



HAL
open science

Economics of attention: The gender-based big communication study on depression

Yulin Hswen, Nguemdjo Ulrich, Yom-Tom Elad, Bruno Ventelou

► **To cite this version:**

Yulin Hswen, Nguemdjo Ulrich, Yom-Tom Elad, Bruno Ventelou. Economics of attention: The gender-based big communication study on depression. *SSM - Population Health*, 2022, 17, pp.100993. 10.1016/j.ssmph.2021.100993 . hal-03545595

HAL Id: hal-03545595

<https://amu.hal.science/hal-03545595>

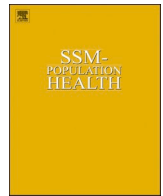
Submitted on 15 Sep 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives 4.0 International License



Economics of attention: The gender-based Bing communication study on depression

Yulin Hswen^{a,b}, Nguemdjo Ulrich^{c,d,*}, Yom-Tom Elad^{e,f}, Bruno Ventelou^c

^a Department of Epidemiology and Biostatistics, University of California San Francisco, San Francisco, USA

^b Bakar Computational Health Sciences Institute, University of California San Francisco, San Francisco, USA

^c Aix Marseille Univ, CNRS, AMSE, Marseille, France

^d Aix Marseille Univ, LPED, Marseille, France

^e Microsoft Research, Herzeliya, Israel

^f Faculty of Industrial Engineering and Management, Technion, Israel Institute of Technology, Haifa, Israel

ARTICLE INFO

Keywords:

Personalized communication
Depression
Bing
COVID-19

ABSTRACT

This study examines the impact of personalized gender-based communication to encourage the screening of depression and seeking out mental health care consultation. An internet search engine advertisement was deployed on Bing, Microsoft during the COVID-19 pandemic lockdowns in the Provence-Alpes-Côte d'Azur (PACA) region in France during the month of May 2020, the height of the France lockdowns. A two-armed study was conducted with Arm A containing a non-personalized (control) advertisement and Arm B containing a personalized gender-based advertisement. 53,185 advertisements were shown between the two arms. Results show that receiving a personalized gender-based message increases the probability of clicking on the advertisement. However, upon clicking the advertisement, there was no significant difference in the completion of the depression questionnaire between the two groups. These results suggest that although personalized gender messaging is effective at drawing in a greater click rate, it did not increase, nor decrease, the conversion rate to monitor depression by self-assessment.

1. Introduction

Previous disaster mental health research has provided evidence that adverse mental health responses are associated with quarantining and social distancing (Dailey & Kaplan, 2014). During the Covid-19 pandemic, shelter-in-place and social distancing were the most effective methods for combatting the spread of disease in the absence of a vaccine. Concerns were raised of the possible rise in depression during shelter-in-place. Additionally, since persons were instructed to shelter-in-place, there may have been difficulty in detecting mental health symptoms in the population since persons were not routinely interacting with their health care providers to be able to identify early signs of depression. In France, a national lockdown of shelter-in-place was implemented during March 17, 2020 to May 11, 2020 (Ramiz et al., 2021). With the French population requiring to shelter-in-place, connection through the Internet and digital resources was a method to reach the population and those who may have been mentally impacted by these quarantine policies.

Internet searches queries have been used as a method to perform detection of surveillance of disease symptoms and behaviors (Zhang et al., 2019). In the context of disorder detection, searches from users for symptoms of depression may be a method of connecting with the population during a time when offline treatment is uneasily available during the COVID-19 pandemic. Based on these internet search queries, relevant communication can be devised to target users based on their symptoms for depression and direct them to resources for their relevant mental health needs.

Thus, to potentially address the potential rise in depression, we sought to test a digital search campaign and behavioral economic strategy to reach those experiencing depression and guide them to seeking help for their underlying symptoms. To increase the likelihood of users interacting with our surveillance we proposed an economic-psychological behavioral “limited capacity model”, that states that an individual possesses a limited pool of informational processing resources such as attention, calculation capacity, or cognitive effort (Kahneman, 1973). This “economics of attention” at the age of internet, insists on the

* Corresponding author. Aix Marseille Univ, CNRS, AMSE, Aix Marseille Univ, LPED, Marseille, France.

E-mail address: ulrich-boris.nguemdjo.kamguem@univ-amu.fr (N. Ulrich).

<https://doi.org/10.1016/j.ssmph.2021.100993>

Received 30 June 2021; Received in revised form 15 October 2021; Accepted 1 December 2021

Available online 18 December 2021

2352-8273/© 2021 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

role of communication style to attract attention (Lanham, 2006). Based on these theoretical points, marketing studies have tested various methods to improve subjects' attention by adjusting online communication. In the field of marketing, targeting a user with an advertisement based on certain personalized characteristics (age, gender, location etc.) has been shown to attract the users' attention and increase the likelihood of conversion (an online purchase transaction) (Ansari & Mela, 2003; Benlian, 2015; Wessel & Thies, 2015).

