University of Glasgow | Institute of Neuroscience & Psychology

CENTRE FOR COGNITIVE NEUROIMAGING

Using E-Mental Health to Detect Emerging Psychosis

Kate Haining – PhD Student

Supervisor - Professor Peter Uhlhaas

The Big Picture

- Approximately 1.1 billion people are living with mental health and substance use disorders
- Leading source of disability, healthcare expenditure and personal suffering
- 75% of mental health disorders emerge between 15-24 years of age

The Big Picture

- Early detection and intervention is a powerful way to improve long-term outcomes.

- Barriers
  - Stigma
  - Continued underfunding of services
  - Difficultly accessing services

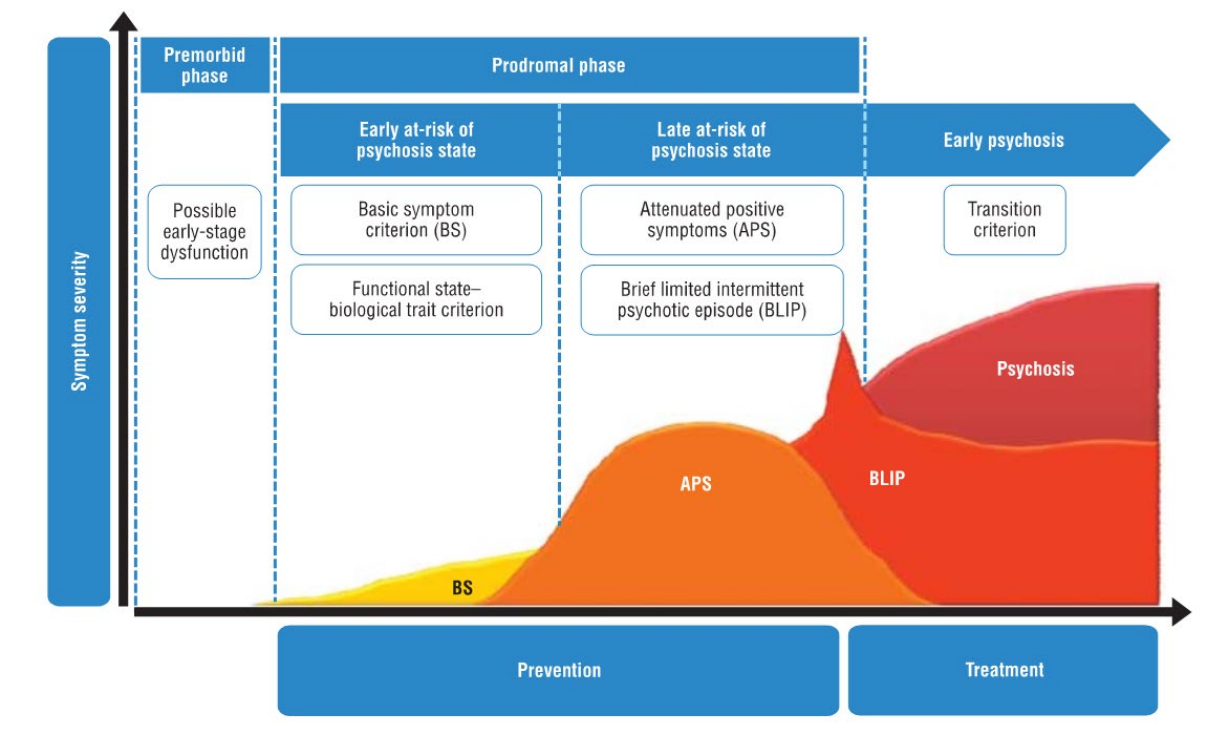
The Big Picture

- Today's youth are surrounded by and immersed in a digital environment.
- In the UK, ~93% of individuals aged 18-34 own a smartphone
- Over 50% own a smartphone in low and middle income countries

Early Detection and Intervention in Psychosis

- Psychosis is a severe mental health disorder commonly associated with delusions, hallucinations and changes in behaviour.

