

Washington University School of Medicine

Digital Commons@Becker

2020-Current year OA Pubs

Open Access Publications

5-1-2021

The impact of COVID-19 on the well-being and cognition of older adults living in the United States and Latin America

Ganesh M Babulal

Ana Baena

Jorge Llibre-Guerra

et al

Follow this and additional works at: https://digitalcommons.wustl.edu/oa_4



ELSEVIER

Contents lists available at ScienceDirect

EClinicalMedicine

journal homepage: www.elsevier.com/locate/eclinm

Research paper

The impact of COVID-19 on the well-being and cognition of older adults living in the United States and Latin America

Ganesh M. Babulal^{a,1}, Valeria L. Torres^{b,1}, Daisy Acosta^c, Cinthya Agüero^b, Sara Aguilar-Navarro^d, Rebecca Amariglio^b, Juliana Aya Ussui^b, Ana Baena^{a,e}, Yamile Bocanegra^e, Sonia Maria Dozzi Brucki^f, Julian Bustin^g, Diego M. Cabrera^h, Nilton Custodioⁱ, Monica M. Diaz^{h,j}, Lissette Duque Peñailillo^k, Idalid Franco^b, Jennifer R. Gatchel^b, Ana Paola Garza-Naveda^b, Mariana González Lara^l, Lidia Gutiérrez-Gutiérrez^d, Edmarie Guzmán-Vélez^b, Bernard J. Hanseeuw^{b,m}, Ivonne Z. Jimenez-Velazquezⁿ, Tomás León Rodríguez^o, Jorge Llibre-Guerra^a, María J. Marquine^p, Jairo Martinez^b, Luis D. Medina^q, Claudia Miranda-Castillo^r, Alejandra Morlett Paredes^s, Diana Munera^b, Alberto Nuñez-Herrera^k, Maira Okada de Oliveira^t, Santiago J. Palmer-Cancel^u, Enmanuelle Pardilla-Delgado^b, Jaime Perales-Puchalt^v, Celina Pluim^b, Liliana Ramirez-Gomez^b, Dorene M. Rentz^b, Claudia Rivera-Fernández^w, Monica Rosselli^x, Cecilia M Serrano^y, Maria Jose Suing-Ortega^d, Andrea Slachevsky^o, Marcio Soto-Añari^z, Reisa A. Sperling^b, Fernando Torrente^g, Daniela Thumala^{aa}, Patrizia Vannini^b, Clara Vila-Castelar^b, Tatiana Yañez-Escalante^w, Yakeel T. Quiroz^{b,*}

^a Washington University School of Medicine, St Louis, MO, USA^b Massachusetts General Hospital, Harvard Medical School, 1st Avenue, Suite 101, Boston 02129, MA, USA^c Universidad Nacional Pedro Henríquez Ureña, Santo Domingo, Dominican Republic^d Department of Geriatrics, Instituto Nacional de Ciencias Médicas y Nutrición "Salvador Zubiran" Mexico City, Mexico^e Grupo de Neurociencias de Antioquia, Universidad de Antioquia, Medellín, Colombia^f University of São Paulo, Department of Neurology, São Paulo, Brasil^g Institute of Cognitive and Translational Neuroscience (INCYT), INECO Foundation, Favaloro University, CONICET, Buenos Aires, Argentina^h Universidad Peruana Cayetano Heredia, Lima, Peruⁱ Unit Cognitive Impairment and Dementia Prevention, Peruvian Institute of Neurosciences, Lima, Peru^j Department of Neurology, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA^k Cognitive Disorders Unit – Neuromedicenter, Quito, Ecuador^l National Institute of Geriatrics, Mexico City, Mexico^m Neurology Department, Cliniques Universitaires Saint-Luc, Belgiumⁿ Geriatrics Division, Internal Medicine Department, University of Puerto Rico, Medical Sciences Campus, San Juan, Puerto Rico^o Memory and Neuropsychiatric Clinic (CMYN), Neurology Department, Del Salvador Hospital and University of Chile School of Medicine, Santiago, Chile^p University of California San Diego, Department of Psychiatry, San Diego, CA, USA^q University of Houston, Department of Psychology, Houston, TX, USA^r Faculty of Nursing Universidad Andres Bello, Millennium Institute for Research in Depression and Personality, Santiago, Chile^s University of California San Diego, Department of Neuroscience, San Diego, CA, USA^t University of São Paulo, Department of Neurology; São Paulo, Brasil^u Ponce Health Sciences University, School of Behavioral and Brain Sciences, Ponce, Puerto Rico^v University of Kansas Alzheimer's Disease Center, Fairway, KS, USA^w Universidad Nacional de San Agustín de Arequipa, Perú^x Florida Atlantic University, Davie, FL, USA^y Neurology Department, Cesar Milstein Hospital, Buenos Aires, Argentina^z Universidad Católica San Pablo, Arequipa, Perú^{aa} Psychology Department, Social Sciences Faculty, University of Chile, Geroscience Center for Brain Health and Metabolism (GERO), Santiago, Chile

ARTICLE INFO

Article history:

Received 29 November 2020

Revised 24 March 2021

Accepted 29 March 2021

Available online 27 April 2021

Keywords:

COVID-19

<https://doi.org/10.1016/j.eclinm.2021.100848>

2589-5370/© 2021 The Authors. Published by Elsevier

Latin America

Diversity

Well-being

Cognition

ABSTRACT

Background: In the COVID-19 pandemic, older adults from vulnerable ethn racial groups are at high risk of infection, hospitalization, and death. We aimed to explore the pandemic's impact on the well-being and cognition of older adults living in the United States (US), Argentina, Chile, Mexico, and Peru.

Methods: 1,608 (646 White, 852 Latino, 77 Black, 33 Asian; 72% female) individuals from the US and four Latin American countries aged ≥ 55 years completed an online survey regarding well-being and cognition during the pandemic between May and September 2020. Outcome variables (pandemic impact, discrimination, loneliness, purpose of life, subjective cognitive concerns) were compared across four US ethn racial groups and older adults living in Argentina, Chile, Mexico, and Peru (<http://www.elsevier.com/licenses/by-nc-nd/4.0/>)

Findings: Mean age for all participants was 66.7 ($SD = 7.7$) years and mean education was 15.4 ($SD = 2.7$) years. Compared to Whites, Latinos living in the US reported greater economic impact ($p < .001$, $\eta^2 = 0.021$); while Blacks reported experiencing discrimination more often ($p < .001$, $\eta^2 = 0.050$).

Research in context

Evidence before this study

A PubMed search from January 1 to October 21, 2020, using the terms “(COVID-19 OR SARS-CoV2) AND (ethnoracial OR race OR ethnicity) AND (older OR elderly adult) AND (discrimination OR loneliness OR life purpose OR subjective cognitive concerns) AND (LMICs OR low income country OR middle income country OR Latin America)”. Only a handful of studies retrieved appeared relevant and discussed the importance of social distancing, resources in LMICs, and data limitations in addressing inequities in the pandemic. We were unable to find a single study that examined the impact of the pandemic and psychosocial outcomes in ethnoracial groups in Latin America and the US.

Added value of this study

In the US, Latinos indicated more economic challenges, while Black older adults reported more perceived discrimination than other groups in the US. Latinos living in Chile, Mexico, and Peru experienced higher pandemic impact than those in the US. In contrast, those in Argentina, Chile, and Peru experienced lower perceived discrimination than Latinos residing in the US. These findings provide evidence that the pandemic burden is different for non-White individuals and those in low-and-middle-income countries.