The main objective of the present research is to test the effectiveness of personalization on increasing i) the self-screening of depression by the *cesd* tool and ii) the delivery of psychologic resources for respondents who have screened positive for depression. We assume that personalized messaging based on gender would increase attention and the likelihood of clicking on advertisement and of being screened for depression. Personalization was based on gender because recent empirical studies have shown that targeting based on gender affects the way people attend to and interpret information (Ellemers, 2018). This has yet to be studied in the public health intervention literature and we sought to determine if gender-based advertisement about depression impacts the conversion of users evaluating their mental health and seeking further help.

2. Method

The goal of the research study was to examine the impact of personalization based on gender to seek help for mental health during the COVID-19 pandemic lockdowns in the Provence-Alpes-Côte d'Azur (PACA) region in France. The month of May 2020 was the height of the lockdowns in the PACA region, as residences were not allowed to leave their home without government granted permission to leave for a specific purpose and for a certain amount of time. To reach the population in the PACA region, an internet search engine advertising campaign was developed to target this region of France. Ethical advice was obtained prior to the study from the board of the Southeastern Health Regional Observatory, in charge of the surveillance of population's health in the same region and was deemed public health surveillance.

2.1. Internet search engine advertising

Our internet search engine advertising was conducted through Microsoft Bing Advertising. Microsoft Bing acquires 14.6 billion monthly searches on PC's around the globe (Microsoft, 2021). Ads are shown to users of search engines such as Bing if their search terms match the keywords selected by advertisers and if additional parameters such as user location match advertisers' preferences. When such matches exist the ad appears above or below the search results on Bing. We present the terms and advertisement messages in English for ease of reading but all search terms and advertisement messages were translated into the French language as the study was done in France. The search terms selected were as follows: Anguish; sadness; dark thoughts; sad music; cheerful music; stress; bad mood; anxiety; depression; weight gain; overweight; alcohol; boredom; solitude; fun; suicide; comical. These search terms were selected based on the types of keywords persons would potentially use in their searches if they had feelings of depression.

2.2. Personalization of online advertisements

The messages in the advertisements for Bing have the requirements of a title (two fields with maximum length of 30 characters) and a text body (three fields with a maximum of 90 characters). Two arms were generated for the advertisements. Arm A was considered the control arm and did not contain any personalized gender messaging. Arm B was the test arm and contained personalized gender messaging. In the appendix, Table A1 shows the title and body of the ads for Arms A and B in French and Table A2 shows the ads in English. These messages were included with 5 different titles. In arm B, the title remained the same as the

control but with the addition of the personalized message related gender component to the body of the advertisement. As a method to personalize the advertisement towards gender, depression statistics in men and women were used. Men are less likely to seek help for their depression (Möller-Leimkühler, 2002) and women are more often diagnosed with depression (Albert, 2015).

The advertisements were targeted to users in the major cities of the PACA region, France, with a 25mile radius to encompass the area of PACA.

2.3. Depression measure

The Center for Epidemiological Studies-Depression (CES-D) is a standard clinical self-reported measure of depressive symptoms. The CES-D consists of a 20-item score that rates how often, over the past week, respondents have experienced symptoms associated with depression, that include restless sleep, poor appetite, and feeling lonely (Eaton et al., 2004). A cutoff score of >16 is considered to be at risk for clinical depression (Li et al., 2009). The CES-D has been used across wide age ranges and in different languages (Li et al., 2009). For this study, the translated French version of the CES-D was used (Van Dam & Earleywine, 2011) and placed on LimeSurvey, a statistical survey web app in order to collect the online answers from the CES-D. If a user clicked on the advertisement they would be referred to the LimeSurvey to take the CES-D. Separate surveys and links were provided to Arm A and B to identify which Arm the user came from.

2.4. Follow-up for seeking treatment

It is important for those who have a risk of clinical depression to seek treatment (Nuzzarello & Goldberg, 2004). Therefore we also sought to study whether users had the intent of following up with a provider to seek treatment for their symptoms of depression after they had been provided their CES-D score. Users with a CES-D score greater than 16 were provided advice that they should go see a provider for their symptoms. A follow up question was provided after the advice was given to these users of, "The lockdown has been extended and this is likely to further affect your mood. In the coming week, do you plan to implement the consultation advice received?" Since research shows that different rates of seeking help for depression for men versus women, for the control Arm A, users were presented with a personalized message based on their gender. For men, they received the message that "Men are less likely to seek help for their depression, before asking if they would seek consultation. For females, they received the message "Women have a greater risk for depression ..." before asking if they would seek consultation. Those who did not define a gender were given the message that "Those who do not define their gender in a binary format are at a greater risk for depression" followed by a question about seeking consultation. This allowed us to determine if personalized gender messaging would impact a person's intent to seek treatment. A flow chart of the complete study design can be seen in Fig. 1.

