White Male Effect in Perceived COVID-19 Mortality Risk
Supplemental materials

Last updated: September 13, 2021

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Datasets

- Understanding America Study Coronavirus in America (COVID) Survey, April 1, 2020 - June 22, 2021 (referred to as UAS; 27 waves total)
- COVID-19 Case Surveillance Public Use Data (referred to as CDC; updated July 16, 2021)
- American Community Sample (ACS) microdata analysis tool (provided by the U.S. Census Bureau for population breakdown by demographic background)

Descriptive statistics (UAS)

Attrition

There are a total of 8296 individuals who responded to at least one wave. Out of these individuals, 8127 individuals responded to more than one wave, and 169 individuals responded to only one wave.

Wave	**Timeframe**	**Attrition rate**
Wave 2	April 1 to April 28, 2020	65.10%
Wave 3	April 15, 2020 – May 13, 2020	74.76%
Wave 4	April 29, 2020 – May 26, 2020	76.27%
Wave 5	May 13 - June 9, 2020	76.12%
Wave 6	May 27 - June 23, 2020	76.15%
Wave 7	June 10 - July 8, 2020	75.31%
Wave 8	June 24 - July 22, 2020	72.05%
Wave 9	July 8 - August 5, 2020	74.35%
Wave 10	July 22 - August 19, 2020	75.47%
Wave 11	August 5 - September 2, 2020	73.77%
Wave 12	August 19 - September 16, 2020	74.20%
Wave 13	September 2 - September 30, 2020	74.43%

Wave 14	September 16 - October 14, 2020	72.48%
Wave 15	September 30 - October 27, 2020	72.20%
Wave 16	October 14 - November 11, 2020	73.24%
Wave 17	October 28 - November 25, 2020	73.88%
Wave 18	November 11 - December 9, 2020	71.64%
Wave 19	November 25 - December 23, 2020	71.07%
Wave 20	December 9, 2020 - January 6, 2020	71.22%
Wave 21	December 23, 2020 - January 20, 2020	70.97%
Wave 22	January 6, 2021 - February 3, 2020	72.35%
Wave 23	January 20, 2021 - February 17, 2020	73.04%
Wave 24	February 2, 2021 - March 3, 2021, 2020	74.81%
Wave 25	February 17, 2021 - March 30, 2021	73.13%
Wave 26	March 17, 2021 - April 27, 2021	71.85%
Wave 27	April 14, 2021 - May 25, 2021	71.59%
Wave 28	May 12, 2021 - June 22, 2021	70.65%

Table 1.

Sample size

Group	**N**	**%**
White men	2692	32.45%
White women	3688	44.46%
Non-White women	1224	14.75%
Non-White men	692	8.34%
Total	8296	100.00%

Table 2.

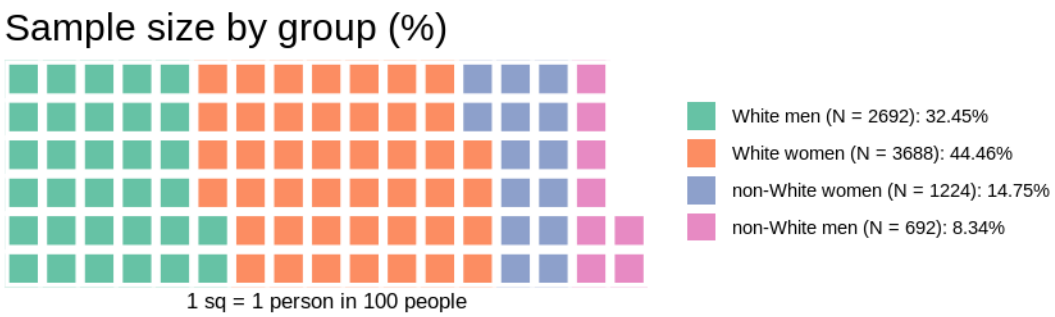

Figure 1.

Sample demographic variables

variable	min	median	mean	max
age	18	49	49.29	110
household income	1 (less than $5,000)	13 ($60,000 to 74,999)	11.24 ($40,000 to 49,999)	16 ($150,000 or more)
education	1 (Less than 1st grade)	11 (Associate degree in college)	11.31 (Associate degree in college)	16 (Doctorate degree)
hospitalized how many family or	0	0	0.21	50

close friends				
died how many family or close friends	0	0	0.11	67
N days in the past seven worked from home	0	1	2.48	7
household size	0	1	1.72	11

Table 3.

