

# THE LANCET

## Healthy Longevity

### Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Yang H, Chen W, Hu Y, et al. Pre-pandemic psychiatric disorders and risk of COVID-19: a UK Biobank cohort analysis. *Lancet Healthy Longev* 2020; published online Oct 26. [https://doi.org/10.1016/S2666-7568\(20\)30013-1](https://doi.org/10.1016/S2666-7568(20)30013-1).

**Supplementary Table 1. International Classification of Disease (ICD) codes, ninth (ICD-9) and tenth (ICD-10) revisions for diagnoses used in this study**

		ICD-10	ICD-9
<b>Psychiatric disorders</b>	Any	F10-F29, F32-F33, F40-F41, F43	291, 295, 296.1, 297, 298, 300.0, 300.2, 300.4, 303-305, 308, 309, 311
	Depression	F32-F33	296.1, 300.4, 311
	Anxiety	F40-F41	300.0, 300.2
	Stress-related disorder	F43	308, 309
	Substance misuse	F10-F19	291, 303-305
	Psychotic disorder	F20-F29	295, 297, 298
<b>COVID-19</b>	-	U07.1, U07.2	-
<b>Other infections</b>	-	A, B, I30.0, I30.1, I33, I38-I39, I40.0, G00-08, J00-J06, J09-J22, J32, J35.0, J37.0, J37.1, J37.2, J40-J42, H60, H65-H67, H70, N10-N12, N13.6, N15.1, N15.9, N30, N34.0, N39.0, N41.0, N41.1-N41.3, N43.1, N45, N48.1, N48.2, N49, N61, N70-N76, N77.1, K29, K35-K37, L01-L08, M00, M01, M46, M60.0, M65, M71.0, M71.1, M86	-
<b>Somatic comorbidities</b>	Chronic cardiac disease	G45, G46, I11.0, I13.0, I13.2, I21, I22, I25.2, I50, I60-I71, I73.1, I73.8, I73.9, I77.1, I79.0, I79.2, K55.1, K55.8, K55.9, R02, Z95.8, Z95.9	410, 412, 430-438, 440, 441, 4280, 4439, 7854, V434
	Diabetes	E10.9, E11.9, E12.9, E13.9, E14.9	2500
	Chronic pulmonary disease	J40-J44, J46, J47, J60-67, J70, J684, J841, J920, J96.1, J98.2,	490-492, 494-496, 500-505
	Chronic kidney disease	I20, I13.1, N03.2-N03.7, N05.2-N05.7, N18, N19, N25.0, Z94.0, Z99.2	582, 583, 585, 586, 588, V420, V56
	Asthma	J45	493, V175

**Supplementary Table 2. Risk of COVID-19 among individuals with pre-pandemic psychiatric disorders, by different adjustment strategies, compared with that of individuals without such conditions**

Model information	All COVID-19			Inpatient COVID-19			COVID-19-related deaths		
	Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders	OR (95% CI)	Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders	OR (95% CI)	Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders	OR (95% CI)
<b>Model 1:</b> adjusted for birth year, sex			2.16 (1.94-2.40)			2.46 (2.17-2.78)			3.44 (2.77-4.27)
<b>Model 2:</b> Model 1+ sociodemographic factors (i.e., race or ethnicity, Townsend deprivation index, educational attainment, and annual household income)	442/50809 (0.87%)	1509/370205 (0.41%)	1.84 (1.65-2.06)	338/50809 (0.67%)	1012/370205 (0.27%)	2.08 (1.83-2.36)	120/50809 (0.24%)	256/370205 (0.07%)	2.89 (2.31-3.61)
<b>Model 3:</b> Model 2+ body-mass index and smoking status			1.85 (1.65-2.07)			2.04 (1.78-2.33)			2.71 (2.14-3.42)
<b>Model 4:</b> Model 3+ history of chronic cardiac disease, diabetes, chronic pulmonary disease, chronic kidney disease, and asthma			1.44 (1.28-1.62)			1.55 (1.34-1.78)			2.03 (1.59-2.59)

Data are n/N (%), unless otherwise specified. ORs (95% CI) were derived from logistic regression models, adjusted for covariates listed in the model information column. OR=odds ratio.

