

COVID-19 VACCINATION: DIFFERENCES AND SIMILARITIES IN EUROPEANS OVER 50 YEARS OF AGE.

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Abstract: We analyzed the differences and similarities of Europeans' aged 50 and above attitudes to COVID-19 prevention. Our analysis is based on the Börsch-Supan, A. (2022). Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 9. COVID-19 Survey 2. Release version: 8.0.0. Our findings point to countries specific differences in the level of willingness for prevention of COVID-19. Results show the presence of a definite leader in terms of positive attitudes towards the prevention of COVID-19, and that is Israel. As well, a clear leader in negative attitudes towards the prevention of COVID-19 is Bulgaria. In general, the current attitudes in the EU are positive regarding prevention against COVID-19 (in 17 out of a total of 28 states included in this study).

Keywords: COVID-19, precautionary behaviors, SHARE data; Intuitionistic fuzzy sets.

JEL: I18, J14

1. INTRODUCTION

European governments have adopted the policy of implementing mass free vaccination against COVID-19 as an efficient way to protect their populations in pandemic conditions. However, vaccine hesitancy is still widespread in many of these countries. In this paper, we analyze the differences and similarities of Europeans' attitudes to COVID-19 prevention. To answer this research question, we focus on the population aged 50 years or older, as the risk of developing severe symptoms is highest among them. For this purpose, we use data from the SHARE Wave 9. COVID-19 Survey 2 conducted in 2022 among 49,253 respondents over the age of 50 from 27 European countries and Israel. (1)

With a large international sample ($n = 8317$), recent research study (2) examined which beliefs and attitudes about COVID-19 predict 1) following government recommendations, 2) taking health precautions (including mask wearing, social distancing, handwashing, and staying at home), and 3) encouraging others to take health precautions. According to the authors belief that taking health procedures is effective for avoiding COVID-19 emerged as one of the strongest predictors of rule following, semipartial $r_s = .34-.35$; taking health precautions, semipartial $r_s = .47$; and giving health advice to others, semipartial $r_s = .18$, with and without controls. Health importance was also consistently a fairly strong

predictor of rule following, semipartial $r_s = .19$; taking health precautions, semipartial $r_s = .25-.26$; and giving health advice to others, semipartial $r_s = .26-.32$. Perceived vulnerability, beliefs that getting COVID-19 would be disruptive, and government trust had very small to non-existent relationships with our three behavioral outcomes (however, there was a small trend indicating that believing that getting COVID-19 would be disruptive was associated with less rule following). Other variables, including age, gender, and personality traits, demonstrated very small to non-existent relationships with the three behavioral outcomes as well. (2)

Based on the restricted SHARE-COVID-19 Survey 1 sample to those observations that were recorded during the eight weeks between 8 June 2020 and 2 August 2020 Anikó Bíró, Réka Branyiczki and Péter Elek investigate the time patterns of precautionary health behaviors of individuals aged fifty and above during the summer of 2020, an easing phase of the COVID-19 pandemic in Europe. They have found that while on average, people became less cautious during our analyzed period, this is less so for those who are at a higher risk. Their research shows large regional differences in precautionary health behaviors and show that higher risk individuals are on average more cautious in all regions. (3) .

2. METHODS

2.1. Data

Our analysis is based on the Börsch-Supan, A. (2022). Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 9. COVID-19 Survey 2. Release version: 8.0.0. SHARE-ERIC. Data set. DOI: 10.6103/SHARE.w9ca.800. (1). The variables that are in the focus of our analysis are five indicators of precautionary behavior as follows:

- (1) „took medicines or drugs as a prevention against COVID-19“;
- (2) “has been vaccinated against Covid-19”;
- (3) “wants to get vaccinated against Covid-19”;
- (4) “got flu vaccination in last 12 months”;
- (5) “had pneumonia vaccination within last 6 years”;

Information about the data we used is summarized in Table 1

Tab.1 COVID-19 Survey 2 dataset used

<i>indicators of health behavior</i>	Cases					
	Valid		Missing		Total	
	<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>
<i>took drugs or medicine as prevention against COVID-19</i>	49228	99,9%	25	0,1%	49253	100,0%
<i>has been vaccinated against Covid-19</i>	49227	99,9%	26	0,1%	49253	100,0%
<i>vaccinated against Covid-19</i>	49226	99,9%	27	0,1%	49253	100,0%
<i>got flu vaccination in last 12 months</i>	49226	99,9%	27	0,1%	49253	100,0%
<i>Health: had pneumonia vaccination within last 6 years</i>	49226	99,9%	27	0,1%	49253	100,0%

They capture respondents' attitudes towards prevention in relation to COVID-19. To interpret the results, we dichotomize all five selected indicators by three intuitionistic fuzzy

grades - intuitionistic fuzzy membership degree μ , intuitionistic fuzzy non-membership degree ν and intuitionistic fuzzy hesitation degree $\pi = 1 - \mu - \nu$.

2.2. Analytic approach

The IFS (Intuitionistic Fuzzy Set) theory (4) is in the basis of multiple methods for problem solving due to the common presence of some uncertainty in life. It is especially appropriate for modelling of human behavior as it usually implements some degree of hesitation.

