Using imaging genetics approach to development of potential biomarkers for psychological resilience

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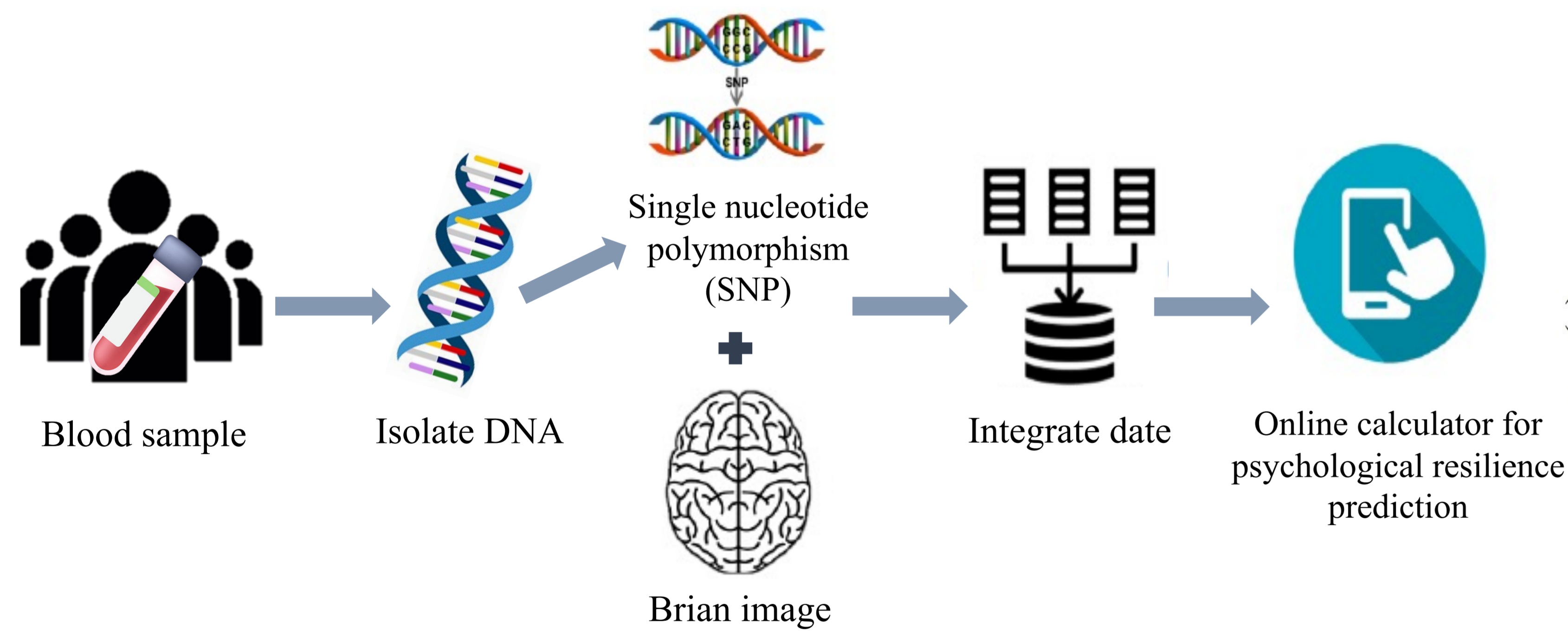[3]*Department of Graduate Institute of Mind, Brain and Consciousness, College of Social Sciences, Taipei Medical University, Taipei, Taiwan*

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Background

Resilience is defined as the process of effectively negotiating, successful emotional, social adaptation or adjustment despite exposure to significant adversity, stress, or trauma. Our study combined neuroimaging (structural magnetic resonance imaging, sMRI) and genetic variation (single nucleotide polymorphism, SNP), used more effective statistical approaches to identify high-risk cases and provide more comprehensive recommendations for potential predictive factors of personal mental health.

Blood sample → Isolate DNA → Single nucleotide polymorphism (SNP) + Brian image → Integrate date → Online calculator for psychological resilience prediction

Methods

We recruited 94 young adults and divided them into two groups (high resilience and low resilience) by Connor-Davidson Resilience Scale (CD-RISC). All participants were conducted genome-wide association studies (GWAS) from blood DNA and scanned by magnetic resonance imaging. Then we integrated single nucleotide polymorphism (SNP) and structural MRI (sMRI) data by the canonical correlation analysis (CCA) and used ROC curve analysis for discriminating psychological resilience.

