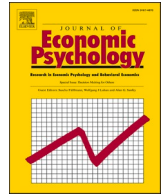




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The prosociality of married people: Evidence from a large multinational sample

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ABSTRACT

Single people are more likely to die from COVID-19. Here we study whether this higher death rate could be partly explained by differences in compliance with protective health measures against COVID-19 between single and married people, and the drivers of this marital compliance gap. Data collected from 46,450 respondents in 67 countries reveal that married people are more likely to comply with protective measures than single people. This marital gap in compliance is higher for men (approximately 5%) than for women (approximately 2%). These results are robust across a large range of countries and independent of country level differences with respect to culture, values or infection rates. Prosocial characteristics linked to morality and social belonging explain more than 38% of the marital gap, while individual risk perceptions play a minor role. These findings help explain single people's and particularly single men's greater vulnerability to COVID-19, which in turn can be leveraged to improve the effectiveness of international public policy campaigns aimed at promoting protective health measures.

1. Introduction

Although the pace of immunization campaigns against COVID-19 is increasing in most developed countries, governments worldwide still struggle to induce citizens to comply with non-pharmaceutical protective health measures to address this ongoing global pandemic. Most governments focus their efforts on the people with an elevated risk of dying from COVID-19. Mortality data show that men and single people are among the most vulnerable to this disease (Drefahl et al., 2020; Williamson et al., 2020).¹ To encourage adoption of protective measures, policymakers must understand whether and why men and single people are less inclined to comply with protective measures (Capraro and Barcelo, 2020; Nivette et al., 2021). With such information, they could better address pandemic spread and benefit vulnerable segments of the population for future pandemics.

According to recent research conducted in eight OECD countries, men are less likely to comply with protective measures (Galasso et al., 2020; Nivette et al., 2021). International data among unmarried people, and particularly unmarried men, are missing though. Marriage differences in mortality to COVID-19 might reflect causes outside people's immediate control: for example, studies have observed that single individuals are often characterized by poorer overall health compared to the general better health of married

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¹ Men have more than twice as high a risk of dying from COVID-19 than women; unmarried people have a 1.5–2 times greater risk than those who are married (Drefahl et al., 2020).

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people (Kiecolt-Glaser and Newton, 2001; Koball et al., 2010), irrespective of compliance to COVID-19 rules. But married people also might differ in their attitudes toward COVID-19 and their likelihood to comply with protective measures. Such compliance is beneficial at both the individual level, by reducing individual risk of exposure to COVID-19, and at the group level, by limiting the spread of the disease, as a form of prosocial behavior (Campos-Mercade et al., 2021). That is, if married people are more likely to adopt protective health measures than single people, the cause might be married people's distinct risk preferences or prosocial tendencies. Thus, differences in compliance with protective measures to COVID-19, risk preferences, and prosocial tendencies that vary by marital status might have important implications for public policy and for communicating with relevant populations to curb the spread of the pandemic.

This research presents results based on a preregistered analysis plan among 46,450 respondents, across 67 countries. We analyze marriage-based differences in self-reported compliance with protective measures (i.e. reduced interpersonal contacts, hygiene measures, and support for public policies aimed at reducing the spread of the virus) as well as their determinants.

First, we expect marriage to increase compliance with protective measures because of the indirect benefits of such compliance. Indeed, being careful protects not only the individuals but also their families (Becker, 1981). Marriage could also increase compliance because it appears linked to more prosocial behaviors and increased charitable donations (e.g., Li et al., 2011; Rooney et al., 2005). Marriage has been shown to influence individual behaviors both within and outside the household (Kiecolt-Glaser & Newton, 2001), and monogamous marriage establishes social advantages at the community level (Henrich et al., 2012). Similarly, parenthood represents an important life course event that induces substantial biological, social, and psychological changes, including shifts in values (Ferriman et al., 2008). For example, parents are more intrinsically motivated to volunteer than non-parents (Aydinli et al., 2015). Thus, both marriage and parenthood might influence compliance with protective health measures. Because marriage and parenthood are correlated and might foster compliance, we disentangle the distinct effects of both types of status.

Second, we expect gender to be an important determinant of compliance with protective health measures and to interact with marriage. Men tend to score lower than women on prosocial scales (e.g., Andreoni and Vesterlund 2001; Croson and Gneezy 2009), and married men and fathers tend to be more altruist and prosocial than single or childless men (Gettler et al., 2020; Gray and Campbell, 2009), whether due to selection (i.e., men with prosocial traits are more likely to get married and have children) or adaptation (i.e., men adjust their values after they get married and have children). Therefore, we expect men to be less compliant with protective health measures against COVID-19, but to a lesser extent if they are married.

