EMPIRICAL STUDY OF THE COVID-19 SOCIAL EFFECTS ON GENDER AND GENERATIONS: SCIENTIFIC INSIGHTS FOR FUTURE PUBLIC POLICIES

ESTUDIO EMPÍRICO DE LOS EFECTOS SOCIALES DEL COVID-19 EN GÉNERO Y GENERACIONES: PERCEPCIONES CIENTÍFICAS PARA FUTURAS POLÍTICAS PÚBLICAS

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Abstract

Society management and the COVID-19 pandemic require continuous restatement and consolidation. Furthermore, the 2030 Agenda for Sustainable Development created by the United Nations establishes a set of 17 Sustainable Development Goals (SDGs) that meet the needs of the present without compromising the ability to meet the needs of future generations and where Goal 5 addresses gender equality as a central priority. The main aim of this paper is to present a crossed-analysis study on how the health crisis has influenced differently the social behaviour between gender and generations in Spain. For this study there have been used a massive open data from the Sociological Research Centre (CIS). The mixed techniques' methodology of this research was applied to study four social effect dimensions, such as "way of living", "way of thinking", "way of self-healthcare" and "social habits and behaviour". The used techniques contributed analytically to gender and generations management during the pandemic with the intent of complementarity. Obtained fin dings by

Resumen

La gestión de la sociedad durante la pandemia del COVID-19 ha servido de base para su próxima y futura consolidación. La Agenda 2030 para el Desarrollo Sostenible de la ONU establece 17 Objetivos de Desarrollo Sostenible (ODS) que buscan satisfacer las necesidades presentes sin comprometer las de las generaciones futuras, destacando la igualdad de género en el Objetivo 5. Este artículo presenta un estudio de análisis cruzado sobre cómo la crisis sanitaria ha afectado de manera diferente el comportamiento social entre géneros y generaciones en España. Se han utilizado datos abiertos del Centro de Investigaciones Sociológicas (CIS) y se ha aplicado una metodología de técnicas mixtas para estudiar cuatro dimensiones del impacto social: «modo de vivir», «modo de pensar», «modo de autocuidado de la salud» y «hábitos y comportamientos sociales». Estas técnicas analíticas se han sustentado en la gestión de género y generaciones durante la pandemia, complementándose entre sí. Los hallazgos obtenidos explican las diferencias en los efectos de la pandemia entre hombres y mujeres, y entre generaciones

analysing four studied dimensions explain the effects and consequences of the pandemic involving differences between men and women, younger and older generations, leading to society management implications that can timely serve as a paradigm with scientific insights for public policies.

Keywords: Gender; Generations; COVID-19; Public Policies; K-Means Cluster Analysis; Multiple Correspondence Analysis.

jóvenes y mayores, lo que tiene implicaciones para la gestión de la sociedad y puede servir como fundamento científico para las próximas políticas públicas.

Palabras clave: Género; Generaciones; COVID-19; Políticas Públicas; Análisis Clúster K-de Medias; Análisis de Correspondencias Múltiples.

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1. INTRODUCTION

After many "hard" and "soft" phasis of the health pandemic caused by COVID-19, in May 4, 2023, the Word Health Organization´s Director-General transmitted the Report of the fifteenth meeting of the International Health Regulations (IHR) Emergency Committee regarding the coronavirus 2019 disease pandemic that is not considered as pandemic anymore (WHO, 2023). Problem statement studied in this research paper positions that although officially the health pandemic is over, there can be found diverse social effects in short and long term, such as post-traumatic stress, anxiety, diminishing sense of well-being or some changes in social behaviour (Gubler *et al.*, 2021; Bower *et al.*, 2023; De Esteban & Antonovica, 2022) that impacts people around the world their daily performance. Thus, it should be mentioned that these social effects influence gender (Zhou *et al.*, 2020) and also diverse age cohorts in a different way (Kotta *et al.*, 2021). In the case of Spain, the central argument and context framing the question of this research refers to examining what are the specific social effects that have been affecting Spanish population during the health pandemic and what is the difference from the gender and generation perspective, as it is important to create present and future social well-being policies (Zhou *et al.*, 2018) in order eliminate gaps between genders and not leave behind any age group even if there are not economically active yet or any more.

Many academic studies show the great impact on health, social behaviour and well-being not only those who have got infected by the SARS-CoV-2 virus or medical personal who have worked under pressure caused by the COVID-19 pandemic at the hospitals and other mental or physical health improvement centres (Oertelt-Prigione, 2020), but also on general populace (Nagasu *et al.*, 2021; Zheng *et al.*, 2020). Also, there are numerous academic studies on Spanish population´s well-being, specifically on mental health and well-being among academic and administrative staff in Spain done by González *et al.*, 2023; study on gender-based violence and mental health researched by Rodriguez-Jimenez *et al.*, 2023; about gender differences in mental distress and affect balance during the first wave researched by Matud *et al.*, 2022, or on mental health on general population cohort in Catalonia done by Goldberg *et al.*, 2023. In this context, this study complements to an existing academic literature by adding insights on gender and generations´ well-being in Spain during the health pandemic from the social effect viewpoint, based on a massive open data analysis obtained from the Sociological Research Centre (CIS). This paper contributes theoretical, empirical and methodological aspects with an interdisciplinary approach to studies on population´s well-being from the gender & generations´ (G&G) perspective in order to help understanding and create better future public policies. Hence, the use of mixed statistical techniques, K-Means Cluster and Multiple Correspondence Analysis, justifies and strengthens the obtained results in relation to the G&G model (presented in Figure 1) and the findings of these methods are presented in an easy-to-interpret manner.

In this setting, the authors for this study propose the following objectives:

O1. To discover if there is a significative difference on the social study effects between gender affected by the COVID-19 pandemic among the Spanish population to promote public policies on gender.

O2. To study if there is a significative difference on the social study effects between generations affected by the COVID-19 pandemic among the Spanish population to orientate public governance.