Descriptive statistics for the perceived COVID-19 mortality risk by group

Group	M	SD	SEM
White men	15.11	23.88	0.10
White women	17.81	24.50	0.09
non-White men	17.35	23.91	0.21
non-White women	18.50	24.30	0.16

Table 4.

Perceived COVID-19 mortality risk by group over time

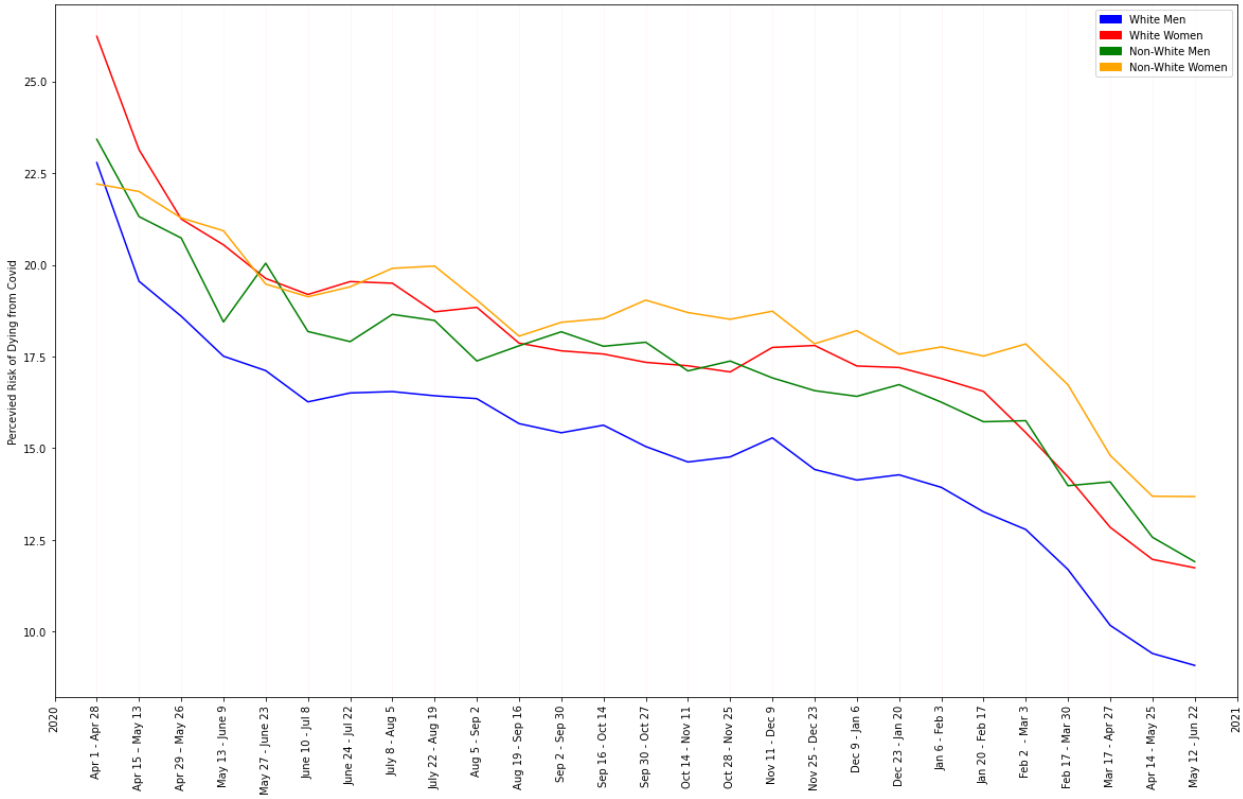

Figure 2.

Descriptive statistics (CDC)

Note: only lab-confirmed cases were included, and entries with missing race or gender information were excluded.

Sample size for recorded cases

Group	N cases
White men	2228681
White women	2511026
non-White men	4380096
non-White women	4735947
Total	13855750

Table 5.

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Sample size for recorded deaths

Group	N deaths
White men	126203
White women	113487
non-White men	134077
non-White women	106053
Total	479820

Table 6.

Representation of COVID-19 mortality by group

Note: Using the ACS microdata analysis tool provided by the U.S. Census Bureau, group represented in the U.S. population is appended to this table for reference.

group	N cases	N deaths	group represented in total deaths %	group represented in population %
White men	2228681	113487	23.65%	37.13%
White women	2511026	126203	26.30%	37.91%
non-White men	4380096	134077	27.94%	12.10%
non-White women	4735947	106053	22.10%	12.86%
total	13855750	479820	100.00%	100.00%
data source	CDC	CDC	U.S. Census	U.S. Census

Table 7.

