2021

Strengthening Mental Health Diagnostic Detection in Integrated Primary Care

Julia Brechbiel
Virginia Commonwealth University

STRENGTHENING MENTAL HEALTH DIAGNOSTIC DETECTION IN INTEGRATED PRIMARY CARE

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

by

Julia Brechbiel
B.S., College of William and Mary, May 2014
M.S., Virginia Commonwealth University, December 2017

Advisor: Jared W. Keeley, Ph.D.
Assistant Professor
Department of Psychology

Virginia Commonwealth University
Richmond, Virginia
April 2021

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Abstract

Primary care behavioral health (PCBH) is crucial for providing mental health treatment to underserved, minority, and uninsured populations. There is a lack of knowledge about accurate mental health diagnosis at PCBH. Underdetection of mental health symptoms has the potential to worsen racial and socioeconomic disparities. Using an expert review process, I developed an abbreviated diagnostic clinical interview (ADCI) for integrated primary care. Next, patients (N = 82) completed the interview after attending PCBH appointments. According to the interview, 63.4% of participants met criteria for a diagnosis, while 64.7% received a diagnosis from their provider. A large portion of patients met criteria for a somatic symptom disorder (25.8%), likely associated with data collection occurring during the COVID pandemic. Kappa agreement between the ADCI and providers' diagnosis of mood disorders (i.e., depression, anxiety, or both) was significant but in the fair range. The pattern of disagreement demonstrated that the ADCI was significantly more likely to detect comorbid depression and anxiety than providers. Overall, results suggest that the ADCI might be capturing comorbid psychopathology that is underdetected due to the brief PCBH model. For example, referrals from providers often focus on more behavioral health concerns, and the brevity of services does not always allow for in-depth assessment. The ADCI represents an opportunity to improve mental health service in primary care by offering a quick mechanism for identifying a more complete picture of a patient's mental health concerns.

Keywords: primary care, mental health, diagnostic detection

Strengthening Mental Health Diagnostic Detection in Integrated Primary Care

Approximately 43.8 million U.S. adults experienced a mental health condition in the past year (Nguyen & Counts, 2015; Sayers, 2001) with disproportionate rates among those below the federal poverty guidelines (Americares Mental Health Initiative, 2016; Americares U.S. Program: Behavioral Health, 2018). Primary care clinics serve as a crucial source of mental health treatment for underserved, minority, and uninsured populations. The integration of mental health services within primary health clinics, referred to as primary care behavioral health (PCBH), leads to improvements in patient functioning and a reduction in mental health symptoms beyond the care provided by primary care physicians and nurses alone (Bryan et al., 2012; Sadock et al., 2014). While the PCBH environment has many advantages in health services provision (e.g., access to a variety of specialties at one clinic, team-based approach, reduced stigma associated with mental health services), the diagnosis and management of mental health conditions remains a challenge due to time and resource constraints.

The efficacy of PCBH to provide clinically indicated mental health services for minority and vulnerable populations is limited by the field's lack of diagnostic tools (Possemato et al., 2018). Disparities in health for racial minorities, low socioeconomic status (SES), or underserved populations are well documented and contribute to disproportionate rates of these individuals experiencing mental health conditions (D. R. Williams et al., 2010). Though SES often accounts for much of the observed racial differences in health outcomes, racial differences exist even at comparable levels of SES (D. R. Williams, 1999). For instance, Black individuals are at greater risk for not receiving mental health services for depressive symptoms when compared to their White peers with equivalent symptoms (Alegría et al., 2008). Health disparities and limited

access to mental health services exist in part due to underdiagnosis of mental health conditions, resulting in inadequate services and patients experiencing prolonged distress.

PCBH clinics are uniquely designed to provide treatment for racial and SES minorities in order to address health disparities; however, there is limited research about the diagnosis and management of mental health conditions for these individuals. Additionally, PCBH lack brief diagnostic screening tools to determine patients' mental health diagnoses, contributing to rates of underdiagnosed minority patients. The objective of this study is to fill in this gap in PCBH through the development of an abbreviated diagnostic clinical interview (ADCI; Study 1) and pilot the measure in PCBH clinics to assess feasibility, presence of disorders, and examine the relationship between patients' diagnoses provided by their clinician compared to those identified by the ADCI (Study 2).

Literature Review

The following sections review the current state of the literature on mental health screening and diagnostic accuracy within the PCBH model to elucidate the needs and potential benefits of developing an abbreviated diagnostic clinical interview for PCBH.

Integrated Primary Care Behavioral Health

A national movement has focused on integrating mental health or "behavioral health" services into primary health clinics to provide holistic care. PCBH refers to the inclusive branch of health psychology and medicine comprised of care of physical health symptoms and chronic conditions, behavioral medicine conditions (e.g., sleep difficulties, chronic pain, weight management, and medication adherence), substance abuse, and traditional mental health concerns (e.g., anxiety, depression, ADHD, and disruptive behaviors; Peek & The National Integration Academy Council, 2013; Reiter, Dobmeyer, & Hunter, 2018). A systematic review of

PCBH literature revealed that approximately 25 studies have examined the outcomes of mental health services at PCBH (Possemato et al., 2018). Overall, integration of mental health services within primary care leads to improvements in patient functioning and a reduction in mental health symptoms over the care provided by primary care physicians (Bryan et al., 2012; Sadock et al., 2014). Moreover, these improvements continue to increase beyond termination of mental health services, suggesting that patients continue to benefit long-term from brief treatment (Corso et al., 2012; Sadock et al., 2017).

PCBH involves close collaboration between primary care physicians and mental health providers to deliver a broad range of health care services to underserved and uninsured populations, regardless of a patient's ability to pay (Nguyen, Makam, & Halm, 2016). These populations are defined by the number of primary care providers per 1,000 individuals, the number of individuals over 65, infant mortality rate, and the percentage of the population living in poverty (Bureau of Health Workforce, n.d.; Wong, 2015). In urban settings, these underserved populations are often minority groups, with a growing number of those communities being Black (Lanoye et al., 2017; Sadock et al., 2014; Sadock et al., 2017). PCBH has the potential to reduce the stigma associated with mental health that is often present in these underserved populations (Ayalon & Alvidrez, 2007; Rao et al., 2007). These findings indicate that PCBH is an effective modality for providing vulnerable or underserved populations with mental health services (Possemato et al., 2018).

Additionally, mental health interventions are typically brief, focus on patients' self-identified problem areas, and are evidence-informed (e.g., psychoeducation, cognitive behavioral therapy, motivational interviewing; Hunter, Goodie, Oordt, & Dobmeyer, 2017; Sadock et al., 2014). These interventions typically focus on anxiety and depression symptoms, along with

select health problems as needed (e.g., smoking cessation, weight management, insomnia, chronic pain; Hunter et al., 2017; Sadock et al., 2017). A recent review of PCBH literature highlighted concerns about the lack of research on treatment fidelity and whether clinical interventions documented in electronic medical records (EMR) are consistent with patients' needs and diagnoses (Hunter et al., 2018). Lack of clinical diagnostic procedures could result in underdetection of patients' mental health conditions and lack of access to clinically indicated services. However, traditional clinical diagnostic interviews are not feasible at PCBH due to the brief model of care.

Within the PCBH model, mental health providers provide care to patients of any age and any health condition, aim to provide services on the same day as the referral or primary care appointment, and work closely with other primary care providers to disseminate mental health knowledge and provide team-based primary care (Reiter et al., 2018). To accomplish these objectives, clinicians use brief, focused (15-30 minute) appointments to assist with specific symptoms and patient concerns, or improve functioning (Reiter et al., 2018). This brief treatment model mirrors the productivity expectations for primary care physicians in the same clinic and ensures that mental health providers are reaching a large percentage of the clinic population (Reiter et al., 2018). However, this brief model, along with the low modal number of mental health appointments, presents logistical challenges to assess adequately for the presence of mental health diagnoses and provide clinically indicated services.

