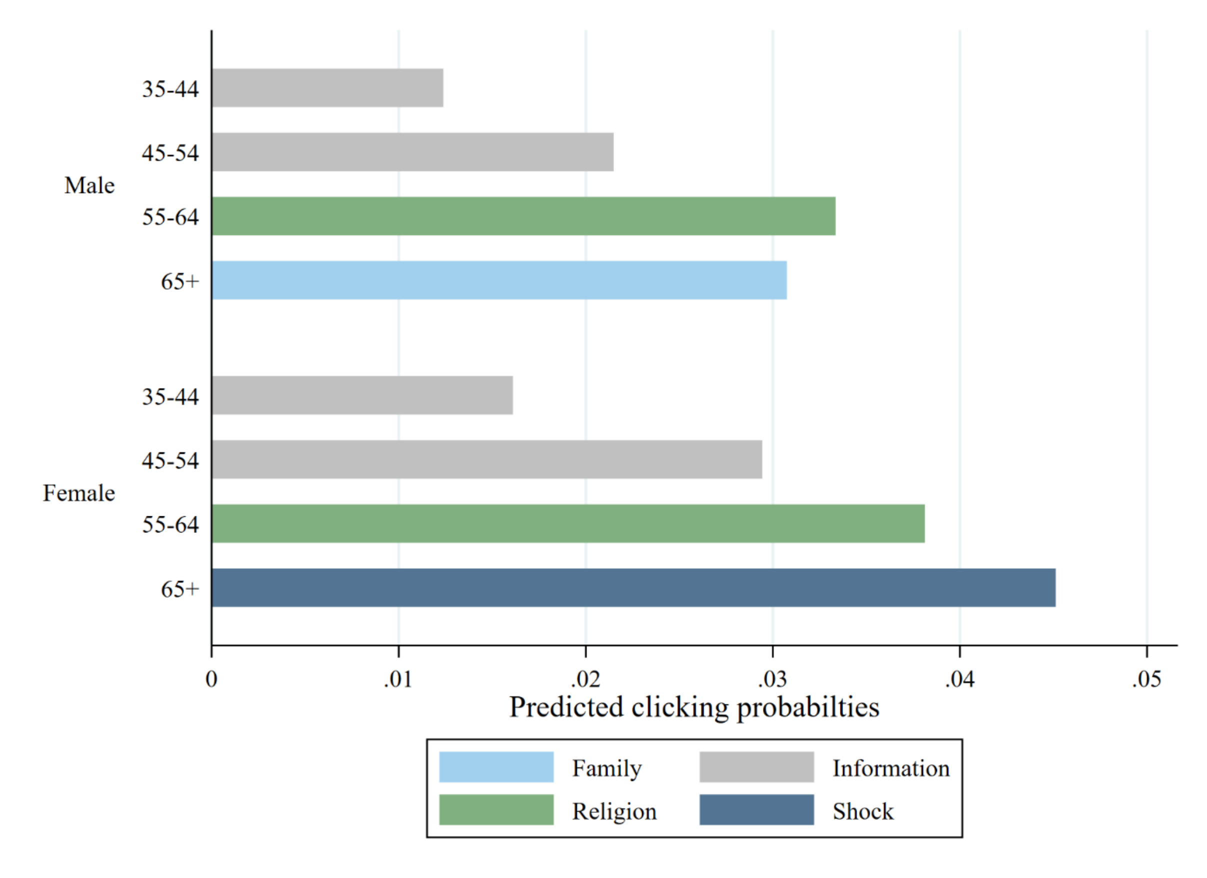

Figure 4: Best performing ad theme for eight population groups (age group × gender).

The "information" theme is estimated to be the best performing ad for four of the eight groups, all of which all belong to the two youngest cohorts. Older generations respond stronger to other themes, with the "shock" theme achieving the largest overall predicted probability: men above the age of 65 being exposed to the "shock" ad are predicted to click on it in 4.5% of all cases. This is more than twice the size of the mean clicking rate of 1.84%.

5.4 A comparison of the sample population and the general population

Next, we describe to what extent our generated sample of participants who completed the screening questionnaire differs from the universe of people that meet our eligibility criteria in Jakarta and Yogyakarta. To do so, we rely on different data sources: We use the official population statistics from the Indonesian Statistics Office (Badan Pusat Statistik – BPS, 2022), we derive health data for prevalence rates of high blood sugar and high blood pressure as well as data on risk factors (smoking, physical activity, diet) for the population above the age of 35 from RISKESDAS 2018 and lastly, we rely on primary survey data from the project SUNI-SEA – a large-scale, international policy and research project that implements NCD interventions in Southeast Asia and in which two of the authors (MF and MG) are involved. From this project, we use data collected in the two urban regions Kota Surakarta (Central Java) and Kota Kediri (East Java) on the topic of NCD screening activities. Although this sample does not present a representative sample for the cities Jakarta and Yogyakarta, it covers a randomly selected sample of individuals living in two urban areas on the same island as Jakarta and Yogyakarta (Java), and therefore provides an urban-Java-specific benchmark for the information that were not available in the representative sample of the RISKESDAS data.

Table 3 compares the data collected in the screening questionnaire with the population benchmark data from BPS, RISKESDAS and the data from SUNI-SEA, depending on the data availability. Column (1) contains the mean of the given variable from our generated data from the screening questionnaire, Column (2) presents the mean of the given variable from the comparison data, Columns (3) and (4) contain the information about the sample size and data source of the comparison data.

In comparison to the age distribution derived from the BPS statistics, the distribution generated in our experiment is slightly skewed towards the age group 45-55 and especially the group above the age of 65 is underrepresented in our sample. This is, however, not surprising, given that Facebook is over-proportionally used by younger cohorts in Indonesia (Statista, 2022b). Yet, it means that a Facebook campaign such as ours is less suited to address older generations as they are less often represented on social media platforms. In contrast, it can very effectively encourage the middle-aged generation in the age span of 45-54 years to conduct a self-screening activity online. This is an important finding, given that the risk of developing type 2 diabetes rises significantly after the age of 45 and regular diabetes screenings are recommended from the age of 45 onwards by the Indonesian Endocrinology Association (Soelistijo et al., 2021). In terms of the composition by sex, our generated sample can be considered statistically similar to the total population in Jakarta and Yogyakarta. There are no significant differences in the gender distribution between our data and the benchmark population.

Fifty percent of the respondents of the screening questionnaire claim to have ever been found to have high blood sugar. Unfortunately, there is no similar question being asked in RISKEDAS for comparison. However, the share of individuals above the age of 35 having ever been diagnosed with diabetes by a doctor is equal to 3.5% in the total Indonesian population and 6% in Jakarta and Yogyakarta, the shares of individuals with diabetes and pre-diabetes according to blood testing in total Indonesia are 14% and 30%, respectively, implying that only 25% of the individual with diabetes are aware of it. The sample from the SUNI-SEA project indicates that 62% have ever been screened for high blood sugar levels. Certainly, we cannot make a statement about how the terms “high blood sugar levels” were interpreted by the respondents in our questionnaire and having high blood sugar levels do not always imply (pre-)diabetes. Yet, such a high share implies a certain level of awareness about the possibility of having high blood sugar as well as a comparably higher risk in contrast to the benchmark population. Hence, taken together, it seems that we over-proportionally attract individuals who have at least once been tested for high blood sugar levels and had a positive test outcome. Similarly, the share of individuals having ever been diagnosed with high blood pressure or taking anti-hypertensive medication in our sample is significantly higher than in the benchmark population (33% vs. 16%), even though it is still smaller than the prevalence rate of hypertension according to measurements (44%). The same holds true for the risk factors obesity, daily physical activity and daily fruit consumption. On average the individuals in our sample are more likely to be obese, less likely to have sufficient physical activity and less likely to consume fruits or vegetables on a daily basis compared to the benchmark population. Only the prevalence of current smokers is significantly smaller in our sample than in the overall population.

To conclude, the sample generated by our experiment is skewed towards the age group 45-55 and seems to be significantly more at risk for having or developing diabetes compared to the total population in Jakarta and Yogyakarta. We interpret this self-selection as an indication that our campaign is very effective in reaching out to people at high risk that could potentially benefit from such an online screening activity. It could, of course, also imply that we only attract individuals that are already well aware of their high risk, potentially even have already been tested for (pre-)diabetes and therefore do not profit from the screening questionnaire in terms of new information about their risk status.

To prove that the latter scenario is less likely, we followed-up on those individuals who agreed to participated in further research activities, and show below that only one third of individuals that self-selected into the survey were already aware of having diabetes.

Table 3. Comparison of the sample and a benchmark population (population living in Jakarta and Yogyakarta, older than 35)

	(1) Mean (sample)	(2) Mean (pop. data)	(3) Sample Size (pop. data)	(4) Data source
Demographics				
Age				
35-45	0.32**	0.34	6,503,389	BPS 2022
45-54	0.47***	0.29	6,503,389	BPS 2022
55-54	0.16***	0.21	6,503,389	BPS 2022
Above 65	0.05***	0.16	6,503,389	BPS 2022
Female (=1)	0.49	0.50	6,503,389	BPS 2022
Blood glucose				
Ever been found to have high blood sugar levels	0.50	-		
Ever diagnosed with diabetes (Jakarta & Yogyakarta)		0.060	10,070	RISKESDAS 2018
Ever diagnosed with diabetes (Indonesia)[1]	-	0.035	418,187	RISKESDAS 2018
Diabetes according to blood test (Indonesia)[1]	-	0.14	25,767	RISKESDAS 2018
Pre-diabetes according to blood test (Indonesia)[1]	-	0.30	18,876	RISKESDAS 2018
Ever had blood sugar measured by health worker	-	0.62	775	SUNI-SEA 2021
Blood pressure / hypertension				
Ever diagnosed with high blood pressure or taking anti-hypertensive medication	0.33***	0.16	10,062	RISKESDAS 2018
Hypertension according to measurement[2]	-	0.44	6,079	RISKESDAS 2018
BMI				
Weight	69.25***	64.31	775	SUNI-SEA 2021
Height	162.36***	158.61	775	SUNI-SEA 2021
BMI[3]	26.14**	25.61	775	SUNI-SEA 2021
Underweight (BMI < 18.5)	0.03***	0.07	11,215	RISKESDAS 2018
Normal (BMI ≥18.5 - < 25.0)	0.44**	0.47	11,215	RISKESDAS 2018
Overweight (BMI ≥ 25.0 - < 27)	0.18*	0.16	11,215	RISKESDAS 2018
Obesity (BMI ≥27)	0.35***	0.29	11,215	RISKESDAS 2018
Risk factors				
Daily physical activity (Yes=1)	0.60***	0.68	11,598	RISKESDAS 2018
Smoking				
Never smoked	0.66***	0.57	11,778	RISKESDAS 2018
Stopped smoking	0.20***	0.15	11,778	RISKESDAS 2018
Currently smoking	0.14***	0.28	11,778	RISKESDAS 2018
Daily fruit consumption (Daily=1)	0.45***	0.93	11,791	RISKESDAS 2018

Notes: [1]The data for the diabetes and pre-diabetes prevalence rates come from the full Indonesian sample above the age of 35, since data per province and age category was not available. [2]The prevalence rate for hypertension comes only from the Jakarta sample, since data for Yogyakarta per age category was not available. [3]The BMI classifications are those provided in RISKESDAS. They differ from the scale used in the screening questionnaire, which relies on the risk-scale for BMI cut-off points for Asian populations provided by the WHO (2004), in which overweight is classified as having a BMI above 23 instead of 25 and obesity as having a BMI above 27.5.