**Supplementary Table 3 Sub-analysis for the association between any pre-pandemic psychiatric disorders, identified according to diagnosis from either UK Biobank inpatient data or primary care data, and COVID-19**

	All COVID-19			Inpatient COVID-19			COVID-19-related deaths		
	Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders	OR (95% CI)	Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders	OR (95% CI)	Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders	OR (95% CI)
Both inpatient and primary care diagnosis	159/17417 (0.91%)		1.95 (1.57-2.40)	110/17417 (0.63%)		1.96 (1.51-2.54)	43/17417 (0.25%)		2.96 (1.93-4.56)
Only inpatient diagnosis	46/4791 (0.96%)	366/102093 (0.36%)	1.89 (1.38-2.59)	36/4791 (0.75%)	235/102093 (0.23%)	2.11 (1.47-3.04)	13/4791 (0.27%)	67/102093 (0.07%)	2.39 (1.30-4.41)
Only primary care diagnosis	282/54360 (0.52%)		1.43 (1.22-1.68)	182/54360 (0.33%)		1.44 (1.18-1.76)	50/54360 (0.09%)		1.53 (1.05-2.22)

Data are n/N (%), unless otherwise specified. ORs (95% CI) were derived from logistic regression models, adjusted for birth year, sex, race or ethnicity, Townsend deprivation index, educational attainment, annual household income, body-mass index, smoking status, and history of chronic cardiac disease, diabetes, chronic pulmonary disease, chronic kidney disease, and asthma. OR=odds ratio.

**Supplementary Table 4. Sensitivity analyses for the association between any or specific pre-pandemic psychiatric disorder, identified according to primary diagnosis of the UK Biobank inpatient hospital data, and COVID-19**

