Eurobarometer 494 Proposal and Analysis Plan
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Draft Project Title: *Survey responses to estimate the association between Covid-19 sources of information, beliefs, and vaccination rates*

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Data set:
Flash Eurobarometer 494: ZA 7771
https://europa.eu/eurobarometer/surveys/detail/2512

1. BACKGROUND
Topics to be included in lit searches:
- Country-specific national governments in the EU have implemented a variety of strategies to manage the covid pandemic. (variable is country and/or region)
- These strategies are carried out in the context of the unique characteristics of each country-specific health system. (variable is % of GDP spent on healthcare)
- Moreover, these strategies are promulgated to citizens through myriad sources of information. (Q6)
- These sources of information, in turn, drive:
    - beliefs about the safety (SD2_1) and efficacy of vaccinations (SD2_2),
    - willingness to be vaccinated/rates of vaccination (Q1)
    - satisfaction with government/EU level vaccination strategy (Q8),
- Complicating beliefs are citizen-specific characteristics of socio-economic background (have), life experiences (Q9, SD1_1, SD1_2), family living situations (have), and comorbidities (do not have).
- These beliefs, in turn, are associated with rates of infection (Q1),

2. STUDY OBJECTIVE
The **objectives of this study** are to compare the sources of information individuals choose to read about covid, and their:
- Beliefs about the safety and efficacy of covid vaccinations, satisfaction with government level vaccination strategy and
- Willingness to be vaccinated/vaccination rates.

3. SPECIFIC AIMS
Aim 1: Estimate the association between Covid-19 <u>sources of information</u> and <u>beliefs about vaccine safety and efficacy and satisfaction with government level vaccination strategy.</u>
  Hypotheses:
- We hypothesize that those who receive their information from <u>authorities and health professionals</u> will be more likely to believe that vaccines are safe and effective, when compared to those who receive their information from <u>media and websites</u>.
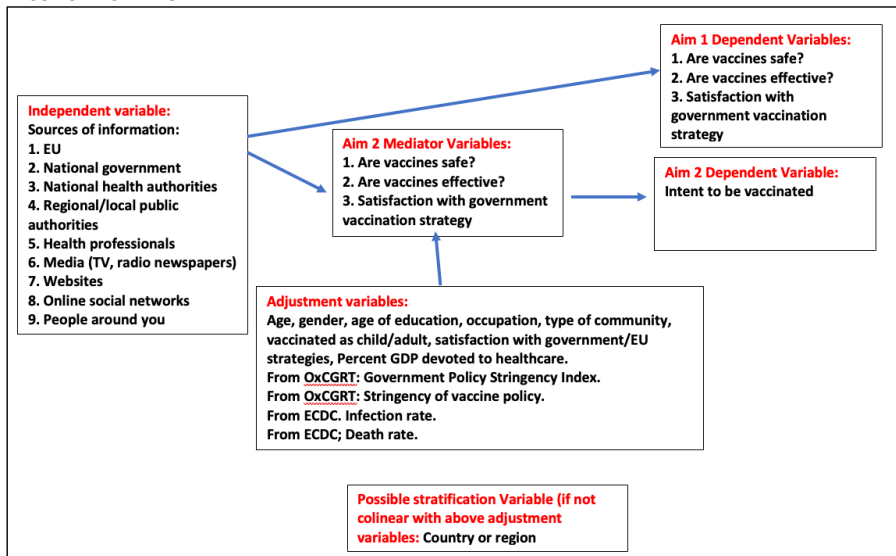
- We hypothesize that those who receive their information from <u>authorities and health professionals</u> will be more likely to believe that vaccines are safe and effective, when compared to those who receive their information from <u>online social networks or people around them.</u>
- We hypothesize that those who receive their information from <u>authorities and health professionals</u> will be more likely to be satisfied with their national government vaccination strategy, when compared to those who receive their information from <u>media and websites.</u>
- We hypothesize that those who receive their information from <u>authorities and health professionals</u> will be more likely to be satisfied with their national government vaccination strategy, when compared to those who receive their information from <u>online social networks or people around them.</u>

