



## Short Communication

# Screening for ADHD in adults with cystic fibrosis: Prevalence, health-related quality of life, and adherence ☆☆☆

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## Abstract

**Background:** International guidelines recommend depression and anxiety screening in individuals with cystic fibrosis (CF), but Attention-Deficit Hyperactivity Disorder (ADHD) remains understudied.

**Methods:** Adults with CF ( $n = 53$ ) were screened using the Adult ADHD Self-Report Scale-v1.1 Symptom Checklist (ASRS-v1.1), Cystic Fibrosis Questionnaire-Revised (CFQ-R), and a self-report measure of treatment adherence.

**Results:** Elevated ADHD symptoms on the ASRS-v1.1 screener were reported by 15% of participants. Self-reported adherence, Body Mass Index in  $\text{kg}/\text{m}^2$  (BMI), and Forced Expiratory Volume in 1 Second, Percent Predicted (FEV1%pred) did not differ between participants with vs. without elevated ADHD scores. Three CFQ-R scales, Physical Functioning, Role Functioning, and Respiratory Symptoms, were significantly lower in participants with elevated ADHD screens (unadjusted  $p < 0.05$ ). This difference remained statistically significant for the Role Functioning and Respiratory Symptoms scales following correction for multiple comparisons.

**Conclusions:** The highly specific screening tool ASRS-v1.1 can ascertain previously undetected ADHD symptoms in adults with CF. ADHD was substantially more prevalent than expected in this population. Elevated ASRS-v1.1 screens correlated with poorer Health-Related Quality of Life (HRQoL) in some domains, but not with BMI, FEV1%pred, or self-reported CF treatment adherence. Additional research will elucidate the impact of ADHD and its treatment on HRQoL, CF self-care and health outcomes.

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**Keywords:** Cystic fibrosis; Attention-deficit hyperactivity disorder; Health-related quality of life; Adherence

**Abbreviations:** ADHD, Attention-Deficit Hyperactivity Disorder; ASRS-v1.1, Adult ADHD Self-Report Scale-v1.1 symptom checklist; BMI, Body Mass Index in  $\text{kg}/\text{m}^2$ ; CES-D, Center for Epidemiologic Studies Depression scale; CF, Cystic fibrosis; CFQ-R, Cystic Fibrosis Questionnaire-Revised; CFTR, Cystic Fibrosis Transmembrane Conductance Regulator; FEV1%pred, Forced Expiratory Volume in 1 Second, Percent Predicted; HADS, Hospital and Anxiety Depression Scale; HRQoL, Health-Related Quality of Life; MGH, Massachusetts General Hospital; TIDES-CF, The International Depression Epidemiological Study.

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## 1. Background

While international consensus statements recommend universal screening of adolescents and adults with CF for depression and anxiety [1], insufficient data exists regarding the prevalence and impact of Attention-Deficit Hyperactivity Disorder (ADHD) in CF. ADHD is a syndrome featuring hyperactivity, impulsivity, and/or inattention impairing self-regulation in multiple settings (e.g., home, school/work, social interaction) [2]. ADHD occurs in 7–9% of children and adolescents and 4–5% of adults, but is more common in some medically ill populations [2]. The prevalence of diagnosed ADHD in children and adolescents with CF is estimated at 8–10%, mirroring the general population [3–5].

For individuals with chronic illness, ADHD symptoms such as forgetfulness, task avoidance, disorganization, and difficulty attending to detailed instructions can be barriers to successfully managing treatment and navigating the health care system [2]. ADHD is associated with increased mortality [6] and adverse health markers [7], and increases risk for onset of depression, anxiety, substance abuse and disordered eating, which could magnify detrimental effects on self-care [2].

In previously reported pediatric cases, successful treatment of ADHD frequently corresponded with improved adherence to CF treatment [4]. However, no prior studies document the prevalence or correlates of ADHD in adults with CF. This study pilots systematic screening in a CF clinic for ADHD symptoms using the Adult ADHD Self-Report Scale-v1.1 Symptom Checklist (ASRS-v1.1), evaluating the prevalence of ADHD symptoms in adults with CF, and relationships with health status and self-report measures of HRQoL and treatment adherence.