5.5 Results from the follow-up survey

The primary aim of the follow-up survey was to elicit whether individuals with a high risk for diabetes complied with the received recommendation to schedule an appointment in a primary health care facility or with their general practitioner to undergo a blood test for diabetes. Also, if they reported not to plan to schedule an appointment, we were interested in the reasons. In total, 53 individuals participated in this survey, of which around 60% had received a high-risk score in the screening, 29% a medium-risk score and 11% a low-risk score. Obviously, we must assume that the group of respondents is not necessarily representative for the overall sample of 1,469 individuals that participated in the screening as the survey participation was voluntary and hence was based on self-selection. Yet, when comparing their observable characteristics with those of the overall sample we did not find any statistically significant differences in their characteristics, as displayed in Table E1 in Appendix E. Power of these tests is of course limited given the small sample size, but even the absolute size of the differences is in most cases surprisingly small. When asking whether the participants could remember their results from the screening, one third answered that they could not, without however any significant correlation between not being able to remember and the respective risk level (see Figures E1, E2 and Table E1 in Appendix E).

We asked about plans for a professional appointment to those individuals that either were at high risk according to their screening results or who mentioned to remember to have had a high risk. Of those individuals, 34% reported that they are already aware that they have diabetes and hence no further professional test was needed, 37% reported that they do not plan to schedule a professional appointment and 28% reported that they already have scheduled an appointment since they participated in our screening or that they intend to do so in the next month (14% each) (Figure 5a). Hence, almost one third of those deemed to be at high risk, corresponding to 43% of those being unaware of their disease status, seem to comply with the recommendation to request a professional blood test for diabetes. If we extrapolate this share to the full sample, this amounts to 250 complying individuals at high risk. Moreover, these numbers also verify that the campaign does not only attract individuals that are already well aware of having diabetes, but that we achieve to attract a significant share of individuals being at high risk of developing diabetes and being unaware about it.

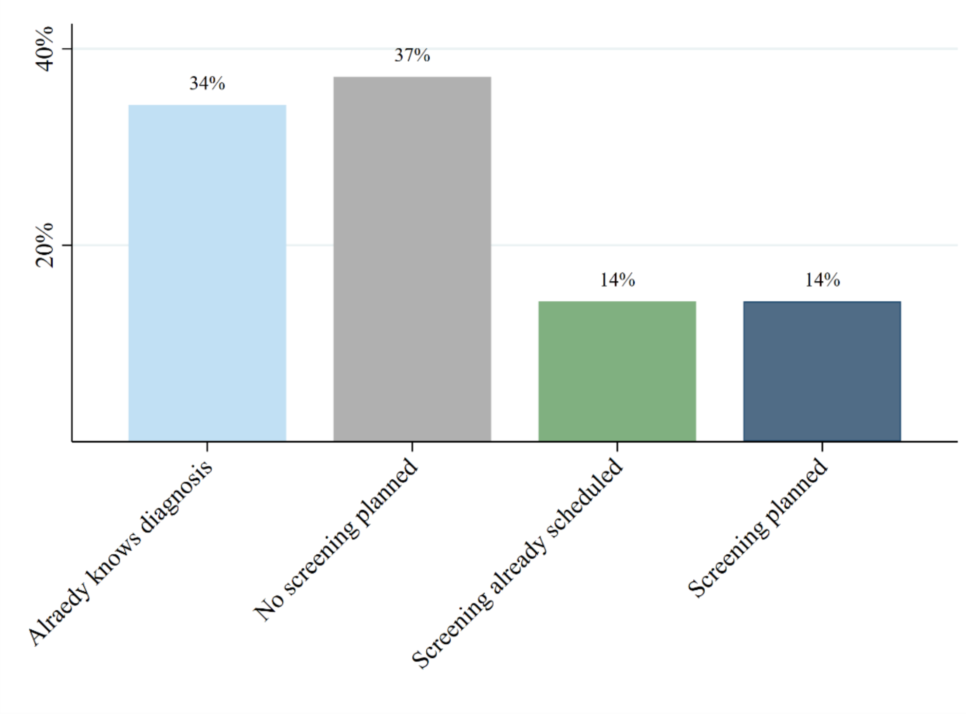

Figure 5a. Plans for professional follow-up screening

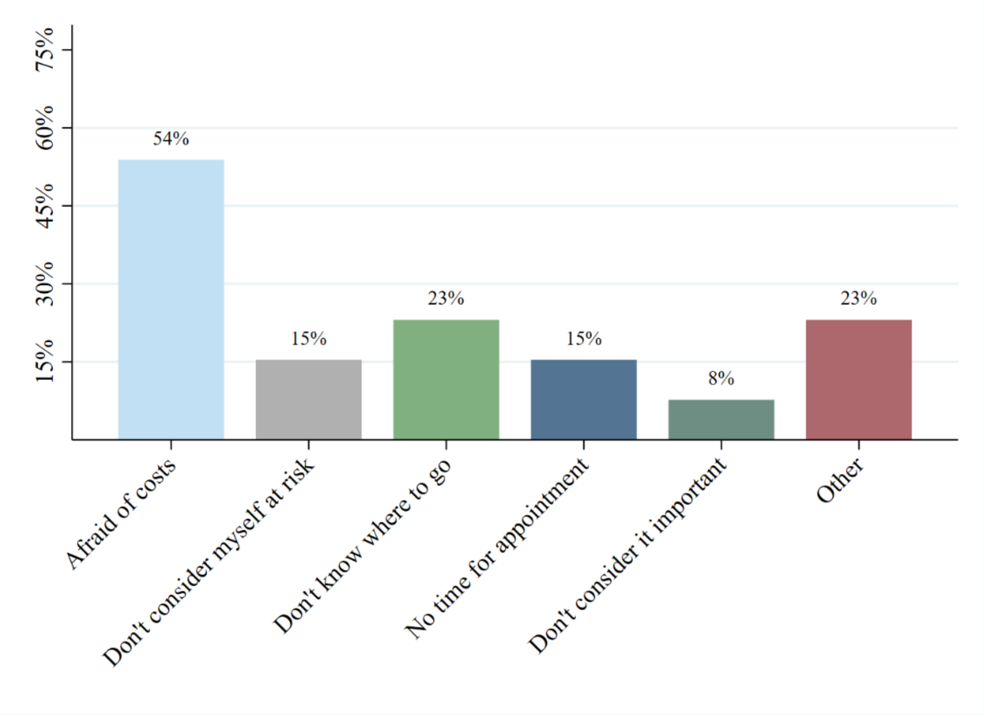

Figure 5b. Reasons for not planning a professional follow-up screening

Notes: Figure 5a (top) shows the responses of respondents the question whether they plan to follow up with the received recommendation of scheduling a professional diabetes screening. Figure 5b (bottom) shows the reasons for not scheduling an appointment for those who answered they do not plan a professional diabetes screening.

To account for a potential desirability bias in our survey, i.e., individuals may just report to comply with the received recommendation because they expect that this is the socially desired answer, we randomized two different framings of the same question. One framing highlighted the importance of scheduling a professional appointment given the possible severe health consequences of diabetes, the other framing implied that the time that had passed since the screening was probably too short to already have scheduled a meeting (the exact framings are shown in Appendix E). Whereas the first framing should increase the psychological cost of admitting not having made an appointment, the second framing makes it psychologically rather cheap to admit not having made an appointment. If both framings lead to a comparable share of respondents who report to have taken an appointment, we interpret this as evidence that a desirability bias is not at work. And indeed, we do not find any significant differences in the response pattern to the questions, which increases our trust in the reported answers (Table E3, Appendix E).

Individuals reporting not intending to schedule an appointment for a professional blood test were further asked for the main reasons keeping them from doing so (Figure 5b). More than half answered to be afraid of the cost that such a test might imply. Given the small sample size for this question, the results have to be interpreted carefully. Yet, since preventive health care visits, including tests for chronic diseases, are free of charge for those covered by the national health insurance JKN (which around 80% in our sample are), a potentially promising strategy to increase screening rates for diabetes could be to distribute detailed information about the services covered in the insurance scheme.

6. Cost-effectiveness

In a context of limited public health budgets, identifying cost-effectiveness of health interventions is crucial for the design of a national health strategy. Indonesia had a health budget of less than 3% of its GDP over the last two decades, with which it ranks behind, for example, India, Vietnam and Thailand (World Bank, 2022). The government started to integrate the WHO's *Package of Essential Noncommunicable Disease* (PEN) interventions into its national public health strategy to counteract the surge of NCDs (WHO, 2010; Rattanavipapong et al., 2016; Widyaningsih et al., 2022). Yet, the country is still in the process of designing a nationwide cost-effective NCD strategy (Rattanavipapong et al., 2016). While the current national policy includes regular diabetes (and hypertension) screening activities at the community level (called *POSBINDU)*, this policy has been shown to suffer from suboptimal implementation and targeting, low participation rates and inadequate coverage (Rattanavipapong et al., 2016; Alfiyah and Pujiyanto, 2021; Widyaningsih et al., 2022).

In the following, we analyze the cost-effectiveness of our Facebook health campaign, under the assumption that it would be scaled-up to a one-year-running health campaign across the whole Island of Java. This implies a target population of about 25 million Facebook users above the age of 35. We perform a simple cost-effectiveness calculation based on the cost and effectiveness parameters derived from our study and enrich them with a repeated decision-tree model. The final cost parameter of interest is the cost per newly diagnosed person.