Aim 2: Estimate the association between Covid 19 <u>sources of information</u> and <u>willingness to be vaccinated/vaccination rates.</u>
    Hypotheses:
- We hypothesize that <u>willingness to be vaccinated/vaccination rates</u> will be higher in those who receive their information from <u>authorities and health professionals</u>, when compared to those who receive their information from <u>media and websites.</u>
- We hypothesize that <u>willingness to be vaccinated/vaccination rates</u> will be higher in those who receive their information from <u>authorities and health professionals</u>, when compared to those who receive their information from <u>online social networks or people around them</u>.

4. CONCEPTUAL MODEL

Independent variable:
Sources of information:
1. EU
2. National government
3. National health authorities
4. Regional/local public authorities
5. Health professionals
6. Media (TV, radio newspapers)
7. Websites
8. Online social networks
9. People around you

Aim 2 Mediator Variables:
1. Are vaccines safe?
2. Are vaccines effective?
3. Satisfaction with government vaccination strategy

Aim 1 Dependent Variables:
1. Are vaccines safe?
2. Are vaccines effective?
3. Satisfaction with government vaccination strategy

Aim 2 Dependent Variable:
Intent to be vaccinated

Adjustment variables:
Age, gender, age of education, occupation, type of community, vaccinated as child/adult, satisfaction with government/EU strategies, Percent GDP devoted to healthcare.
From OxCGRT: Government Policy Stringency Index.
From OxCGRT: Stringency of vaccine policy.
From ECDC. Infection rate.
From ECDC; Death rate.

Possible stratification Variable (if not colinear with above adjustment variables: Country or region

5. METHODS
Study Design: This study is a retrospective database analysis using individua-level data.

Data Source: We will use the cross-sectional survey data collected in the context of the *Flash* Eurobarometer initiative, which is a set of surveys conducted on behalf of the European Commission. *Flash* Eurobarometer surveys are conducted in all EU member states at specified times and include serial surveys that cover a wide range of special topics (e.g. Common Currency, EU Enlargement, Information Society, Entrepreneurship, and healthcare). In all countries general population samples are drawn among the national or EU population, aged 15 years and older. Interviews are conducted in the national language of each country. The fieldwork is carried out by Ipsos European Public Affairs.

We will retrieve data from the Eurobarometer 494, a cross-sectional survey conducted between May 21 and May 26, 2021 in 27 EU countries. Eurobarometer 494 comprises a representative sample of residents of the European Union with approximately 1000 individuals from each country. The selection of individuals is carried out using a, weighted, multi-stage random sampling method. (See appendix for detail on weighting methods used.) All interviews were carried via Computer-Assisted Web Interviewing (CAWI), using Ipsos online panels and their partner network. Respondents were selected from online access panels, groups of pre-recruited individuals who had agreed to take part in research. Sampling quota were set based on age (15-24 year-olds, 25-34 year-olds, 35-44 year-olds, 45-54 year-olds, 55-64 year-olds, 65+ year-olds), gender and geographic region (NUTS1, NUTS2, or NUTS 3), depending on the size of the country and the number of NUTS regions. Data describing the proportion of respondents who partially completed the survey, and data of low quality are removed from the dataset. The sampling procedure of the survey consisted of a non-probability (quota) method. In this type of sampling the target population is subdivided into separate and mutually exclusive segments according to some predefined quotation criteria of the population distribution of sociodemographic characteristics such as age, gender, ethnicity or income among others in order to reflect the real structure of the target population.

Population: The Eurobarometer 494 dataset is comprised of 26,106 individual-level observations and includes those ≥15 years of age.