- The first episode of psychosis (FEP) is preceded by a so-called clinical high-risk (CHR) state for psychosis



Fusar-Poli et al. 2012

YouR-Study
Youth Mental Health Risk and Resilience Study

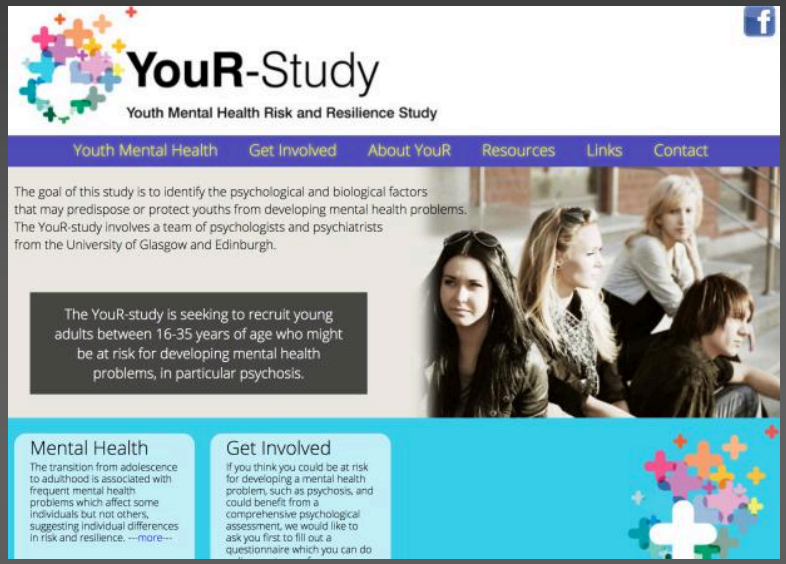
The **Youth Mental Risk and Resilience Study (YouR-Study)** is an MRC-funded project that aims to develop a biomarker for psychosis-prediction

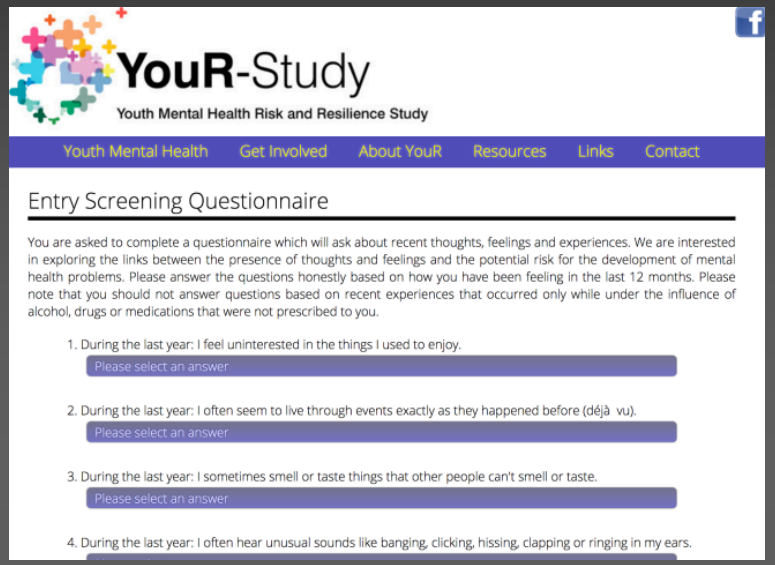
Participants (16-25 years)**:**

- **180** participants meeting CHR criteria (CAARMS/SPI-A)
- **25** participants meeting FEP criteria
- **40** participants with affective disorders/substance abuse
- **50** control participants

Follow-Up: Up to three years to detect transition to psychosis, development of other mental health disorders and functional outcome

An e-Mental Health Approach to Detect Emerging Psychosis





Questionnaires: a) 16-item Prodromal Questionnaire (PQ)
b) 9-item Basic Symptom Scale (PCA)

Recruitment

- Email invitations sent to colleges and universities in Glasgow and Edinburgh
- Posters and flyers advertised in NHS clinics and public transportation
- Letters sent to general practioners (GPs)