Due to these limitations, many PCBH instead use symptom screeners such as the Generalized Anxiety Disorder-7 (GAD-7) or Patient Health Questionnaire-9 (PHQ-9) to alert providers to potential mental health symptoms and to track changes across appointments (Pollard et al., 2013). While these screeners document patients' symptoms, they do not consistently

measure impairment and distress that might accompany these symptoms which are required to meet criteria for a mental health disorder. Therefore, these screeners have clinical utility, but they are not designed to detect all symptoms and are not diagnostic tools for mental health disorders, nor are they designed for PCBH patients who typically present with a complex, comorbid array of medical and mental health symptoms (Funderburk et al., 2014; Gask et al., 2008).

While several structured, empirically-supported diagnostic interviews exist for mental health conditions, they are used predominately as research tools and rarely implemented in PCBH for a clinical purpose (Jordanova et al., 2004; Levis et al., 2018). Existing diagnostic tools are not necessarily applicable to PCBH because (a) they are not tailored for the typical primary care patient, who is a racial minority, uninsured, attends only one to three mental health appointments, and often has more than one health condition affecting their lives (Funderburk et al., 2014; Radcliff, 2017; Sadock et al., 2014) and (b) they are typically utilized in research or assessment contexts and were not developed for the brevity of PCBH services and solution-focused appointments (Hunter et al., 2017; Jordanova et al., 2004). For example, the Structured Clinical Interview for DSM (SCID), Composite International Diagnostic Interview (CIDI), and the Clinical Interview Schedule-Revised (CIS-R) are diagnostic interview assessment tools that are consistent with diagnostic criteria; however, administration takes over an hour depending on the patient's mental status, and these measures have limited research on their validity in PCBH (Jordanova et al., 2004). Instead, the development and implementation of a brief structured diagnostic interview could allow providers to identify mental health conditions and provide adequate mental health services quickly and accurately.

Diagnostic Accuracy

Prevalence rates of mental health conditions in primary care clinics range from 20-50% of patients seen by medical providers (Ansseau et al., 2004; Kroenke et al., 2007; Spitzer et al., 1994). Many mental health problems go undetected in primary care settings despite high prevalence levels and the development of new symptom screeners to assist providers with assessing patients' mental health concerns. Borowsky and colleagues (2000) revealed that physicians were less likely to detect mental health problems for African Americans, men, and patients less than 35 years of age. However, they were more likely to detect mental health symptoms in the context of coexisting medical conditions (i.e., diabetes and hypertension) or patients experiencing more severe mental health diagnoses (i.e., concurrent major depressive episode and dysthymia). These findings are consistent with literature on the use of decision-making heuristics in the medical field. Due to the PCBH model emphasizing brief treatment and high productivity, providers have limited time with patients, larger caseloads, and potentially depleted cognitive resources needed to mitigate decision-making errors (Garb, 2005; Graber et al., 2002). For example, in Borowsky et al.'s study (2000) physicians might have associated specific medical conditions (e.g., hypertension) with higher rates of mental health problems and were correct to refer these patients for additional services. However, overreliance on this heuristic might have also resulted in them overlooking or not screening for mental health concerns for patients without specific coexisting medical conditions. Overreliance on heuristics and personal beliefs and attitudes can also result in the development of biases. There is extensive research about racial biases among providers that contribute to racial health disparities. For example, van Ryn and Fu (2003) found that doctors perceived Black patients as less intelligent, less educated, more likely to abuse drugs and alcohol, more likely to fail to comply with medical

advice, more likely to lack social support, and less likely to participate in cardiac rehabilitation than white patients, even after accounting for patients' income, education, and personality characteristics.

There is limited research about debiasing strategies to help providers improve their clinical decision-making, despite the plethora of research about providers' racial biases and rates of under diagnoses (Croskerry et al., 2013). Structured diagnostic interviews are one form of debiasing that can help clinicians consider differential diagnoses and identify accurate diagnoses. Furthermore, accurate diagnosis using a diagnostic interview would assist PCBH providers in meeting patients' mental health needs and improve rates of providers collecting all necessary patient information and avoid relying on biases and assumptions about the typical PCBH patient. The lack of mental health screening tools tailored to the unique PCBH setting can lead to missed diagnoses resulting in higher rates of diagnostic adverse events such as receiving inadequate treatment or inaccurate medication, and prolonging patients' distress (Piccardi et al., 2018; Zwaan et al., 2012). Existing diagnostic classification systems, including the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (DSM-5) and ICD-10, are often difficult to apply at PCBH due to the brief intervention model, high rates of comorbidity, and problems with cross-cultural applicability (Gask et al., 2008). However, there are modified diagnostic classification systems developed for use in PCBH that are amenable for brief administration protocols and the ADCI development.

The ICD-10 Primary Health Care (PHC) is the most widely used system in PCBH and provides diagnostic criteria paired with clinical treatment for six disorders/conditions: cognitive disorders, alcohol/drug use disorders, psychotic disorders, depression, anxiety disorders, and unexplained somatic complaints that are common in primary care settings (Ustün et al., 1995).

Disorders were included in the ICD-10 PHC based on their clinical importance in primary care. Specifically, selected disorders had to meet the following criteria: (a) they are common and able to be effectively managed in PCBH, (b) medical and mental health providers agree on their classification and management, (c) they are cross-culturally applicable, and (d) the disorder is important for public health outcomes (Ustün et al., 1995). These guidelines for the inclusion of disorders in the ICD-10 PHC are consistent with the PCBH model because physicians are providing brief, generalized interventions rather than specialty, long-term mental health care that might benefit from more specific, nuanced diagnoses. Field trials of the ICD-10 PHC were conducted in more than 50 countries and demonstrated increased detection of some mental health conditions (e.g., depression and unexplained somatic symptoms) by physicians (Upton et al., 1999). However, there is not a clear procedure for how the ICD-10 PHC should be implemented at PCBH. Previous examination of the dissemination of ICD-10 PHC guidelines to providers at PCBH was not associated with improved detection of mental health disorders (Upton et al., 1999). Recognizing time constraints, unique challenges, and existing assessments present in the PCBH setting is key for implementing changes in the diagnostic process. One promising option is to develop the ICD-10 PHC into an abbreviated diagnostic clinical interview (ADCI) that capitalizes on structural and organizational elements used to develop other diagnostic interviews (e.g., SCID) and incorporates symptom screeners already used in PCBH settings.

The ADCI would incorporate the symptom screeners already used in PCBH and follow a similar development and organizational structure as the SCID. The SCID follows a three-column format with questions in the left-hand column, corresponding criteria in the middle column, and the rating and instructions that operationalize the diagnostic criteria in the right-hand column (Spitzer, Williams, Gibbon, & First, 1992; Williams et al., 1992). The SCID's grouping by

diagnosis and inclusion of criteria for each diagnosis allows the clinician to have access to information about diagnostic features and test hypotheses about differential diagnoses. The SCID structure also allows for shorter administration times because the interviewer can skip remaining questions for criteria in a diagnosis after a required criterion is not met for that diagnosis. While the SCID-5 parallels the diagnostic criteria in the DSM-5, the ADCI will be based on the diagnoses and criteria in the ICD-10 PHC and relevant sections of the DSM-5 due to diagnostic updates since the development of the ICD-10 PHC. Replicating the format of the SCID in the ADCI offers several advantages: (a) it provides the interviewer with necessary knowledge about the ICD-10 PHC diagnostic criteria; (b) it allows the interviewer to skip remaining questions after a required criterion is not met resulting in shorter administration times; and (c) the structured format allows for nurses or other staff members to administer it in advance of a referral to a psychologist (Spitzer et al., 1992; Williams et al., 1992). Due to the prevalence of mental health concerns and the harm associated with lack of diagnosis, it is vital to develop a mechanism to provide quality diagnoses. Development of an empirically-supported ADCI could allow PCBH providers to quickly and accurately identify patient diagnoses and insure clinically indicated services are provided (Basco et al., 2000).

