

# Using E-Mental Health to Detect Emerging Psychosis

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# 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



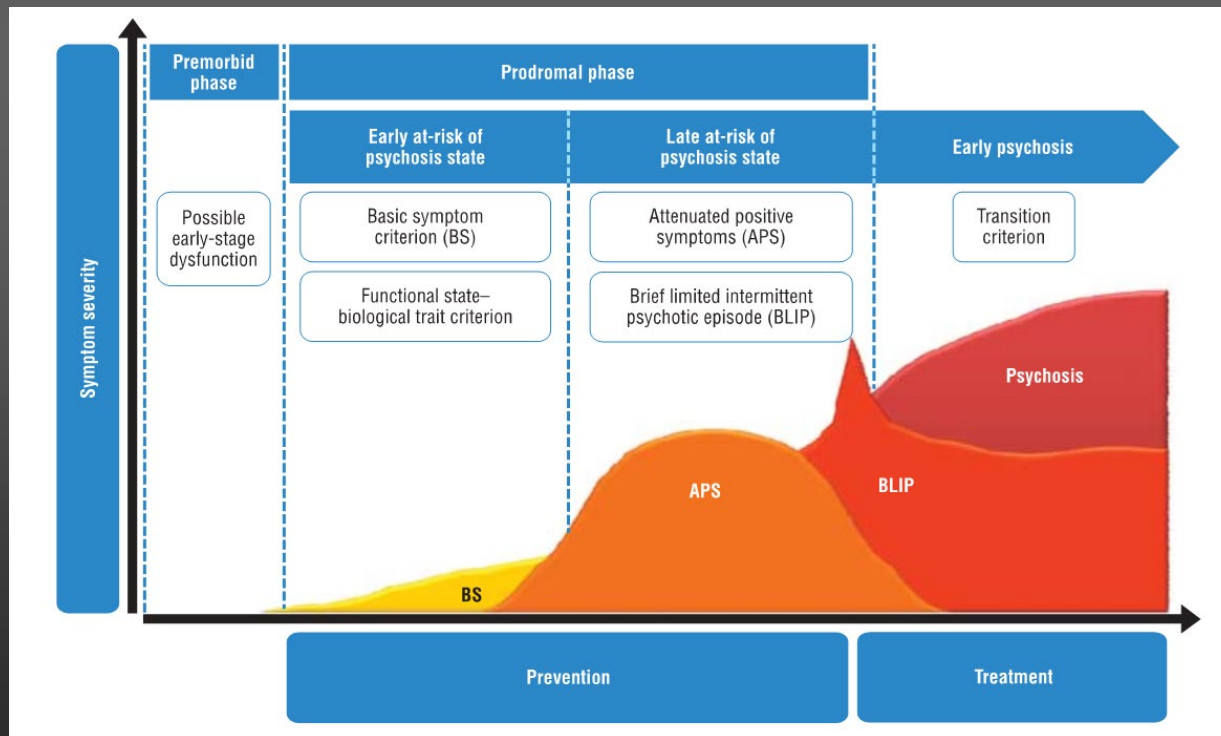
# The Big Picture



- 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





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):**

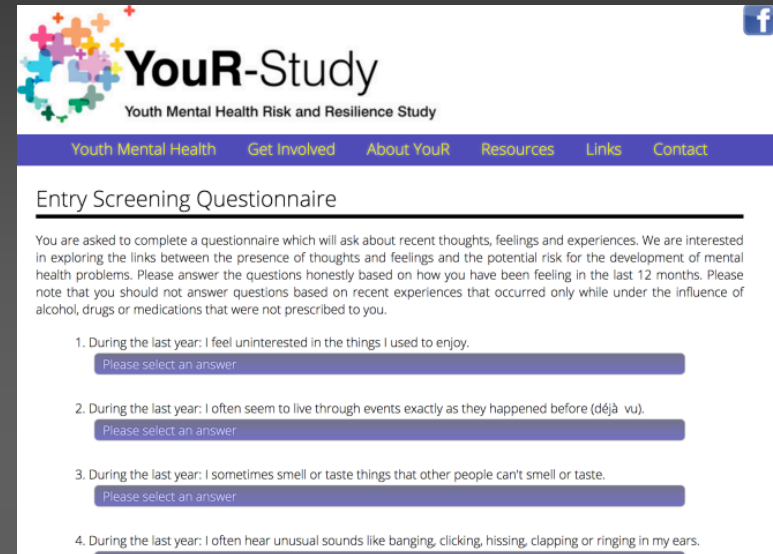
- **180** participants meeting CHR criteria (CAARMS/SPI-A)
- **25** participants meeting FEP criteria
- **40** participants with affective disorders/substance abuse
- **50** control participants