Finally, we explore the potential roles of risk perception (optimism, perceived risk of the virus) and prosocial tendency (social belonging, morality identity) in determining the adoption of protective measures against COVID-19 as self-reported risk (Harper et al., 2020; Müller and Rau, 2020) and prosociality (Campos-Mercade et al., 2021; Pfattheicher et al., 2020; Zettler et al., 2020) were identified as important determinants of attitudes and behaviors in response to health hazards. All our hypotheses were preregistered at <https://aspredicted.org/7b4zh.pdf>.

We find a robust, culture-independent relationship between marriage and the adoption of protective health measures, which we denote the *marital gap*. As predicted, the compliance gap between single and married people is higher for men (approximately 5%) than for women (approximately 2%). In other words, though men are less likely to comply with protective health measures than women, married men are more likely to comply than single men, and this difference is more extreme than that between married and single women. Parenthood, beyond its correlation with marriage, has no additional effect on the adoption of protective health measures. These significant relationships are robust across countries and cannot be explained by cultural or political differences, nor by disease severity. Our empirical analysis reveals that 35%–40% of this marriage gap is due to differences in prosocial preferences (i.e., moral identity and social belonging). Specifically, we find that social belonging traits are the main determinant of marital differences in the compliance with public health measures, at the within- and cross-country level. Variations with respect to risk perceptions (i.e., optimism and infection risk) instead have negligible impacts.

Our findings contribute to a growing literature that examines the attitudes of populations towards health policies (Barrios et al., 2021; Campos Mercade et al., 2021; Lunn et al., 2020). Previous research has established that gender is a strong determinant, such that men are less compliant with rules proposed by the WHO and public authorities (Capraro and Barcelo, 2020; Galasso et al., 2020). We add evidence that marriage is another important determinant of attitudes toward protective rules: unmarried people, and particularly unmarried men, are less likely to comply. This important finding can inform public policy, considering that single men are more likely to die from COVID-19. Our findings also complement studies on the determinants of prosocial behaviors (Lee et al. 2021; Dimant, 2019; Zhang, 2019) particularly during pandemics (Allcott et al., 2020; Bargain & Aminjonov, 2020; Barrios et al., 2021; Campos-Mercade et al., 2021). Previous research identifies self-reported risk (Harper et al., 2020; Müller and Rau, 2020) and prosociality (Campos-Mercade et al., 2021; Pfattheicher et al., 2020; Zettler et al., 2020) as important determinants of attitudes and behaviors in response to health hazards; we determine that prosociality, to a greater extent than perceived risk, drives married people's compliance with protective public health measures. Our analysis of the impact of risk perception and pro-social attitudes on the marital gap implies that tapping into married people's prosocial motives might be an effective lever, and fostering single people's prosocial values could increase their willingness to comply with protective measures.

In the next section, we present the data and methodology, before reviewing our results and discussing public policy implications for increasing the adoption of protective measures against COVID-19 among vulnerable populations.

2. Data and empirical methodology

2.1. Data

The data for this study were collected online by a large international group of researchers in April 2020 (Azevedo et al., 2022; Van Bavel et al., 2022). The 46,450 respondents represent 67 countries (Mean age = 43.09 years; 47.6% women).² More than 500 respondents participated in 44 countries; representative samples with respect to age and gender were obtained for 30 countries. For additional methods and data collection details, including information regarding the sample size by country, data exclusion criteria, and measures, see Van Bavel et al. (2022).

Appendix A contains an excerpt of the questionnaire, featuring the variables we used for this study. The outcome variable is based on responses to several questions related to compliance with protective measures against COVID-19. Specifically, respondents completed three scales related to physical distancing (4 items, e.g., “I have been staying home as much as practically possible”),³ hygiene (5 items, e.g., “I have been washing my hands longer than usual”), and public policy support (5 items, e.g., “I have been in favor of closing all schools and universities”). All items were rated on a slider with three labels: 0 = *strongly disagree*, 5 = *neither agree nor disagree*, and 10 = *strongly agree*. The measures for each scale are the average of the constitutive items. The three scales are moderately correlated, so we can use a general aggregate as an overall score of endorsement of COVID-19 protective measures, which we denote “compliance.”