Lacking clinical diagnostic tools has potentially lasting effects in the PCBH environment, particularly for populations who already have increased difficulty accessing treatment (Graber, 2013; Makary & Daniel, 2016; Sayers, 2001; Zwaan et al., 2012). Missed diagnosis of mental health conditions for these individuals could result in increased diagnostic-associated adverse events such as receiving inadequate treatment, inaccurate medication, and prolonging patients' distress (Graber, 2013; Makary & Daniel, 2016; Sayers, 2001; Zwaan et al., 2010). In

comparison to other types of medical errors, diagnostic errors are associated with more severe and prolonged harm to patients (Sevdalis et al., 2010; Zwaan et al., 2010).

The Present Study

An important step towards improving PCBH includes the development of a diagnostic tool applicable to the clinical setting and patients. The development of a diagnostic tool and the review of service provision will help assess rates of underdiagnosis and treatment. First, this project will provide important information about how to feasibly assess for mental health diagnoses for PCBH patients through the development of the ADCI. A feasible diagnostic clinical interview for PCBH would expand knowledge about the prevalence rate of mental health disorders present at PCBH, inform PCBH about the mental health services that should be provided to their patients, and improve patient quality of care. Dissemination and implementation of the ADCI could help to reduce rates of underdetection of mental health symptoms that might contribute to racial health disparities. Second, this study aims to pilot the ADCI in PCBH to assess its feasibility and the presence of mental health concerns at local PCBH clinics. Additionally, findings for the ADCI will be compared to diagnoses from clinicians to help understand how the ADCI could benefit PCBH, clinicians, and patients. For example, increased knowledge about prevalence of disorder could help reduce health disparities as a result of underdetection of symptoms, minimize potential harm to patients, and increase the efficacy of services provided.

In sum, assessment and provision of mental health services could be improved through the development of a clinically appropriate ADCI (Study 1) and the use of this novel ADCI to assess of mental health concerns at PCBH and compare findings to clinicians' provisional diagnoses (Study 2).

Study 1

The aim of the first study is to develop the abbreviated structured diagnostic clinical interview (ADCI) protocol appropriate for the context of PCBH. The ADCI will be developed from the ICD-10 PHC and DSM guidelines using a method similar to the development of the SCID (Spitzer et al., 1992; Williams et al., 1992). The ADCI will undergo expert and iterative review using the Delphi method and snowball sampling to identify expert reviewers, starting with clinicians and supervisors at PCBH located in Richmond, VA and psychopathology experts. Development will conclude when expert agreement reaches at least 80% with no revisions requested.

Study 2

The aim of the second study is to pilot the ADCI (Study 1) with PCBH clinicians, assess the feasibility of the measure, collect information about disorders prevalent at these clinics and compare results from the ADCI to provisional diagnoses provided by PCBH clinicians. The administration of the ADCI and review of provisional diagnoses will occur at PCBH clinics, specifically the Ambulatory Care Clinic (ACC) and Hayes E. Willis Clinic (Hayes). Approximately 200 adult primary care patients who have attended at least one mental health appointment in the past two weeks were contacted via phone to complete the ADCI. Next, participants' clinicians were contacted to provide provisional diagnoses. Last, concordance calculations identified the rate of agreement between the ADCI-identified mental health diagnoses and participants' provisional diagnoses.

The outcomes of the study will generate a new clinical diagnostic tool that mental health providers will be able to implement in PCBH. Additionally, the study will help clinical settings gain a better understanding of their patients' needs and improve knowledge about the mental

health disorders present in these communities. These findings have implications for PCBH to improve mental health diagnostic procedures and address health disparities. The concordance rates between ADCI and clinicians' diagnostic methods is an exploratory aim to determine whether the ADCI is appropriately capturing patients concerns. No specific agreement was expected between ADCI and clinicians' reported diagnoses due to the brevity of the PCBH model and behavioral health appointment along with the focus of addressing referrals and patients' concerns rather than assessment and diagnosis.

Method

Study 1 involved the iterative development of the ADCI using expert feedback. Study 2 comprised a one-time prospective administration of the ADCI via telephone to local PCBH patients paired with collection of provisional diagnoses from these patients' clinicians. Last, the concordance rate was calculated to examine efficacy of the ADCI and/or unmet needs of the patient population.

Study 1

The ADCI was developed to parallel the diagnostic criteria from the ICD-10 PHC and DSM. The feasibility and applicability of the diagnostic interview was first assessed using the Delphi method to solicit feedback from experts in psychopathology, along with clinical supervisors and mental health providers at local PCBH clinics. These experts are not considered study participants, as no data about them was analyzed; instead, they are considered collaborators who shared their expertise.

Expert Reviewers. A total of 14 reviewers were recruited, consistent with past research using the Delphi method (Christmann, 2009; Kraj, 2015). Reviewers were recruited using snowball sampling, starting with Drs. Keeley, Perrin, and Rybarczyk. The team of expert

reviewers was recruited via email and was comprised of four experts in psychopathology along with five clinical supervisors and five mental health providers from local PCBH clinics.

Procedure. An initial bank of diagnostic questions was developed from symptom screeners typically used in PCBH (e.g., PHQ-9, GAD-7, AUDIT) and from the diagnostic guidelines in the ICD-10 PHC. Questions were separated into two types: (a) initial screener questions about symptoms required to qualify for a mental health disorder and (b) diagnostic questions to identify the specific mental health disorder. The development and format of these questions paralleled the procedure from the development of the SCID (Segal et al., 1994; Spitzer et al., 1992; Williams et al., 1992). Questions were grouped by diagnosis and by criteria in a three-column format with questions in the left-hand column, corresponding diagnostic guidelines in the middle column, and the symptom rating in the right-hand column. Once all potential questions were collected or written, they underwent a revision or exclusion process to eliminate redundancies, vague wording, or improve over-specificity and sensitivity. After a final list was developed, branching logic was drafted. For example, if a required guideline was not met for a specific disorder, the remaining questions for that diagnosis were skipped. This branching logic was essential to ensure shorter administration times and to reduce burden on providers and patients. Last, an electronic version was developed in Qualtrics, a HIPAA compliant survey tool, for easier administration, presentation of diagnostic results, and data collection.

All expert reviews were completed via email and brief Qualtrics survey. First, experts in psychopathology and PCBH were asked to provide general feedback about the plan for development, feedback, and revision. The reviewers also had the opportunity to provide general feedback about the initial items, questions, and structure.

Following integration of initial feedback, reviewers received prompts to provide specific feedback about a variety of aspects of the ADCI; for example, final items, structure, and the feasibility and applicability of the ADCI for PCBH. Experts used a feedback survey in Qualtrics to provide an overall rating of the ADCI, along with ratings and comments about the following domains: previous revisions made, user experience, and applicability to PCBH on a seven-point Likert scale (1 being "not appropriate" to 7 being "extremely appropriate"). The feedback survey also prompted experts to provide additional explanation or rationale if they provided low ratings on any of the above domains. On the first round of the feedback survey, reviewers reached over an 80% agreement on all ratings of the ADCI; thereby the review process was completed over a total of three phases.