**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



The screenshot shows the homepage of the YouR-Study website. At the top left is the logo, which consists of a cluster of colorful plus signs in shades of blue, green, yellow, and red, followed by the text "YouR-Study" in a bold, sans-serif font. Below the logo is the subtitle "Youth Mental Health Risk and Resilience Study". To the right of the logo is a small blue Facebook icon. A navigation bar with a blue background and white text contains the following links: "Youth Mental Health", "Get Involved", "About YouR", "Resources", "Links", and "Contact". Below the navigation bar is a large image of four young people (three women and one man) sitting together and looking towards the camera. To the left of the image, there is a text box with a dark background and white text that reads: "The YouR-study is seeking to recruit young adults between 16-35 years of age who might be at risk for developing mental health problems, in particular psychosis." Below the image, there are two columns of text. The left column is titled "Mental Health" and discusses the transition from adolescence to adulthood. The right column is titled "Get Involved" and describes the study's goal and how to participate. At the bottom right of the page, there is a graphic of colorful plus signs and a white cross.



The screenshot shows the "Entry Screening Questionnaire" page of the YouR-Study website. At the top left is the logo, which consists of a cluster of colorful plus signs in shades of blue, green, yellow, and red, followed by the text "YouR-Study" in a bold, sans-serif font. Below the logo is the subtitle "Youth Mental Health Risk and Resilience Study". To the right of the logo is a small blue Facebook icon. A navigation bar with a blue background and white text contains the following links: "Youth Mental Health", "Get Involved", "About YouR", "Resources", "Links", and "Contact". Below the navigation bar is the title "Entry Screening Questionnaire" in a bold, sans-serif font. Below the title is a paragraph of text that reads: "You are asked to complete a questionnaire which will ask about recent thoughts, feelings and experiences. We are interested in exploring the links between the presence of thoughts and feelings and the potential risk for the development of mental health problems. Please answer the questions honestly based on how you have been feeling in the last 12 months. Please note that you should not answer questions based on recent experiences that occurred only while under the influence of alcohol, drugs or medications that were not prescribed to you." Below the text are four numbered questions, each followed by a blue button that says "Please select an answer".

**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 practitioners (GPs)

# An e-Mental Health Approach to Detect Emerging Psychosis

The screenshot displays the 'YouR-Study' website, which is the 'Youth Mental Health Risk and Resilience Study'. The page features a blue header with navigation links: 'Youth Mental Health', 'Get Involved', 'About YouR', 'Resources', 'Links', and 'Contact'. The main content area is titled 'Entry Screening Questionnaire' and includes an introductory paragraph: 'You are asked to complete a questionnaire which will ask about recent thoughts, feelings and experiences. We are interested in exploring the links between the presence of thoughts and feelings and the potential risk for the development of mental health problems. Please answer the questions honestly based on how you have been feeling in the last 12 months. Please note that you should not answer questions based on recent experiences that occurred only while under the influence of alcohol, drugs or medications that were not prescribed to you.'

The questionnaire consists of several items, with the first three visible:

1. During the last year: I feel uninterested in the things I used to enjoy.  
Please select an answer  
 No it is not true  
 Yes it is true, but it is not causing me any distress.  
 Yes it is true, and it is causing me mild distress.  
 Yes it is true, and it is causing me moderate distress.  
 Yes it is true, and it is causing me severe distress.  
Please select an answer
2. During the last year: I often hear unusual sounds like banging, clicking, hissing, clapping or ringing in my ears.
3. During the last year: I often hear unusual sounds like banging, clicking, hissing, clapping or ringing in my ears.

On the left side of the page, there are several partially visible sections with titles like 'Taking...', 'Part...', 'Cons...', and 'Entr...', each accompanied by a small icon and a brief description. The website also features a decorative graphic of colorful plus signs and a row of Facebook social media icons at the top right.





# 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  $\geq 6$ )
- ~73.6% of participants met cut-off criteria for the PCA (score of  $\geq 3$ )
- ~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



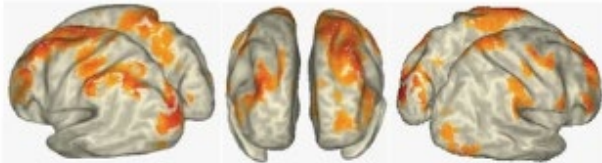
- 1) MEG: auditory/visual oscillations, resting-state
- 2) MRS: levels of GABA and Glutamate in auditory/visual areas
- 3) MRI: resting state fMRI, anatomical scan, DTI sequence