Implications of all the available evidence

Discrimination, loneliness, life purpose, and memory concerns deeply influence an individual's health and interact with social determinants of health. Ethnoracial groups and older adults are at a higher risk for health disparities, and COVID-19 exponentially increases mortality and morbidity risks. Future studies should examine between-country differences and also how mediators like income and coping skills modify the pandemic's impact.

1. Introduction

The spread of Coronavirus Disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was declared a pandemic on March 11, 2020, by the World Health Organization [1]. To date, the worldwide impact grosses over 124 million cases, with over 2.74 million deaths [2]. Many countries continue to report higher cases and related deaths. The Centers for Disease Control and Prevention (CDC) reported over 29.9 million cases and over 544,000 deaths in the US, resulting from the pandemic (1/21/20–3/24/2021) [3]. Risk is increased through physical contact, enclosed environments, and longer exposure duration [4]. Sociobiological risk factors, older age, and pulmonary and cardiovascular comorbidities increase the risk of poor outcomes [5,6]. In the United States (US), healthcare disparities are exacerbated for ethnic and racial (ethnoracial) groups [7]. Compared to non-Latino Whites, the CDC reports higher rate ratios of cases (2.8, 2.6), hospitalizations (4.6, 4.7), and deaths (1.1, 2.1) among Latino and Black individuals, respectively [8]. A higher number of Latinos and Blacks have several of the aforementioned risk factors, increasing the risk for a more severe course if infected [9].

Long-term recovery is complicated by comorbidities, psychological sequelae, and lingering symptoms/deconditioning post-

treatment [10,11]. For Latinos and Blacks, a greater multifactorial risk of COVID-19 encompasses long-standing systemic structures that restrict access to a complex healthcare system needed to create, sustain, and protect life beyond biological processes [12,13]. Greater perceived loneliness, lower life purpose, higher memory concerns, and greater discrimination are associated with poorer health outcomes and higher mortality among older adults [14–17]. Moreover, loneliness, and depression are related to subjective experiences like social isolation or perceived stress [18]. Ethnicity and culture can influence the development of these symptoms among elderly populations [19]. Preventative measures and national mandates emphasizing shelter-in-place/stay-at-home likely exacerbate stress, isolation, and discrimination for vulnerable populations [20]. The pandemic's impact extends to low- and middle-income countries (LMICs) with differential effects resulting from access to screening/testing, policies mandating work, school, travel, and reporting of COVID-19 cases and deaths. LMICs encounter challenges with more fragile supply chains, collectivistic-based households promoting higher transmission, and less developed sanitation systems [21,22].

There are limited data on the impact of COVID-19 on ethnoracial groups and whether those in LMICs face greater challenges than those in the US [23]. This study presents baseline data from an ongoing international effort entitled, “The Impact of COVID-19 on Well-being and Cognition in Older Ethnically Diverse Individuals,” launched in May, 2020. This study investigates if differences exist in cognitive concerns, loneliness, life purpose, perceived discrimination, and pandemic impact among older adults across ethnoracial groups living in the US, and in Latin American countries. We hypothesize that 1) Latinos and Blacks living in the US will be more impacted by the pandemic compared to non-Latino Whites and 2) that older individuals living in Argentina, Chile, Mexico, and Peru will encounter more burden compared to their Latino counterparts living in the US.

2. Methods*2.1. Design and sampling*

We report cross-sectional findings from an ongoing, longitudinal study of the general noninstitutionalized older adult population (55 years or older). The sample is non-probabilistic and was selected based on convenience in the US and several Latin American Spanish-speaking countries (Argentina, Chile, Mexico, Peru).

2.2. Procedure

A group of researchers from the US and 14 Latin American countries formed in May 2020. The survey was launched simultaneously in the US and Latin America. The first survey was completed on May 15th, 2020, and the last survey data included in this study was completed on September 9th, 2020. Participants were recruited via social media outlets (e.g., Twitter, Facebook), researcher's contacts (family, friends, ongoing studies), virtual meetings, and word-of-mouth. All participants completed a one-hour survey (online with a computer or smartphone or via phone call with a researcher) in English ($n = 844$) or Spanish ($n = 852$). Study data were collected, accessed (VLT & YTQ), and managed in REDCap (Research Electronic Data Capture) [24] hosted at Massachusetts General Hospital. All measures were forward-and-back translated to Spanish following World Health Organization guidelines [25].

* Corresponding author.

E-mail address: yquiroz@mg.harvard.edu (Y.T. Quiroz).¹ Indicates shared authorship.

2.3. Ethical considerations

The study was approved by the Massachusetts General Brigham Human Research Review Board, and Local Institutional Review Boards from Puerto Rico (Ponce Medical School Foundation, Ponce Research Institute), Perú (Universidad Católica San Pablo, Comité de Ética de la Dirección de Investigación), México (Instituto Nacional de Ciencias y Nutrición Salvador Zubirán, Comité de Ética en Investigación), Chile (Universidad de Chile, Comité de Ética de Investigación en Seres Humanos), Ecuador (Neuromedicenter: Unidad de Trastornos Cognitivos – Centro Diurno), República Dominicana (Universidad Nacional Pedro Henríquez Ureña), and Argentina (Fundación Falvaloro Hospital Universitario, Comité de Ética en Investigación). All participants provided online consent.

2.4. Outcome variables/questionnaires

Participants completed a sociodemographic questionnaire, self-report measures, and indicated the country of residence. Ethnoracial group was assessed with two US Census questions about self-identified race (e.g., White, Black, Asian) and ethnicity (Latino versus Non-Latino). Use of White, Black, and Asian entail non-Hispanic origin. For US comparisons, Latinos were grouped irrespective of their race, whereas non-Latino individuals were separated by race.

The Epidemic-Pandemic Impacts Inventory (EPII) [26] was used to measure overall impact. This is a newly developed questionnaire for assessing the coronavirus pandemic's impact on personal and family life including employment, education, home life, social activities, economic, emotional health and well-being, physical health, physical distancing and quarantine, infection history, and positive change. Greater subscale and total scores suggest more burden, except for the positive change subscale, in which higher scores suggest less burden (See Appendix A).

The Everyday Discrimination Scale [27] (Short Version) [28] asks about experiences of unfair treatment in day-to-day life. Higher scores indicate greater perceived discrimination. The Everyday Cognition (ECog) Scale [29] is a subjective measure of current cognitive daily abilities compared with past abilities (ten years earlier). The 7-Memory questionnaire measures subjective memory concerns (SMC) [30,31]. Higher scores indicate greater memory concerns. The De Jong Gierveld Loneliness Scale [32] measures overall emotional and social loneliness across six items. Higher scores indicate greater loneliness. The Life Purpose Questionnaire [33] is a modified 10-item measure of Psychological Well-Being [34]. Higher scores indicate greater purpose in life.

2.5. Statistical analyses

Descriptive statistics using student's *t*-test and Chi-square examined group differences in demographic variables. In the US sample, one-way univariate general linear models (GLM) compared four ethnoracial groups across six outcome measures. Additionally, ten one-way GLM compared the groups in the ten EPII subscales. Age (years, continuous), education (years, continuous), and sex (male/female, dichotomous) were included as covariates in all analyses. The ten models using EPII as the outcome were adjusted for multiple comparisons using Bonferroni correction ($\alpha = 0.005 [0.05/10]$) [35]. Additional one-way GLM analyses were used to compare each Latin American country and the US Latinos in the EPII subscales and the five outcome measures. For each set of analyses, the Bonferroni correction described above was included to correct for multiple comparisons in the EPII subscales.

