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La reticencia a vacunarse desde la óptica del marketing. Tres ensayos.

Vaccine hesitancy from a marketing perspective: Three essays.

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Resumen.

La reticencia a vacunarse, entendida esta como la renuencia o el rechazo a las vacunas a pesar de la disponibilidad de las mismas, está aumentando a nivel mundial. Su crecimiento es tan importante que la Organización Mundial de la Salud (OMS) identificó la reticencia a la vacunación como una de las diez amenazas principales para la salud mundial en 2019.

Aunque los avances en el estudio científico de este fenómeno son recientes, iniciándose a mediados de la década de los años 10 del presente siglo, tenemos a nuestra disposición diversos modelos que explican los principales elementos y relaciones que componen el mismo. Sin embargo, desde la óptica de marketing los estudios son mucho más escasos. El enfoque que esta disciplina aporta, a través principalmente del marketing social, es complementario al que ofrecen los instrumentos más tradicionales de intervención en salud pública debido a que su objetivo es que los que se muestran renuentes a vacunarse cambien su comportamiento de forma voluntaria.

Para la mayoría de las vacunas el porcentaje de población objetivo que tiene que estar vacunada para que se consiga el control de la evolución de la enfermedad es tan elevado que el que un pequeño grupo de personas no lo haga pone en riesgo los objetivos perseguidos por las autoridades sanitarias. Esta razón ha llevado a que históricamente la vacunación se haya intentado imponer por ley en diversas ocasiones. Pero el efecto finalmente conseguido ha sido contrario al que se buscaba. El marketing social no trata de imponer sino de convencer. A través de sus actuaciones busca que aquellos que muestren resistencia a la vacunación finalmente se vacunen de forma voluntaria y que los que ya se vacunan lo sigan haciendo.

La aplicación del marketing social requiere del conocimiento profundo del comportamiento que los ciudadanos tienen hacia las vacunas como punto de partida. En un mundo globalizado como el que vivimos las enfermedades transmisibles no conocen de fronteras. Sin embargo, los modelos de gestión que se han utilizado han sido desarrollados con una óptica local, siguiendo las recomendaciones establecidas por los organismos internacionales de salud. La primera investigación que se contempla en esta tesis muestra que en 28 países europeos existen segmentos globales de comportamiento hacia la vacunación. En concreto, se obtienen 7 segmentos diferenciados correspondiendo 1 de ellos a aquellos ciudadanos que se muestran a favor de vacunarse y los 6 restantes a ciudadanos que muestran diversos grados de reticencia a la vacunación. Se muestra además como se distribuyen estos segmentos en cada uno de los países y si tienen una presencia diferencialmente significativa respecto al resto.

La siguiente investigación profundiza en el comportamiento hacia la vacunación planteando un modelo de medición que contempla la relación que existe entre este y la utilidad que perciben los ciudadanos de las vacunas, la confianza en las instituciones y el populismo político. Las dos primeras variables han sido abordadas en estudios anteriores como determinantes de la reticencia a vacunarse, pero la influencia que el populismo político a nivel individual pudiera tener es una novedad. Los populistas han encontrado en la resistencia a la vacunación un campo de actuación que se alinea perfectamente con sus intereses políticos. Basados fundamentalmente en la desconfianza hacia las élites —grandes empresas farmacéuticas, organismos internacionales de salud, medios de comunicación tradicionales, gobiernos, etc.—, el fracaso de las campañas de vacunación les proporciona una vía de generación de desconfianza que les permite obtener mayor relevancia y réditos electorales. Por otra parte, dado que el fenómeno que investigamos es global, cualquier análisis que se realice tiene que partir de instrumentos de medida que sean invariantes. Ningún análisis de los realizados anteriormente a esta investigación había abordado este aspecto. Los resultados muestran que el modelo de medición propuesto es invariante y que las relaciones que se habían hipotéticamente establecido entre populismo, utilidad de las vacunas y desconfianza en las instituciones se confirman. Los resultados obtenidos, al ser invariantes, permiten la comparación de las medias de comportamiento de estas tres variables en 28 países europeos. Se obtiene así una agrupación de los países europeos por segmentos en función de la utilidad que conceden a las vacunas, la confianza que tienen en las instituciones y el populismo manifestado por sus ciudadanos. Este análisis complementa al obtenido a la primera investigación.

Profundizando en estos resultados, analizamos en la tercera investigación como la desconfianza en las instituciones se relaciona con la vacunación y si está relación esta mediada por el populismo político. Dado que este este conjunto de relaciones es el que está subyacente en el foco que están poniendo los partidos populistas sobre la reticencia a la vacunación como arma política, quedaba por evidenciar si eran contrastadas por los datos. Los resultados son elocuentes al obtenerse una mediación total. En los 28 países europeos analizados, la desconfianza en las instituciones está altamente relacionada con el incremento del populismo político y este a su vez se relaciona con una menor probabilidad de vacunarse.

Como consecuencia de nuestras investigaciones, se concluye que el fenómeno de la resistencia a vacunarse debe ser abordado a través del marketing social, como complemento de los otros instrumentos de intervención en salud pública. Que hay que adoptar una visión estratégica global dada la naturaleza del fenómeno y la existencia de segmentos globales de comportamiento. Por último, la dificultad de gestionar la reticencia a la vacunación se ha visto incrementada

debido a que los partidos populistas, a través de la utilización de la desconfianza en las instituciones, generan menores tasas de vacunación en aquellos ciudadanos que son partidarios de sus postulados. El restablecimiento de la confianza en las instituciones se muestra como uno de los principales objetivos a conseguir por las campañas de marketing social para que la reticencia a la vacunación se vea reducida a niveles que permitan una gestión adecuada de la evolución de las enfermedades.

Abstract.

Vaccine hesitancy—the reluctance or refusal to vaccinate despite the availability of vaccines— is rising worldwide. Its growth is so significant that the World Health Organization (WHO) identified vaccine hesitancy as one of the top ten threats to global health in 2019.

Although the scientific discoveries about this phenomenon are recent, starting in the middle of the decade of the 10s of this century, several models that explain the principal elements and relationships that make it up are available. However, from a marketing perspective, studies are much scarcer. This discipline's approach, mainly studied through social marketing, is complementary to the one previously offered by the more traditional instruments of intervention in public health because its main goal is to change voluntarily the behavior of those who show hesitancy towards vaccines.

For most vaccines, the percentage of the target population that must be jabbed to control the evolution of the disease is so high that the minority that does not follow the vaccination protocols puts at risk the objectives pursued by the health authorities. This reason has led to the fact that, by law, compulsory vaccination has been implemented on several occasions. Nevertheless, the results from this implementation have been far away from what was sought. Social marketing is not about forcing but rather about convincing. Social marketing actions seek that those who show hesitancy towards vaccination get vaccinated voluntarily and that those already vaccinated continue doing so.

The application of social marketing requires a deep understanding of the behavior that citizens have towards vaccines. In a globalized world, infectious diseases do not know about borders. However, the management models have been implemented from a local perspective, following the recommendations established by international health organizations. Our first research of this doctoral thesis shows global vaccination behavioral segments in 28 European countries. Specifically, seven different segments have been observed. One of them corresponds to those citizens who favor vaccination and the remaining six to citizens who show varying vaccine hesitancy degrees. Furthermore, it also shows how these segments are distributed in each country and tests if they have a significantly different presence compared to each other.

The following research delves into the behavior towards vaccination by proposing a measurement model that contemplates the relationship between this behavior and the perceived usefulness of vaccines, trust in institutions, and

political populism. The first two variables have been addressed in previous studies as crucial factors of vaccine hesitancy. Hence, political populism's influence is a novelty at the individual level. Worldwide, populists have found a field of action that aligns perfectly with their political interests in the population's vaccine hesitancy. Mainly based on distrust of elites – large pharmaceutical companies, international health organizations, traditional media, governments, etc. – the failure of vaccination campaigns reinforce them with arguments that create distrust among the population leading them to the obtention of greater relevance and electoral returns.

On the other hand, since the phenomenon we investigate is global, any analysis carried out has to start by measuring invariant instruments. No study of those conducted before this research had addressed this aspect. The results show that the proposed measurement model is invariant and that the hypothetically established relationships between populism, vaccine usefulness, and distrust in institutions hold. Furthermore, the results obtained, being invariant, allow the comparison of the behaviors' means of these three variables in 28 European countries. Thus, we obtained a European countries' segmentation according to their vaccines' usefulness perception, their trust in institutions, and the populism manifested by their citizens. This analysis supports and complements the one carried out in our first investigation.

Continuing with the results and conclusions that we obtained in our previous research, we analyze in the third research how distrust in institutions is related to vaccination and whether it is related to political populism. Given that this set of relationships was underlying the focus that populist parties are deploying on using vaccine hesitancy as a political weapon, it was necessary to check if the data was backing this up. Finally, the results were eloquent because full mediation was reached. In the 28 European countries analyzed, distrust in institutions was highly related to the increase in political populism and this, in turn, was related to a lower probability of getting vaccinated.

After considering the results and conclusions obtained in our three research essays, we conclude that the phenomenon of vaccine hesitancy should be addressed through social marketing as a complement to the other instruments in public health intervention. Furthermore, a global strategic vision must be adopted, given the nature of the phenomenon and the existence of global behavioral segments. Internationally, the difficulty of managing the vaccine hesitancy has increased due to the distrust prompyed by populist parties. Ultimately, this has generated lower vaccination rates in those citizens who are supporters of their postulates.Therefore, the restoration of trust in institutions

is shown as one of the main objectives of social marketing campaigns. If this trust is restored, the vaccination hesitancy would be reduced to levels that will facilitate the adequate management of the evolution of diseases

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Capítulo 1: Introducción

1.1 La reticencia a vacunarse. Delimitación conceptual.

La resistencia a vacunarse, entendida esta como la renuencia o el rechazo a las vacunas a pesar de la disponibilidad de las mismas, está aumentando a nivel mundial. Aunque las vacunas se consideran uno de los logros más importantes de la salud pública, ya que previenen aproximadamente 2,5 millones de muertes cada año en todo el mundo y reducen los costos de tratamiento específicos de enfermedades [1], la Organización Mundial de la Salud (OMS) identificó la reticencia a la vacunación como una de las diez amenazas principales para la salud mundial en 2019 [2].

La reticencia a las vacunas no es una tendencia nueva. Desde 1795, cuando Edward Jenner publicó el libro titulado "An Inquiry into the Cowpox", la vacunación se ha convertido en una práctica médica convencional en todo el mundo [3]. Sin embargo, desde sus inicios, las inoculaciones han tenido sus detractores. Los primeros fueron las personas relacionadas con la iglesia. Ellos razonaron que las enfermedades infecciosas eran un hecho de vida o muerte decidido por Dios. Algunos médicos, los que ganaban mucho dinero con curas inútiles pero lucrativas, también se inscribieron pronto en el movimiento anti vacunas [3]. La vacunación se asoció con diversos peligros, incluidos la tuberculosis, el cáncer, la locura, el envenenamiento de la sangre y la sífilis [4]. Desde mediados del siglo XIX, Gran Bretaña y los países bajo su influencia hicieron obligatoria la vacunación. Los padres que se negaron a vacunar a sus hijos fueron enviados a prisión. Los resultados fueron desastrosos, con disturbios sociales que terminaron con la abolición de las leyes que hacían obligatoria la vacunación en 1909. Las lecciones que dejaron estas primeras experiencias fueron claras: los riesgos de la vacunación no deben silenciarse, y la vacunación obligatoria no fue la respuesta adecuada a la falta de confianza pública en las vacunas.

En la actualidad, los escépticos hacia las vacunas están aumentando en número. En varios países occidentales, enfermedades que casi habían sido erradicadas están volviendo a aparecer debido a la disminución de sus tasas de vacunación. El rechazo a las vacunas ha ido en aumento en muchos Estados miembros de la UE [5]. Entre 2000 y 2019, la aceptación de la primera dosis de la vacuna del sarampión ha disminuido en 12 Estados miembros de la UE [6]. Además, 14 Estados miembros de la UE estaban por debajo del umbral de tasa de inmunización del 95 % que se requería para lograr la inmunidad colectiva en 2019 [7]. En la misma situación se encontraba la gripe estacional y otras enfermedades infecciosas [5]. El último episodio de resistencia a vacunarse está relacionado con la pandemia de COVID-19. Las diferencias en las tasas de aceptación varían enormemente de un país a otro en todo el mundo [8,9]. Los gobiernos, los funcionarios de salud pública, las empresas farmacéuticas y otros

actores que forman parte de la cadena de valor de la vacunación están preocupados por la falta de disposición de un grupo creciente de personas a recibir vacunas cuando corresponda [10].

El éxito de una campaña de vacunación depende, entre otros factores, de que se consiga un porcentaje muy alto de inoculación de la población. La inmunidad colectiva —también conocida como inmunidad de grupo e inmunidad de rebaño—, es el nivel en el que se debe mantener la cobertura de inmunización para que sea eficaz. Depende de la vacuna, pero normalmente oscila entre el 80 % y el 90 % de la población [11,12]. Por lo tanto, un pequeño número de personas que dudan en vacunarse puede tener enormes efectos adversos sobre la inmunidad colectiva y la propagación de epidemias (paradoja de los pequeños coletivos o "small pocket issue"). Más aún, si consideramos que ese bajo porcentaje que puede quedar sin vacunar, una vez alcanzada la inmunidad de rebaño, tiene que reservarse para personas con sistemas inmunológicos comprometidos o demasiado jóvenes (por ejemplo, neonatos).

Conseguir la inmunidad de grupo implica un enorme reto desde el punto de vista de gestión. En términos generales, al menos el 90% de la población objetivo debe tener inmunidad para que se obtengan los resultados esperados [13]. La inmunidad es un concepto dinámico debido a que, en muchas vacunas, es necesario dispensar dosis de recuerdo o desarrollar nuevas fórmulas para hacer frente a las mutaciones que el agente infeccioso puede desarrollar [14]. Esta dificultad ha conllevado que históricamente en situaciones críticas las vacunaciones se hayan querido imponer por ley en algunos países [15]. Dado que uno de los principios fundamentales de la ética médica reside en la necesidad de dar un consentimiento a cualquier actuación que se vaya a llegar a cabo, no se puede obligar a que una persona, o las que dependen legalmente de ella, sean vacunadas [16,17]. Debido a esta razón, la obligatoriedad legal se suele instrumentar a través de determinadas penalizaciones a aquellos que no se vacunan [18]. Por ejemplo, es muy común excluir a los niños no vacunados de los centros de enseñanza debido a que son un espacio idóneo para la transmisión de infecciones —Italia, Francia, Australia y, desde 1980, más de 50 estados de EE.UU. condicionan la entrada en la escuela a la necesidad de estar vacunados; además, en Australia e Italia algunas ayudas y subvenciones para las familias sólo están disponibles en el caso de que los hijos estén vacunados— [19].

1.2 El mix de intervención público ante las pandemias y las endemias. El marketing social.

Aunque la obligatoriedad legal de vacunarse ha existido de una u otra forma a lo largo de los últimos 200 años, no ha alcanzado los resultados esperados de conseguir tasas altas de vacunación en el largo plazo que permitieran alcanzar

la inmunidad de grupo [20]. En el corto plazo, si hay evidencias de haber conseguido resultados positivos. Es el caso, por ejemplo, de Australia que a través de la introducción en 2015 de la legislación denominada *no jab – no paid* (sin vacunas no hay ayudas) han conseguido aumentar las tasas de vacunación hasta el nivel del 95% [21]. Sin embargo, la historia demuestra que en el largo plazo el resultado de la imposición legal ha tenido menos éxito. Así, el sarampión fue considerado en el año 2010 como una infección erradicable en el año 2020 por la Organización Mundial de la Salud (O.M.S.) dado que las tasas de vacunación estaban cercanas al 95% a nivel mundial [22]. Sin embargo, a principios del año 2020 Europa presentaba 17 veces más casos de sarampión que los registrados en 2016, EE.UU. registraba rebrotes que ponían en peligro los enormes logros alcanzados y países como Reino Unido, Albania, Grecia y la Republica Checa perdieron su condición de zonas libres de sarampión [23]. Al mismo tiempo, los países que mostraban una mayor tasa de vacunación, superior al 95%, en la vacuna conocida como triple viríca (protege contra el sarampión, las paperas y la rubeola) eran Portugal y Suecia, donde la vacunación no era obligatoria [20,24]. La evidencia muestra que la resistencia a vacunarse es un fenómeno social altamente complejo que no es fácilmente solucionable a través de limitaciones legales.

Los programas de vacunación deben contemplar el marketing social y las técnicas de las ciencias del comportamiento para conseguir sus objetivos [25–31]. Existe abundante evidencia científica que muestra como la aceptación de las vacunas está influenciada tanto por cuestiones relacionadas con el acceso a las mismas como por factores de carácter social, cultural, político, psicológico y de acceso a la información [32–35]. Los académicos de campos interdisciplinarios (por ejemplo, sociólogos, psicólogos, antropólogos y expertos en marketing social y comunicación de salud) deben trabajar juntos [29]. Los complejos retos de cambio de comportamiento que están asociados con las pandemias van más allá de las aproximaciones tradicionales que se realizaban principalmente desde el punto de vista de comunicación. Los programas de comunicación basados en un buen análisis, planificación, ejecución y control son una parte vital de un programa de gestión y control de pandemias. Pero como queda demostrado en diversas investigaciones [36,37], las decisiones por parte de los ciudadanos sobre las vacunas se toman basadas no sólo en decisiones racionales de carácter personal después de haber analizado toda la información disponible, sino también en un abanico más amplio de motivaciones. Si queremos influir en el comportamiento de la ciudadanía ante las vacunas, debemos aplicar un enfoque más sofisticado para comprender y desarrollar estrategias integrales que incluyan la elección no racional [38]. Esta nueva comprensión deja clara la necesidad de diseñar estrategias de influencia del comportamiento que vayan más allá de la

transmisión de información objetiva y precisa como la principal forma de influir en el comportamiento y la opinión antes, durante y después de los eventos pandémicos [39,40]. Se hace necesario delimitar el papel a desarrollar en el marco legal, la educación y el marketing social.

El marketing social, entendido este como la utilización del marketing para diseñar y llevar a cabo programas que promuevan un cambio de comportamiento voluntario que beneficia tanto al individuo como a la sociedad, ha ganado posiciones en el ámbito de la salud y, en concreto, de la vacunación [41]. Siguiendo el consenso que se alcanzó en el año 2013 entre la *International Social Marketing Association*, la *European Social Marketing Association* y la *Australian Association of Social Marketing*, "El marketing social busca desarrollar e integrar los conceptos de marketing con otros métodos que influyen en los comportamientos para beneficiar tanto a los individuos como a las comunidades en la búsqueda de un mayor bienestar social … Busca integrar la investigación, las mejores prácticas, la teoría y el conocimiento de los diversos públicos objetivos y sus relaciones para desarrollar programas de acción segmentado que, siendo conocedores de la competencia que existe en estos mercados, busquen un cambio social que sea efectivo, eficiente, equitativo y sostenible"[42]. El marketing social, al facilitar la aceptación, el rechazo, la modificación, el abandono o el mantenimiento de ciertos comportamientos, se adecua al objetivo que se persigue a través de los programas de vacunación. Así, para alcanzar la meta socialmente deseada de la inmunidad de grupo, una vez conocidos los diversos comportamientos que se dan en las sociedades hacia la vacunación, a través del marketing social se tendrá como objetivo que aquellos ciudadanos y grupos de interés que estén en favor de la vacunación se mantengan en esa posición y que los que están en contra, o dubitativos, modifiquen su comportamiento.

Otro de los aspectos importantes de la definición del marketing social es que el cambio de comportamiento que se persigue debe ser hecho de forma voluntaria. En este sentido, se contrapone a la utilización de la ley para obligar a la población a vacunarse. O, visto de otra forma, podríamos decir que son instrumentos complementarios. Las medidas coercitivas de carácter legal son el instrumento más eficaz a corto plazo que tienen las autoridades sanitarias y políticas cuando la sociedad no quiere pagar el coste asociado a que un cierto número de personas no quieran vacunarse por diversos motivos [43,44]. Sin embargo, como ya hemos visto, la evidencia muestra que este tipo de medidas no son suficientes en el largo plazo. Por el contrario, el marketing social intenta influir en el comportamiento ofreciendo alternativas que invitan al cambio voluntario. La utilización del marketing social será más eficaz cuando los objetivos de la sociedad no son coincidentes con los intereses del público

objetivo, pero se puede influir en su comportamiento en la dirección deseada a través de acciones de marketing.

Para delimitar el campo de actuación del marketing social es necesario diferenciarlo de otro potente instrumento como es la educación. Siguiendo a Rothschild [44], la educación informa y persuade a las personas para que voluntariamente adopten comportamientos saludables a través del conocimiento de los beneficios que conseguirán con el cambio. Los ciudadanos a los que se dirige la actuación educativa son libres de elegir la respuesta que van a dar a la actividad educativa, aceptando la sociedad los costes de que estas personas continúen con la práctica de los comportamientos no deseados. La educación es más eficaz cuando los objetivos de la sociedad son consistentes con los del público objetivo, los beneficios del cambio de comportamiento son inherentemente atractivos, inmediatos y obvios, los costes del cambio son pequeños y las habilidades y otros recursos necesarios para llevar a cabo el cambio pretendido son fácilmente obtenibles. Como se puede ver, la educación y el marketing social dan libertad de elección al individuo. Como diferencia fundamental, observamos que el marketing social busca incidir directamente en las decisiones del individuo, aumentando el atractivo de los beneficios y reduciendo los costes, más que esperar un sacrificio del mismo en beneficio de la sociedad.

La influencia sobre el comportamiento se sitúa en el centro de atención de la gestión de cualquier enfermedad contagiosa que pueda ocasionar una pandemia. El comportamiento sobre el que hay que actuar puede estar referido al de los individuos —bien para protegerse ellos mismos o a otras personas—, al de los profesionales sanitarios, al papel de comunicación de los medios, partidos políticos, gobiernos, organizaciones sociales, organizaciones no gubernamentales, empresas sociales, empresas farmacéuticas, empresas tecnológicas y una amplia variedad de grupos de interés relacionados con la salud. Diversos estudios han demostrado que los ciudadanos y las comunidades de las que forman parte no se comportan de forma aislada ante los procesos de cambio, sino de forma colaborativa, coordinada e interrelacionada con aquellos grupos con los que comparten intereses[45–48]. Es, por lo tanto, necesario que el marco para comprender el comportamiento de las personas que se resisten a vacunarse contemple el complejo sistema de relaciones en el que se desarrolla.

1.3 Retos del marketing social ante la vacunación. Multiplicidad de públicos objetivo, segmentación, invarianza de los instrumentos de medición y politización.

Los programas de marketing social para influir en el comportamiento de los ciudadanos hacia la vacunación necesitan contemplar un conjunto de objetivos

claros, medibles y alcanzables. Una de las características distintivas de las pandemias es su naturaleza impredecible combinada con la posible incapacidad de los servicios sanitarios en los momentos más álgidos de su evolución. El estrés al que se ven sometidos estos servicios requiere que las tareas de gestión y de información, tanto a los ciudadanos como a los profesionales sanitarios, se vean incrementadas para trasladar adecuadamente que es lo que está ocurriendo y cuáles son las recomendaciones sobre los comportamientos que se deben adoptar para tratar de mitigar la infección. Esta situación de excepcionalidad hace que la definición de objetivos sea especialmente difícil. En este sentido, Rittel y Weber [49] diferencian entre los que denominan problemas normales (*tamed problems*) y problemas enrevesados (*wicked problems*). Los problemas normales no son necesariamente simples de abordar, pero pueden ser claramente definidos y existe una solución identificada a través de la gestión de variables que son controlables y de las que de antemano se conoce cuál es la relación causa-efecto. Por el contrario, los problemas enrevesados son más complejos, difíciles de definir y normalmente incluyen muchas variables. La resistencia a la vacunación se corresponde con un problema del segundo tipo de los mencionados [50].

La gestión de los programas de vacunación, desde el punto de vista de marketing social, se enfrenta al enorme reto que supone la multiplicidad de públicos objetivos a los que se dirigen y el diferente tipo de acciones que se requieren según la fase en la que se encuentra la pandemia de que se trate. De hecho, en opinión de la comunidad de expertos de marketing social, los fallos en la gestión de estos grupos se consideran como una de las razones principales del fracaso de los programas de marketing llevados a cabo [51]. Más en concreto, el fallo consiste en la falta de una adecuada investigación previa que permita un conocimiento del comportamiento de los públicos objetivo. Esto imposibilita focalizar adecuadamente las actividades a llevar a cabo obteniendo impactos muy limitados [52,53].

Las segmentaciones llevadas hasta la fecha en el ámbito del análisis de los diferentes comportamientos que se dan ante la vacunación en diversos países no abordan dos cuestiones fundamentales: la existencia o no de comportamientos globales y, por otra parte, la invarianza de los diferentes instrumentos de medida utilizados.

La existencia de segmentos de ciudadanos que tienen un comportamiento global hacia la vacunación en distintos países es fundamental desde el punto de vista de la gestión, tanto por razones de eficacia como de eficiencia [54]. Las enfermedades que se pueden combatir con la utilización de vacunas son globales por naturaleza. Es decir, no conocen de fronteras territoriales a la hora de expandirse. Los valores, actitudes y comportamientos observados de las personas deben ser la base sobre la decidir el enfoque de las diferentes

intervenciones a llevar a cabo con el objetivo de, por una parte, maximizar la vacunación y, por otro lado, minimizar el riesgo de contagio (mantenimiento de la distancia de seguridad con el resto de las personas, uso de sistemas personales de protección, etc.). Las organizaciones que trabajan en el mercado global se enfrentan al dilema de la existencia o no de un consumidor global, entendiendo por tal el hecho de que los consumidores se comporten de manera similar independientemente del territorio en el que estén situados. En el caso de la existencia de un consumidor global, las organizaciones suelen llevar a cabo una estrategia estandarizada, es decir, desarrollan el mismo mix de intervención para uno o varios segmentos determinados en los diferentes territorios. Si no se observan esos comportamientos globales en el público objetivo, se lleva a cabo una estrategia adaptada, es decir, aplicando distintos mix de intervención en los diferentes mercados atendiendo a esas características diferenciales. Estas dos opciones estratégicas que acabamos de mencionar son los extremos del continuo en el que se suelen ubicar las organizaciones que operan en los mercados internacionales [55]. La identificación de segmentos de ciudadanos que se comportan de forma similar hacia la vacunación, en la medida de que estos existan, permitiría llevar a cabo intervenciones más eficaces y eficientes en el sentido de que estarían mejor orientadas y permitiría llevar a cabo las mismas actuaciones en diferentes territorios. Sin embargo, en la mayoría de los casos, las recomendaciones dadas por las organizaciones de salud internacionales y los gobiernos no se plantean esta cuestión [56–58]. Antes al contrario, siguiendo el principio de que "el contexto importa", lo que sugieren es que los diferentes territorios diseñen y pongan en marcha programas de intervención adaptados a las características diferenciales que se pueden dar en sus ámbitos espaciales de actuación. A despejar esta duda de si existe o no segmentos de comportamiento global ante la vacunación se dedica la primera de las investigaciones que presentamos que lleva por título *Global Vaccine Hesitancy Segmentation: A Cross-European Approach*.

Un segundo problema que afecta a las segmentaciones efectuadas en el ámbito de la vacunación es la ausencia de análisis de la invarianza de los instrumentos de medida cuando se estudia más de un territorio. Los comportamientos de los ciudadanos hacia las vacunas se suelen medir a través de variables no observables directamente sino calculadas en base a la utilización de escalas que componen las denominadas variables latentes o constructos. Cuando se tiene más de un grupo, como es nuestro caso dado que queremos establecer comparaciones entre diferentes países, para poder comparar las medias o establecer relaciones entre variables es necesario verificar que estas funcionan de manera similar en cada grupo evaluado. Es decir, que cada variable latente o constructo que sirve para medir el comportamiento hacia la vacunación tiene que ser entendido y medido de forma equivalente en todos los países que van a

formar parte de nuestro estudio [59,60]. La medición de la invarianza se ha convertido en un tema importante en el mundo de la investigación, pero no todavía en el campo de la resistencia a vacunarse. En una búsqueda realizada en la base de datos bibliográfica *Web of Science* en el mes de julio de 2021 [61], los términos relacionados con la medición de la invarianza dieron como resultado un total de 6.337 coincidencias. La resistencia a la vacunación también atrajo el interés de los investigadores dando como resultado de la búsqueda, en esa misma base de datos y fecha, un total de 5.225 coincidencias. Pero, al cruzar los dos resultados anteriores, sólo dos trabajos que habían abordado la resistencia a las vacunas habían hecho un análisis de la invarianza de las escalas de medida propuestas. Para tratar de abordar este vacío existente, sobre todo cuando se trata de llevar a cabo una comparativa basada en encuestas de gran tamaño realizada en múltiples países abordando un problema global como es el del comportamiento de los ciudadanos hacia la vacunación, se llevó a cabo el segundo trabajo de investigación que se presenta en este compendio y que lleva por título *Vaccine Hesitancy and Political Populism. An Invariant Cross-European Perspective*.