6. OVERVIEW OF ANALYSIS PLAN
Independent variable: Sources (Q6)
Dependent variable: 1. Beliefs about the safety and efficacy of the vaccine (SD2_1/SD2_2) and satisfaction with government level vaccination strategy (Q8)
2. Willingness to be vaccinated, vaccination rates (Q1)
Mediator variables: Beliefs about the safety and efficacy of the vaccine (SD2_1/SD2_2) and satisfaction with government level vaccination strategy (Q8)

Aim 1: Estimate the association between Covid-19 <u>sources of information</u> and <u>beliefs about vaccine safety and efficacy and satisfaction with government level vaccination strategy.</u>

Variables
Independent variable: The independent variable is the sources of information about covid. This is Question 6 in the Eurobarometer 494 survey.

Q6. Among the following sources, which ones would you trust more to give you reliable information on covid vaccines (multiple answers possible)
The EU
The government of [fill in your country]
The health authorities of [fill in your country]
The regional or local public authorities
Health professionals, doctors, nurses and pharmacists
Media (television, radio, newspapers(
Websites
Online social networks
People around you (colleagues, friends and family)
Don't know

Dependent variable: The dependent variables are three. These are questions SD2_1, SD2_2 and Q8_1 in the Eurobarometer 494 survey.

SD2	To what extent do you agree or disagree with the following statements about vaccines in general:	
	(ONE ANSWER PER STATEMENT)	
	STATEMENTS	
SD2_1	Vaccines are safe	
SD2_2	Vaccines are effective	
	RESPONSE SCALE	
	Totally agree	1
	Tend to agree	2
	Tend to disagree	3
	Totally disagree	4
	Don't know	998

	ASK ALL	
Q8	Thinking about the way the following institutions have handled the vaccination strategy, would you say you are...	
	(ONE ANSWER PER STATEMENT)	
	STATEMENTS	
Q8_1	the (NATIONALITY) government	
Q8_2	the European Union	
	RESPONSE SCALE	
	Very satisfied	1
	Fairly satisfied	2
	Fairly dissatisfied	3
	Not satisfied at all	4
	Don't know	998

Adjustment variables:

We will include adjustment variables that best reflect the characteristics of the individuals surveyed. We will select those that are not correlated.

Variables we plan to include are age, gender, country/region of permanent residence, age when stopped full-time education (Question D4), occupation (D5 questions; we will create our own composite variable), type of community (D13), and whether you were vaccinated as a child/adult (SD1_1, SD1_2).

	ASK ALL	
SD1	For each of the following statements, please tell me if it applies to you or not	
	(ONE ANSWER PER STATEMENT)	
	STATEMENTS	
SD1_1	You have been vaccinated as a child	
SD1_2	You have been vaccinated as an adult (e.g. against yellow fever, tetanus, etc.)	
	RESPONSE SCALE	
	Yes	1
	No	2
	Don't know	998
	Prefer not to answer	999

We will also include adjustment variables at country-level:
1) percent of national Government Health Expenditure (% Health spending) on healthcare using data from the WHO Global Expenditure Database to characterize type of health-system at a country-specific
https://apps.who.int/nha/database
https://apps.who.int/nha/database/country_profile/Index/en

2) a government policy Stringency Index using data from data from the Covid-19 Government Response Tracker Project, led by the University of Oxford, and

3) number of confirmed Covid-19 cases and deaths using data from the Covid-19 Government Response Tracker Project, led by the University of Oxford.
https://github.com/OxCGRT/covid-policy-tracker/tree/master/data/timeseries

We will characterize national healthcare spending as tertiles, and the rates of confirmed Covid-19 cases and deaths per 100,000 population. The Oxford Stringency Index will be calculated using 9 variables. The different items of the Stringency index include 1) school closures, (2) workplace closures, (3) the cancellation of public events, (4) restrictions on gatherings, (5) public transportation closures, (6) stay at home requirements, (7) restrictions on domestic travel, (8) restrictions on international travel, and (9) public information campaigns, measuring the response level of a national government against the COVID-19 pandemic.

Since the collection period comprised May 21-26, 2021, we will compute means of that period for the rates of confirmed Covid-19 cases and deaths, and the Stringency Index.

Possible stratification variable: We are able to subgroup by country, nation group, or region in the EU.