Study 2

The second study compared diagnostic results from the ADCI (Study 1) with provisional diagnoses provided by the participants' clinicians. The ADCI was administered to eligible patients who consented to participate in the study via telephone after attending a mental health appointment at a PCBH clinic. Next, their clinician was contacted to collect a provisional diagnosis that informed treatment and intervention. Last, concordance ratings were calculated for the agreement between the ADCI-assessed diagnoses and clinicians' provisional diagnoses.

Selected PCBH Clinics. The two PCBH selected for the study are located in Richmond, VA and are associated with Virginia Commonwealth University (VCU). The Ambulatory Care Clinic (ACC) and Hayes E. Willis Clinic (Hayes) provide services to underserved and minority groups with an overrepresentation of racial/ethnicity minorities (Radcliff, 2017; Sadock et al., 2014, 2017).

Participants. Literature states that to detect a fair to moderate kappa rating (κ = 0.40-0.50) at 90% power and .05 alpha, a sample of at least 66 participants is needed (Bujang & Baharum, 2017; Sim & Wright, 2005). Thus, a final sample of 82 ensured that the study was adequately powered to detect agreement while also remaining feasible based on patient flow in clinics and comparable to similar studies conducted at these PCBH (Radcliff, 2017; Sadock et al., 2014, 2017). Anticipating that approximately half of patients would decline to participate, I planned to contact at least 200 potential participants. Patients were screened using their EMR to ensure they met inclusion criteria. To be included, participants had to: a) be 18 years or older, b) speak English as their primary language, c) attend at least one mental health appointment in the past two weeks, and d) have a telephone number on record and access to an email address to receive electronic gift cards. Participants were excluded if they were under the age of 18, their primary language was something other than English, or they did not have both a telephone number and access to an email account.

Procedure. Five research assistants (RAs) were trained to administer the ADCI via telephone. Each RA was required to complete a minimum of 8 hours of training before they were cleared to complete the ADCI independently. Training consisted of a four-hour class, two practice interviews with peers, and required to pass two test interviews that were supervised by myself or Dr. Keeley. See Table 1 for interrater reliability for each RA's practice interviews; reliability was significant and in the acceptable range for all interviewers for both practice interviews.

Table 1
Interrater Reliability

	Practice Interview 1			Practice Interview 2		
	κ	95% CI	*p*	κ	95% CI	*p*
Interviewer 1	.639	.494, .761	.001	.768	.624, .895	.001
Interviewer 2	.706	.570, .838	.001	.829	.695, .945	.001

Interviewer 3	.745	.607, .881	.001	.793	.695, .886	.001
Interviewer 4	.828	.697, .929	.001	.745	.607, .881	.001
Interviewer 5	.891	.786, .966	.001	.903	.802, .976	.001

Over the course of data collection from April to November 2020, patients who attended behavioral health appointments at either ACC or Hayes received flyers notifying them about the ongoing study and providing instructions for how to opt out of participation. Next, eligible patients received an initial phone call inquiring whether they would be interested in participating in the study. If interested, they received a brief description of the study, information about compensation, then completed the consent procedure. Consent was obtained verbally before any conducting study-related procedures. All participants were offered an emailed copy of the informed consent containing contact information for the study personnel and for the VCU Office of Research Subjects Protection. Additionally, patients who were not available to participate at the time of the initial phone call were provided the option to schedule a time that worked with their schedule. HIPAA compliant voicemails were left for patients who did not answer, containing information about whom to contact if interested in participating in a VCU research study. Participants' return calls were saved in a password protected voicemail box in a secure lab space. Participants who did not answer or return voicemails after two attempts over the course of two weeks were excluded from the study.

Interviews averaged approximately 28 minutes (ranging from approximately 7 to 120 minutes) depending on rapport, participant participation, and mental health history. See Appendix A for a script of the telephone interview. During the diagnostic phone interview, interviewers coded patients' answers into the ADCI survey on Qualtrics. Individuals who completed the interview received a $10 electronic Amazon gift card to their email address. If participants reported suicidal ideation or self-harm, interviewers encouraged participants to share

this information at their next PCBH appointment and offered them a list of mental health resources available to them in the community. Additionally, if a participant reported suicidal ideation, the interviewer was required to contact Dr. Keeley, PhD, LCP, for risk assessment and determine the need for emergency interventions (e.g., safety planning or hospitalization).

Throughout the study, only I had access to participants' EMR records to protect private health information. After the diagnostic interviews, I reviewed participants' EMR for descriptive information (i.e., date of birth, race, gender) and name of the participants' clinicians. Next, these clinicians were contacted through REDCap, a HIPAA compliant survey site, to provide provisional diagnoses for each of their patients that participated in the study. Surveys pre-filled with patient information and a check list of diagnoses were sent to the clinician; the surveys were protected.

Statistical Analysis Plan

First, I provide a detailed overview of the ADCI development and revision process. Patient demographics were compared across PCBH clinics using independent t-tests. Next, I provide a summary of diagnostic results from both the ADCI and clinicians and use independent t-tests and chi-square analyses to compare across diagnostic methods. Last, I assessed the agreement between each of the participants' diagnoses from the ADCI and from their clinicians. Concordance ratings were measured using kappa (κ), a statistical measure of percent agreement that takes into account the possibility of agreement occurring by chance (Bujang & Baharum, 2017). I calculated an overall kappa concordance of diagnosis along with separate kappa analyses for each diagnosis to examine potential differences in concordance by diagnoses. I also calculated bootstrapped 95% confidence intervals to measure the statistical reliability of the degree of agreement.

Results

Study 1

Item development was inspired by symptom screening measures (e.g., PHQ-9, GAD-7, AUDIT, and primary care behavioral health screeners) and diagnostic interviews (e.g., SCID). Initial item development created approximately 200 questions that were sent to reviewers. The first round of feedback was focused on revising item phrasing and organization along with whether and/or how to best include the following elements: diagnostic criteria, screening questions, a brief mental status exam, and a brief cognitive exam. Several of these concerns were addressed by finalizing the interview's structure and organization; for specific feedback and revision by sections see Table 2. See Figure 1 for an example of the three-column format and initial branching logic.

Questions & Instructions	Diagnosis and Criterion	Rating
SC1. **Over the past month have you noticed any difficulties with your memory, attention or other thinking problems?**	Patients that meet criteria of Cognitive Disorder may report problems with forgetfulness, clouded thinking, or wandering attention related to recent decline in memory, thinking, judgement, or orientation.	**YES** NO UNKNOWN ***If yes,*** *go to COGNITIVE*
SC2. **In the past month, have you or others had any problems or concerns about your alcohol, tobacco or other drug use?**	Patients that meet criteria for Alcohol, Tobacco, and Other Drug Disorders may sometimes deny concerns about alcohol, tobacco, or other drug use. Family or doctors may request help before the patient does.	**YES** NO UNKNOWN ***If yes,*** *go to ALCHOL, TOBACCO, and OTHER DRUGS*
SC3. **In the past month, have you had**	Patients that meet criteria	

Figure 1. Example of three-column format and branching logic from the screening section.