2.5. The econometric approach

We assess the effect of personalized message using, at the first stage, a simple econometric model to evaluate the effect of gender-based messaging on the willingness to click on the advertisement, and at the second stage, a three steps model, including the *cesd* completeness, the *cesd* positiveness, and the willingness to follow up with the provider. The models are described using the following equations:

First personalized message: clicking on the advertisement.

Clicking (rows 1 and 2):

$$Y_i^{click} = \begin{cases} 1 & [\beta_{click} Group_i + \epsilon_i^{click} > 0] \\ 0 & otherwise \end{cases} \quad (1)$$

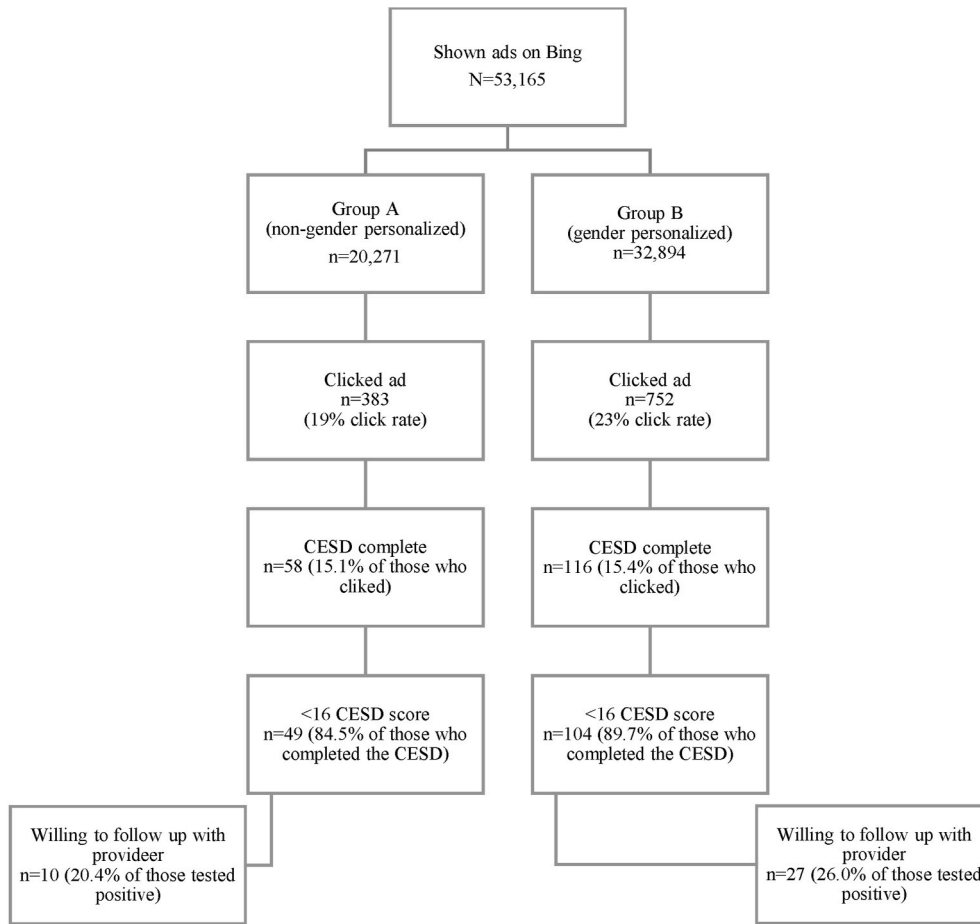


Diagram 1. General framework of the study.

Second personalized message: willing to follow up.

Completeness (row 3):

$$Y_i^{comp} = \begin{cases} 1 & [\beta_{comp} Group_i + \epsilon_i^{comp} > 0] \\ 0 & otherwise \end{cases} \quad (2)$$

Positiveness (row 4):

$$Y_i^{pos} = \begin{cases} 1 & [\alpha_{pos}^1 Sex_i + \alpha_{pos}^2 Age_i + \alpha_{pos}^3 House_i + \alpha_{pos}^4 Members_i + \epsilon_i^{pos} > 0] \text{ if } Y_i^{comp} = 1 \\ 0 & otherwise \end{cases} \quad (3)$$