Pearson correlations examined the relationship between the EPII total and the five outcome measures. Finally, three one-way GLM compared the groups in the EPII total, including the Loneliness scale, Life Purpose Questionnaire, and ECog Total as covari-

ates. Parallel GLM models were repeated comparing each individual country (Argentina, Chile, Mexico, and Peru) to Latinos residing in the US. Mean substitution was used for the corresponding ethnoracial group for eight participants with missing educational data. Analyses were conducted in SPSS version 27 (Chicago, IL, USA).

2.6. Role of the funding source

The funding source(s) had no involvement in the study design, data collection, analysis, or interpretation.

3. Results

3.1. Participants

The initial sample included 1845 participants. The following were excluded: thirteen participants who reported living outside of the United States or Latin America; nine participants who reported being born outside of the United States or Latin America; eight participants who were statistical outliers; thirty-four participants who did not report their ethnicity/cultural background; and 26 participants who reported 'Other' ethnicities. Due to low participation among Native American ($n = 6$) and Native Hawaiian or Pacific Islander ($n = 2$) participants, these individuals were also removed from the analyses. Similarly, due to a lower number of survey responses (<50), 139 participants were removed across 10 Latin American countries (Fig. 1). The final sample ($N = 1608$) included: 646 non-Latino White, 717 Latino, 77 Black, and 33 Asian individuals. The sample included 135 (15.8%) Latinos living in the US and 717 living in the four Latin American countries; Argentina ($n = 106$), Chile ($n = 151$), Mexico ($n = 308$), and Peru ($n = 152$). The mean age of the total sample was 66.74 years (range 55–95), 15.4 mean years of education (range 0–26), and an average of 72.3% females (range 67–87%) across the groups (Tables 1 and 2). In the Black group, there was a slightly higher percentage (84%) of females compared to males. Within the US sample, 64 (7.2%) participants reported having experienced COVID-19 symptoms, six reported having been tested and currently having the disease, and 11 reported having tested positive for the disease but no longer being symptomatic. Within Argentina, Chile, Mexico, and Peru, 10 (1.4%) reported having experienced COVID-19 symptoms, 5 reported having been tested and currently having the disease, and 20 reported having tested positive for the disease (Table 2). The US sample had 59.4% married/in a civil union with similar proportions across ethnoracial groups, but a higher proportion of single individuals in the Black sample, $\chi^2 (3, [n = 889], p = .028$. Self-reported household income (low/middle and high) did not differ between the ethnoracial groups. There were no differences between older individuals residing in Argentina, Chile, Mexico, or Peru, when compared to those living in the US on marital status or household income (Table 2).

3.2. Ethnoracial differences in the US

In the US, the ethnoracial groups differed in age, where the White group was older than the Latino group ($p < 0.001$). Years of education differed between the groups ($p < 0.001$), specifically between Whites and Latinos ($p = .012$), and Asians and Latinos ($p = .001$). Whites and Asians reported higher education than Latinos. Latinos reported higher economic impact suggesting more financial hardships on the EPII compared to Whites ($p < .001$) and Blacks ($p = .01$). The Black and Latino participants reported more positive change on the EPII than White participants (all $p < .001$), suggesting more positive reframing and coping with the pandemic. On the self-report of everyday perceived discrimination, Blacks experienced everyday discrimination more often than the other

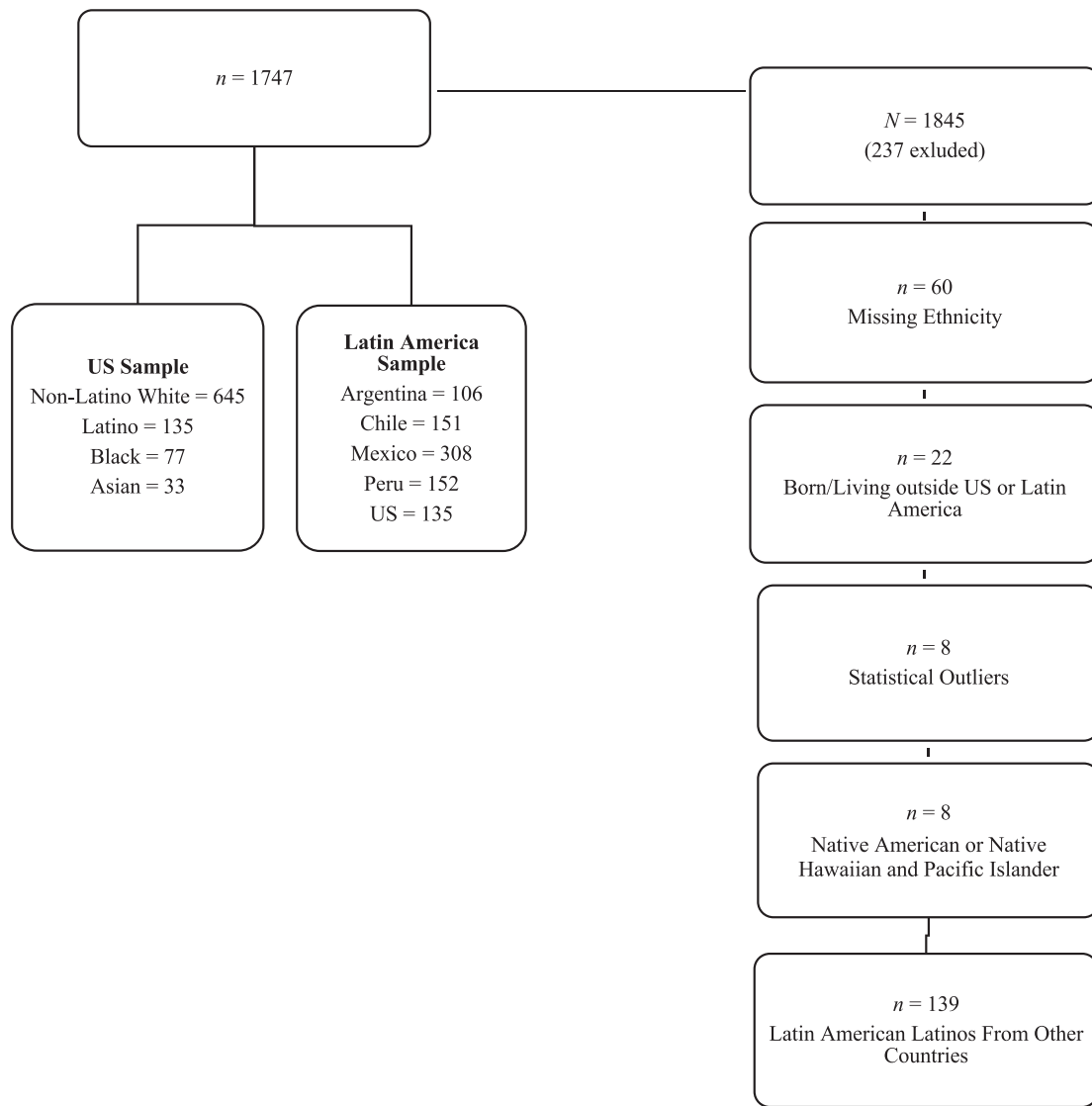


Fig. 1. Study flowchart of participants.

groups, (all $p < .001$). There were no between-group differences on the EPII total or its subscales, the 7-Memory Questionnaire, Loneliness Scale, Life Purpose Questionnaire, or ECog Total (Table 3).