Table 4, Panel A presents the cost indicators from our Facebook campaign averaged over the sub-groups: ad theme × gender × age group × region. Panel B presents the cost indicators by ad theme. The most relevant indicator is the cost per completed questionnaire, which is on average US$0.74, yet with a large variation. The cheapest cost per completed questionnaire was achieved by the "information ad", targeting females aged 45-55 and living in Jakarta (US$ 0.24), whereas it was extremely costly to generate conversion, i.e., completed questionnaires, with the "religion ad", targeting males aged 65+ and living in Yogyakarta (US$ 3.91). For the further analysis in terms of the campaign cost, we assume that the ad theme "information" would exclusively be used, since it proved most effective in terms of generating conversions (0.6% of Facebook users seeing the ad completed the screening questionnaire) and had on average the lowest cost per conversion (US$0.49).

Table 4. Cost per view, reach, click and conversion (in US$)

	(1) Mean	(2) SD	(3) Min	(4) Max
Panel A				
Cost per view	0.001	0.000	0.001	0.003
Cost per reach	0.004	0.001	0.002	0.008
Cost per click	0.203	0.056	0.084	0.035
Cost per conversion	0.738	0.385	0.237	3.909

	(1) Cost per view	(2) Cost per reach	(3) Cost per click	(3) Cost per conversion
Panel B				
Ad theme				
Family	0.001	0.004	0.226	0.987
Information	0.001	0.003	0.145	0.488
Geography	0.001	0.004	0.221	0.705
Religion	0.002	0.005	0.255	1.152
Shock	0.001	0.004	0.202	0.700

Notes: Table 5, Panel A presents the summary statistics of the cost indicators, averaged over the sub-groups: ad theme × gender × age group × region. Panel B presents the cost indicators by ad theme.

We use the average cost for a professional diabetes blood test at an Indonesian primary health care facility drawn from Rattanavipapong et al. (2016), who estimate a cost of US$2.84 per professional screening. Further, we rely on an assumption regarding the test sensitivity and two assumptions which we derive from the results of the screening questionnaire and our follow-up survey.

First, we assume that the screening questionnaire is adequately sensitive to detect diabetes, and hence we assume that the prevalence rate of diabetes in the "medium risk" and "low risk" group is 0%, whereas the prevalence rate in the "high risk" group is 80%. This sensitivity measure is well in line with that identified by Harbuwono et al. (2021) in Indonesia, who estimate a sensitivity between 68% and 93%, depending on the cut-off level.

Second, we have to acknowledge some form of self-selection, since we do attract a disproportional high share of individuals that has ever been told to have high blood sugar levels (50% of participants) and a significant share that is already aware of the diagnosis. Hence, to reflect the 34% of individuals with a high risk who indicated they do not need to conduct a professional follow-up screening since they already know they have diabetes, we assume that 50% of the 80% of individuals that have diabetes (given the first assumption) are already aware of their diagnosis. This leads to in total 40% of those individuals with high a risk already being diagnosed, which is slightly higher than the 37% identified in our study.

Given this self-selection process into the campaign participation, it also implies that the total prevalence rate of diabetes in the campaign-participating population is slightly higher than in the non-participating population. Since the weighted prevalence rate for both groups (participating and not-participating) must be equal to the overall prevalence rate of 14%, the prevalence rate of diabetes in the non-participating group is reduced to 13.78% and the ratio of diagnosed to undiagnosed cases is slightly lower (24.4%) than in the overall population.

Third, reflecting the results of the follow-up survey, we assume that individuals with a “high risk” which are *unaware* of their diseases status follow up with a professional diabetes screening in 40% of the cases (slightly less than the 43% found in our study).

We conduct multiple one-way sensitivity analyses below to assess the robustness of our results with respect to the three outlined assumptions.

Integrating the former assumptions, the cost and effectiveness measures and the risk distribution identified in our study as well as the prevalence rates of diagnosed and non-diagnosed diabetes according to the RISKESDAS survey leads to the final decision-tree depicted in Figure 6.

We model the decision tree-flow for the total population of 25 million Javanese Facebook users above 35 and as a monthly repeating intervention over the course of one year, i.e., all individuals who do not participate in the online screening questionnaire in the first (second, third etc.) month enter the decision-tree again in the second (third, fourth etc.) month. At the end of the decision-tree, an individual can have one of the following statuses: i) healthy, ii) diagnosed diabetes or iii) undiagnosed diabetes.

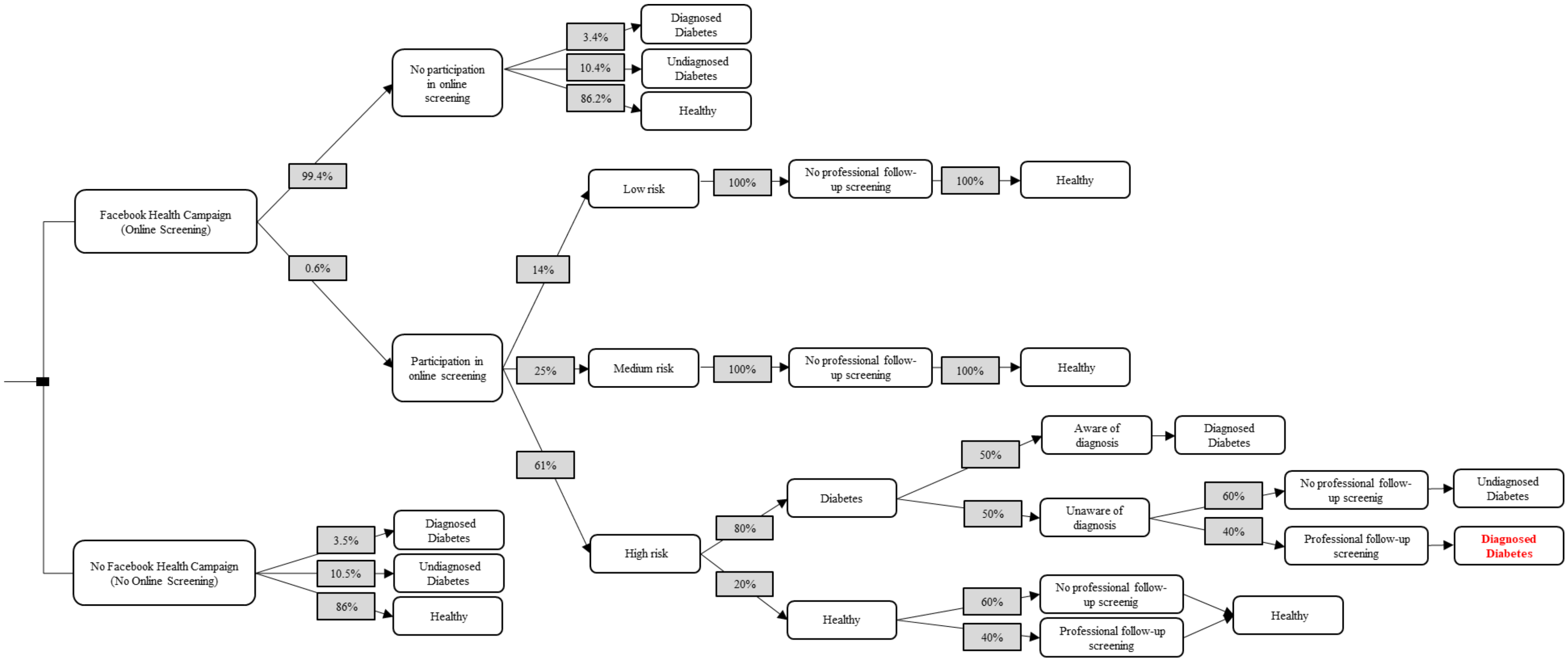

Figure 6: Decision Tree

To be precise, the important difference between the results of the screening vs. the non-screening scenario is the distribution of individuals that have diabetes (actually 14% of the total population) between the two states “diagnosed diabetes” and “undiagnosed diabetes”.

The results of this repeated decision tree simulation are presented in Table 5. The first row presents the results associated with the parameter assumptions outlined above ((i) the sensitivity of the online screening questionnaire, (ii) the share of individuals in the high risk group being aware of their diabetes status, and (iii) the share of individuals with a high risk and being unaware of the diagnosis following up with professional screening). We conduct further sensitivity checks by modifying these three assumptions first one by one and then all together to see how they impact the final cost-effectiveness. The modified parameter is marked in bold in each row (see Table 5).

The main analysis reveals that the hypothetical upscaling of the intervention to whole Java over the period of one year could lead to about 1.7 million users participating in the online screening, of which about 250,000 would continue with the professional follow-up screening, and finally to the diagnosis of almost 170,000 previously undetected diabetes cases. This corresponds to an increase from 25% to 29% of diagnosed cases relative to all cases, i.e., an increase of 16%. While the share might still seem small, the absolute number is large especially in light of the low cost and low effort needed to implement an online health campaign. This low cost is further confirmed when we look at the total cost of the proposed intervention (including the professional follow-up screening), which is slightly more than $US1.5 million. Dividing the total cost by the 170,000 newly diagnosed cases, the cost to detect one more previously undiagnosed person amounts to approximately US$9.

Modifying several of the input parameters shows that the cost per diagnosed person hardly surpasses a threshold of $US15. Even in the most pessimistic scenario (last row), with an assumed test-sensitivity of only 60%, with 75% of individuals receiving a high-risk score and having diabetes already knowing their diagnosis, and only 20% of individuals following up with the recommendation, the cost for one newly diagnosed person amounts only to $US37. Contrasting these amounts to the cost of long-term diabetes care in Indonesia suggest a large cost-saving potential. Hidayat et al. (2022) estimate the direct medical cost for a patient with diabetes consequences at US$930 per person and year in the Indonesian health care system, whereas a patient without consequences accumulates cost of only US $420. Under the premise that early diagnosis reduces the probability of developing severe diabetic consequences, an online diabetes health campaign offers the possibility to reduce health care expenditures in the long term.