Follow up (rows 5 and 6):

$$Y_i^{follow} = \begin{cases} 1 & [\beta_{follow} Group_i + \alpha_{follow}^1 Sex_i + \alpha_{follow}^2 Age_i + \alpha_{follow}^3 House_i + \alpha_{follow}^4 Members_i + \alpha_{follow}^5 Sleep_i + \alpha_{follow}^6 Humor_i + \epsilon_i^{follow} > 0] \text{, if } Y_i^{pos} = 1 \\ 0 & otherwise \end{cases} \quad (4)$$

Y_i^{click} is for clicking on the advertisement, Y_i^{comp} is for completing the *cesd* questionnaire, Y_i^{pos} is for having a positive score to the *cesd* questionnaire, Y_i^{follow} is for the willingness to follow the consultation advise. The main coefficients of interest are β_{click} , β_{comp} , and β_{follow} that evaluate

the effect of personalized message that is capture by the variable $Group_i$. $Group_i$ is a binary variable that represent the two groups involved in the experiment (group A and group B). In eqs (1) and (2), being in the test

group (group B) is expected to affect positively the probability of clicking on the advertisement whereas in eq (4), being in the control group (group A) is expected to affect positively the willingness to follow up the consultation advise since at this stage the control group (group A) was the one that received the personalized message.

In eqs (3) and (4), we included other explanatory variables such as the sex of the respondent, the age, the type of house owns by the respondent, the number of household members living with the respondent, the sleep variable which is a binary variable that takes 1 if the lockdown has affected the respondent' sleep and 0 otherwise, and the humor variable which is a binary variable that takes 1 if the lockdown has affected the respondent' humor and 0 otherwise.

We use two estimation methods to evaluate effect of personalize message. A simple probit model to estimate the clicking equation (eq (1)); a Heckman selection probit models to estimate the positiveness equation (eq (3)) with the completeness equation (eq (2)) as selection, and the follow-up equation (eq (4)) with the positiveness equation (eq (3)) as selection. This second method accounts for the problems of non-exposure bias and selection bias. A non-completeness of the cesd or a negative score on the cesd may lead to non-exposure and selection bias because being positive to the cesd is only possible for respondent that completed the cesd, and responding to the follow up question is only possible for positive respondents.

3. Results

3.1. Descriptive statistics

Fig. 1 gives the different steps of the analysis. 53,185 advertisements were shown to the two groups, 38.1% to group A (20,271) and 61.9% to group B (32,894). Out of those who were exposed to the ads in group A, 19% clicked on the advertisement whereas in group B, 23% clicked on the advertisements (statistically significant, chi2 test, $P < 10^{-4}$). 15.4% of those who clicked on the ads in group A completed the CESD questionnaire, same proportion as those who clicked on the ads in the gender personalized arm (group B). In the non-personalized arm (group A), Among those who completed the CESD 84.5% had a positive score to the CESD whereas in the personalized arm (group B), the proportion tested positive is 89.7% (Not statistically significant, chi2 test, $p = 0.32$). Among the positive to the CESD in the non-personalized group, 20.4% were willing to follow up with the consultation advise. In the personalized arm, the proportion of those willing to follow the consultation advise among the positive is 26% (Not statistically significant, chi2 test, $p = 0.45$).

Table 1 presents some descriptive statistics on other variables

Table 1
Descriptive statistics.

	CESD Complete (n = 58 + 116)	Positive score (n = 49 + 104)
Sex		
Female	61,2%	63,6%
Male	34,4%	32,4%
Hidden	4,3%	3,8%
Age		
Less than 25 yrs.	34,4%	37,6%
25-49 yrs.	19,3%	19,4%
more than 50 yrs.	46,2%	42,8%
House		
Ind-house	64,5%	59,7%
Ind-Apartment	35,4%	40,2%
Members		
Alone	24,7%	27,2%
Sleep affected	41,9%	49,3%
Humor affected	55,9%	59,7%

collected on the users that completed the cesd questionnaire. Out of those users who completed the CESD questionnaire (respectively tested positive to the CESD), 61.2% are women and 34.4% are men (respectively 63.6% and 32.4%), 46.2% are aged more than 50 years and 34.4% are aged less than 25 years (respectively 42.8% and 37.6%), 35.4% are living in an individual apartment (respectively 40.2%), 24.7% are living alone (respectively 27.2%), 41.9% found their sleep affected by the lockdown (respectively 49.3%), and 55.9% found their humor affected by the lockdown (respectively 59.7%).

3.2. The effect of gender-based messaging

Table 2 present the marginal effects of the estimations of the different probit regression models. For the clicking equation (eq (1)), the results show a significant and positive association between the group and the willingness to click on the ads meaning that being in the gender personalized arm (group B) increased the probability of clicking on the advertisement by 0.4%. For the completeness equation (eq (2)), we found that being in the gender personalized arm (group B) increases the probability of complete the CESD questionnaire by 0.07% but the result is non-significant.