# MEG-Resting State Activity

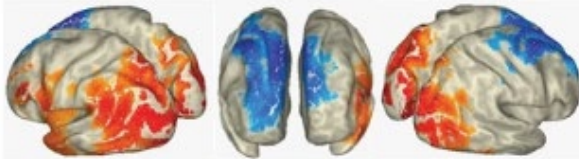
88 CHR participants, 21 FEP participants, 34 chronic schizophrenia patients and matched control groups

high GAMMA (64-90 Hz)  
source power difference

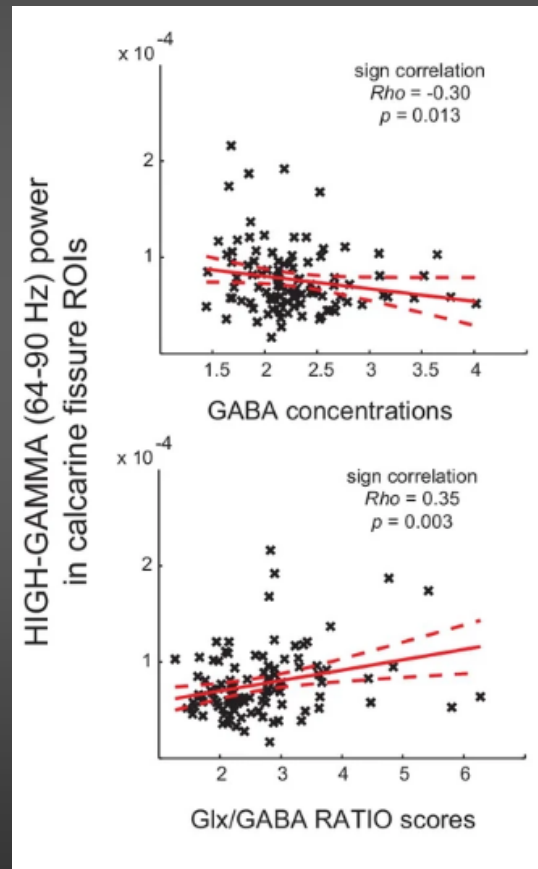
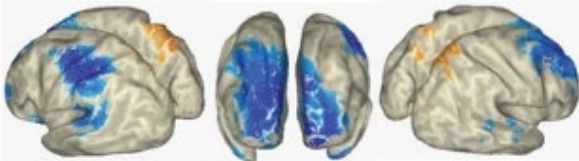
all CLINICAL  
HIGH-RISK



FIRST-EPIISODE  
PSYCHOSIS



CHRONIC  
SCHIZOPHRENIA



# 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:**

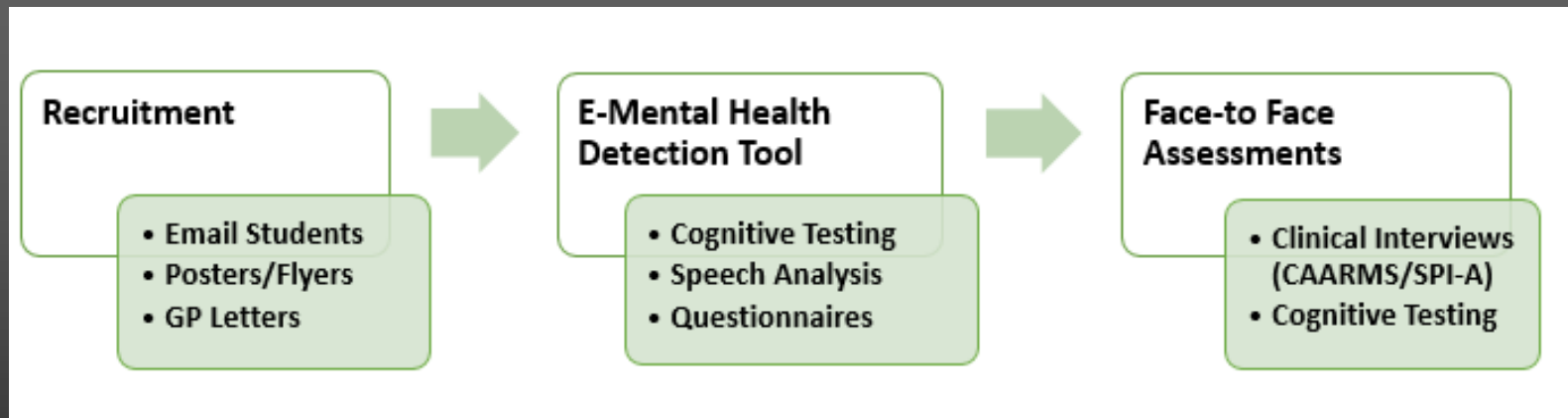
- 1) Incorporate known risk-factors for emerging psychosis**
- 2) Perform online cognitive testing**
- 3) Obtain speech samples to detect thought disorder/semantic anomalies**