Based on the SHARE-COVID-19 Survey 2 and selected indicators we define an IFS V_{EU} as a set with the European average intuitionistic fuzzy grades by:

$$V_{EU} = \{ \{x, \mu_{V_{EU}}(x), \nu_{V_{EU}}(x)\} | x \in E \} \quad (1)$$

where x is a specific question from the questionnaire survey and E is the universal set of the selected five questions x , with intuitionistic fuzzy membership μ , intuitionistic fuzzy non-membership ν and intuitionistic fuzzy degree of uncertainty π as follows:

$\mu_{V_{EU}}(x): E \rightarrow [0,1]$, is the percentage of those who answered the question x positively;

$\nu_{V_{EU}}(x): E \rightarrow [0,1]$, is the percentage of those who answered the question x negative;

$\pi_{V_{EU}}(x) = 1 - \mu_{V_{EU}}(x) - \nu_{V_{EU}}(x)$, is the intuitionistic fuzzy hesitation degree.

For every country included in SHARE-COVID-19 Survey 2, we separately define the IRS V_i

$$V_i = \{ \{x, \mu_{V_i}(x), \nu_{V_i}(x)\} | x \in E \} \quad (2)$$

For each of $x \in E$ it is valid: $0 \leq \mu_V(x) + \nu_V(x) \leq 1$.

Then, as part of the suggested analytic method, we find the similarity of each of the defined IFS V_i with the V_{EU} IFS, composed as a set with the European average intuitionistic fuzzy grades. This step utilizes one of the similarity measures, defined in (5). More specifically, the similarity measure, defined for the third IF norm, for the first IF negation and for the first type of IF subtraction:

$$\psi_3^{1'}(A, B) = \frac{(\sigma_{3,B,A}^{1'} + 1 - \sigma_{3,A,B}^{1'})}{2} \quad (3)$$

Where $\sigma_{3,B,A}^{1'}$ is a distance metric between the elements of the IF sets B and A, defined on the third IF norm, the first IF negation and the first type of IF subtraction; and $\sigma_{3,A,B}^{1'}$ is the analogous distance metric between the elements of the IF sets A and B.

The similarity measure $\psi_3^{1'}(A, B)$ evaluates to a crisp value between 0 and 1. This could serve to find out which one of any two IF sets has better IF degrees utilizing following properties:

- If $\psi_3^{1'}(A, B) < 0.5$, then the IF grades of the set A are better than those of the set B.
- If $\psi_3^{1'}(A, B) > 0.5$, then the IF grades of the set B are better than those of the set A.
- If $\psi_3^{1'}(A, B) = 0.5$, then the IF grades of the sets A and B are equal.

3. RESULTS

As a starting point, we calculate IF sets V_{EU} and V_i by formula (1) and formula (2). Tab. 2 shows data and calculated by as intuitionistic fuzzy grades for the first indicator of health behavior – survey question (1) „took medicines or drugs as a prevention against COVID-19“

Tab.2 Data & intuitionistic fuzzy grades for the first indicator of health behavior – survey question (1)

Country	Refusal	Don't know	Yes	No	total	m	n
Austria	0	2	162	2150	2314	0.070009	0.929127
Germany	0	2	45	1990	2037	0.022091	0.976927
Sweden	0	0	36	932	968	0.037190	0.962810
Netherlands	0	0	64	666	730	0.087671	0.912329
Spain	0	2	15	1780	1797	0.008347	0.990540
Italy	2	1	94	3263	3360	0.027976	0.971131
France	0	0	104	1750	1854	0.056095	0.943905
Denmark	0	1	26	1564	1591	0.016342	0.983030
Greece	0	0	430	2969	3399	0.126508	0.873492
Switzerland	0	1	113	1637	1751	0.064535	0.934894
Belgium	1	5	262	3181	3449	0.075964	0.922296
Israel	1	5	71	1210	1287	0.055167	0.940171
Czech Republic	0	1	832	1255	2088	0.398467	0.601054
Poland	0	0	264	2532	2796	0.094421	0.905579
Luxembourg	0	1	38	828	867	0.043829	0.955017
Hungary	0	0	358	504	862	0.415313	0.584687
Portugal	0	1	52	1018	1071	0.048553	0.950514
Slovenia	1	0	515	2430	2946	0.174813	0.824847
Estonia	4	9	1038	3017	4068	0.255162	0.741642
Croatia	0	1	148	1761	1910	0.077487	0.921990
Lithuania	1	3	102	1153	1259	0.081017	0.915806
Bulgaria	0	0	159	547	706	0.225212	0.774788
Cyprus	1	0	38	611	650	0.058462	0.940000

Country	Refusal	Don't know	Yes	No	total	m	n
Finland	0	0	84	1227	1311	0.064073	0.935927
Latvia	0	1	184	790	975	0.188718	0.810256
Malta	0	1	133	656	790	0.168354	0.830380
Romania	0	0	256	1211	1467	0.174506	0.825494
Slovakia	0	0	535	390	925	0.578378	0.421622
Slovakia	11	37	6158	43022	49228	0.125091	0.873934
EU average	22	74	12316	86044	98456	0.125091	0.873934

Tab. 3 shows only calculated by as intuitionistic fuzzy grades for all five indicators of health behavior, as described in 2.1.