The EPII total significantly correlated (all $p < .001$ —low magnitude) with the Loneliness scale ($r = 0.35$), Life Purpose Questionnaire ($r = -0.20$), ECog Total ($r = 0.23$), Discrimination scale ($r = 0.37$), and 7-Memory Questionnaire ($r = 0.29$) [Fig. 2].

The inclusion of the Loneliness scale, Life Purpose Questionnaire, and ECog Total into the models examining the EPII were significant as main effects (all $p < .001$) and improved the models, as indicated by an increased adjusted R^2 value from 0.060 in the original model to 0.186, 0.108, and 0.119, respectively. A significant interaction ($p = .014$) between the ethnoracial groups and the ECog suggested that the Black participants who reported more cognitive concerns also reported greater pandemic impacts than the other groups Fig. 3.

3.3. Between country comparisons

A total of 717 individuals reported living in 4 Latin American countries (Argentina: 106, Chile: 151, Mexico: 308, Peru: 152) and 135 Latinos reported living in the US. Outcome measures were compared among respondents from the four Latin Ameri-

can countries and Latinos living in the US (See Table 4). Argentinians reported greater pandemic effects on the Education and Training subscale ($p = .001$), compared to the US Latinos. Chileans also reported greater detrimental effects in Education and Training ($p < .001$) and less discrimination than US Latinos ($p = .006$). Mexicans had a higher EPII total score, indicating greater overall pandemic effects ($p < .001$), including the Education and Training ($p < .001$), Home Life ($p = .002$), and Economic effect ($p < .001$) subscales. Conversely, Mexicans reported experiencing greater Positive Change ($p = .001$) and more subjective memory concerns ($p = .010$) than US Latinos. Peruvians had higher EPII total scores ($p < .001$), as well as higher scores in the Economic ($p < .001$), Physical Distancing ($p < .001$), Infection History ($p < .001$), and positive change ($p = .001$) subscales.

Among Latinos living in the US, 112 (83%) reported having lived in the country for over 20 years, eight reported living 15–20 years, and the rest lived for less than 15 years. There were no differences in age for Latinos living in the US with those residing in Chile, Mexico, or Peru; however, those living in Argentina were slightly older ($p < .001$). There were no differences in levels of education.

Within the US Latinos, scores on the EPII total significantly correlated with the Loneliness scale ($r = 0.32$, $p = .001$) and Dis-

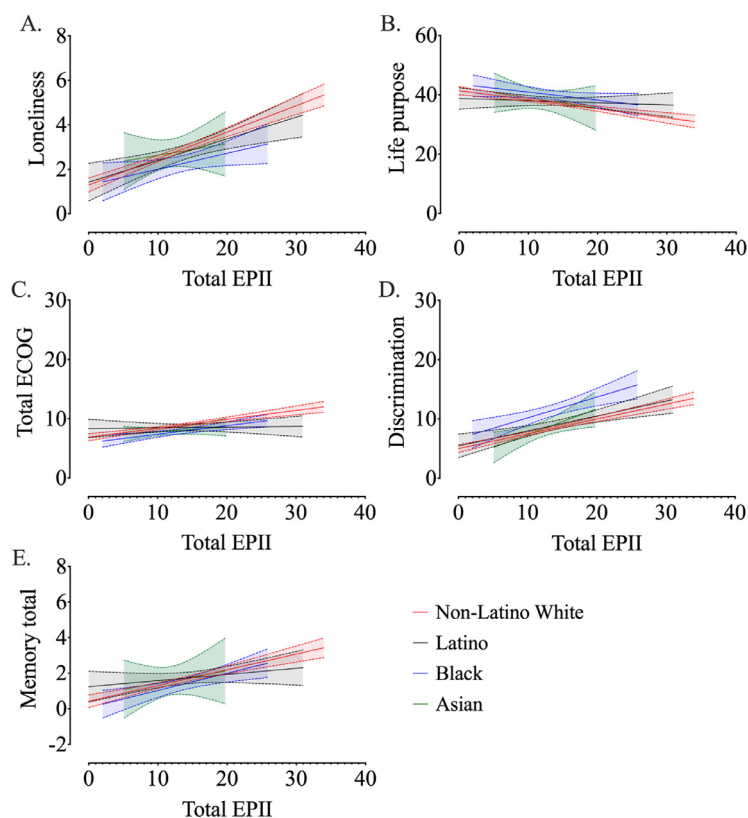


Fig. 2. Associations Between Total EPII and Outcome Measures in the US participants. EPII = Epidemic-Pandemic Impacts Inventory; ECog = Everyday Cognition Scale. A) Correlation between De Jong Gierveld Loneliness Scale and Total EPII; B) Correlation between Life Purpose Questionnaire and Total EPII; C) Correlation between Total ECog and Total EPII; D) Correlation Between Discrimination Scale and Total EPII; E) Correlation between 7-Memory Questionnaire and Total EPII.

crimination scale ($r = 0.32, p < .001$). Within the Argentinian participants, scores on the EPII total significantly correlated with the Loneliness scale ($r = 0.21, p = .028$), Discrimination scale ($r = 0.27, p = .006$), and 7-Memory Questionnaire ($r = 0.24, p = .015$). Within the Latinos in Chile, scores on the EPII total significantly correlated (all $p < .001$ —low magnitude) with the Loneliness scale

($r = 0.48$), ECog Total ($r = 0.21, p = .010$), Discrimination scale ($r = 0.43$), and 7-Memory Questionnaire ($r = 0.35$). Within the Mexican participants, scores on the EPII total significantly correlated (all $p < .001$ —low magnitude) with the Loneliness scale ($r = 0.41$), Life Purpose Questionnaire ($r = -0.15; p = .007$), ECog Total ($r = 0.28$), Discrimination scale ($r = 0.33$), and 7-Memory

Table 3
Mean differences in outcome measures in the US between ethnoraical groups.