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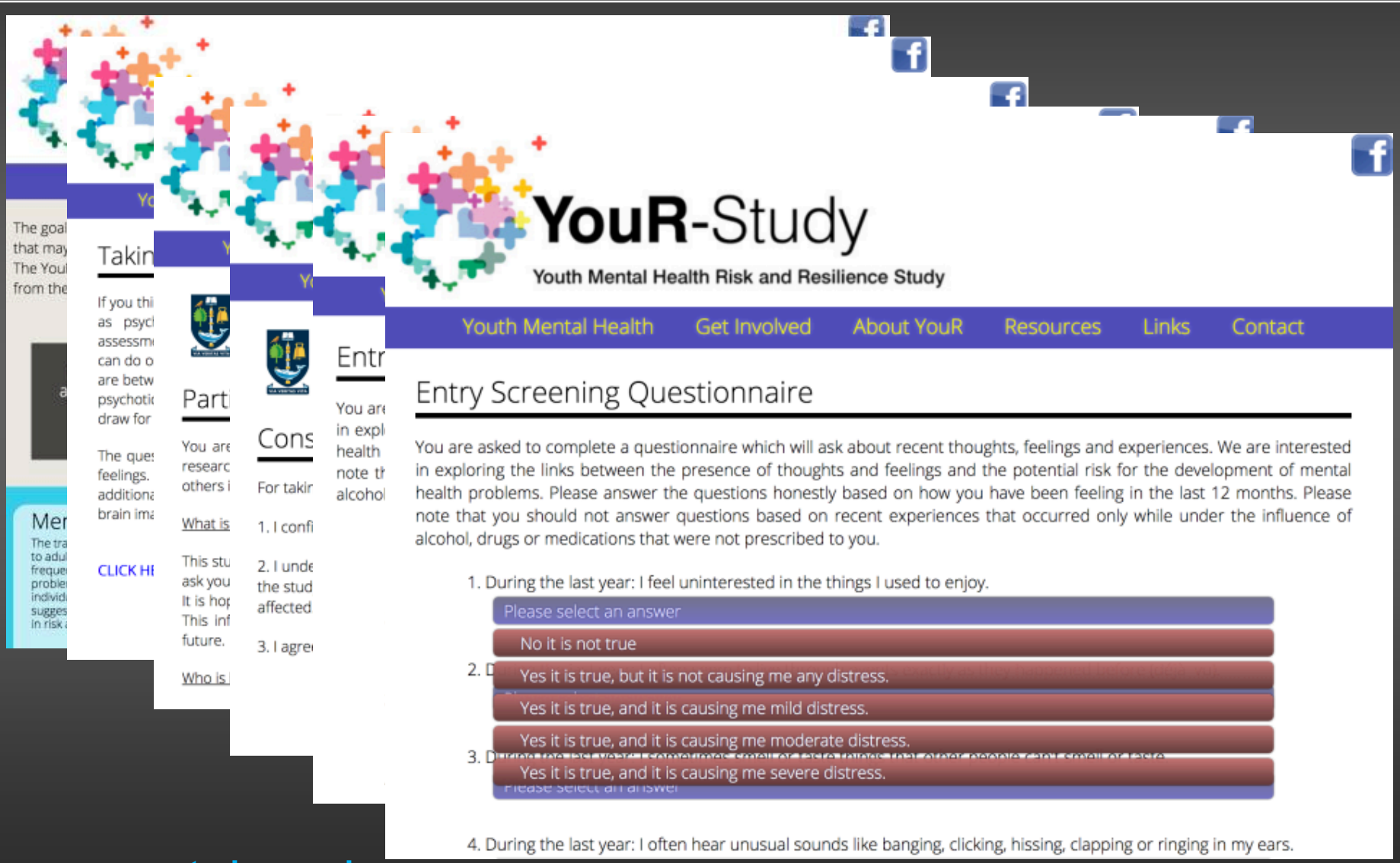


www.your-study.org.uk

McDonald et al. (Schiz Bulletin, 2018)

An e-Mental Health Approach to Detect Emerging Psychosis

- 3500 participants took the online questionnaires over a 4-year period
- ~52.3% of participants met cut-off criteria for the PQ (score of ≥ 6)
- ~73.6% of participants met cut-off criteria for the PCA (score of ≥ 3)
- ~500 participants (~20-25%) who met cut-off criteria on the PQ and/or PCA were invited for clinical interviews:
  - Comprehensive Assessment of At-Risk Mental States (CAARMS)
  - Schizophrenia Proneness Instrument, Adult Version (SPI-A)