The structure of this original research paper is presented in this manner: firstly, the introduction part with the general context and "state of the art" of the study; secondly, basic study concepts are integrated in the theoretical background; thirdly, the data characteristics, its use and mixed techniques for its analysis are presented in the methodological part; fourthly, research findings and confirmation of hypothesis are in part of results; fifthly, discussion of results with other studies and theories; and finally, the conclusion part with theoretical and practical implications, limitations and future research agenda.

2. THEORETICAL BACKGROUND

2.1. Gender COVID-19 effects on social behaviour and well-being

The COVID-19 pandemic has affected differently G&G (gender and generations) (Olaseni *et al.*, 2020; Choi *et al.*, 2021). There is scientific evidence from the previous epidemics during the last two decades caused by SARS, Ebola, Zika, MERS and H1N, that females were on a higher risk to develop mental disorders or had more post-traumatic stress related symptoms in a longer time period (Brooks *et al.*, 2020; Simba& Ngcobo, 2020; Zhang & Zheng, 2020). Thus, the functional equivalence perspective suggests that although affective disorders and behavioural disorders are unique classes of mental health and well-being conditions, they are more or less interchangeable expressions of psychological misery and pain. The idea is that gendered cultural scripts dictate that woman express misery with affective disorders like depression and anxiety, while men express misery with behavioural disorders like substance abuse and antisocial behaviour (Hill & Needham, 2013). On the other hand, studies about the differences between women and men on well-being have not yielded consistent outcomes. Results have demonstrated few gender differences in psychological well-being, although women reported having experienced positive and negative emotions with greater frequency and intensity than men (Matud *et al.*, 2019).

Hence, there are diverse studies around the globe that indicate tendency that females show higher rates of anxiety, post-traumatic stress-related symptoms or feeling of helplessness caused by the COVID-19 pandemic (Malik & Naeem, 2020; Simba & Ngcobo, 2020), and that could affect their life attitudes and social behaviour in the longer run (Zhou *et al.*, 2020). Also, study results done by Bucciarelli *et al.* (2022) indicate that COVID-19 pandemic affected male and female populations in different ways. Women seem to experience less severe short-term complications but suffer worse long-term COVID complications, including depression, reduced physical activity, and deteriorating lifestyle habits. Similarly study in the UK on the COVID-19 mental well-being impact confirm that women were more exposed to domestic and time use factors that were associated with worse declines in well-being. For parents, these factors explain a noticeable fraction of the gender gap. Specifically, there are important gender differences in social factors, with women reporting substantially more increases in loneliness (Etheridge & Spantig, 2022).

At governmental level, gender mainstreaming represents an approach that should ensure public policies development integrating gender-related issues (Hervías & Radulović, 2023). To learn on how the health crisis has influenced differently the social behaviour between gender allows public authorities to refine the implementation of public policies to combat gender inequality in the framework of Goal 5 from the 2030 Agenda for Sustainable Development created by the United Nations establishing a set of 17 Sustainable Development Goals (SDGs).

2.2. Generation COVID-19 effects on social behaviour and well-being

Also, the way how we face different kind of life difficulties, vary from one age group to other (Bernabe-Valero *et al.*, 2021; Kotta *et al.*, 2021), taking into account that with the age we accumulate our life experiences and know what to do if there repeating the same or similar exterior and interior challenges (Ebert *et al.*, 2020; Bidzan-Bluma *et al.*, 2020). In relation to the COVID-19 pandemic and its effects, there have been numerous worldwide studies which reflect that present younger generations (Bono *et al.*, 2020; Cowie & Myers, 2021) have demonstrated higher level of pandemic impact to their mental health and well-being due to the fact that they have traumatised more or it was harder to adapt to the strict lockdown measures by cutting down their face-to-face social relations at schools and universities

(Imran *et al.*, 2020; Lucchetti *et al.*, 2020), and other daily routine activities (Buzzi *et al.*, 2020; Rogowska *et al.*, 2020). Likewise, economic instability caused by the COVID-19 pandemic, have affected younger generations future visions and expectations (Reading *et al.*, 2021). But still, it is hard to evaluate, what are the long-term effects and consequences and how they affect different age groups. Thus, diverse researches show that the behavioural responses differ from one generation to other, and especially maladaptive health habits (like more drug use, alcohol consumption etc.) are higher among young people (El-Galabawy & Sommer, 2021; Li *et al.*, 2021).

On the other hand, studies about older people well-being in Poland and Germany indicate that the elderly people were more optimistic during the COVID-19 pandemic, which could be explained by the lower number of potential stressors—for instance those associated with potential job loss, which was common among young individuals, and this could have translated into lower anxiety, which is associated with higher optimism (Bidzan-Bluma *et al.*, 2020). Also, Lopez *et al.* (2020), express that older people did not evidence poorer psychological well-being than young persons. Age has only a negative impact on personal growth. The nature of the COVID-19 impacts (except for the loss of a loved one) may not be as relevant for the older adults' well-being as their appraisals and personal resources for managing COVID-related problems.

From a perspective of governance, the spirit of 2030 Agenda for Sustainable Development created by the United Nations establishing a set of 17 Sustainable Development Goals (SDGs) needs scientific research to improve life for future generations, in a sustainable way and making positive science-driven public policies (Mondini, 2019).

2.3. COVID-19 effect surveys on social behaviour and well-being by the Spanish "Sociological Research Centre"

This research paper is particularly interested in the Spanish population and what social effects the

COVID-19 crisis has done to it. Hence, leading research centre in social sciences in Spain "Sociological Research Centre" (in Spanish "Centro de Investigación Sociológicas (CIS)) had employed numerous opinion surveys related to the pandemic and social behaviour changes. Thus, in June 2020 and February 2021 there have been employed surveys titled "Study of emotional wellbeing" (Estudios CIS, 2021) and "Survey on the mental health of Spanish people during the COVID-19 pandemic" (Estudios CIS, 2021), where the main objective was to discover emotional wellbeing and mental health, taking in account different psychological aspects, during the "hard" lockdown and "soft pandemic" in all country. Similarly, this research centre has applied various studies titled "Effects and consequences of coronavirus" where are included different sociopsychological and behavioural effects that have influenced Spaniards. For accomplishing research objectives (presented in Introduction) there have been used a study titled "CIS Study Nº 3324 Effects and Consequences of the Coronavirus IV" from May 2021 (Estudios CIS, 2021), with the research interest to deepen insight effects of COVID-19 pandemic on the Spanish population in general. Particularly, there have been used Question 5 with its four study social effect variables "way of living", "way of thinking", "way of self-healthcare" and "social habits and behaviour", that could be introduced in an overall understanding of concept well-being for studying it from the gender and generation perspective.