Table 5: Cost-effectiveness results from the repeated decision tree model with sensitivity analysis

	Input parameters (assumptions)			Input parameters (cost)		Results				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Sensitivity of online screening questionnaire	Share of individuals with "high risk" following up with professional screening	Share of individuals in high risk group being aware of diabetes status	Cost per online screening ($US)	Cost per professional follow-up screening ($US)	# of online screenings	# of professional follow-up screenings	Total cost ($US) (4)*(6)+(5)*(7)	Newly diagnosed cases	Cost per newly diagnosed patient ($US)
Main analysis	80%	50%	40%	0.49	2.84	1,741,772	254,995	1,574,171	169,997	9.26
Sensitivity analysis	**60%**	50%	40%	0.49	2.84	1,741,772	297,494	1,694,868	127,498	13.29
	70%	50%	40%	0.49	2.84	1,741,772	276,245	1,634,521	148,747	10.99
	90%	50%	40%	0.49	2.84	1,741,772	233,746	1,513,823	191,246	7.92
One-way sensitivity analysis	80%	**25%**	40%	0.49	2.84	1,741,772	339,994	1,815,568	254,995	7.12
	80%	**75%**	40%	0.49	2.84	1,741,772	169,997	1,332,776	84,998	15.68
	80%	50%	**20%**	0.49	2.84	1,741,772	127,498	1,212,079	84,998	14.26
	80%	50%	**60%**	0.49	2.84	1,741,772	382,493	1,936,265	254,995	7.59
Best-case scenario	**90%**	**25%**	**60%**	0.49	2.84	1,741,772	494,053,00	2,253,095	430,305	5.24
Worst-case scenario	**60%**	**75%**	**20%**	0.49	2.84	1,741,772	116,872,00	1,181,901	31,874	37.08

Notes: Table 5 shows the results from the repeated decision tree simulations. The first row presents the cost-effectiveness results when the input parameters are set as discussed in Section 6. The following rows present the results when the input parameters are modified. The modified parameters are indicated in bold. In the last two rows, all three input parameters as discussed in Section 6 are modified to present a best-case and worst-case scenario.

7. Conclusion

While diabetes is a preventable disease and can be treated effectively if it is timely diagnosed, it presents currently the sixth leading cause of death in middle-income countries and the third leading cause of death in Indonesia. A major reason for that is the large share of undetected cases; in Indonesia, only one in four persons with diabetes is aware of its diagnosis. To counteract the surging rates, governments across South- and Southeast Asia are striving for (cost-)effective solutions to prevent and control diabetes. Indonesia for example focuses on screening at the community level (*POSBINDU*), yet so far without sizeable success.

Public health campaigns can help to increase the awareness about the disease and to incentivize populations at risk to change unhealthy lifestyle behaviors, to inform them about important preventive health measures, such as screening, and to ensure adequate treatment in case of a positive diagnosis. In this paper, we design and evaluate the impact of an online awareness campaign about type 2 diabetes implemented on the social media platform Facebook. Our randomized experiment shows that advertisements that convey factual information about the health consequences of diabetes and those containing a rather shocking message about the deadly consequences of diabetes are most effective in incentivizing viewers to click on the ads and to search for more information. Overall, we were able to reach out to almost 300,000 individuals in only three weeks of time and with a budget of less than US$1,100. More than 1,400 individuals completed the offered online diabetes risk screening on our campaign website, implying a cost of less than US$0.75 per person screened in that way.

We find that such a campaign is especially well suited to reach out to the population in the age range 45-55. This is an encouraging finding, given that the risk of diabetes ascends after the age of 45 and a diagnosis of elevated blood sugar at this age offers the opportunity for early treatment to prevent further devastating health consequences. We also find that a large share of participants in the online screening has an over-proportional high risk for diabetes compared to a benchmark population. When we investigate further whether this is driven by a self-selection process of patients already aware of their diagnoses, we find that 34% of individuals with a high risk have already been diagnosed. This, however, leaves a significant proportion of 66% of individuals with a high risk still being unaware of their actual disease status, which can potentially benefit from such a campaign.

Using the cost and benefit parameters derived in our study to perform a cost-effectiveness analysis based on decision tree model, we find that our campaign – if up-scaled to the Island of Java over a period of one year – offers the potential to detect around 170,000 previously undetected cases. This implies costs per additional person diagnosed of only about $US9.

Overall, our study suggests that a diabetes health campaign implemented on the social media platform Facebook can reach out to hundreds of thousands of people in a short period of time at a very low cost.

We believe that our results have a similar validity for many other middle-income countries, especially in the Southeast Asian region.

To the best of our knowledge our study is the first to implement a health-related field experiment via Facebook in a low or middle-income country context. Obviously, similar Facebook campaigns could also be run for other health issues, such as testing for sexual transmitted diseases, Covid-19 vaccinations or drink-driving. Our study also provides important insights what kind of framings or pictorial contents drive health-related decisions and hence provide evidence about which psychological channels can effectively incentivize individuals to learn about their health risks.

References

Alfiyah, A., & Pujiyanto, P. (2019). An Analysis on the Implementation of the Integrated Guidance Post (Posbindu) Activities for Non-Communicable Diseases at Bogor City in 2018. *Journal of Indonesian Health Policy and Administration*, *4*(1), 11-15.

American Diabetes Association (1993). American Diabetes Alert. *Diabetes Forecast*, *46*(3), 54-55.

American Diabetes Association (2019). Good to Know: Diabetes Risk Test. *Clinical Diabetes*, *37*(3), 291.

Ananda, A., & Bol, D. (2021). Does knowing democracy affect answers to democratic support questions? a survey experiment in Indonesia. *International Journal of Public Opinion Research*, *33*(2), 433-443.

Bakti, I.G.M.Y., Sumardjo, S., Fatchiya, A., & Syukri, A.F. (2021) Public Knowledge of Diabetes and Hypertension in Metropolitan Cities, Indonesia. *The Public Health Science Journal*, *13*(1), 1-13.

Bloom, D.E., Chen, S., McGovern, M., Prettner, K., Candeias, V., Bernaert, A. & Cristin, S. (2015). *The Economics of Non-Communicable Diseases in Indonesia*. World Economic Forum, Harvard School of Public Health. Online available at: https://www3.weforum.org/docs/WEF_The_Economics_of_non_Disease_Indonesia_2015.pdf. [Last accessed 24.05.2022].

BPJS Kesehatan (2015). Laporan Pengeloaan Program Tahun 2015 & Lapuran Keuangan Tahun 2015 (Auditan). Online available at: https://bpjs-kesehatan.go.id/bpjs/arsip/view/572. [Last accessed 21.05.2022].

BPJS Kesehatan (2016). Laporan Pengeloaan Program Tahun 2016 & Lapuran Keuangan Tahun 2016 (Auditan). Online available at: https://bpjs-kesehatan.go.id/bpjs/arsip/view/835. [Last accessed 21.05.2022].

Breza, E., Stanford, F.C., Alsan, M., Alsan, B., Banerjee, A., Chandrasekhar, A.G., ... & Duflo, E. (2021). Effects of a large-scale social media advertising campaign on holiday travel and COVID-19 infections: a cluster randomized controlled trial. *Nature Medicine*, *27*(9), 1622-1628.

Badan Pusat Statistik – BPS (2022). Population Indicators. [Dataset]. Online available at: https://www.bps.go.id/subject/12/kependudukan.html#subjekViewTab3. [Last accessed 17.05.2022].

Capuno, J., Kraft, A., & O'Donnell, O. (2021). Effectiveness of clinic-based cardiovascular disease prevention: A randomized encouragement design experiment in the Philippines. *Social Science & Medicine*, *283*, 114194.

Centers for Disease Control and Prevention (2020). CDC in Indonesia. Factsheet Indonesia. Online available at: https://www.cdc.gov/globalhealth/countries/indonesia/pdf/indonesia-fs.pdf. [Last accessed 21.03.22].

Choi, I., Milne, D.N., Glozier, N., Peters, D., Harvey, S.B., & Calvo, R A. (2017). Using different Facebook advertisements to recruit men for an online mental health study: Engagement and selection bias. *Internet Interventions*, *8*, 27-34.

Dammert, A.C., Galdo, J.C., & Galdo, V. (2014). Preventing dengue through mobile phones: evidence from a field experiment in Peru. *Journal of Health Economics*, *35*, 147-161.

Dans, A., Ng, N., Varghese, C., Tai, E.S., Firestone, R., & Bonita, R. (2011). The rise of chronic non-communicable diseases in southeast Asia: time for action. *The Lancet*, *377*(9766), 680-689.

de Vries Mecheva, M., Rieger, M., Sparrow, R., Prafiantini, E., & Agustina, R. (2021). Snacks, nudges and asymmetric peer influence: Evidence from food choice experiments with children in Indonesia. *Journal of Health Economics*, *79*, 102508.

Deloitte Indonesia (2019). *Ensuring the Sustainability of JKN-KIS for the Indonesian People: Intended to cover the health costs of all Indonesians, the JKN-KIS national insurance program is now on the brink. How can this program survive?* Deloitte Indonesia Perspectives. Online available at: https://www2.deloitte.com/content/dam/Deloitte/id/Documents/about-deloitte/id-about-dip-edition-1-chapter-1-en-sep2019.pdf. [Last accessed 17.05.22].

Dukpa, W., Teerawattananon, Y., Rattanavipapong, W., Srinonprasert, V., Tongsri, W., Kingkaew, P., ... & Wangmo, K. (2015). Is diabetes and hypertension screening worthwhile in resource-limited settings? An economic evaluation based on a pilot of a Package of Essential Non-communicable disease interventions in Bhutan. *Health Policy and Planning, 30*(8), 1032-1043.

Fauzi, N.F.M., Wafa, S.W., Ibrahim, A.M., Raj, N.B., & Nurulhuda, M.H. (2022). Translation and Validation of American Diabetes Association Diabetes Risk Test: The Malay Version. *The Malaysian Journal of Medical Sciences: MJMS, 29*(1), 113.

Gallagher, K. M., & Updegraff, J. A. (2012). Health message framing effects on attitudes, intentions, and behavior: a meta-analytic review. *Annals of Behavioral Medicine*, *43*(1), 101-116.

Gordon, B.R., Zettelmeyer, F., Bhargava, N., & Chapsky, D. (2019). A comparison of approaches to advertising measurement: Evidence from big field experiments at Facebook. *Marketing Science*, *38*(2), 193-225.

Grow, A., Perrotta, D., Del Fava, E., Cimentada, J., Rampazzo, F., Gil-Clavel, S., & Zagheni, E. (2020). Addressing public health emergencies via Facebook surveys: advantages, challenges, and practical considerations. *Journal of Medical Internet Research, 22*(12), e20653.