Como se puede deducir del título de este segundo trabajo, en él se aborda una relación muy concreta que se da entre la resistencia a vacunarse y el populismo político. Ambos fenónemos están impulsados por motivaciones similares: una profunda desconfianza en las élites y en los expertos. Las influencias políticas son uno de los determinantes contextuales del comportamiento de indecisión ante las vacunas [29]. Kennedy [62] encontró que, en 14 países europeos, había una asociación significativa entre los porcentajes de personas en un país que votaron por partidos populistas y aquellos que creían que las vacunas no eran importantes o efectivas. De la misma manera, Peretti-Watel et al. [63] encontraron que, en Francia, aquellos que habían votado por un candidato de extrema izquierda o de extrema derecha, así como aquellos que se abstuvieron de votar, eran mucho más propensos a declarar que rechazarían las vacunas. Hasta donde sabemos, hasta ahora nadie ha estudiado sistemáticamente la relación entre las actitudes populistas de los ciudadanos y la vacilación de las vacunas a nivel individual en una muestra grande de países. Por lo tanto, nuestro objetivo es ampliar trabajos anteriores estudiando este vínculo subyacente con datos individuales que provienen de una encuesta a gran escala que incluye a todos los países que pertenecen a EU-27 + U.K. En ese sentido, Europa es la región con el nivel más alto de resistencia a vacunarse [64] y el populismo han tenido recientemente una tendencia al alza [65].

La única certeza clara que existe sobre las pandemias es que estas seguirán existiendo y que son impredecibles [66]. Algunas investigaciones nos han demostrado que la confianza es uno de los sentimientos claves a la hora de enfrentar situaciones de riesgo [67]. Además, la confianza es frágil y difícil de

mantener en el tiempo, pudiéndose perder ante cualquier evolución negativa del entorno [32]. Larson et al. [32] abogan por más investigación sobre los determinantes individuales de la confianza pública y sobre qué combinación de factores es más probable que sirvan para mantenerla, ya que creen que ha habido una falta de calidad y rigor en gran parte de la investigación que se centra en la comprensión de la psicología, los factores sociales y políticos que afectan la confianza pública en las vacunas. Según estos autores, en un mundo rico en tecnología e intercambio de información en rápido desarrollo, Internet y otras nuevas formas de medios sociales y redes sociales no sólo han permitido el intercambio rápido y ubicuo de información y desinformación, sino que también han facilitado nuevos métodos de auto-organización y empoderamiento entre las comunidades en línea para desarrollarse rápidamente. Algunas de estas comunidades han cuestionado y seguirán cuestionando la información y los consejos formulados por las organizaciones de salud pública oficiales y profesionales.

El descontento que habían mostrado ciertos grupos hacía las vacunas no había sido politizado hasta la aparición de la última pandemia provocada por la COVID-19 [68]. Tradicionalmente, la política había jugado un papel importante en la salud pública a través de actividades como la investigación y desarrollo, la adquisición de vacunas e, incluso, las decisiones sobre quién y cuándo se va a vacunar a los ciudadanos. Pero nunca anteriormente las vacunas se habían utilizado con la finalidad de infundir desconfianza y obtener una ventaja política [69].

Los países desarrollados y en desarrollo muestran una tendencia al alza que apoya a los partidos populistas, lo que implica un desafío importante para la atención médica universal [70]. Los partidos populistas defienden a la gente normal frente a la élite. La élite suele referirse a los principales partidos políticos tradicionales, los medios de comunicación, las clases altas y los intelectuales [71]. Cuando se aplica a cuestiones de salud, el populismo médico [72] se basa en la desconfianza hacia las intervenciones basadas en la evidencia y la condena del conocimiento tecnocrático [73–75]. Así, el enfoque populista atrae a grupos de ciudadanos que se han quedado atrás por varias razones, incluidas las consecuencias del proceso de globalización [73,76]. Los líderes populistas se aprovechan de su descontento, culpando de su desgracia a las acciones de la élite. En consecuencia, se produce un círculo degenerativo preocupante: el populismo alimenta la propagación de enfermedades infecciosas y las enfermedades infecciosas alimentan el populismo [76]. Este marco de actuación común del populismo ante las pandemias se ha podido observar en casos como la negación del H.I.V. en Sudáfrica [77], la campaña de temor ante las vacunas del sarampión y la rubeola en Ucrania [78], el boicot nigeriano a la vacuna de la poliomelitis [79], el escándalo contra la vacuna del dengue en Filipinas y países

del entorno [80], el miedo a la epidemia del virus Ébola en África occidental [81], el miedo a la vacunación en Italia [82] y las respuestas más recientes a las vacunas contra la COVID-19 en EE.UU., Brasil, Filipinas, Polonia, Rusia, India y el Reino Unido [76]. Los gobiernos populistas implementaron medidas políticas blandas y desalentaron los esfuerzos de los ciudadanos para contrarrestar la pandemia en todos estos casos. Como resultado, los países con gobiernos populistas se han visto más afectados por las pandemias [83]. El objetivo principal de nuestra tercera investigación, que lleva por título *Political Populism, Institutional Distrust and Vaccination Uptake: A Mediation Analysis*, es medir cómo la relación entre la desconfianza en las instituciones y la aceptación de la vacuna está mediada por la insatisfacción política. Hasta donde sabemos, nadie lo había estudiado antes.

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Capítulo 2: Compendio de las publicaciones publicadas

Estudio 1. Global Vaccine Hesitancy Segmentation: A Cross-European Approach

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1. Abstract

Vaccine-preventable diseases are global mainly in a globalized world that is characterized by a continuous movement of people and goods across countries. Vaccine hesitancy, the reluctance or refusal to vaccinate despite the availability of vaccines, is rising worldwide. What if the problem of vaccine hesitancy could be most effectively managed when treated globally rather than on a national or regional basis? What if a global vaccine-hesitant segment exists and the differences among countries are not so significant? Based on the Global Marketing Strategy paradigm, this paper shows that seven different cross-European segments exist based on the beliefs, attitudes, and behaviors collected in 28 European countries. These pan-European segments are differentiable (people in those segments have similar characteristics that are visibly dissimilar from the ones in other segments) and actionable (organizations would be able to propose interventions to the hesitant segments based on their profiles). With segmentation being the starting point of many public health intervention strategies for avoiding vaccine-hesitancy, the results recommend moderating the full-adaptation strategy that follows the "context matters" principle suggested by several political and public health international organizations. Embracing a more standardized strategy will allow the development of better services and strategies that support and enable desirable vaccination behaviors.

2. Keywords

vaccine hesitancy; segmentation; social marketing

3. Introduction

Vaccine hesitancy—the reluctance or refusal to vaccinate despite the availability of vaccines- is rising worldwide. Even though vaccines are considered one of the most important achievements of public health, preventing an estimated 2.5 million deaths each year worldwide and reducing disease-specific treatment costs [1], the World Health Organization (WHO) identified vaccine hesitancy as one of the top ten global health threats of 2019 [2].

Vaccine hesitancy is not a new trend. Since 1795, when Edward Jenner published the book titled "*An Inquiry into the Cowpox*", vaccination has become a mainstream medical practice all over the world [3]. Nevertheless, from their beginnings, inoculations have had their detractors. The earliest ones were men of the church. They reasoned that infectious diseases were a God-given fact of life and death. Some medical doctors, those that were earning a lot of money

from useless but lucrative cures, also enrolled in the anti-vaccination movement early [3]. Vaccination was associated with diverse hazards including tuberculosis, cancer, madness, blood poisoning, and syphilis [4]. From the middle of the 19th century, Great Britain and the countries under its influence made vaccination compulsory. Parents that refused to inoculate their children were sent to prison. The results were disastrous, with social riots that ended with the abolishment of the acts that made vaccination compulsory in 1909. The lessons provided by these first experiences were clear: the risks of vaccination must not be silenced, and compulsory vaccination was not the answer to the lack of public confidence in vaccines.

Nowadays, vaccine doubters are increasing in number. In several Western countries, diseases that had nearly been eradicated are coming into sight again due to their vaccine rates weakening. Vaccine refusal has been increasing in many EU member states [5]. Between 2000 and 2019, the uptake of measles-containing-vaccine first-dose has decreased in 12 EU member states [6]. Moreover, 14 EU member states were below the immunization rate threshold of 95% that was required to achieve herd immunity in 2019 [7]. The same situation could be found in seasonal influenza and other infectious diseases [5]. The last episode of vaccine hesitancy is related to the COVID-19 pandemic. Some people are afraid that the pace of both scientific review and vaccine control could compromise safety. Differences in acceptance rates rage enormously from country to country around the world [8,9]. Governments, public health officials, pharmacy companies, and other stakeholders are worried about people's willingness to receive vaccines when appropriate [10]. Vaccine-preventable diseases are global in nature. National immunization programs would benefit from coordinated analysis, action, and control to combat cross-border health threats [11]. In order to avoid the negative consequences of the vaccine hesitancy across the general population, it is necessary, first, to determine population sub-groups that adopt that behavior and, second, to reduce any fear or concern and manage the demand for vaccines [12]. Organizations such as governments and public health services face their particular bundle of distinctive challenges. Based on the premise that context matters, the scientific literature has mostly identified a set of key processes that could overcome hesitancy barriers and would enhance vaccine uptake on a nation-by-nation basis [13]. What if the problem of vaccine hesitancy could be most effectively managed when treated globally rather than on a national or regional basis? What if a global vaccine-hesitant segment exists and the differences among countries are not so significant?

Independent of the pro-vaccination strategy to follow, audience targeting and segmentation strategy are the keys to success [13]. People's attitudes, values,

and observed behaviors are the basis to obtain insights for better targeting the intervention mix to maximize vaccine uptake [14]. Organizations that work in worldwide markets face the dilemma of whether to segment markets on a country-by-country basis or to treat the different segments that exist with adapted value propositions, or whether to target one or more similar segments in a standardized way with the same intervention mix—also known as cross-market segmentation—[15]. Public health has used health education, health promotion, and social marketing as effective tools for influencing behavior in the fight against several communicable and non-communicable diseases [16]. Identifying global vaccination segments, to the extent that they exist, would allow designing and implementing a more efficient and effective public health intervention strategy, since cross-country segments would be targetable with similar activities.

To the best of our knowledge, the Global Marketing Strategy (GMS) paradigm has not been applied to fight against infectious diseases by supranational political institutions and health organizations. GMS proposes that a global organization must standardize its marketing programs across countries as much as possible, mainly concerning its product offering, promotional mix, price, and channel structure [17]. Most of the guidelines that international and national health organizations and governments suggest following when designing a social marketing vaccination strategy are not global [16,18–22]. Based on the principle of "context matters", they suggest that different countries must design and implement marketing plans adapted to their "unique" characteristics. It means they have adopted the traditional form of international segmentation known as a multidomestic strategy. Several researchers argue that global marketing strategy plays a critical role in determining an organization's performance in the global market [17,23–25]. Hence, these international political institutions and health organizations that do not apply—or recommend not to apply—the GMS paradigm could be achieving suboptimal outcomes on developing better services and strategies that support and enable desirable vaccination behaviors.

The standardized strategy accompanying the GMS approach enhances performance in sectors in which competition is global in scope [17]. These major benefits are mainly obtained through economies of scale and scope, consistency in dealing with the target groups, and the ability to exploit good ideas at a global scale. The global pharmaceutical industry produces vaccines. The pharmaceutical industry is comprised of some major multinational companies operating in a highly global competitive market that has experienced significant growth during the past two decades. Pharmaceutical revenues worldwide totaled USD 1.25 trillion in 2019 [26]. Vaccine hesitancy

is also fueled by misinformative campaigns promoted by political, religious, and social organizations on a global scale [27]. Misinformation leads to mistrust in public health organizations and encourages antiscience sentiments [28]. This fake information is transmitted worldwide at lightning speed in a single click. Responding to the global threat posed by vaccine hesitancy with local intervention actions seems not to be enough.

This study is designed to answer two research questions. The first is to confirm whether there are homogeneous segments based on vaccination attitudes, beliefs, and behaviors across European countries. Cross-national segmentation is challenging when cultural and economic differences influence customer preferences [29]. Our study, which analyzes cross-national market segments of individuals with respect to the acceptance of vaccination in 28 European member countries, provides valuable insights into international political and health organizations, companies, practitioners, and academics. The second question is whether the pan-European segments that exhibit higher hesitancy are differentiable (the people in those segments should have similar needs that are visibly dissimilar to the needs of the people in other segments) and actionable (organizations have to be able to propose interventions to the hesitant segments).

4. Materials and Methods

The data comes from the EUROBAROMETER survey 91.2 that was carried out between the 15th and the 29th of March 2019, at the request of the European Commission [30]. The dataset was accessed through GESIS (Leibniz-Institute für Sozialwissenschaften, University of Cologne, Germany). The EUROBAROMETER is part of wave 91.2 and covers the population of the respective nationalities of the European Union member states, residents in each of the member states, and aged 15 years and over. In these countries, the survey covers the national population of citizens of the respective nationalities and the population of citizens of all the European Union member states that are resident in those countries and have a sufficient command of one of the respective national language(s) to answer the questionnaire. The basic sample design applied in all states is a multi-stage random one.

The following table (Table 1) shows the sample size in each country and the total population aged 15 or more years.

For answering whether cross-European vaccination segments exist based on vaccination attitudes, beliefs and behaviors, we applied a factor-cluster segmentation approach. We selected all the variables shown in Table A1. From the 46 variables, 44 were coded as binary, and 2 as polytomous (the one that asked if *"vaccines are effective"* and the one that asked *"the most trusted info*

source"). For performing the correct association matrix for the factor analysis—using tetrachoric or polychoric correlations, when appropriate—we used the "polycor" package from R [32]. Aiming to reduce the complexity of the

Table 1. Sample size by country, Total population 15+.

COUNTRY	Number of Interviews	Population 15+
Austria	1006	7,554,711
Belgium	1041	9,693,779
Bulgaria	1026	6,537,535
Croatia	1010	3,796,476
Czech Republic	1068	9,238,431
Denmark	1017	4,838,729
Estonia	1005	1,160,064
Finland	1000	4,747,810
France	1013	54,097,255
Germany	1507	70,160,634
Greece	1014	9,937,810
Hungary	1030	8,781,161
Ireland	1078	3,592,162
Italy	1021	52,334,536
Latvia	1012	1,707,082
Lithuania	1004	2,513,384
Luxemburg	512	457,127
Malta	497	364,171
Netherlands	1017	13,979,215
Poland	1011	33,444,171
Portugal	1013	8,480,126
Republic of Cyprus	505	741,308
Romania	1025	16,852,701
Slovakia	1020	4,586,024
Slovenia	1016	1,760,032
Spain	1014	39,445,245
Sweden	1021	7,998,763
United Kingdom	1021	52,651,777
TOTAL	27,524	431,452,219

Source: Eurobarometer 91.2. European Commission [30,31] Table A1 (Appendix A) shows the variables selected from this Eurobarometer to perform the analysis and the sample statistical descriptives.

observed data to a more limited set of components and to avoid multicollinearity problems, we computed a principal component analysis (PCA) using the "psych" package from R. Zero frequency cells were replaced by 0.5 considering Yate's correction for continuity [33]. Using the scores for the resulting components, we clustered them choosing the best clustering method between hierarchical methods, K-Means, and PAM considering three internal measures of clustering validation: Connectivity, Dunn, and Silhouette. Attending to the compactness, separation, connectivity, and interpretability of the solution, we chose the optimal number of segments, described and labeled them. For testing whether the pan-European segments that exhibit higher hesitancy were differentiable, we calculated segments' means differences applying an ANOVA (Tukey HSD). To check if the found segments were cross-European, we ran a Bayesian multilevel multinomial analysis. Once we confirmed that there were no differences between countries for the clustering solution, we performed a multinomial logit regression for testing the actionability of the segments. For better interpreting these results, we used marginal effects.

5. Results

PCA analysis results are shown in Table A2 (Appendix B). To determine the number of components we ran a parallel analysis [34] using the "psych" package from R. The results of the parallel analysis suggested that 14 components explaining 66% of the total variance might be most appropriate—RMSR = 0.05 and fit based upon off-diagonal values = 0.94–0.0

For interpreting the components, we used the Varimax rotated component analysis matrix depicted in Table A2 (Appendix B). Our cutoff point for interpretation purposes was all loadings ±0.4 or above [35–37]. Considering the loadings, we named the components as depicted in Table 2.

In sum, we obtained 14 components out of the 44 original variables that explained 66% of the total variance. The two most important ones, in terms of the total variance explained individually, were related to the belief that infectious diseases kill (C2, 8% of the total variance) and vaccines are important to fight them (C1, 9% of the total variance). On the other hand, if we consider all the components that were connected with the information (C4, C6, C8, C9, C10, and C13) summed up the highest proportion of the total variance explained (23%). The rest of the components could also be gathered into three different groups: the first connected with the vaccination status (C5 and C11, 9% of the total variance); the second related to the knowledge about vaccines (C3) and vaccination (C12), which together explained 9% of the total variance; and, finally, two components (C7 and C14) linked with the international level

Table 2. Principal Components Analysis (Varimax Rotation).

Component # [1]	Component Name [1]	Original Variables with Significant Loadings	Percentage of Total Variance
C1	Vaccines not important	Vaccines important Vaccines are rigorously tested before being authorized for use Everybody needs to have routine vaccinations Not getting vaccinated can lead to serious health issues Vaccines are important to protect not only yourself but also others Vaccination of other people is important to protect those that cannot be vaccinated	9%
C2	Infectious diseases kill	Flu is causing deaths in the EU nowadays Measles is causing deaths in the EU nowadays Polio is causing deaths in the EU nowadays Hepatitis is causing deaths in the EU nowadays Meningitis is causing deaths in the EU nowadays Tetanus is causing deaths in the EU nowadays	8%
C3	Vaccines are dangerous	Vaccines overload and weaken the immune system Vaccines can cause the disease against which they protect Vaccines can often produce serious side-effects Do not know at which level vaccination programs should be coordinated	5%

Table 2. Principal Components Analysis (Varimax Rotation) —continued—.

Component # [1]	Component Name [1]	Original Variables with Significant Loadings	Percentage of Total Variance
C4	Vaccine informed	Seen vaccine info in the last six months on TV Seen vaccine info in the last six months on the radio Seen vaccine info in the last six months in newspapers or magazines Seen vaccine info in the last six months on online social networks Seen vaccine info in the last six months on other Internet sites	6%
C5	Children vaccinated	Have a vaccination card for children Children vaccinated in the last five years	5%
C6	Family & friends info	If you were looking for information about vaccination, you would consult family If you were looking for information about vaccination, you would consult friends	3%
C7	European vaccination programs	Vaccination programs should be coordinated at European level Vaccination programs should be coordinated at a national level Vaccination programs should be coordinated at a regional or local level	4%
C8	Information insecurity	If you were looking for information about vaccination NONE of the following sources you would consult If you were looking for information about vaccination DO NOT KNOW which of the following sources you would consult Family is the source you trust the most for information on vaccination	4%

Table 2. Principal Components Analysis (Varimax Rotation) —continued—.

Component # [1]	Component Name [1]	Original Variables with Significant Loadings	Percentage of Total Variance
C9	Other sources of info	If you were looking for information about vaccination, you would consult other sources of information In the past six months, you have seen, read or heard any information on vaccination in other media	3%
C10	Health system info	If you were looking for information about vaccination, you would consult other health care workers (nurses, specialist doctors, etc.) If you were looking for information about vaccination, you would consult pharmacists If you were looking for information about vaccination, you would consult the health authorities	3%
C11	Self-vaccinated	I got vaccinated in the last five years I have a vaccination card Tend to agree that not getting vaccinated can lead to serious health issues	4%
C12	Vaccination lack of knowledge	Do not know if you or someone in your family had any vaccinations in the last five years Do not know if you have a vaccination card Do not know if you were looking for information about vaccination, which of the following sources would you consult Do not know if in the past six months you have seen, read or heard any information on vaccination in the media	4%

Table 2. Principal Components Analysis (Varimax Rotation) —continued—.

Component # [1]	Component Name [1]	Original Variables with Significant Loadings	Percentage of Total Variance
C13	Online media info	If you were looking for information about vaccination you would consult online social networks If you were looking for information about vaccination you would consult other Internet sites In the past six months you have seen, read or heard information on vaccination on online social networks In the past six months you have seen, read or heard information on vaccination on another Internet sites	4%
C14	International vaccination programs	You think vaccination programs should be coordinated at an international level You have a vaccination card	3%

[1] The fourteen components obtained were labeled in two different ways. First, with a capital C followed by a number (Component #). This is the name given by R software when using the "psych" library for performing PCA analysis. We maintained these original names without any change for research reproducibility reasons. The other name of each the components were given in the need for obtaining a substantive interpretation of the pattern of the component loadings for the variables. Variables with higher significant factor loadings influenced the name selected to represent a factor to a greater extent [38].

at which the vaccination programs should be managed (7% of the total variance explained).

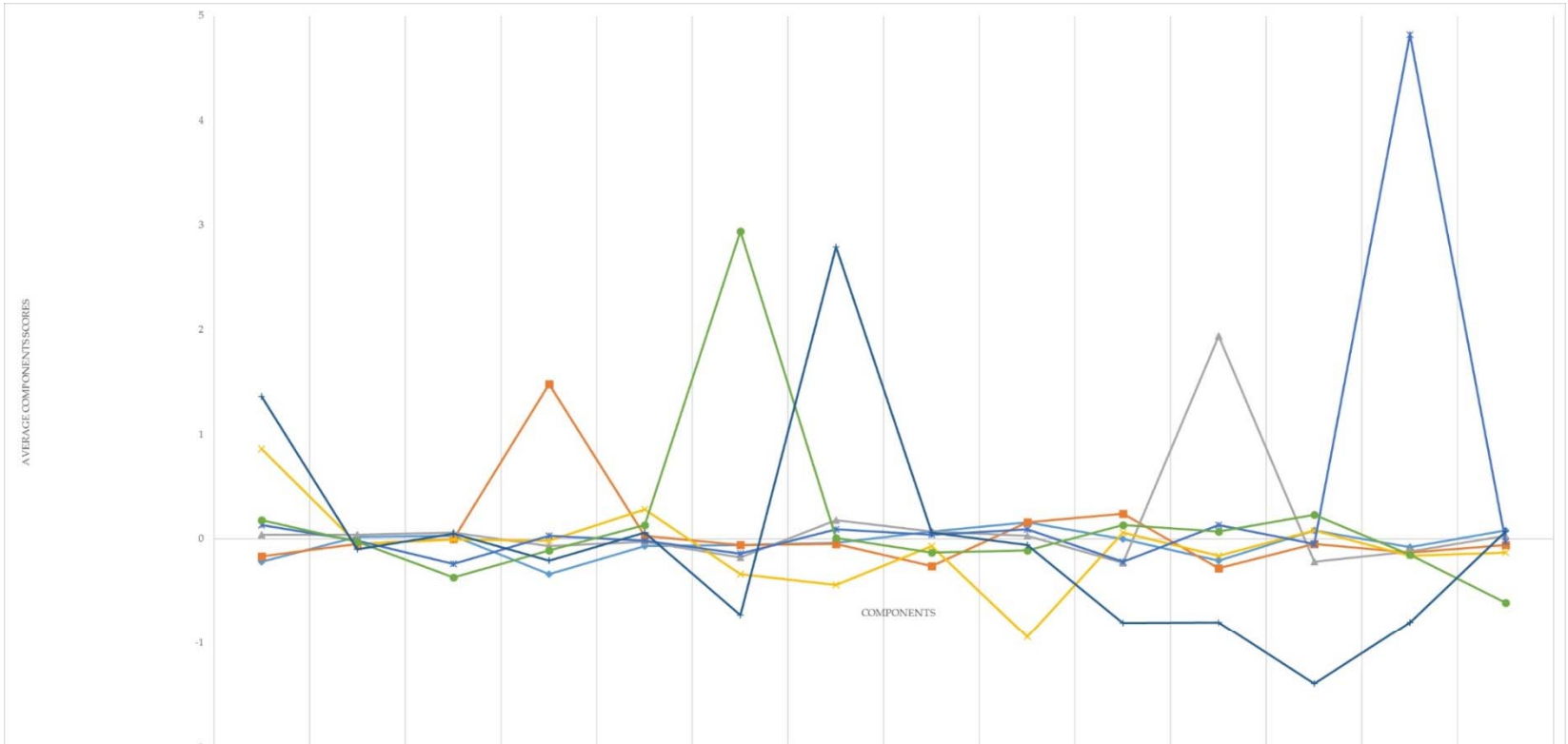
Using the factor scores for each of the fourteen components obtained in the previous step for all the interviewees, we proceeded to analyze the different behavioral segments that existed towards vaccination in the European Union. For choosing the best clustering method we used the package "clValid" from R [39]. Hierarchical methods performed better than K-Means and PAM for the three internal measures of clustering validation used (Connectivity, Dunn, and Silhouette). Considering the compactness, separation, connectivity, and interpretability, the seven-cluster solution performed the best. Figure 1 depicts the results of the hierarchical clustering approach (using the squared Euclidean distance and the Ward method). The characteristics of each of the found segments were:

1. **Pro-Vaccinators** (55.7% of the sample). It was the most numerous European segment. Following the segment profile represented in Figure 1, people for whom vaccines were the most important for avoiding the negative effects of infectious diseases formed it (in Table A3, Appendix C, we saw that mean differences with all the other segments were statistically significant). It belonged to the group of segments that answered that they felt better informed about vaccines, but the information received was highly insecure. Attending to how the "Information insecurity" component was composed, we saw that it had three significant loadings—the answers "None (SPONTANEOUS)" and "DK" to the question "If you were looking for information about vaccination, which of the following sources would you consult?", and the high importance of the option "Family" when responding the question "And which of the following sources do you trust the most for information on vaccination?"—It portrays a component with the family as the most important source of information about vaccination, under the feeling of insecurity about any information source related to this issue. All the fake news that is present in the information environment is affecting the perception of knowledge, even in the pro-vaccinators segment. Insecurity about information affects the perception of knowledge. Therefore, the Europeans that belonged to this segment had the lowest scores on knowledge about vaccines and vaccination. They were vaccinated in the last five years. Their most preferred source of information was the Health System Info. They agreed that either

European or international organizations should manage vaccination programs globally.

2. **Self-hesitants** (14.2% of the sample). It was the second segment that made a point on jabs to avoid infectious diseases. They shared a profile with Pro-vaccinators in relation to the information: they had information but not knowledge about vaccines, and were not personally vaccinated due to information insecurity. They had no doubts about their child's vaccination (see in Figure 1 that they had the highest score of all segments) but they did when they were inoculated. That was why they were labeled as "Self-hesitants". Their favored source of information was Online Media Info, followed by the Health-System Info. They agreed that vaccination programs should be managed by international organizations, with the European authorities being the most preferred ones.
3. **Social-hesitants** (9.6% of the total sample). This segment displayed a medium-range position on the importance of vaccines in avoiding infectious diseases. The respondents replied having been inoculated in the past five years at the same level as the Pro-vaccinators but their hesitance affected their child's vaccination. They declared themselves to be informed but with a feeling of lack of knowledge about vaccines and vaccination. This led them to information insecurity. They did not trust Online Media Info nor Health System Info preferring, by far, their relatives as the main information source. That is why we called them Social-hesitants. They slightly preferred that international organizations managed the vaccination programs instead of the European authorities.
4. **Anti-vaccinators** (11.7% of the sample). They showed the lowest confidence in vaccines of all the segments. They declared themselves to be well informed and with top knowledge on vaccines but not on vaccination. They did not feel insecure about the information received. Their unconfident belief caused them not to be open about taking vaccines, but they did not show the same behavior for their children. Their preferred sources of information were Online Media Info and Health System Info. A remarkable characteristic of this segment was that they did not trust international organizations for managing the vaccination programs, mainly favoring the European ones.

5. **Alternative-hesitants** (2.5% of the sample). The hesitancy for this group was mainly based on the lack of confidence in Online Media Info and Health System Info. Otherwise, they felt comfortable with Family and Friends Info and showed an absolute preference for Other Sources of Info. In consequence, the reported information insecurity was also high. They portrayed a lack of knowledge about vaccines and vaccination. They shared with the other hesitant groups the lack of confidence in vaccines but, surprisingly, they and their children were among the top segments that had taken vaccines in the last five years.
6. **Illiterate-hesitants** (4% of the sample). This group share with other hesitants their lack of confidence in vaccines. Their most noteworthy characteristic is that they declared themselves not to be well informed about vaccines. Their vaccination status in the past five years was in the medium range of all groups. The most liked source of information was the Health System Info, closely followed by Online Media Info and Family and Friends. They showed a complete lack of confidence in international organizations when managing the vaccines' programs. European authorities were also not well considered.
7. **Uninformed Anti-Vaccinators** (2.3% of the sample). The first distinctive attribute is that they had the lowest score in vaccine trust. Accordingly, they showed the lowest score in believing that infectious diseases kill. They declared themselves to be vaccine informed and to have an average knowledge on vaccines. Nonetheless, they had an absolute lack of knowledge about vaccination. The insecurity felt by this group about the information received was also the highest of all the segments found. It was so high that they did not trust any source of information. They rather preferred that the international organization would manage the vaccination programs. All these sentiments produced low vaccination rates among their children.