For the positiveness equation, the IMR that accounts for the selection bias induce by the completeness equation (eq (3)) is non-significant, meaning that there is no selection bias due to the lack of observations on respondents who did not complete the cesd questionnaire. In addition, we found that living in a single-family home significantly reduces the probability of having a positive score by 17%. Finally, for the follow up equation (eq (4)), the two IMRs were non-significant ($p = 0.25$; $p = 0.20$), meaning that there is no selection bias due to the lack of observations on respondents tested negative to the cesd questionnaire. Regarding the personalized message, being in the initial gender personalized arm (group B) increased by 4.6% the willingness to follow up the consultation advise but the effect is non-significant. We also found that young people (less than 25 years) are less likely to follow up the consultation advice compare to people aged more than 50 years.

We also conducted a test for the non-negativity of the coefficients by running a one-tail test on the regression coefficients (Table 3). The purpose of this (asymmetric) test was to better shape the H0 hypothesis, which now includes negativity in coefficients. This allowed us to test whether the initial personalization "reduces" -vs just "changes"- the willingness to click on the advertisement, the willingness to complete the cesd questionnaire and the willingness to follow-up with a medical consultation for those that were screened as depressed. The results show that at the level of 1% for Eqs (1) and (10)% for Eq (2), we are unable to reject the hypothesis that gender personalized messaging reduces the willingness to click and conversion to complete the cesd. However, the coefficient is still non-significative for the follow-up equation.

4. Discussion

A consequence of the Covid-19 pandemic there has been a rise in issues related to mental health, and France was not spared (Ramiz et al., 2021). It is essential to identify effective strategies to monitor and assess the mental health and well-being of the population during this global crisis, especially during the period of a national lockdown - when social isolation was at its peak. Our study reports on using internet search-based advertisement and personalized gendered communication to monitor depression and intent to seek help. We grounded our study on a preexisting body of knowledge established in marketing studies, suggesting that internet users' "attention" could be improved by an enhancement in personalized communication. We used gendered messaging we promoted an online self-screening process for anxiety and depression. We obtained that, as for commercial advertisement, personalizing the internet search query advertisements based on gender increases the click rate -in our case by 21%. However, upon clicking the advertisement, there were no significant differences between the gender

Table 2
Marginal effects of the probit models.

Marginal effects								
	Clicking on Ads		Completed the cesd		Positive cesd score		Follow up	
	Eq 1		Eq 2		Eq 3		Eq 4	
	Coef	p-value	Coef	p-value	Coef	p-value	Coef	p-value
Group, ref = group A								
Group B	0.0040 (0.0013)	0.0017	0.0007 (0.0005)	0.1812			0.0466 (0.1206)	0.6991
Sex, ref = male								
Female					0.0487 (0.0799)	0.541	0.0576 (0.1108)	0.6033
Hidden					-0.4537 (0.2451)	0.0642	0.2346 (0.2746)	0.3929
Age, ref = more than 50 yrs								
Less than 25 yrs					0.1487 (0.1044)	0.1544	-0.3952 (0.1601)	0.0136
25-49 yrs					-0.0623 (0.1197)	0.6027	0.1214 (0.1506)	0.4201
House, ref = Ind-Appartment								
Ind-house					-0.1744 (0.0685)	0.0109		
Members, ref = Alone								
Not Alone					-0.1204 (0.0751)	0.1089	-0.1124 (0.1650)	0.4958
Sleep, ref = affected								
Not affected							0.0365 (0.1156)	0.7520
Humor, ref = affected								
Not affected							-0.0337 (0.1160)	0.7713
IMR - InvMillsRatio					-1.4175 1.2366	0.2517	-0.4254 (0.3341)	0.2029
Pseudo R-square	0.001		0.001		0.165		0.203	
Observations	53165		53165		93		77	

Table 3
Marginals effects of probit, one-tailed test.

Marginal effects, one-tailed test for the coefficients						
	Clicking on Ads		Completed the cesd		Follow up	
	Eq 1		Eq 2		Eq 4	
	Coef	p-value	Coef	p-value	Coef	p-value
Group, ref = group A						
Group B	0.0040 (0.0013)	0.0010	0.0007 (0.0005)	0.0957	0.0466 (0.1206)	0.3493
Control variables	No		No		Yes	
IMR	No		No		Yes	
Pseudo R square	0.001		0.001		0.203	
Observations	53165		53165		77	

message group and the control group to complete the cesd depression questionnaire. Therefore, although gender-based marketing was effective at drawing in a greater click rate, it was not effective at increasing the (“conversion”) rate to monitor depression by self-assessment. Nor did gender-based messaging have an impact on those who scored >16, for depression, on the intent to follow up with a provider.