One-way Repeated Measures ANCOVA

Does perceived risk of COVID-19 mortality differ between groups?

Interpretation: One-way repeated measures ANOVA showed that there is a significant difference in perceived risk of COVID-19 between White men, White women, non-White men, and non-White women. Tukey's post hoc showed that the comparisons between non-White men and non-White women, White men and non-White women, White men and non-White men, and White men and White women are significant. Simple effect analysis includes all controls and random effects terms, which showed that White men have the lowest risk perception. Kruskal-Wallis test

is also performed as a non-parametric analogue of ANOVA, although it does not take into account any controls. The result from the Kruskal Wallis test is also consistent, which is that there are significant differences in perceived risk of COVID-19 between groups.

Equation	*perceived risk of COVID-19 mortality = group + household income + age + education + hospitalized how many family or close friends + died how many family or close friends + N days in the past seven worked from home + household size + (1|wave) + (1|uasid)*

fixed effect	**df**	**SS**	**F value**	**p-value**
group	1	320195	310.005	< 0.001
household income	1	887557	2577.938	< 0.001
age	1	514972	1495.752	< 0.001
education	1	285825	830.186	< 0.001
hospitalized how many family or close friends	1	15391	44.703	< 0.001
died how many family or close friends	1	26	0.076	0.783
N days in the past seven worked from home	1	18717	54.364	< 0.001
household size	1	819	2.377	0.123

Table 8.

Tukey's post-hoc test

comparison	**difference**	**p-value**
non-White women-non-White men	1.150	< 0.001
White men-non-White men	-2.239	< 0.001
White women-non-White men	0.465	0.179
White men-non-White women	-3.389	< 0.001
White women-non-White women	-0.685	0.001

White women-White men	2.704	< 0.001

Table 9.

Simple effect analysis

Controlled means of perceived COVID-19 mortality risk by group

Group	M
White men	9.548
White women	11.671
non-White men	13.048
non-White women	15.319

Table 10.

Kruskal-Wallis test

Non-parametric test to examine group differences in perceived COVID-19 mortality risk

chi-squared	df	p-value
624.90	3	< 0.001

Table 11.

Dunn's test

Non-parametric post hoc test to Kruskal-Wallis

	non-White men	non-White women	White men
non-White women	-0.72		
White men	12.37***	16.15***	
White women	-1.46	-0.78	-23.64***

Table 12.

*p < 0.001***p < 0.01**p < 0.05**

Two-way ANOVAs

Does race interact with gender to predict perceived risk perception of COVID-19 mortality?

Interpretation: A two-way repeated measures ANOVA showed that race and gender have main effects (p < 0.001 for both) in predicting perceived risk of COVID-19 mortality. There was no

interaction effect. A followup linear mixed additive model was created to examine main effects (see LMMs section).

equation	*perceived risk of COVID-19 mortality = race2 x gender + household income + age + education + hospitalized how many family or close friends + died how many family or close friends + N days in the past seven worked from home + household size + (1|uasid) + (1|wave)*

fixed effect	**df**	**SS**	**F value**	**p-value**
Whites	1	930.251	13.150	< 0.001
Men	1	571.248	8.075	< 0.01
age	1	5,487.193	77.565	0.000
household income	1	3,329.516	47.065	0.000
education	1	8,994.235	127.139	0.000
hospitalized how many family or close friends	1	3,174.115	44.868	0.000
died how many family or close friends	1	655.749	9.269	< 0.01
N days in the past seven worked from home	1	9.938	0.140	0.708
household size	1	0.219	0.003	0.956
Whites x men	1	7.010	0.099	0.753

Table 13.

Does time interact with group to predict perceived risk perception of COVID-19 mortality?

Interpretation: A two-way repeated measures ANOVA showed that time and group do not interact to predict perceived risk of COVID-19. A followup linear mixed additive model was created to examine main effects. The results showed that time ($p < 0.001$) and group ($p < 0.001$) have main effects. This means time and group independently predict perceived risk of COVID-19.

equation	*perceived risk of COVID-19 mortality = wave x group2 + household income + age + education + hospitalized how many family or close friends + died how many family or close friends + N days in the past seven worked from home +*

household size + (1|uasid)

fixed effect	df	SS	F value	p-value
wave	1	201780.100	2836.873	< 0.001
White men	1	4085.388	57.437	< 0.001
household income	1	3705.974	52.103	< 0.001
age	1	5206.991	73.206	< 0.001
education	1	8984.198	126.311	< 0.001
hospitalized how many family or close friends	1	3340.909	46.971	< 0.001
died how many family or close friends	1	699.375	9.833	0.002
N days in the past seven worked from home	1	39.594	0.557	0.456
household size	1	0.354	0.005	0.944
wave x White men	1	646.898	9.095	0.003

Table 14.