On basis of the previous literature, taking as a basis four variables ("way of living", "way of thinking", "way of self-healthcare" and "social habits and behaviour") and following research objectives, authors have proposed numerous hypotheses presented in a summarized way in Table 1. Thus, in Figure 1 authors present a study model, where four social effect variables through gender and generation spectre are studied by statistical K-Means Cluster and Correspondence Analysis in order to create G&G (gender & generations) model.

Table 1. Hypothesis and social study effect variables.

Hypothesis	Social study effect variables
H1. There is a significative difference between gender in a way of living affected by COVID-19.	
H2. There is significative difference between gender in a way of thinking affected by COVID-19.	
H3. There is significative difference between gender in a way of self-healthcare affected by COVID-19.	
H4. There is a significative difference between gender in social habits and behaviour affected by COVID-19.	
H5. There is a significative difference between generations in a way of living affected by COVID-19.	V1. Way of living
H6. There is significative difference between generations in a way of thinking affected by COVID-19.	V2. Way of thinking
H7. There is a significative difference between generations in a way of self-healthcare affected by COVID-19.	V3. Way of self-healthcare
H8. There is a significative difference between generations in social habits and behaviour affected by COVID-19.	V4. Social habits and behaviour
H9. There is a significative difference between gender and generations in a way of living affected by COVID-19.	
H10. There is significative difference between gender and generations in a way of thinking affected by COVID-19.	
H11. There is a significative difference between gender and generations in a way of self-healthcare affected by COVID-19.	
H12. There is a significative difference between gender and generations in social habits and behaviour affected by COVID-19.	

Source: own elaboration.

Figure 1. Study conceptual model for studying COVID-19 social effects and behaviour.

Source: own elaboration.

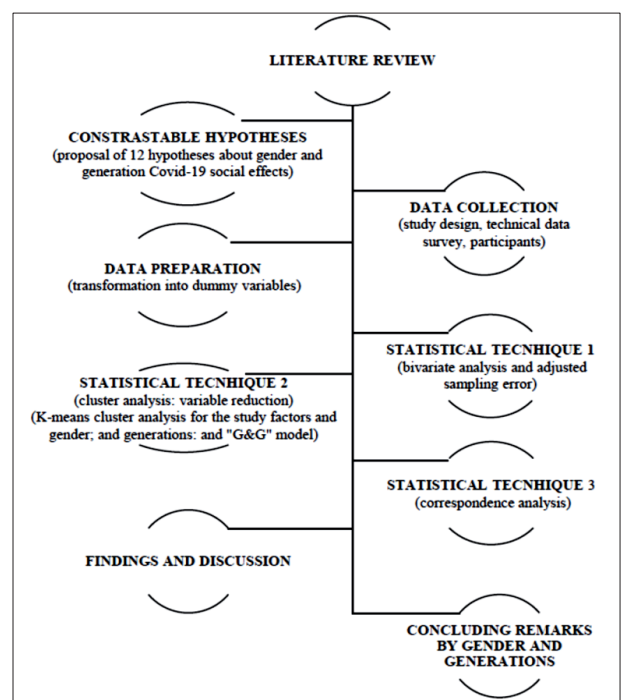**Figure 2. Methodological pathway of this research.**
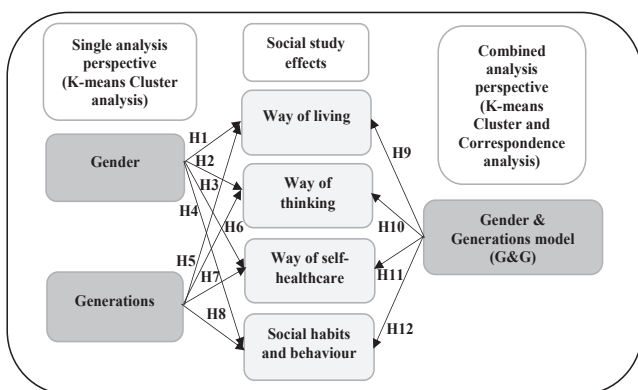
Source: own elaboration.

3. MATERIALS AND METHODS

After the literature review and contrastable hypotheses that have been explained previously, the methodology of this research has followed the pathway described in Figure 2.

3.1. Data Collection

3.1.1. Study Design

For this research paper in order to accomplish research objectives, there have been used survey data obtained from the Sociological Research Centre study titled "CIS Study Nº 3324 Effects and Consequences of the Coronavirus IV" published on its website in Spanish in May 2021 (www.cis.es). This study survey consists of five thematic blocks: media communication, health, quality of life, interpersonal relations and personal situation, in total 76 questions including sociodemographic data of surveyed population (Estudios CIS, 2021).

3.1.2. Technical data survey

The CIS study 3324 includes 3008 realized interviews with the Spanish population from both sexes older than 18. It has been applied a simple random sampling technique via mobile and landline phones. The selection of the interviewees was based on sex and age quotas. As the sampling points, there have been included 1,066 municipalities and 50 provinces. The questionnaires were applied by a computer-assisted telephone interview (CATI) system. The calculated sampling error was +/- 1,8 for the 95% of the confidence level. The study was applied between May 14 and 21, 2021 (Estudios CIS, 2021).

3.1.3. Participants

In total there have been participated 3008 people, 48.4% males and 51.6% females. The age groups were distributed in the following manner: from 18 to 24 years old 6.6%; from 25 to 34 years old 12%; from 35 to 44 years old 18%; from 45 to 54 years old 20.7%; from 55 to 64 years old 18.1% and 65 years and older 24,6% (Estudios CIS, 2021). Therefore, for accomplishing proposed objectives of this study in relation to the generation differences, there have been renamed and recreated age group variables into generation division variables proposed by Solomon *et al*. (2014: 451-458); Concejo (2018) and Dimock (2019) in the following manner: Generation Z (18-25 years old), Millennials (26-45 years old), Generation X (46-65 years old) and Grey Generation (66 and more).

