Methodological Implications for Linking Speech Characteristics with Measures of Psychosis: A Meta-Analysis

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What is the Methodological Issue Being Addressed? There is substantial interest in using speech characteristics to inform measurement of symptoms of psychosis. However, this field is marked by significant heterogeneity in both speech elicitation methods and the features extracted. This analysis examined whether associations between speech characteristics and psychosis symptoms vary as a function of these methodological factors.

Introduction Interest in the relationship between speech characteristics and psychosis symptoms has spanned several decades (e.g., Rochester, 1987), with increasing methodological sophistication in recent years (e.g., Cohen et al., 2014; Parola et al., 2020). Prior reviews have summarized this literature, including work focused on clinician-rated speech features (Hoekert et al., 2007) and quantitative acoustic and linguistic measures (Cohen et al., 2014; Parola et al., 2020). However, prior meta-analyses were based on literature published through April 2018. We extend this work by evaluating more recent studies and examining methodological characteristics as moderators of the association between speech and symptom severity.

Methods We conducted a systematic review of studies examining associations between speech characteristics and symptoms of psychosis. The search strategy was informed by prior reviews (e.g., Cohen et al., 2014; Low et al., 2020; Parola et al., 2020) and a pre-registered protocol (PROSPERO: CRD420261337184). The present results do not include study quality or publication bias assessments. We screened 263 titles and abstracts identified via PubMed. Of these, 65 full texts were reviewed, with 17 articles (2022–2026) meeting inclusion criteria, yielding 291 effect sizes. Each effect size was coded for speech elicitation methodology (e.g., picture description, free speech) and speech characteristic (e.g., semantic, linguistic). Effect sizes represented either (1) associations between speech features and symptom severity or (2) group differences between healthy controls and individuals with first-episode psychosis or schizophrenia.

Results Due to methodological variability across studies, absolute values of effect sizes were analyzed using a mixed-effects meta-regression model (REML estimator) including two moderators (speech elicitation methodology and speech characteristic). The test of moderators was significant, indicating that these factors explained variability in effect sizes ($QM [df = 23] = 155.96$, $p < .001$). Residual heterogeneity remained but was modest ($\tau^2 = .0026$ [SE = .0009]; $I^2 = 22.69\%$; $QE [df = 263] = 305.76$, $p = .036$). Moderators and their interactions explained a substantial proportion of between-study variance ($R^2 = 62.4\%$). Lexical and pragmatic features were associated with larger effect sizes, and less structured speech elicitation methods (e.g., free speech) yielded stronger

associations compared to more constrained tasks.

Conclusion Results indicate that the strength of associations between speech characteristics and symptoms of psychosis is highly dependent on methodological context, including both speech elicitation strategy and feature extraction approach. Given that effect sizes vary systematically with both elicitation and speech feature factors, standardization of speech elicitation paradigms and methods for extracting speech variables as components of speech-derived endpoints may improve sensitivity and utility in multicenter CNS clinical trials. Findings from this analysis offer guidance for such efforts.

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Keywords

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