Hall, M.G., Grummon, A.H., Higgins, I.C., Lazard, A.J., Prestemon, C.E., Avendaño-Galdamez, M.I., & Taillie, L.S. (2022). The impact of pictorial health warnings on purchases of sugary drinks for children: A randomized controlled trial. *PLoS Medicine, 19*(2), e1003885.

Harbuwono, D. S., Mokoagow, M. I., Magfira, N., & Helda, H. (2021). ADA Diabetes Risk Test Adaptation in Indonesian Adult Populations: Can It Replace Random Blood Glucose Screening Test?. *Journal of Primary Care & Community Health*, *12*, 21501327211021015.

Hidayat, B., Ramadani, R.V., Rudijanto, A., Soewondo, P., Suastika, K., & Ng, J.Y.S. (2022). Direct Medical Cost of Type 2 Diabetes Mellitus and Its Associated Complications in Indonesia. *Value in Health Regional Issues*, 28, 82-89.

International Diabetes Federation. (2021). IDF Diabetes Atlas, 10th Edition. Brussels, Belgium. Online available at: https://www.diabetesatlas.org. [Last accessed 19.03.22].

Internet World Stats (2022). Internet 2021 Usage in Asia Internet Users, Facebook Subscribers & Population Statistics for 35 countries and regions in Asia. Online available at: https://www.internetworldstats.com/stats3.htm. [Last accessed 24.05.22].

Kementerian Kesehatan Republik Indonesia (2018). RISKESDAS 2018. Laporan Nasional Riskesdas. Jakarta: Kementerian Kesehatan Republik Indonesia.

Kepios (2022). Digital 2022: Indonesia. [Presentation]. Online available at: https://datareportal.com/reports/digital-2022-indonesia. [Last accessed 24.05.22].

Kim, H. B., Lee, S. A., & Lim, W. (2019). Knowing is not half the battle: impacts of information from the National health screening program in Korea. *Journal of Health Economics, 65*, 1-14.

Kosinski, M., Matz, S. C., Gosling, S. D., Popov, V., & Stillwell, D. (2015). Facebook as a research tool for the social sciences: Opportunities, challenges, ethical considerations, and practical guidelines. *American Psychologist*, *70*(6), 543.

Kostova, D., Husain, M. J., Sugerman, D., Hong, Y., Saraiya, M., Keltz, J., & Asma, S. (2017). Synergies between communicable and noncommunicable disease programs to enhance global health security. *Emerging Infectious Diseases*, *23*(Suppl 1), 40-46.

Krishnamurthy, P., Carter, P., & Blair, E. (2001). Attribute framing and goal framing effects in health decisions. *Organizational Behavior and Human Decision Processes*, *85*(2), 382-399.

Kristina, S.A., Salsabila, F.A., & Hanifah, S. (2020). Awareness of Diabetes Mellitus Among Rural Population in Indonesia. *International Journal of Pharmaceutical Research*, *13*(1), 168-175.

Ku, G.M., & Kegels, G. (2013). The performance of the Finnish Diabetes Risk Score, a modified Finnish Diabetes Risk Score and a simplified Finnish Diabetes Risk Score in community-based cross-sectional screening of undiagnosed type 2 diabetes in the Philippines. *Primary Care Diabetes*, *7*(4), 249-259.

Kuehnle, D. (2019). How effective are pictorial warnings on tobacco products? New evidence on smoking behaviour using Australian panel data. *Journal of Health Economics, 67*, 102215.

Levy, R. E. (2021). Social media, news consumption, and polarization: Evidence from a field experiment. *American Economic Review, 111*(3), 831-70.

Ligita, T., Wicking, K., Harvey, N., & Mills, J. (2018). The profile of diabetes healthcare professionals in Indonesia: a scoping review. *International Nursing Review, 65*(3), 349-360.

Lim, H.M., Chia, Y.C., & Koay, Z.L. (2020). Performance of the Finnish Diabetes Risk Score (FINDRISC) and Modified Asian FINDRISC (ModAsian FINDRISC) for screening of undiagnosed type 2 diabetes mellitus and dysglycaemia in primary care. *Primary Care Diabetes, 14*(5), 494-500.

Lindstrom, J., & Tuomilehto, J. (2003). The diabetes risk score: a practical tool to predict type 2 diabetes risk. *Diabetes Care, 26*(3), 725-731.

Manne-Goehler, J., Geldsetzer, P., Agoudavi, K., Andall-Brereton, G., Aryal, K.K., Bicaba, B.W., ... & Jaacks, L. M. (2019). Health system performance for people with diabetes in 28 low-and middle-income countries: a cross-sectional study of nationally representative surveys. *PLoS Medicine, 16*(3), e1002751.

Marcus, M.E., Reuter, A., Rogge, L., & Vollmer, S. (2022). The effect of SMS reminders on health screening uptake: A randomized experiment in Indonesia. CRC-PEG Discussion Papers, No. 284. Online available at http://www2.vwl.wiso.uni-goettingen.de/courant-papers/CRC-PEG_DP_284.pdf. [Last accessed 21.03.22].

Meta. (2022a). About A/B testing. Online available at https://en-gb.facebook.com/business/help/1738164643098669. [Last accessed 11.04.22].

Meta. (2022b). Understand how results are sometimes calculated differently. Online available at https://en-gb.facebook.com/business/help/1329822420714248. [Last accessed 11.04.22].

Meta. (2022c). Add URL parameters to your ads. Online available at https://en-gb.facebook.com/business/help/1016122818401732. [Last accessed 11.04.22].

Muñoz-González, M.C., Lima-Martínez, M.M., Nava, A., Trerotola, G., Paoli, M., Cabrera-Rego, J.O., ... & Paez, J. (2019). FINDRISC modified for Latin America as a screening tool for persons with impaired glucose metabolism in Ciudad Bolívar, Venezuela. *Medical Principles and Practice*, *28*(4), 324-332.

Neundorf, A., & Öztürk, A. (2021). Recruiting Research Participants through Facebook: Assessing Facebook Advertisement Tools. OSF Preprint. Online available at https://osf.io/3g74n/. [Last accessed 22.03.22].

Nieto-Martínez, R., González-Rivas, J.P., Aschner, P., Barengo, N.C., & Mechanick, J.I. (2017). Transculturalizing diabetes prevention in Latin America. *Annals of Global Health*, *83*(3-4), 432-443.

Orazi, D.C., & Johnston, A.C. (2020). Running field experiments using Facebook split test. *Journal of Business Research*, *118*, 189-198.

Parackal, M., Parackal, S., Eusebius, S., & Mather, D. (2017). The use of Facebook advertising for communicating public health messages: a campaign against drinking during pregnancy in New Zealand. *Journal of Medical Internet Research: Public Health and Surveillance*, *3*(3), e7032.

Pereira da Veiga, C.R., Semprebon, E., da Silva, J.L., Lins Ferreira, V., & Pereira da Veiga, C. (2020). Facebook HPV vaccine campaign: insights from Brazil. *Human Vaccines and Immunotherapeutics*, *16*(8), 1824-1834.

Prabhakaran, S., Dutta, A., Fagan, T., & Ginivan, M. (2019). *Financial Sustainability of Indonesia's Jaminan Kesehatan Nasional: Performance, Prospects, and Policy Options*. Washington, DC: Palladium, Health Policy Plus, and Jakarta, Indonesia: Tim Nasional Percepatan Penanggulangan Kemiskinan (TNP2K).

Rattanavipapong, W., Luz, A.C.G., Kumluang, S., Kusumawardani, N., Teerawattananon, Y., Indriani, C.I.D., ... & Singh, D. (2016). One step back, two steps forward: an economic evaluation of the PEN program in Indonesia. *Health Systems & Reform*, *2*(1), 84-98.

Rokhman, M.R., Arifin, B., Zulkarnain, Z., Satibi, S., Perwitasari, D.A., Boersma, C., ... & van der Schans, J. (2022). Translation and performance of the Finnish Diabetes Risk Score for detecting undiagnosed diabetes and dysglycaemia in the Indonesian population. *PloS one*, *17*(7), e0269853.

Rothman, A.J., & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: the role of message framing. *Psychological Bulletin*, *121*(1), 3.

Slade, A.N. (2012). Health investment decisions in response to diabetes information in older Americans. *Journal of Health Economics*, *31*(3), 502-520.

Soelistijo, S.A., Suastika, K., Lindarto, D., Decroli, E., Permana, H., Sucipto, K.W., … & Susanto, H. (2021). *Pedoman pengelolaan dan pencegahan diabetes melitus tipe 2 di Indonesia 2021*. [E-Book] Perkumpulan Endokrinologi Indonesia, 1-119. Online available at https://pbperkeni.or.id/wp-content/uploads/2021/11/22-10-21-Website-Pedoman-Pengelolaan-dan-Pencegahan-DMT2-Ebook.pdf. [Last accessed 01.05.2022].

Statista (2022a). Share of Facebook users in Indonesia as of April 2021, gender. Online available at https://www.statista.com/statistics/997045/share-of-facebook-users-by-gender-indonesia/. [Last accessed 16.05.2022].

Statista (2022b). Share of Facebook users in Indonesia as of April 2021, by age group. Online available at https://www.statista.com/statistics/1235773/indonesia-share-of-facebook-users-by-age/. [Last accessed 16.05.2022].

Thornton, L., Batterham, P.J., Fassnacht, D.B., Kay-Lambkin, F., Calear, A.L., & Hunt, S. (2016). Recruiting for health, medical or psychosocial research using Facebook: Systematic review. *Internet Interventions*, *4*, 72-81.

Widyahening, I.S., Van Der Graaf, Y., Soewondo, P., Glasziou, P., & Van Der Heijden, G.J. (2014). Awareness, agreement, adoption and adherence to type 2 diabetes mellitus guidelines: a survey of Indonesian primary care physicians. *BMC Family Practice*, *15*(1), 1-8.

Widyaningsih, V., Febrinasari, R.P., Pamungkasari, E.P., Mashuri, Y.A., Sumardiyono, S., Balgis, B., ... & Probandari, A. (2022). Missed opportunities in hypertension risk factors screening in Indonesia: a mixed-methods evaluation of integrated health post (POSBINDU) implementation. *BMJ Open*, *12*(2), e051315.

World Bank (2022). Current health expenditure (% of GDP). World Bank Indicators. Online available at: https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS . [Last accessed 17.05.2022].

World Health Organization - WHO Expert Consultation (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *The Lancet*, *363*(9403), 157-163.