3.2. Data Preparation

During the data preparation there have been reformulated variables on basis of a bivariate analysis of significant differences to understand better the relationships of variables taken two by two. In this manner, four social study effects presented in Table 1 have been transformed from the CIS 3324 study, such as "way of living", "way of thinking", "way of self-healthcare" and "social habits and behaviour". These variables were recoded in dummy variables.

3.3. Data Analysis

3.3.1. Statistical technique 1: Bivariate Analysis

With the previously transformed dummy variables there has been performed a Bivariate Analysis from operational analysis of ANOVA and means with adjusted sampling error using SPSS Version 27. Watkins *et al*. (2004) consider that an interpretation of bivariate data identifies whether the trend is strong or weak, variable or constant, and whether there are plausible explanations for that trend.

3.3.2. Statistical technique 2: K-Means Cluster Analysis

Cluster Analysis has been carried out for determining, which social study effects means differ among clusters. Firstly, a variable reduction analysis has been proposed before implementing K-means Clusters by the characteristics of gender, of generations, and gender/generations at the same time ("G&G model") in order to find out the most discriminative ones. The cluster ANOVA test has been applied for contrasting the given hypotheses in terms of validity (F test) and reliability (p-values). The distance was measured as squared Euclidean distance, and the number of clusters was determined using the elbow criterion. Cluster Analysis has been often used in gender researches as in Heinz *et al*. (2020) where a complete linkage was used to compact clusters assumed a priori.

3.3.3. Statistical technique 3: Multiple Correspondence Analysis

A Correspondence Analysis has been implemented to identify how of the four social study effects has been influenced by COVID-19 according to G&G model. Several scientific papers have undertaken Multiple Correspondence Analysis to detect generation relationship, such as Hysa *et al*. (2020) who have examined whether the generation variable interacts with some predictors (in our case, social study effects).

4. RESULTS

4.1. Data preparation: dummy variables

The CIS questionnaire of the survey contains information on how COVID-19 has affected each subject in terms of the four social study effects ("way of living", "way of thinking", "way of self-healthcare" and "social habits and behaviour") in Question 5, where each variable is measured with an eight-point rating scale: very much, much, moderately, somehow, little, very little, don´t know, don´t reply.

To simplify the analysis of this research, these variables have been transformed into dummy ones as follows:

> *- Yes, it has affected: very much, much.*
> *- No, it has not affected: moderately, somehow, little, very little, don´t know, don´t reply.*

The recalculation of the social study effects has been made so that the means are directly obtained for a better evaluation of the COVID-19 impact (Table 2). 69% of the surveyed subjects have been affected in their "way of living"; 49% in their "way of thinking" and so on.

Table 2. Means of the social study effects once transformed into dummy variables.

Social study effects	Total number	Minimum	Maximum	Mean	Standard deviation
Way of living	3008	0	1	69.1%	0.46
Way of thinking	3008	0	1	49.4%	0.50
Way of self-healthcare	3008	0	1	52.2%	0.50
Social habits and behaviour	3008	0	1	74.1%	0.44
Total valid numbers	3008				

Source: own elaboration.

4.2. Bivariate analysis for the social study effects of gender and generations

Tables 3a and 3b present four social study effects ("way of living", "way of thinking", "way of self-healthcare" and "social habits and behaviour") transformed into dummy variables and their means with their adjusted sampling error and crossed by gender and generations. Thus, the respective means have been calculated in order to compare the difference with the overall mean and its adjusted sampling error. For example, in the case of women and their "way of thinking", there is an average of 56%, an overall average for both men and women of 49%, as well as an adjusted sampling error of 4.3%. If we subtract (56% - 49%), it comes out 7% which is higher than 4.3%, being able to conclude that in the case of women the significant difference of the variable "way of thinking" is higher than the total men and women. In order words, the impact of the COVID-19 in the "way of thinking" is greater for women than men.

Visually, the cases with the highest incidence have been highlighted in blue-coloured. On the contrary, when the incidence is lower for a gender group than the overall mean, it has been highlighted in orange one.

In this first approach findings demonstrate on how women have been more affected by the pandemic than men. Furthermore, COVID-19 has posed more life impacts on young adulthood than prior generations.

Table 3a. G&G bivariate analysis and social study effects.

	Total number of cases	Way of living	Way of thinking	Way of self-healthcare	Social habits and behaviour
		Mean	Mean	Mean	Mean
TOTAL	3008	69%	49%	52%	74%
Male	1456	65%	42%	47%	70%
Female	1552	73%	56%	57%	78%
Generation Z	233	77%	55%	61%	77%
Millennials	933	75%	53%	55%	80%
Generation X	1174	68%	48%	53%	76%
Grey Generation	668	60%	44%	44%	61%

Low incidence   High incidence

Source: own elaboration.

Table 3b. Adjusted sampling error of Table 2a (G&G Bivariate Analysis and social study effects).

	Way of living	Way of thinking	Way of self-healthcare	Social habits and behaviour
	Adjusted sampling error	Adjusted sampling error	Adjusted sampling error	Adjusted sampling error
TOTAL	1.68%	1.82%	1.82%	1.60%
Male	4.18%	4.41%	4.44%	4.01%
Female	3.94%	4.34%	4.34%	3.69%
Generation Z	7.21%	8.34%	8.20%	7.09%
Millennials	4.53%	5.09%	5.08%	4.21%
Generation X	4.40%	4.74%	4.73%	4.07%
Grey Generation	5.48%	5.67%	5.66%	5.37%

Source: own elaboration.

4.3. Variable reduction analysis of social study effects: How many data clusters?

First off, it has been carried out some type of variable reduction analysis before tackling the problem of cluster one. The key point of this reduction is to find the ideal balance point between two extreme poles:

- Single-group solution that includes all subjects.
- Solution of as many groups as subjects.