	VACCINES NOT IMPORTANT	INFECTIOUS DISEASES KILL	VACCINE INFORMED	CHILDREN VACCINATED	VACCINE KNOWLEDGE	VACCINATION LACK OF KNOWLEDGE	INFORMATION INSECURITY	SELF VACCINATED	EUROPEAN VACCINATION PROGRAMMES	ONLINE MEDIA INFO	FAMILY & FRIENDS INFO	HEALTH SYSTEM INFO	OTHER SOURCES OF INFO	INTERNATIONAL VACCINATION PROGRAMS
Pro-vaccinators (55.7%)	-0,22	0,02	0,03	-0,34	-0,07	-0,06	-0,04	0,07	0,16	0	-0,21	0,08	-0,08	0,08
Self-hesitants (14.2%)	-0,17	-0,05	0	1,48	0,03	-0,06	-0,05	-0,26	0,16	0,24	-0,28	-0,05	-0,13	-0,06
Social hesitants (9.6%)	0,04	0,04	0,06	-0,07	-0,03	-0,18	0,18	0,07	0,03	-0,23	1,94	-0,22	-0,12	0,03
Anti-vaccinators (11.7%)	0,86	-0,05	-0,01	-0,02	0,28	-0,34	-0,44	-0,07	-0,94	0,06	-0,16	0,08	-0,16	-0,13
Alternative hesitants (2.5%)	0,13	-0,02	-0,24	0,03	-0,02	-0,14	0,09	0,04	0,09	-0,22	0,13	-0,05	4,82	-0,03
Illiterate hesitants (4%)	0,18	-0,03	-0,37	-0,11	0,13	2,94	0,01	-0,13	-0,11	0,13	0,07	0,23	-0,15	-0,61
Uninformed anti-vaccinators (2.3%)	1,36	-0,1	0,05	-0,21	0,06	-0,73	2,79	0,06	-0,06	-0,81	-0,8	-1,39	-0,8	0,07

Figure 1. European sentiments towards vaccines. Behavioral segments profile.

For answering the question of whether countries affected the results obtained we ran a Bayesian multilevel multinomial analysis using STAN [40]. The dependent variable was the one with the resulting segments (reference category: Pro-Vaccinators) and as independent variables, we considered each of the fourteen principal components obtained. In doing so, we checked to what extent did the log-odds varied between countries computing an unconditional mean model and calculating the intraclass correlation coefficient (ICC). The parameters used for running the Hamiltonian Monte Carlo sampler algorithm (MCMC) were 2500 warmup iterations, 4 chains, 10,000 iterations per chain, and initials values taken at random. The solution converged (Rhat = 1.0) and the results are shown in Table 3.

Table 3. Bayesian Multilevel Multinomial Analysis. Unconditional Mean Model (log-odds).

Title	Posterior Mean 1	Posterior SD 2	Rhat 3
Population-level effects (reference category: Pro-vaccinators)			
Intercept Self-hesitants	−1.38	0.07	1.0
Intercept Social-hesitants	−1.85	0.11	1.0
Intercept Anti-vaccinators	−1.63	0.12	1.0
Intercept Alternative-hesitants	−3.20	0.11	1.0
Intercept Illiterate-hesitants	−2.90	0.17	1.0
Intercept Uninformed Anti-vaccinators	−3.54	0.21	1.0
Country-level effects (reference category: Pro-vaccinators)			
Intercept Self-hesitants	0.33	0.05	1.0
Intercept Social-hesitants	0.58	0.09	1.0
Intercept Anti-vaccinators	0.63	0.09	1.0
Intercept Alternative-hesitants	0.55	0.09	1.0
Intercept Illiterate-hesitants	0.89	0.14	1.0
Intercept Uninformed Anti-vaccinators	1.07	0.17	1.0

[1] Mean of the posterior distribution using MCMC. [2] Standard deviation of the posterior distribution using MCMC. [3] Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

The ICC quantifies the degree of homogeneity of the outcome within countries. The ICC represents the proportion of the between-countries variation $var(u_{0j})$ in the total variation (Equation (1)).

$$ICC = \frac{var\ (u_{0j})}{var(u_{oj}) + (\pi^2/3)} \quad (1)$$

In which, $var(u_{0j})$ is the level-2 variance component and $(\pi^2/3)$ refers to the standard logistic distribution, that is, the level-1 variance component. The ICC may range from 0 to 1. ICC = 0 indicates perfect independence of residuals: The chance to pertain to a behavioral segment does not depend on country membership. However, ICC = 1 indicates perfect interdependence of residuals: The segment's membership only varies between countries. Calculating, we obtained ICC= 0.095. In other words, it means that between countries the differences in the segmentation achieved are negligible. Due to this reason, we performed a multinomial logit model for calculating the relationship between the segments and the principal components found (see Table 4).

From Table 4, we noticed that most of the independent variables—the principal components—are statistically significant in explaining the European segments. To improve the interpretability of the regression coefficients, we used marginal effects. The marginal effect is a measure of the instantaneous effect that a change in a particular explanatory variable has on the predicted probability of the dependent variable when the other covariates are kept fixed [41]. The dependent variable is modeled as follows:

$$\boldsymbol{y} = \boldsymbol{E}(\boldsymbol{y}/x) + \boldsymbol{\varepsilon}, \quad (2)$$

where $\boldsymbol{E}(\boldsymbol{y}/\boldsymbol{x})$ is the conditional mean function, $\boldsymbol{x}$ is the vector of explanatory variables and $\boldsymbol{\varepsilon}$ is the error term. The conditional mean function is given by:

$$\boldsymbol{E}(\boldsymbol{y}/\boldsymbol{x}) = \boldsymbol{F}(\boldsymbol{\beta}'\boldsymbol{x}), \quad (3)$$

where $\boldsymbol{F}$ denotes a cumulative distribution function and $\boldsymbol{\beta}$ denotes the parameters. Therefore,

$$\mathbf{Pr}(\boldsymbol{y} = \mathbf{1}) = \boldsymbol{F}(\boldsymbol{\beta}'\boldsymbol{x}). \quad (4)$$

Table 4. Cross-European Segments Towards Vaccination. Multinomial Logit Model (log-odds).

	Dependent Variable (Reference Category Pro-Vaccinators):					
	Self-Hesitants	Social Hesitants	Anti-Vaccinators	Alternative Hesitants	Illiterate Hesitants	Uninformed Anti-vaccinators
C1	−0.088 −0.058	0.593 *** −0.07	2.475 *** −0.055	2.037 *** −0.419	1.899 *** −0.215	3.135 *** −0.396
C2	−0.498 *** −0.041	0.05 −0.053	−0.488 *** −0.044	−0.076 −0.486	0.619 *** −0.231	0.454 −0.438
C3	0.308 *** −0.049	0.194 *** −0.062	1.141 *** −0.046	1.257 *** −0.393	1.591 *** −0.194	0.875 *** −0.309
C4	−0.262 *** −0.039	−0.249 *** −0.056	−0.611 *** −0.05	−0.691 −0.555	−2.597 *** −0.273	−1.617 *** −0.554
C5	2.845 *** −0.043	0.157 *** −0.051	0.538 *** −0.043	−0.644 −0.663	0.198 −0.23	0.171 −0.464
C6	−0.569 *** −0.067	3.694 *** −0.065	−0.146 * −0.077	0.912 ** −0.428	0.673 *** −0.223	−3.979 *** −1.352
C7	−0.180 *** −0.045	−0.800 *** −0.062	−3.637 *** −0.063	−1.922 *** −0.498	−1.843 *** −0.222	−1.129 ** −0.441

Table 4. Cross-European Segments Towards Vaccination. Multinomial Logit Model (log-odds) —continued—.

	Dependent Variable (Reference Category Pro-Vaccinators):					
	Self-Hesitants	Social Hesitants	Anti-Vaccinators	Alternative Hesitants	Illiterate Hesitants	Uninformed Anti-vaccinators
C8	0.06 −0.057	−0.720 *** −0.076	0.151 ** −0.068	0.925 −0.59	0.221 −0.321	3.880 *** −0.435
C9	−0.337 *** −0.106	0.537 *** −0.138	0.465 *** −0.123	5.333 *** −0.446	0.301 −0.515	−0.702 −0.792
C10	−0.264 *** −0.043	−0.165 ** −0.068	−0.729 *** −0.05	−1.181 * −0.608	−0.014 −0.301	−3.343 *** −0.761
C11	−0.378 *** −0.033	−0.101 ** −0.045	−0.359 *** −0.039	−0.224 −0.472	−0.851 *** −0.225	−1.261 ** −0.514
C12	0.214 ** −0.107	0.033 −0.141	0.607 *** −0.111	4.421 *** −0.382	6.999 *** −0.346	0.699 −0.48
C13	0.546 *** −0.037	−0.456 *** −0.056	−0.425 *** −0.048	−0.773 −0.487	−0.704 *** −0.248	−3.534 *** −1.045
C14	−0.366 *** −0.036	−0.468 *** −0.048	−1.092 *** −0.041	−1.366 *** −0.373	−2.323 *** −0.202	−1.013 ** −0.409
Constant	−3.303 *** −0.065	−3.934 *** −0.083	−3.039 *** −0.06	−9.268 *** −0.687	−8.875 *** −0.541	−12.241 *** −1.153

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Marginal effects are obtained by computing the derivative of the conditional mean function given by:

$$\frac{\partial E(y/x)}{\partial x} = \left[\frac{\partial F(\beta' x)}{\partial \beta' x}\right]\beta = f(\beta' x)\beta, \quad (5)$$

where $f(.)$ is the density function that corresponds to the cumulative function $F(.)$. The marginal effects are nonlinear functions of the parameter estimates and levels of the explanatory variables. Hence, they generally cannot be inferred directly from parameter estimates. In this case, we used the R library called "margins". The results are available in Appendix D,
Figures A1–A14.

By simultaneously interpreting the data contained in Table 4 and Figures A1–A14, we obtained the following results. Pro-Vaccinators and Anti-Vaccinators had differentiated profiles. Furthermore, the predicted probability for belonging to one of these groups showed an inverted shape in the case of "Vaccines Not Important" (Figure A1), "Infectious Diseases Kill" (Figure A2), "Vaccines Informed" (Figure A3), "Vaccine Knowledge" (Figure A5), "'Self Vaccinated" (Figure A8), "European Vaccination Programs" (Figure A9), "Health System Info" (Figure A12), and "International Vaccination Programs" (Figure A14). Self-Hesitants shared with Anti-Vaccinators the aforementioned reversed profile with Pro-Vaccinators in the case of "Infectious Diseases Kill" (Figure A2), "Vaccines Informed" (Figure A3), "Self Vaccinated" (Figure A8) and "Health System Info" (Figure A12). Moreover, this inverted predicted probability profile between Self-Hesitants and Pro-Vaccinators was also present in the variables "Children Vaccinated" (Figure A4) and "Online Media Info" (Figure A10). Illiterate-Hesitants depicted their main differential characteristic with Pro-Vaccinators in the variable "Vaccination Lack of Knowledge" (Figure A6). The main portrayed difference between Uninformed Anti-Vaccinators and Pro-Vaccinators arose in the component "Information Insecurity" (Figure A7). Social-Hesitants and Pro-Vaccinators differed markedly in "Family and Friends Info" (Figure A11). Finally, the main differential characteristic between Alternative-Hesitants and Pro-Vaccinators rose in 'Other Sources Info' (Figure A13). These results corroborated the findings commented when previously describing the behavioral segments' profiles in Figure 1.

6. Discussion

In the previous section, we have presented results that allow answering the two main research questions proposed. First, based on vaccination attitudes, beliefs and behaviors there exist seven different homogeneous segments across the European countries. These pan-European segments are differentiable and actionable.

In a recent report based on a descriptive analysis of the same survey that we used in this paper, the European Commission stated that "…While in general Europeans have a reasonably high level of awareness and a generally positive attitude towards vaccination, there is considerable variation in knowledge and behavior across countries and between socio-demographic groups" [42] (p. 59). The results in the previous section of this paper depicted that cross-European segments based on attitudes towards vaccination existed. When European countries were considered in order to see if there were any significant variation between them in the segments obtained, we concluded that it was not the case. The geographical differences found by the European Commission could be rather linked to the different proportions in which the cross-European segments were represented in each of the member countries than the non-existence of these homogeneous groups. It can be graphically appreciated in Figure 2. It shows a MOSAIC chart [43] that can be interpreted, in a two-way table, as a grouped bar chart where the width of each bar corresponds to the relative frequencies of the first variable (number of interviews per country) and the height of each bar shows the relative frequencies of the second variable (European segments towards vaccination). Standardized residuals are represented in the chart by shadowing the tiles: those that exceed values 2 and 4 in absolute terms are deep-colored. When it occurs, it means that the found pattern departures from the Equiprobability model (independence between the variables). Statistically speaking, it means that, as the standardized residuals are approximately unit-normal N(0,1), the shadowed areas are those whose individual residuals are significant at 0.05 level (when the value exceeds 2) and 0.0001 level (when the value exceeds 4) [44]. For the shake of clarity, we observe in Figure 2 that Pro-Vaccinators had a statistically significant higher presence in Belgium, the Netherlands, the United Kingdom, Spain, Portugal, Finland, Sweden, Malta, and Slovenia. On the contrary, Pro-Vaccinators showed a statistically significant lower presence in Austria, Czech Republic, Estonia, Latvia, Poland, Slovenia, Bulgaria, Romania, and Croatia. On the other side of the attitudes' spectrum, Anti-Vaccinators had a statistically significantly higher presence in France, Luxembourg, Austria, Czech Republic, Estonia, Latvia, Lithuania, Bulgaria, Romania, and Croatia. In contrast, Belgium, the Netherlands, Denmark, Spain, Portugal, Finland, Sweden, Hungary, and Poland had a statistically significantly lower presence of Anti-Vaccinators. The rest of the segments and countries could be distinctly exhibited in Figure 2. The differences observed by the European Commission between European countries in their descriptive analysis are due to the different share that the seven cross- European segments had in each of the territories. Nevertheless, the profile of any of the individuals

that belong to a segment remains homogeneous to the rest of the individuals that also pertain to the same segment, independently of the European country under study.

The seven segments obtained overcome the traditional pro-vaccine versus anti-vaccine approach. Between these two extreme poles, five other vaccine-hesitant behaviors were found. As we have seen, the individuals that comprised these segments can retard, be averse but still uptake, or decline some or all vaccines. Furthermore, the process followed to obtain the segments avoided the negative connotations associated with the terms "anti-vaccine" and "vaccine-hesitant". When conducting research about vaccine hesitancy we have to take into account that even those individuals that present the most radical profile do not recognize themselves as "anti-vaccine" [45]. Thus, in the survey that we used, the individuals were first asked about beliefs, attitudes, and behaviors about vaccines and vaccination, and then, after applying sound statistical techniques, we found the segments that were labeled taking into account their different profiles.

From the private companies' management perspective, the findings presented are important. Infectious diseases are global by their nature, mostly in a global economy characterized by a continuous flow of goods and persons between countries. The pharmacy industry and vaccines are also global [46]. Therefore, only if different client behaviors exist that are profitable for the private companies to fulfill with adapted marketing strategies, it would be justified not to follow a Global Marketing Strategy (GMS) approach. Nowadays, for instance, there is more convergence in demand for newer vaccine types and more divergence in demand for mature and combination vaccine types. For the latter ones, adaptations to existing vaccine presentations and packaging are required and increasingly requested. Manufacturers benefit from these distinct presentations, as they prevent parallel trade between high-income countries and low-income countries enable manufacturers to pursue multiple pricing strategies. The existence of cross-European vaccination segments offers additional evidence for private companies when deciding on the continuum that goes from the full standardization to the full adaptation of marketing strategy.

For social marketers (v.gr. European Commission, International Health Organizations, governments, and health authorities), behavioral segmentation is key for success when choosing the target audience and developing different marketing strategies for selected population segments. Social marketing has been long employed in designing, implementing, and evaluating public health programs in the fight against several forms of communicable diseases [47–49]. Moreover, the GMS approach remains valid: adaptation is mainly

recommended when there are behavioral differences between the segments that when taken into action produce better results. Our Bayesian multilevel multinomial analysis showed that there were no statistically significant differences for the clusters when considering the 28 countries that formed the European Union. Hence, public organizations that apply a standardized marketing strategy across countries will obtain better outcomes [17,23–25]. The Anti-Vax industry is applying these standardized marketing strategies in their disinformation campaigns obtaining better results than the public institutions that are fighting against them with adapted marketing actions [50].

Information is key in both the understanding of the vaccine up-taking decision process and the characterization of the different segments around vaccination. From the results obtained, we noticed that the components related to the different sources of information summed up the highest proportion of the total variance explained (23%). From Table A1 we knew that the most trusted source of information was a general practitioner, a doctor, or a pediatrician (79.1% of the total responses). Several investigations showed that a significant share of health care providers is vaccine-hesitant [51–55]. Even though few health care providers are openly against vaccines, many of them find conversations about vaccines with vaccine-hesitant people to be difficult and unproductive [52]. This has to be a matter of concern for public health authorities. The results of our research also showed that some segments declare a lack of knowledge around vaccines and/or vaccination (Uninformed Anti-Vaccinators and Social-Hesitants). Fighting against the lack of knowledge has to be a priority as a starting point. Nevertheless, lessening the growth of vaccine hesitancy requires not only to communicate information about vaccine efficacy

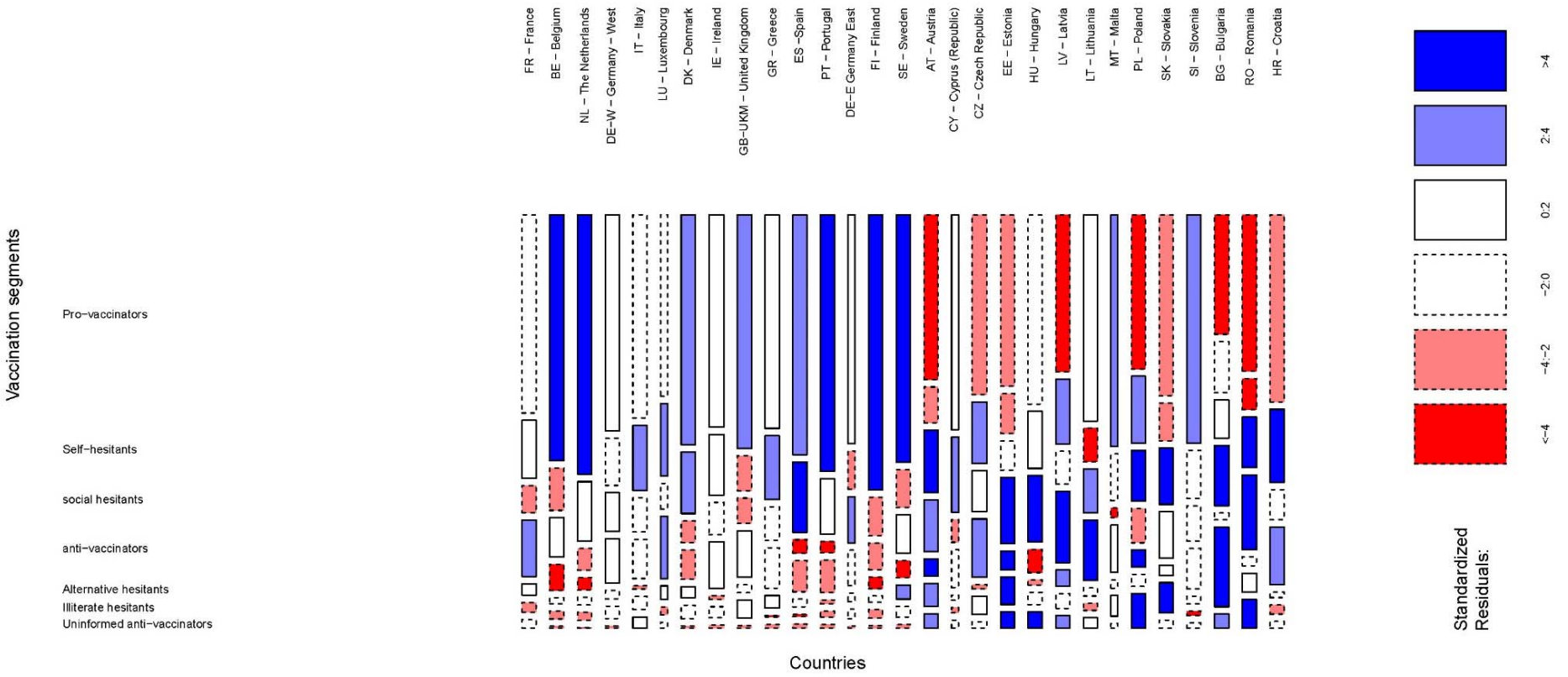


Figure 2. European Attitudes Towards Vaccination. Segments by Country.

and safety but engaging with the problems expressed by the citizens in an empathically two-way communication strategy [56,57]. Furthermore, it also means sending the tailored messages through the right communication channels. As we saw in the Results section, Pro-Vaccinators and Illiterate-Hesitants preferred the Health system info, Self-Hesitants and Anti-Vaccinators favored social media Info, Social-Hesitants chose their relatives as the main information source, Alternative-Hesitants indicated other sources of information and, finally, Uninformed Anti-Vaccinators felt such high insecurity about the information received that they did not place trust in any source of information.

Trust in international organizations positively influences people's willingness to adopt recommended behavior [58,59]. As we saw, the level of trust in the international organizations to carry on the vaccination programs varied among segments. Pro-vaccinators trusted in European as well as international organizations for managing vaccination programs. Self-Hesitants and Alternative-Hesitants preferred the European ones. Reversely, Social-Hesitants and Uninformed Anti-Vaccinators favored International Organizations. Anti-Vaccinators and Illiterate-Hesitants did not trust any international organization in the management of the vaccination programs, mainly the European ones. Therefore, depending on the target audience, the source of the tailored communication campaign has to be adequately selected to be trusted.

Once that we know that global vaccine hesitancy segments exist across, Europe some other challenges arise. For instance, in Europe immunization programs are a national competence with vaccination schedules that vary across the different territories. We face the GMS dilemma of global consumers with local organizations. The European Commission and the Member States need to put in place coordinated operational guidelines for overcoming infrastructural and legal barriers through more standardized vaccination management. In this regard, two European initiatives taken in 2018 [11,60] accomplished an actions' framework that was undertaken by the Commission, with the collaboration of the Member States, under three key pillars: (1) tackling vaccine hesitancy and improving vaccination coverage; (2) sustainable vaccination policies in the EU; (3) EU coordination of and contribution to global health. The roadmap for the implementation of actions contained in these two European initiatives fixes several challenges that a global social marketing strategy for reducing vaccine hesitancy must face because immunization programs are a national competence.

Finally, more study is required to understand the effect that age, gender, family status, occupation, education, type of community where the person

lives, political orientation, and religion have in the cross-European segments found and the proposed GMS strategy.

7. Appendix A

Table A1. Sample descriptives.

Variable# [1]	Variable	Response Categories	*n*	Sample Share
qc1	Diseases causing deaths in the EU nowadays	Flu	16,464	59.8
		Measles	10,547	38.3
		Polio	4808	17.5
		Hepatitis	11,323	41.1
		Meningitis	14,190	51.6
		Tetanus	6315	22.9
		None of them	2348	8.5
		Don't Know (DK)	1728	6.3
qc2	Vaccines effective	Yes, definitely	13,972	50.8
		Yes, probably	9450	34.3
		No, probably not	1664	6
		No, not at all	870	3.2
		It depends on the disease	1011	3.7
		Don't Know (DK)	557	2
qc3	Vaccinations in family last five years	Yes, yourself	11,820	42.9
		Yes, your children	7164	26
		Yes, someone else	5521	19.1
		No	9683	35.2
		Don't Know (DK)	315	1.1
qc6	Have vaccination card	Yes, for yourself	11,754	42.7
		Yes, for your children	6813	24.8
		No	11,978	43.5
		Don't Know (DK)	651	2.4
qc7_1	Vaccines affect the immune system	TRUE	8849	32.2
		FALSE	14,461	52.5
		Do not Know (DK)	4214	15.3
qc7_2	Vaccines cause diseases	TRUE	10,669	38.8
		FALSE	13,066	47.5
		Don't Know (DK)	3789	13.8
qc7_3	Vaccines side-effects	TRUE	13,617	49.5
		FALSE	10,735	39
		Don't Know (DK)	3172	11.5
qc7_4	Vaccines tested	TRUE	21,884	79.5
		FALSE	2736	9.9
		Don't Know (DK)	2904	10.6
qc8_1	Routine vaccination important	Totally agree	14,222	51.7
		Tend to agree	8776	31.9
		Tend to disagree	2670	9.7
		Totally disagree	890	3.2
		Don't Know (DK)	966	3.5

Variable# [1]	Variable	Response Categories	*n*	Sample Share
qc8_2	Vaccines only for children	Totally agree	3643	13.2
		Tend to agree	4551	16.5
		Tend to disagree	8351	30.3
		Totally disagree	10,270	37.3
		Don't Know (DK)	709	2.6
qc8_3	Not vaccinated serious health issues	Totally agree	13,065	47.5
		Tend to agree	9371	34
		Tend to disagree	3008	10.9
		Totally disagree	932	3.4
		Don't Know (DK)	1148	4.2
qc8_4	Vaccines' importance for self and others	Totally agree	15,284	55.5
		Tend to agree	8956	32.5
		Tend to disagree	1819	6.6
		Totally disagree	577	2.1
		Don't Know (DK)	888	3.2
qc8_5	Vaccines' importance for non-vaccinated	Totally agree	14,505	52.7
		Tend to agree	9296	33.8
		Tend to disagree	1786	6.5
		Totally disagree	598	2.2
		Don't Know (DK)	1339	4.9
qc9	Vaccine info sources	Family	2627	9.5
		Friends	1351	4.9
		Your general practitioner, a doctor, or a pediatrician	21,765	79.1
		Other health care workers (nurses, specialist doctors, etc.)	8647	31.4
		Pharmacists	5103	18.5
		Online social networks	1632	5.9
		Other Internet sites	3539	12.9
		The health authorities	7570	27.5
		Other (SPONTANEOUS)	298	1.1
		None (SPONTANEOUS)	504	1.8
		Don't Know (DK)	238	0.9
qc10	Most trusted vaccine info source	Family	845	3.1
		Friends	355	1.3
		Your general practitioner, a doctor, or a pediatrician	17,521	63.7
		Other health care workers (nurses, specialist doctors, etc.)	2695	9.8
		Pharmacists	928	3.4
		Online social networks	285	1
		Other Internet sites	553	2
		The health authorities	3323	12.1
		Other (SPONTANEOUS)	74	0.3
		None (SPONTANEOUS)	576	2.1
		Don't Know (DK)	369	1.3

Variable# [1]	Variable	Response Categories	*n*	Sample Share
qc11	Vaccine programs' coordination level	At international level	8911	32.4
		At European level	8399	30.5
		At a national level	4526	42.4
		At regional or local level		
		There should be no vaccination programs, it is a personal choice	2512	9.1
		Don't Know (DK)	1305	4.7
qc12	Media info on vaccine last six months	No	8052	29.3
		Yes, on TV	15,447	56.1
		Yes, on the radio	4775	17.3
		Yes, in newspapers or magazines	5771	21
		Yes, on online social networks	3571	13
		Yes, on other Internet sites	2835	10.3
		Other (SPONTANEOUS)	433	1.6
		Don't Know (DK)	490	1.8

[1] We kept the question number used in the Eurobarometer in order to be easily identifiable in the original questionnaire codebook. Source: Eurobarometer 91.2. European Commision [30].

8. Appendix B

Table A2. PCA components loadings (VARIMAX rotation).