World Health Organization (2010). *Package of Essential Noncommunicable (PEN) disease interventions for primary health care in low-resource settings*. Geneva: World Health Organization.

World Health Organization (2013). *Global action plan for the prevention and control of noncommunicable diseases 2013-2020*. Geneva: World Health Organization.

World Health Organization (2021). Diabetes Fact Sheet. Online available at: https://www.who.int/news-room/fact-sheets/detail/diabetes. [Last accessed: 19.03.22].

Zhou, B., Lu, Y., Hajifathalian, K., Bentham, J., Di Cesare, M., Danaei, G., ... & Gaciong, Z. (2016). Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants. *The Lancet*, *387*(10027), 1513-1530.

Appendix A: Ad themes and designs

Figure A1. Ad theme "Family". *Notes:* English translation: Diabetes can affect every family. Diabetes can be prevented and controlled. Learn about your diabetes risk now!

Figure A2. Ad theme "Geography – Yogyakarta". *Notes:* English translation: Yogyakarta is one of the cities with the highest diabetes prevalence rates. Learn about your diabetes risk now!

Figure A3. Ad theme "Geography – Jakarta". *Notes:* English translation: Jakarta is the city with the highest diabetes prevalence rate in Indonesia. Learn about your diabetes risk now!

Figure A4. Ad theme "Information". *Notes:* English translation: Diabetes can cause blindness, heart diseases and kidney failure. Learn about your diabetes risk now!

Figure A5. Ad theme "Religion". *Notes:* English translation: ``and do not throw [yourselves] with your [own] hands into destruction'' (Q.S. Al-Baqarah, 2:195). Diabetes can be prevented and controlled. Learn about your diabetes risk now!

Figure A6. Ad theme "Shock". *Notes:* English translation: Diabetes can have deadly consequences. Diabetes can be prevented and controlled. Learn about your diabetes risk now!

Appendix B: Screening questionnaire

Table B1: Screening questionnaire and scoring system (English)

No	Question	Alternatives	Score
1	How old are you?	Younger than 45	0
		45-55	1
		56-65	2
		Older than 65	3
2	What is your gender?	Female	0
		Male	1
3	Have you ever been found to have high blood sugar levels? (This could be, for example, in a health examination, during an illness or during pregnancy.)	No	0
		Yes	3
4	Have you ever been diagnosed with high blood pressure or are you taking any anti-hypertensive drugs?	No	0
		Yes	1
5	Do you have a mother, father, sister or brother who was diagnosed with diabetes?	No	0
		Yes	1
6	What is your weight? (in kg)		
7	What is your height? (in cm)		
	BMI calculated from 6 and 7	≤ 23	0
		23 – 27.5	1
		27.5 – 32.5	2
		≥ 32.5	3
8	Do you usually have at least 30 minutes of physical activity per day? (Physical activity means moderate or vigorous activity such as walking, swimming, badminton etc.)	Yes	0
		No	1
9	Do you smoke cigarettes?	No, I never smoked.	0
		No, I stopped smoking.	0
		Yes	1
10	Do you eat fruit or vegetables every day? (Please do not count fruit juices.)	Yes	0
		No	1
11	Do you drink sugary beverages every day? (Examples of these are soft drinks, sweetened tea or fruit juices with sugar.)	No	0
		Yes	1
Scoring			
≤ 3	**Low risk**		
4–5	**Medium risk**		
≥ 6	**High risk**		

Notes: Adapted from the American Diabetes Association (1993, 2019), Lindstrom and Tuomilehto (2003), Fauzi et al. (2022) and Rokhman et al. (2022).

Table B2. Screening questionnaire and scoring system (Bahasa Indonesia)

No	Question	Alternatives	Score
1	Berapa umur Anda?	Di bawah 45 tahun	0
		45-55 tahun	1
		56-65 tahun	2
		Di atas 65 tahun	3
2	Apa jenis kelamin Anda?	Perempuan	0
		Laki-laki	1
3	Apakah hasil pemeriksaan gula darah Anda pernah tinggi?	Tidak	0
	(Contohnya saat tes kesehatan, ketika sakit, atau selama kehamilan.)	Ya	3
4	Apakah Anda pernah didiagnosis menderita tekanan darah tinggi atau	Tidak	0
	sedang mengonsumsi obat antihipertensi?	Ya	1
5	Apakah Anda memiliki ibu, ayah, saudara perempuan atau saudara laki-laki	Tidak	0
	yang menderita diabetes?	Ya	1
6	Berapa berat badan Anda? (dalam kilogram)		
7	Berapa badan tinggi Anda? (dalam sentimeter)		
	IMT berdasarkan 6 dan 7	≤ 23	0
		23 – 27.5	1
		27.5 – 32.5	2
		≥ 32.5	3
8	Apakah Anda biasa melakukan aktivitas fisik, minimal 30 menit per hari?	Ya	0
	(Aktivitas fisik yang dimaksud adalah aktivitas fisik sedang atau berat seperti berjalan kaki, berenang, bulu tangkis, dll.)	Tidak	1
9	Apakah Anda merokok?	Tidak, saya tidak pernah merokok.	0
		Tidak, saya berhenti merokok.	0
		Ya	1
10	Seberapa sering Anda mengkonsumsi sayur atau buah?	Setiap hari	0
	(Tidak termasuk jus buah.)	Tidak setiap hari	1
11	Seberapa sering Anda mengkonsumi minuman manis?	Tidak setiap hari	0
	(Contohnya adalah minuman ringan, minuman bersoda, teh manis, atau jus buah dengan gula.)	Setiap hari	1
Skor			
≤ 3	**Risiko rendah**		
4–5	**Risiko sedang**		
≥ 6	**Risiko tinggi**		

Notes: Adapted from the American Diabetes Association (1993, 2019), Lindstrom and Tuomilehto (2003), Fauzi et al. (2022) and Rokhman et al. (2022).

Appendix C: Additional summary statistics of the screening questionnaire

Table C1. Summary statistics of started screening questionnaires (with duplicates)

	(1) Mean	(2) SD	(3) Min	(4) Max	(5) Obs.
Age					2,052
Below 45	0.28				
45-54	0.46				
55-54	0.18				
Above 65	0.08				
Female (=1)	0.48				1,873
Ever had high blood glucose	0.50				1,810
Ever diagnosed with high blood pressure	0.34				1,794
Family member with diagnosed diabetes	0.53				1,777
Weight	69.30	16.87	33	185	1,561
Height	162.51	7.86	140	195	1,561
BMI	26.13	5.52	11	70	1,561
Daily physical activity (Yes=1)	0.60				1,544
Smoking					1,541
Never smoked	0.65				
Stopped smoking	0.20				
Currently smoking	0.15				
Daily fruit or vegetable consumption (Daily=1)	0.45				1,539
Daily sweet beverages consumption (Daily=1)	0.30				1,533
Risk score	6.34	2.58	0	14	1,533
Low risk	0.15				
Medium risk	0.25				
High risk	0.60				

Table C2. Summary statistics of completed questionnaires, full sample with duplicates

	(1) Mean	(2) SD	(3) Min	(4) Max	(5) Obs.
Age					1,533
Below 45	0.32				
45-54	0.46				
55-54	0.16				
Above 65	0.05				
Female (=1)	0.48				1,533
Ever had high blood glucose	0.49				1,533
Ever diagnosed with high blood pressure	0.33				1,533
Family member with diagnosed diabetes	0.54				1,533
Weight	69.31	16.95	33	185	1,533
Height	162.51	7.81	140	195	1,533
BMI	26.14	5.55	11	70	1,533
Daily physical activity (Yes=1)	0.60				1,533
Smoking					1,533
Never smoked	0.65				
Stopped smoking	0.20				
Currently smoking	0.15				
Daily fruit or vegetable consumption (Daily=1)	0.45				1,533
Daily sweet beverages consumption (Daily=1)	0.30				1,533
Risk score	6.34	2.58	0	14	1,533
Low risk	0.15				
Medium risk	0.25				
High risk	0.60				

Appendix D: Additional regression tables and figures (main results)

Table D1. Results – Ad effectiveness (Regression Coefficients - Logit model)

	(2) Link clicks	(3) Link clicks men	(4) Link clicks women	(6) Conversions	(7) Conversions men	(8) Conversions women
Reference ad: Family						
Information	0.221***	0.107*	0.348***	0.462***	0.412***	0.502***
	(0.042)	(0.058)	(0.061)	(0.083)	(0.115)	(0.121)
Geography	-0.019	-0.113*	0.075	0.284***	0.188	0.378***
	(0.046)	(0.065)	(0.066)	(0.089)	(0.127)	(0.125)
Religion	0.111**	0.050	0.172**	0.062	0.057	0.065
	(0.048)	(0.068)	(0.068)	(0.101)	(0.142)	(0.142)
Shock	0.147***	0.074	0.219***	0.366***	0.262**	0.463***
	(0.045)	(0.063)	(0.065)	(0.089)	(0.127)	(0.125)
Female	0.221***			0.216***		
	(0.028)			(0.053)		
Reference age: Below 45						
45-54	0.583***	0.585***	0.576***	0.705***	0.650***	0.758***
	(0.034)	(0.048)	(0.047)	(0.062)	(0.087)	(0.087)
55-64	0.931***	0.970***	0.883***	0.752***	0.759***	0.738***
	(0.041)	(0.057)	(0.060)	(0.081)	(0.111)	(0.119)
65+	0.913***	0.949***	0.862***	0.221*	0.326**	0.020
	(0.050)	(0.066)	(0.077)	(0.122)	(0.152)	(0.208)
Region (Yogyakarta=1)	-0.007	0.044	-0.065	-0.297***	-0.302***	-0.292***
	(0.028)	(0.039)	(0.041)	(0.055)	(0.076)	(0.079)
Constant	-4.610***	-4.572***	-4.421***	-5.930***	-5.854***	-5.784***
	(0.045)	(0.060)	(0.060)	(0.089)	(0.119)	(0.118)
Observations	286,776	160,560	126,216	286,776	160,560	126,216
P-values of pairwise-tests:						
Information vs. Geography	0.000	0.000	0.000	0.019	0.032	0.256
Information vs. Religion	0.012	0.353	0.005	0.000	0.004	0.000
Information vs. Shock	0.069	0.562	0.031	0.202	0.151	0.722
Religion vs. Geography	0.006	0.017	0.149	0.018	0.330	0.018
Religion vs. Shock	0.443	0.712	0.482	0.001	0.124	0.003
Shock vs. Geography	0.002	0.032	0.025	0.318	0.525	0.452

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The number of completed survey questionnaires counted as "conversion" are derived from the reduced sample without duplicated questionnaires (N=1,469) of which 1,443 could be linked to the referring ad theme. The missing 26 could not be linked to the referring ad theme due to tracking restrictions. The table shows the regression coefficients from the logistic regression.