Aim 2: Estimate the association between Covid 19 <u>sources of information</u> and <u>willingness to be vaccinated/vaccination rates.</u>

Variables
> **Independent variable:** The independent variable is the sources of information about covid. This is Question 6 in the Eurobarometer 494 survey.

> **Q6. Among the following sources, which ones would you trust more to give you reliable information on covid vaccines (multiple answers possible)**
> The EU
> The government of [fill in your country]
> The health authorities of [fill in your country]
> The regional or local public authorities
> Health professionals, doctors, nurses and pharmacists
> Media (television, radio, newspapers(
> Websites
> Online social networks
> People around you (colleagues, friends and family)
> Don't know

Dependent variable: Willingness to be vaccinated/vaccination rates. This is question in the Eurobarometer 494 survey.

Q1	When would you like to get vaccinated against COVID-19 (coronavirus)?	
	(ONE ANSWER ONLY)	
	As soon as possible	1
	Some time in 2021	2
	Later	3
	Never	4
	I have already been vaccinated	5
	Don't know	998
	Prefer not to answer	999

Mediator variables: The mediator variables are three: the perceived safety and efficacy of the vaccines and satisfaction with government level vaccination strategy. These are questions SD2_1, SD2_2 and Q8_1 in the Eurobarometer 494 survey.

SD2	To what extent do you agree or disagree with the following statements about vaccines in general:	
	(ONE ANSWER PER STATEMENT)	
	STATEMENTS	
SD2_1	Vaccines are safe	
SD2_2	Vaccines are effective	
	RESPONSE SCALE	
	Totally agree	1
	Tend to agree	2
	Tend to disagree	3
	Totally disagree	4
	Don't know	998

	ASK ALL	
Q8	Thinking about the way the following institutions have handled the vaccination strategy, would you say you are...	
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	STATEMENTS	
Q8_1	the (NATIONALITY) government	
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	RESPONSE SCALE	
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Adjustment variables:

We will include adjustment variables that best reflect the characteristics of the individuals surveyed. We will select those that are not correlated.

Variables we plan to include are age, gender, country/region of permanent residence, age when stopped full-time education (Question D4), occupation (D5 questions; we will create our own composite variable), type of community (D13), and whether you were vaccinated as a child/adult (SD1_1, SD1_2).

	ASK ALL	
Q8	Thinking about the way the following institutions have handled the vaccination strategy, would you say you are...	
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	RESPONSE SCALE	
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We will also include adjustment variables at country-level:
1) percent of national Government Health Expenditure (% Health spending) on healthcare using data from the WHO Global Expenditure Database to characterize type of health-system at a country-specific
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3) number of confirmed Covid-19 cases and deaths using data from the Covid-19 Government Response Tracker Project, led by the University of Oxford.
https://github.com/OxCGRT/covid-policy-tracker/tree/master/data/timeseries

All variables will be checked for their role as confounders, precision variables, and effect modifiers.

Possible stratification variable: We are able to subgroup by country, nation group, or region in the EU.

7. STATISTICAL ANALYSIS PLAN CODE FOR RSTUDIO
Preparation of variables:
Vaccination rates (3 groups):
    1) Vaccinated: those who have already been vaccinated or who plan to be vaccinated as soon as possible
    2) Later: those who plan to be vaccinated later or sometime in 2021
    3) Never: those who never plan to be vaccinated

Vaccine is safe (2 groups):
    1) Yes: totally agree/tend to agree
    2) No: Tend to disagree/totally disagree

Vaccine is effective (2 groups):
    1) Yes: totally agree/tend to agree
    2) No: Tend to disagree/totally disagree

Satisfied with national government vaccination strategy (2 groups):
    1) Satisfied: Very satisfied/fairly satisfied
    2) Dissatisfied: Fairly dissatisfied/not satisfied at all

Sources of information (3 or more groups):
    a. Perform a Latent Class Analysis to determine the number of potential groups by sources of information.
    Determining the optimal number of clusters is based on both model fit statistics and diagnostic statistics, the latter to measure classification certainty. The selected model should have the lowest an Akaike information criterion (AIC) and Bayesian information criterion (BIC), and not have a cluster with a population percentage lower than 5%, in addition to other simplicity and coherence criteria for subsequent statistical analyses.