Components	Components (Eigen Values)													
	C1 (5.00)	C2 (4.43)	C4 (3.29)	C5 (2.53)	C3 (2.47)	C12 (2.30)	C8 (2.24)	C11 (2.16)	C7 (2.14)	C13 (1.86)	C6 (1.71)	C10 (1.69)	C9 (1.62)	C14 (1.33)
Question #	Vaccines are Not Important	Infectious Diseases Kill	Vaccine Informed	Children Vaccinated	Vaccines Are Dangerous	Vaccination Lack of Knowledge	Information Insecurity	Self Vaccinated	European Vaccination Programs	Online Media Info	Family & Friends Info	Health System Info	Other Sources of Information	International Vaccination Programs
qc1.1		0.7												
qc1.2		0.7												
qc1.3		0.8												
qc1.4		0.7												
qc1.5		0.7												
qc1.6		0.8												
qc1.7														
qc1.8														
qc2	0.6													
qc3.1								0.7						
qc3.2				0.8										

Compo-nents	Components (Eigen Values)													
	C1 (5.00)	C2 (4.43)	C4 (3.29)	C5 (2.53)	C3 (2.47)	C12 (2.30)	C8 (2.24)	C11 (2.16)	C7 (2.14)	C13 (1.86)	C6 (1.71)	C10 (1.69)	C9 (1.62)	C14 (1.33)
Question #	Vaccines are Not Im-portant	Infectious Diseases Kill	Vaccine Informed	Children Vaccinated	Vaccines Are Dangerous	Vaccination Lack of Knowledge	Information Insecurity	Self Vaccinated	European Vaccination Programs	Online Media Info	Family & Friends Info	Health System Info	Other Sources of Infor-mation	International Vaccina-tion Programs
qc3.3								0.7						
qc3.4														
qc3.5						0.7								
qc6.1								0.5						0,5
qc6.2				0.9										
qc6.3														
qc6.4						0.7								
qc7_1					0.8									
qc7_2					0.8									
qc7_3					0.8									
qc7_4	0.5													
qc8_1	0.8													
qc8_2								0.5						
qc8_3	0.8													
qc8_4	0.9													

Compo-nents	Components (Eigen Values)													
	C1 (5.00)	C2 (4.43)	C4 (3.29)	C5 (2.53)	C3 (2.47)	C12 (2.30)	C8 (2.24)	C11 (2.16)	C7 (2.14)	C13 (1.86)	C6 (1.71)	C10 (1.69)	C9 (1.62)	C14 (1.33)
Question #	Vaccines are Not Im-portant	Infectious Diseases Kill	Vaccine Informed	Children Vaccinated	Vaccines Are Dangerous	Vaccination Lack of Knowledge	Information Insecurity	Self Vaccinated	European Vaccination Programs	Online Media Info	Family & Friends Info	Health System Info	Other Sources of Infor-mation	International Vaccina-tion Programs
qc8_5	0.8													
qc9.1											0.8			
qc9.2											0.8			
qc9.3														
qc9.4												0.7		
qc9.5												0.5		
qc9.6										0.6				
qc9.7										0.8				
qc9.8												0.8		
qc9.9													0.7	
qc9.10	0.5						0.5							
qc9.11	0.4					0.4	0.5							
qc.10							0.9							
qc11.1														0,6
qc11.2									0.6					

Compo-nents	Components (Eigen Values)													
	C1 (5.00)	C2 (4.43)	C4 (3.29)	C5 (2.53)	C3 (2.47)	C12 (2.30)	C8 (2.24)	C11 (2.16)	C7 (2.14)	C13 (1.86)	C6 (1.71)	C10 (1.69)	C9 (1.62)	C14 (1.33)
Question #	Vaccines are Not Im-portant	Infectious Diseases Kill	Vaccine Informed	Children Vaccinated	Vaccines Are Dangerous	Vaccination Lack of Knowledge	Information Insecurity	Self Vaccinated	European Vaccination Programs	Online Media Info	Family & Friends Info	Health System Info	Other Sources of Infor-mation	International Vaccina-tion Programs
qc11.3									0.8					
qc11.4									0.8					
qc11.5	0.6													
qc11.6					0.4									
qc12.1														
qc12.2			0.8											
qc12.3			0.9											
qc12.4			0.7											
qc12.5			0.6							0.5				
qc12.6			0.5							0.5				
qc12.7													0.8	
qc12.8						0.5								

9. Appendix C

Table A3. ANOVA (Tukey HSD). Segments' mean differences.

TitleVaccine-Hesitancy Segments	Vaccines are Not Important	Infectious Diseases Kill	Vaccine Informed	Children Vaccinated	Vaccines Are Dangerous	Vaccination Lack of Knowledge	Information Insecurity
Self-hesitants/Pro-vaccinators	0.05 **	−0.08 ***	−0.03	1.82 ***	0.10 ***	0	−0.01
Social hesitants/Pro-vaccinators	0.27 ***	0.02	0.04	0.28 ***	0.04	−0.12 ***	0.22 ***
Anti-vaccinators/Pro-vaccinators	1.08 ***	−0.08 ***	−0.04	0.32 ***	0.35 ***	−0.29 ***	−0.40 ***
Alternative hesitants/Pro-vaccinators	0.35 ***	−0.05	−0.27 ***	0.37 ***	0.05	−0.08 **	0.14 ***
Illiterate hesitants/Pro-vaccinators	0.40 ***	−0.05	−0.4 ***	0.24 ***	0.20 ***	3.00 ***	0.05
Uninformed anti-vaccinators/Pro-vaccinators	1.58 ***	−0.13 **	0.02	0.13 ***	0.14 **	−0.67 ***	2.84 ***
Social hesitants/Self-hesitants	0.21 ***	0.09 ***	0.06*	−1.55 ***	−0.06	−0.12 ***	0.23 ***
Anti-vaccinators/Self-hesitants	1.03 ***	0.00	−0.01	−1.5 ***	0.25 ***	−0.29 ***	−0.39 ***
Alternative hesitants/Self-hesitants	0.30 ***	0.03	−0.24 ***	−1.45 ***	−0.05	−0.08 *	0.15 ***
Illiterate hesitants/Self-hesitants	0.35 ***	0.03	−0.37 ***	−1.59 ***	0.10 *	3.00 ***	0.06
Uninformed anti-vaccinators/Self-hesitants	1.53 ***	−0.05	0.05	−1.69 ***	0.04	−0.67 ***	2.85 ***
Anti-vaccinators/Social hesitants	0.82 ***	−0.09 ***	−0.08 **	0.04	0.31 ***	−0.16 ***	−0.62 ***
Alternative hesitants/Social hesitants	0.08	−0.06	−0.31 ***	0.09	0.01	0.04	−0.09

TitleVaccine-Hesitancy Segments	Vaccines are Not Important	Infectious Diseases Kill	Vaccine Informed	Children Vaccinated	Vaccines Are Dangerous	Vaccination Lack of Knowledge	Information Insecurity
Illiterate hesitants-Social hesitants	0.14 ***	−0.07	−0.44 ***	−0.04	0.16	3.13 ***	−0.17 ***
Uninformed anti-vaccinators/Social hesitants	1.32 ***	−0.14 ***	−0.02	−0.15 ***	0.1	−0.55 ***	2.61 ***
Alternative hesitants/Anti-vaccinators	−0.073 ***	0.03	−0.23 ***	0.05	−0.30 ***	0.20 ***	0.53 ***
Illiterate hesitants-Anti-vaccinators	−0.68 ***	0.02	−0.36 ***	−0.08 *	−0.15 ***	3.29 ***	0.45 ***
Uninformed anti-vaccinators/Anti-vaccinators	0.50 ***	−0.05	0.06	−0.19 *	−0.21 ***	−0.38 ***	3.23 ***
Illiterate hesitants/Alternative hesitants	0.05	0.00	−0.13 *	−0.13 ***	0.15 *	3.08 ***	−0.09
Uninformed anti-vaccinators/Alternative hesitants	1.23 ***	−0.08	0.29 ***	−0.24 **	0.09	−0.59 ***	2.70 ***
Uninformed anti-vaccinators/Illiterate hesitants	1.18 ***	−0.08	0.42 ***	−0.11 ***	−0.06	−3.67 ***	2.78 ***

TitleVaccine-Hesitancy Segments	Self-Vaccinated	European Vaccination Programs	Online Media Info	Family & Friends Info	Health System Info	Other Sources of Information	International Vaccination Programs
Self-hesitants/Pro-vaccinators	−0.34 ***	0.01	0.24 ***	−0.07 ***	−0.13 ***	−0.04 ***	−0.14 ***
Social hesitants/Pro-vaccinators	0	−0.13 ***	−0.23 ***	2.15 ***	−0.30 ***	−0.04 ***	−0.05

TitleVaccine-Hesitancy Segments	Self-Vaccinated	European Vaccination Programs	Online Media Info	Family & Friends Info	Health System Info	Other Sources of Information	International Vaccination Programs
Anti-vaccinators/Pro-vaccinators	−0.14 ***	−1.09 ***	0.06 *	0.05 ***	0	−0.07 ***	−0.21 ***
Alternative hesitants/Pro-vaccinators	−0.04	−0.07	−0.22 ***	0.34 ***	−0.13 **	4.90 ***	−0.11
Illiterate hesitants/Pro-vaccinators	−0.20 ***	−0.27 ***	0.13 ***	0.28 ***	0.15 ***	−0.06 ***	−0.69 ***
Uninformed anti-vaccinators/Pro-vaccinators	−0.01	−0.22 ***	−0.81 ***	−0.59 ***	−1.47 ***	−0.72 ***	−0.01
Social hesitants/Self-hesitants	0.34 ***	−0.14 ***	−0.47 ***	2.23 ***	−0.16 ***	0	0.10 **
Anti-vaccinators/Self-hesitants	0.20 ***	−1.10 ***	−0.18 ***	0.13 ***	0.13 ***	−0.03 **	−0.07 *
Alternative hesitants/Self-hesitants	0.30 ***	−0.08	−0.46 ***	0.42 ***	0	4.95 ***	0.03
Illiterate hesitants/Self-hesitants	0.14 **	−0.27 ***	−0.11 **	0.35 ***	0.28 ***	−0.02	−0.54 ***
Uninformed anti-vaccinators/Self-hesitants	0.32 ***	−0.22 ***	−1.05 ***	−0.51 ***	−1.34 ***	−0.67 ***	0.13 *
Anti-vaccinators/Social hesitants	−0.14 ***	−0.96 ***	0.29 ***	−2.10 ***	0.30 ***	−0.04	−0.17 ***
Alternative hesitants/Social hesitants	−0.04	0.06	0.01	−1.81 ***	0.16 ***	4.94 ***	−0.06
Illiterate hesitants-Social hesitants	−0.20 ***	−0.14 ***	0.35 ***	−1.87 ***	0.45 ***	−0.03 **	−0.64 ***
Uninformed anti-vaccinators/Social hesitants	−0.01	−0.09	−0.59 ***	−2.74 ***	−1.18 ***	−0.68 ***	0.04

TitleVaccine-Hesitancy Segments	Self-Vaccinated	European Vaccination Programs	Online Media Info	Family & Friends Info	Health System Info	Other Sources of Information	International Vaccination Programs
Alternative hesitants/Anti-vaccinators	0.11	1.02 ***	−0.28 ***	0.29 ***	−0.13 **	4.98 ***	0.10
Illiterate hesitants-Anti-vaccinators	−0.06	0.83 ***	0.07	0.23 ***	0.15 ***	0.01	−0.47 ***
Uninformed anti-vaccinators/Anti-vaccinators	0.13 *	0.88 ***	−0.87 ***	−0.64 ***	−1.47 ***	−0.64 ***	0.20 ***
Illiterate hesitants/Alternative hesitants	−0.17 **	−0.19 ***	0.35 ***	−0.06	0.28 ***	−4.97 ***	−0.58 ***
Uninformed anti-vaccinators/Alternative hesitants	0.02	−0.14 *	−0.59 ***	−0.93 ***	−1.34 ***	−5.62 ***	0.10
Uninformed anti-vaccinators/Illiterate hesitants	0.19 **	0.05	−0.94 ***	−0.87 ***	−1.63 ***	−0.65 ***	0.68 ***

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

10. Appendix D

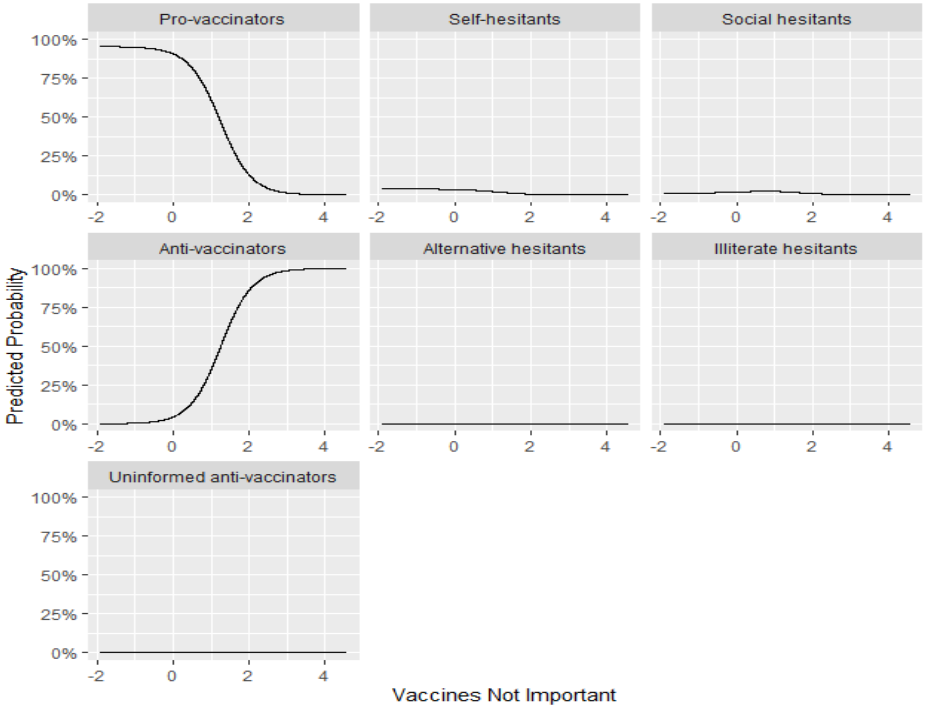


Figure A1. Marginal Effects Multinomial Logistic Regression. Vaccines Not Important.

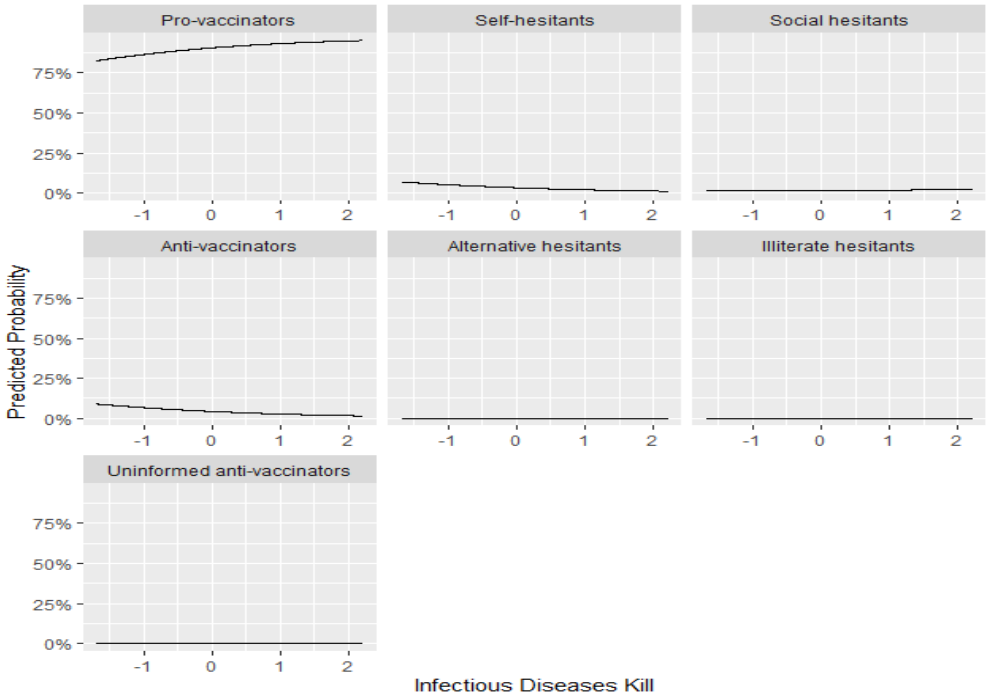


Figure A2. Marginal Effects Multinomial Logistic Regression. Infectious Diseases Kill.

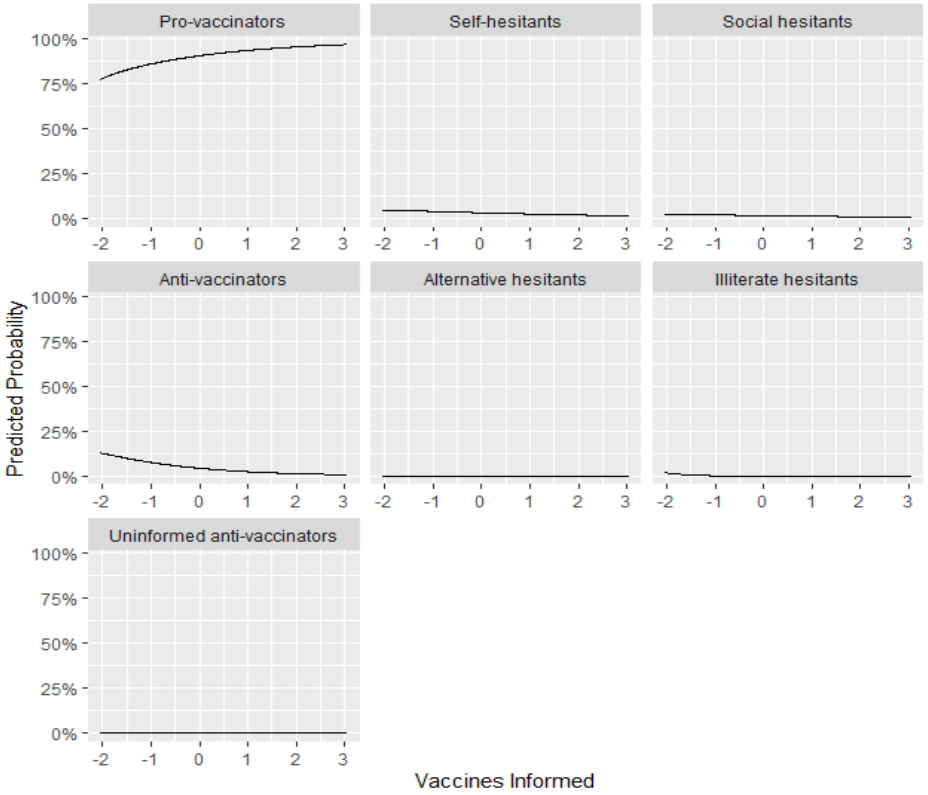


Figure A3. Marginal Effects Multinomial Logistic Regression. Vaccines Informed.

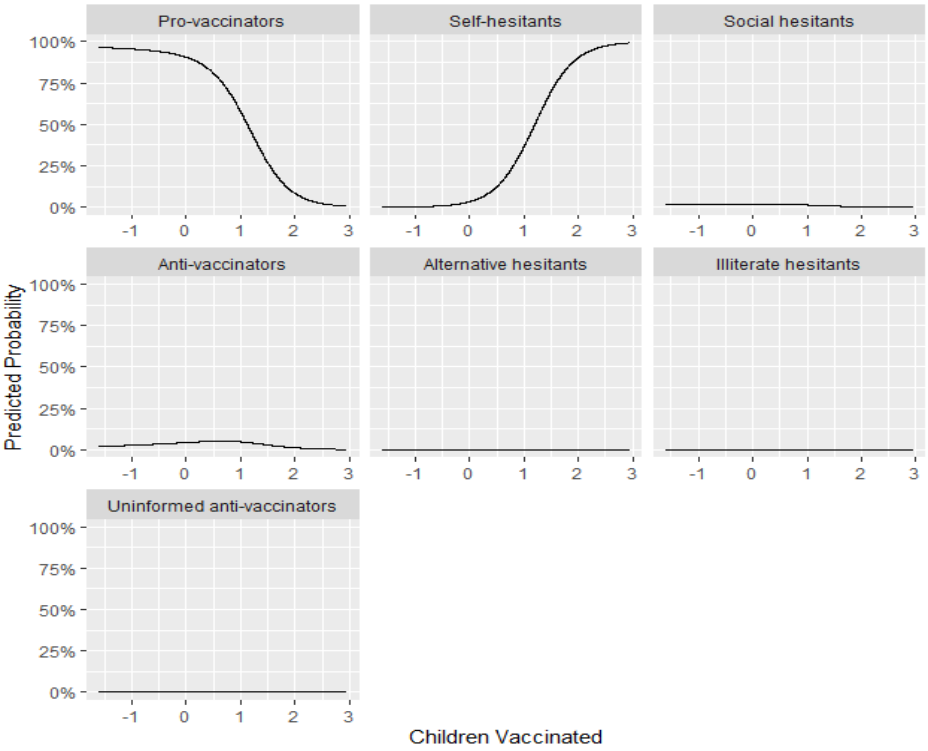


Figure A4. Marginal Effects Multinomial Logistic Regression. Children Vaccinated.

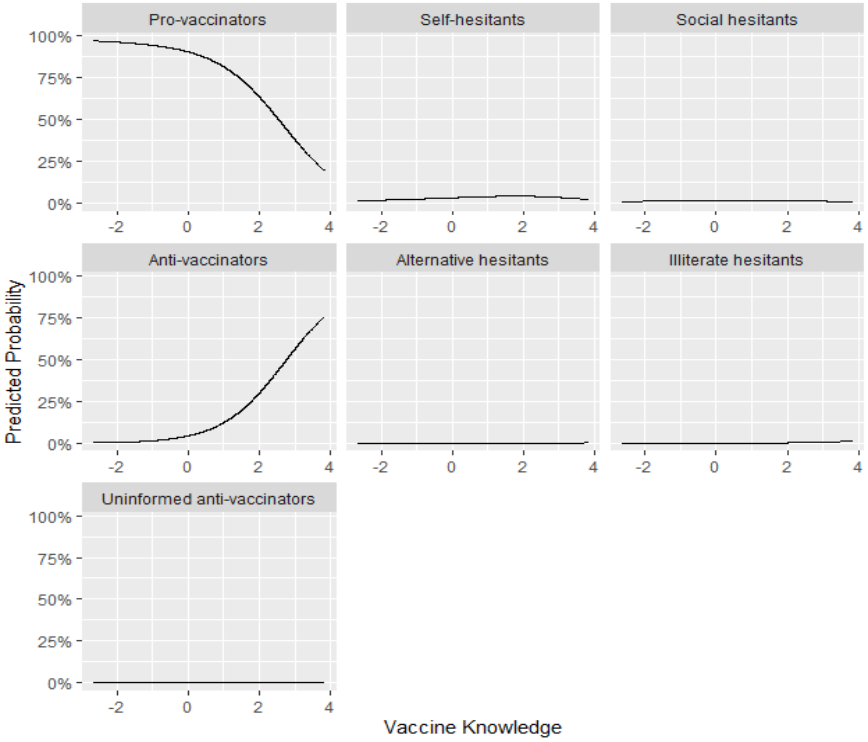


Figure A5. Marginal Effects Multinomial Logistic Regression. Vaccine Knowledge.

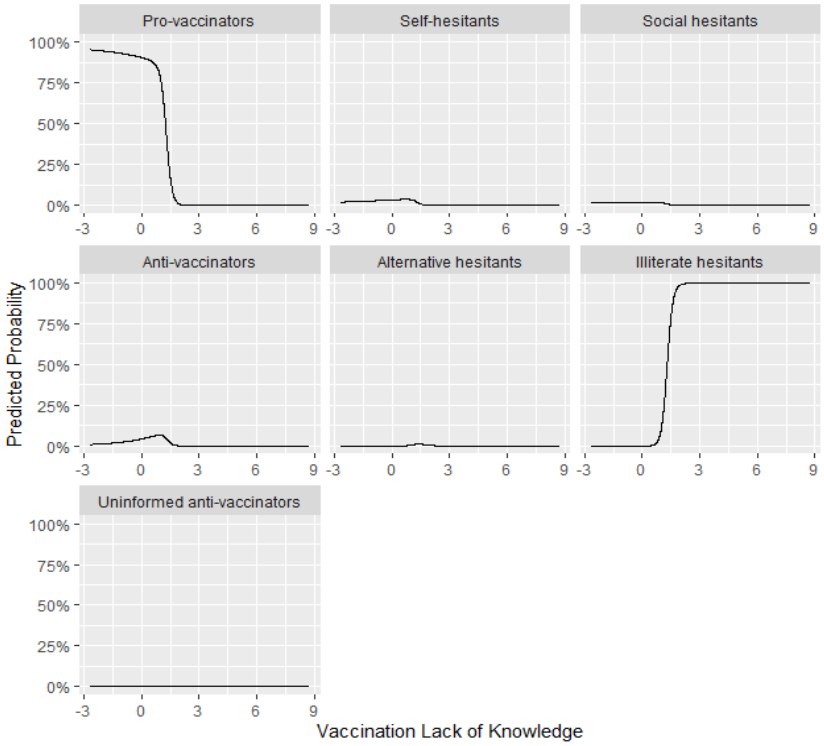


Figure A6. Marginal Effects Multinomial Logistic Regression. Vaccination Lack of Knowledge.

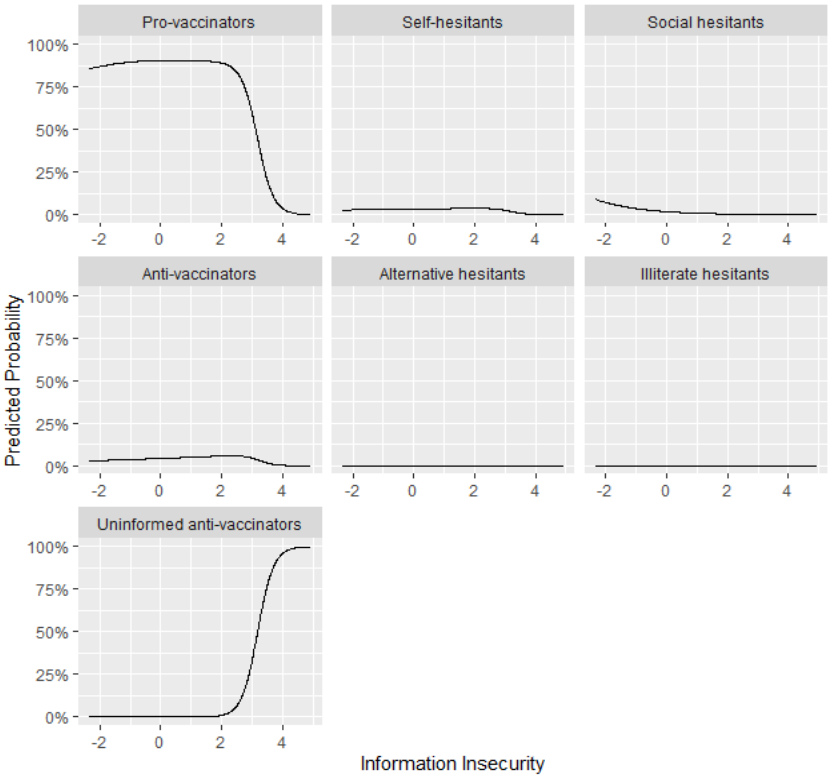


Figure A7. Marginal Effects Multinomial Logistic Regression. Information Insecurity.

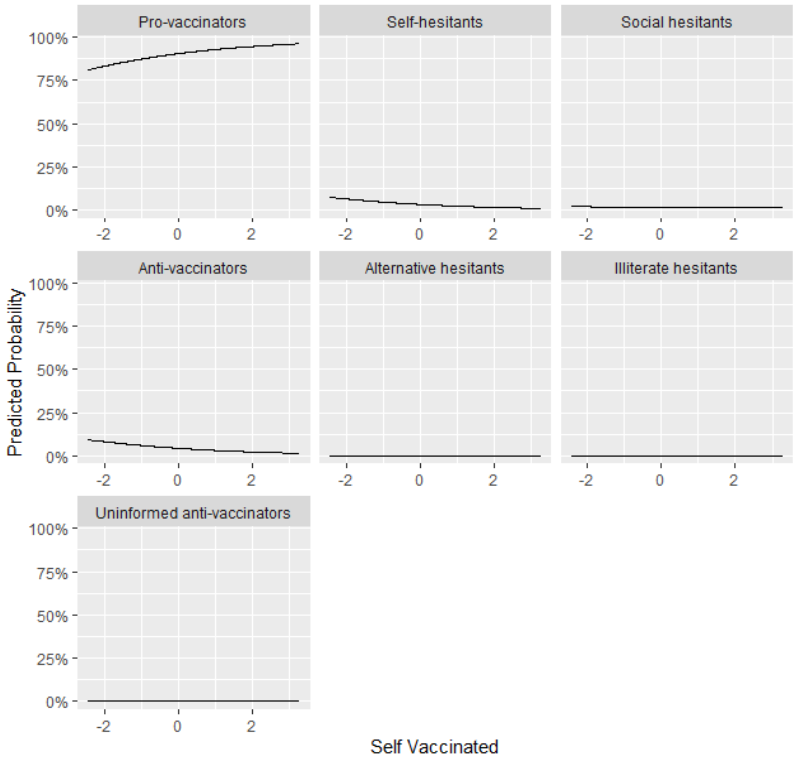


Figure A8. Marginal Effects Multinomial Logistic Regression. Self Vaccinated.