# 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

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- 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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# References

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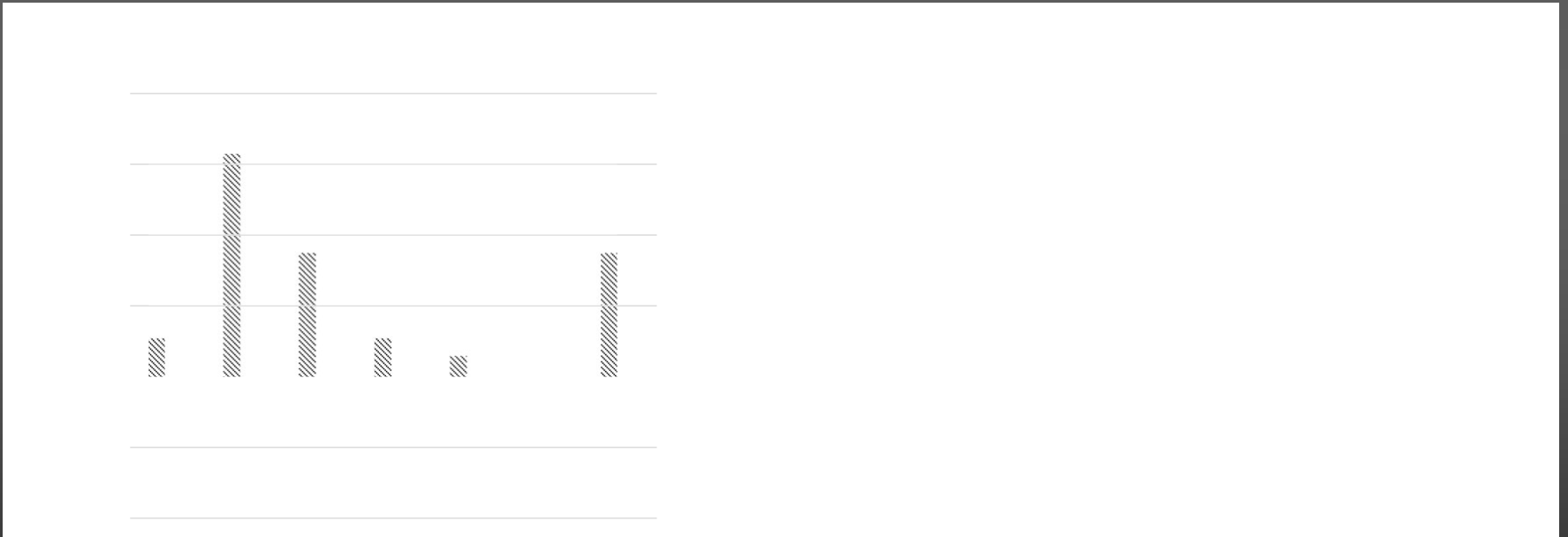
<https://www.pewresearch.org/global/2019/02/05/in-emerging-economies-smartphone-adoption-has-grown-more-quickly-among-younger-generations/>





# 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).



# 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

12 months follow-up:

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	CHR (N = 108)	HC (N = 55)	CHR-Ns (N = 42)	df	F/ X <sup>2</sup> /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 <sup>2</sup> = 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
<b>GAF, median (range)</b>	<b>59.50</b>	<b>88</b>	<b>70</b>	<b>2</b>	<b>H = 105.13</b>	<b>&lt;0.001</b>
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 <sup>2</sup> = 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)			
<b>Diagnosis, N (%)</b>	<b>97 (89.8)</b>	<b>3 (5.45)</b>	<b>26 (61.9)</b>	<b>2</b>	<b>X<sup>2</sup> = 109.5</b>	<b>&lt;0.001</b>
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)			
<b>Suicide Risk</b>	<b>57 (52.8)</b>	<b>1 (1.8)</b>	<b>10 (23.8)</b>			
Alcohol Dependence/Abuse	31 (28.7)	2 (3.6)	9 (21.4)			
Substance Dependence/Abuse	13 (12.0)	0 (0)	1 (2.4)			

# 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 <sup>+</sup>	AUC	Standard Error	95% CI	<i>P</i>
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 <sup>+</sup>	AUC	SE	95% CI	<i>P</i>
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**

# Neural Oscillations in Visual Cortex during Emerging Psychosis