Respondents also completed psychological scales pertaining to their moral identity, social belonging, optimism, and risk perceptions.⁴ Moral identity (Aquino and Reed, 2002) includes five items pertaining to evaluations of a person as “caring, compassionate, fair, friendly, generous, helpful, hardworking, honest and kind” (see Appendix A). The measure of social belonging uses four items (e.g., “I feel connected with others”; Malone et al., 2012), and optimism features two items (e.g., “I am always optimistic for my future”; Scheier et al., 1994). We evaluate individual perceptions of the risk of COVID-19 infection by asking respondents how likely they thought the average person in their country to be infected with COVID-19 by April 30, 2021, on a scale from 0 to 100, which we normalized to 0–10 for ease of comparison. Finally, respondents completed a short sociodemographic questionnaire and indicated their gender, age, marital status (single, in a relationship, married), and number of children.⁵

From our initial data set, we excluded respondents who did not explicitly self-identify as male or female, as well as respondents who did not provide answers regarding their marital or parenthood status, approximately 2% of the sample. We also excluded people who did not indicate their compliance with protective measures, which represents another approximately 2%. The final sample thus consists of 44,429 respondents. Descriptive statistics by gender and marital status are in Table 1.

2.2. Empirical methodology

We start with a multivariate regression of compliance rates according to age, age squared, marital status, and parenthood, separately for men and women. However, caution is necessary when running these regressions, because age, marital status, and parenthood are highly correlated. Most married women have children; married men are older than single men. Single fathers are rare, particularly so in certain countries. Such correlations can decrease the quality and precision of the estimates, so we require careful verification of all interactions in our results. With additional regressions that include the interactions, we check the robustness and verify key drivers of the results.

Because we expect individual average behaviors to depend on country differences, due to norms, cultures, infection rates, national policies, and so forth, we account for cross-country differences in all our regressions. We have hundreds of observations for each of the 67 countries, so we can include 67 country dummies in the multivariate model. This approach is robust to potential correlations between country-fixed effects and specific individual characteristics, such as marital status. We also compute clustered standard errors at the country level to address the possibility that variances in the disturbance term differ for each country.

To evaluate the impact of observable differences in personality traits across genders and marital status, we adopt an Oaxaca decomposition (Blinder, 1973; Oaxaca, 1973). To this end, we run regression models in which the individual adherence score depends on our psychological measures (i.e., optimism and infection risk) and prosocial attitudes (i.e., social belonging and moral identity), which economic theory indicates should be the main individual behavioral determinants. We separate the regression models by gender for the gender gap, and then by gender and marital status for the marital gap. Among the various decomposition possibilities, we choose a pooled approach (Jann, 2008). The decomposition of the marital gap involves a smaller subsample (35,435 observations) because it excludes unmarried people in a relationship.⁶ The regression models used for the decomposition include country dummies and clustered errors at the country level, allowing us to control for aggregate effects at the country level, such as cross-country cultural

² The initial sample size, before preregistration, included 47,205 people, but the data contained outliers, such as people older than 100 years of age. After removing clearly fraudulent entries, we retained 46,450 respondents, using the same criteria as in van Bavel et al. (2022).

³ A fifth item was removed by Van Bavel et al. (2022) to increase the reliability of this scale.

⁴ Other scales pertain, for example, to narcissism and generosity, but they do not inform our analysis.

⁵ In most countries (87%) in our sample, monogamous marriage is the norm. In 9 of the 67 countries (Bangladesh, India, Iraq, Morocco, Nigeria, Pakistan, Philippines, Senegal, and Singapore), polygamy is allowed, though in some cases, only among the Muslim population.

⁶ Complementary analyses show that unmarried people living in a relationship state behaviors that fall between those stated by single and married people, with respect to both protective measures against COVID-19 and psychological measures.

Table 1
Summary statistics.

	Women	Single	Married	Men	Single	Married
<i>N</i>	23,126	8,082	9,996	21,303	6,929	10,570
Age	41.8	39.2	47.0	44.8	37.2	51.7
	(15.6)	(17.2)	(13.2)	(16.3)	(16.0)	(13.9)
<i>Fraction with children</i>	0.55	0.31	0.83	0.54	0.17	0.85
	(0.50)	(0.46)	(0.37)	(0.50)	(0.37)	(0.36)
Full-time employed	0.39	0.33	0.43	0.50	0.39	0.57
	(0.49)	(0.47)	(0.49)	(0.50)	(0.49)	(0.49)
Well-being scale	6.17	5.79	6.49	6.19	5.67	6.51
	(2.02)	(2.08)	(1.95)	(2.05)	(2.18)	(1.93)
Compliance	8.32	8.26	8.42	7.81	7.61	7.98
(scale 0–10)	(1.47)	(1.52)	(1.42)	(1.64)	(1.72)	(1.55)
<i>Subscale: Social distancing</i>	8.75	8.70	8.84	8.27	8.08	8.43
	(1.62)	(1.66)	(1.56)	(1.84)	(1.97)	(1.71)
<i>Subscale: Hygiene</i>	8.21	8.10	8.34	7.62	7.31	7.85
	(1.77)	(1.85)	(1.69)	(1.95)	(2.08)	(1.82)
<i>Subscale: Policy support</i>	8.09	8.07	8.17	7.62	7.53	7.74
	(2.15)	(2.20)	(2.10)	(2.34)	(2.39)	(2.28)
Risk perception						
(scale 0–10)						
Optimism	7.17	6.95	7.41	7.12	6.74	7.39
	(2.17)	(2.32)	(2.04)	(2.15)	(2.35)	(1.98)
Infection risk	5.08	5.11	4.90	4.68	4.77	4.55
	(2.77)	(2.75)	(2.77)	(2.79)	(2.82)	(2.75)
Pro-social traits						
(scale 0–10)						
Moral identity	8.01	8.01	7.97	7.52	7.41	7.60
	(1.67)	(1.72)	(1.67)	(1.73)	(1.81)	(1.68)
Social belonging	7.33	7.06	7.60	7.13	6.71	7.43
	(1.89)	(2.00)	(1.77)	(1.88)	(2.06)	(1.73)

