Digital phenotyping in schizophrenia: Do clinical assessments matter anymore?

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Introduction

There has been increasing study of the use of wearables and mHealth for improving patient outcomes across a range of indications. The potential to improve clinical outcomes, predict adverse events or even relapse would be a powerful addition to any clinician's toolbox. Digital phenotyping, a term coined by Torous et al, 2015 and expanded by Insel et al, 2017, refers to the process of gathering passive (biometric and/or smart phone) data and active (self-report questionnaire data) to develop illness signatures that can inform treatment decisions. They further defined the process as the 'moment-by-moment quantification of the individual-level human phenotype in situ using data from personal digital devices'.

In schizophrenia and other psychoses there have been studies on adherence and acceptability (e.g., Killikenny et al, 2017), interest (Firth et al, 2017), and autonomic activity compared to healthy normal volunteers (Cella et al, 2017), but little on linking these digital data signatures to the anchoring clinical assessments. We know some of the clinical factors associated with relapse in schizophrenia, including deficits in insight; this study asked if there are factors that can be obtained passively (actigraphy) and actively (electronic PROs) through digital means.

Our aim here was to retrospectively analyze data from a Sponsor's pilot study that used wearables and mHealth applications ("apps") alongside clinical assessment to assess relapse risk in schizophrenia.

Objectives

To assess digital phenotyping in schizophrenia and how it may be used to predict relapse events, i.e., is there an autonomic signature of disease that can be obtained through the combination of digital and clinical information?

Methods

Data were analyzed using SPSS 21.0 from a single-site pilot study using wearable devices and mHealth apps with recently discharged, stable, patients with a diagnosis of schizophrenia or schizoaffective disorder according to DSM-5 criteria. The clinical measures were performed at biweekly intervals for sixteen weeks during the trial, and included the PANSS, BPRS and CGI-S.

Results

The mean PANSS total score for all visits was μ = 35 (σ = 4.6) with the BPRS mean total score of μ = 25 (σ = 4.3) for all visits indicating subclinical severity across the n=40 population. The mean CGI-S score was μ = 3.7 approximating a CGI-S of "moderate severity". No meaningful comparisons could be made to the mHealth devices as there were no recorded relapse events captured by the PANSS or BPRS.

Digital phenotyping process flow
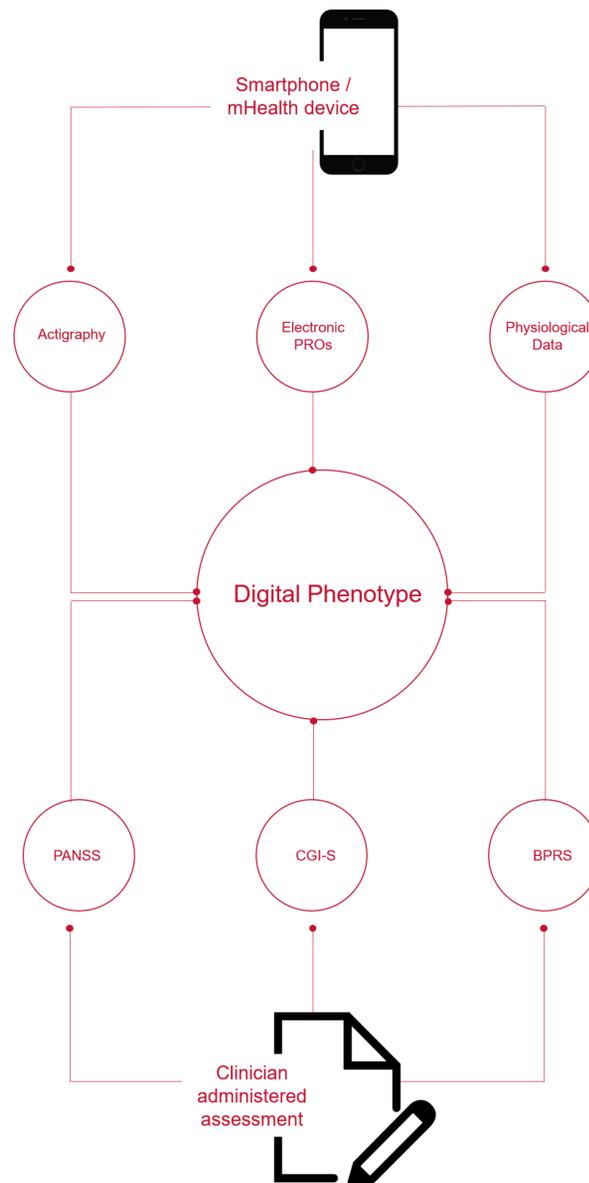
Conclusion

The values obtained do not correspond with normative data for a schizophrenia population; we would expect much higher scores in an outpatient context. Hermes et al, 2013 noted that in the CATIE dataset, for example, a sub-population (n=707) of stable subjects that had a mean PANSS score of 76.0 (σ = 17.4). It was theorized that because 30-35% of patient relapse within several months following treatment that a potential "relapse signature" would emerge. However, because the clinical assessment indicated sub-clinical or doubtful symptom severity, a digital phenotype of any consequence failed to emerge. An adequate monitoring program would have identified that this patient sample and/or rater cohort was not optimal.

Development of a cohesive, objective and systematic categorization of psychiatric illness has been a rate limiter in the development of new compounds for treatment. Equally, determining which elements are most salient in predicting relapse or other sub-optimal outcomes have been elusive. Digital phenotyping may well evolve the science of diagnostics and prediction but is substantially limited by the need, at this time, to pair these more objective data points with traditional assessment types that can have high measurement error.

In order for digital phenotyping to gain traction and enhance or replace subjective outcome measures there must first be rigorous clinical assessments to anchor the technology; at this early stage the digital phenotypes will only be as good as the psychometric ratings and the probability of making Type I or Type II errors remains high.

References

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