Table 2.
First Round of Feedback and Revisions

Aspect of ADCI	Feedback	Revisions
Questions Overall	Some questions contained too much overlap across diagnoses,	Increased specificity of questions to reduce overlap, used

	too much psychological jargon, adjust frequency of how often patients experience symptoms to meet criteria	more colloquial language for mood and substance use, revised phrasing to increase frequency of symptoms so question met threshold for diagnosis
Diagnostic criteria	Too lengthy, too in depth regarding differential diagnoses and patient vs. family presentation	Diagnostic criteria were abbreviated to fit in the middle column and included only the diagnostic symptoms relevant to each question Differential diagnosis was incorporated into the coding of branching logic
Screening Questions	Too many questions and too much overlap of symptoms across questions, both of which would result in completion of more modules and be burdensome on patients and interviewers	Reduced number of questions by removing questions about transdiagnostic symptoms
Brief Mental Status Exam (e.g., mood, behavior, thought process)	Explore ways to abbreviate and distinguish which questions are completed by the interviewer and which are questions posed to the patient, and should these questions occur at the end or beginning of the interview	Abbreviated number of questions, questions to be answered by the interviewer moved to the end to reduce burden on patients
Brief Cognitive Exam	Cognitive impairment is a transdiagnostic symptom and expert reviewers felt a brief cognitive screen would help differentiate cognitive and mood disorders	Included questions for both patient's subjective self-assessment and brief cognitive exam using validated questions. Additionally, screened for medical etiology of cognitive symptoms

After the initial round of edits was made and three column structure and branching logic were implemented, the interview was sent back out to reviewers. Reviewers provided feedback using a combination of comments, tracked changes, and written summary via email. The format of feedback was flexible to accommodate individual differences in preferred method of collaborative writing. This round of feedback was focused significantly more on larger themes of the ADCI. For example, most reviewers provided general feedback about each diagnostic

module (e.g., depression, anxiety, cognition) and formatting. The two major pieces of feedback were (a) numerous questions and concerns about scoring, interpretation, and measurement validity of the cognitive module and (b) that the organization of screening questions, modules, and results summary should be more intentional to create a consistent procedure that also makes clinical sense. To address this feedback, the cognitive module was removed, and the order of screening questions and modules was revised to mirror base rate presentation of mental health disorders in PCBH. For a more detailed explanation of revisions, see Table 3.

Table 3.
Second Round of Feedback and Revisions

Aspect of ADCI	Feedback	Revisions
Length and Organization	Length and complexity of organization and instructions would be burdensome to interviewer, thereby impacting feasibility in PCBH settings	Eliminated questions that the majority of reviewers found unnecessary or redundant. Order of screening questions and modules was revised to be consistent with base rate of presentation in PCBH.
Cognitive Module	Consulted expert reviewers for threshold of accuracy to score brief cognitive assessment. However, reviewers had numerous suggestions and requests for assessment and validation that were beyond the aims and scope of the study, and not feasible in PCBH.	Eliminated module due to low base rate in primary care unless working with older adults. Also, there are several brief, validated cognitive screeners already in existence. Instead included a set of brief screening questions located at the end of the interview and recommendations for brief screening tools (e.g., MOCA, MMSE)
Scoring convention	Yes and No are limited scoring options, so reviewers recommended adding third option and operationalizing.	"Unknown" or "?" was the original third option, revised to "unable to assess" so that patients or interviewers are able to document a lack of information or limited assessment
Substance Use Disorders	Discouraged grouping substances by "alcohol, tobacco, and other drugs." Reviewers	Created a two-tiered set of questions to assess substance use. Questions first assessed

	suggested making module more streamlined and structured to precisely assess quantity and frequency of use	frequency and quantity of substance use then assessing diagnostic criteria (e.g., symptoms of tolerance, withdrawal, and cravings).
Psychosis	Screening question for delusions lacks specificity and picks up on OCD or trauma responses. Request to include a caveat for cultural beliefs in the diagnostic criteria	Rephrased screening question for delusions. In the middle column, added caveat for cultural beliefs.
Results Summary	Reviewers recommended outlines at end of interview to help reduce interviewers' cognitive burden. Suggested elements: results of risk assessment, recommended next steps in care/referrals for cognitive evaluation, substance use treatment, and safety planning	Summary page lists: modules completed, mental status exam, provisional diagnoses, review of risk assessment, and referral suggestions

Between round two and three of reviews, the ADCI was uploaded into Qualtrics. Although Qualtrics has many advantages, such as being HIPAA compliant, and offering complex branching logic and survey distribution options, it was not able to accommodate the proposed three column format. Several alternative formats were trialed. The best option that clearly presented all information was a two-column format, with questions remaining in the left-hand column and scoring in the right-hand column, but with extra space over the scoring for diagnostic criteria and instructions; see Figure 2 for an example and link to the ADCI can be found in Appendix A. During this next round of feedback, reviewers were asked to use a feedback survey, also in Qualtrics, to collect their comments, suggestions and quantitative ratings of the ADCI. Ratings were collected on the domains of previous revisions completed, user experience, and applicability to PCBH on a seven-point Likert-type scale (1 being "strongly disagree" to 7 being "strongly agree"). We required at least 80% of expert ratings to be greater

than or equal to a rating of 5 “somewhat agree” to find the domain acceptable. Ratings for all three domains met this benchmark. User experience received an average rating of 5.28 (*SD* = 1.08), and no reviewers rated it below a 5 or “somewhat agree.” The removal of the cognitive module received an average rating of 5.60 (*SD* = 1.57). One reviewer rated the removal of the cognitive module as “disagree” (2 out of 7) and their feedback was used to improve the results summary page with recommendations for cognitive assessment. The feasibility of using the ADCI was rated on average as 5.64 (*SD* = 1.36); one reviewer provided a rating of “disagree” (2 out of 7). Based on their feedback, the study methodology and the ADCI were revised to clarify the target population and help discriminate the measure as diagnostic in contrast to existing measures which are screening tools. The majority of these revisions occurred during the development of the complex algorithm that takes into account comorbid symptoms and differential diagnosis. The ADCI’s diagnostic algorithm is a key factor that separates it from existing symptom screening tools like the GAD-7 or PHQ-9. See Table 4 for a more detailed explanation of revisions and qualitative data of reviewers’ ratings.

Figure 2. Example of final layout from the screening section.

Table 4.
Final Round of Feedback and Revisions

Aspect of ADCI	Feedback	Revisions
Depression	Confident that module will review necessary symptoms of depression for diagnosis. Question on why use "one month" vs "two weeks" cutoff of symptom presentation. Question about amount of weight change that is diagnostically significant	Question stem was changed from "in the past month" to "in the past two weeks" to match diagnostic criteria in DSM-5 There is not clear consensus for how to operationalize "significant weight change;" therefore, whether a patient met this criterion was left up to patient's subjective opinion
Anxiety	Confident that module will assess symptoms for a variety of anxiety diagnoses. Add other situations that could elicit social anxiety. Spacing issue, questions and responses are not aligned.	Added social situations with friends and work that might lead to anxiety. Revised formatting to resolve misalignment between question and responses
Substance Use Disorders	Good reception for changing first page of module to collect frequency and quantity of use. Concerns that withdrawal symptoms differ across drugs.	List of withdrawal symptoms was expanded to include wider variety of symptoms; however, unable to reduce list due to individual differences in presentation of

	Concerns about tobacco: smoking vs. nonsmoking, withdrawal symptoms, how to score a range of number of cigarettes.	withdrawal. Created separate questions for smoke vs. smokeless tobacco during screening. Added more information about cut-off ranges for alcohol and number of cigarettes for nicotine dependence during screening questions
Somatic Symptom Disorder	Specific item-level edits to response options and administration instructions. Clarify whether patients' medical conditions and concerns are diagnostic criteria and include a space to record patients' response.	Copy-editing of items to make scoring clearer and provide spaces for interviewer to record patients' medical conditions and symptoms
Psychosis	Include specific phrasing for how to assess spirituality or religiosity. Resolve minor errors in formatting and recording description of patients' psychoses. Recommend moving the psychosis module earlier if patient endorses symptoms during screening.	Included instructions on how to probe for whether symptom is a cultural belief to a normative degree. Fixed formatting to make it clearer how to score questions. Psychosis screening questions are the last questions, and if patient endorses either symptom, the psychosis module will be completed next for better flow and interview rapport.
Suicide Risk Assessment	Error in branching logic on the results summary page; feedback on summary page is simplistic	Revised branching logic and collected practice interviews to ensure survey flowed properly
Mental Status Exam	Separate questions for patients to answer from those for the interviewer to answer to avoid administration errors	Questions that need answers from patient were moved earlier and script ends interview with patient before proceeding to questions meant for interviewer to answer
User Experience	Maybe add a "back" button so interviewer could change options and/or in case a patient changes their response. Add space to expand upon "unable to assess," also applies to reset of interview	Back button was added but occasionally, unable to go back due to branching logic Added a free-text box at the end of each page to collect notes, notes are then summarized on the results page at end of interview
Removal of Cognitive Module	Requested inclusion of validated measures of cognitive functioning	If patient screens positive for cognitive difficulties, a few validated measures of cognitive functioning are included in the recommendations in the results summary at the end of interview

