The Early Psychosis Screener (EPS):
A validated accurate web-based self-report screener for Attenuated Psychotic Syndrome and First Episode Psychosis

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TELESAGE™ Standardized Behavioral Health Diagnoses and Outcomes

EPS Early Psychosis Screener

Background

Identifying individuals with a high risk of developing a psychotic disorder is critical to many CNS clinical trials. The paper Structured Interview for Psychosis-risk Syndromes (SIPS) has been the 'gold standard' clinician interview but takes about 90 minutes to administer. The paper Prodromal Questionnaire - Brief Version (PQ-B) has served as a less rigorous self-report alternative. Unfortunately, these assessments suffer from high false positive rates and low predictive value and a lack of automation. These deficiencies complicate the efficient conduct of CNS clinical trials.

Objective

To develop and validate a simple self-report assessment that will accurately identify individuals who are experiencing First Episode Psychosis or who have Attenuated Psychotic Syndrome and are at high risk of developing First Episode Psychosis within the next twelve months.

EPS-SVM Features include:

Self-report at 5th grade reading level

PC, laptop, tablet, and smartphone administration supported via standard internet browsers *(average 8 minutes)*:
- Automated telephone administration *(average 9 minutes)*
- Optional paper EPS-SVM administration followed by rapid data entry with mouse-less feature

Automated Non-linear Support Vector Machine based scoring algorithm

Optional real-time reporting:
- probability of conversion to First Episode of Psychosis within 12 months
- probability of current First Episode Psychosis

Geo-redundant HIPAA-compliant encrypted cloud databases

Secure real-time remote access to all item and response level data

Optional data export to SPSS and SAS

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Methods

Participants: Test survey items were administered together with the PQ-B to individuals being screened with the SIPS at North American Prodrome Longitudinal Study (NAPLS) sites including Calgary, Columbia, Emory, UCLA, UCSD, UNC, Yale, Zucker Hillside Hospital, and at the Columbia University COPE. The recruitment procedures for the NAPLS sites and for the COPE were based on the Criteria of Psychosis-risk Syndromes (COPS) and have been comprehensively described in the literature (Addington, 2012; Brucato, 2017). A non-clinical control sample was also recruited.

Items: For this study, we administered 148 test items, but prior to the start of quantitative analyses we realized that 24 of these items might lead to spurious differentiations. These 24 items were removed apriori leaving a total of 124 for analysis.

Analysis: A single analytic plan was selected apriori. This plan included Spectral Clustering Analysis (SCA) followed by Non-linear Support Vector Machine (SVM) analysis. An addendum to this poster describing these two techniques can be obtained from Dr. Brodey.

Results

Participants:
In all, we recruited 353 participants from the eight early psychosis sites where SIPS screening is part of the standard protocol. Participants from the early psychosis sites were further divided into: Clinically Low Risk (CLR) 71, Clinically High Risk (CHR) 234, and First Episode Psychosis (FEP) 42. We also recruited 107 Non-Clinical Control (NCC) participants, students from UNC Chapel Hill.

149 participants were followed to conversion or for a minimum of 12 months. 35 participants did not convert even after 24 months, 5 did not convert during the first 12 months but did convert during the subsequent 12 months, and 75 did not convert during the first 12 months, but were lost to follow up prior to 24 months. These three groups can be aggregated as 115 participants who are known not to have converted during the first 12 months. The remaining 34 converted during the first 12 months. For the purpose of developing SVM algorithms these groups were aggregated as follows: Group zero comprised CLR participants plus CHR participants who did not convert even after 24 months. Group one comprised CHR participants who converted within 12 months plus FEP participants. These two groups were selected for training the SVM because they represented the populations for whom differentiation is most clinically relevant.

Table 1
Cross-validated performance of the EPS-SVM classifiers, as well as the performance of SIPS alone, or in combination with EPS-SVM, in correctly distinguishing between subjects in Group 0 and Group 1.

Method	SIPS	PQ-B	PQ-B	EPS-26	EPS-SVM	SIPS + EPS-SVM
Threshold		3	6	Default	Default	
True Positive Fraction (%) TP/(TP+FN)(100)	99.0	84.2	71.1	81.6	51.3	76.3
False Positive Fraction (%) FP/(FP+TN)(100)	33.0	51.9	37.7	45.3	11.3	8.5
Positive Predictive Value (%) TP/(TP+FP) (100)	68.5	53.8	57.5	56.4	76.5	86.6
Overall accuracy (%) (TP+TN)(TP+TN+FP+FN)(100)	83.5	66.2	66.7	68.2	70.0	83.9

Table 2
Percent (number) of participants in each category who were classified as "Group 1."