Results

Individuals were separated into high (≥60) and low (<60) resilience groups by the scores of the CD-RISC. Our study selected 9 SNPs that correspond p-value $< 10^{-5}$ in the genome-wide association analysis using PLINK. We excluded the three SNPs due to strong multicollinearity, and thus the 6 SNPs were analyzed in CCA. The proportion of explained variance is 54.26 (p-value = 0.016) based on the first pair of canonical variables of SNP and sMRI data using CCA. Then the result of ROC curve analysis with 10-fold cross validation showed the AUC and accuracy values of 0.92 and 0.90, respectively.
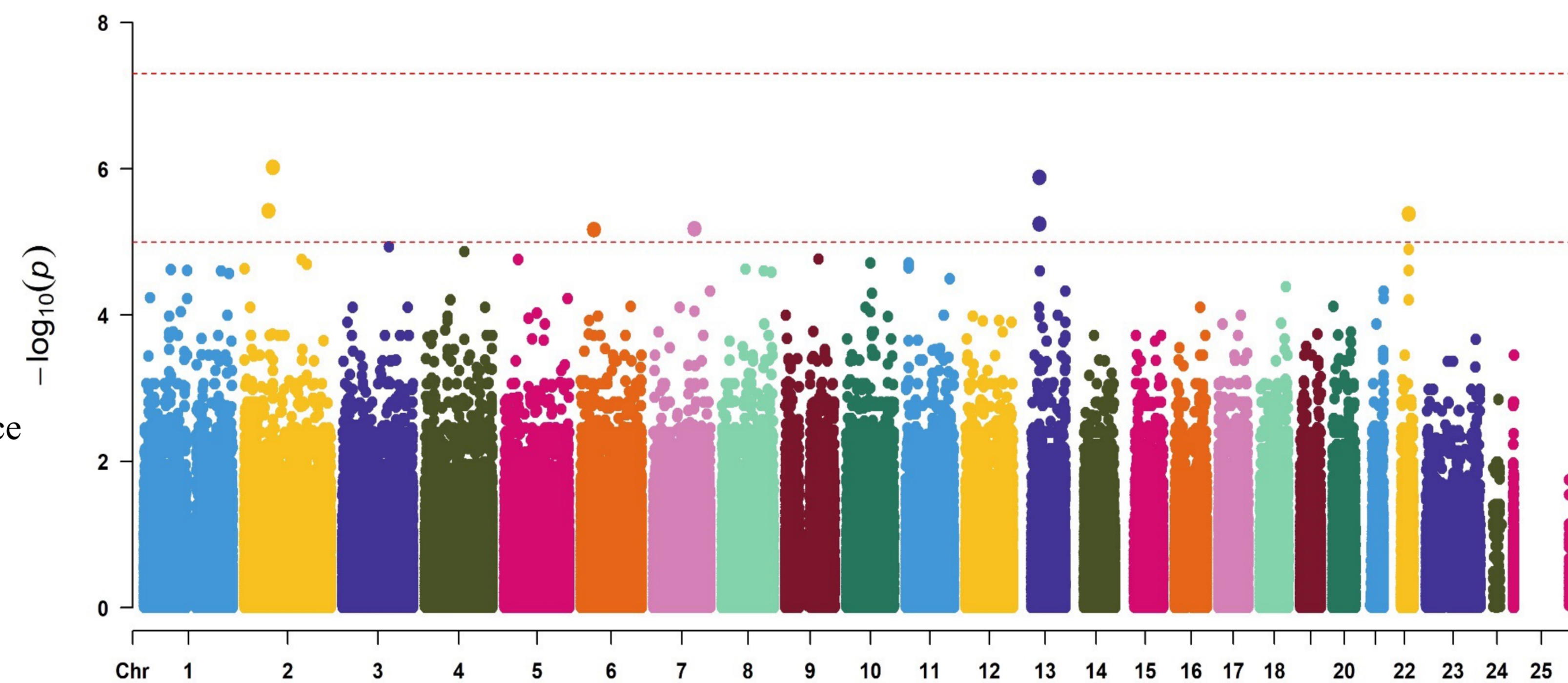
Summary results	Canonical correlation analysis			
	1 (first pair)	2	3	4
Eigenvalue	1.069	0.450	0.232	0.118
Proportion of explained variance	54.26	22.82	11.76	5.98
Canonical correlation	0.72	0.56	0.43	0.32
F value	1.44	0.93	0.66	0.48
p-value	0.016	0.624	0.951	0.990

Total Points: 58
Risk of Low Resilience: 43.2%

Gender — Male / Female

SNP

rs17017697	TT	TC	CC
rs9566600	GG	AG	AA
rs75035711	GG	AG	AA
rs3218253	GG	AG	AA
rs2520583	CC	TC	TT
rs78927014	GG	AG	AA

MRI

Caudalanteriorcingulate (rh)	3250
Fusiform (rh)	9042
Lateraloccipital (rh)	7860
Parstriangularis (rh)	5805
Transversetemporal (rh)	1200
Insula (rh)	7530
Lateralorbitofrontal (lh)	8530
Medialorbitofrontal (lh)	4270
Paracentral (lh)	4312
Precuneus (lh)	8640
Rostralanteriorcingulate (lh)	2590
Rostralmiddlefrontal (lh)	17520
Supramarginal (lh)	11980

Case 1 | Case 2 | Case 3 | Clear

Conclusion

In our study, the results not only showed the selected SNPs related to the resilience traits, but also integrated the SNPs and neuroimaging data to distinguish high from low resilience subjects. In future, we will perform the external validation study in an independent sample based on the training set model of resilience.