Table D2. Results – Ad effectiveness (Marginal effects - Logit model)

	(1) Link clicks	(2) Link clicks men	(3) Link clicks women	(4) Conversions	(5) Conversions men	(6) Conversions women
Reference ad: Family						
Information	0.004***	0.002*	0.007***	0.002***	0.002***	0.003***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Geography	-0.000	-0.002*	0.001	0.001***	0.001	0.002***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Religion	0.002**	0.001	0.003**	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Shock	0.003***	0.001	0.004***	0.002***	0.001**	0.002***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Female	0.004***			0.001***		
	(0.001)			(0.000)		
Reference age: Below 45						
45-54	0.009***	0.008***	0.010***	0.003***	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
55-64	0.018***	0.017***	0.019***	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)
65+	0.017***	0.017***	0.018***	0.001*	0.001*	0.000
	(0.001)	(0.002)	(0.002)	(0.000)	(0.001)	(0.001)
Region (Yogyakarta=1)	-0.000	0.001	-0.001	-0.001***	-0.001***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Mean of dependent variable in reference group (Family)	0.017	0.017	0.017	0.0039	0.0041	0.0037
Observations	286,776	160,560	126,216	286,776	160,560	126,216

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The number of completed survey questionnaires counted as "conversion" are derived from the reduced sample without duplicated questionnaires (N=1,469) of which 1,443 could be linked to the referring ad theme. The missing 26 could not be linked to the referring ad theme due to tracking restrictions. The table shows the marginal effects from the logit model.

Table D3. Results – Ad effectiveness for link clicks (OLS model)

	(1) Link clicks full sample	(2) Link clicks women	(3) Link clicks men	(4) Link clicks with controls	(5) Link clicks gender interactions	(6) Link clicks age interactions
Reference ad: Family						
Information	0.00308***	0.00649***	0.00105	0.00402***	0.00180*	0.00360***
	(0.00076)	(0.00121)	(0.00098)	(0.00076)	(0.00098)	(0.00089)
Geography	-0.00094	0.00104	-0.00253**	-0.00021	-0.00162	0.00049
	(0.00075)	(0.00114)	(0.00100)	(0.00075)	(0.00100)	(0.00088)
Religion	0.00203**	0.00328***	0.00089	0.00196**	0.00082	0.00034
	(0.00085)	(0.00126)	(0.00116)	(0.00085)	(0.00116)	(0.00099)
Shock	0.00239***	0.00434***	0.00086	0.00265***	0.00127	0.00243**
	(0.00081)	(0.00123)	(0.00107)	(0.00081)	(0.00107)	(0.00096)
Reference age: Below 45						
45-54				0.00932***	0.00930***	0.00936***
				(0.00056)	(0.00056)	(0.00121)
55-64				0.01789***	0.01786***	0.01449***
				(0.00099)	(0.00099)	(0.00198)
65+				0.01719***	0.01719***	0.01974***
				(0.00124)	(0.00124)	(0.00275)
Gender (Female=1)				0.00400***	0.00123	0.00401***
				(0.00051)	(0.00110)	(0.00051)
Region (Yogyakarta=1)				-0.00015	-0.00017	-0.00013
				(0.00051)	(0.00051)	(0.00051)
Information#Female					0.00508***	
					(0.00156)	
Geography#Female					0.00291*	
					(0.00152)	
Religion#Female					0.00234	
					(0.00171)	
Shock#Female					0.00286*	
					(0.00163)	
Information#45-54						0.00136
						(0.00168)
Information#55-64						0.00260
						(0.00284)
Information#65+						-0.00548
						(0.00369)
Geography#45-54						-0.00195
						(0.00165)
Geography#55-64						0.00283
						(0.00294)
Geography#65+						-0.00615*
						(0.00374)
Religion#45-54						0.00151
						(0.00183)
Religion#55-64						0.01018***
						(0.00331)
Religion#65+						-0.00249
						(0.00415)
Shock#45-54						-0.00096
						(0.00175)
Shock#55-64						0.00329
						(0.00301)
Shock#65+						0.00232
						(0.00413)
Constant	0.01704***	0.01718***	0.01691***	0.00852***	0.00988***	0.00873***
	(0.00055)	(0.00079)	(0.00076)	(0.00070)	(0.00084)	(0.00076)
Observations	286,776	126,216	160,560	286,776	286,776	286,776
R-squared	0.00014	0.00029	0.00011	0.00281	0.00285	0.00292

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table D4. Results – Ad effectiveness for conversions (OLS model)

	(1) Conversion full sample	(2) Conversion women	(3) Conversion men	(4) Conversion with controls	(5) Conversion gender interactions	(6) Conversion age interactions
Reference ad: Family						
Information	0.00209***	0.00264***	0.00180***	0.00224***	0.00188***	0.00212***
	(0.00039)	(0.00062)	(0.00050)	(0.00039)	(0.00050)	(0.00046)
Geography	0.00110***	0.00172***	0.00061	0.00126***	0.00077	0.00106**
	(0.00039)	(0.00060)	(0.00051)	(0.00039)	(0.00051)	(0.00045)
Religion	0.00029	0.00032	0.00027	0.00022	0.00018	-0.00031
	(0.00041)	(0.00060)	(0.00055)	(0.00041)	(0.00055)	(0.00044)
Shock	0.00168***	0.00250***	0.00106**	0.00171***	0.00111**	0.00150***
	(0.00041)	(0.00065)	(0.00054)	(0.00042)	(0.00054)	(0.00049)
Reference age: Below 45						
45-54				0.00342***	0.00341***	0.00279***
				(0.00031)	(0.00031)	(0.00061)
55-64				0.00377***	0.00375***	0.00349***
				(0.00050)	(0.00050)	(0.00098)
65+				0.00082*	0.00080*	0.00154
				(0.00048)	(0.00048)	(0.00102)
Gender (Female=1)				0.00110***	0.00044	0.00110***
				(0.00027)	(0.00053)	(0.00027)
Region (Yogyakarta=1)				-0.00146***	-0.00146***	-0.00146***
				(0.00027)	(0.00027)	(0.00027)
Information#Female					0.00075	
					(0.00080)	
Geography#Female					0.00105	
					(0.00079)	
Religion#Female					0.00008	
					(0.00082)	
Shock#Female					0.00130	
					(0.00084)	
Information#45-54						0.00110
						(0.00091)
Information#55-64						-0.00078
						(0.00141)
Information#65+						-0.00251*
						(0.00137)
Geography#45-54						0.00090
						(0.00092)
Geography#55-64						0.00057
						(0.00151)
Geography#65+						-0.00246*
						(0.00134)
Religion#45-54						0.00069
						(0.00091)
Religion#55-64						0.00188
						(0.00157)
Religion#65+						0.00112
						(0.00165)
Shock#45-54						0.00034
						(0.00094)
Shock#55-64						0.00028
						(0.00152)
Shock#65+						0.00113
						(0.00172)
Constant	0.00390***	0.00406***	0.00376***	0.00241***	0.00274***	0.00261***
	(0.00026)	(0.00039)	(0.00036)	(0.00036)	(0.00042)	(0.00038)
Observations	286,776	126,216	160,560	286,776	286,776	286,776
R-squared	0.00013	0.00022	0.00010	0.00094	0.00096	0.00100

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table D5. Probability of Attrition (LPM) – conditional on starting the screening questionnaire

	(1) Attrition	(2) Attrition	(3) Attrition	(4) Attrition
Reference age: below 45				
45-54	0.084***		0.034*	
	(0.021)		(0.019)	
55-64	0.175***		0.108***	
	(0.029)		(0.028)	
65+	0.342***		0.231***	
	(0.042)		(0.045)	
Gender (Female=1)		-0.006	0.005	
		(0.018)	(0.018)	
Reference: below 45#male				
45-54#male				0.023
				(0.027)
55-64#male				0.096**
				(0.038)
65+ #male				0.243***
				(0.055)
Below 45#female				-0.007
				(0.028)
45-54#female				0.039
				(0.027)
55-64#female				0.114***
				(0.041)
65+ #female				0.190**
Constant	0.155***	0.185***	0.129***	0.135***
	(0.015)	(0.012)	(0.017)	(0.020)
Observations	2,052	1,873	1,873	1,873
R-squared	0.046	0.000	0.025	0.025