    b. Survey-weighted descriptive statistics:
    In general (IV, DV, covariates)
    By sources of information groups
    By safety/effectiveness of vaccines opinion and satisfaction with government vaccination strategy
    By country (only main variables)

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c. Survey-weighted chi squared analyses:
Sources of information vs Safety of vaccine
Sources of information vs Effectiveness of vaccine
Sources of information vs Satisfaction with government vaccination strategy
Sources of information vs Vaccination rates

**d. Survey-weighted logistic regression with and without covariate adjustments:**
Binomial: Safety of vaccine ~ Sources of information (x2)
Binomial: Effectiveness of vaccine ~ Sources of information (x2)
Binomial: Satisfaction with government vaccination strategy ~ Sources of information (x2)
Multinomial: Vaccination rates ~ Sources of information (x2)

e. Covariate-balanced propensity-score weighting method on Sources of information clusters:
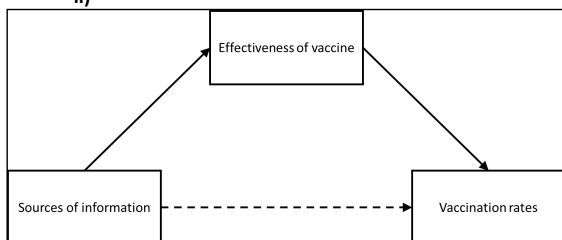
f. Repetition of step 4 using only CBPS weights

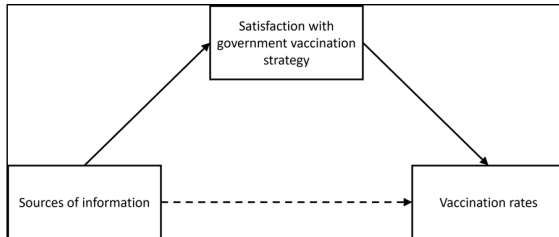**g. SEM-Mediation analyses in the weighting sample using CBPS weights:**

i)
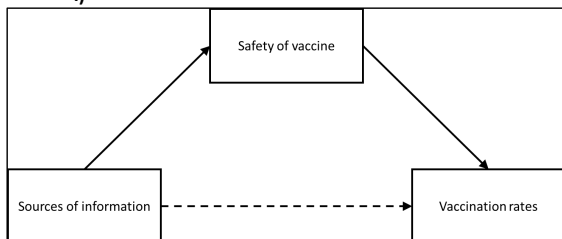
ii)

iii)

Application of weights:
We will evaluate different weights were applied in the statistical analyses. Post-stratification survey weights will be used for the covariate-balancing propensity-score method. No weighting will be used in the latent class analysis. The mediation models will be weighted with the covariate-balancing propensity-score weights. Binomial and multinomial logistic regression models will be performed without weights and without covariate adjustment; post-stratification survey weights and without covariate adjustment; post-stratification survey weights and with covariate adjustment; and covariate-balancing propensity-score weights and without covariate adjustment. In the case of the models employing post-stratification survey weights and with covariate adjustment, the rates of COVID-19 confirmed cases and deaths per 100,000 population will be transformed as standardized z-scores and used separately in these logistic regression models. Additionally, the z-score of COVID-19 confirmed deaths per 100,000 population will be used in the covariate-balancing propensity-score method.

If findings do not change among different weighting and adjustment strategy, results for logistic regressions and SEM models using covariate-balancing propensity-score weights will be reported.

Rstudio functions and packages used in the statistical analyses:
We will use R Version 3·6·1 (https://www.r-project.org/). Latent class analyses will be run with function *poLCA* from the *poLCA* package. Covariate-balancing propensity score method will be run with function *CBPS* from the *CBPS* package. Binomial logistic regressions will be run with function *glm* from the *stats* package. Multinomial logistics regressions will be run with function *nnet* from the *multinom* package. Structural equation modelling will be run with function *sem* from the *lavaan* package.