Linear Mixed Models (LMMs)

Rationale: given the repeated measures (respondents are repeatedly sampled) and longitudinal (respondents are sampled across waves) aspects, simple linear regression is insufficient in capturing the relationship we are interested in. Linear mixed models (LMMs) allow for examining both fixed and random effects, taking into account the repeated sampling aspect by adding a nested random effect term as well as the longitudinal aspect by adding a crossed random effect term. Therefore, the results we obtained take into account that respondents have been sampled repeatedly, and that some respondents may drop out after a few waves while others have remained. The mixed models approach is used across linear and ANOVA models, with the exception of analyzing a subset of respondents who only participated in one wave, since the repeated measures and longitudinal aspects are irrelevant for this subset. For more information on LMMs, refer to references 2-4.

Main model: Is there a relationship between group and perceived risk of COVID-19 mortality?

Interpretation: White men have significantly lower perceived risk of COVID-19 mortality ($p < 0.001$).

Equation	*perceived risk of COVID-19 mortality = group2 + age + household income + education + hospitalized how many family or close friends + died how many family or close friends + N days in the past seven worked from home + household size + (1|wave) + (1|uasid)*

Fixed effects	**correlation**	**SE**	**t-value**	**p-value**
White men	-3.527	0.501	-7.042	< 0.001
age	0.156	0.018	8.572	< 0.001
household income	-0.272	0.038	-7.072	< 0.001
education	-1.245	0.111	-11.182	< 0.001
hospitalized how many family or close friends	0.098	0.015	6.705	< 0.001
died how many family or close friends	0.091	0.030	3.050	0.002
N days in the past seven worked from home	-0.011	0.028	-0.382	0.703
household size	0.002	0.102	0.019	0.985

Table 15.

- Random effects terms: 1|wave, 1|uasid
    - Residual variability in data explained by wave (crossed random effect): 1.22%.
    - Residual variability in data explained by uasid (nested random effect): 79.20%.

Interaction model: Do race and gender interact to predict perceived risk of COVID-19 mortality?

Interpretation: Both linear mixed modeling and two-way ANOVA showed that race and gender do not interact to predict perceived risk of COVID-19 mortality. *This means the association between race and perceived risk of COVID-19* mortality *does not depend on gender, and vice versa. A linear mixed additive model is used to examine main effects. Results show that Whites have significantly lower perceived risk of COVID-19 mortality (p < 0.001), and that men have significantly lower perceived risk of COVID-19 mortality (p < 0.001).*

Equation	*perceived risk of COVID-19 mortality = race2 x gender + age + household income + education + hospitalized how many family or close friends + died how many family or close friends N days in the past seven worked from home + household size + (1|wave) + (1|uasid)*

fixed effect	correlation	SE	t-value	p-value
Whites	-2.497	0.689	-3.626	< 0.001
Men	-2.743	0.965	-2.842	0.005
age	0.160	0.018	8.807	< 0.001
household income	-0.264	0.039	-6.860	< 0.001
education	-1.253	0.111	-11.276	< 0.001
hospitalized how many family or close friends	0.098	0.015	6.698	< 0.001
died how many family or close friends	0.090	0.030	3.045	0.002
N days in the past seven worked from home	-0.010	0.028	-0.375	0.708
household size	0.006	0.102	0.056	0.956
Whites x Men	-0.339	1.077	-0.315	0.753

Table 16.

- Residual variability in data explained by wave (crossed random effect): 1.23%.
- Residual variability in data explained by uasid (nested random effect): 79.13%.

Additive model: Does race or gender predict perceived risk of COVID-19 mortality?

Interpretation:

Equation — *perceived risk of COVID-19 mortality = race2 + gender + age + household income + education + hospitalized how many family or close friends + died how many family or close friends + N days in the past seven worked from home + household size + (1|wave) + (1|uasid)*

fixed effect	correlation	SE	t-value	p-value
Whites	-2.634	0.533	-4.941	< 0.001
Men	-3.005	0.491	-6.126	< 0.001
age	0.160	0.018	8.803	< 0.001
household income	-0.264	0.039	-6.857	< 0.001
education	-1.253	0.111	-11.277	< 0.001

hospitalized how many family or close friends	0.098	0.015	6.698	< 0.001
died how many family or close friends	0.090	0.030	3.044	0.002
N days in the past seven worked from home	-0.010	0.028	-0.373	0.709
household size	0.006	0.102	0.056	0.955

Table 17.