Notes: Standard deviations are in parentheses.

differences, communication policies, values, or infection rates.

3. Results

3.1. Raw results: gender, marital status, and parenthood

Gender has a significant role in determining compliance with protective measures against COVID-19. Women report a compliance rate that is 6.5% higher than men's; specifically, their overall compliance rate is 0.51 points higher (11-point scale; Table 1). The gender gap appears robust to various model specifications, such that whether we control for country-fixed effects and age or focus on sub-measures, it remains around 7%.⁷ Similar gender gaps in compliance are identified by Haischer et al. (2020) and Galasso et al. (2020). The Mann-Whitney test of gender differences in the median measures leads to p -values < 0.001 in every case.

Marriage also has a significant role. Married men report a compliance rate that is 5% higher than single men; married women report a compliance rate that is 2% higher than single women (Table 1). The effect is robust with respect to several specifications. A Mann-Whitney test of the difference in means indicates a p -value lower than 0.001 for any subsample or submeasure. When we include country-fixed effects and age controls, the impact of marriage is strongly significant and greater for men than for women (Table 2, columns 1–2).

The raw effect of parenthood is positive and represents an increase of approximately 2% in the compliance rate. The average compliance rate of mothers reaches 8.36 versus 8.27 for non-mothers, and 7.88 for fathers versus 7.72 for non-fathers. When we include country-fixed effects and age controls, we observe a child-related effect of the same magnitude (Table 2, column 3–4). Since marriage and parenthood are strongly correlated, we extend our analysis to disentangle the relative importance of these two characteristics.

3.2. Disentangling the effects of marital status and parenthood

In our sample, 83% of married women have at least one child, whereas only 31% of single women do. The effect is even stronger for

⁷ A simple regression model of the log of the compliance rate on gender gives a female coefficient equal to 0.074 (stderr = 0.0024). Including country and age controls produces a female coefficient equal to 0.070 (stderr = 0.0023). Decomposing by type of measure, we find a social distancing coefficient of gender of 0.067 (stderr = 0.0027), a hygiene coefficient of 0.034 (stderr = 0.0029), and a policy support coefficient of 0.060 (stderr = 0.0036). The Mann-Whitney test of gender differences in the median measures leads to p -values < 0.001 in every case.

Table 2
Multivariate regressions of compliance score, by gender.

	(1) Women	(2) Men	(3) Women	(4) Men	(5) Women	(6) Men
Has child			0.180*** (0.019)	0.221*** (0.019)	0.001 (0.024)	-0.057** (0.029)
In a relationship	-0.009 (0.025)	0.155*** (0.031)			0.037 (0.025)	0.166*** (0.031)
Married	0.211*** (0.021)	0.390*** (0.024)			0.166*** (0.024)	0.360*** (0.030)
Age controls	NO	NO	NO	NO	YES	YES
Country fixed effects	YES	YES	YES	YES	YES	YES

Notes: Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

men: 85% of married men have children, and only 17% of single men do. The correlation coefficient in both cases is greater than 0.5. Age also correlates with marriage and parenthood. With a multivariate regression model that includes all these covariates, we can control consistently for this correlation, though only at a loss of precision in the estimates. Results shown in Table 1 are robust to the inclusion of interaction terms.⁸ The driving force of the effect of parenthood on the compliance score is marital status (Table 2, columns 5–6). When we control for marital status, the effect of parenthood on compliance is not significant for women and is negative for men.⁹ We also find that compared with the raw results, the effect of marriage decreases for women and increases for men.

The evidence regarding the impact of marriage on compliance is robust across all subscales, with the strongest effect being observed for hygiene measures (Table B2, Appendix B). Finally, and as predicted, the impact of marriage on compliance is stronger for men than for women.