	United States Sample				p	η_p^2
	Ethnoraical Group					
	Non-Latino White M (SE)	Latino M (SE)	Black M (SE)	Asian M (SE)		
EPII Work and Employment	0.84 (0.06)	0.82 (0.11)	0.66 (0.15)	0.79 (0.22)	0.69	.002
EPII Education and Training	0.07 (0.01)	0.12 (0.03)	0.12 (0.03)	0.06 (0.05)	0.26	.005
EPII Home Life	0.45 (0.04)	0.42 (0.08)	0.74 (0.11)	0.23 (0.16)	0.03	.010
EPII Social Activities	5.05 (0.09)	5.18 (0.18)	5.48 (0.24)	4.67 (0.35)	0.18	.005
EPII Economic	0.20 (0.03)	0.49 (0.05)	0.24 (0.07)	0.29 (0.10)	< 0.001†	.031
EPII Emotional Health and Well-Being	1.91 (0.06)	1.99 (0.12)	1.73 (0.16)	1.46 (0.23)	0.14	.006
EPII Physical Health Problems	2.54 (0.07)	2.65 (0.14)	2.54 (0.18)	2.37 (0.27)	0.79	.001
EPII Physical Distancing and Quarantine	1.47 (0.06)	1.62 (0.12)	1.27 (0.16)	1.37 (0.23)	0.30	.004
EPII Infection History	0.16 (0.02)	0.25 (0.04)	0.23 (0.06)	0.12 (0.09)	0.17	.006
EPII Positive Change	6.02 (0.15)	7.46 (0.31)	8.07 (0.42)	6.35 (0.61)	< 0.001†	.040
EPII Total	12.69 (0.24)	13.54 (0.49)	12.99 (0.65)	11.34 (0.95)	0.17	.006
7-Memory Questionnaire	1.59 (0.08)	1.66 (0.17)	1.44 (0.22)	1.76 (0.33)	0.82	.001
De Jong Gierveld Loneliness Scale	2.87 (0.08)	2.76 (0.17)	2.34 (0.21)	2.81 (0.31)	0.11	.007
Life Purpose Questionnaire	37.30 (0.32)	37.93 (0.66)	39.39 (0.87)	37.48 (1.28)	0.12	.007
Discrimination Scale	8.41 (0.17)	8.94 (0.35)	11.62 (0.47)	8.10 (0.69)	< 0.001*	.050
ECog Total	8.92 (0.14)	8.46 (0.28)	8.08 (0.36)	8.19 (0.53)	0.05	.009

Abbreviations: M = Mean; SE = Standard Error; EPII = Epidemic-Pandemic Impacts Inventory; ECog = Everyday Cognition Scale.

† $p < .005$ (Adjusted for Bonferroni correction).

* $p < .05$.

Table 1
Demographic Characteristics of the US Participants.

	United States Sample												p
	Non-Latino White			Latino			Black			Asian			
	M	SD	n	M	SD	n	M	SD	n	M	SD	n	
Age	67.72	7.67	645	64.53	7.30	135	66.40	6.95	77	66.27	8.37	33	< 0.001
Education	15.93	2.06	645	15.28	2.99	135	16.09	1.91	77	16.91	1.23	33	< 0.001
Sex Male			171			27			10			11	
Female			474			107			65			22	
Marital Status			250 (38.8%)			57 (42.2%)			43 (55.8%)			11 (33.3%)	
Not Single			394 (61.2%)			78 (57.8%)			34 (44.2%)			22 (66.7%)	
Income			525 (82.9%)			118 (89.4%)			67 (87.0%)			25 (75.8%)	
Low/Medium			108 (17.1%)			14 (10.6%)			10 (13.0%)			8 (24.2%)	
High			48 (5.5%)			9 (1.0%)			6 (0.7%)			1 (0.1%)	
COVID-19 Symptoms			2 (0.2%)			4 (0.4%)			0 (0.0%)			0 (0.0%)	
Positive test and current symptoms			7 (0.8%)			4 (0.4%)			0 (0.0%)			0 (0.0%)	
Positive test no current symptoms													

Abbreviations: M = Mean; SD = Standard Deviation.

Table 2
Demographic Characteristics of the Latino Participants by Country.

	Latino Sample														p	
	Country															
	Argentina			Chile			Mexico			Peru			USA			
	M	SD	n (%)	M	SD	n (%)	M	SD	n (%)	M	SD	n (%)	M	SD	n (%)	
Age	69.36	6.69	106	66.10	7.35	151	65.42	7.99	308	66.41	7.72	152	64.53	7.30	135	<0.001
Education	14.97	2.27		16.33	1.54		14.97	3.03		12.65	3.99		15.28	2.99		<0.001
Sex Male			34 (32.08%)			59 (39.07%)			75 (24.35%)			57 (37.50%)			27 (20%)	
Female			72 (67.92%)			92 (60.93%)			233 (75.65%)			95 (62.50%)			107 (79.26%)	
Marital Status			38 (35.85%)			60 (39.74%)			158 (51.30%)			49 (32.24%)			57 (42.22%)	
Not Single			68 (64.15%)			91 (60.26%)			150 (48.70%)			103 (67.76%)			78 (57.78%)	
Income			91 (85.85%)			121 (80.13%)			300 (97.40%)			145 (95.39%)			118 (87.41%)	
Low/Middle			13 (12.26%)			30 (19.87%)			4 (1.30%)			7 (4.61%)			14 (10.37%)	
High			106 (100%)			148 (98.01%)			304 (98.70%)			149 (98.03%)			135 (100%)	
COVID-19 Symptoms			0			3 (1.99%)			4 (1.30%)			3 (1.97%)			0	
Yes			106 (100%)			149 (98.68%)			306 (99.35%)			151 (99.34%)			131 (97.04%)	
test Yes			0			2 (1.32%)			2 (0.65%)			1 (0.66%)			4 (2.96%)	
Positive test			106 (100%)			148 (98.01%)			300 (97.40%)			143 (94.08%)			131 (97.04%)	
test Yes			0			3 (1.99%)			8 (2.60%)			9 (5.92%)			4 (2.96%)	

Abbreviations: M = Mean; SD = Standard Deviation.

Current symptoms

Table 4
Mean differences in outcome measures in US Latinos and Latinos in Argentina, Chile, Peru, and Mexico.

