

# 探討弓漿蟲感染和常見精神疾病的關聯

## Exploring the Relationship between Toxoplasma gondii Infection and Common Mental Disorders

學生：黃旻穎 指導老師：郭柏秀 教授

### 一、摘要

本篇研究採用UK Biobank資料，探討弓漿蟲感染和精神疾病(雙極性情感疾患、憂鬱症、思覺失調症)的相關性。不論是以感染陽性率或抗原抗體濃度作為指標，結果發現弓漿蟲感染和此三種精神疾病沒有顯著相關。

### 二、方法

#### (1) 資料與樣本

資料來源為UK Biobank。納入所有具有弓漿蟲感染資料和精神疾病(雙極性情感疾患、憂鬱症、思覺失調症)的個案。

#### (2) 弓漿蟲感染評估

主要在2006年到2010年間檢測，採用p22和sag1抗原抗體濃度作為指標，並設立感染陽性定義(p22>100或sag1>160)。本篇研究分別以陽性率和抗原抗體濃度執行分析。

#### (3) 精神疾病診斷

雙極性情感疾患和憂鬱症使用兩個變項的資料，一個是ICD 10診斷，另一為雙極和憂鬱狀況(Bipolar and major depression status)，再將兩者的樣本數取聯集。而思覺失調症的診斷使用ICD 10。

#### (4) 共變項

性別、年齡、種族、家庭稅前年收入

#### (5) 分析方法與工具

使用Chi-square test/Fisher Exact test和Independent t-test比較各變項分組的平均值。再以多變項的logistic regression進行分析。

### 三、結果與討論

弓漿蟲感染和雙極性情感疾患、憂鬱症、思覺失調症沒有顯著相關

#### • 共變項的部分

- 性別 → 女性有較高的憂鬱症和任一精神疾病的風險
- 年齡 → 年齡增加有較低的憂鬱症和任一精神疾病的風險
- 種族 → 沒有顯著相關
- 收入 → 收入增加有較低的雙極性情感疾患、憂鬱症和任一精神疾病的風險

Table 1. 雙極性情感疾患之各變項分布

Variables	Category	BP (N = 43)	Without BP (N = 9647)	P value (compare mean)	OR (95% CI)
Sex	Female	19 (44.19%)	5401 (55.99%)	0.1199	(Reference)
	Male	24 (55.81%)	4246 (44.01%)		1.607 (0.879 – 2.937)
Age (years)	(mean ± SD)	55.12 ± 8.63	56.55 ± 8.14	0.2494	0.979 (0.944 – 1.015)
Ethnicity (missing = 38)	Non-White	5 (12.20%)	512 (5.33%)	0.0513	(Reference)
	White	36 (87.80%)	9099 (94.67%)		0.405 (0.158 – 1.037)
Income (missing = 1420)	< 18000	18 (48.65%)	1840 (22.35%)	0.0017	(Reference)
	18000 - 30999	8 (21.62%)	2115 (25.69%)		0.387 (0.168 – 0.891)
	31000 – 51999	6 (16.22%)	2166 (26.31%)		0.283 (0.112 – 0.715)
	>= 52000	5 (13.51%)	2112 (25.65%)		0.242 (0.090 – 0.653)
Seropositivity	Negative	31 (72.09%)	6917 (71.70%)	0.9546	(Reference)
	Positive	12 (27.91%)	2730 (28.30%)		0.981 (0.503 – 1.913)
Serointensity	Log(p22) (mean ± SD)	3.28 ± 1.36	3.40 ± 1.35	0.5644	0.938 (0.754 – 1.167)
	Log(sag1) (mean ± SD)	4.48 ± 0.86	4.46 ± 0.95	0.8949	1.022 (0.744 – 1.404)

Table 2. 憂鬱症之各變項分布

Variables	Category	Depression (N = 886)	Without Depression (N = 8804)	P value (compare mean)	OR (95% CI)
Sex	Female	581 (65.58%)	4839 (54.96%)	<.0001	(Reference)
	Male	305 (34.42%)	3965 (45.04%)		0.641 (0.554 – 0.741)
Age (years)	(mean ± SD)	55.94 ± 8.21	56.60 ± 8.14	0.0197	0.990 (0.982 – 0.998)
Ethnicity (missing = 38)	Non-White	44 (5.00%)	473 (5.39%)	0.6223	(Reference)
	White	836 (95.00%)	8299 (94.61%)		1.083 (0.789 – 1.487)
Income (missing = 1420)	< 18000	248 (32.63%)	1610 (21.44%)	<.0001	(Reference)
	18000 - 30999	195 (25.66%)	1928 (25.67%)		0.657 (0.538 – 0.801)
	31000 – 51999	172 (22.63%)	2000 (26.63%)		0.558 ( 0.455 – 0.686)
	>= 52000	145 (19.08%)	1972 (26.26%)		0.477 (0.385 – 0.592)
Seropositivity	Negative	616 (69.53%)	6332 (71.92%)	0.1313	(Reference)
	Positive	270 (30.47%)	2472 (28.08%)		1.123 (0.966 – 1.305)
Serointensity	Log(p22) (mean ± SD)	3.41 ± 1.38	3.40 ± 1.35	0.7605	1.008 (0.958 – 1.061)
	Log(sag1) (mean ± SD)	4.49 ± 0.94	4.46 ± 0.95	0.4188	1.031 (0.958 – 1.109)