3.3. Understanding the marital gap in compliance

The marital gap in compliance with protective health measures can be observed in almost all countries in our sample. Fig. 1 represents the average scores at the country level, by gender and marital status. The level of compliance is higher among married than single men in every country, except Pakistan. It also is higher among married than single women in most countries, though to a lesser extent than for men. Only in Bulgaria, Romania, Slovakia, Macedonia, and Singapore do single women exhibit higher compliance rates than married women. The gender gap in compliance appears in all countries (except Denmark), and we observe the same ordering across countries¹⁰. As shown in Fig. 1A and 1B, single men exhibit the lowest scores; married women register the highest scores; Married men and single women report intermediate values.

We now turn to potential explanations for these gaps. As noted, both risk perceptions and prosocial traits might affect individual protective health behaviors. On the one hand, protective health behaviors aim to reduce infection risk for a given individual, so they might be modeled as a choice among risky outcomes. On the other hand, protective health behaviors present strong positive externalities but imply individual constraints. Behaviors might thus reflect both individual risk perceptions and prosocial attitudes.

In our data, we capture risk perceptions with two measures: general optimism and beliefs about the COVID-19 infection risk for an average citizen in their country. Prosocial attitudes also involve two measures: moral identity and social belonging. According to the multivariate regressions (Table B3, Appendix B), optimism, subjective infection risk, moral identity, and social belonging increase compliance with protective measures. The effect of optimism might appear at first sight surprising. It is not since it can affect both perceptions of infection risk and the effectiveness of the protective measures against infection. We find a positive effect of optimism on compliance, suggesting that the second channel (effectiveness perception) is stronger.

The decomposition of the marital gap for compliance in Table 3 reveals that though country dummies offer strong explanatory power, they have no impact on the marital gap. Not even one country dummy appears significant at the 10% threshold to explain the difference in the marital gap.

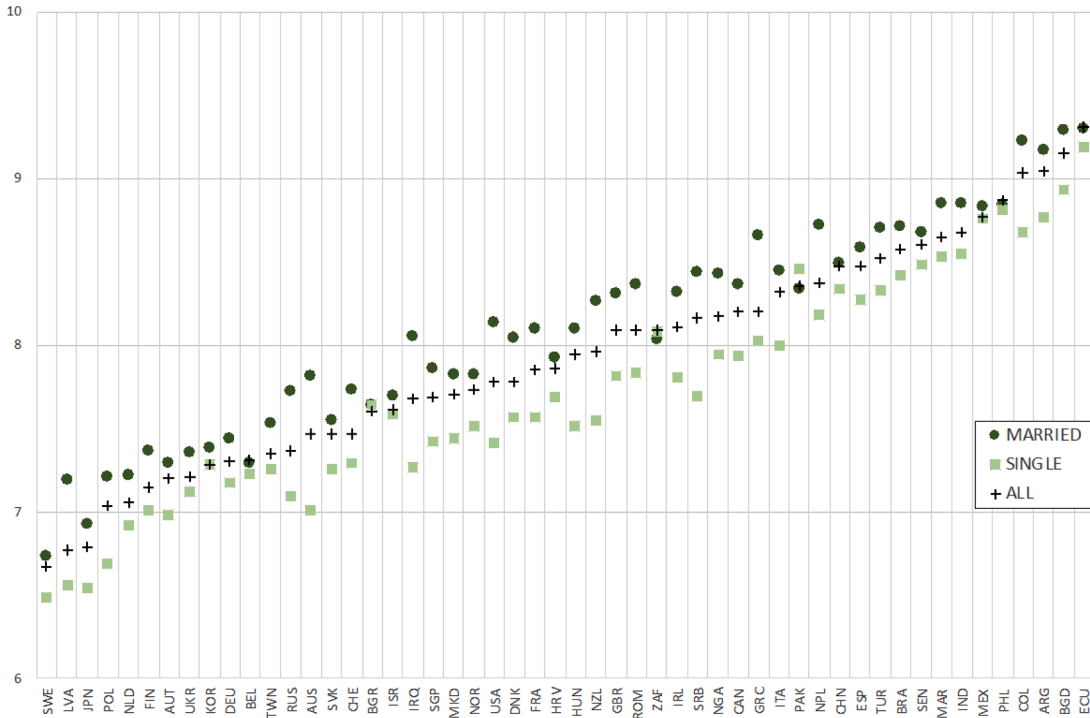
The marital gap is mainly explained by differences in prosocial traits, both among women and men. More specifically, social belonging and moral identity explain 45% of the marital gap for men and 38% for women, implying that married people score higher on prosocial traits. This finding explains a key portion of the behavioral differences in compliance with protective health measures across marital status. Social belonging appears to be the main determinant, for both men and women. Married people report stronger

⁸ Complementary analyses (see Table B1 in the Appendix) show that the effect of parenthood within each type of relationship is never significant at the 5% level, so we are confident of the robustness of the results of Table 2. Here, we present the results without these interaction terms for better readability of the effects.