Feasibility in PCBH setting	Requested additional information about how the ADCI would be used in PCBH, how it differed from screening measures and the rationale for the inclusion of select disorders	Brief summary of study rationale was provided to the reviewers at beginning of the study. Key rationales are a) any provider could use measure to assess whether patients would benefit from mental health services, b) existing screening measures are not designed to be diagnostic tools and c) included disorders were limited to those with highest rate of prevalence in primary care

Study 2

Participants. Between April and November 2020, 223 patients met eligibility criteria and were contacted. Approximately 31.80% of patients declined (n = 71) to participate and 31.4% did not return calls or voicemails within the two-week window (n = 70). To improve patient engagement, our research team spent a significant amount of time calling patients. RAs spent a total of 8-10 hours per week over 30 weeks calling patients; several patients expressed interest in participating, resulting in approximately 470 calls back and forth between RAs and patients. The final sample contained 82 patients, see Table 5 for demographic information by primary care clinic. Across the two clinics, participants' race ($\chi^2(3) = 0.37$, $p = 0.83$), sex ($\chi^2(1) = 1.02$, $p = 0.31$), and age ($t(80) = 0.41$, $p = 0.68$) did not differ significantly.

Table 5.
Participant Demographics

	Ambulatory Care Clinic		Hayes E. Willis Clinic		Total	
	n	%	*n*	%	*n*	%
Sex (%)						
Female	40	76.9	20	66.7	60	73.2
Male	12	23.1	10	33.3	20	26.8
Race (%)						
African American/Black	35	67.3	19	63.3	54	65.9
Caucasian	15	28.8	9	30.0	24	29.3

Other	2	3.8	2	6.7	4	4.9
Age *M (SD)*	49.64 (12.68)		48.29 (16.42)		49.15 (14.08)	
Total (*N*)	52	100	30	100	82	100

Feasibility. Time between patients' behavioral health appointments and completion of the ADCI averaged 11.85 days (SD = 7.85, ranging 1-41 days). Participating in the study took participants an average of 42.32 minutes (SD = 26.65); a portion of that time was spent on consent and study protocol, which averaged 15.07 minutes (SD = 7.85). Excluding study protocol, the ADCI took an average of 27.89 minutes (SD = 17.20, ranging 6.45-126.02 minutes). Per our RAs, receiving training to administer the ADCI improved feasibility, data collection, and their confidence for scoring participants' responses. A brief, one-session training conducted for a total of 3 hours was sufficient for our interviewers. However, this time could likely be shortened to approximately an hour for providers with more clinical experience (medical assistants, nurses, etc.). At the beginning of the study, patients were informed that the interview varied from 30-60 minutes. Occasionally, patients expressed concerns that an hour would be too long. Patients were reassured to know that we were tracking the average completion time which was constant at ~30 minutes. Only one patient was unable to complete the interview due to time constraints. There were no reported technical issues (e.g., wrong questions, wrong modules). If interviewers wanted to revise scoring after completing an interview, Qualtrics made it very easy to edit select questions. The majority of problems occurred due to remote data collection, collecting data during the COVID pandemic, and conducting interviews using remote access to a landline. For example, consultation with the supervising licensed psychologist involved placing participants on hold and then making a second call to Dr. Keeley. Occasionally, it required more than one attempt to connect the second call. No calls with participants were dropped during calls for supervision. However, several RAs

and patients did have connectivity issues due to reduced internet and cellular data bandwidth at the beginning of the pandemic. This resulted in poor sound quality but did not interfere with completing interviews. Conducting the study remotely was an added challenge for recruiting participants. Some patients were initially interested but declined to participate after learning more about the study and completing the consent procedure. One patient placed a formal complaint with the study PI and clinic due to not receiving an opt-out study flyer and felt their privacy was violated. The situation was resolved effectively with apologies from the study's research coordinator, the clinic supervisor, and the patient's clinician.

Mental Status Exam. Data on participants' current mental status was collected in two ways: a subjective report from the participant and interviewer's perception of the participant. Most patients shared having depressed mood (29.3%, *n* = 24), followed by appropriate and full range of mood (24.4%, *n* = 20), angry or irritable mood (18.4%, *n* = 15), anxious mood (13.4%, *n* = 11), other (10.9%, *n* = 9), and unable to assess mood (3.6%, *n* = 3). Very few patients endorsed a period of manic mood that lasted more than a few days (14.6%, *n* = 12). From the interviewers' perspectives, most patients presented as having appropriate or full range of affect (48.8%, *n* = 40), followed by flat affect (28.0%, *n* = 23), constricted or blunted (19.5%, *n* = 16), and labile affect (3.7%, *n* = 3). However, interviewers' assessment of mood was limited due to the ADCI occurring via telephone.

Participants' attention and memory were assessed through self-report and from the interviewers' perspective. The majority of patients (80.5%, *n* = 66) reported concerns about their cognitive functioning and would have benefitted from their primary care doctor completing a MoCA or MMSE. Of the 66 patients who would benefit from cognitive screening, 78.8% (*n* = 52) reported concerns about inattention and difficulty concentrating, 43.9% (*n* = 36) reported

memory difficulties, and interviewers reported that 29.3% (*n* =24) exhibited inattention or memory difficulties that interfered with the interview process.

Interviewers also assessed participants' thought process, content, and speech. The majority of patients had appropriate and logical thought processes (79.3%, *n* = 65), a few were circumstantial in their answering of questions (17.1%, *n* = 14) followed by tangential thought processes (2.4%, *n* = 2). Out of the 18 participants who screened positive for psychosis, seven endorsed auditory hallucinations, six endorsed visual hallucinations, and six shared delusional thinking. Patients' speech was most often characterized as normal (52.4%, *n* = 43), and volume was often described as soft (41.5%, *n* = 34) and occasionally loud (7.3%, *n* = 6). Rhythm of speech was often described as slow (42.7%, *n* =34) and rarely pressured (3.7%, *n* = 3).

ADCI Diagnostic Process. Participants completed a set of screening questions to determine which diagnostic modules should be completed. A surprising number of patients screened positive to complete the psychosis module: 22% (*n* = 18). Of those participants, only 6 or 33.3% met criteria for a psychotic diagnosis. The majority of patients (90.2%, *n* = 74) screened positive for depression; however, only 43.2% (*n* = 32) of those patients met criteria. A significant number of participants also screened positive for anxiety (86.6%, *n* = 71). Thirty-eight percent of those patients (*n* = 27) met criteria for generalized anxiety disorder, while 26.8% (*n* = 19) met criteria for panic disorder. An unexpected number of patients screened positive for somatic concerns (68.3%, *n* = 56) and 55.4% of those patients (*n* = 31) met criteria for somatic symptom disorder. Last, 39% of participants (*n* = 32) expressed concern regarding their substance use or a high quantity of substance use; however, only one patient met criteria for a substance use disorder. To meet criteria for the above disorders, the patient had to endorse functional impairment in one or more domains for functioning; see Table 6 for frequencies.