Table 3. 思覺失調症之各變項分布

Variables	Category	SCZ (N = 21)	Without SCZ (N = 9669)	P value (compare mean)	OR (95% CI)
Sex	Female	9 (42.86%)	5411 (55.96%)	0.2269	(Reference)
	Male	12 (57.14%)	4258 (44.04%)		1.694 (0.713 – 4.025)
Age (years)	(mean ± SD)	55.48 ± 8.45	56.55 ± 8.14	0.5477	0.984 (0.935 – 1.037)
Ethnicity (missing = 38)	Non-White	1 (4.76%)	516 (5.36%)	1.0000	(Reference)
	White	20 (95.24%)	9115 (94.64%)		1.132 (0.152 – 8.452)
Income (missing = 1420)	< 18000	16 (94.12%)	1842 (22.32%)	<.0001	(Reference)
	18000 - 30999	1 (5.88%)	2122 (25.71%)		0.054 (0.007 – 0.409)
	31000 – 51999	0 (0.00%)	2172 (26.32%)		<0.001 (<0.001 - >999.999)
	>= 52000	0 (0.00%)	2117 (25.65%)		<0.001 (<0.001 - >999.999)
Seropositivity	Negative	12 (57.14%)	6936 (71.73%)	0.1381	(Reference)
	Positive	9 (42.86%)	2733 (28.27%)		1.903 (0.801 – 4.522)
Serointensity	Log(p22) (mean ± SD)	3.71 ± 1.83	3.40 ± 1.35	0.2923	1.191 (0.861 – 1.647)
	Log(sag1) (mean ± SD)	4.66 ± 0.97	4.46 ± 0.95	0.3305	1.278 (0.784 – 2.082)

Table 4. 雙極性情感疾患之多變項分析

Variables	Category	OR (95% CI) by Seropositivity	OR (95% CI) by log(p22)	OR (95% CI) by log(sag1)
Sex	Female	(Reference)	(Reference)	(Reference)
	Male	1.646 (0.847 – 3.196) p = 0.1412	1.669 (0.859 – 3.245) p = 0.1306	1.644 (0.847 – 3.192) p = 0.1420
Age (years)	(continuous)	0.973 (0.933 – 1.014) p = 0.1928	0.973 (0.933 – 1.015) p = 0.2008	0.973 (0.933 – 1.014) p = 0.1959
Ethnicity (missing = 38)	Non-White	(Reference)	(Reference)	(Reference)
	White	0.431 (0.157 – 1.186) p = 0.1032	0.420 (0.153 – 1.154) p = 0.0926	0.427 (0.154 – 1.186) p = 0.1026
Income (missing = 1420)	< 18000	(Reference)	(Reference)	(Reference)
	18000 - 30999	0.331 (0.137 – 0.800) p = 0.0140	0.330 (0.136 – 0.797) p = 0.0137	0.331 (0.137 – 0.799) p = 0.0139
	31000 – 51999	0.249 (0.096 – 0.645) p = 0.0042	0.246 (0.095 – 0.637) p = 0.0039	0.248 (0.096 – 0.644) p = 0.0042
	>= 52000	0.198 (0.070 – 0.558) p = 0.0022	0.196 (0.069 – 0.553) p = 0.0021	0.198 (0.070 – 0.558) p = 0.0022
Seropositivity		0.866 (0.413 – 1.818) p = 0.7045	-	-
Serointensity	Log (p22)	-	0.883 (0.692 – 1.127) p = 0.3171	-
	Log (sag1)	-	-	0.937 (0.659 – 1.331) p = 0.7151