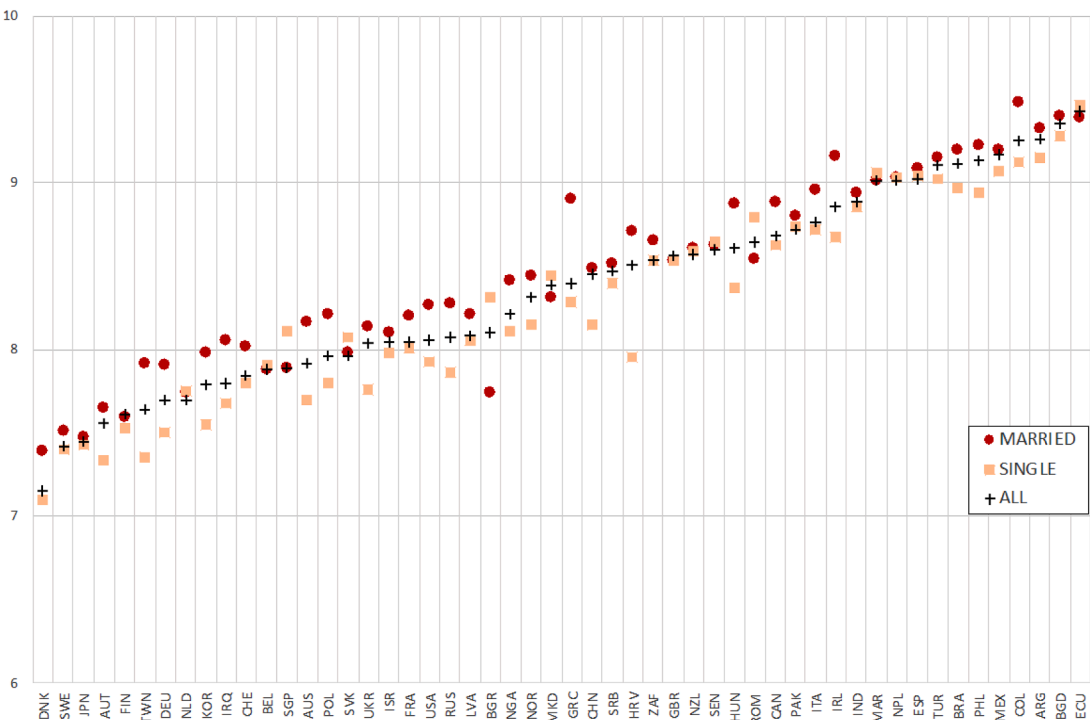
⁹ To understand the negative effect of parenthood on compliance, we run separate regressions for the three sub-scales regarding compliance (social distancing, hygiene, and policy support; Appendix B, Table B1). The negative effect of parenthood seems driven by responses to social distancing, which is not surprising; many social contacts involve children (e.g., playdates, visiting in-laws). Parenthood does not influence compliance with measures related to hygiene, but it has a negative effect on policy support, though only among men.

¹⁰ We can also notice from these graphs that the marital gap for men seems to have an inverted U-shaped relationship with the level on compliance.

A. Marital gap in compliance, men



B. Marital gap in compliance, women



(caption on next page)

Fig. 1. Compliance with protective health measures against COVID-19 for men (A) and women (B), by marital status and country. **A. Marital gap in compliance, men. B. Marital gap in compliance, women.** Notes: These graphs exclude countries with fewer than 100 observations. “All” represents the country average by gender, with any marital status, such as unmarried couples.

Table 3

Decomposition of the marital gap.