Biomarkers for the Early Detection of Psychosis

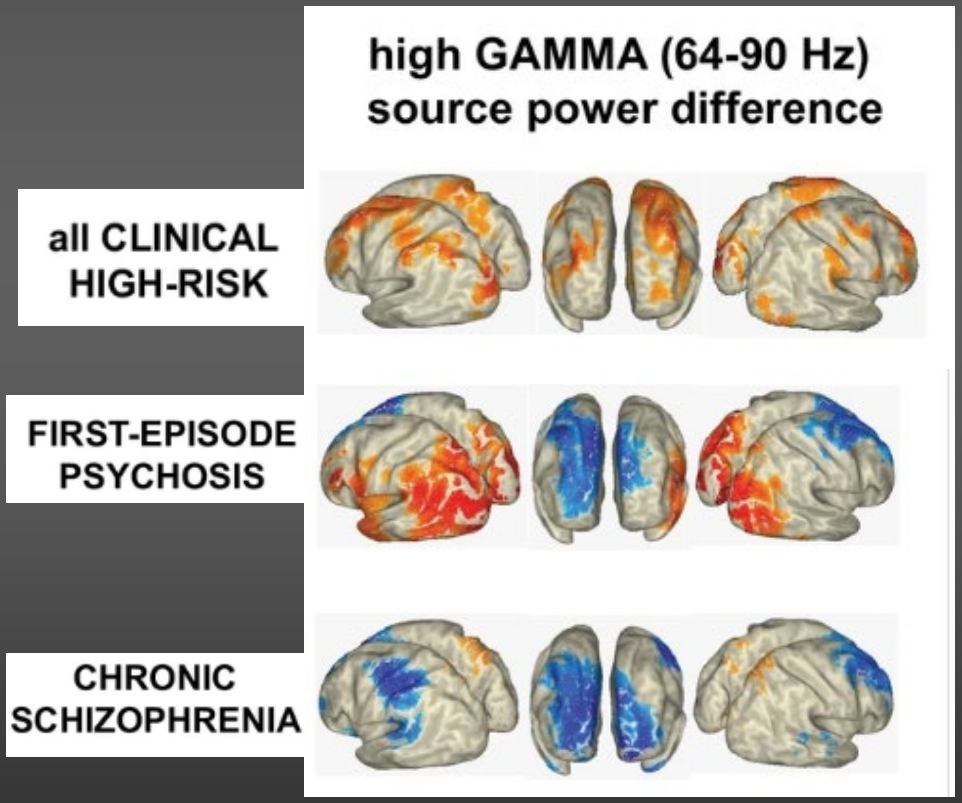
1) MEG: auditory/visual oscillations, resting-state

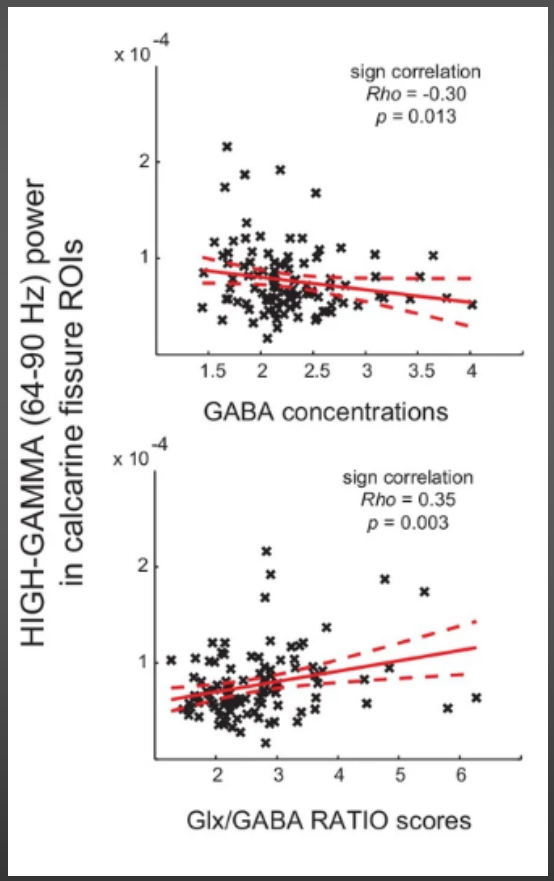
2) MRS: levels of GABA and Glutamate in auditory/visual areas

3) MRI: resting state fMRI, anatomical scan, DTI sequence

MEG-Resting State Activity

88 CHR participants, 21 FEP participants, 34 chronic schizophrenia patients and matched control groups





Grent-'T-Jong et al. (eLife pii: e37799. doi: 10.7554/eLife.37799)