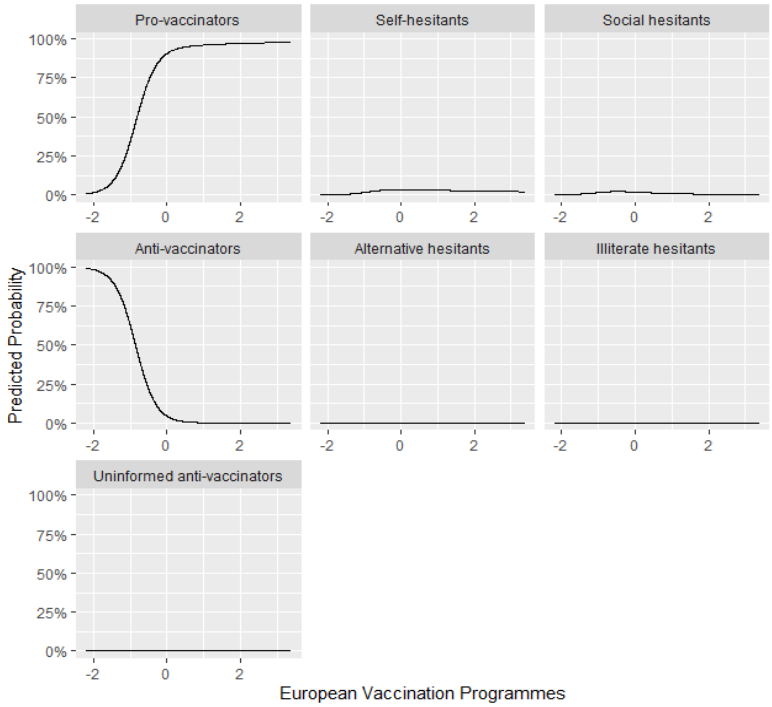


Figure A9. Marginal Effects Multinomial Logistic Regression. European Vaccination Programs.

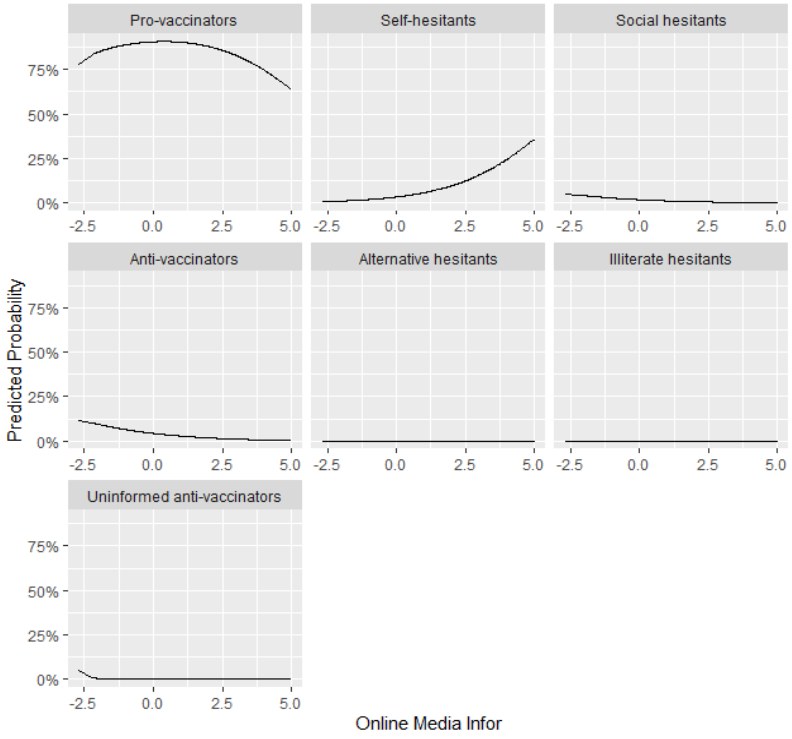


Figure A10. Marginal Effects Multinomial Logistic Regression. Online Media Info.

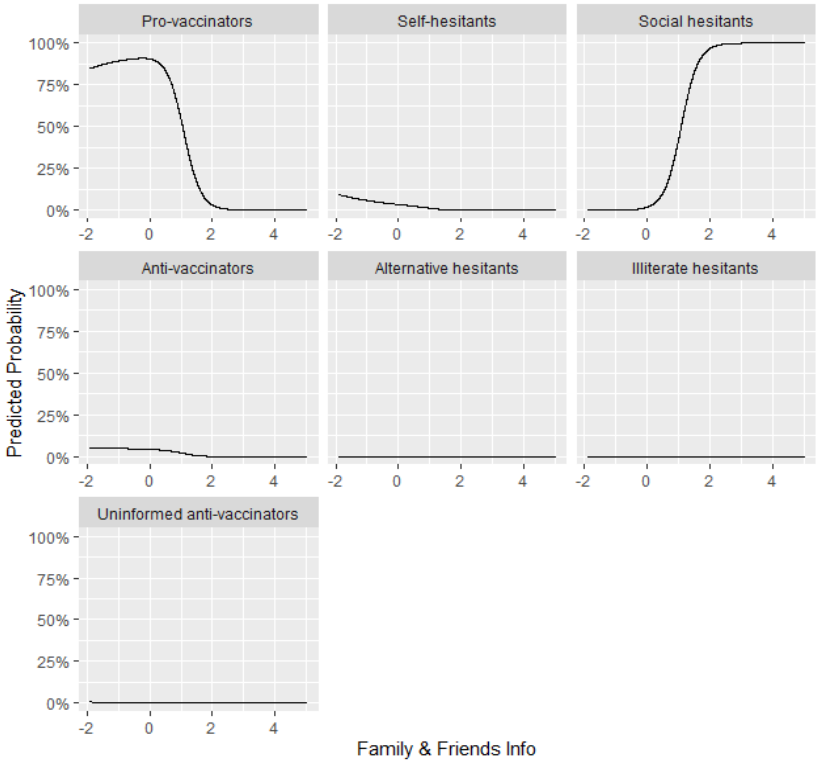


Figure A11. Marginal Effects Multinomial Logistic Regression. Family and Friends Info.

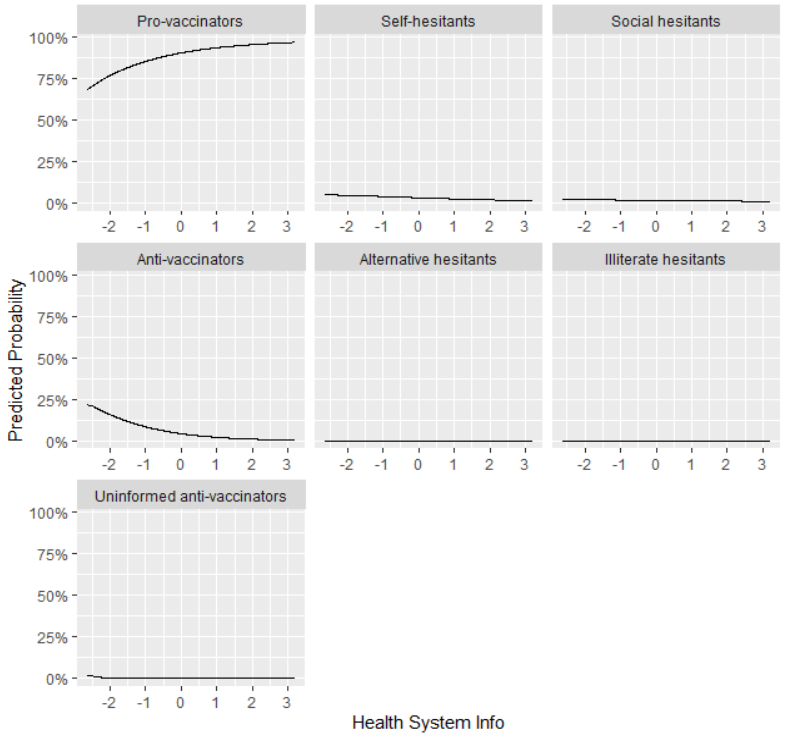


Figure A12. Marginal Effects Multinomial Logistic Regression. Health System Info.

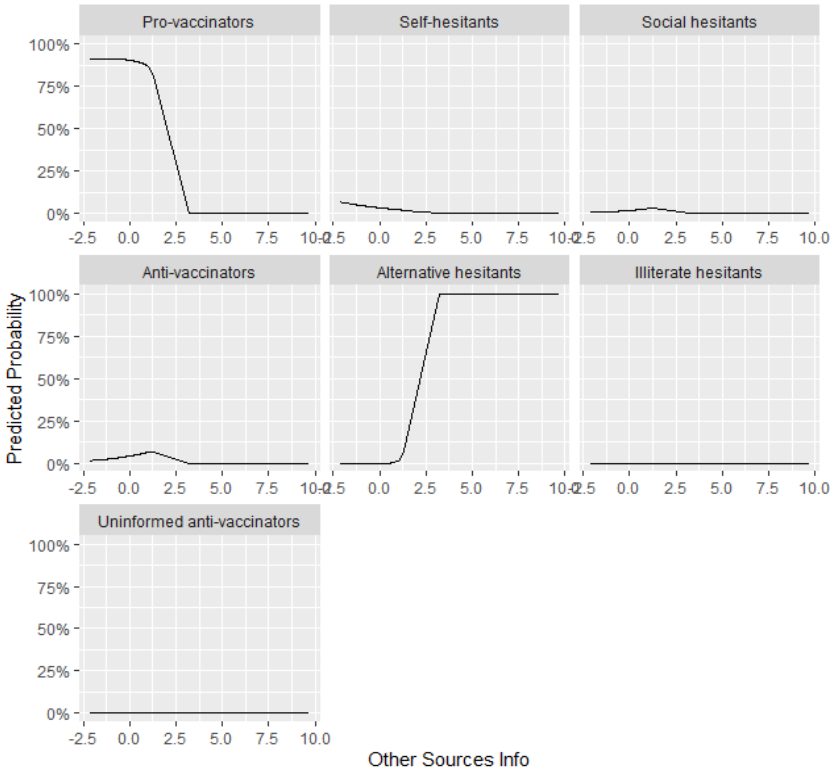


Figure A13. Marginal Effects Multinomial Logistic Regression. Other Sources Info.

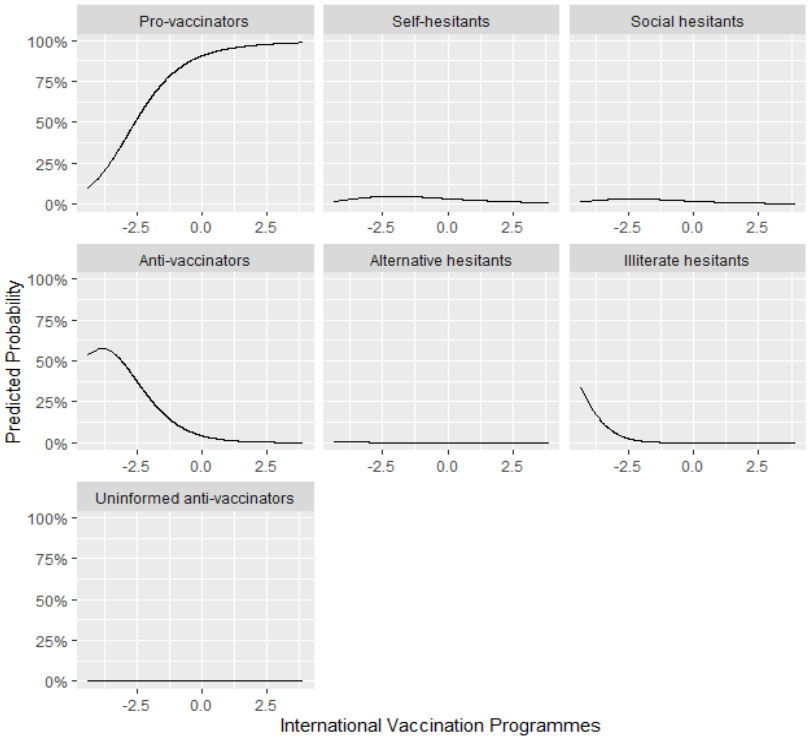


Figure A14. Marginal Effects Multinomial Logistic Regression. International Vaccination Programs.

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Estudio 2. Vaccine Hesitancy and Political Populism. An Invariant Cross-European Perspective.

Recio-Román, A.; Recio-Menéndez, M.; Román-González, M.V. Vaccine Hesitancy and Political Populism. An Invariant Cross-European Perspective. *Int. J. Environ. Res. Public Health* **2021**, 18, 12953. https://doi.org/10.3390/ijerph182412953

1. Abstract

Vaccine-hesitancy and political populism are positively associated across Europe: those countries in which their citizens present higher populist attitudes are those that also have higher vaccine-hesitancy rates. The same key driver fuels them: distrust in institutions, elites, and experts. The reluctance of citizens to be vaccinated fits perfectly in populist political agendas because is a source of instability that has a distinctive characteristic known as the "small pockets" issue. It means that the level at which immunization coverage needs to be maintained to be effective is so high that a small number of vaccine-hesitants have enormous adverse effects on herd immunity and epidemic spread. In pandemic and post-pandemic scenarios, vaccine-hesitancy could be used by populists as one of the most effective tools for generating distrust. This research presents an invariant measurement model applied to 27 EU + UK countries (27,524 participants) that segments the different behaviours found, and gives social-marketing recommendations for coping with the vaccine-hesitancy problem when used for generating distrust.

2. Keywords

vaccine hesitancy; populism; alignment; invariance; social marketing.

3. Introduction

Vaccine hesitancy and political populism are propelled by similar motivations: a profound distrust in elites and experts. Political influences are one of the contextual determinants of vaccine hesitancy behaviour [1]. Kennedy [2] found that, in 14 European countries, there was a significant association between the percentages of people in a country who voted for populist parties and of those who believed that vaccines were not important or effective. In the same way, Peretti-Watel et al. [3] found that, in France, those who had voted for a far left or far right candidate, as well as those who abstained from voting, were much more likely to state that they would refuse vaccines. To the best of our knowledge, so far no one has studied systematically the relationship between citizen's populist attitudes and vaccine hesitancy at an individual level in a large sample of countries. Hence, we aim to expand previous works by studying this underlying link with individual data that come from a large-scale survey that includes all the countries that belong to EU-27+U.K. In that vein, Europe is the region with the highest level of vaccine hesitancy [4] and populism has recently been on an upward trend [5].

Vaccine hesitancy—the reluctance or refusal to vaccinate despite the availability of vaccines—is a global issue that has become more pronounced in

recent years in almost every country [6]. One distinctive characteristic of vaccines, when compared with other medicines, is that it works both at individual and community level. Even in countries with high national vaccine uptake rates, if a population subgroup delays in acceptance or refusal of vaccines, the overall immunization strategy (at regional, national or global level) could be in danger [1].

Achieving a quantitative knowledge of the factors associated with anti-vaccination attitudes is challenging due to the "small pockets" problem: the number of people with strong anti-vaccination attitudes represents a small minority of the population. Furthermore, any large-scale survey must be context-specific and valid. The team managing the survey, and the ulterior statistical analysis performed with the collected data, need to prove that scales are suitable in all countries and that their scores and relationships among variables could be compared. Statistically speaking, this issue is called measurement invariance.

Measurement invariance is becoming an increasingly important topic, but not yet in the vaccine hesitancy ground. In July 2021, the terms related to measurement invariance returned about 6,337 hits in a Web of Science search (see Appendix A, Table A1 search #10). Vaccine hesitancy also attracted the interest of researchers, yielding about 5,225 hits (see Appendix A, Table A1, search #3). For answering the question of to what extent the research about vaccine hesitancy did measurement invariance analysis, we crossed the previous queries and obtained only 2 hits (see Appendix A, Table A1, search #11). Main scales used for measuring vaccine hesitancy, based on scores of latent factors from multiple observed responses, are valid to the extent that the estimated parameters hold in each group under study (v.gr. country, region, etc.). Therefore, there is a gap in the scientific literature about vaccine-hesitancy.

Social marketing has been long employed in designing, implementing, and evaluating public health programs in the fight against several forms of communicable diseases [7–9]. From the marketing perspective, audience targeting and segmentation strategy are the keys to success [10]. To maximize vaccine uptake, better targeting is reached when based on people's attitudes, values, and observed behaviours [11]. For this purpose, we used invariant measures of two of the main determinants of vaccine hesitancy—distrust and usefulness of vaccines [12]—and political populism ideas in the European citizens for determining how these variables relate to each other in EU27+UK. Considering the average score that the interviewees in each country had in these three variables, we clustered them to obtain the different segments of European countries attending to the relationship between vaccine hesitancy

and political populism. Governments and public health services (either international, national, or regional) could use these results when designing social marketing programs for overcoming hesitancy barriers associated with political populism beliefs, attitudes, and behaviours.

4. Populism and Vaccines

Political ideology influences how policymakers address and give solutions to healthcare issues [13]. Recently, many established democracies have experienced a flourishing of populist political movements [14]. Most of them belong to the right-wing political spectrum, but not necessarily. Hence, they do not need to share the same interests but only to fight against the same enemy ("the elite" or "the establishment") that frustrates and endangers them all ("the people") [15]. The elite normally refers to mainstream political parties, the media, the upper classes, intellectuals, and, in the territorial scope of this work, the European Union [16]. When applied to healthcare matters, medical populism [17] is based on a distrust of evidence-based policy interventions and the condemnation of technocratic knowledge [18–20].

Vaccine resistance fits perfectly in populist agendas. High levels of distrust and polarization are fruitful grounds for amplifying dissatisfaction with the elite [21]. Citizen's feelings about vaccines depend on their perceptions regarding the competence and motivation of each of the components of the vaccines value chain (v.gr., the pharmaceutical business, investigators, and health professionals), i.e., the elite, in populist terms [22].

At the individual level, thoughts and feelings can influence getting vaccinated [23]. Vaccine attitudes lie on a spectrum between the extremes that represent those people that have fixed anti-vaccination or pro-vaccination views [24]. Active refusal is not the main concern for the 20 vaccines that are normally included in most of the high-income countries' routine vaccination schedules [25,26]. Delaying or spreading out vaccination is a major concern [23].

For understanding the context in which individual vaccination decisions operate, we first have to know how the actors perceive the risk involved and how it influences their behaviour. Considering the negative impact that vaccine fear has on people's behaviour, public health experts have prioritized confidence in vaccines as a key driver in vaccination [27,28]. A second key component of vaccine confidence relates to trust in the social institutional system in which vaccination occurs [29]. Citizens usually receive vaccination from a healthcare professional (physician, nurse, or pharmacist), so that trust in them seems to be a very important relationship to consider. Nevertheless, several studies showed that variation in trust of healthcare providers does not

explain variation in vaccination coverage [30,31]. The influence of trust in vaccination behaviour must consider other social institutions that could exert more impact in the vaccination decision-process. Among them, we found the information media, the political parties, the regional or local public authorities, the national government, the national Parliament, and the European Union [32–35].

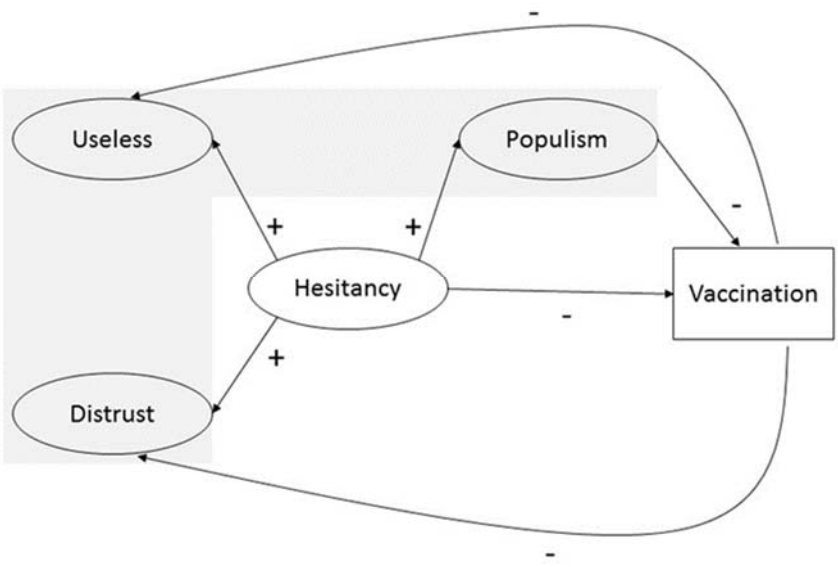

Figure 1. Conceptual Model. The grey-shaded area represents the measurement model composed of three latent variables (Useless, Distrust and Populism). The full conceptual model added a second order latent variable that constituted vaccine hesitancy (Hesitancy) and an observed variable that exhibited vaccine uptake (Vaccination). Arrows and signs represent the hypothesized relationships among the concepts.

Scales for measuring attitudes toward vaccines have been usually developed for specific infectious diseases [23]. When measuring confidence toward vaccines in general, there is evidence that a simplified scale that only considers the perceived benefits of vaccines performs as well as the entire scale [29]. As the goal of our research is to develop a parsimonious invariant measurement model for testing the relationship between vaccine hesitancy and populism in general terms, only two drivers would be considered: the usefulness of being vaccinated (hereinafter referred as USELESS because it is reverse coded) and trust in the institutions that form the vaccine environment (hereinafter referred as DISTRUST because it is reverse coded).

Hence, our measurement model was composed of three variables: two (USELESS and DISTRUST) that comprised vaccine-hesitancy (hereinafter

referred as HESITANCY), and one that represented the politic populism (hereinafter referred as POPULISM) (see the grey-shaded area in Figure 1). Once the measurement model proposed is stated as invariant in all countries under study, we expected that the country means for each of the latent variables would show differences among countries. We hypothesized, following Kennedy [2], a highly positive significant association between vaccine hesitancy and political populism. We expected that the positive association between the variables would be even higher in the case of the DISTRUST-POPULISM because, as previously explained, distrust in institutions is one of the main key drivers of political populism and the nexus with vaccine hesitancy (see Figure 2).

H_1 = USELESS, DISTRUST, and POPULISM are positively associated.

H_2 = DISTRUST and POPULISM have the highest positive association.

H_3 = POPULISM and VACCINE HESITANCY have a positive significant association across countries.

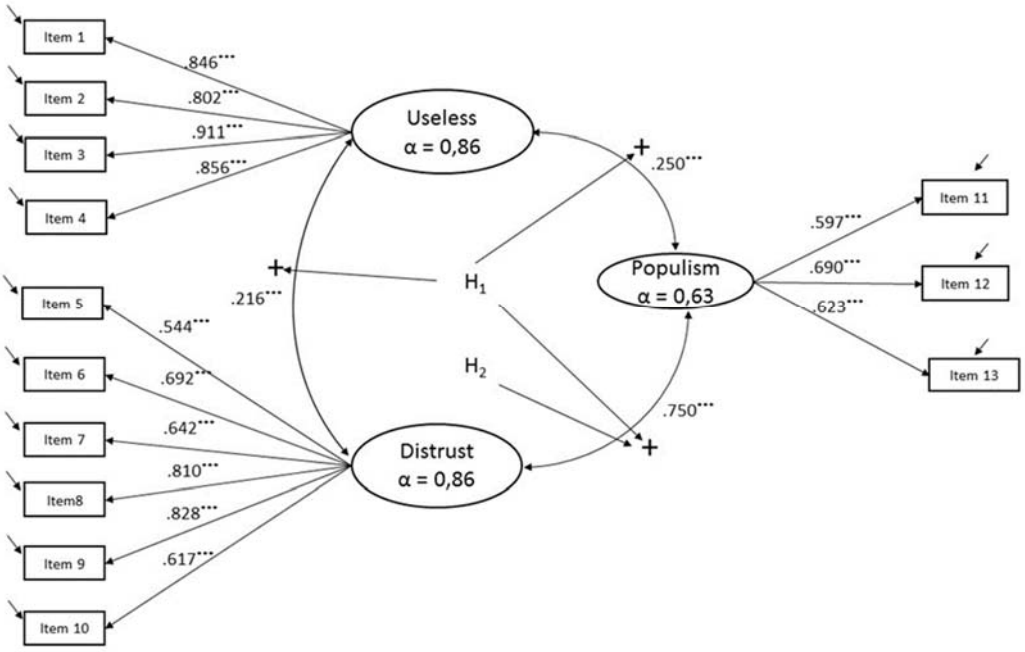

Figure 2. Measurement Model. The latent variables proposed in the model (circled) and the signs hypothesized in their relationships are depicted in the center of the figure. Each latent variable has its associated Conbrach's alpha (α). All of the path loads from latent variables to items are in standardized terms. *** represents p-values significant at the 1% level of significance.

5. Materials and Methods

5.1. Sample

The data stem from the EUROBAROMETER survey 91.2 that was carried out between the 15th and the 29th of March 2019 by the company Kantar Public, at the request of the European Commission [36]. The dataset was accessed through GESIS (Leibniz-Institute für Sozialwissenschaften, University of Cologne, Germany) at https://www.gesis.org/ (accessed on16 October 2021). The EUROBAROMETER is part of wave 91.2 and covers the population of the respective nationalities of the European Union member states, residents in each of the member states, and aged 15 years and over. In these countries, the survey covers the national population of citizens of the respective nationalities and the population of citizens of all of the European Union member states that are resident in those countries and have a sufficient command of one of the respective national language(s) to answer the questionnaire. The basic sample design applied in all states is a multi-stage random one, totalling 27,524 respondents (see Table A2 in the Appendix A).

5.2. Instrumentation

The survey measured vaccine usefulness (Cronbach's Alpha = 0.86) using four items. Each item—"To what extent do you agree or disagree with the following statements …" Item 1. "It is important for everybody to have routine vaccinations", Item 2. "Not getting vaccinated can lead to serious health issues", Item 3. "Vaccines are important not only to protect yourself but also others", Item 4. "Vaccination of other people is important to protect those that cannot be vaccinated …"—was measured on a four-point scale ranging from 1 "Totally agree" to 4 "Totally disagree". As the scale was reversed, we named the latent variable obtained from these indicators as USELESS. We included six items for measuring trust (Cronbach's alpha = 0.77)—"… how much trust you have in certain media and institutions…" Item 5. "The media", Item 6. "Political parties", Item 7. "Regional or local public authorities", Item 8. "The national government", Item 9. "The national parliament", Item 10. "The European Union". Respondents expressed their agreement with these statements on a two-item scale from 1. "Totally agree" to 2. "Totally disagree". As the scale was also reversed, we choose to name the resulting latent variable as DISTRUST. Finally, the survey asked the interviewees three questions that formed POPULISM (Cronbach's alpha = 0.63). The first one (Item 11), measured on a four-point scale from 1. "Totally agree" to 4. "Totally disagree", was: "The interests of people like you are well taken into account by the political system in (OUR COUNTRY)". The second one (Item 12), measured on a four-point scale from 1. "Totally agree" to 4. "Totally disagree", questioned "On the whole, are you very satisfied, fairly satisfied, not very satisfied, or not at all

satisfied with the way democracy works in (OUR COUNTRY)?" The third one (Item 13), asked the participants "At the present time, would you say that, in general, things are going in the right direction or in the wrong direction, in (OUR COUNTRY)?" We recoded this indicator in 1. "Things are going in the right direction", 2. "Neither the one nor the other (SPONTANEOUS), 3, "Things are going in the wrong direction". The measurement model proposed could be seen in Figure 2.

5.3. Statistical Analysis

From a methodological perspective, as we compared data from 28 different countries to check how the vaccine hesitancy's drivers (USELESS and DISTRUST) were related to the populist political ideology, we first assessed that the answers were comparable and that the proposed measurement model applies in all countries (measurement invariance, MI) [37]. Following the analysis made by Muthén and Asparouhov [38], from the different methods available to evaluate MI, alignment should be the chosen one. This election was made based on the following reasons. First, the alignment method works very well with a small number of indicators. Second, the number of groups is less than 30 (28 countries in our study). Third, for accomplishing the goals of our research it is very important to know which countries contribute to non-invariance. The alignment method conveniently provides this information when compared with the other methodological alternatives (approximate Bayesian invariance or multilevel random intercepts/random slopes approach). Finally, considering that our observed indicators are measured in Likert scales, the alignment method is better because it is nonparametric, allowing any kind of measurement parameter distribution.

For evaluating the MI of the proposed model, the first step was to check if there was an identity of parameters among countries through a Multi-Group Confirmatory Factor Analysis (MGCFA) [39]. MGCFA helped in answering to what degree the proposed model was invariant/equivalent across European countries. Three (increasingly restrictive) types of identity were assessed: configural, metric, and scalar invariance. Configural invariance requires that the same items load on the same factor(s) in all countries [40]. If the items are associated with the latent factor(s) as expected, then configural invariance holds [41]. A scale has metric invariance when the magnitudes of the relationships between items (factor loadings) and latent factors are equivalent among countries. If the model fit worsens in comparison with the configural one, we would proceed with examining partial invariance [42]. If the metric invariance is supported, we proceed to test scalar invariance. This occurs when, additionally to the previous requisites, intercepts are equivalent among

countries [41]. Scalar invariance is established when the fit of the model, with factors loadings and indicators, and intercepts constrained to be equal, does not worsen from the fit of the metric model [43]. One of the main goals of our paper intended to establish meaningful comparisons among the three factors' (useless, distrust, and populism) means across the European countries. Hence, we needed scalar invariance.

The notations of these three levels of invariance for a particular item of each factor are (Equation (1), (2) and (3)):

Configural: (1)

$$y_{ij} = v_j + \lambda_j f_{ij} + \varepsilon_{ij}$$
$$E(f_i) = \alpha_j = 0, V(f_i) = \psi_j = 1$$

Metric:

$$y_{ij} = v_j + \lambda f_{ij} + \varepsilon_{ij} \quad (2)$$
$$E(f_i) = \alpha_j = 0, V(f_i) = \psi_j = 1$$

Scalar:

$$y_{ij} = v + \lambda f_{ij} + \varepsilon_{ij} \quad (3)$$
$$E(f_i) = \alpha_j, V(f_i) = \psi_j$$

where v is a measurement intercept, λ is a factor loading, f is a factor with mean α and variance ψ, and ε is a residual with mean zero and variance θ uncorrelated with f.