## 2. Methods

This study was developed to contribute data to The International Depression Epidemiological Study (TIDES-CF) [8], while expanding our single-center protocol to include aims regarding ADHD screening, reported herein. This analysis, approved by the Massachusetts General Hospital (MGH) Institutional Review Board, includes all participants  $\geq 18$  years old; solid organ transplant recipients were ineligible. Following written informed consent, participants completed questionnaires at a routine CF clinic outpatient well-visit. At this visit, participants completed a demographics and health history form requesting self-report of current, past or suspected clinical diagnoses of ADHD or other psychiatric conditions, CF-related and psychological treatments, as well as educational history and work status. Participants also completed established measures of depression, anxiety, ADHD and HRQoL, as well as self-reported estimates of adherence. Forced expiratory volume in one second percent predicted (FEV1%pred) and body mass index in kg/m<sup>2</sup> (BMI) obtained on the date of questionnaire completion were extracted from medical records; in the event that FEV1%pred or BMI measurements were not made in the course of usual care at the time of the CF clinic visit during which the study questionnaires were completed, the FEV1%pred or BMI values chronologically nearest to the date of questionnaire completion were used.

### 2.1. Measures

Participants completed the ASRS-v1.1, a widely available 18-item measure including a 6-item screener that contains the items most predictive of ADHD. A positive ADHD screen was defined per ASRS-v1.1 instructions, in participants who checked 4 or more shaded boxes on screening items 1–6; this threshold results in sensitivity of 68.7% and specificity of 99.5% for ADHD [9]. Participants also completed the Cystic Fibrosis Questionnaire-Revised Teen/Adult v2.0 (CFQ-R), a CF-specific measure of HRQoL [10], and 2 scales selected for TIDES-CF [8], the Center for Epidemiologic Studies Depression Scale (CES-D) and the Hospital Anxiety and Depression Scale (HADS).

The adherence questionnaire was designed to assess difficulty with completing specific categories of CF treatment. For each item applicable to their treatment plan, participants completed a linear scale from 0% (missed every treatment) to 100% (completed every treatment) by decile, circling the spot closest to the percentage of time that they completed the treatment in the past month. The questionnaire was introduced with wording normalizing difficulty with adherence: “Many people with chronic illness have difficulty keeping up with treatments. In the past month, how much of the time did you actually take the following treatments?” Overall adherence was calculated by averaging the percentage of treatments completed for all reported applicable treatments.

Data analysis was performed using IBM SPSS Statistics for Windows, version 22. Analysis of Variance (ANOVA) analyses were conducted to examine differences in BMI, FEV1%pred, CFQ-R, and self-reported frequency of adherence to CF care in participants with and without elevated screening scores for ADHD. An alpha level of 0.05 was used for statistical tests; to adjust for multiple comparisons, a Benjamini-Hochberg procedure was applied with a critical value for false discovery rate of 0.05.

## 3. Results

### 3.1. Participant characteristics, ADHD screening data, and psychiatric comorbidity

Of the 152 patients  $\geq 18$  years old followed in the MGH CF Program during the study period, 53 (35%) participated in this study. FEV1%pred ranged from 24 to 104%. Fifteen percent scored in the elevated range on the 6-item ASRS-v1.1 screener, indicating a probable diagnosis of ADHD (Table 1).

There were no statistically significant differences in age, gender, educational attainment or employment between participants with and without elevated ADHD scores. Three of the 8 (38%) participants with elevated ASRS-v1.1 screens had repeated a grade in school. All 3 reported that learning, social, or behavioral difficulties contributed to this decision; two reported that medical illness also contributed. Only 11% (5 of 45) of participants without elevated ADHD screening scores had repeated a grade.

Six of the 8 participants with elevated ADHD screens reported lifetime evaluation by a psychologist/psychiatrist. None reported a current clinical diagnosis of ADHD, but 2 reported suspected ADHD, and 1 reported a past ADHD diagnosis. Only 1 participant who met criteria for probable ADHD on the ASRSv1.1 reported

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