Tab.3 Intuitionistic fuzzy grades for the five indicators of health behavior.

Country	Q1		Q2		Q3		Q4		Q5	
	m	n	m	n	m	n	m	n	m	n
Austria	0.070	0.929	0.866	0.131	0.022	0.108	0.284	0.711	0.186	0.806
Germany	0.022	0.977	0.907	0.093	0.030	0.061	0.541	0.457	0.311	0.677
Sweden	0.037	0.963	0.976	0.024	0.004	0.019	0.573	0.424	0.244	0.745
Netherlands	0.088	0.912	0.959	0.041	0.007	0.034	0.625	0.375	0.092	0.907
Spain	0.008	0.991	0.968	0.032	0.012	0.019	0.634	0.361	0.173	0.805
Italy	0.028	0.971	0.902	0.096	0.035	0.060	0.511	0.487	0.095	0.892
France	0.056	0.944	0.864	0.135	0.035	0.099	0.547	0.447	0.054	0.934
Denmark	0.016	0.983	0.981	0.018	0.006	0.012	0.609	0.390	0.439	0.554
Greece	0.127	0.873	0.767	0.232	0.073	0.158	0.521	0.479	0.281	0.714
Switzerland	0.065	0.935	0.825	0.174	0.026	0.147	0.357	0.640	0.029	0.969
Belgium	0.076	0.922	0.950	0.049	0.008	0.041	0.575	0.423	0.160	0.834
Israel	0.055	0.940	0.936	0.061	0.004	0.049	0.594	0.392	0.396	0.544
Czech Republic	0.398	0.601	0.832	0.167	0.039	0.125	0.253	0.745	0.153	0.841
Poland	0.094	0.906	0.737	0.262	0.053	0.204	0.092	0.907	0.014	0.985
Luxembourg	0.044	0.955	0.931	0.067	0.025	0.042	0.452	0.543	0.238	0.750
Hungary	0.415	0.585	0.885	0.115	0.013	0.102	0.222	0.778	0.049	0.949
Portugal	0.049	0.951	0.934	0.066	0.049	0.018	0.585	0.411	0.214	0.752
Slovenia	0.175	0.825	0.715	0.284	0.054	0.228	0.253	0.746	0.030	0.966
Estonia	0.255	0.742	0.721	0.276	0.060	0.213	0.160	0.835	0.010	0.983
Croatia	0.077	0.922	0.704	0.296	0.053	0.241	0.296	0.695	0.006	0.990
Lithuania	0.081	0.916	0.627	0.372	0.081	0.283	0.172	0.828	0.034	0.963
Bulgaria	0.225	0.775	0.191	0.809	0.099	0.707	0.037	0.963	0.011	0.987
Cyprus	0.058	0.940	0.846	0.152	0.025	0.128	0.469	0.529	0.092	0.895
Finland	0.064	0.936	0.943	0.057	0.019	0.037	0.536	0.459	0.210	0.767
Latvia	0.189	0.810	0.515	0.484	0.064	0.416	0.117	0.883	0.031	0.964
Malta	0.168	0.830	0.982	0.018	0.003	0.015	0.666	0.333	0.030	0.961
Romania	0.175	0.825	0.327	0.672	0.052	0.619	0.230	0.770	0.003	0.995
Slovakia	0.578	0.422	0.649	0.348	0.094	0.251	0.058	0.942	0.017	0.979
EU average	0.125	0.874	0.808	0.191	0.039	0.150	0.386	0.611	0.128	0.863

As the next step, we calculate the similarity of each of the defined IFS V_i with a V_{EU} IFS by formula (3) . The results are summarized in tab.4.

Tab.4 Similarity measures

Country	Similarity measures
Israel	0.4399292334
Malta	0.4530210104
Sweden	0.4568325321
Portugal	0.4582844076
Denmark	0.4604657036
Spain	0.4605080795
Germany	0.4626198875
Finland	0.4641085374
Netherlands	0.4648903833
Belgium	0.4649121287
Luxembourg	0.4732237166
Greece	0.4742387211
Czech Republic	0.4800005366
Italy	0.4865719309
Hungary	0.4871641652
France	0.4900252269
Cyprus	0.4975826910
EU average	0.5000000000
Austria	0.5027901240
Slovakia	0.5171336266
Switzerland	0.5180457231
Slovenia	0.5310241874
Estonia	0.5319872368
Croatia	0.5403354095
Poland	0.5535431354
Lithuania	0.5581985644
Latvia	0.5720442295
Romania	0.5946279430
Bulgaria	0.6237430745

Our findings point to countries specific differences in the level of willingness for prevention of COVID-19. Results show the presence of a definite leader in terms of positive attitudes towards the prevention of COVID-19, and that is Israel. As well, a clear leader in negative attitudes towards the prevention of COVID-19 is Bulgaria. In general, the current attitudes in the EU are positive regarding prevention against COVID-19 (in 17 out of a total of 28 states included in this study).

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