- Residual variability in data explained by wave (crossed random effect): 1.23%.
- Residual variability in data explained by uasid (nested random effect): 79.13%.

Exploratory analysis

Do respondents who dropped out after one wave influence the results?

Interpretation: Excluding respondents who participated in only one wave, results are consistent with those from the full dataset. A linear mixed model showed that White men have significantly lower perceived risk of COVID-19 ($p < 0.001$), whereas a one-way repeated measures ANCOVA showed that there are significant group differences in perceived risk of COVID-19. Finally, Tukey's post hoc and simple effect analysis also showed results that were consistent with those from the full dataset. Further analysis of the respondents who dropped out after one wave showed inconsistent results, although including them in the full dataset using a mixed modeling approach controlling for both crossed and nested random effects, as we did, should most likely still yield accurate outcomes.

One-way repeated measures ANCOVA

equation	*perceived risk of COVID-19 mortality = group + age + household income + education + hospitalized how many family or close friends + died how many family or close friends + N days in the past seven worked from home + household size + (1|wave) + (1|uasid)*

fixed effect	**df**	**SS**	**F value**	**p-value**
group	1	321190	311.007	< 0.001
age	1	445889	1295.255	< 0.001
household income	1	954909	2773.900	< 0.001
education	1	284742	827.143	< 0.001

hospitalized how many family or close friends	1	15420	44.794	< 0.001
died how many family or close friends	1	29	0.083	0.773
N days in the past seven worked from home	1	18948	55.042	< 0.001
household size	1	816	2.371	0.124

Table 18.

Tukey's post-hoc test

group comparison	**difference**	**p-value**
non-White women-non-White men	1.1554	< 0.001
White men-non-White men	-2.2408	< 0.001
White women-non-White men	0.4634	0.1823
White men-non-White women	-3.3962	< 0.001
White women-non-White women	-0.6920	< 0.001
White women-White men	2.7043	< 0.001

Table 19.

Simple effect analysis

group	**M**
non-White men	13.054
non-White women	15.319
White men	9.543
White men	11.667

Table 20.

Linear mixed model

equation *perceived risk of COVID-19 mortality = group2 + age + household income + education + hospitalized how many family or close friends + died how many family or close friends + N days in the past seven worked from home + household size + (1|wave) + (1|uasid)*

fixed effect	correlation	SE	t-value	p-value
group2	-3.598	0.504	-7.143	< 0.001
age	0.154	0.018	8.413	< 0.001
household income	-0.273	0.039	-7.075	< 0.001
education	-1.232	0.112	-10.994	< 0.001
hospitalized how many family or close friends	0.098	0.015	6.704	< 0.001
died how many family or close friends	0.091	0.030	3.056	0.002
N days in the past seven worked from home	-0.010	0.028	-0.350	0.726
household size	0.001	0.102	0.012	0.990

Table 21.

- Residual variability in data explained by wave (crossed random effect): 1.221%.
- Residual variability in data explained by uasid (nested random effect): 79.196%.

How do perceived COVID-19 mortality risks compare with their actual mortality risks?

Interpretation: The test of equal proportions compares two populations. The null hypothesis is that these two populations share equal proportions. Comparing perceived and real risks (N of recorded deaths per group divided by the total N of recorded deaths; provided by CDC as of July 16, 2021) using a chi-squared test, we found that perceived and real risks are not equal (p = 0.695). This means that participants are not accurate in estimating their risks. However, the shared proportion between perceived and real risks for each group shows that White men are worst at estimating their risks (prop = 28.765%), while non-White women are the best at estimating their risks (prop = 40.941%).

Chi-square test

Contingency table

Perceived mortality risk are the controlled means per group.

	White men	White women	non-White men	non-White women
group represented in total deaths %	23.65%	26.30%	27.94%	22.10%
perceived mortality risk %	9.55%	11.67%	13.05%	15.32%

Table 22.

Table 22.

- Chi-squared statistic: 1.445
- Degrees of freedom: 3
- P-value: 0.695

Test of equal or given proportions

White men	White women	non-White men	non-White women
28.765%	30.735%	31.837%	40.941%

Table 23.

References

1. COVID-19 Survey, Understanding America Study (UAS), USC Center for Economic and Social Research
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3. Bates, D., Mächler, M., Bolker, B., & Walker, S. (2014). Fitting linear mixed-effects models using lme4. *arXiv preprint arXiv:1406.5823*.
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11. Covid-19 Much More Fatal for Men, Especially Taking Age into Account , Brookings Institute
12. Comparison of Two Population Proportions, R Tutorial (*test of equal or given proportions*)