Gender-based marketing have often been exploited for the last five decades to market and increase purchasing behaviors in men and women (Grau & Zotos, 2016). However, considering our study results, this did not apply to encouraging online users to self-assess their mental health or increase their likelihood of seeking future care. These findings may showcase that in the realm of mental or public health, gender-based messaging may not be an effective strategy. One possible concern is that the gender-based messaging used in this study was not portrayed in traditionally gendered roles. For instance, historically marketing has used gender stereotypes that subsequently present advertisement towards women in more decorative and demure roles that are directed towards beauty and body (Grau & Zotos, 2016; Uray & Burnaz, 2003),

and men as more independent and authoritarian (Reichert & Carpenter, 2004). Because of shifting social norms, we decided to ground gender-based messaging on more “scientific” differentiation: the precise type of mental health risks that were associated with gender; and we differentiated the messaging by differences in evidence-based information rather than using traditional gender stereotypes. Therefore, it may be the case that this form of gendered marketing may be effective at increasing click rates but not effective at increasing conversion. One other consideration is the trade-offs between personalization and privacy. This personalization privacy paradox (Xu et al., 2011) is one which there is a trade-off between intensity of personalization and users’ privacy concerns whereby if there is too much personalization, users are less likely to engage because of concerns of there being too much information being gathered about them. We are less incline to believe this is the case considering the light-handed nature of our gender-based marketing.

A longitudinal analysis of the impact of the national lockdown showed that the proportion of those with anxiety symptoms increased

from 17.3% to 20.1% and average mental health decreased from 7.77 to 7.58 points. Our results parallel findings in this longitudinal study that also showed that a greater proportion of younger users experienced depression. This is also consistent with studies that have seen dramatic rises in depression and anxiety amongst students during the lockdowns in France and across the world (Islam et al., 2020; Rudenstine et al., 2021; Tang et al., 2020). Youth under the age of 25 that were deemed clinically depressed were also less likely to have the intent to seek future treatment with a provider for their depression. Previous research has documented that women experience higher rates of depression (Kessler, 2003). However our study did not find significant differences in depression scores between men and women. This traditional gap in depression between men and women may have been reduced during the lockdowns because both genders may have experienced the same environmental constraints that increased their risk for depression such as confinement and isolation.

A limitation of the study was the lack of strong gender personalization. Because of shifting social norms in gender-based roles, we opted to use an informative gender-based personalization. This may have impacted the effectiveness of the personalization to increase attention to the advertisements. Our results may be interpreted by a “deception” phenomenon. Since users were recruited based on gendered personalization, they may have wanted a depression screening questionnaire that was similarly personalized by gender. When they received a general survey not based on gender, it may have reduced their desire to complete the *cesd* depression screening. Thus, our findings suggests that personalized advertisement is not sufficient for full conversion. For conversion to occur, the “product” -or in our study the *cesd* depression screening questionnaire-may also need to be personalized. As the gender personalization of product is not always possible, future studies on marketing for public health should look across other personalized characteristics such as age, occupation, profession to identify which characteristics are most effective at promoting uptake of public health interventions.

Although the main first assumption has been tested on more than 50,000 sessions, we acknowledge that the sample sizes in the last stages of the analyses are small. Our sample size was particularly contracted in the latest stage when we asked users if they would seek out a mental health consultation for their depression, thus our non-significant findings in the last stage be the result of a lower response rate in the first stage of the study.¹ However, the drawback that could occur at the latter stages was if being recruited through gender personalization has reduced the willingness to complete the questionnaire and follow the advice. Despite the small sample, the asymmetric one tailed *t*-test seemed to eliminate the first negative effect on completeness; yet the same asymmetric one tailed *t*-test was, however, not conclusive for the follow-up behavior (to follow the advice of mental-health care consultation). Finally, these models are based among those who self-selected to

click on the advertisement, which may not be reflected of the general population.

Conclusion. Internet advertisement could facilitate earlier detection of depression. Gender-based communication strategies for public health may be effective at increasing attention and promoting a self-screening process for mental health. Additional forms of personalization based on other demographic characteristics should be tested to understand its effectiveness in delivering public health interventions. Methods to retain population of users to seek help for their symptoms of depression need to be identified.

Ethical statement

Prior to the study, ethical advice has been asked to the board of the South-eastern Health Regional Observatory, in charge of the surveillance of population’s health in the region.

Participants signed a consent at the start of the survey. Data were organized in accordance with the EU GDPR principles and provided to the research team in total anonymity of the participating persons. With such data collection, an ethical agreement from an IRB is waived. The DPO (Data protection officer) of the South-eastern Health Regional Observatory, in charge of the surveillance of population’s health in the region, approved the study by email dated April 15, 2020.