Four groups have been proposed in such a way that, on the one hand, the objects belonging to the same group are very similar to each other and, on the other hand, the objects belonging to different groups have a different behaviour compared with the social study effects.

Tables 4a and 4b show the adequacy of reducing the social study effects in four clusters with a significant initial ANOVA (p-values less than .000) in all of them. The F-test is higher in the "way of thinking" (F=4483.569) of respondents indicating more variability of this data set reduction.

Table 4a. Centres of final clusters for initial variable reduction.

Centres of final clusters				
Social study effects	Cluster			
	1	2	3	4
Way of living	1.00	1.00	.00	.00
Way of thinking	1.00	.00	.23	.14
Way of self-healthcare	.77	.41	.36	.16
Social habits and behaviour	.90	.80	1.00	.00

Source: own elaboration.

Table 4b. ANOVA for initial variable reduction.

ANOVA						
Social study effects	Cluster		Error		F	Sig.
	Quadratic mean	gl	Quadratic mean	gl		
Way of living	214.028	3	.000	3004	.	.
Way of thinking	204.872	3	.046	3004	4.483.569	.000
Way of self-healthcare	56.106	3	.194	3004	289.475	.000
Social habits and behaviour	112.223	3	.080	3004	1.404.035	.000

Source: own elaboration.

Furthermore, the social study effects have been relabelled (see Table 5a) for the four data clusters as "affected in all four dimensions" (1315 cases out 3008), "way of life and social behaviour" (764 out 3008), "only in social behaviour" (435 out 3008), "little affected" (494 out 3008).

Table 5a. Four data clusters and their labels.

Number of cases in each cluster				
Cluster	1	1315	44%	Affected in all 4 dimensions
	2	764	25%	Way of living and social behaviour
	3	435	14%	Only in social behaviour
	4	494	16%	Slightly affected
Valid cases		3008		

Source: own elaboration.

Then, it has been calculated the percentage means for the crossed analysis of the four data cluster and the social study effects (Table 5b). A graded colour scale has been applied to identify the lowest values (red) and the highest values (blue). In terms of "way of living" and "way of thinking", all subjects (100%) have been affected by the pandemic. Globally speaking, "social habits and behaviour" and "way of living" have the highest percentages of being hit by COVID-19 with 74% and 69% respectively. Finally, "way of self-healthcare" (52%) and "way of thinking" (49%) have the lowest ones.

Table 5b. Percentage means for the crossed analysis of the four data clusters and the social study effects.

Final cluster centres		Cluster			
		1	2	3	4
	TOTAL	Affected in all 4 dimensions	Way of living and social behaviour	Only in social behaviour	Slightly affected
Way of living	69%	100%	100%	0%	0%
Way of thinking	49%	100%	0%	23%	14%
Way of self-healthcare	52%	77%	41%	36%	16%
Social habits and behaviour	74%	90%	80%	100%	0%

Low value   High value

Source: own elaboration.

4.4. Cluster Analysis for the social study effects and gender

A K-means Cluster has been used for programming the centroids (determined reduction values) so that the subjects are grouped around previously social study effects and gender (Table 6a). In this sense, the variables "way of living", "way of thinking", "way of self-healthcare" and "social habits and behaviour" work good for these four clusters and fit statistical significance tests of ANOVA p-values (Table 6b). The F-test is lower in the "way of living" (F=708.878) of respondents indicating less variability of the data when gender clustering is applied.

Table 6a. Final clusters centres for the social study effects and gender.

Final cluster centres	Cluster			
	1	2	3	4
Way of living	3	2	3	5
Way of thinking	5	2	3	6
Way of self-healthcare	4	2	3	6
Social habits and behaviour	2	1	5	5
Gender of the interviewed person	1	2	1	1

Source: own elaboration.

Table 6b. ANOVA for the social study effects and gender.

ANOVA						
Social study effects / Gender	Cluster		Error		F	Sig.
	Quadratic mean	gl	Quadratic mean	gl		
Way of living	1.161.590	3	1.639	3004	708.878	.000
Way of thinking	2.218.033	3	1.572	3004	1.410.783	.000
Way of self-healthcare	2.131.997	3	1.751	3004	1.217.930	.000
Social habits and behaviour	2.315.380	3	.665	3004	3.482.690	.000
Gender of the interviewed person	4.133	3	.246	3004	16.804	000

Source: own elaboration.

The undertaken hypotheses testing in these statistical analyses show that the significance level is below the cut-off value set for the p-values (lower than .000). As such, it can be stated:

- H1: There is a significative difference between gender in a way of living affected by COVID-19? The null hypothesis is rejected and the hypothesis one is **accepted**.

- H2: There is significative difference between gender in a way of thinking affected by COVID-19? The null hypothesis is rejected and the hypothesis two is **accepted**.

- H3: There is a significative difference between gender in a way of self-healthcare affected by COVID-19? The null hypothesis is rejected and the hypothesis three is **accepted**.

- H4: There is a significative difference between gender in social habits and behaviour affected by COVID-19? The null hypothesis is rejected and the hypothesis four is **accepted**.

4.5. Cluster Analysis for the social study effects and generations

Another K-means Cluster has been carried out to group around previously social study effects and generations (Table 7a). Equally, the variables "way of living", "way of thinking", "way of self-healthcare" and "social habits and behaviour" are appropriate for these four clusters and fit statistical significance tests of ANOVA p-values (Table 7b). All F-tests are pretty similar for the four social study effects (between F= 18.662 and 51.790) showing generations fit well for this cluster analysis.

Table 7a. Final clusters centres for the social study effects and generations.

Final cluster centres/ Generation	Cluster			
	1	2	3	4
Way of living	3	2	3	2
Way of thinking	4	3	4	3
Way of self-healthcare	4	3	3	3
Social habits and behaviour	3	2	2	2
Generation age groups	74.09	45.59	60.13	28.50

Source: own elaboration.

Table 7b. ANOVA for the social study effects and generations.

ANOVA						
Social study effects / Generation	Cluster		Error		F	Sig.
	Quadratic mean	gl	Quadratic mean	gl		
Way of living	62.668	3	2.736	3004	22.904	.000
Way of thinking	69.386	3	3.718	3004	18.662	.000
Way of self-healthcare	96.451	3	3.783	3004	25.494	.000
Social habits and behaviour	146.602	3	2.831	3004	51.790	.000
Generation age groups	249.095.841	3	23.928	3004	10.410.277	.000

Source: own elaboration.