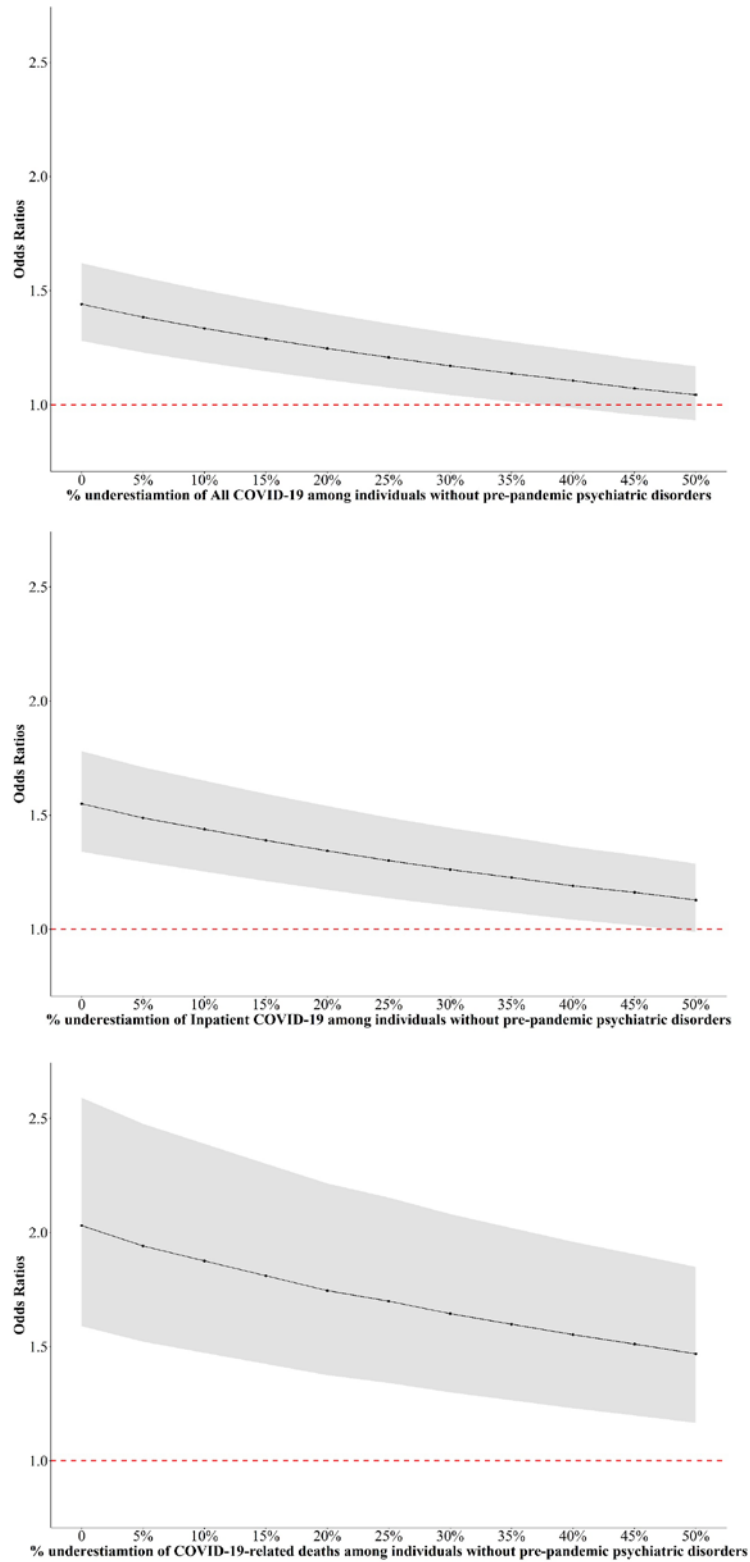
	All COVID-19			Inpatient COVID-19			COVID-19-related deaths		
	Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders	OR (95% CI)	Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders	OR (95% CI)	Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders	OR (95% CI)
<b>Any psychiatric disorder</b>	53/4366 (1.21%)	1898/416648 (0.46%)	1.66 (1.26-2.20)	37/4366 (0.85%)	1313/416648 (0.32%)	1.59 (1.14-2.23)	12/4366 (0.27%)	364/416648 (0.09%)	2.03 (1.13-3.65)
<b>Depression</b>	20/1625 (1.23%)	1931/419389 (0.46%)	1.74 (1.11-2.72)	13/1625 (0.80%)	1337/419389 (0.32%)	1.56 (0.90-2.72)	3/1625 (0.18%)	373/419389 (0.09%)	1.33 (0.42-4.17)
<b>Anxiety</b>	11/865 (1.27%)	1940/420149 (0.46%)	1.78 (0.98-3.25)	8/865 (0.92%)	1342/420149 (0.32%)	1.80 (0.89-3.64)	2/865 (0.23%)	374/420149 (0.09%)	1.62 (0.40-6.56)
<b>Stress-related disorder</b>	4/380 (1.05%)	1947/420634 (0.46%)	1.43 (0.53-3.88)	3/380 (0.79%)	1347/420634 (0.32%)	1.52 (0.48-4.79)	1/380 (0.26%)	375/420634 (0.09%)	2.36 (0.33-17.07)
<b>Substance misuse</b>	15/1239 (1.21%)	1936/419775 (0.46%)	1.45 (0.86-2.43)	11/1239 (0.89%)	1339/419775 (0.32%)	1.42 (0.77-2.60)	5/1239 (0.40%)	371/419775 (0.09%)	2.60 (1.06-6.40)
<b>Psychotic disorder</b>	6/777 (0.77%)	1945/420237 (0.46%)	0.97 (0.43-2.17)	4/777 (0.51%)	1346/420237 (0.32%)	0.89 (0.33-2.38)	1/777 (0.13%)	375/420237 (0.09%)	0.94 (0.13-6.80)

Data are n/N (%), unless otherwise specified. ORs (95% CI) were derived from logistic regression models, adjusted for birth year, sex, race or ethnicity, Townsend deprivation index, educational attainment, annual household income, body-mass index, smoking status, and history of chronic cardiac disease, diabetes, chronic pulmonary disease, chronic kidney disease, and asthma. OR=odds ratio.