CRedit author statement

LL-D; GG-M: Project administration, Formal analysis, Conceptualization, Methodology, Data curation, Writing- Original draft preparation, Visualization, Investigation, Supervision, Writing- Reviewing and Editing. **SDA:** Conceptualization, Methodology, Visualization, Investigation, Supervision, Writing- Reviewing and Editing. **MFV-V:** Formal analysis, Data curation, Writing- Reviewing and Editing **VCA; BMC; IR-C; EJN-G; SCL; SI-G; PP-A; JJB-R; BN-M; KC-A; ERM-M; AO; SM-A:** Writing- Reviewing and Editing.

Declaration of competing interest

Ulrich NGUEMDJO, Bruno VENTELOU, Elad YOM-TOV, Yulin HSWEN declare that they have no conflict of interest.

Acknowledgements

This work was supported by the French National Research Agency Grant ANR-17-EURE-0020 and ANR RESPIRE ANR-21-COVR-0041-0, and by the Excellence Initiative of Aix-Marseille University - A*MIDEX.

we thank ORS PACA; Laurence Bouvard and Gregory Cornu for their assistance in obtaining the data for this study.

Appendix

Table A1

Advertisement Messages on Microsoft Bing (In French)

	Title of ad	Body of ad
Arm A	Etes-vous triste?	Suivez ce lien pour en savoir plus sur vous-même
	Le confinement est difficile?	Suivez ce lien pour en savoir plus sur vous-même
	Triste pendant le confinement?	Suivez ce lien pour en savoir plus sur vous-même
	C'est un moment angoissant?	Suivez ce lien pour en savoir plus sur vous-même
	Vous vivez une période de stress?	Suivez ce lien pour en savoir plus sur vous-même

(continued on next page)

¹ As we had no prior ideas of the click-rates, and on the number or person who will be tested *cesd*-positive, it was not possible to have a study-design based on a sample size calculation. Note that, although these final numbers are limited, they are relatively similar in size compared to in person studies on marketing (Li, 2016).

Table A1 (continued)

	Title of ad	Body of ad
Arm B	Females	
	Etes-vous triste?	Les femmes sont plus à risque de dépression. Suivez ce lien pour en savoir plus sur vous-même
	Le confinement est difficile?	Les femmes sont plus à risque de dépression. Suivez ce lien pour en savoir plus sur vous-même
	Triste pendant le confinement?	Les femmes sont plus à risque de dépression. Suivez ce lien pour en savoir plus sur vous-même
Arm B	Males	
	Etes-vous triste?	Les hommes sont mal pris en charge pour leur dépression. Suivez ce lien pour en savoir plus sur vous-même
	Le confinement est difficile?	Les hommes sont mal pris en charge pour leur dépression. Suivez ce lien pour en savoir plus sur vous-même
	Triste pendant le confinement?	Les hommes sont mal pris en charge pour leur dépression. Suivez ce lien pour en savoir plus sur vous-même
	C'est un moment angoissant?	Les hommes sont mal pris en charge pour leur dépression. Suivez ce lien pour en savoir plus sur vous-même
	Vous vivez une période de stress?	Les hommes sont mal pris en charge pour leur dépression. Suivez ce lien pour en savoir plus sur vous-même

Table A2

Advertisement Messages on Microsoft Bing (In English)

	Title of ad	Body of ad
Arm A	Are you sad?	Follow this link to find out more about yourself
	Lockdown is difficult?	Follow this link to find out more about yourself
	Sad during lockdown?	Follow this link to find out more about yourself
	This is a stressful moment?	Follow this link to find out more about yourself
	You are stressed?	Follow this link to find out more about yourself
Arm B	Females	
	Are you sad?	Women are at greater risk for depression. Follow this link to find out more about yourself
	Lockdown is difficult ?	Women are at greater risk for depression. Follow this link to find out more about yourself
	Sad during lockdown?	Women are at greater risk for depression. Follow this link to find out more about yourself
	This is a stressful moment?	Women are at greater risk for depression. Follow this link to find out more about yourself
Arm B	Males	
	Are you sad?	Men are poorly followed for depression. Follow this link to find out more about yourself
	Lockdown is difficult?	Men are poorly followed for depression. Follow this link to find out more about yourself
	Sad during lockdown?	Men are poorly followed for depression. Follow this link to find out more about yourself
	This is a stressful moment?	Men are poorly followed for depression. Follow this link to find out more about yourself
	You are stressed?	Men are poorly followed for depression. Follow this link to find out more about yourself