All p-values of the ANOVA test are lower than ".000" then there is sufficient evidence to establish the following outcomes to the given hypotheses:

- H5: There is a significative difference between generation in a way of living affected by COVID-19? The null hypothesis is rejected and the hypothesis five is **accepted**.

- H6: There is significative difference between generation in a way of thinking affected by COVID-19? The null hypothesis is rejected and the hypothesis six is **accepted**.
- H7: There is a significative difference between generation in a way of self-healthcare affected by COVID-19? The null hypothesis is rejected and the hypothesis seven is **accepted**.
- H8: There is a significative difference between generation in social habits and behaviour affected by COVID-19? The null hypothesis is rejected and the hypothesis eight is **accepted**.

4.6. Cluster Analysis for the data Clusters and "G&G model"

A third K-means Cluster (Table 8a) has been analysed made of mixed-type data, where gender and generations variables have been combined at once. Such integration of gender and generations simultaneously is important to the success of political, marketing, and sociological initiatives. The p-values at all the items denote the strength of clustering in the observed data for "G&G model" (lower than ,05). The F-test is lower in the "social behaviour" (F=381.265) (Table 8b) of subjects denoting more homogeneity of the data when "G&G model" clustering is applied.

Table 8a. Final clusters centres for data clusters and "G&G model".

Final cluster centres	Cluster			
	1	2	3	4
Way of living	4	2	2	4
Way of thinking	5	2	3	5
Way of self-healthcare	5	2	2	5
Social habits and behaviour	3	2	2	4
Gender&Generation	23.04	22.63	12.66	12.81

Source: own elaboration.

Table 8b. ANOVA for data clusters and "G&G model".

ANOVA						
Social study effects / Generation	Cluster		Error		F	Sig.
	Quadratic mean	gl	Quadratic mean	gl		
Way of living	962.348	3	1.838	3004	523.695	.000
Way of thinking	1.657.735	3	2.132	3004	777.640	.000
Way of self-healthcare	2.026.248	3	1.856	3004	1.091.660	.000
Social habits and behaviour	822.065	3	2.156	3004	381.265	.000
Gender& Generation	25.339.018	3	.761	3004	33.312.174	.000

Source: own elaboration.

As all p-values of ANOVA test are less than some significance level ($\alpha = .05$), then the last hypotheses for "G&G model" have been accepted:

- H9: There is a significative difference between gender and generations in a way of living affected by COVID-19? The null hypothesis is rejected and the hypothesis nine is **accepted**.
- H10: There is significative difference between gender and generations in a way of thinking affected by COVID-19? The null hypothesis is rejected and the hypothesis ten is **accepted**.
- H11: There is a significative difference between gender and generations in a way of self-healthcare affected by COVID-19? The null hypothesis is rejected and the hypothesis eleven is **accepted**.
- H12: There is a significative difference between gender and generations in social habits and behaviour affected by COVID-19? The null hypothesis is rejected and the hypothesis twelve is **accepted**.

After the cluster analysis and hypotheses tests, it has been calculated the means of the data clusters and "G&G model" in order to dimension percentages (Table 9a). As done earlier in a block 3.1, the respective means of data clusters have been calculated to compare the difference with the overall mean of data clusters and their adjusted sampling error (Table 9b). Visually, the cases with the highest incidence have been highlighted in blue-coloured. On the contrary when the incidence is lower in orange one.

In terms of gender, pandemic has affected more the woman in the four characteristics used to cluster (60%) than men (40%). In terms of generations, the youngers (in particular Millennials with 21%) have been less affected by pandemic in their way of thinking, living, healthcare and social behaviours.

Table 9a. Means of data clusters and "G&G model".

	TOTAL	Affected in all 4 dimensions	Way of living and social behaviour	Only in social behaviour	Slightly affected
	3008	1315	764	435	494
Male	48%	40%	55%	49%	60%
Female	52%	60%	45%	51%	40%
Generation Z	8%	9%	9%	6%	5%
Millennials	31%	33%	34%	30%	21%
Generation X	39%	39%	38%	43%	37%
Grey Generation	22%	19%	19%	20%	36%

Low incidence   High incidence

Source: own elaboration.

Table 9b. Adjusted sampling error of Table 8a (means of data clusters and "G&G model").

	TOTAL	Affected in all 4 dimensions	Way of living and social behaviour	Only in social behaviour	Slightly affected
	Adjusted sampling error	Adjusted sampling error	Adjusted sampling error	Adjusted sampling error	Adjusted sampling error
Male	2%	5%	5%	7%	6%
Female	2%	5%	5%	7%	6%
Generation Z	1%	3%	3%	3%	3%
Millennials	2%	4%	5%	6%	5%
Generation X	2%	4%	5%	7%	6%
Grey Generation	2%	4%	4%	5%	6%

Source: own elaboration.

4.7. Correspondence Analysis for the social study effects and "G&G model": how the study effects have been affected?

A Multiple Correspondence Analysis has been implemented to identify how of the four social study effects has been influenced by COVID-19 according to G&G model. Hence, it is observed that the first two dimensions explain 93% of the Correspondence Analysis, so a two-dimensional model is sufficient enough (Table 10).

Table 10. Explanation of the Multiple Correspondence Analysis for the social study effects and "G&G model".

Dimension	Singular value	Inertia	Chi square	Sig.	Proportion of inertia		Confidence Singular Value	
					Accounted for	Accumulative	Standard deviation	Correlation
								2
1	.056	.003			.770	.770	.022	-.001
2	.026	.001			.165	.934	.023	
3	.016	.000			.066	1.000		
Total		.004	8.147	1.000a	1.000	1.000		

Source: own elaboration.

To calculate the basic form of Correspondence Analysis, standard coordinates have been used weighted by the value of G&G model and getting set of scores for plotting dimension 1 and 2 (Table 11).