8. RESULTS
Proposed Output Tables:
      Table 1: Demographics
      Table 2: Results of propensity score weighting
      Table 2: Unadjusted and Adjusted Analysis for Aim 1
      Table 3: Unadjusted and Adjusted Analysis for Aim 2

      (Additional tables by subgroup of country or region can be included as appendices)

      Proposed Output Figures: By country: sources of information, safety, efficacy, satisfaction with government vaccination strategy, willingness to be vaccinated/vaccination rates. (Others to be decided)

8. DISCUSSION
- Recap of results
- Comparison of our work to others
- Contribution to the literature
- Policy Implications
- Strengths
- Limitations
  - The Limitations of this study include potential misclassification based on individual characteristics and nonresponse bias. The cross-sectional nature of this survey precludes causal inference. The survey includes only those respondents who had previously agreed to take part in survey research. The specific cut points employed for the social determinants may have affected the accuracy of the estimates.
  - As ours are individual-level analyses, we were unable to take into consideration the response measures at a country level.
  - We do not have actual vaccination rates.
- Future work

10. REFERENCES

11. APPENDIX
Weighting Methods in Eurobarometer 494

The Flash Eurobarometer, in accordance with the standard series, usually provide two types of weighting.
For ***post-stratification weighting*** (also referred to as "redressment" or "unit non-response weighting") a comparison between the sample and the universe was carried out country by country. Starting with Flash Eurobarometer 183 the relevant (active) variables which are introduced in the iteration (raking) procedure are stated as being for all countries: age by sex groupings, activity (active worker, retired, other non-active), and regions NUTS II. The universe description is usually gathered from local statistical offices.
In the case of special target group surveys, corresponding relevant variables are used in national raking procedures (e.g. activity and company size for samples of enterprises).
The ***population size weighting*** corrects for the fact that most countries have almost identical sample sizes, no matter how large or small their populations are. They ensure that each country is represented in proportion to its population size when the group of all countries is the object of study (i.e. country group averages). The population size weights usually include the post-stratification weighting factors.
If surveys are conducted in mixed-mode, face-to-face and webCATI (see sampling and fieldwork information), additional ***dual-frame weighting*** is introduced dealing with telephone owners for the countries concerned. This TELEPHONE ACCESS WEIGHT is based on information on the fix-phone lines and directory listed fix phone numbers in the household (selection probability depending on number telephone lines).
Official EC publications (reports) are usually based on weighted data.
Post-stratification weights
The COUNTRY FACTOR is supposed to be applied for descriptive analysis whenever individual countries are analysed separately. This "sample internal" weighting factor reproduces the real number of cases for each country. There is not necessarily such a weight for the special target group surveys.
Population size weights (including post-stratification)
The EU FACTOR is mandatory when analysing the group of all member countries, or specific historical subgroups (e.g. the new member countries as of 2004) as a whole. Special target group surveys may include this weight without post-stratification factors.
Note:
For UNIVARIATE (descriptive) analysis the application of the Eurobarometer POST-STRATIFICATION WEIGHTS is recommended, the application of the POPULATION SIZE WEIGHTS mandatory. Official Eurobarometer reports are based on weighted data.

Comentado [BD1]: Häder, Sabine; Gabler, Siegfried (1997): Deviations from the Population and Optimal Weights, in: Saris, Willem E.; Kaase, Mas (eds.): ZUMA Nachrichten Spezial. Band 2, Mannheim.
Arzheimer, Kai (2009): Gewichtungsvariation. In: Schoen, Harald; Rattinger, Hans; Gabriel, Oscar (Hrsg.): Vom Interview zur Analyse. Baden-Baden. S. 361-388.
Gabler, Siegfried; Ganninger, Matthias (2010): Gewichtung. In: Wolf, Christof; Best, Henning (Hrsg.): Handbuch der sozialwissenschaftlichen Datenanalyse: VS Verlag für Sozialwissenschaften, S. 143-164.