As we already mentioned in the first paragraph of this section, among the different alternatives available when invariance did not meet, we chose the alignment method. Following the reasoning made by Asparouhov and Muthén [44] and its implementation in the software MPLUS 8.6 (Muthén & Muthén, Los Angeles, CA, USA) [45], we began estimating the configural model letting loadings and intercepts free across countries, factor means fixed at 0 in all countries, and factor variances fixed at 1 in all countries. Then, we proceeded with the alignment optimization freeing the factor means and variances and choosing their values to minimize the total amount of non-invariance [44,46].

6. Results

As a first step, we checked if the hypothesized measurement model (see Figure 2) fits well for each European country under study (separately calculated). In order to evaluate whether measurement invariance was supported, we first performed chi-square difference tests. Chi-square tests are overly sensitive when, as in our study, sample sizes are large and when the data is not normally distributed. In these cases, even substantially irrelevant differences can turn up as statistically significant [47]. This limited the usefulness of this index in our analysis. Additionally, we considered three global fit measures: the comparative fit index (CFI), the root mean square error

of approximation (RMSEA), and the standardized root mean residual (SRMR). We considered models with a CFI value higher than 0.90, and RMSEA and SRMR values lower than 0.08 as acceptable [48–50]. Fit indices for all European countries met the generally accepted criteria (see Appendix A, Table A3).

In step two, we tested the configural invariance. This meant that we checked that each latent variable in the measurement model had the same set of indicators in each country, the model fits the data well in each country, and all factor loadings are substantial. Fit indices met the aforementioned criteria: $\chi^2(2828) = 7642.839$, $p = 0.000$; RMSEA = 0.042; CFI = 0.966; SRMR = 0.052 (see Table 1).

Table 1. MGCFA Model Fit. Configural, Metric and Scalar Invariance Analysis.

Test Results	Configural	Metric	Scalar
χ^2	7642.839	11507.306	17318.669
χ^2 df	2828	3179	3530
χ^2 *p*-Value	0.000	0.000	0.000
RMSEA	0.042	0.052	0.063
ΔRMSEA		0.01	0.011
CFI	0.966	0.941	0.903
ΔCFI		−0.025	−0.038
SRMR	0.052	0.062	0.072
ΔSRMR		0.01	0.01

Note: χ^2 = chi-square, χ^2 df = chi-square degrees of freedom, χ^2 p-value = chi-square p-value, RMSEA = Root Mean Square of Approximation, CFI = Comparative Fit Index, SRMR = Standardized Root Mean Residual, ΔRMSEA = difference in RMSEA from the previous step, ΔCFI = difference in CFI from the previous step, ΔSRMR = difference in SRMR from the previous step.

In step three, the fit of the model with all factor loadings constrained across the 28 European countries (metric model) was compared to the fit of the configural model. If the model fit did not significantly decrease after imposing these restrictions, the more restrictive model (metric model) could be accepted. As previously explained, the change in χ^2 was statistically significant [$\chi^2(3179) = 11507.306$, $p = 0.000$] (see Table 1), but was not very useful because of the test's

high sensitivity to the large sample used. For that reason, we followed the suggestions made by Chen [51] who advised considering the differences in other model fit statistics (CFI, RMSEA, and SRMR). With N > 300, differences between configural and metric models are considered relevant when the change in CFI is larger than 0.010, accompanied by a change in RMSEA larger than 0.015, or a change in SRMR larger than 0.030. The variation in RMSEA and SRMR held with the maximum 0.01 recommended, but the 0.03 variation in CFI exceeded it.

Table 2. Alignment Fit Statistics.

	Factor loadings		Intercepts		Factor loadings + Intercepts
Item code	Fit function contribution	R2	Fit function contribution	R2	Total contribution
Useless					
Item 1	−136.881	0.878	−163.207	0.814	−300.088
Item 2	−134.464	0.898	−152.257	0.902	−286.721
Item 3	−131.675	0.943	−127.993	0.969	−259.668
Item 4	−130.332	0.943	−133.887	0.940	−264.220
Distrust					
Item 5	−164.872	0.249	−242.401	0.509	−407.273
Item 6	−187.521	0.452	−197.492	0.825	−385.013
Item 7	−165.045	0.346	−183.488	0.789	−348.532
Item 8	−145.813	0.649	−162.651	0.815	−308.465
Item 9	−150.295	0.663	−173.275	0.882	−323.570
Item 10	−159.713	0.103	−217.085	0.000	−376.798
Populism					
Item 11	−143.368	0.624	−187.273	0.727	−330.641
Item 12	−149.007	0.763	−201.916	0.869	−350.923
Item 13	−185.306	0.557	−226.041	0.737	−411.347

Note: The R2 value gives the parameter variation across groups in the configural model that is explained by variation in the factor mean and factor variance across groups. A value close to 1 implies a high degree of invariance and a value close to 0 implies a low degree of invariance (Asparouhov and Muthén, 2014, p. 6 [44]).

The metric and scalar models showed many large modification indices. This implied that for reaching a final good scalar model with acceptable fit indices, too many modifications were needed. Furthermore, the final result could lead us to a wrong model.

As we already mentioned in the methodological section, for overcoming the non-invariance we applied the alignment method. The advantage of the alignment method is that metric and scalar invariance are not required for comparing factor means among countries because it makes them comparable while minimizing measurement non-invariance [44]. We ran the alignment procedure using the software MPLUS 8.6 [45] with the country with the smallest factors mean (the Netherlands in our case) as the reference group [52]. Results reached an overall non-invariance of 21.5% (see Appendix A, Table A4). This result met the recommended rule of thumb (lower than 25% [53]) and could be considered acceptable. Additionally, we also summarized in Table 2 the fitting functions of both the factor loading and intercept for each item considered in the latent variables of our model. R2 values in this table corroborated these results.

For supporting the acceptance of the alignment result, we also performed Monte Carlo simulations based on the alignment parameter estimates for testing that factor means were well estimated so that countries' comparisons could be made. In doing so, we used the number of items, the number of countries, the degree of measurement non-invariance, the country-varying factor means and variances, and the sample sizes in the countries. We carried out the analysis using MPLUS 8.6 software [45] performing 1,000 replications. In order to be trustworthy, a near-perfect correlation was required—at least 0.98—between the estimated factor means and the generated Monte Carlo ones [38]. In our case, the correlations were USELESS = 1.000, DISTRUST = 0.999, and POPULISM = 0.998, suggesting excellent alignment despite non-invariance.

All of the previous results allowed us to feel confident in the reliability of the latent mean estimates and their comparisons across 28 countries. For better interpreting the results, the factor means for each of the 28 countries can be seen in Figure 3 (country codes and number of respondents per country are available in Table A2, and numerical results in Table A5, both in Appendix A).

For simplifying the interpretation of the results in a data-analytic way, we clustered the factor means among countries concerning their similarities. Using the factor means for each of the 28 countries obtained in the previous step, we proceeded to analyze the different country segments that existed. For choosing the best clustering method we used the package “clValid” from R [54]. Hierarchical methods performed better than K-Means and PAM for the three internal measures of clustering validation used (Connectivity, Dunn, and

Silhouette). Considering the compactness, separation, connectivity, and interpretability, the five-cluster solution performed the best. Figure 3 visually depicts the results of the hierarchical clustering approach (using the squared Euclidean distance and the Ward method). For testing whether the country segments found were differentiable, we calculated segments' means differences by applying an ANOVA-Tukey HSD analysis (see Table 3). From these results, we concluded that the country segments' mean differences were statistically significant for DISTRUST—except when comparing cluster 5 and cluster 2—and POPULISM—except when comparing clusters 5 and 3. USELESS only had statistically significant mean differences when comparing cluster 3 with any of the others.

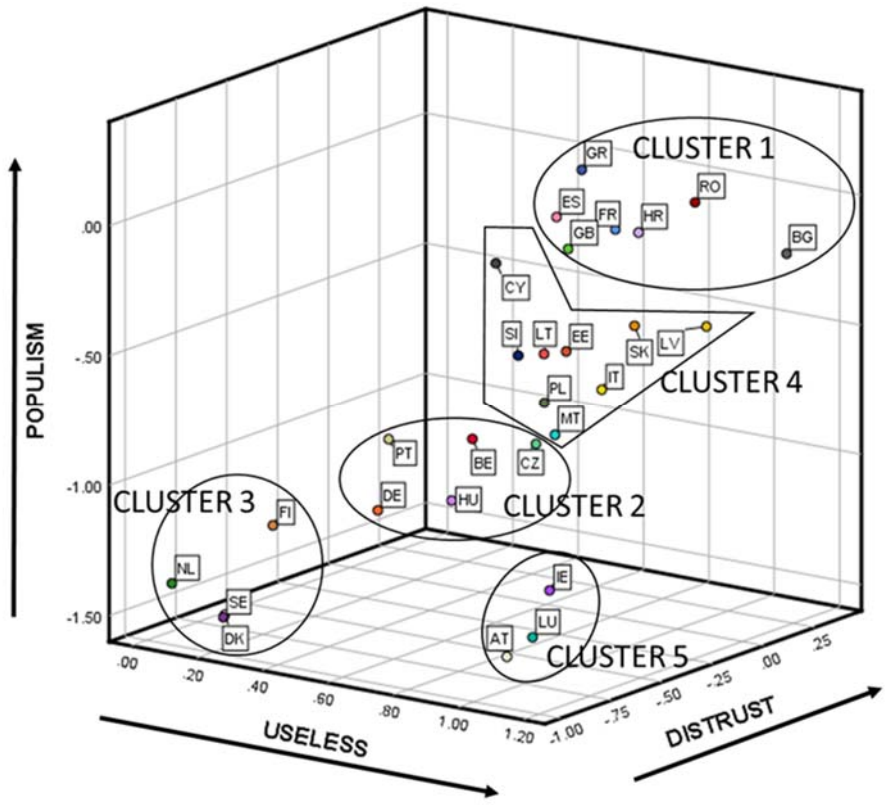

Figure 3. Factor Means for USELESS, DISTRUST, and POPULISM in 28 Countries. Alignment Method. Country codes and number of respondents per country are available in Table A2, and numerical results in Table A5, both in Appendix A.

Table 3. ANOVA (Tukey HSD). Country-Segment's Mean Differences.

Country-Segments	Useless	p	Distrust	p	Populism	p
2-1	−0.26	n.s.	−0.52	***	−0.86	***
3-1	−0.64	***	−0.99	***	−1.27	***
4-1	−0.04	n.s.	−0.23	*	−0.46	***
5-1	0.08	n.s.	−0.64	***	−1.37	***
3-2	−0.38	*	−0.48	***	−0.41	***
4-2	0.22	n.s.	0.28	*	0.4	***
5-2	0.34	n.s.	−0.12	n.s.	−0.51	***
4-3	0.6	***	0.76	***	0.81	***
5-3	0.72	***	0.35	n.s.	−0.09	n.s.
5-4	0.12	n.s.	−0.41	**	−0.91	***

Note: Country-Segments indicate the segment code number as depicted in Figure 3. Level of significance: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$, *n.s.* not significant.

The characteristics of each of the found segments were:

- Cluster 1. The countries that belonged to this cluster were France, United Kingdom, Spain, Greece, Romania, Bulgaria, and Croatia. They showed the highest mean in POPULISM, DISTRUST, and USELESS—in this latter case only surpassed by cluster 5, but not statistically significant.
- Cluster 2. The countries that formed this cluster were Germany, Portugal, Belgium, Hungary, and the Czech Republic. They presented a medium position in POPULISM—higher than clusters 3 and 5 and lower than clusters 1 and 4—and a medium-low position in DISTRUST—higher than cluster 3, lower than clusters 1 and 4 and not statistically significantly different from cluster 5. USELESS did not have any statistically significant difference with any other cluster.
- Cluster 3. The countries that pertained to this cluster were The Netherlands, Finland, Sweden, and Denmark. They displayed one of the two lowest positions in POPULISM and DISTRUST—shared

with cluster 5. USELESS, especially useful for marking the difference between this cluster and all the rest, presented the lowest position.

- Cluster 4. The countries related to this cluster were Italy, Poland, Slovakia, Estonia, Latvia, Lithuania, Slovenia, Cyprus, and Malta. POPULISM and DISTRUST exhibited a medium-high level—higher than clusters 2, 3, and 5, and lower than cluster 1. The only statistically significant difference found for USELESS was that previously commented with cluster 3.
- Cluster 5. The countries connected to this cluster were Austria, Luxemburg, and Ireland. As already mentioned when describing cluster 3, this cluster had the lowest positions in POPULISM and DISTRUST, tied with cluster 3, but not in USELESS, which was in line with the mean of clusters 1, 2, and 4.

7. Discussion and Conclusion

As a compulsory analytic prerequisite to making comparisons when data from large-scale surveys in several countries are used, we chose the alignment method that allowed us to check the invariance of the proposed measurement model. We reached a parsimonious invariant measurement model for studying the relationships between vaccine hesitancy and political populism in EUR 27 + UK.

From the two latent variables studied that we used for measuring vaccine hesitancy, DISTRUST had the strongest relationship with POPULISM (see Figure 2) while USELESS was only statistically significant for differentiating cluster 3 from all the others (see Appendix A, Table A4). Hence, hypotheses 1 and 2 holds.

Several European countries felt that the vaccine's usefulness to fight against infectious diseases was not very high. Only the countries that belong to Cluster 3 (Denmark, The Netherlands, Sweden, and Finland) showed sound confidence in vaccines. For the rest of the country clusters, the perception of vaccines' uselessness could be explained by different reasons. Some European countries that were exposed to Soviet communism (Bulgaria, Latvia, Romania, and Slovakia) depicted higher rates of vaccine USELESS (see Appendix A, Table A5). Several investigations have found that weak trust in government, medical personal, and medical advice from doctors explained these cases [55–57]. For

some other eastern European countries that were also under the influence of Soviet communism (mainly the Czech Republic, Poland, and Hungary), the higher usefulness that they portrayed in vaccines could be explained by their experience developing vaccines since the 1950s and the role that they played in the propaganda campaigns claiming credit for their superiority [58]. The rest of the ex-communist states felt, in these moments, the authoritarianism inherent in communist states when imposing vaccination trials and uptakes, which generated anti-vaccine sentiments that have remained ever since. Furthermore, not all the countries with low levels of DISTRUST and POPULISM believed that vaccines were useful for fighting against infectious diseases. As we saw, all the countries that belonged to cluster 5 (Austria, Luxembourg, and Ireland) felt that vaccines were useless. From a social marketing perspective, the results obtained for USELESS suggested that, except for countries that belonged to Cluster 3, marketing actions needed to be implemented to reinforce the association of vaccines as a proven and successful solution to fight against infectious diseases.

Distrust in institutions was the main underlying driver that was associated with both vaccine hesitancy and political populism (see Figure 2). We also saw (Figure 3) that a positive relationship existed between the two variables that formed vaccine hesitancy (USELESS and DISTRUST) and POPULISM. Hence, hypothesis 3 also holds.

The challenge that the world seems to be facing is trustdemic: falling public trust is all around the world [59–61]. This could explain how vaccine-hesitancy is increasing worldwide while having highly effective vaccines. Trusted institutions are the grease in the social machine. As Khanna [62] said, "When citizens lack trust, they are less likely to comply with laws and regulations, pay taxes, tolerate different viewpoints or ways of life, contribute to economic vitality, resist the appeals of demagogues, or support their neighbours. Without trust, societies are at risk of chaos and conflict."

Populist political parties know that vaccines are fertile ground for instilling doubt and trying to gain from polarized debates [63]. The main strategy of populists is to polarize pro and con views on vaccines, joining them with any other sentiments (anti-chemical, anti-science, anti-migration, anti-abort, anti-government, etc.) [64]. Results from this strategy were clear: our measurement model portrayed a strong positive relationship among DISTRUST and POPULISM in all the European countries.

Vaccine-hesitancy is also very adequate for the populism strategy due to the "small pockets" issue. They do not need to convince the whole population to follow a vaccine-hesitant attitude. "Herd immunity", the level at which immunization coverage has to be maintained in order to be effective, depends

on the vaccine but it typically ranges between 80% and 90% of the population [23,65]. Hence, a small number of vaccine-hesitants can have enormous adverse effects on herd immunity and epidemic spread. Even more, if we consider that this low percentage that is leftover to attain "herd immunity" has to be reserved for people with compromised immune systems or for those that are too young, for example, neonates.

We also must bear in mind that to be vaccine-hesitant does not necessarily imply that one does not take any vaccines. Willingness to be vaccinated lies in a continuum ranging from those who accept all vaccines without any doubt to those who reject all without any doubt. It is complex and context-specific, varies across time, place, and vaccines [65,66]. Therefore, from the willingness to be vaccinated to the uptake there is still a myriad of factors that could influence the final decision and that belong to the demand side of vaccination [8,67]. One of them could be how populism affects vaccination uptake. It has not been studied in this paper. The mediation role of populism on vaccine uptake, depicted in Figure 1, is part of an ongoing research study that has obtained promising preliminary results.

From the results, there are several implications for management. First, sixteen out of twenty-eight European countries under study showed high rates of distrust in institutions and populism and medium-low levels of confidence in vaccines for fighting against infectious diseases. They are all the countries that belong to Cluster 1 and Cluster 4. Populist organizations likely take advantage of this situation for generating social instability based on vaccine-hesitancy. Second, having low levels of distrust and populism does not mean living without problems. Countries that compose Cluster 3 have the highest perception that vaccines are not useful. Hence, vaccine hesitancy could be high and populist organizations could profit from this situation. Third, countries that constitute cluster 3 are at the medium of the spectrum. The two countries that belonged to the former Soviet communism area of influence (Hungary and Czech Republic) are proud of the role played during the Cold War when developing vaccines. Nevertheless, the economic, political, and economic situation in these countries could make them follow the same path as Poland (also proud of their vaccine experience in the past, but with higher levels of distrust and populism). Germany shares a similar problem: the *landers* that were in the Soviet communism area of influence have higher degrees of vaccine hesitancy and populist organizations are making use of it [68]. Fourth, countries included in Cluster 3 portray the best position represented by the low rates of the three drivers. Nevertheless, the "small pockets" concern could be a problem in these countries due to the existence of global vaccine-hesitant segments [69].

Social marketing must be targeted for convincing vaccine-hesitants that to be vaccinated is a societal health strategy and not just a question about individual rights. Proactive steps must be implemented for restoring the trust in scientists that develop vaccines, governments, institutions, and businesses. A lifetime acceptance of vaccine programs, orchestrated through a relationship marketing campaign, could be the basis of a trust chain for better resisting the negative economic and social outcomes derived from the association that this paper shows between populism and vaccine-hesitancy.

8. Limitations

The present study has some limitations. The clearest one is the use of the Eurobarometer's predefined items. Nevertheless, the benefit of the large-scale surveys carried out by well-known public international organizations is the high quality of the data obtained through a standardized sampling procedure. It was intended by the authors to fill the gap that existed in the vaccine-hesitancy literature for testing the invariance of the measurement items used when several countries were present. For this purpose, Eurobarometer's data fit perfectly.

Further research is necessary to quantify how populism mediates the final vaccination uptake decision. The limitation of using MGFA with alignment for validating the proposed measurement model could be relaxed—including covariates and using full structural equation modeling—when testing the mediation model proposed in Figure 1.

Finally, data used for the analysis were gathered between the 15th and the 29th of March 2019, before the Covid-19 pandemic. New more recent data are needed for reinforcing the proposed relationship between vaccine hesitancy and populism.

9. Appendix A

Table A1. Search Strategy in Web of Science in order to know how many vaccine hesitancy publications used measurement invariance analysis.

Query	Search Terms	Hits
#1	TI=("vaccin* hesitan*" OR "hesitan* to vaccine*" OR "vaccin* refusal" OR "refusal to vaccine*" OR "vaccin* opposition" OR "opposit* to vaccin*" OR "antivacc* group*" OR "antivax" OR autovaccination OR "object* to vaccin*" OR "resilience to vaccin*" OR "debate against vaccin*" OR "vaccin* *compliance" OR "vaccin* *adherence" OR "resist* to vaccin*" OR "incomplete vaccin*" OR "misinformation about vaccine*" OR "vaccin* criticism*" OR "delaying vaccin*" OR "anxiety from vaccin*" OR "criticism to vaccin*" OR "barrier* to vaccin*" OR "lack of intent to vaccin*" OR "poor completion of vaccin*" OR "compulsory vaccin*" OR "negative perception about vaccin*" OR " negative attitudes vaccin*" OR "engagement in vaccin*" OR "choice to vaccin*" OR "awareness about vaccin*" OR "knowledge about vaccin*" OR "behavi* toward vaccin*" OR "poor vaccin* uptake" OR "vaccin* uptake rate" OR "doubts about vaccin*" OR "acceptance of vaccin*" OR "acceptability of vaccin*" OR "contravers* about vaccin*" OR "religious exemption vaccine*" OR "fear from vaccin*" OR "belief in vaccin*" OR "mandatory vaccin*" OR "compulsory vaccin*" OR "willingness to accept vaccin*" OR "parental control of child* vaccin*" OR "willingness to vaccine*" OR "willingness to accept vaccin*")	1,663
#2	AB=("vaccin* hesitan*" OR "hesitan* to vaccine*" OR "vaccin* refusal" OR "refusal to vaccine*" OR "vaccin* opposition" OR "opposit* to vaccin*" OR "antivacc* group*" OR "antivax" OR autovaccination OR "object* to vaccin*" OR "resilience to vaccin*" OR "debate against vaccin*" OR "vaccin* *compliance" OR "vaccin* *adherence" OR "resist* to vaccin*" OR "incomplete vaccin*" OR "misinformation about vaccine*" OR "vac-cin* criticism*" OR "delaying vaccin*" OR "anxiety from vaccin*" OR "criticism to vaccin*" OR "barrier* to vaccin*" OR "lack of intent to vaccin*" OR "poor completion of vaccin*" OR "compulsory vaccin*" OR "negative perception about vaccin*" OR " negative attitudes vaccin*" OR "engagement in vaccin*" OR "choice to vaccin*" OR "awareness about vaccin*" OR	4,333

	"knowledge about vaccin*" OR "behavi* toward vaccin*" OR "poor vaccin* uptake" OR "vaccin* uptake rate" OR "doubts about vaccin*" OR "acceptance of vaccin*" OR "acceptability of vaccin*" OR "contravers* about vaccin*" OR "religious exemption vaccine*" OR "fear from vaccin*" OR "belief in vaccin*" OR "mandatory vaccin*" OR "compulsory vaccin*" OR "willingness to accept vaccin*" OR "parental control of child* vaccin*" OR "willingness to vaccine*" OR "willingness to accept vaccin*")	
#3	(#1) OR #2	5,225
#4	TI=("measurement invariance" OR "multigroup invariance" OR "Multi-group confirmatory factor analysis" OR "factorial invariance" OR "measurement equivalence" OR MGCFA)	2,267
#5	AB=("measurement invariance" OR "multigroup invariance" OR "Multi-group confirmatory factor analysis" OR "factorial invariance" OR "measurement equivalence" OR MGCFA)	5,614
#6	(#4) OR #5	6,174
#7	TI=("configural" AND "metric" AND "scalar")	4
#8	AB=("configural" AND "metric" AND "scalar")	616
#9	(#7) OR #8	618
#10	(#6) OR #9	6,337
#11	(#3) AND #10	2

Source: Adapted from Sweileh [70].

The query was made from 1900 to July, the 22nd 2021 in the Web of Science Core Collection, Current Contents Connect, Derwent Innovation Index, KCI- Korean Journal Database, MEDLINE, Russian Science Citation Index, and SciELO Citation Index. Search strategy consisted in searching for the selected key terms in the Web of Science's "Title" and "Abstract" fields. Some changes were made to the original key terms used by Sweileh (2020) because of the appearance of false positives when validating the final results. No language restriction was made.

Table A2. Reference codes, sample size by country, and total population 15+.

Country	Country code	Country code number	Number of Interviews	Population 15+
France	FR	1	1013	54,097,255
Belgium	BE	2	1041	9,693,779
The Netherlands	NL	3	1017	13,979,215
Germany	DE	4	1507	70,160,634
Italy	IT	5	1021	52,334,536
Luxemburg	LU	6	512	457,127
Denmark	DK	7	1017	4,838,729
Ireland	IE	8	1078	3,592,162
United Kingdom	UK	9	1021	52,651,777
Greece	GR	10	1014	9,937,810
Spain	ES	11	1014	39,445,245
Portugal	PT	12	1013	8,480,126
Finland	FI	13	1000	4,747,810
Sweden	SE	14	1021	7,998,763
Austria	AT	15	1006	7,554,711
Republic of Cyprus	CY	16	505	741,308
Czech Republic	CZ	17	1068	9,238,431
Estonia	EE	18	1005	1,160,064
Hungary	HU	19	1030	8,781,161
Latvia	LV	20	1012	1,707,082
Lithuania	LT	21	1004	2,513,384
Malta	MT	22	497	364,171
Poland	PL	23	1011	33,444,171
Slovakia	SK	24	1020	4,586,024
Slovenia	SI	25	1016	1,760,032
Bulgaria	BG	26	1026	6,537,535
Romania	RO	27	1025	16,852,701
Croatia	HR	28	1010	3,796,476
TOTAL			27,524	431,452,219

Source: Eurobarometer 91.2. European Commission [36].

Table A3. Fit Indices of the Measurement Model in Each Country.

Country	χ^2	χ^2df	χ^2p	RMSEA	CFI	SRMR
France	217.747	62	0.000	0.050	0.955	0.035
Belgium	157.106	62	0.000	0.038	0.972	0.033
The Netherlands	140.942	62	0.000	0.035	0.975	0.030
Germany	252.921	62	0.000	0.045	0.967	0.031
Italy	261.537	62	0.000	0.056	0.958	0.037
Luxembourg	128.510	62	0.000	0.050	0.960	0.040
Denmark	156.490	62	0.000	0.040	0.970	0.030
Ireland	152.800	62	0.000	0.040	0.980	0.030
United Kingdom	213.690	62	0.000	0.050	0.960	0.030
Greece	261.640	62	0.000	0.060	0.940	0.030
Spain	183.460	62	0.000	0.040	0.960	0.030
Portugal	204.470	62	0.000	0.050	0.970	0.030
Finland	198.010	62	0.000	0.050	0.960	0.040
Sweden	112.670	62	0.000	0.030	0.980	0.030
Austria	326.950	62	0.000	0.060	0.910	0.050
Cyprus (Republic)	113.250	62	0.000	0.040	0.970	0.040
Czech Republic	215.590	62	0.000	0.050	0.960	0.040
Estonia	203.050	62	0.000	0.050	0.960	0.030
Hungary	408.160	62	0.000	0.070	0.940	0.040
Latvia	227.280	62	0.000	0.050	0.950	0.040
Lithuania	157.190	62	0.000	0.040	0.970	0.030
Malta	271.480	62	0.000	0.080	0.920	0.050
Poland	364.660	62	0.000	0.070	0.900	0.060
Slovakia	523.750	62	0.000	0.080	0.910	0.050
Slovenia	153.170	62	0.000	0.040	0.980	0.030
Bulgaria	285.100	62	0.000	0.060	0.950	0.040
Romania	318.880	62	0.000	0.060	0.930	0.050
Croatia	304.180	62	0.000	0.060	0.950	0.040

Note: χ2 = chi-square, χ2 df = chi-square degrees of freedom, χ2 p = chi-square p-value, RMSEA = Root Mean Square of Approximation, CFI = Comparative Fit Index, SRMR = Standardized Root Mean Residual.

Table A4. Alignment results. Approximate measurement (non) invariance for intercepts and loadings, 28 countries.