Table 11. Standard coordinates of the Multiple Correspondence Analysis for the social study effects and "G&G model".

	Dimension score	
	1	2
Males- Generation Z	-32%	7%
Males - Millennials	-34%	5%
Males - Generation X	-14%	15%
Males- Grey Generation	13%	14%
Females- Generation Z	39%	10%
Females- Millennials	13%	-12%
Females- Generation X	3%	0%
Females- Grey Generation	-4%	-39%
Way of living	-19%	-1%
Way of thinking	27%	-26%
Way of self-healthcare	29%	24%
Social habits and behaviour	-21%	2%
	X	Y
MAX	39%	24%
MIN	-34%	-39%

Source: own elaboration.

The first dimension on the X axis and the second dimension on the Y axis generate the standard Multiple Correspondence Analysis in Figure 3.

Thus, Figure 3, apart the confirmation of the validity of the G&G model and accomplishment of objectives 1 and 2, shows overall tendency that "social habits and behaviour" and "way of living" influence more males in Generation Z, Millennials and Generation X, as they could considered as the active participants and consumers of leisure, working and sport activities out of home before the pandemic. In this sense, the "hard pandemic" with the strict lockdown affected them more in these variables as they were forced to stay at home 24h. On the other hand, the social study effect "way of self-healthcare" impacted male Grey Generation or older males that could be understood as the following, the older Spanish man in general before pandemic looked very little after their health state, because for that generation it was considered as "ladies´ thing" or among other that age cohort males could be seen as less "masculine". Thus, high numbers of death caused by the SARS-CoV-2 virus among older generation forced older males to re-think their attitude towards their health care and self-protection. Similarly, youngest studied females´ age cohort or Generation Z show that the "way of self-healthcare" is important for them during the pandemic, which could be interpreted in this way, young ladies considered that they are young, they have good health, and nothing will happen with them, but the pandemic has shown the other reality. Also, young people got infected, and they could have very hard long-term consequences caused by the virus or they could transmit the virus to their older family members like parents and grandparents, and for them virus could be deadly.

Figure 3. Graphical representation of Multiple Correspondence Analysis for the social study effects and "G&G model".
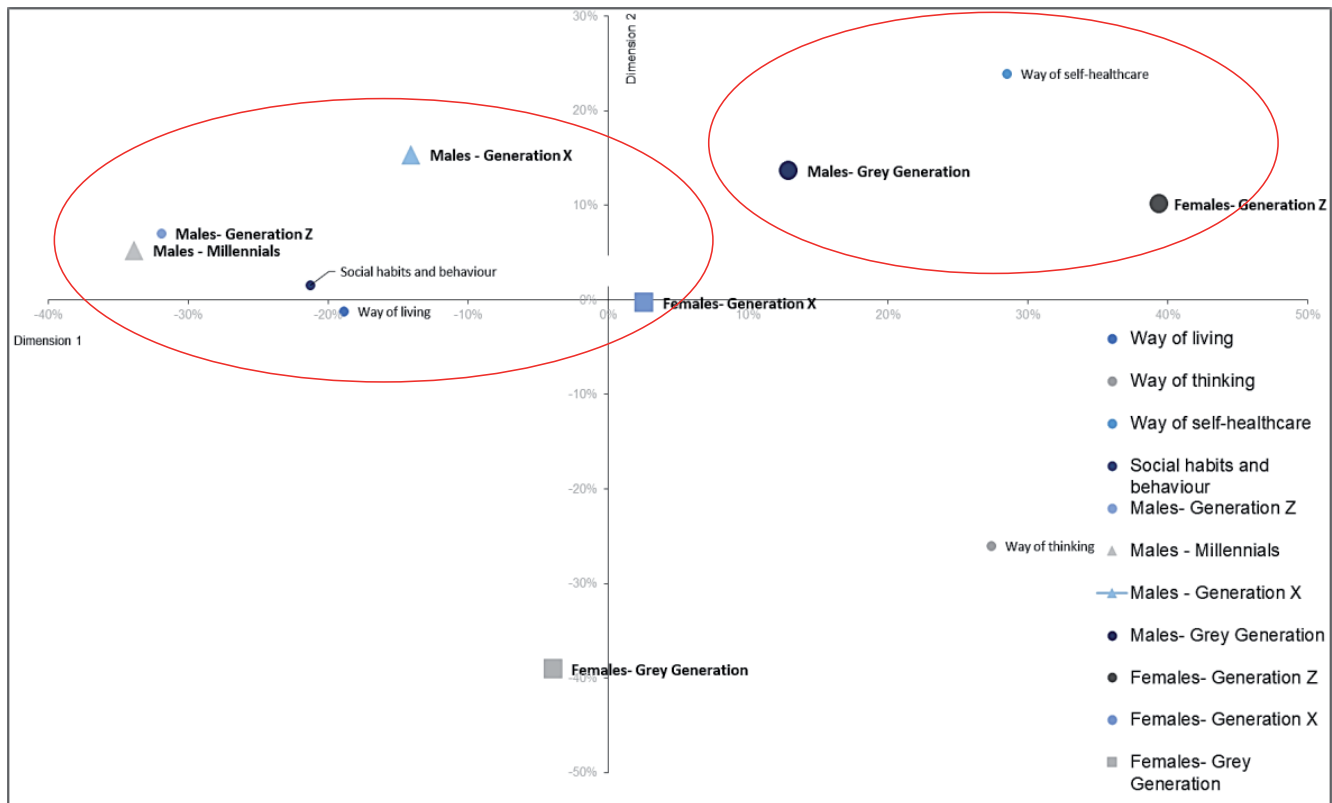
Source: own elaboration.