Participants most often reported that mental health symptoms made it difficult to maintain home responsibilities and relationships with friends and family.

Table 6.
Frequency of Functional Impairment by Domain

	Yes		No		Unable to Assess	
	n	%	*n*	%	*n*	%
Work	28	34.1	41	50.0	12	14.6
Friends/Family	36	43.9	43	52.4	0	0
Home	43	52.4	38	46.3	0	0
Self	22	26.8	59	72.0	0	0
Other	32	39.0	49	59.8	0	0

The anxiety and depression modules contained additional questions for instances when participants triggered one of these modules after completing another (e.g., substance use) but did not endorse the original screening questions. Seven participants triggered these discrepancy check questions for the depression module. Only one met criterion for a diagnosis of depression, five reported subclinical depressive symptoms, and one declined to answer depression questions due to feelings of sadness and hopelessness being more related to marijuana use than depression. Five people triggered the discrepancy check questions in the anxiety module. None met criteria for generalized anxiety or panic disorders. However, three reported subclinical social anxiety and the other two were experiencing subclinical anxious mood and difficulty controlling worry.

Suicidality. The suicide assessment module was completed for 12.2% of participants (*n* = 10). Of those 10 patients, one declined to answer questions about suicidality, and four endorsed passive thoughts only. One patient shared passive thoughts and plan, but no intent. Three reported active thoughts of suicide without plan or intent. One patient shared active thoughts of suicide with intent, but no plan and one patient shared active thoughts with plan and intent. None reported suicidal and/or preparatory behaviors. Each participant who met criteria for a suicide risk assessment triggered study protocol for the interviewer to consult their clinical supervisor,

Dr. Jared Keeley, to discuss risk and resources. All patients reported either discussing these thoughts with their PCBH clinician and/or having a follow-up appointment with their clinician scheduled. There were an additional five participants who shared a history of suicidal ideation but denied any ideation currently or in the past month.

Comparing Diagnoses from ADCI and Clinicians. After participants completed the interview, their clinicians were contacted to provide diagnoses. See Table 7 for the frequency of diagnoses from both the ADCI and clinicians. Chi-square analyses were used to examine differences between clinicians' and ADCI diagnoses. Across the two diagnostic methods, rates of depression ($\chi^2(1) = 1.16$, $p = 0.23$), generalized anxiety ($\chi^2(1) = 0.78$, $p = 0.38$), substance use disorders ($\chi^2(1) = 0.08$, $p = 0.78$), and somatic symptom disorder (χ^2 1) = 3.37, p = .06) did not differ significantly. Clinicians and the ADCI differed significantly on diagnosis of panic disorder ($\chi^2(1) = 4.50$, $p = 0.03$) and on the number of disorders for which participants met criteria ($\chi^2(2) = 10.93$, $p = 0.03$).

Table 7.
Frequency of Diagnoses by ADCI and Clinicians

	ADCI		Clinicians' Diagnosis	
	n	%	*n*	%
Depression	32	26.7	30	37.9
GAD	27	22.5	28	35.4
Panic*	18	15.0	5	6.4
Substance Use Disorders	1	0.83	6	7.6
Somatic Symptom Disorder	31	25.8	2	2.5
Psychosis	6	5.00	0	0
Other (self-reported)	5	4.17	8	10.2
Total	120	100	79	100
Does not meet criteria	30	36.6	29	35.3
One disorder*	17	20.7	39	47.6
>1 disorder*	35	42.7	14	17.1

Note. * denotes significant difference between diagnoses for the ADCI and clinicians

Next, kappa analyses were used to examine the concordance between patients' diagnoses from the ADCI and diagnoses provided by their mental health provider. See Table 8 for statistical results of kappa analyses. First, diagnoses were dichotomized into whether or not participants met criteria for a disorder; the ADCI and clinicians did not show significant agreement on whether participants did or did not meet criteria for any diagnosis.

Table 8.
Kappa Concordance (ADCI vs. Clinicians)

	κ	95% CI	*p*
Met Criteria for a Disorder	-.030	-.241, .212	.787
Mood Disorders[a]	.140	.003, .277	**.025**
Met Criteria for an Anxiety Disorder[b]	.223	-.022, .445	**.044**
Depression	.119	-.098, .348	.281
Generalized Anxiety Disorder	.097	-.118, .329	.378
Panic Disorder	.183	-.044, 420	**.034**
Substance Use Disorders	-.021	-.054, .000	.777
Somatic Symptom Disorder	.079	.000, .193	.066
Number of Disorders (None, one, >1)	.076	-.068, .213	.269

Note. [a]Patients were grouped as either meeting criteria for no disorder, depression, an anxiety disorder or both depression and anxiety.
[b]Patients were grouped as meeting criteria for an anxiety disorder (either Generalized Anxiety or Panic) or not meeting criteria for an anxiety disorder

Participants were then categorized as meeting criteria for depression, anxiety, or both, which was significant but in the fair range. The ADIC and clinicians demonstrated more agreement for participants who did not meet criteria for a disorder rather than depression, anxiety, and both. The pattern of disagreement demonstrated that the ADCI was significantly more likely to detect comorbid depression and anxiety than providers. See Table 9 for frequency of mood disorder diagnoses across both diagnostic modalities.

Table 9.
Frequency for Diagnosis of a Mood Disorder

		Diagnosis from Clinicians				
		No Diagnosis	Depression	Anxiety	Both	Total
ADCI	No diagnosis	20	9	8	4	41

Depression	5	2	2	0	9
Anxiety	2	3	4	0	9
Both	6	5	5	7	23
Total	33	19	19	11	82

Next, kappa was calculated for one disorder at a time. Agreement on the presence of an anxiety disorder was significant and in the fair range, see Table 10 for frequency of patients meeting criteria for anxiety disorder. The ADCI and clinicians seemed to identify similar numbers of patients with and without a disorder. The confidence interval for this kappa does contain zero. Kappa includes a measure of variability and when it is calculated it depends on sample size. Therefore, the inclusion of zero in the confidence interval is likely a reflection of small sample size rather than nonsignificant results (Bujang & Baharum, 2017; Sim & Wright, 2005). Agreement for panic disorder was also significant and in the fair range; the ADCI was more likely to detect patients meeting criteria for panic disorder than providers. See Table 11 for frequency of panic disorder diagnoses across modalities. There was no significant agreement between the ADCI and clinicians for depression, generalized anxiety disorder, substance use disorder, or somatic disorder. The ADCI and clinicians also did not significantly agree on the number of disorders for which participants met criteria; the ADCI identified significantly higher rates of comorbidity. Kappa could not be calculated for psychotic disorders due to no clinicians reporting patients with psychosis. See Appendix B (Tables 12-18) for frequency counts for nonsignificant kappa analyses.