	US M (SE)	Argentina M (SE)	p	η_p^2	US M (SE)	Chile M (SE)	p	η_p^2	US M (SE)	Mexico M (SE)	p	η_p^2	US M (SE)	Peru M (SE)	p	η_p^2
EPII Work and Employment	0.93 (.14)	1.20 (.14)	0.15	.009	1.01 (.14)	1.40 (.12)	0.03	.017	1.07 (.13)	1.38 (.09)	0.03	.010	1.04 (.13)	1.46 (.11)	0.02	.021
EPII Education and Training	0.09 (.04)	0.30 (.05)	0.001 [†]	.047	0.14 (.04)	0.34 (.04)	<0.001 [†]	.043	0.11 (.05)	0.45 (.03)	<0.001 [†]	.079	0.16 (.03)	0.09 (.03)	0.12	.009
EPII Home Life	0.46 (.09)	0.52 (.10)	0.70	.001	0.45 (.10)	0.62 (.09)	0.20	.006	0.51 (.12)	0.92 (.08)	0.002 [†]	.022	0.50 (.10)	0.61 (.08)	0.38	.003
EPII Social Activities	5.29 (.19)	4.84 (.20)	0.09	.013	5.37 (.20)	5.10 (.17)	0.29	.004	5.26 (.20)	5.14 (.13)	0.56	.001	5.30 (.18)	5.76 (.16)	0.06	.013
EPII Economic	0.55 (.11)	0.91 (.12)	0.02	.023	0.50 (.09)	0.63 (.08)	0.29	.004	0.51 (.12)	1.40 (.08)	<0.001 [†]	.092	0.50 (.10)	1.17 (.08)	<0.001 [†]	.095
EPII Emotional Health and Well-Being	1.97 (.14)	2.23 (.15)	0.19	.007	2.09 (.14)	2.26 (.12)	0.35	.003	2.06 (.13)	2.43 (.09)	0.01	.014	2.13 (.13)	1.91 (.12)	0.22	.005
EPII Physical Health Problems	2.71 (.14)	3.02 (.15)	0.11	.011	2.75 (.15)	3.17 (.13)	0.03	.018	2.71 (.15)	2.93 (.10)	0.20	.004	2.62 (.15)	2.43 (.13)	0.33	.003
EPII Physical Distancing and Quarantine	1.75 (.14)	2.01 (.15)	0.19	.007	1.65 (.14)	2.09 (.12)	0.02	.020	1.70 (.14)	2.00 (.10)	0.06	.008	1.55 (.15)	2.30 (.13)	<0.001 [†]	.049
EPII Infection History	0.28 (.05)	0.07 (.05)	0.002 [†]	.042	0.31 (.06)	0.28 (.05)	0.64	.001	0.29 (.06)	0.40 (.04)	0.08	.007	0.29 (.07)	0.93 (.06)	<0.001 [†]	.146
EPII Positive Change	7.70 (.34)	7.53 (.36)	0.73	.001	7.92 (.34)	8.53 (.30)	0.17	.007	7.90 (.30)	9.06 (.21)	0.001 [†]	.027	7.78 (.30)	9.10 (.26)	0.001 [†]	.037
EPII Total	14.02 (.54)	15.09 (.57)	0.16	.009	14.26 (.57)	15.88 (.51)	0.03	.017	14.22 (.58)	17.04 (.40)	<0.001 [†]	.042	14.08 (.54)	16.66 (.47)	<0.001 [†]	.045
7-Memory Questionnaire	1.65 (.17)	1.05 (.18)	0.01*	.028	1.67 (.17)	1.59 (.15)	0.72	.000	1.74 (.19)	2.28 (.13)	0.01	.015	1.70 (.17)	2.00 (.15)	0.19	.006
De Jong Gierveld Loneliness Scale	2.67 (.18)	2.18 (.18)	0.05*	.019	2.79 (.18)	2.71 (.17)	0.73	.001	2.71 (.19)	2.66 (.13)	0.81	<.0001	2.88 (.18)	2.77 (.14)	0.64	.001
Life Purpose Questionnaire	38.01 (.74)	37.22 (.79)	0.44	.003	37.83 (.66)	38.44 (.58)	0.48	.002	37.74 (.69)	37.56 (.48)	0.82	>.0001	37.95 (.70)	39.25 (.61)	0.16	.007
Discrimination Scale	9.06 (.41)	7.29 (.43)	0.002*	.040	9.43 (.41)	7.96 (.36)	.006*	.027	9.24 (.40)	8.77 (.28)	0.30	.002	9.11 (.34)	6.93 (.30)	<0.001*	.077
ECog Total	8.61 (.29)	8.03 (.30)	0.15	.009	8.64 (.27)	8.06 (.23)	.09	.010	8.58 (.29)	8.94 (.20)	0.26	.003	8.62 (.31)	9.58 (.27)	0.02*	.020

Abbreviations: M = Mean; SE = Standard Error; EPII = Epidemic-Pandemic Impacts Inventory; ECog = Everyday Cognition Scale.

[†] $p < .005$ (Adjusted for Bonferroni correction)

* $p < .05$

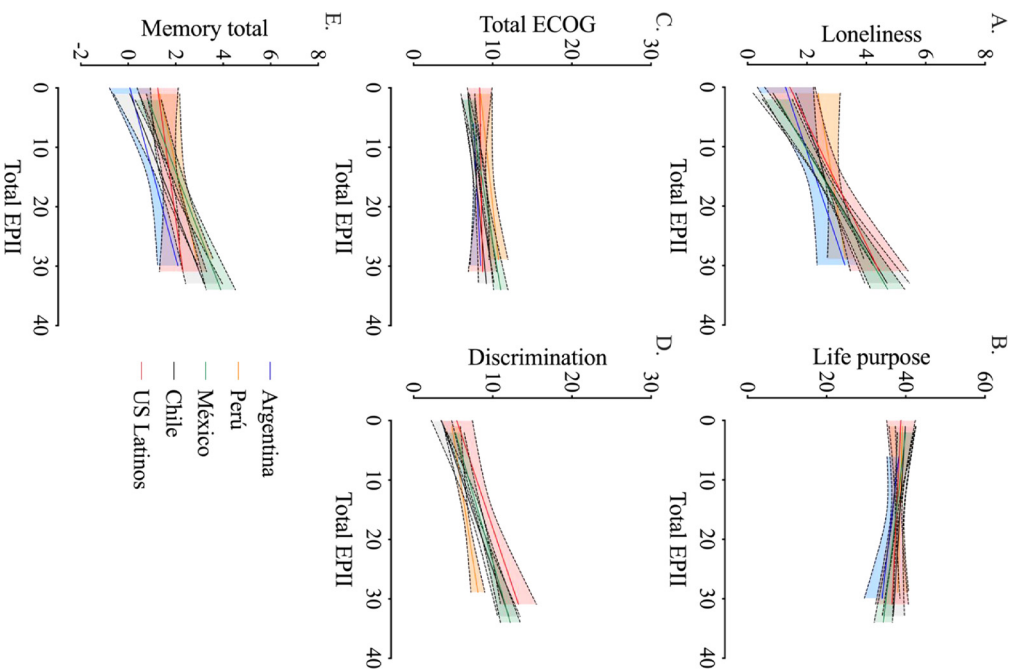


Fig. 3. Associations between Total EPII and outcome measures in the Latino participants, including those residing in the US and those residing in Mexico, Chile, Argentina and Peru. EPII = Epidemic-Pandemic Impacts Inventory; ECog = Everyday Cognition Scale. A) Correlation between De Jong Gierveld Loneliness Scale and Total EPII; B) Correlation between Life Purpose Questionnaire and Total EPII; C) Correlation between Total ECog and Total EPII; D) Correlation between Discrimination Scale and Total EPII; E) Correlation between 7-Memory Questionnaire and Total EPII.

Questionnaire ($r = 0.30$). Finally, within the Peruvian participants, scores on the EPII total significantly correlated with the Discrimination scale ($r = 0.28$, $p = .001$) and 7-Memory Questionnaire ($r = 0.17$, $p = .035$).

4. Discussion

This prospective, cross-sectional study found no differences in the pandemic's self-reported overall impact among older adults across four US ethnic groups. However, Latinos indicated more economic challenges, like paying bills/rent/utilities and obtaining medications. Black older adults self-reported more perceived discrimination compared to other groups, while Latinos residing in the US reported more perceived discrimination than their Latin American counterparts across four countries. Additionally, Latinos living in Latin America (i.e., Argentinian, Chileans) self-reported experiencing higher pandemic impact, especially within Education and Training, compared to those in the US. There were no differences in self-reported memory concerns, loneliness, or purpose in life among any of the older adult cohort groups.

Data on the pandemic's social impact within and outside of the US are limited beyond proximal clinical outcomes, incidence, and mortality statistics [36]. The current findings provide evidence and confirmation of initial anecdotal commentaries [7,9,13] that the pandemic's burden is different for non-White groups and those in LMICs. Discrimination is also a driver in the backdrop of the pandemic and ongoing discussions about equality, race, and ethnicity. Black older adults self-reported more perceived discrimination than the other groups and US Latinos similarly reported more discrimination than those residing in Argentina, Chile, and Peru. While it is unclear if perceived discrimination was greater or reduced for Black participants pre-pandemic, these results support prior findings of greater discrimination in Black older adults than their White counterparts [37]. Discrimination influences if and when healthcare services are accessed, how information about the pandemic is interpreted, and trust in the healthcare system [38,39]. Latinos also reported more economic difficulties in this study. Nationally-representative data show that compared to Whites, Latino adults aged 18–64 were more likely to have difficulty accessing and using health care due to language and economic barriers [40]. A prior history of limited healthcare access and utilization predicts future underutilization of care to manage chronic conditions. Latinos residing in Chile, Mexico, and Peru reported a higher impact of the pandemic, including greater difficulty with work and employment (Chile, Mexico, Peru), education and training (Argentina, Chile, Mexico), economics (Argentina, Mexico, and Peru), and physical distancing and quarantine (Chile, Mexico, Peru [e.g., limited physical closeness with a loved one and household quarantine]). Therefore, despite a higher number of cases and deaths in the US, particularly among vulnerable populations, the country's economic infrastructure and reserves may help reduce the pandemic's impact than those of LMICs.