Table 5. 憂鬱症之多變項分析

Variables	Category	OR (95% CI) by Seropositivity	OR (95% CI) by log(p22)	OR (95% CI) by log(sag1)
Sex	Female	(Reference)	(Reference)	(Reference)
	Male	0.680 (0.581 – 0.795) p <.0001	0.682 (0.583 – 0.797) p <.0001	0.681 (0.582 – 0.796) p <.0001
Age (years)	(continuous)	0.981 (0.971 – 0.990) p <.0001	0.981 (0.972 – 0.991) p = 0.0002	0.981 (0.971 – 0.991) p = 0.0001
Ethnicity (missing = 38)	Non-White	(Reference)	(Reference)	(Reference)
	White	1.079 (0.761 – 1.531) p = 0.6682	1.056 (0.745 – 1.497) p = 0.7606	1.067 (0.751 – 1.515) p = 0.7183
Income (missing = 1420)	< 18000	(Reference)	(Reference)	(Reference)
	18000 - 30999	0.643 (0.525 – 0.786) p <.0001	0.640 (0.523 – 0.783) p <.0001	0.641 (0.524 – 0.784) p <.0001
	31000 – 51999	0.524 (0.424 – 0.649) p <.0001	0.521 (0.421 – 0.644) p <.0001	0.522 (0.422 – 0.646) p <.0001
	>= 52000	0.430 (0.342 – 0.541) p <.0001	0.428 (0.341 – 0.538) p <.0001	0.429 (0.341 – 0.539) p <.0001
Seropositivity		1.122 (0.951 – 1.324) p = 0.1728	-	-
Serointensity	Log (p22)	-	0.995 (0.940 – 1.053) p = 0.8509	-
	Log (sag1)	-	-	1.016 (0.937 – 1.102) p = 0.7036

Table 6. 思覺失調症之多變項分析

Variables	Category	OR (95% CI) by Seropositivity	OR (95% CI) by log(p22)	OR (95% CI) by log(sag1)
Sex	Female	(Reference)	(Reference)	(Reference)
	Male	1.697 (0.714 – 4.035) p = 0.2313	1.670 (0.702 – 3.974) p = 0.2466	1.704 (0.717 – 4.051) p = 0.2275
Age (years)	(continuous)	0.979 (0.929 – 1.031) p = 0.4233	0.981 (0.931 – 1.033) p = 0.4667	0.979 (0.929 – 1.032) p = 0.4326
Ethnicity (missing = 38)	Non-White	(Reference)	(Reference)	(Reference)
	White	1.436 (0.188 – 10.982) p = 0.7276	1.333 (0.175 – 10.142) p = 0.7812	1.440 (0.187 – 11.095) p = 0.7264
Seropositivity		1.969 (0.822 – 4.713) p = 0.1283	-	-
Serointensity	Log (p22)	-	1.190 (0.858 – 1.650) p = 0.2974	-
	Log (sag1)	-	-	1.314 (0.796 – 2.170) p = 0.2860

Table 7. 此三種精神疾病(有任一疾病)之多變項分析

Variables	Category	OR (95% CI) by Seropositivity	OR (95% CI) by log(p22)	OR (95% CI) by log(sag1)
Sex	Female	(Reference)	(Reference)	(Reference)
	Male	0.710 (0.609 – 0.827) p <.0001	0.712 (0.611 – 0.830) p <.0001	0.711 (0.610 – 0.828) p <.0001
Age (years)	(continuous)	0.981 (0.971 – 0.990) p <.0001	0.981 (0.972 – 0.991) p <.0001	0.981 (0.971 – 0.990) p <.0001
Ethnicity (missing = 38)	Non-White	(Reference)	(Reference)	(Reference)
	White	1.017 (0.727 – 1.423) p = 0.9220	0.996 (0.712 – 1.394) p = 0.9824	1.006 (0.718 – 1.410) p = 0.9725
Income (missing = 1420)	< 18000	(Reference)	(Reference)	(Reference)
	18000 - 30999	0.615 (0.505 – 0.749) p <.0001	0.613 (0.503 – 0.746) p <.0001	0.614 (0.504 – 0.748) p <.0001
	31000 – 51999	0.502 (0.408 – 0.619) p <.0001	0.499 (0.405 – 0.615) p <.0001	0.501 (0.406 – 0.617) p <.0001
	>= 52000	0.409 (0.326 – 0.511) p <.0001	0.407 (0.325 – 0.509) p <.0001	0.408 (0.326 – 0.510) p <.0001
Seropositivity		1.108 (0.942 – 1.304) p = 0.2152	-	-
Serointensity	Log (p22)	-	0.993 (0.940 – 1.050) p = 0.8134	-
	Log (sag1)	-	-	1.014 (0.936 – 1.098) p = 0.7376

### 四、討論與研究限制

- 推測是因為樣本數較少，因此本篇研究和過去研究的結果有所差異
  - 過去研究發現雙極性情感疾患個案中有較高的弓漿蟲感染陽性率
  - 過去研究發現弓漿蟲感染和思覺失調症有中度以上相關
- 過去研究發現弓漿蟲感染非憂鬱症的危險因子，本篇研究未發現顯著相關
- 思覺失調症組別中，缺少收入≥31000的樣本 → 無法分析收入的相關性
- 沒有感染日期 → 無法探討弓漿蟲感染和發生精神疾病的時序性

### 五、結論

根據UK Biobank資料，弓漿蟲感染和雙極性情感疾患、憂鬱症、思覺失調症沒有顯著相關，需有更多研究探討其關聯。