5. DISCUSSION

There have been published numerous studies all around the world on the COVID-19 social effects on gender and generations (Bernabe-Valero *et al.*, 2021; Oertelt-Prigione, 2020; Choi *et al.*, 2021). Also, in Spain there have been applied investigations on how the "hard pandemic" during full lockdowns and "soft pandemic" with lighter social restrictions have influenced differently overall well-being of gender and generations (Justo-Alonso *et al.*, 2020). Thus, this research paper data, obtained from the Spanish "Sociological Research Centre" and analysed by the K-means Cluster and Multiple Correspondence techniques, show in-depth results on how the COVID-19 pandemic impacted differently gender and generations in Spain by empirically examining four social effects "way of living", "way of thinking", "way of self-healthcare" and "social habits and behaviour". In terms of gender, the sanitary pandemic has impacted more woman than men in Spain. Similar results can be found in studies done by Choi *et al.*, 2021; Simba

& Ngcobo, 2020; Zhou *et al.*, 2020; Kotta *et al.*, 2021, Silva *et al.*, 2022. Precisely, findings obtained from the cluster analysis of this paper show that females were more impacted in all examined social effects "way of living", "way of thinking", "way of self-healthcare" and "social habits and behaviour". Research results approve that full lockdown and its postprocess or "soft pandemic" pressure with responsibilities increase at home like working online, children care and schooling, housekeeping activities, caring parents and possible illness or job loss, limited social activities affected females physical and mental well-being.

In terms of generations, published scientific literature shows that the pandemic social restrictions impacted more negatively present younger generations (Ebert *et al.*, 2020; Bidzan-Bluma *et al.*, 2020; Cowie & Myers, 2021; Buzzi *et al.*, 2020). Similarly, this empiric analysis confirms that younger Spaniards (Generation Z and Millennials) were more affected in "way of living", "way of self-healthcare" and "social habits and behaviour" in comparison to other studied

generations (Generation X and Grey Generation), and not so much in a "way of thinking". Thus, it verifies overall importance of missing physical social contacts with friends, practicing sport/leisure/cultural activities for younger generations, and even digital tools and virtual platform leisure/cultural/communication offer couldn't compensate the real person's or physical world´s experiences.

In relation to the proposed G&G model, obtained results from the Multiple Correspondence Analysis reveal that "social habits and behaviour" and "way of living" influence more males in Generation Z, Millennials and Generation X, as they are "active full-time consumers" of leisure and sport activities out of home before the COVID-19 pandemic. Nonetheless, the Spanish Generation Z females show that the "way of self-healthcare" is important for them during the sanitary crisis, and it means that young ladies understand that the virus SARS-CoV-2 infection can affect hardly not only older generations, but anyone "you are young or old". Following the Correspondence Analysis for the G&G model, the social study effect variable "way of self-healthcare" also affected in a certain degree more males in Grey Generation than opposite sex in the same generation. This indicates that older ladies independently of situation (in times of pandemic or no) take care of themselves on permanent basis, but the COVID-19 pandemic for the same male age cohort forced to rethink the importance of their personal mental and physical self-care in order to be physical fit, protect themselves from possible virus infection and maintain general well-being (Eckenrode & Wethington, 1990).

Thus, it is worthily to mention that this study results by applying K-means Cluster and Multiple Correspondence techniques are based on comparatively large sample size (3008 subjects) and representative selection in comparison to similarly made studies (Zheng *et al.*, 2020; Bernabe-Valero *et al.*, 2021; Gubler *et al.*, 2021), that gives higher credibility of obtained results for the G&G model on studied social effects.

6. CONCLUSIONS

Understanding the population´s overall physical and mental well-being affected by the COVID-19 pandemic is crucially important for practice and public policies management of societies needs and necessities after pandemic in a long-run. The difference of social effects impact on gender and generations is in a continuous observation and study, and only real effects and consequences caused by the SARS-CoV-2 virus we will be able to evaluate in longer time period.

From *theoretical viewpoint*, this empirical research paper proposes a framework for public policies by using K-means Cluster and Multiple Correspondence Analysis techniques. It studies at the same time different social effects in crossing gender and generations (G&G model) variables in light of the COVID-19 pandemic. This kind of investigation can serve as a paradigm for public officers and other social study researchers for exploring society´s changes and impacts.

On the other hand, it is clearly known that before the pandemic the gender equality at work (like formal employment and unpaid care work at home) and society (like high level decision-making jobs and violence against women) in general in Spain and all around the world was not at the same level. Thus, these different inequalities affected females even more during the pandemic and therefore it reflects in their mental and physical wellbeing, social behaviour, and they are risking paying higher price for the pandemic aftermath. From the *practical viewpoint* this study suggests that it is vitally important to take "an action now" by society management implications in different formal and informal sectors by not allowing that the pandemic crisis and post-pandemic period affect more females than males. Consequently, as an example or a way for improvement in an unformal way could be mentioned that males share more household duties and child/elderly care, and in this sense, it could be way for "unstereotype" gender roles (Blaskó *et al.*, 2020). For the formal sector could be mentioned flexible working hours, distance online work, job-preserving support for those females who has some special family commitments and need for hours reduction, more representation of women in decision-making positions. It is also extremally critical to "sensibilize" society on violence against women and create inclusive politics for gender equality term at the companies and official institutions.

On the other hand, the results of this study and other many studies around the world show how differently the COVID-19 pandemic crisis affected generations.

Therefore, it is crucially important to understand and not to leave behind any generation only because they are "too old" and have lived and experienced already a lot, or "too young" and there still have all their life ahead. All age cohorts play a vital role in our society, and it is crucial to respond to their respective mental, physical, and social needs. All the members of our society from different ages have been creators of our present social, economic, political system, etc., and they are and will be our future policy makers.

In sum, understanding effects and consequences of the COVID-19 pandemic involving differences between men and women, younger and older generations, is a basis for creating future dynamic balances of a post-pandemic life, by taking in account that "life will never be the same" as it was before. Thus, this study findings can serve for the society policy makers on institutional and company level to make decisions by applying inclusive and sustainable politics.

6.1. Limitations and future research agenda

Despite the various theoretical and practical contributions, authors assume some limitations associated with this research. First, analysed open massive data is from a survey published in May 2021, so further time periods for longitudinal studies may increase the generalizability of the results. The second limitation of the study is the use of a telephone survey (CATI) as data collection. Reaching some population ages using telephone interviewing may be difficult. On the other hand, future studies could include more diverse social effects and how they have affected gender and generation well-being and social behaviour. Also, inclusion of other sociodemographic variables would give different insights of the studied subject in the light of public policies.

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