An E-Mental Health Approach to Detect Emerging Psychosis

Digital Innovator Award (with P. Fusar-Poli)

Overall goal: To create an innovative and scalable E-Mental Health Detection tool for emerging psychosis (both CHR and FEP)

Possible ways to improve the current online-screening platform:

1) Incorporate known risk-factors for emerging psychosis

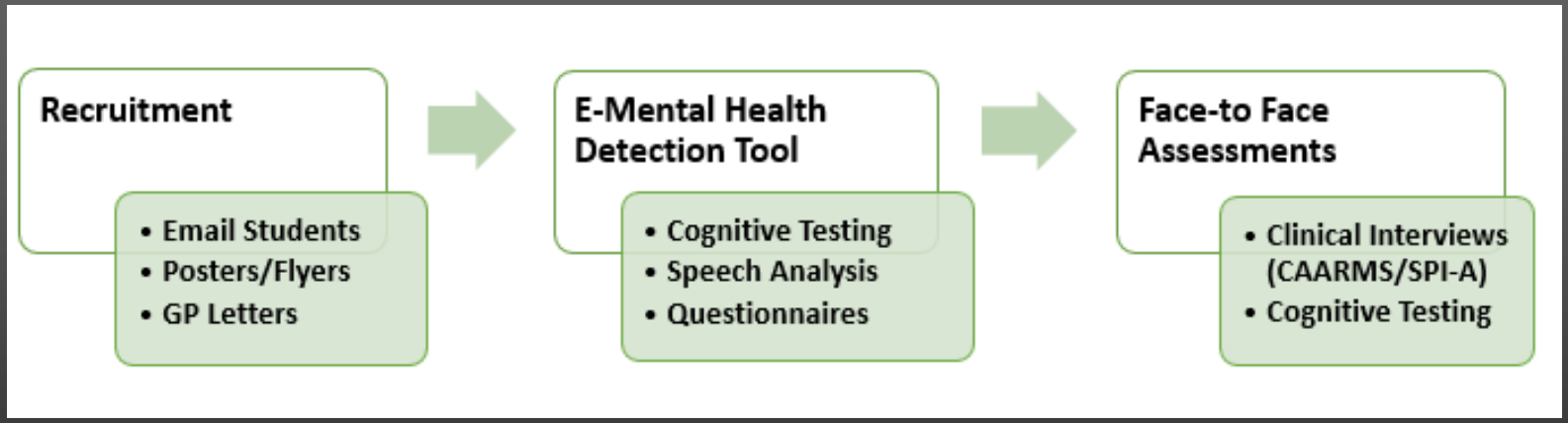
2) Perform online cognitive testing

3) Obtain speech samples to detect thought disorder/semantic anomalies

An E-Mental Health Approach to Detect Emerging Psychosis

Digital Innovator Award (with P. Fusar-Poli)

- Online data will be collected from 3000 participants over an 18 month period
- ~850 participants will also undergo face-to-face assessments at London and Glasgow sites



Summary

1) E-mental health approaches have the potential to provide novel ways of identifying emerging psychosis in the community

   a) significant number of CHR and FEP individuals were detected

   b) majority of participants were not in touch with services

2) Our findings also:

a) Highlight the importance of low-threshold entry points for early intervention

b) Reinforce the unmet mental health needs of young people

c) Emphasise the need for scalable early detection/intervention methods

Acknowledgments

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YouR-Study
Youth Mental Health Risk and Resilience Study

Jozien Goense

Tineke Grent-'t-Jong

Marc Recasens
Hannah Thune
Emmi Mikanmaa
Lingling Hua

Andrew Gumley

Stephen Lawrie

Matthias Schwannauer

Ruchika Gajwani

Joachim Gross

Funding:

MRC Medical Research Council

References

Fusar-Poli, P., Borgwardt, S., Bechdolf, A., Addington, J., Riecher-Rössler, A., Schultze-Lutter, F., . . . Yung, A. (2013). The psychosis high-risk state: a comprehensive state-of-the-art review. JAMA Psychiatry, 70(1), 107-120.

Grent, T., Gross, J., Goense, J., Wibral, M., Gajwani, R., Gumley, A. I., ... & Koethe, D. (2018). Resting-state gamma-band power alterations in schizophrenia reveal E/I-balance abnormalities across illness-stages. *eLife*, 7, e37799.

Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. Archives of general psychiatry. 2005 Jun 1;62(6):593-602.

McDonald M, Christoforidou E, Van Rijsbergen N, Gajwani R, Gross J, Gumley AI, et al. Using Online Screening in the General Population to Detect Participants at Clinical High-Risk for Psychosis. Schizophr Bull. 2018.

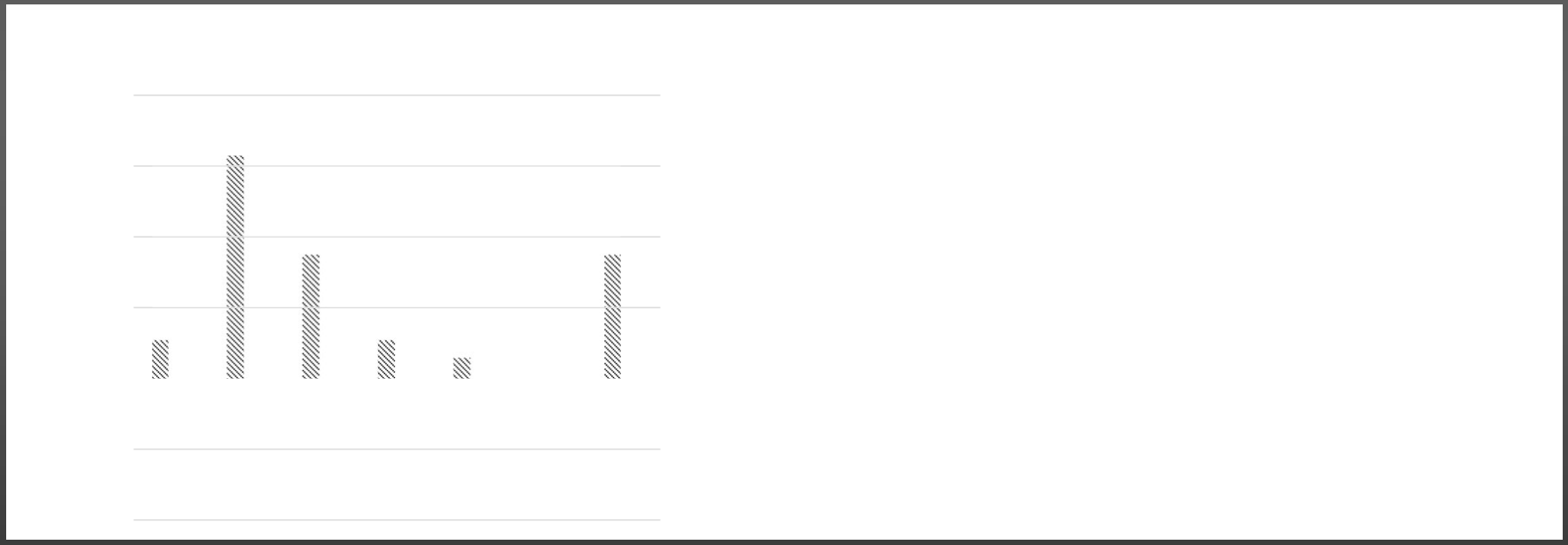
Uhlhaas, P. J., Gajwani, R., Gross, J., Gumley, A. I., Lawrie, S. M., & Schwannauer, M.(2017). The Youth Mental Health Risk and Resilience Study (YouR-Study). BMC Psychiatry, 17(1), 43. doi:10.1186/s12888-017-1206-5

Vos T, Abajobir AA, Abate KH, Abbafati C, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries,1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet. 2017 Sep 16;390(10100):1211-59.

https://www.pewresearch.org/global/2019/02/05/in-emerging-economies-smartphone-adoption-has-grown-more-quickly-among-younger-generations/

Cognitive Deficits in Community-Recruited CHRs

There is extensive evidence on the presence of neurocognitive deficits in CHR-populations across a range of domains that mirror observations in established ScZ (Fusar-Poli et al., 2012; Giuliano et al., 2012; Bora et al., 2014).