**Supplementary Table 5. Sensitivity analyses for the association between any or specific pre-pandemic psychiatric disorder and COVID-19 by restricting to the study period before April 27, 2020**

	All COVID-19		OR (95% CI)	Inpatient COVID-19		OR (95% CI)	COVID-19-related deaths		OR (95% CI)
	Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders		Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders		Individuals with pre-pandemic psychiatric disorders	Individuals without pre-pandemic psychiatric disorders	
<b>Any psychiatric disorder</b>	310/50809 (0.61%)	967/370205 (0.26%)	1.59 (1.38-1.84)	259/50809 (0.51%)	796/370205 (0.22%)	1.56 (1.33-1.83)	103/50809 (0.20%)	220/370205 (0.06%)	2.01 (1.54-2.63)
<b>Depression</b>	165/22352 (0.74%)	1112/398662 (0.28%)	1.82 (1.53-2.17)	132/22352 (0.59%)	923/398662 (0.23%)	1.72 (1.42-2.08)	57/22352 (0.26%)	266/398662 (0.07%)	2.63 (1.94-3.55)
<b>Anxiety</b>	117/16573 (0.71%)	1160/404441 (0.29%)	1.78 (1.46-2.17)	97/16573 (0.59%)	958/404441 (0.24%)	1.76 (1.42-2.18)	33/16573 (0.20%)	290/404441 (0.07%)	1.89 (1.30-2.74)
<b>Stress-related disorder</b>	6/872 (0.69%)	1271/420142 (0.30%)	1.37 (0.61-3.08)	6/872 (0.69%)	1049/420142 (0.25%)	1.64 (0.73-3.71)	2/872 (0.23%)	321/420142 (0.08%)	2.09 (0.51-8.57)
<b>Substance misuse</b>	145/23620 (0.61%)	1132/397394 (0.28%)	1.28 (1.04-1.58)	127/23620 (0.54%)	928/397394 (0.23%)	1.32 (1.06-1.65)	43/23620 (0.18%)	280/397394 (0.07%)	1.08 (0.74-1.60)
<b>Psychotic disorder</b>	16/1431 (1.12%)	1261/419583 (0.30%)	2.00 (1.21-3.32)	11/1431 (0.77%)	1044/419583 (0.25%)	1.61 (0.88-2.94)	6/1431 (0.42%)	317/419583 (0.08%)	2.96 (1.30-6.76)

Data are n/N (%), unless otherwise specified. ORs (95% CI) were derived from logistic regression models, adjusted for birth year, sex, race or ethnicity, Townsend deprivation index, educational attainment, annual household income, body-mass index, smoking status, and history of chronic cardiac disease, diabetes, chronic pulmonary disease, chronic kidney disease, and asthma. OR=odds ratio.



**Supplementary Figure 1 Changes of odd ratios with 95% confidence intervals<sup>a</sup>, by assuming 5-50% underestimation of the studied outcomes among individuals without pre-pandemic psychiatric disorders**

<sup>a</sup> Odds ratios with 95% confidence intervals were derived from logistic regression models, adjusted for birth year, sex, race or ethnicity, Townsend deprivation index, educational attainment, annual household income, body-mass index, smoking status, and history of chronic cardiac disease, diabetes, chronic pulmonary disease, chronic kidney disease, and asthma. For certain selected percentage (5-50%, by every 5%), odd ratio and its 95% confidence interval were the average values of these estimates calculated based on 100 datasets with certain percentage of misclassified cases randomly selected from individuals without pre-pandemic psychiatric disorders.