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

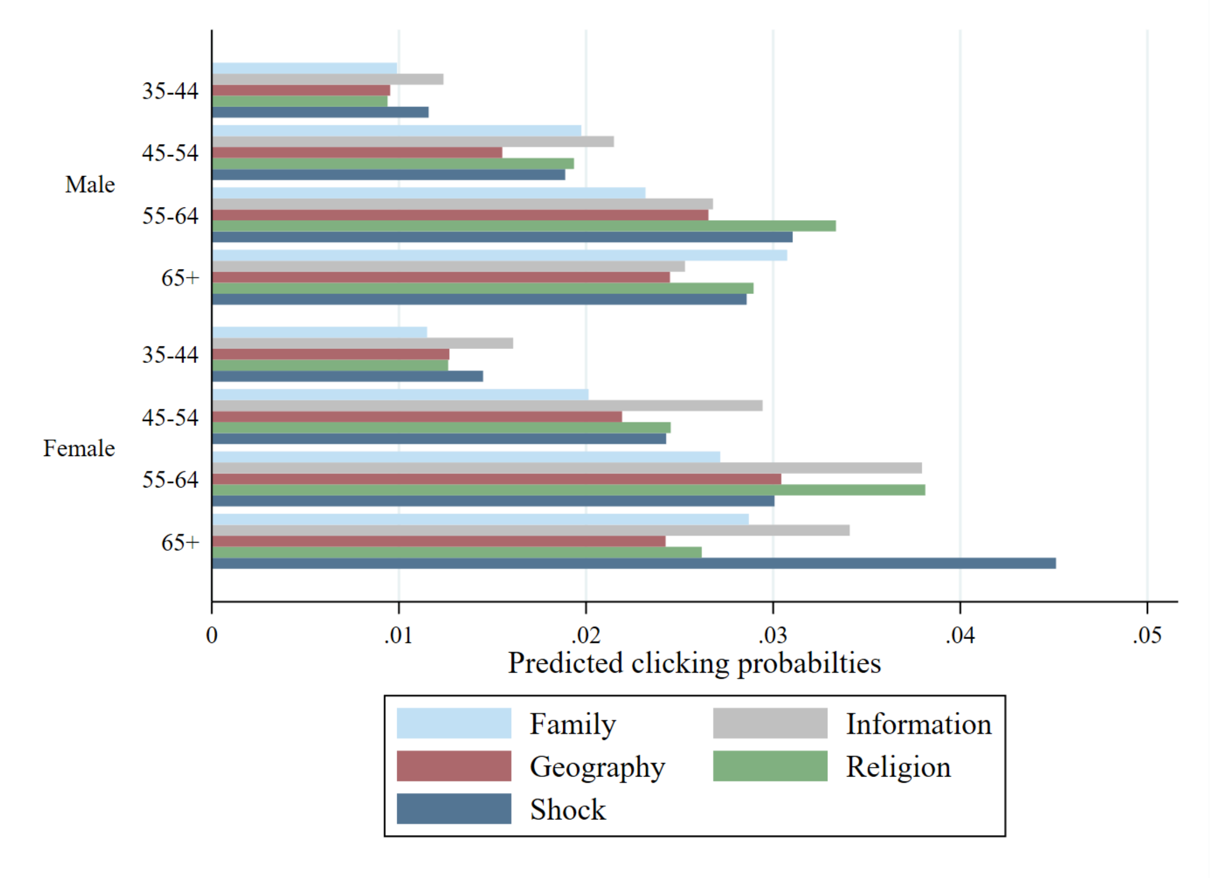

Figure D1: Predicted clicking probabilities for all age × gender subgroups by ad-theme

Appendix E: Additional tables and figures from the follow-up survey

Differences between full sample, e-mail providers and follow-up completers

Table E1. Differences between full sample, e-mail providers and follow-up completers

	(1) Full Sample	(2) E-mail providers	(3) Follow-Up completers	(4) Difference (1)-(2)	(5) Difference (1)-(3)
Age distribution					
35-45	0.32	0.21	0.23	0.13***	0.09
45-54	0.47	0.52	0.60	-0.07	-0.13
55-54	0.16	0.20	0.12	-0.04	0.05
Above 65	0.05	0.07	0.06	-0.02	-0.00
Female	0.49	0.51	0.46	-0.03	0.03
Ever had high blood sugar levels	0.50	0.66	0.60	-0.18***	-0.10
Ever diagnosed with high blood pressure	0.33	0.33	0.37	0.01	-0.03
Family member with diagnosed diabetes	0.54	0.60	0.56	-0.07	-0.02
Weight	69.28	67.82	68.11	1.71	1.22
Height	162.43	161.6	162.33	0.97	0.11
BMI	26.15	25.88	25.80	0.32	0.36
Daily physical activity	0.60	0.61	0.56	-0.01	0.04
Smoking					
Never smoked	0.66	0.66	0.63	0.00	0.02
Stopped smoking	0.20	0.20	0.17	0.00	0.03
Currently smoking	0.14	0.14	0.19	0.00	-0.05
Daily fruit consumption	0.45	0.45	0.44	0.00	0.01
Daily sweet beverages consumption	0.30	0.29	0.37	0.02	-0.06
Risk score	6.37	7.00	6.85	-0.73***	-0.49
Low risk	0.14	0.11	0.12	0.04	0.03
Medium risk	0.25	0.22	0.29	0.03	-0.04
High risk	0.61	0.67	0.60	-0.07*	0.01
Number of observations	1,469	205	52	1,469	1,469

Notes: Table E1 presents the results of the mean comparisons between the full sample of participants that completed the screening, the e-mail providers and the sample of participants that completed the follow-up survey. *** p<0.01, ** p<0.05, * p<0.1.

Risk distribution and recalled risk of follow-up survey respondents

Figures E1 and E2 display the risk distribution of respondents who participated in the follow-up survey. Figure E1 displays the risk distribution of respondents according to the risk level that was calculated in the screening questionnaire. Figure E2 displays the risk distribution according to the reported risk by the respondent in the follow-up survey.

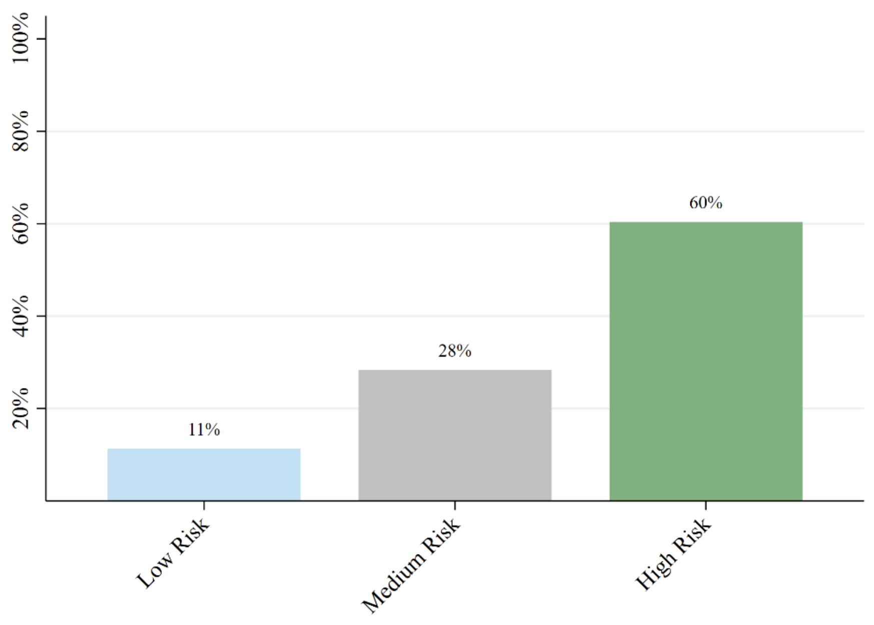

Figure E1. Share of respondents in follow-up survey by risk group according to screening.

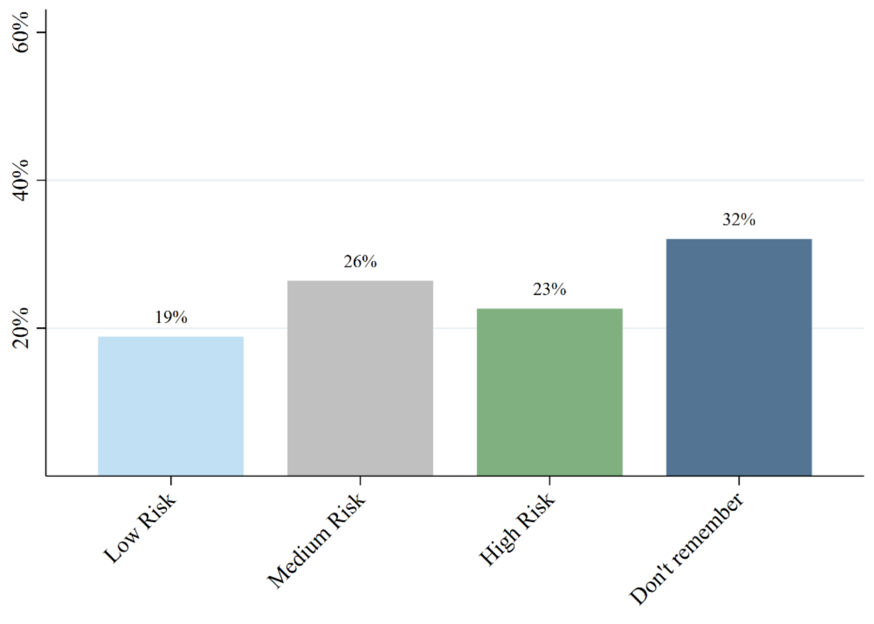

Figure E2. Share of respondents in follow-up survey according to own recall.

Table E2 reports the results of a chi-squared test to assess whether the reporting of not being able to remember the risk results from the screening questionnaire differed across the three risk groups. The results suggest that this is not the case, since the null-hypothesis of no significant correlations cannot be rejected (p-value 0.362).

Table E2. Screening risk and recall risk distribution

		Reported Risk (Recall)				
		Don't remember	Low Risk	Medium Risk	High Risk	Total
Screening Risk	Low Risk	1	3	1	1	6
	Medium Risk	4	4	3	4	15
	High Risk	12	3	10	7	32
	Total	17	10	14	12	53

Pearson chi2(6) = 6.9114 Pr = 0.329

Details on and results of the randomized framing

To account for a potential desirability bias in our survey, i.e. individuals may just report to comply with the received recommendation because they expect that this is the socially desired answer, we randomized two different framings of the same question.

Framing 1:

After the completion of the test you have received the recommendation to meet with a physician or GP to request a professional blood test for diabetes.

Since it has already been 6 weeks since the completion of the risk test and given the urgency of a high diabetes risk, we assume that you have already scheduled an appointment with a doctor for a professional diabetes screening.

- ☐ Indeed, I have already scheduled an appointment.
- ☐ No, but I plan to schedule an appointment.
- ☐ I don't plan to schedule an appointment.
- ☐ I don't need an appointment since I already know that I have diabetes.

Framing 2:

After the completion of the test you have received the recommendation to meet with a physician or GP to request a professional blood test for diabetes.

Since you have completed the online diabetes risk test only 6 weeks ago, we assume that the time might have not been sufficient to schedule an appointment with a doctor for a professional diabetes screening.

- ☐ Indeed, but I plan to schedule an appointment
- ☐ I don't plan to schedule an appointment.
- ☐ I have already scheduled an appointment
- ☐ I don't need an appointment since I already know that I have diabetes.

Table E3 reports the results of a chi-squared test to assess whether the response pattern to the question about the professional blood test differs by the two framings presented above. The results suggest that this is not the case, since the null-hypothesis of no significant correlations cannot be rejected (p-value 0.494).

Table E3. Framing experiment

		Plans for scheduling professional blood test				
		Already knows diagnosis	No plans to schedule	Scheduled after screening	Plans to schedule	Total
Framing	Framing 1	4	8	3	3	18
	Framing 2	8	5	2	2	17
	Total	12	13	5	5	35

Pearson chi2(3) = 2.399 Pr = 0.494