Haining et al. (2019) Psychological Medicine

Clinical Outcomes of Community-Recruited CHRs

Mean follow-up period for CHR group (n = 110): ~ 12 months

Transitions to Psychosis: n = 7 total

CHR-subgroups: SPI-A: - CAARMS: n = 2 CAARMS/SPI-A: n = 5 (15-20 %)

No transitions in CHR-negative group (n = 40), one participant developed UHR-symptoms

<u>12 months follow-up:</u>

Follow-up completion 75-80%

n = 61 participants meeting UHR criteria at baseline with a 12-month follow-up:

n = 19 with UHR-criteria (31%)

59.0% have poor functional outcome (GAF < 65)

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Clinical Characteristics of Community-Recruited CHRs

Characteristic	CHRs (N = 108)	HCs (N = 55)	CHR-Ns (N = 42)	df	F/ X^2/H	p
Age (years), M ± SD	21.85 ± 4.33	22.31 ± 3.39	23.24 ± 5.00	2, 97	F = 1.27	0.29
Gender, N female (%)	82 (75.9)	37 (63.7)	28 (66.7)	2	X^2 = 2.01	0.37
Years of education, M ± SD	15.50 ± 3.13	16.38 ± 2.84	16.57 ± 3.62	2, 202	F = 2.29	0.10
GAF, median (range)	59.50	88	70	2	H = 105.13	<0.001
CAARMS-Positive Severity, median (range)	28.50 (0-72)	0 (0-12)	5 (0-24)	2	H = 129.41	<0.001
GF: Social, median (range)	8 (5-10)	9 (8-10)	8 (6-9)	2	H = 64.44	<0.001
GF: Role, median (range)	8(5-9)	9 (5-9)	8 (5-9)	2	H = 45.05	<0.001
PAS, median (range)						
Childhood	0.11 (0-0.57)	0.04 (0-0.21)	0.07 (0-0.46)	2	H = 25.92	<0.001
Early adolescence	0.17 (0-0.54)	0.06 (0-0.23)	0.11 (0-0.46)	2	H = 42.51	<0.001
Late adolescence	0.14 (0-0.57)	0.06 (0-0.29)	0.11 (0-0.71)	2	H = 27.41	<0.001
Medication, N (%)	53 (49.1)	1 (1.8)	19 (45.2)	10	X^2 = 45.49	<0.001
Anti-psychotic	0 (0)	0 (0)	1 (2.4)			
Mood stabiliser	1 (0.9)	0 (0)	0 (0)			
Anti-depressant	23 (21.3)	0 (0)	10 (23.8)			
Other	13 (12.0)	1 (1.8)	6 (14.3)			
Multiple	16 (14.8)	0 (0)	2 (4.7)			
Diagnosis, N (%)	97 (89.8)	3 (5.45)	26 (61.9)	2	X^2 = 109.5	<0.001
Anxiety disorders	80 (74.1)	0 (0)	19 (45.2)			
Mood disorders	67 (62.0)	0 (0)	12 (28.6)			
Eating disorders	11 (10.2)	0 (0)	1 (2.4)			
Suicide Risk	57 (52.8)	1 (1.8)	10 (23.8)			
Alcohol Dependence/Abuse	31 (28.7)	2 (3.6)	9 (21.4)			
Substance Dependence/Abuse	13 (12.0)	0 (0)	1 (2.4)			

McDonald et al. (Schiz Bulletin, 2018)

An e-Mental Health Approach to Detect Emerging Psychosis

Table 3. ROC-Analyses for PQ-16, PCA and PCA/PQ-16 Combined

Measure	Cut-off	Sensitivity	Specificity	PPV %	NPV %	LR^+	AUC	Standard Error	95% CI	*P*
PQ-16	6	0.81	0.44	29	89	1.45	0.72	0.033	0.66–0.78	<.001
PQ-16	7	0.73	0.55	32	88	1.62				
PCA	3	0.95	0.13	25	89	1.06	0.69	0.033	0.62–0.75	<.001
PCA	4	0.90	0.26	27	90	1.22				
PCA	5	0.83	0.44	31	89	1.48				
Combined	10	0.89	0.43	42	89	1.56	0.74	0.028	0.69–0.80	<.001