Method	PQ-B	PQ-B	EPS-26	EPS-SVM
Threshold	3	6	Default	Default
NonClinical (n=107)	27.1 (29)	12.2 (13)	29.0 (19)	0.9 (1)
CLR (n=71)	29.6 (21)	16.9 (12)	19.7 (14)	4.2 (3)
CHR-0 (n=115)	93.9 (108)	74.8 (86)	99.1 (114)	22.6 (26)
CHR-1 (n=34)	85.3 (29)	70.6 (24)	79.4 (27)	47.1 (16)
FEP (n=42)	83.3 (35)	71.4 (30)	83.3 (35)	54.8 (23)

Figure 1: The PPV of the SIPS alone, the PQ-B with its published cutoffs of 3 and 6, and the EPS-SVM for actual conversion within 12 months among individuals who were found to be CHR.

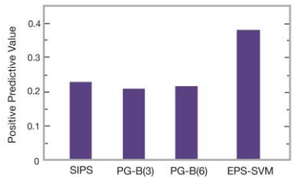


Figure 2: A receiver operating curve was prepared for the EPS-SVM to demonstrate its ability to correctly predict who among CHR individuals will convert within 12 months.

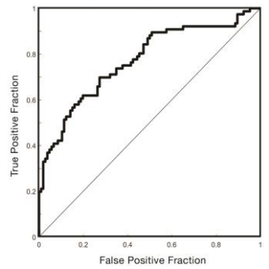
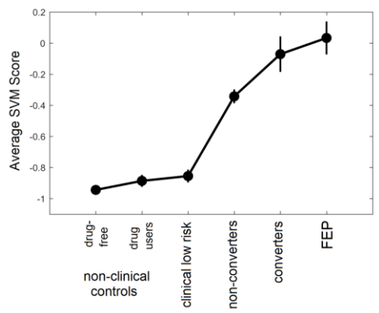


Figure 3: Average EPS-SVM scores for six groups:
- non-clinical controls who denied any 30-day drug use
- non-clinical controls reporting some 30-day drug use
- CLR
- 12 month non-converters
- Converters
- FEP participants

The Standard Error of the Mean (SEM) for each data point is also provided.



Discussion

The PPV for the EPS-SVM was superior to that of the SIPS, EPS-26, and PQ-B *(see Table 1; also see Figure 1)*. This finding is important because while the SIPS is a loosely structured interview that requires substantial training and about 90 minutes to administer, as well as periodic inter-rater reliability testing, the EPS-SVM is a 64 item self-report assessment that is intended to be at a 5th grade reading level and takes less than 10 minutes to administer. The EPS-SVM can be used widely to screen individuals for in-person evaluation in clinical and research settings. This has two important implications; first the EPS-SVM can be used as a public health intervention to identify help seeking individuals who have APS or FEP. Second, by facilitating the referral of at-risk individuals to early psychosis clinics, our nation will gain a much greater capacity to identify interventions that have the potential to prevent or ameliorate the progression of psychosis. Lastly, the EPS can be used in conjunction with the SIPS to further improve the overall accuracy of predictions.

Along with the Likert scale response set, two additional benefits of the EPS-SVM are noteworthy. First, to the greatest extent possible, we designed the individual EPS items so that each one asks about a single granular concept. If we look at the individual item endorsement patterns, it should be possible to determine which granular concepts and clusters are associated with CHR and FEP status. It should also be possible to improve the signal to noise ratio in clinical trials by looking closely at the clusters of symptoms that respond to the intervention rather than at a broad diagnosis.

Conclusion

The EPS appears to be more accurate at identifying individuals who are either prodromal or in the early stages of psychosis than either the SIPS or the PQ-B. Because the EPS is accurate and brief, it may be ideal for screening individuals for admission into clinical trials relating to prodromal and first episode psychotic disorders.

TeleSage is about to release an on-line Psychosis Risk Estimator and Referral System (PRERS) for at-risk individuals between the ages of 18 and 35 that can be accessed through www.telesage.com. The goal of this site is to identify and refer both high risk individuals and FEP individuals in order to increase referrals to clinical trials and to carefully characterize individuals entering clinical trials so as to improve the signal to noise ratio, promote early treatment, and reduce the duration of untreated psychosis.

References and full poster available upon request, and are available on the CNS Summit Platform.