Variable/Item	Intercept	Loadings
Useless		
Item 1	(1) 2 3 4 (5) (6) 7 (8) (9) 10 11 12 13 (14) 15 16 (17) 18 19 20 21 22 (23) 24 25 26 27 28	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 (21) 22 (23) 24 25 26 27 28
Item 2	1 2 (3) 4 5 6 (7) (8) 9 10 11 (12) (13) 14 15 16 (17) 18 (19) 20 21 22 (23) 24 25 26 (27) 28	(1) 2 3 4 5 6 7 8 9 10 11 12 (13) 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Item 3	1 2 3 4 5 6 7 8 9 10 11 (12) 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	1 2 3 4 5 6 (7) 8 9 10 11 12 (13) 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Item 4	1 2 (3) 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 (23) 24 25 26 27 28	1 2 3 4 5 6 7 8 9 10 11 12 13 (14) 15 16 17 18 19 20 21 22 23 24 25 26 (27) 28
Distrust		
Item 5	1 2 (3) 4 5 6 (7) 8 (9) 10 11 (12) (13) 14 15 16 (17) (18) (19) (20) (21) (22) 23 24 25 (26) (27) 28	1 2 3 4 5 6 7 8 9 10 11 (12) 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Item 6	1 2 3 4 (5) 6 7 8 9 10 11 12 13 14 15 16 17 18 19 (20) 21 22 23 24 25 26 27 (28)	(1) 2 (3) 4 5 6 7 8 9 (10) (11) (12) 13 14 15 (16) 17 18 19 (20) 21 22 23 24 (25) 26 27 (28)
Item 7	(1) 2 3 (4) (5) 6 (7) (8) 9 (10) (11) (12) (13) 14 15 (16) 17 18 19 20 21 (22) (23) (24) (25) (26) (27) (28)	1 2 3 (4) (5) 6 7 8 9 (10) 11 (12) 13 14 15 16 17 18 19 20 21 22 23 24 (25) 26 27 (28)
Item 8	1 (2) 3 4 5 (6) 7 8 9 10 11 12 13 14 15 16 (17) (18) 19 20 21 (22) 23 24 25 26 (27) (28)	1 2 3 4 5 6 7 8 (9) (10) (11) 12 13 14 15 16 17 18 19 20 21 22 23 (24) 25 26 27 28
Item 9	1 (2) 3 4 5 6 7 (8) 9 (10) (11) (12) (13) (14) 15 16 (17) (18) 19 (20) (21) 22 (23) (24) 25 (26) (27) 28	1 2 3 4 5 6 7 8 9 10 (11) (12) 13 14 15 16 17 18 19 20 21 22 23 24 25 (26) 27 28
Item 10	1 2 (3) (4) 5 6 7 (8) 9 (10) (11) 12 13 14 (15) (16) (17) 18 19 (20) (21) 22 23 (24) (25) (26) (27) (28)	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (19) 20 21 (22) (23) 24 25 26 27 28

Table A4. Alignment results. Approximate measurement (non) invariance for intercepts and loadings, 28 countries —continued—.

Variable/Item	Intercept	Loadings
Populism		
Item 11	1 2 (3) 4 5 6 (7) 8 9 (10) 11 12 (13) 14 15 (16) 17 (18) (19) 20 (21) 22 23 24 25 (26) (27) (28)	1 2 (3) 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Item 12	1 2 3 (4) (5) 6 (7) 8 9 (10) (11) 12 13 14 15 16 (17) 18 (19) 20 21 (22) (23) 24 25 26 (27) (28)	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Item 13	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 (18) 19 20 (21) (22) 23 24 25 26 27 28	(1) 2 3 4 5 6 7 8 (9) (10) 11 12 13 (14) 15 16 17 (18) 19 20 21 (22) 23 24 25 26 (27) (28)

Note: numbers indicate the country code (see Table A2). The parentheses indicate whether the parameter (intercept or factor loading) is non invariant for that specific group (country code) by variable.

Table A5. Factor Mean Comparisons of 28 Countries on USELESS, DISTRUST, AND POPULISM Factors.

Ranking	Country Code	Mean	Countries With Significantly Smaller Factor Mean
Useless			
1	26	2.182	27 15 24 5 6 28 1 8 18 21 22 2 23 19 17 9 10 25 11 16 4 12 14 13 7 3
2	20	1.973	24 5 6 28 1 8 18 21 22 2 23 19 17 9 10 25 11 16 4 12 14 13 7 3
3	27	1.942	24 5 6 28 1 8 18 21 22 2 23 19 17 9 10 25 11 16 4 12 14 13 7 3
4	15	1.858	24 5 6 28 1 8 18 21 22 2 23 19 17 9 10 25 11 16 4 12 14 13 7 3
5	24	1.602	28 1 8 18 21 22 2 23 19 17 9 10 25 11 16 4 12 14 13 7 3

Table A5 (continued). Factor Mean Comparisons of 28 Countries on USELESS, DISTRUST, AND POPULISM Factors.

Ranking	Country Code	Mean	Countries With Significantly Smaller Factor Mean
6	5	1.502	21 22 2 23 19 17 9 10 25 11 16 4 12 14 13 7 3
7	6	1.409	2 23 19 17 9 10 25 11 16 4 12 14 13 7 3
8	28	1.39	2 23 19 17 9 10 25 11 16 4 12 14 13 7 3
9	1	1.356	2 23 19 17 9 10 25 11 16 4 12 14 13 7 3
10	8	1.315	2 23 19 17 9 10 25 11 16 4 12 14 13 7 3
11	18	1.314	2 23 19 17 9 10 25 11 16 4 12 14 13 7 3
12	21	1.284	2 19 17 9 10 25 11 16 4 12 14 13 7 3
13	22	1.27	17 9 10 25 11 16 4 12 14 13 7 3
14	2	1.108	25 11 16 4 12 14 13 7 3
15	23	1.098	11 16 4 12 14 13 7 3
16	19	1.06	11 16 4 12 14 13 7 3
17	17	1.02	11 16 4 12 14 13 7 3
18	9	1.001	11 16 4 12 14 13 7 3
19	10	0.996	11 16 4 12 14 13 7 3
20	25	0.954	11 4 12 14 13 7 3
21	11	0.784	12 14 13 7 3
22	16	0.756	12 14 13 7 3
23	4	0.74	12 14 13 7 3
24	12	0.524	14 13 7 3
25	14	0.266	3
26	13	0.201	3
27	7	0.193	3
28	3	0	
Distrust			
1	11	0.992	28 9 1 27 16 24 20 25 23 5 17 18 22 8 21 12 2 19 6 4 13 3 15 7 14

Table A5 (ontinued). Factor Mean Comparisons of 28 Countries on USELESS, DISTRUST, AND POPULISM Factors.

Ranking	Country Code	Mean	Countries With Significantly Smaller Factor Mean
2	26	0.903	1 27 16 24 20 25 23 5 17 18 22 8 21 12 2 19 6 4 13 3 15 7 14
3	10	0.9	1 27 16 24 20 25 23 5 17 18 22 8 21 12 2 19 6 4 13 3 15 7 14
4	28	0.876	1 27 16 24 20 25 23 5 17 18 22 8 21 12 2 19 6 4 13 3 15 7 14
5	9	0.802	27 24 20 25 23 5 17 18 22 8 21 12 2 19 6 4 13 3 15 7 14
6	1	0.721	5 17 18 22 8 21 12 2 19 6 4 13 3 15 7 14
7	27	0.688	18 8 21 12 2 19 6 4 13 3 15 7 14
8	16	0.686	18 8 21 12 2 19 6 4 13 3 15 7 14
9	24	0.677	18 8 21 12 2 19 6 4 13 3 15 7 14
10	20	0.674	18 8 21 12 2 19 6 4 13 3 15 7 14
11	25	0.655	18 8 21 12 2 19 6 4 13 3 15 7 14
12	23	0.653	18 8 21 12 2 19 6 4 13 3 15 7 14
13	5	0.605	21 12 2 19 6 4 13 3 15 7 14
14	17	0.586	21 12 2 19 6 4 13 3 15 7 14
15	18	0.532	12 2 19 6 4 13 3 15 7 14
16	22	0.518	19 6 4 13 3 15 7 14
17	8	0.503	2 19 6 4 13 3 15 7 14
18	21	0.439	19 6 4 13 3 15 7 14
19	12	0.413	19 4 13 3 15 7 14
20	2	0.342	4 13 3 15 7 14
21	19	0.298	4 13 3 15 7 14

Table A5 (continued). Factor Mean Comparisons of 28 Countries on USELESS, DISTRUST, AND POPULISM Factors.

Ranking	Country Code	Mean	Countries With Significantly Smaller Factor Mean
22	6	0.278	13 3 15 7 14
23	4	0.168	13 3 15 7 14
24	13	0.051	7 14
25	3	0	7 14
26	15	-0.049	14
27	7	-0.127	
28	14	-0.173	
Populism			
1	27	1.12	26 28 1 11 16 9 24 20 21 18 25 5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
2	10	1.049	26 28 1 11 16 9 24 20 21 18 25 5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
3	26	0.87	16 9 24 20 21 18 25 5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
4	28	0.859	16 9 24 20 21 18 25 5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
5	1	0.803	9 20 21 18 25 5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
6	11	0.787	9 24 20 21 18 25 5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
7	16	0.678	20 21 18 25 5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
8	9	0.612	20 21 18 25 5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
9	24	0.585	18 25 5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
10	20	0.463	5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
11	21	0.461	5 23 12 22 3 2 17 19 4 13 8 15 6 14 7
12	18	0.417	23 12 22 3 2 17 19 4 13 8 15 6 14 7

Table A5 (continued). Factor Mean Comparisons of 28 Countries on USELESS, DISTRUST, AND POPULISM Factors.

Ranking	Country Code	Mean	Countries With Significantly Smaller Factor Mean
13	25	0.4	23 12 22 3 2 17 19 4 13 8 15 6 14 7
14	5	0.304	23 12 22 3 2 17 19 4 13 8 15 6 14 7
15	23	0.131	2 17 19 4 13 8 15 6 14 7
16	12	0.095	17 4 13 8 15 6 14 7
17	22	0.048	4 13 8 15 6 14 7
18	3	0	4 13 8 15 6 14 7
19	2	−0.047	4 13 8 15 6 14 7
20	17	−0.056	4 13 8 15 6 14 7
21	19	−0.068	4 13 8 15 6 14 7
22	4	−0.247	8 15 6 14 7
23	13	−0.293	8 15 6 14 7
24	8	−0.496	15 14 7
25	15	−0.675	
26	6	−0.703	
27	14	−0.716	
28	7	−0.839	

Note: This table presents an ordered listing ranging from high to low; the factor mean for each country is followed by the identification of countries having factor means that are statistically significantly different ($p < 0.05$). The numbers indicate the country code (see Table A2).

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Estudio 3. Political populism, institutional distrust and vaccination uptake: a mediation analysis.

Recio-Román, A.; Recio-Menéndez, M.; Román-González, M.V. Political Populism, Institutional Distrust and Vaccination Uptake: A Mediation Analysis. *Int. J. Environ. Res. Public Health* **2022**, 19, 3265. https://doi.org/10.3390/ijerph19063265

1. Abstract

Politics are ubiquitous in public health, but vaccines had never been weaponized to instill distrust to gain political advantage. In pandemic and post-pandemic scenarios, populist political parties could use vaccine-related issues to generate distrust in evidence-based knowledge.. Therefore, some questions arise. How much impact could populists political parties impinge on vaccination uptake rates through sowing political discontent? What could the medical institutions do to avoid the adverse effects that these political strategies could infringe? For answering these research questions, we first hypothesized that vaccine uptake was negatively associated with distrust in the institutions. Furthermore, we analyzed whether populism mediates this relationship. In doing so, we hypothesized a positive association between distrust and populism because populists, mainly fueled by politically discontent citizens, offer hope of a better future, blaming on the actions of the elite their misfortune. Additionally, we hypothesized that those citizens with a higher level of political dissatisfaction, following the claims of the populist political parties, will have lower vaccine uptake results because they will be discouraged from making the efforts to counter the pandemic. Based on a survey carried out by the European Commission that covered 27 E.U.+U.K. countries (totaling 27,524 respondents), this paper proves that an individual's political discontent fully mediates the relationship between distrust in institutions and vaccine uptake. Targeting vaccine-hesitants is quite convenient for populists because they only need to convince a minority of citizens not to be vaccinated to achieve their destabilizing goals. New outbreaks will appear if the minimum herd immunity coverage is not reached, reinforcing a vicious circle of distrust in elites in consequence. For tackling this matter, recommendations are given to institutional managers from a social marketing standpoint.

2. Keywords

vaccine hesitancy; populism; consumer behavior; social marketing

3. Introduction

Covid-19 has come carrying a new role for politics in the global vaccines scenario [1].Governments buy vaccines and decide who will be jabbed, and when. Traditionally, the pharmaceutical industry and the health system's institutions —at national, regional, or local levels— took these decisions. In addition, politics played, and still play nowadays, an essential role in several other vaccine-related dimensions: research & development, procurement, production, and marketing activities [2]. Hence, politics are ubiquitous in

public health [3], but vaccines have never been weaponized to instill distrust to gain a political advantage [4].

An upward trend supporting populist parties is present in developed and developing countries, implying a significant challenge for universal healthcare [5]. Several studies showed that votes for populist parties are mainly based on dissatisfaction with the political establishment [6]. Political populism defends ordinary people in contrast with the real or perceived elite. The elite usually refers to mainstream political parties, the media, the upper classes, intellectuals, and, in the territorial scope of this work, the European Union [7]. When applied to healthcare issues, medical populism [8] is based on a distrust of evidence-based policy interventions and the condemnation of technocratic knowledge [3,9,10]. Worsening population health may cause more significant social discontent and the growth of populist sentiments [11]. Hence, populist leaders will exploit health crises for political gain [7,11].

Resistance to vaccination could be seen in disenchanted citizens as a way to express their discontent [12]. The populist approach appeals to groups of citizens that have been left behind for various reasons, including the consequences of the globalization process [3,13]. Populist leaders take advantage of their discontent, blaming their misfortune on the elite's actions. Populist politicians offer politically dissatisfied people the hope of a better future attracting their votes [13,14]. Consequently, a worrisome circle occurs: populism fuels the spread of infectious diseases and infectious diseases fuel populism [13].Several real examples illustrate that medical populism is not occasional but a frequent response to pandemic emergencies [8]. A common medical populism framework for action was shared in cases like the H.I.V. denialism in South Africa [15], the measles-rubella vaccine scare in Ukraine [16], the Nigerian boycott of the polio vaccine [17], the Dengue vaccine scandal in the Philippines and other countries of the global south [18], the West African Ebola virus epidemic scare [19], the anti-vaccination movement in Italy [20], and the more recent responses to COVID-19 pandemic [13] in U.S.A., Brazil, the Philippines, Poland, Russia, India, and the United Kingdom . Populist governments implemented soft policy measures and discouraged citizens' efforts to counter the pandemic in all these cases. As a result, populist governed countries are hit worse by a pandemic than conventional ones [21],

The main goal of this paper is to measure how the relationship between distrust of institutions and vaccine uptake is mediated by political dissatisfaction. To the best of our knowledge, no one has ever studied it before.

4. Conceptual Background

4.1. Trust and vaccine uptake

Public trust in vaccination has declined in the last two decades [22]. Following Larson [22], trust is the "relationship that exists between individuals, as well as between individuals and a system, in which one party accepts a vulnerable position, assuming the best interests and competence of the other, in exchange for a reduction in decision complexity." Vaccine-related information and decision-making are technically complex enough to rely on people's confidence in the different health system components [23]. There are several levels of trust involved in the vaccine uptake process. The core of the vaccine's trust framework comprises three items [24]: the trust in the vaccine, the provider, and the political system. Quantitative studies that examined the relationship between trust in the health system and vaccine uptake found a positive association among them [25–28]. However, other studies showed that the variation in trust between vaccines and healthcare providers does not explain the variation in vaccination coverage [29,30]. Therefore, to study the variability of the influence of trust in vaccine uptake, we must mainly consider other social institutions that could influence the vaccination decision-making process. Among these social institutions, we thought it essential to analyze the information media, the political parties, the regional or local public authorities, the national government, the national Parliament, and, due to the territorial scope of this paper, the European Union [24,31]. These could explain how vaccine-hesitancy increases worldwide while having highly effective vaccines [32]. Building on Recio-Román et al. [32], we measured trust using a simplified scale that considers the social institutions mentioned earlier (from now on referred to as Distrust because it was reverse coded). Following the previous reasoning, we expected that the higher a person distrusts the institutions, the lower the vaccine uptake is.

H1: The higher the Distrust in the institutions, the lower the Vaccine Uptake is.

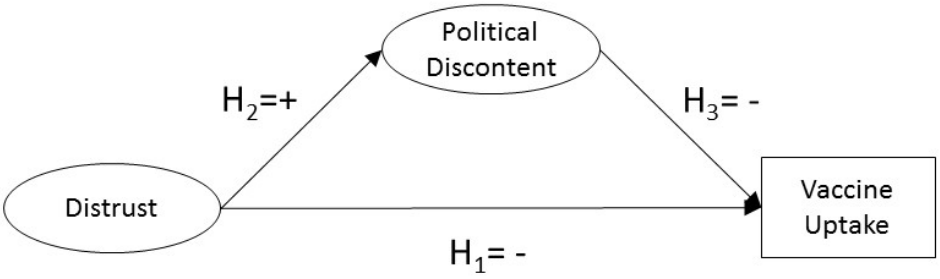

Figure 1. Conceptual model and hypotheses.

4.2. Political dissatisfaction, populism, vaccine hesitancy, and vaccine uptake

Vaccines have a differential characteristic from other medicines: to be effective it is necessary to immunize a high percentage of the population. Also known as herd immunity — the level at which immunization coverage must be maintained to be effective—, this percentage varies between 80% and 90% in most vaccines [23,33]. If this level is not reached and maintained, the risk of new outbreaks increases —also called the small pockets issue—. Vaccine reluctance and refusal are not the same things. Vaccine hesitancy —the reluctance or refusal to vaccinate despite the availability of vaccines— lies between those who accept all vaccines without any doubt and those who reject all vaccines without any doubt [34]. It is an increasing trend all around the world [35].

The existing body of literature on the rising support of populist movements across the globe emphasizes the highly significant role of political discontent [36–38]. Therefore, political dissatisfaction is critical in developing definitions of populism [8,39,40]. Populism is a consequence of democratic dysfunction caused by the feeling that democratic institutions are not working well [41,42]. Following Kitschelt [43], populism is an expression of dissatisfaction with existing modes of organized elite-mas political intermediation and the desire to abandon the intermediaries that stand between citizens and rulers. Furthermore, political discontent increases the likelihood of stable voting for populist parties [44]. Vaccine hesitancy matches flawlessly in populist agendas. Both share the profound distrust in elites and experts as their main drivers [45]. High levels of distrust and polarization are fertile areas for strengthening dissatisfaction against the elite [46].

H2: Distrust in institutions is positively associated with political discontent (populism).

Political ideology influences how policymakers address and solve healthcare issues [47]. Populist political parties know that vaccines are fertile ground for instilling doubt and gaining from polarized debates [48]. In pandemic and, mainly, post-pandemic scenarios, populists polarize pro and cons beliefs on vaccines linking them with any other factionalizing feelings — anti-chemical, anti-science, anti-migration, anti-abort, anti-government, etc.— [49]. Targeting vaccine-hesitants is very convenient for populists because they only need to convince a minority of citizens not to be vaccinated to achieve their

destabilizing goals. New outbreaks will appear if the minimum herd immunity coverage is not reached, reinforcing a vicious circle of distrust in elites [23,33].

H3: Political discontent (populism) is negatively associated with vaccine uptake.

Hence, in this paper, considering political discontent as a proxy for political populism, we study how Populism mediates between Distrust and Vaccine Uptake. We expect that the higher the Distrust, the lower the Vaccine Uptake —total effect—. As Figure 1 depicts, we hypothesized that those with a higher level of political dissatisfaction have lower vaccine uptake results—indirect effect—. The total effect not explained by the populism mediation comprised the direct effect.

Finally, several studies also consider sociodemographic variables as moderators of vaccine uptake [12,50–52]. However, it is remarkable that they reach inconclusive or contradictory findings [53]. These could be explained by considering them as potential confounders of factors that determine vaccine uptake. Even though they could be related to vaccine uptake, they cannot explain its variation. They could help to target purposes, but the design of the planned intervention must rely on the other drivers that the model offers.

5. Materials and Methods

5.1. Sample

The data stem from the EUROBAROMETER survey 91.2 carried out between the 15th and the 29th of March 2019 by the company Kantar Public, at the request of the European Commission [54]. The dataset was accessed through GESIS (Leibniz-Institute für Sozialwissenschaften, University of Cologne, Germany) at https://www.gesis.org/ (accessed on16 October 2021). The EUROBAROMETER is part of wave 91.2 and covers the population of the respective nationalities of the European Union member states, residents in each of the member states, and aged 15 years and over. In these countries, the survey covers the national population of citizens of the respective nationalities and the population of citizens of the entire European Union member states that are resident in those countries and have a sufficient command of one of the respective national language(s) to answer the questionnaire. The basic sample design applied in all states is a multi-stage random one, totaling 27,524 respondents (see Table A1 in the Appendix).

5.2. Measures

5.2.1. Model measurement constructs (Distrust).

The survey measured vaccine trust (Cronbach's Alpha = 0.77) using six items — "… how much trust you have in certain media and institutions…" Item 1. "The media", Item 2. "Political parties", Item 3. "Regional or local public authorities", Item 4. "The national government", Item 5. "The national parliament", Item 6. "The European Union"—. Respondents expressed their agreement with these statements on a two-item scale from 1. "Totally agree" to 2. "Totally disagree". As the scale was reversed, we named the resulting latent variable as DISTRUST.

5.2.2. Mediator variable (Populism).

The survey asked the interviewees three questions about political discontent (Cronbach's alpha = 0.63). The first one (Item 7), measured on a four-point scale from 1. "Totally agree" to 4. "Totally disagree", was: "The interests of people like you are well taken into account by the political system in (OUR COUNTRY)". The second one (Item 8), measured on a four-point scale from 1. "Totally agree" to 4. "Totally disagree", questioned "On the whole, are you very satisfied, fairly satisfied, not very satisfied, or not at all satisfied with the way democracy works in (OUR COUNTRY)?" The third one (Item 9), asked the participants "At the present time, would you say that, in general, things are going in the right direction or in the wrong direction, in (OUR COUNTRY?" We recoded this indicator in 1. "Things are going in the right direction", 2. "Neither the one nor the other (SPONTANEOUS), and 3, "Things are going in the wrong direction". As we commented in section 2.2, political discontent and political populism are close related concepts. Therefore, we use the first as a proxy of the latter.

5.2.3. Outcome variable (Vaccine uptake).

The main outcome was the vaccine uptake reported by participants. It took the value 1 "Yes" if respondents answered affirmatively to either of the two survey questions "Have you had any vaccinations in the last five years?" and "Why have you not had any vaccination in the last five years? 1. You are still covered by vaccines you received earlier". For the rest, it took value 0 "No".

5.2.4. Confounders

We included the following covariates to explore their effects on the vaccine uptake: age(15–24 years, 8.2%; 25–39 years, 19.8%; 40-54 years, 24.5%; 55 years and older, 47.5%), gender (man, 45.3%; woman, 54.7%), age when stopped full education (no full time education, 0.7%; up to 15 years, 14%; 16–19 years, 43.3%; 20 years and older, 34.7%; still studying, 6%; missing values 1.3%), marital status (unmarried, 16%; (re-)married/single with a partner, 64.8%; divorced

or separated, 8.2%; widowed, 10.4%; missing values, 0.6%), Occupation (self-employed, 6.9%; managers, 10.8%; other white collars, 12.5%; manual workers, 21%; house persons, 4.7%; unemployed, 5.2%; retired, 33%; students, 6%), residential setting (rural area or village, 33.7%; small or medium sized town, 37.5%; large town, 28.7%), problems paying bills (most of the time, 8.3%; from time to time, 23.4%; almost never/never, 66.8%), social class (the working class of society, 26.4%; the lower middle class of society, 15.3%; the middle class of society, 47%; the upper middle class of society, 7%; the higher class of society, 0.6%), views in political matters/left-right positioning (left, 24.5%; center, 34.5%; right, 21.7%; missing values, 19.3%), use of online social networks (every day or almost every day, 14.4%; two or three times a week, 4.3%; about once a week, 1.9 %; less often, 10.4%; never, 44.7%; missing values, 19.9%), childs living at home (none, 76%; one, 11.8%; two, 9.1%; three, 2.2%; four or more, 0.8%).

All these data were obtained from the baseline survey.

5.3. Statistical Analysis

Structural equation modeling (SEM) examined the hypothesized mediating effects using Mplus software version 8.7. All the variables considered in the measurement model were treated as categorical. In accordance, we used the weighted least-squares estimator with mean and variance adjustments (WLSMV). We applied the Probit link because the model's dependent variable —vaccinated— was binary. The goodness of fit was assessed by computing the comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean residual (SRMR) [55]. The acceptable levels of the goodness-of-fit model parameters were CFI > .90, TLI > .90, RMSEA < .08, and SRMR < .08 [56]. Furthermore, to test the statistical significance of the mediating effects, we conducted bias-corrected bootstrap tests with 95% confidence intervals. We run 20 different initial stage starts, and 10,000 bootstrap draws. The significance value was set at .05 in this study. The model also included all the potential confounders detailed previously.

6. Results

Figure 2 shows the final SEM model. This model was trimmed for the confounders that in the first attempt were not statistically significant in all the categories that each of them belonged to (gender, marital status, and residential setting). Fit statistics indicated that the SEM fitted the data well ($\chi^2 = 5369.989$, df = 312, CFI = 0.964, TLI = 0.959 SRMR = 0.054, RMSEA [90% CI] = 0.025 [0.024,0.025]), and all standardized path coefficients were significant except for

the direct effect of DISTRUST on VACCINE. The model explained 9.1% of the variance of the vaccine uptake.

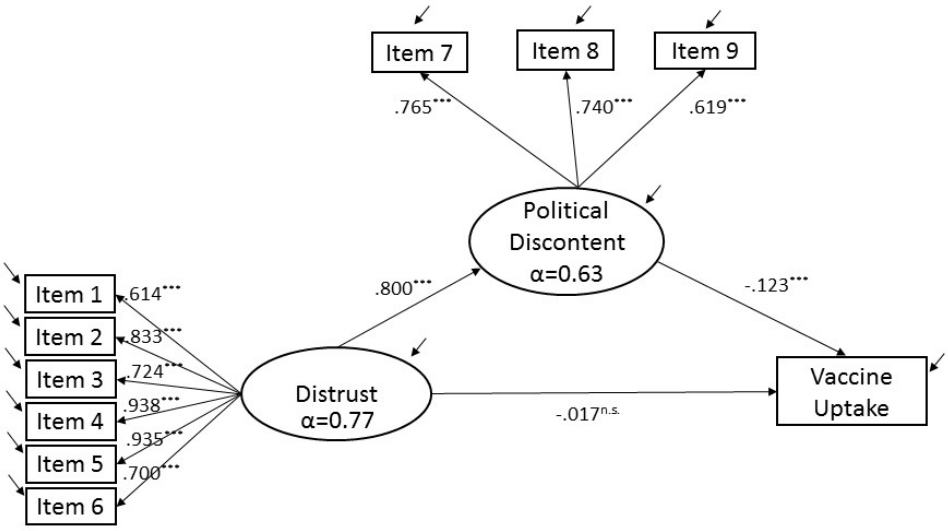

Figure 2. Structural Equation Model. Political populism mediation in the relationship between institutional distrust and vaccine uptake. Each latent variable has its associated Cronbach's alpha (α). All path loads from latent variables to items are in standardized terms. *** represents p-values significant at the 1% level of significance. $^{n.s.}$ means no statistically significant results.

Mediation analysis was conducted to examine the mediation role of POPULISM on the relationship between DISTRUST and VACCINE UPTAKE (see Table 1). The total effect of DISTRUST on VACCINE UPTAKE (see Table 2) was statistically significant (standardized path coefficient, β = -.115; p < .001; 95% CI, -.133 – -.098). The indirect effect between DISTRUST and VACCINE UPTAKE was also statistically significant (standardized path coefficient, Indirect effect = -.0.098; 95% CI, -.133 – -.063). Two effects that were also statistically significant composed this indirect effect: the effect of DISTRUST on POPULISM (standardized path coefficient, β = .800; p < .001; 95% CI, .790 – .811) and the effect of POPULISM on VACCINE UPTAKE (standardized path coefficient, β = -.123; p < .001; 95% CI, -.165 – -.079). Therefore, hypotheses 2 and 3 hold. Finally, the direct effect of DISTRUST on VACCINE uptake was not statistically significant (standardized path coefficient, Direct effect = -.017; p = .432; 95% CI, -.060 – .025). Hence, hypothesis 1 holds, and we conclude that Populism completely mediates the association between Distrust and Vaccine Uptake.

Table 1. Direct, Indirect, and Total Effects of Distrust on Vaccine Uptake

Paths	Unstandardized Path Coefficient, β Estimate (95% CI)	Standardized Path Coefficient, β Estimate (95% CI)	p
Direct Effect			
D→V	-.029 (-.102 .043)	-.017 (-.060 .025)	.432
Indirect Effect			
D→P→V	-.166 (-.225 -.107)	-.098 (-.133 -.063)	<.001
Total Effect			
D→V	-.195 (-.225 -.165)	-.115 (-.133 -.098)	<.001

Abbreviations: CI, Confidence Interval; D, Distrust; P, Populism; V, Vaccine Uptake.

Table 2 shows how the different sociodemographic variables considered in our study affected vaccine uptake. Because these variables were categorical, we needed to transform them into dummy variables to perform the probit analysis. To facilitate the interpretation of the coefficients, we converted the probit coefficients into logit ones following Muthén & Muthén (41, p.43). It was done by applying the formula $logit\hat{\beta} = probit\hat{\beta} * \sqrt{\pi^2/3}$ (42, p.234). Finally, we obtained the odds ratio by exponentiating the logit coefficients (e^{logit}).

Looking into the results depicted in Table 2, we see that odds ratios for vaccine uptake adjusted for age were lower for all the groups when compared to the youngest. Hence, participants between 25-39 years and 55 years and older had 13.8% [OR=0.862, p<0.001] lower odds than people between 15-24 years. Respondents between 40-54 had 16.4% lower odds than the reference group.