References

- Albert, P. R. (2015). Why is depression more prevalent in women? *Journal of Psychiatry & Neuroscience: Journal of Psychiatry & Neuroscience*, 40(4), 219.
- Ansari, A., & Mela, C. F. (2003). E-customization. *Journal of Marketing Research*, 40(2), 131–145.
- Benlian, A. (2015). Web personalization cues and their differential effects on user assessments of website value. *Journal of Management Information Systems*, 32(1), 225–260.
- Dailley, S. F., & Kaplan, D. (2014). Shelter-in-place and mental health: An analogue study of well-being and distress. *Journal of emergency management (Weston, Mass, 12(2))*, 121–131.
- Eaton, W. W., Smith, C., Ybarra, M., Muntaner, C., & Tien, A. (2004). *Center for epidemiologic studies depression scale: Review and revision (cesd and cesd-r)*.
- Ellemers, N. (2018). Gender stereotypes. *Annual Review of Psychology*, 69(1), 275–298. PMID: 28961059.
- Grau, S. L., & Zotos, Y. C. (2016). Gender stereotypes in advertising: A review of current research. *International Journal of Advertising*, 35(5), 761–770.
- Islam, M. A., Barna, S. D., Raihan, H., Khan, M. N. A., & Hossain, M. T. (2020). Depression and anxiety among university students during the covid-19 pandemic in Bangladesh: A web-based cross-sectional survey. *PLoS One*, 15(8), Article e0238162.
- Kahneman, D. (1973). *Attention and effort* (Vol. 1063). Citeseer.
- Kessler, R. C. (2003). Epidemiology of women and depression. *Journal of Affective Disorders*, 74(1), 5–13.
- Lanham, R. A. (2006). *The economics of attention: Style and substance in the age of information*. University of Chicago Press.
- Li, C. (2016). When does web-based personalization really work? The distinction between actual personalization and perceived personalization. *Computers in Human Behavior*, 54, 25–33.
- Li, D., Liu, L., & Odouli, R. (2009). Presence of depressive symptoms during early pregnancy and the risk of preterm delivery: A prospective cohort study. *Human Reproduction*, 24(1), 146–153.
- Microsoft. (2021). *Microsoft search network data*. <https://about.ads.microsoft.com/en-us/insights/planning-tools/microsoft-search-network-data>.
- Möller-Leimkühler, A. M. (2002). Barriers to help-seeking by men: A review of sociocultural and clinical literature with particular reference to depression. *Journal of Affective Disorders*, 71(1–3), 1–9.
- Nuzzarello, A., & Goldberg, J. H. (2004). How perceived risk and personal and clinical experience affect medical students' decisions to seek treatment for major depression. *Academic Medicine*, 79(9), 876–881.
- Ramiz, L., Contrand, B., Castro, M. Y. R., Dupuy, M., Lu, L., Sztal-Kutas, C., & Lagarde, E. (2021). A longitudinal study of mental health before and during covid-19 lockdown in the French population. *Globalization and Health*, 17(1), 1–16.
- Reichert, T., & Carpenter, C. (2004). An update on sex in magazine advertising: 1983 to 2003. *Journalism & Mass Communication Quarterly*, 81(4), 823–837.
- Rudenstine, S., McNeal, K., Schulder, T., Ettman, C. K., Hernandez, M., Gvozdieva, K., & Galea, S. (2021). Depression and anxiety during the covid-19 pandemic in an urban, low income public university sample. *Journal of Traumatic Stress*, 34(1), 12–22.
- Tang, W., Hu, T., Hu, B., Jin, C., Wang, G., Xie, C., Chen, S., & Xu, J. (2020). Prevalence and correlates of ptsd and depressive symptoms one month after the outbreak of the covid-19 epidemic in a sample of home-quarantined Chinese university students. *Journal of Affective Disorders*, 274, 1–7.
- Uray, N., & Burnaz, S. (2003). An analysis of the portrayal of gender roles in Turkish television advertisements. *Sex Roles*, 48(1), 77–87.
- Van Dam, N. T., & Earleywine, M. (2011). Validation of the center for epidemiologic studies depression scale|revised (cesd-r): Pragmatic depression assessment in the general population. *Psychiatry Research*, 186(1), 128–132.
- Wessel, M., & Thies, F. (2015). *The effects of personalization on purchase intentions for online news: An experimental study of different personalization increments*.
- Xu, H., Luo, X. R., Carroll, J. M., & Rosson, M. B. (2011). The personalization privacy paradox: An exploratory study of decision-making process for location-aware marketing. *Decision Support Systems*, 51(1), 42–52.
- Zhang, Y., Yakob, L., Bonsall, M. B., & Hu, W. (2019). Predicting seasonal influenza epidemics using cross-hemisphere influenza surveillance data and local internet query data. *Scientific Reports*, 9(1), 1–7.