The unremarkable findings on memory concerns (with the exception of Mexicans), loneliness, and life purpose in the ethnoraical groups within and outside the US are also interesting. Participants indicated being healthy with only a small number of reported COVID-19 cases. Older age is associated with more loneliness, leading to anxiety and depression [41]. However, potential mediators for higher loneliness in older adults include poor health, higher stress, prior mental health problems, and COVID-19 recovery [20]. One longitudinal study of loneliness among US older adults found little change between January to April 2020 and less loneliness than younger adults [42]. Our findings extend these results by assessing race and ethnicity in the US. Greater life purpose suggests a directional relationship with lower loneliness and, indirectly, a reduced impact of the pandemic among participants in this sample. However, this may change with recurring surges of infection and a prolonged period of no effective treatments or vaccines.

This descriptive, cross-sectional study had several limitations, which limit the generalizability of the results. It is likely that group differences in the outcomes explored in this study design were present pre-pandemic and may have been amplified by the stress of the pandemic. For example, it is very likely that group differences in perceived discrimination existed pre-pandemic (via historical and social norms) and persist as reinforced (via institutional and social determinants of health) by these results. Data were cross-sectional and therefore causality cannot be inferred since data on the outcome measures pre-pandemic were not available nor would recall be helpful in providing an apposite comparison. Given the crucial restrictions resulting from regional, national, and international mandates for social distancing, traditional in-person recruitment strategies, and testing could not be deployed and sampling was not random, which limits external validity. Selection bias may have influenced the results since most respondents completed the survey on a computer or smartphone/tablet

and may differ from individuals who may not have access to such technology. Evidence of this bias is that the sample was relatively well-educated (15 years of education on average), indicating post-secondary education (college, trade, vocational schools). This is not representative of the average/mean years of education statistic in the United States or in Argentina, Chile, Mexico, and Peru. Particularly, given the high level of education of our respondents from Latin American countries, our results should be interpreted with caution and should not be taken as representative of the majority of Latin American population. This sample did not include US Native Americans, who have also been impacted by COVID-19 [43]. Data were self-reported. Further, we did not collect information on race in Latin America, which prevents us from learning about within-Latino ethnoracial differences. Similar to the US, ethnoracial minorities in Latin America might experience a higher burden of COVID-19 compared to the non-ethnoracial minority population. Furthermore, there is considerable heterogeneity (sociocultural, resources, COVID-19 pandemic management, among others) across the Latin American countries included. Future studies should examine potential differences across these countries. Some data, such as COVID-19 positivity, cognition, or physical health, could have been collected more reliably via performance, clinical, or laboratory assessments. Measures were forward-and-back translated but have not all been validated in Spanish, which may impact results' validity and reliability. Finally, most of our participants were female, which matches the patterning distribution observed in other clinical studies [44], but does not represent the entire population.

As many countries struggle with the evolving surge and ebb of the COVID-19 pandemic, research and public policy shift to upstream social determinants of health that increase the community-wide risk for vulnerable populations like older adults and ethnoracial groups. This international study had a number of strengths including, prospectively surveying over 1600 older adults across the US and in 4 Latin American countries, over 700 participants residing in Argentina, Chile, Mexico, and Peru, employing a battery of valid, psychosocial measures and a comprehensive pandemic inventory. Discrimination, loneliness, life purpose, and memory concerns deeply influence an individual's health and interact with social determinants of health. Ethnoracial groups and older adults are at a higher risk for health disparities, and COVID-19 exponentially increases mortality and morbidity risks. Future studies should examine how mediators like income and coping skills modify the pandemic's impact. The pandemic likely has a differential impact across countries; between-country differences should be examined. The percentage of reported positive COVID-19 cases was low in this sample, yet, these results highlight salient themes that physicians and other healthcare workers need to be cognizant of when working with high-risk populations.

Funding

GMB was supported by the NIH National Institute on Aging-NIA (R01AG056466, R01AG067428, R01AG068183), DT was supported by ANID/FONDAP/15150012, CV-C is supported by a grant from the Alzheimer's Association (2019A005859), EG-V was supported by the NIA K23AG061276, YTQ was supported by grants from the NIH NIA (R01 AG054671), the Alzheimer's Association, and Massachusetts General Hospital ECOR.

Data sharing statement

Data will be shared after approval by study investigators. Data requests should be sent to Dr. Quiroz at yquiroz@mgh.harvard.edu

Author contributions

GMB, VT, and YTQ designed the study. VT and BH conducted data analyses with oversight by GMB and YTQ. EGV and VT created the figures. GMB and VT wrote the drafts and integrated contributions from all co-authors. YTQ provided supervisory oversight. All authors searched the literature, participated in data collection, discussed the contents of the manuscript, contributed to editing, and approved the final version of the article. VT and YTQ had full access to all data in the study. All authors had final responsibility for the decision to submit for publication.

Declaration of Competing Interest

Dr. Thumala reports personal fees from National Agency for Research and Development, during the conduct of the study. Dr. Miranda-Castillo reports grants and personal fees from National Agency for Research and Development, during the conduct of the study. Dr. Gatchel reports grants from NIH/NIA, grants from Alzheimer's Association, and served as a one-time consultant with Huron Consulting, outside the submitted work. Dr. Sperling reports personal fees from Roche, Takeda Pharmaceuticals, Eisai, Biogen, AC Immune, Neurocentria, Janssen, Neuraly, Alnylam Pharmaceuticals, Renew, JOMDD, Acumen, Prothema, Cytox, Oligomerix, Inc., and Genentech; grants from Eisai, Eli Lilly, Janssen, NIA, and Alzheimer's Association; personal fees and honorarium (consulting) for Dr. Sperling's spouse (Dr. Keith Johnson) from Novartis, AC Immune, Janssen, and Cerveau, outside the submitted work. Dr. Rentz reports consulting from Digital Cognition Technologies, Neurotrack, and Biogen Idec, outside the submitted work. All other authors have nothing to declare.

Acknowledgements

The authors thank all participants for contributing their valuable time and effort, without which this study would not have been possible.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.eclinm.2021.100848.