The second control variable, occupation, showed three categories that were not statistically significant: Other white collars [OR=1.011, p=0.637], Manual workers [OR=0.998, p=0.962], and House Persons [OR=0.977, p=0.180]. From the rest, there were three categories with higher odds (Managers [OR=1.071, p<0.05], Retired [OR=1.065, p<0.05], and Students [OR=0.083, p<0.05]) and only Unemployed had lower odds for being vaccinated [OR=0.940, p<0.001].

Education was measured by answering the question at what age participants stopped full-time education. It was statistically significant for all the alternatives, except those consinting of people still studying [OR=0.989, p=0.511]. The relationship between education and vaccine uptake was negative: higher education meant lower vaccination odds. Hence, when compared with respondents with no full-time education, participants that received education up to 15 years old had 4.1% higher odds to be jabbed [OR=1.041, p<0.05], those that stopped between 16 and 19 years old had 3.2% lower odds [OR=0.968, p<0.05], and participants with higher education background had 16.6% lower odds to be vaccinated [OR=0.844, p<0.001].

Having children living at home represented higher odds to be vaccinated for one or two children compared with families that had none (One [OR=1.041, p<0.05], Two [OR=1.033, p<0.05]). However, the results for families with three or more children were not statistically significant (Three [OR=1.020, p=0.172], Four or more [OR=0.993, p=0.631]).

The economic situation of the interviewee also affected vaccine uptake. Those who declared problems with paying bills most of the time had 11.7% lower odds [0.883, p<0.001]. Furthermore, people that said that they had problems from time to time had 17.5% lower odds to be jabbed [OR=0.825, p<0.001] than people that said that they almost never/never had problems.

Social class was associated with vaccine uptake. Except for the higher social class that did not present statistically significant results [OR=1.026, p=0.084], we observe that the probability of being vaccinated was also higher as social class increased. Compared with the working class, the lower-middle class had 6.3% higher odds [OR=1.063, p<0.01], the middle class had 7.7 % higher odds [OR=1.077, p<0.001], and the upper-middle-class had 18.1 % higher odds [OR=1.181, p<0.001] of being jabbed.

Political orientation was also related to vaccine uptake. The left-oriented participants were most likely to be vaccinated with 11.9% higher odds than the center-oriented ones [OR=1.119, p<0.001]. Results for right-oriented people were not statistically significant.

The use of online social networks did not shed any clear conclusion about its relationship with vaccine uptake. When compared to those who said they used online social networks every day or almost every day, three out of the five options available were not statistically significant (Two or three times a week[OR=0.029, p=0.066], About once a week [OR=1.002, p=0.912], and Two or three times a month [OR=0.991, p=0.572]). Participants who chose the Less often (than two or three times a week) option had 4.8% lower odds to be vaccinated than the reference group. The only clear insight we obtained was from

comparing participants who never used online social networks with people who use them every day. The former had 10.5% more odds of being vaccinated than the latter. Therefore, it depicted a clear difference between people who use or do not use online social networks. Still, there were no statistically significant differences among the different frequencies of use of online social networks, except for those who declared to use them less often than two or three times a week.

Table 2. Vaccine uptake confounders

Variable	Categories	Probit	p	Logit	e^{logit}
Age	15 - 24 years	Ref.	Ref.	Ref.	Ref.
	25 - 39 years	-0.082	0.000	-0.148	0.862
	40 - 54 years	-0.099	0.000	-0.179	0.836
	55 years and older	-0.082	0.000	-0.148	0.862
Occupation	Self-employed	Ref.	Ref.	Ref.	Ref.
	Managers	0.038	0.001	0.069	1.071
	Other white collars	0.006	0.637	0.011	1.011
	Manual workers	-0.001	0.962	-0.002	0.998
	House persons	-0.013	0.180	-0.024	0.977
	Unemployed	-0.034	0.000	-0.062	0.940
	Retired	0.035	0.036	0.063	1.065
	Students	0.044	0.001	0.080	1.083
Education	No full-time education	Ref.	Ref.	Ref.	Ref.
	Up to 15 years	0.039	0.000	0.071	1.073
	16-19	-0.018	0.045	-0.033	0.968
	20 years and older	-0.094	0.000	-0.170	0.844
	Still studying	-0.006	0.511	-0.011	0.989
Childs Living at home	None	Ref.	Ref.	Ref.	Ref.
	One	0.022	0.007	0.040	1.041
	Two	0.018	0.037	0.033	1.033
	Three	0.011	0.172	0.020	1.020
	Four or more	-0.004	0.631	-0.007	0.993
Problems Paying Bills	Most of the time	-0.069	0.000	-0.125	0.883
	From time to time	-0.106	0.000	-0.192	0.825
	Almost never/never	Ref.	Ref.	Ref.	Ref.

Table 2 (continued). Vaccine uptake confounders

Variable	Categories	Probit	p	Logit	e^{logit}
Social Class	The working class	Ref.	Ref.	Ref.	Ref.
	The lower middle class	0.034	0.000	0.062	1.063
	The middle class	0.041	0.000	0.074	1.077
	The upper middle class	0.092	0.000	0.167	1.181
	The higher class	0.014	0.084	0.025	1.026
Political Left-Right	Left	0.062	0.000	0.112	1.119
	Center Right	0.015	0.059	0.027	1.028
Use Online Social Net-work	Every day or almost every day	Ref.	Ref.	Ref.	Ref.
	Two or three times a week	0.016	0.066	0.029	1.029
	About once a week	0.001	0.912	0.002	1.002
	Two or three times a month	-0.005	0.572	-0.009	0.991
	Less often	-0.027	0.003	-0.049	0.952
	Never	0.055	0.000	0.100	1.105

Note: Dummy variables were created to perform the analysis. Ref. means the selected reference group. Logit coefficients were calculated from probit coefficients applying the formula $logit\hat{\beta} = probit\hat{\beta} * \sqrt{\pi^2/3}$.[58,59]

7. Discussion

This article explored the relationship between institutional distrust and vaccine uptake by recognizing the mediating role of political discontent (used as a proxy for measuring political populism). This research carried out SEM path analysis by using MPLUS 8.7. We found that institutional distrust was a significant predictor of vaccine uptake. Furthermore, the results also depicted that political populism fully mediated the relationship between institutional distrust and vaccine uptake. These outcomes corroborated the relationship observed by Kennedy [60]. Our research completes his work because we used

data at the individual level instead of macro data at the national level for measuring populism. Additionally, we measured one of the main drivers of vaccine hesitancy [22], distrust of institutions, and its influence on vaccine uptake. Moreover, we went one step further, demonstrating that the effect of distrust on vaccine uptake was fully mediated by populism.

The consequences of our findings are clear: populist political parties could use vaccines as a battlefield because, when generating distrust in institutions, citizens with a higher level of political discontent had 11.5% lower odds of being vaccinated. It seems to be more than enough for reaching the destabilizing goals that populists pursue. Moreover, if the minimum herd immunity coverage is not achieved, new outbreaks would appear, reinforcing a vicious circle of distrust in elites [23,33]. These results are in line with several investigations that have studied the relationship between trust and vaccine uptake [25,26,61–64] while broadening and deepening the understanding of this link through the mediation role of political populism.

When analyzing the confounders, the results help predict whom populist political parties could target with their political marketing campaigns . The best profile for populist's purposes was people older than 25 years old, unemployed, that stopped their full-time education at 20 years old and older (high educated), with problems for paying bills, that declared to belong to the working class, politically oriented to the center, and that use online social nets. From this profile, the economic variables (unemployed, problems paying bills, and belonging to the working class) arose as the more important ones for explaining not being vaccinated in odds terms [65]. In a few words, in Europe, the disenchanted from the global economy are the optimal target for populist political campaigns.

In Europe, traditionally, the populists have been categorized as "radical right" or "extreme right" [66]. On the other hand, some other populist leaders have been considered economically left-wing oriented mainly in Central and Eastern Europe [67]. Our results showed that center political oriented European citizens have more odds to be attracted by distrust populists' proclaims to reject the vaccines. Hence, independently of the political orientation of the populist political party that tries to use distrust for campaigning, the main target will be the disenchanted and the center politically oriented.

The use of online social nets reduces the odds of being vaccinated compared to those who never use them. This result is congruent with several investigations [68,69] and shreds of evidence from the populist realpolitik [7]. Nevertheless, the frequency of use of these online social nets did not report any

statistically significant difference. The communication media mix depends on the vaccine hesitancy segment that citizens belong to [70].

8. Conclusions

To reduce the adverse effects of these populist political strategies, it is necessary to reinforce citizenship's institutional trust. Public health has used, and should continue doing so in the future, health education, health promotion, and social marketing as effective tools for influencing behavior in the fight against several communicable and non-communicable diseases [71–74]. As evidence shows, compulsory measures to vaccinate hesitant people have never been the answer to the lack of confidence in vaccines [70,75–78]. Evidence indicates that social marketing has considerable value in voluntarily fostering vaccine acceptance [72,73,79]. These actions necessarily have to be accompanied by an improvement of the living standards of these citizens harmed by the globalization process [80,81]. It seems not to be a lack of trust in the health system, in particular, but rather in the political and economic institutions that the populists are taking advantage of for instilling doubt and trying to gain advantage from polarized debates about vaccines [48].

9. Limitations

This study should be evaluated with its limitations. The clearest one is using the Eurobarometer's predefined items. Nevertheless, the benefit of the large-scale surveys carried out by well-known public international organizations is the high quality of the data obtained through a standardized sampling procedure. The authors intended to fill the gap that existed in the vaccine literature for testing the mediating role of political populism in the relationship between institutional distrust and vaccine uptake. For this purpose, Eurobarometer's data fit perfectly.

Our results showed that the institutional distrust with the mediating role of political populism partially explained vaccination uptake. However, this implies that other variables also sway an individual's decisions since several circumstances finally influence vaccine uptake.

10. Appendix

Table A1. Sample size by country, Total population older than 15 years (15+).

COUNTRY	Number of Interviews	Population 15+
Austria	1006	7,554,711
Belgium	1041	9,693,779
Bulgaria	1026	6,537,535
Croatia	1010	3,796,476
Czech Republic	1068	9,238,431
Denmark	1017	4,838,729
Estonia	1005	1,160,064
Finland	1000	4,747,810
France	1013	54,097,255
Germany	1507	70,160,634
Greece	1014	9,937,810
Hungary	1030	8,781,161
Ireland	1078	3,592,162
Italy	1021	52,334,536
Latvia	1012	1,707,082
Lithuania	1004	2,513,384
Luxemburg	512	457,127
Malta	497	364,171
Netherlands	1017	13,979,215
Poland	1011	33,444,171
Portugal	1013	8,480,126
Republic of Cyprus	505	741,308
Romania	1025	16,852,701
Slovakia	1020	4,586,024
Slovenia	1016	1,760,032
Spain	1014	39,445,245
Sweden	1021	7,998,763
United Kingdom	1021	52,651,777
TOTAL	27,524	431,452,219

Source: Eurobarometer 91.2. European Commission [54]

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Capítulo 3. Conclusiones y futuras líneas de investigación.

3.1 Conclusiones

El crecimiento de la reticencia hacia la vacunación desde el inicio del siglo XXI, y particularmente en la última década, ha hecho que la Organización Mundial de la Salud haya reconocido este comportamiento como uno de los mayores retos a los que se enfrenta la salud pública en este momento a nivel mundial. Enfermedades infecciosas transmisibles, que se consideraban erradicadas gracias a la utilización de vacunas, han vuelto a rebrotar con fuerza. El porcentaje de vacunación que la población debe alcanzar para que una determinada enfermedad infecciosa transmisible pueda considerarse controlada debe ser, como mínimo, entre el 80% y el 95 % de la misma. Este nivel, conocido también con la denominación de *inmunidad de grupo o de rebaño*, implica que prácticamente toda la población debe estar vacunada dado que el mínimo porcentaje que resta hasta el 100% debe estar reservado para los neonatos y las personas que tienen su sistema inmunológico comprometido. Las personas que se muestran reticentes a vacunarse, a pesar de tener la disponibilidad de hacerlo, abarcan un amplio abanico de comportamientos desde los que se niegan en rotundo a ser vacunados bajo ninguna circunstancia hasta los que retrasan la vacunación. Ese pequeño grupo de personas pone en riesgo el logro de los objetivos establecidos por las autoridades sanitarias, tanto a nivel nacional (órganos de gobierno y organismos de gestión sanitaria pública de cada país) como internacional. Los enormes logros conseguidos desde que las vacunas se inventaron hace aproximadamente 200 años y los enormes esfuerzos desplegados ante el surgimiento de nuevos virus, como el caso de la COVID-19, pone de manifiesto la acuciante necesidad de conocer en profundidad como se puede hacer frente a la reticencia a la vacunación.

Dada la enorme importancia que tiene el minimizar al máximo posible el porcentaje de personas que deciden no vacunarse o que retrasan el momento en el que lo pueden hacer, muchos gobiernos se han visto motivados a obligar la vacunación por ley, bien bajo el establecimiento de sanciones o bien no accediendo las personas o familias no vacunadas a determinadas ayudas que si estaban disponibles para los vacunados. Como hemos visto, la evidencia demuestra que más allá de la eficacia que puede tener en el corto plazo, en el largo plazo todas estas medidas se han mostrado inútiles, no evitando el problema de salud que se quería atajar y ocasionando otros de carácter social.

Dentro del mix de instrumentos de intervención pública del que disponen las autoridades hay tres que buscan el cambio de comportamiento voluntario de los individuos hacia la vacunación: la educación, promoción de la salud y el

marketing social. El primero está más indicado cuando el comportamiento que se trata de conseguir es deseado por el público objetivo al que se dirige y se dispone de un amplio plazo de tiempo para ver los resultados de las actuaciones llevadas a cabo. Además, para aumentar sus efectos, debe ser utilizado de forma complementaria con los otros dos. Cada día cobra más importancia el papel de marketing social para afrontar el problema de la reticencia a la vacunación, sobre todo para incidir en los colectivos que tienen dudas. Sin embargo, su utilización, tal y como está llevándose a cabo, adolece de algunos problemas que abordamos en nuestros artículos.

El primero de ellos es el referido a la no utilización del paradigma principal que subyace cuando el comportamiento que se trata de gestionar es global. Sin duda, las pandemias no conocen de fronteras. En las recomendaciones que aparecen en los diversos documentos que se ponen a disposición de las autoridades nacionales por parte de diferentes organismos internacionales se sigue la estrategia de la adaptación de las actuaciones. Influenciados por el principio de que "el contexto importa", se llega a la conclusión de que las diferencias que existen entre los países son más relevantes que las similitudes que se dan en los comportamientos de los ciudadanos ante la vacunación. Esta creencia se ha podido ver influenciada también por el hecho de que la dispensación de las vacunas se ha realizado por sistemas de salud cuya gestión se realiza a nivel nacional. Sin embargo, los grupos que se encuentran en el extremo de la reticencia hacia la vacunación y que la promueven, conocidos también como grupos anti-vacunas, hacen una utilización de las redes sociales electrónicas y del marketing considerando que las similitudes de comportamiento hacia la vacunación como globales. Es decir, han llegado al mismo hallazgo que las empresas multinacionales descubrieron hace décadas: que existen más similitudes que diferencias en el comportamiento de los consumidores de los diferentes países a nivel mundial. Nuestro primer ensayo demuestra que así es cuando se analizan los comportamientos de los ciudadanos hacia las vacunas. Este tema no había sido abordado previamente por ninguna investigación. Analizando la situación de 28 países europeos —con marcadas diferencias desde el punto de vista histórico, económico, social o cultural—, encontramos la presencia de 7 segmentos globales. Para estos segmentos sería más eficaz y eficiente diseñar actuaciones de marketing social basadas en una estrategia estandarizada que en una adaptada. Por otra parte, la necesaria coordinación de estas actuaciones debería recaer en los organismos de carácter multinacional/multilateral —como son las Organización Mundial de la Salud, el Centro Europeo para la Prevención y el Control de Enfermedades y otros organismos similares de carácter regional—, recobrando

parte del poder de actuación, reconocimiento y protagonismo perdido en las últimas décadas.

El primer ensayo, también permite superar uno de los principales problemas con los que se enfrenta cualquier diseño de un programa de marketing social, como es la falta de una segmentación del comportamiento de los ciudadanos que permita fijar adecuadamente el público objetivo, determinar el posicionamiento y elegir la estrategia a llevar a cabo. Las actuaciones de marketing social que traten de combatir la resistencia a vacunarse, deben conocer al detalle los diferentes comportamientos que están detrás del continuo que va desde aquellos que se niegan de forma rotunda a vacunarse, a los que sólo retrasan el momento de la vacunación, o incluso se vacunan con reticencias hacia alguna o todas las vacunas que tienen a su disposición. Además, habrá que estudiarlo de forma dinámica, porque el objetivo principal de la actuación debe ser que los que muestran alguna resistencia a vacunarse, abandonen voluntariamente esa conducta y que los que están dispuestos a vacunarse, sigan en esa disposición. De los resultados del primer ensayo, vemos que el grupo de ciudadanos que está a favor de la vacunación es del 55,7%. El resto, es decir el 44,3%, muestra algún tipo de resistencia a la vacunación. Los seis segmentos encontrados a nivel europeo en este último colectivo, junto con la descripción de sus características, permite a los gestores abordar con mayor conocimiento las tareas de selección de públicos objetivo, posicionamiento y elección de la estrategia a llevar a cabo. Se supera, así, la falta de distinción de comportamientos que existía en las investigaciones precedentes respecto al colectivo que muestra resistencia a vacunarse.

En cuanto a la elección de la estrategia a llevar a cabo, los resultados obtenidos del primer ensayo tienen consecuencias para las organizaciones sanitarias internacionales, organismos supranacionales de carácter político, económico y social —como es el caso de la Comisión Europea— y las autoridades sanitarias nacionales. Para este colectivo, que será el que aplique en mayor medida los programas de marketing social, dado que el análisis muestra que no hay diferencias significativas entre los perfiles de los segmentos hallados entre los países europeos, lo más adecuado sería optar por una estrategia estandarizada de marketing en sus actuaciones. Poner en marcha esta estrategia no estará exenta de dificultades debido a que los programas de inmunización son llevados a cabo, en muchos casos, por autoridades sanitarias de carácter nacional e incluso regional. Nos enfrentamos así al dilema de consumidores globales y organizaciones locales. En Europa, la Comisión Europea y los Estados miembros necesitan desarrollar actuaciones coordinadas que permitan superar las barreras de infraestructuras y legales que dificultan una gestión más estandarizada de la vacunación.

Del primer ensayo, también se concluye una característica que es central y común a todos los segmentos que sienten reticencia hacia la vacunación: la desconfianza en las instituciones. Y es un aspecto de enorme relevancia porque si bien hasta épocas recientes la reticencia a vacunarse no había sido utilizada como un arma política, la situación ha cambiado. El elevado porcentaje de personas vacunadas que es necesario para alcanzar y mantener la inmunidad de rebaño, hace que un pequeño grupo de ciudadanos que no se quieran vacunar, tenga enormes efectos desestabilizadores sobre el sistema en general. Esta característica ha sido aprovechada por los movimientos populistas para tratar de ganar relevancia e influencia.

Los partidos populistas han visto como este sentimiento de desconfianza hacia las instituciones que tienen los ciudadanos que muestran reticencia a vacunarse, encaja perfectamente en sus agendas políticas. No necesitan compartir más ideales que el de combatir un enemigo común: las élites. Estas élites, según su discurso, están compuestas por los partidos políticos tradicionales, los medios de comunicación, las clases altas de la sociedad, los intelectuales y las organizaciones que estos controlan y a través de las que ejercen su poder. Cuando se aplica al ámbito de la vacunación, dentro de lo que se conoce con el término de populismo médico, los populistas consideran que pertenecen a este grupo también la industria farmacéutica, sus investigadores, los médicos y los organismos internacionales dedicados a los temas de salud. Dado que los populistas ganan influencia basándose en la desconfianza hacia la élite, han encontrado un terreno perfecto en los ciudadanos con reticencias hacia la vacunación. Consiguiendo convencer a un pequeño porcentaje de ciudadanos, normalmente menor al 5%, el programa de vacunación fracasa al no lograr la inmunidad de rebaño. Este fracaso hace aumentar la desconfianza en las instituciones generando un ciclo beneficioso para los intereses políticos de los partidos populistas y perjudicial para el interés general de los ciudadanos que ven que las enfermedades infecciosas, en episodios pandémicos o endémicos, siguen presentes. El segundo ensayo muestra datos claros de cómo se produce esta relación en Europa, uno de los territorios en donde más ha crecido tanto la resistencia a la vacunación, como el populismo a nivel mundial en los últimos años.

Además, este segundo ensayo parte de un modelo de medición que aborda otra cuestión que no se contemplaba en las investigaciones que hasta el momento han sido efectuadas en el ámbito de la resistencia a la vacunación: el análisis de la invarianza. Dada la necesaria comparación que se ha de producir entre una diversidad de constructos utilizados para medir los comportamientos de los ciudadanos en muy diversos países, no es soslayable el estudio preliminar de que las mediciones obtenidas a través de esos instrumentos sean comparables. Los resultados del segundo ensayo muestran

que las técnicas actuales permiten tener escalas de medición comparables en 28 países europeos para estudiar en qué medida se relacionan los sentimientos populistas y la resistencia a la vacunación en Europa. Los enormes esfuerzos que en la actualidad se están llevando a cabo para medir la reticencia a la vacunación a nivel mundial deberían abordar esta cuestión sin más dilación.

Del estudio de la relación de los dos componentes que forman la reticencia a la vacunación con el populismo en el segundo ensayo, claramente se concluye que es la desconfianza en las instituciones la que tiene un mayor peso. No es la desconfianza en las vacunas ni en las organizaciones sanitarias y los profesionales que forman parte de ellas lo que explica la variabilidad en las creencias, actitudes y comportamientos de los ciudadanos hacia la vacunación. En la mayoría de los países y de los segmentos analizados, es la desconfianza en las otras instituciones —partidos políticos, empresas farmacéuticas, otras empresas, organismos internacionales relacionados con la salud, medios de comunicación— la que da lugar a comportamientos diferenciales. Conocido el nexo común de influencia que tiene la desconfianza en las instituciones, tanto sobre la reticencia a vacunarse, como en las inclinaciones populistas por parte de los ciudadanos, las organizaciones populistas tienen sencillo llevar a cabo su tarea de desestabilización. Su principal estrategia se basa en polarizar el debate de los aspectos a favor y en contra de la vacunación, poniéndolo en relación con cualquier otro tema que pueda encender aún más el enfrentamiento, como son los sentimientos anti-químicos, anti-ciencia, anti-inmigración, anti-aborto, anti-gobierno, anti-globalización, etc. Además, en sus actuaciones, explotan de una manera eficaz y eficiente el conocimiento que se obtiene de combinar los resultados de nuestros dos primeros ensayos. Conocedores del comportamiento global de los ciudadanos ante las vacunas y de la relación existente entre la resistencia a vacunarse y la desconfianza en las instituciones, llevan a cabo actuaciones altamente estandarizadas a nivel mundial. Estas se han podido observar perfectamente en la gestión de la última pandemia de la COVID-19 por parte de aquellos países que tenían líderes populistas. Pero no es exclusivo de esta enfermedad, sino que ha sido llevada a cabo en otras enfermedades infecciosas a lo largo de las últimas décadas. Por el contrario, los sistemas nacionales de salud, las organizaciones internacionales de salud y los gobiernos, han llevado a cabo estrategias altamente adaptadas y ancladas en antiguas concepciones.

Para completar el análisis quedaba por investigar en qué medida los sentimientos populistas de los ciudadanos afectan a la vacunación. De la investigación llevada a cabo en el tercer ensayo, se concluye que se da una mediación completa del populismo en la relación que existe entre la desconfianza en las instituciones y la vacunación. Los ciudadanos que tienen

mayor descontento político y que, en consecuencia, tienen mayor proximidad con los postulados populistas, muestran un 11,5% menos probabilidad de vacunarse. Una cifra suficientemente alta para poner en riesgo la necesaria inmunidad de rebaño.

Las autoridades sanitarias, las organizaciones internacionales dedicadas a los temas de salud y los gobiernos, pueden utilizar los resultados obtenidos en las investigaciones presentadas, para tratar de ayudar a gestionar uno de los mayores problemas a los que se enfrenta el mundo en este momento: la reticencia a la vacunación. En modo esquemático, atendiendo a los resultados de nuestras investigaciones, sería necesario:

1. Reconocer que las enfermedades infecciosas transmisibles en el mundo globalizado en el que vivimos son un fenómeno global que no conoce de fronteras.
2. Considerar que los comportamientos de los ciudadanos hacia la vacunación responden a perfiles globales.
3. Para conseguir una mayor eficacia y eficiencia de las intervenciones, es conveniente llevar a cabo una estrategia más estandarizada de actuación y, sólo en el caso de que fuera estrictamente necesario, llevar a cabo adaptaciones.
4. Tener a disposición datos recogidos de forma regular, tanto sobre la vacunación, como de los comportamientos asociados con la reticencia a vacunarse.
5. Los datos recogidos deben ser comparables a nivel internacional. Los constructos asociados con la medición de los comportamientos de los ciudadanos hacia las vacunas deben ser invariantes.
6. Reconocido que el tema de la resistencia a vacunarse se ha politizado y que existe una utilización por parte de los movimientos populistas, se hace necesario abordar como cuestión prioritaria la mejora de la confianza en las instituciones.
7. Las medidas coercitivas de vacunación sólo deben ser utilizadas en caso extremo y de forma excepcional y transitoria. Lo deseable es que de forma voluntaria los ciudadanos decidan vacunarse.
8. El marketing social se presenta como la herramienta más adecuada para conseguir la vacunación. Aunque en el mix de intervención pública deben seguir presentes la educación y la promoción de la salud como instrumentos a utilizar, para conseguir el cambio voluntario de comportamiento, considerando los plazos en los que se deben conseguir los resultados y el carácter no deseado del cambio de comportamiento por parte de los que se resisten a vacunarse, el marketing social debe cobrar un mayor protagonismo.

9. Reconocer y aplicar la importancia de la segmentación de mercados como punto de partida de las intervenciones públicas. En este sentido, la reticencia a vacunarse no está compuesta por un solo segmento, sino que agrupa a diversos segmentos globales que deben tratarse de forma diferenciada.
10. La necesidad de que los organismos internacionales dedicados a la salud recobren el papel de liderazgo y coordinación de las acciones de marketing social que es necesario llevar a cabo en el ámbito de la vacunación y de la lucha contra la reticencia a vacunarse.

3.2 Futuras líneas de investigación

Cuando se revisa la producción científica recogida en Web Of Science (W.O.S.) sobre las reticencia a la vacunación (utilizando el término de búsqueda vaccin* hesitan*), se observa que hasta el año 2010 era testimonial, empezando a partir de ese año a ser del interés de los investigadores hasta que llega el año 2021 en el que se produce una explosión de las publicaciones, duplicando las que se habían producido en todos los años anteriores. Algunos trabajos recientes [1] muestran que la investigación sobre este fenómeno se encuentra todavía en sus inicios, siguiendo presentes la mayoría de las líneas que fueron propuestas en revisiones de la literatura realizadas con anterioridad [2–5]. En este apartado, nos centraremos en apuntar líneas de investigación que pueden surgir de los resultados de esta investigación.

En primer lugar, cualquier escala de medición que se utilice para medir un fenómeno que es global y en el que se van a establecer comparaciones entre países deben demostrar, previamente a realizar ningún análisis posterior, que son invariantes. Sobre todo, cuando se utilizan constructos de comportamiento de los ciudadanos. Disponemos de bases de datos que son posteriores a la que se ha utilizado en nuestras investigaciones en las que se volverá a estudiar la invarianza del instrumento de medida propuesto.

En segundo lugar, nuestra investigación muestra la existencia de segmentos globales en la reticencia a la vacunación. Es importante profundizar en este hallazgo y ver en qué medida su existencia y características se confirman en otras áreas geográficas. Asimismo, es necesario estudiar la evolución que tendrá en el tiempo, la composición y las características de estos segmentos, completando los análisis transversales con longitudinales.

En tercer lugar, aunque la variable de comunicación ha sido la más estudiada por la academia, también resulta relevante tratar de ver como se

asocian los perfiles de los segmentos encontrados, con los diferentes medios disponibles. Esto permitirá hacer recomendaciones de cómo alcanzar de manera más eficaz y eficiente a cada uno de los públicos objetivo que se elijan para actuar sobre su comportamiento.

En cuarto lugar, siendo central la cuestión de la confianza en las instituciones en la gestión de la reticencia a la vacunación, es adecuado estudiar en mayor profundidad su medición, no sólo en aspectos relacionados con el sistema de salud y los profesionales que en el trabajan, sino en el resto de instituciones en las que el ciudadano debe tener confianza y que, según los datos de nuestro análisis, contienen la mayor variabilidad.

Por último, resulta crucial profundizar en mayor medida en cómo el populismo afecta a la reticencia a la vacunación. En nuestra investigación se ha utilizado el descontento político como una variable proxy del populismo. Sería conveniente utilizar algunas de las escalas existentes en la literatura, o bien desarrollar una nueva, para ver en qué medida los resultados alcanzados se confirman.

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