Table 4. ROC Analyses for a Subset of Questionnaire and Demographic Data

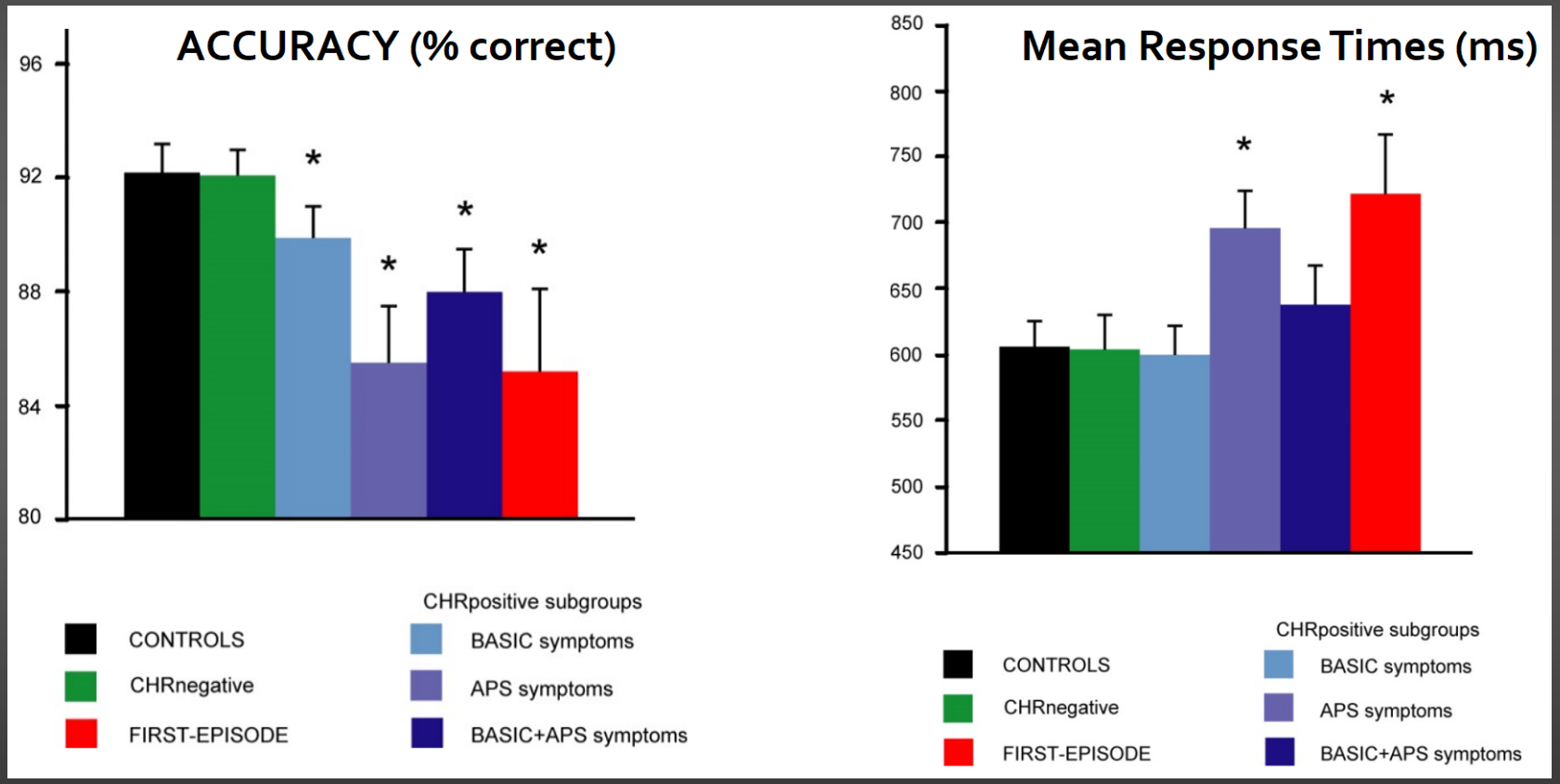
Number of Items	Threshold	Sensitivity	Specificity	PPV %	NPV %	LR^+	AUC	SE	95% CI	*P*
12	5	0.80	0.57	46	86	1.86	0.73	0.028	0.67–0.78	<.001
11	4	0.84	0.51	45	77	1.71	0.72	0.03	0.65–0.77	<.001
10	4	0.81	0.57	54	77	1.88	0.71	0.028	0.65–0.76	<.001

A subset of 10 items including familial risk led to an acceptable sensitivity/specificity for the screener (81%/57%)

FEPs had increased PQ-16 scores than CHRs

McDonald et al. (Schiz Bulletin, 2018)

Neural Oscillations in Visual Cortex during Emerging Psychosis



Hoogenboom et al. (2006, Neuroimage)