		Women		Men	
Predicted compliance score:	Single	8.261***		7.604***	
	Married	8.426***		7.978***	
	Gap	0.165***		0.374***	
Share of difference explained by risk perception			2%		8%
	Optimism	0.018***		0.042***	
	Infection risk	-0.015*		-0.013*	
Share of difference explained by pro-social traits			38%		45%
	Social belonging	0.072***		0.132***	
	Moral identity	-0.009		0.036***	
Share unexplained			60%		47%

Notes: The Oaxaca decomposition is based on regressions of the compliance score on psychological measures, with country-fixed effects (see Appendix Table B3). *Clustered* standard errors. The reference country, Belgium, has no marital gap for men and women and more than 1000 observations. Country dummies are excluded, because they are not significant in explaining the gap. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Interpretation example: The difference in the average compliance rates of married and single men reaches 0.374 (marital gap for men). The difference in optimism levels between these two categories would generate a gap of 0.042 and the difference in infection risks levels would generate a reverse gap of -0.013. Overall, differences in optimism and infection risks rates between married men and single men explain $(0.042 - 0.013) / 0.374 = 8\%$ of the marital gap.

feelings of social belonging than single people (7.4 vs. 6.7 for men; 7.6 vs. 7.1 for women), which in turn increases their likelihood of adopting protective health measures. Moral identity has additional explanatory power regarding the marital gap for men but not for women. That is, married men report greater moral identity than single men, which increases their level of compliance. As stated earlier, the male marital gap in morality could be due to selection (i.e., men with higher morality scores are more likely to get married) or adaptation (i.e., men adjust their level of morality after they get married).

The results also reveal that risk perceptions (optimism and infection risk) explain a very small portion of the marital gap (8% for men, 2% for women), despite being an important determinant of protective behavior on average (Table B3, Appendix B). We note that optimism (but not infection risk) increases the marital gap for both genders. That is, married people tend to be more optimistic than their single counterparts, and this optimism increases their compliance with protective measures. Yet married people tend to have lower perceptions of the risk of infection, which decreases their compliance and reduces the overall marital gap.

For comprehensiveness, we investigate the decomposition of the gender gap using the same variables, such that we can compare the gender gap decomposition with the marital gap decomposition (Table 4). It appears that, again, prosocial traits are the main determinant of gender differences in compliance. Yet they have a weaker role in explaining the gender gap than the marital gap. We also note that moral identity matters more than social belonging for explaining the gender gap in compliance.

To sum up, prosocial traits are the main psychological determinants of heterogeneity of compliance with protective measures across marital status and gender¹¹.

4. Discussion

As immunization campaigns against COVID-19 continue to intensify, governments also realize that people will have to keep complying with non-pharmaceutical protective measures, at least for some time. The priority for policymakers is to increase the effectiveness of public health strategies among the most vulnerable populations, such as men and unmarried people, who are significantly more likely to die from COVID-19.

In complement to recent studies of the determinants of prosocial behaviors (Lee et al. 2021; Dimant, 2019; Zhang, 2019) and health behaviors during pandemics (e.g. Barrios et al., 2021; Campos-Mercade et al., 2021; Lunn et al., 2020), we analyze data collected among 46,450 respondents in 67 countries to determine and understand their compliance behaviors with non-pharmaceutical protective health measures.

Our results reveal that married people are more likely to report complying with protective health behaviors than single people, but parenthood, beyond its correlation with marriage, does not increase compliance. We also observe a strong gender difference in compliance, such that men are less likely to comply than women. In detail, the relationship of marriage and compliance with protective measures is stronger for men than for women, and this relationship is robust across different cultures. The effect is thus not specific to so-called WEIRD (Western, Educated, Industrialized, Rich, and Democratic) populations. Our study extends previous research

¹¹ We further investigate the role of economic resources as a robustness check in Appendix C.

Table 4
Decomposition of the gender gap.

Predicted compliance score for:			
	Men	7.807*	
	Women	8.323	
	Gap	0.516**	
Share of difference explained by risk perception			5%
	Optimism	0.002	
	Infection risk	0.026**	
Share of difference explained by pro-social traits			26%
	Social belonging	0.030***	
	Moral identity	0.103***	
Share unexplained			69%

Notes: Also see Table 3. Country dummies are excluded because they are not significant in explaining the gap. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

(Almutairi et al., 2020; Calucci et al., 2020; Nivette et al., 2021) that mainly focused on gender and age (e.g. Galasso et al., 2020), and psychological and political characteristics (e.g. Painter & Qiu, 2020) by highlighting the role of marital status and identifying an interaction effect of gender and marriage on compliance with protective measures.

Our results thus can help explain, at least in part, why single people and especially single men are more likely to be admitted to intensive care and die from COVID-19. International public health campaigns should recognize that single men are the least likely to comply with such measures without additional encouragement. The greatest additional gains thus might come from targeting single men. Marital status is a variable that can be easily observed, identified and targeted by policymakers, and it would raise less ethical concerns than other variables studied in previous research, such as political orientation (e.g. Painter & Qiu, 2020).

In investigating potential explanations for the marital gap in compliance, among both men and women, we clarify that culture does not explain it. Cross-country differences (in infection rates or culture) have strong effects on compliance but no impact on the marital gap. This finding is especially important when we note that compliance with protective measures tends to be more difficult for residents in poorer countries (e.g., Buheji et al., 2020; Wright et al., 2020).