References

- [1] World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19-11 March 2020. 2020. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-march-2020> (accessed September 6, 2020).
- [2] Johns Hopkins University. COVID-19 dashboard by the center for systems science and engineering at Johns Hopkins University: global Map. 2020. <https://coronavirus.jhu.edu/map.html> (accessed September 6, 2020).
- [3] Centers for Disease Control and Prevention. CDC COVID Data Tracker: united States COVID-19 Cases and Deaths by State. 2020. <https://covid.cdc.gov/covid-data-tracker/#cases> (accessed September 6, 2020).
- [4] Schröder I. COVID-19: a risk assessment perspective. *ACS Chem Health Saf* 2020;27(3):160–9.
- [5] Ioannidis JPA, Axfors C, Contopoulos-Ioannidis DG. Population-level COVID-19 mortality risk for non-elderly individuals overall and for non-elderly individuals without underlying diseases in pandemic epicenters. *Environ Res* 2020;188:109890.
- [6] Jordan RE, Adab P, Cheng KK. Covid-19: risk factors for severe disease and death. *BMJ* 2020;368:m1198–m.
- [7] Blumenthal D, Fowler EJ, Abrams M, Collins SR. Covid-19 – implications for the Health Care System. *N Engl J Med* 2020.
- [8] Centers for Disease Control and Prevention. COVID-19 hospitalization and death by race/ethnicity. 2020. <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html> (accessed December 12, 2020).
- [9] Hooper MW, Nápoles AM, Pérez-Stable EJ. COVID-19 and racial/ethnic disparities. *JAMA* 2020;323(24):2466–7.
- [10] Cortinovis M, Perico N, Remuzzi G. Long-term follow-up of recovered patients with COVID-19. *Lancet* 2021;397(10270):173–5.
- [11] Del Rio C, Collins LF, Malani P. Long-term health consequences of COVID-19. *JAMA* 2020;324(17):1723–4.
- [12] Laurencin CT, McClinton A. The COVID-19 pandemic: a call to action to identify and address racial and ethnic disparities. *J Racial Ethn Health Disparities* 2020:1–5.
- [13] Egede LE, Walker RJ. Structural racism, social risk factors, and Covid-19 – a dangerous convergence for black Americans. *N Engl J Med* 2020.
- [14] Alimujiang A, Wiensch A, Boss J, et al. Association between life purpose and mortality among US adults older than 50 years. *JAMA Netw Open* 2019;2(5):e194270–e.
- [15] Steptoe A, Shankar A, Demakakos P, Wardle J. Social isolation, loneliness, and all-cause mortality in older men and women. *Proc Natl Acad Sci* 2013;110(15):5797–801.
- [16] Barnes LL, De Leon CFM, Lewis TT, Bienias JL, Wilson RS, Evans DA. Perceived discrimination and mortality in a population-based study of older adults. *Am J Public Health* 2008;98(7):1241–7.
- [17] Singh-Manoux A, Dugravot A, Ankri J, et al. Subjective cognitive complaints and mortality: does the type of complaint matter? *J Psychiatr Res* 2014;48(1):73–8.
- [18] Cacioppo JT, Cacioppo S. Social relationships and health: the toxic effects of perceived social isolation. *Soc Personal Psychol Compass* 2014;8(2):58–72.
- [19] Taylor HO, Taylor RJ, Nguyen AW, Chatters L. Social isolation, depression, and psychological distress among older adults. *J Aging Health* 2018;30(2):229–46.
- [20] Morrow-Howell N, Galucia N, Swinford E. Recovering from the COVID-19 pandemic: a focus on older adults. *J Aging Soc Policy* 2020:1–9.
- [21] Lloyd-Sherlock P, Ebrahim S, Geffen L, McKee M. Bearing the brunt of covid-19: older people in low and middle income countries. *BMJ* 2020;368:m1052.
- [22] Hopman J, Allegranzi B, Mehtar S. Managing COVID-19 in low- and middle-income countries. *JAMA* 2020;323(16):1549–50.
- [23] Gupta M, Wahl B, Adhikari B, et al. The need for COVID-19 research in low- and middle-income countries. *Glob Health Res Policy* 2020;5(1):33.
- [24] Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42(2):377–81.
- [25] World Health Organization. Process of translation and adaptation of instruments. 2009. https://www.who.int/substance_abuse/research_tools/translation/en/ (accessed October 28, 2020).
- [26] Grasso DJ, Briggs-Gowan MJ, Ford J.D., Carter A.S. The Epidemic–Pandemic Impacts Inventory (EPII). 2020.
- [27] Williams DR, Yu Y, Jackson JS, Anderson NB. Racial differences in physical and mental health: socio-economic status, stress and discrimination. *J Health Psychol* 1997;2(3):335–51.
- [28] Sternthal M.J., Slopen N., Williams D.R. Racial disparities in health: how much does stress really matter? 1. Du Bois review: social science research on race 2011; 8(1): 95.
- [29] Farias ST, Mungas D, Reed BR, et al. The measurement of everyday cognition (ECog): scale development and psychometric properties. *Neuropsychology* 2008;22(4):531.
- [30] Amariglio RE, Townsend MK, Grodstein F, Sperling RA, Rentz DM. Specific subjective memory complaints in older persons may indicate poor cognitive function. *J Am Geriatr Soc* 2011;59(9):1612–17.
- [31] Go RCP, Duke LW, Harrell LE, et al. Development and validation of a structured telephone interview for dementia assessment (STIDA): the NIMH Genetics Initiative. *J Geriatr Psychiatry Neurol* 1997;10(4):161–7.
- [32] Gierveld DJJ, Tilburg TV. A 6-item scale for overall, emotional, and social loneliness: confirmatory tests on survey data. *Res Aging* 2006;28(5):582–98.
- [33] Boyle PA, Barnes LL, Buchman AS, Bennett DA. Purpose in life is associated with mortality among community-dwelling older persons. *Psychosom Med* 2009;71(5):574.
- [34] Ryff CD. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *J Pers Soc Psychol* 1989;57(6):1069.
- [35] Bland JM, Altman DG. Multiple significance tests: the Bonferroni method. *BMJ* 1995;310(6973):170.
- [36] Abedi V, Olulana O, Avula V, et al. Racial, Economic, and Health Inequality and COVID-19 Infection in the United States. *J Racial Ethn Health Disparities* 2020:1–11.
- [37] Barnes LL, De Leon CFM, Wilson RS, Bienias JL, Bennett DA, Evans DA. Racial differences in perceived discrimination in a community population of older blacks and whites. *J Aging Health* 2004;16(3):315–37.
- [38] Williams DR, Mohammed SA. Discrimination and racial disparities in health: evidence and needed research. *J Behav Med* 2009;32(1):20–47.
- [39] Baqui P, Bica I, Marra V, Ercole A, van Der Schaar M. Ethnic and regional variations in hospital mortality from COVID-19 in Brazil: a cross-sectional observational study. *Lancet Glob Health* 2020;8(8):e1018–e1e26.
- [40] Martinez ME, Ward BW, Adams PF. Health care access and utilization among adults aged 18–64, by race and Hispanic origin: united States, 2013 and 2014: US Department of Health and Human Services. Centers Dis Control 2015.
- [41] van Tilburg TG, Steinmetz S, Stolte E, van der Roest H, de Vries DH. Loneliness and mental health during the COVID-19 pandemic: a study among Dutch older adults. *J Gerontol* 2020.
- [42] Luchetti M, Lee JH, Aschwanden D, et al. The trajectory of loneliness in response to COVID-19. *Am Psychol* 2020.
- [43] Tai DBG, Shah A, Doubeni CA, Sia IG, Wieland ML. The disproportionate impact

of COVID-19 on racial and ethnic minorities in the United States. Clin Infect Dis 2020.

- [44] Harris PA, Scott KW, Lebo L, Hassan N, Lighter C, Pulley J. ResearchMatch: a national registry to recruit volunteers for clinical research. Acad Med 2012;87(1):66.