Furthermore, regarding the effects of risk perception (optimism, infection risk) and prosocial traits (social belonging, moral identity), we find that prosocial traits are the main drivers of compliance among married people, such that social belonging and moral identity explain 45% of the marital gap for men, and social belonging explains 38% of the marital gap for women. Risk perceptions are almost irrelevant to explain the differences across marital status and genders, though they are important determinants of average behaviors per se. Therefore, policy campaigns focused on the social benefits of protective health behaviors could be effective, but they also might widen gender and marriage gaps, because people with stronger prosocial traits (i.e., women and married people) are more likely to react positively to them. In contrast, policy campaigns that provide information about the risk of contagion should be less effective, but they should be able to influence people, regardless of their gender or marital status.

As an important limitation, our analysis cannot provide further answers about the causal mechanisms. The effect of marriage may arise because prosocial people are more attractive marriage partners (e.g., Jensen-Campbell et al., 1995; Margana et al., 2019; Tognetti et al., 2012) or more interested in marrying (Li et al., 2011). It also might stem from specific experiences of marriage (Specht et al., 2011) or bargaining between married partners with different preferences (Chiappori and Ekeland, 2006), as well as social control that tends to be stronger for couples than for singles, particularly for married men (Umberson, 1992). As mentioned earlier, the effect of marriage on compliance may also be due to poorer general health among single versus married people, such as eating and sleeping habits (Umberson, 1992), but it can also be due to the higher likelihood of healthy people to get married (Wyke & Ford, 1992), and stronger incentives of compliance among married people to protect their partner and their children (Becker, 1981).

In addition, our data do not permit to control for the number or type of social interactions at the individual level. According to social network literature, women tend to have fewer but stronger social ties (Friebel and Seabright, 2011; Granovetter, 1973), as might people who are married or live with a partner. Other factors, including occupation and living conditions, can influence the number and type of social interactions a person has on a given day. This variable in turn might influence risk perceptions related to COVID-19 or the likelihood to adopt certain preventive measures. This research does not include measures of social networks or social interactions, so the investigation of these effects must be left to further research.

We also acknowledge that a stronger social desirability bias among women and married people might partially explain the gender and marriage gaps found in this research. Scholars have indeed identified a higher social desirability bias among women (Adams et al., 2005; Chung & Monroe, 2003; Hebert et al., 1997), although recent studies claim that this does not explain gender differences in compliance with Covid-19 measures (Galasso et al. 2020; Becher et al. 2021). Data regarding the interaction of social desirability bias and marital status are scarce and inconsistent. For example, Caputo (2017) found that socio-demographic factors (including marital status) are associated to measures of subjective well-being, but they do not seem to be strongly driven by social desirability biases. Larson (2019) showed that controlling for social desirability biases changes coefficients when explaining some kinds of self-reported behaviors (religious attendance) but not others (environmental impact). Klassen et al. (1975) found no differences when controlling for social desirability bias, regarding reports of mental health between married and single people. Nevertheless we cannot rule out the possibility, that social desirability affects the size of the gender and marriage gaps found in this research and suggest future studies to include measures to control for any sensitivity biases (Blair et al., 2020).

This research also focused only on non-pharmaceutical interventions. It is possible that the effects of gender and marriage vary across protective-policy measures against COVID-19. For example, while men show lower compliance with non-pharmaceutical interventions, they tend to be more willing to get vaccinated (e.g., Lazarus et al. 2021). Future research might then try to replicate our findings across different types of interventions.

Finally, considering the benefits of marriage found in this study and the decline of marriage in most countries (Greenwood et al., 2021; Reynolds, 2020), future research may want to try to identify exogenous differences in incentives and opportunities to getting married.

5. Conclusion

We conclude that marriage exhibits a robust, significant correlation with compliance with public health behaviors, particularly among men, across a large sample of countries. Thus, it is independent of cultural dimensions but inherent to the experience of marriage. The main drivers of this marriage gap are stronger feelings of social belonging among married men and women, as well as higher levels of morality among married men. Risk perceptions influence individual adoption of protective health behaviors, but they do not have strong explanatory power related to the marital gap. Public health communication campaigns related to social benefits should then be more effective among married people and especially married women. Public health campaigns should target single men particularly though, because they are more likely to die from COVID-19 and they are less likely to comply with protective measures per se. As a result, public health campaigns should try to foster single men's feelings of social belonging and prosocial values, to increase their willingness to comply with protective measures. It is even more important to strengthen these values during a pandemic, when isolation and social distancing tend to erode social ties and cooperation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.joep.2022.102545>.

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