Table 10.
Frequency for Diagnosis of an Anxiety Disorder

		Diagnosis from Clinicians		
		No Anxiety	Anxiety	Total
ADCI	No anxiety	36	14	50
	Anxiety	16	16	32
	Total	52	30	82

Table 11.
Frequency for Diagnosis of Panic Disorder

		Diagnosis from Clinicians		
		No Panic	Panic Disorder	Total
ADCI	No Panic	62	2	64
	Panic Disorder	15	3	18
	Total	77	5	82

Discussion

This study demonstrated the feasibility of an abbreviated diagnostic interview to detect mental health disorders in integrated primary care clinics. The interview was developed to address a lack of brief diagnostic tools (Gask et al., 2008; Possemato et al., 2018) with the goal of reducing underdetection of mental health disorders that disproportionately impact racial minorities, underinsured and underserved patients at integrated primary care clinics (Borowsky et al., 2000; Williams et al., 2010). The development process for the interview was rigorous using the Delphi method and expert reviews with the goal of improving the validity of the measure and its acceptability and feasibility for the PCBH setting and brief treatment model. This process yielded a brief, easy to use, electronic version of the Abbreviated Diagnostic Clinical Interview (ADCI). Next, the ADCI was piloted at two clinics, ACC and Hayes, and results were compared to provisional diagnoses provided by the participants' mental health providers. Overall, the ADCI and clinician diagnoses overlapped for anxiety disorders, especially panic disorder. The ADCI and clinicians also had adequate agreement for identifying patients who did not meet criteria for any mental health disorder. The ADCI identified significantly more comorbid disorders, psychotic disorders and somatization disorders. The latter is also likely a reflection of data collection occurring during the COVID-19 pandemic. Differences in diagnosis between the ADCI and clinicians may come from the ADCI capturing more true cases or false

positives; the design of this study was not able to evaluate this point and future work should include additional mechanisms to validate ADCI diagnoses.

In the first study, the ADCI was developed and underwent an iterative review process that ended after reaching adequate group agreement (Tables 2, 3, and 4; Figures 1 and 2). The review process underwent three iterations using the Delphi Method with 14 expert reviewers. The first was appropriately focused on item development, diagnostic inclusion, and initial structure. A key change was the removal of the brief cognitive assessment due to the plethora of validated measures that can be used in primary care (Ismail et al., 2010). The second focused on incorporating initial feedback, organizing modules, and developing the diagnostic algorithm. The third iteration aimed to transfer the ADCI into Qualtrics to code the diagnostic algorithm and further revise the measure to achieve 80% agreement among the group of expert reviewers. The Delphi method was crucial to the development of the ADCI both to provide structure for recruiting expert reviews and to guide the feedback and revision process. Additionally, this methodology increased the acceptability, validity and feasibility of the ADCI. The Delphi method is focused on the principle that the group's judgement or decisions are more valid than an individual's (Aichholzer, 2009; Kraj, 2015). The anonymity of the reviewers supports this principle; therefore, expert review was conducted remotely via email and Qualtrics surveys to remove the usual complexities of group dynamics that can occur during psychometric development (e.g., halo effect, groupthink) while promoting the positive benefits of groups (e.g., diversity of thought and opinions; Aichholzer, 2009; Kraj, 2015). Reviewers were from a wide range of expertise and levels of experience: researchers in psychopathology that have requisite knowledge about diagnostic criteria and development of diagnostic measures; clinical psychologists who supervise PCBH services with first-hand knowledge about how a measure

might fit into the primary care model; and psychology doctorial trainees who are providing mental health services to primary care patients. The diversity of expertise within the group of reviewers lent itself to a range of rich feedback including structural, diagnostic, and clinical aspects that strengthened the acceptability of the measure for PCBH and improved the feasibility. Overall, the Delphi method proved to be a beneficial methodological tool that should be used more often in psychometric development. In addition to the Delphi method and expert reviewers, the diagnostic criteria used were obtained from the ICD-10 PHC and the DSM-5 guidelines. The combination of these two classification systems helped to focus on brevity for the PCBH setting while also using more updated classifications from the DSM-5, because the ICD-10 PHC was released in 1994.

In the second study, the ADCI was successfully piloted in two integrated primary care clinics and a total of 82 patients completed the interview via telephone (Tables 5 and 6). The ADCI identified that 63.4% of participants met criteria for a mental health diagnosis which was comparable to primary care clinicians identifying 64.7% of patients who met criteria for a disorder. Both the ADCI and clinicians reported higher prevalence than the PCBH literature which ranges from 30-52% of patients meeting criteria for a mental health concern (Ansseau et al., 2004; Piontek et al., 2018; Spitzer et al., 1994). There are two factors that influence interpreting this difference. First, these data were collected during the COVID pandemic and rates of mental health concerns have been shown to be higher than previous times (Vindegaard & Benros, 2020). Second, in the literature, there is significant methodological variability in diagnosis of mental health disorder and quantifying its prevalence that interferes with comparing the ADCI result to existing findings (e.g., Moreno-Küstner et al., 2018). The term “prevalence” is used liberally to describe studies that include patients who are referred to mental health

services or screened positive for mental health symptoms by their primary care providers (e.g., Ansseau et al., 2004), or will use symptom screeners (e.g., PHQ-9, GAD-7) as diagnostic tools (e.g., Piontek et al., 2018; Shangguan et al., 2020); these methodologies can artificially inflate prevalence rates while also missing patients who are not being screening or formally assessed. Next, the ADCI also diagnosed significantly more comorbid disorders (approximately 40% of patients) than one disorder (approximately 20%); the opposite was true for clinicians' diagnoses. Rates of comorbidity vary in the literature, from 21.2% across mood, anxiety and somatic symptom disorders and mid-30% for alcohol use disorder with mood or anxiety disorder (Ansseau et al., 2004), up to the mid-40s% for depression and anxiety comorbid with somatization (Kroenke et al., 2007; Piontek et al., 2018).

Although the ADCI reported higher prevalence rates of disorder and comorbidity, rates of depression and anxiety were lower than clinicians' diagnoses. The ADCI identified 26.7% of patients meeting criteria for depression. In a comparable study that used a clinical diagnostic measure in primary care, 31% of patients were diagnosed with a mood disorder (Ansseau et al., 2004). The ADCI diagnosed 22.5% of patients with generalized anxiety and 15% with panic disorders. In the literature, diagnosis of anxiety disorders varies more than depression or mood disorders. Studies have found that 15-19% of patients met criteria for an anxiety disorder, 7.6-10.8% for generalized anxiety and 2.8-6.8% for panic disorders (Ansseau et al., 2004; Kroenke et al., 2007). Rate of somatization diagnosed by the ADCI (25.8%) was comparable to the estimated point prevalence in a similar primary care study (Haller et al., 2015). The ADCI diagnosed significantly fewer substance use disorders compared to primary care, where an estimated 35% of patients meet criteria for at least one substance use disorder (John et al., 2018). The ADCI diagnosed 5% of individuals with an episode of psychosis. A systematic review on

the prevalence of psychosis revealed a significantly lower prevalence of 7.69 per 1000 people over their lifetime (Moreno-Küstner et al., 2018). Overall, rates of diagnosis on the ADCI were comparable to rates in the primary care literature with the exceptions of anxiety and psychosis being higher while substance use was lower. These differences could be attributed to the impact of the COVID pandemic heightening individuals' concern regarding physical complaints and that ACC and Hayes clinics routinely referring patients with substance use disorders to a specialty primary care clinic (MOTIVATE clinic).

In the latter part of study 2, diagnoses from the ADCI were compared to those provided by clinicians (Table 7). The ADCI and clinicians demonstrated significant overlap on detection of any anxiety disorder, panic disorder, and differentiating between no disorder, depression, anxiety, or both. In a similar study, rates of agreement and kappa sizes were similar (Piontek et al., 2018). There were a few diagnoses on which the ADCI and clinicians did not agree: depression, somatization, substance use and psychosis. Piontek and colleagues' (2018) study demonstrated agreement between PCPs and the Composite International Diagnostic Interview (CIDI) for both depression and somatization. However, one key difference in their study involved prescreening patients for symptoms before recruitment. Their methodological approach likely improved their diagnostic agreement between the CIDI and PCPs. Lower levels of agreement between ADCI and clinicians could also be a reflection of successful interventions and patient improvement due to delay in collecting clinicians' diagnoses after behavioral health appointments. Another factor to consider when interpreting disagreement between the ADCI and clinicians is the model of PCBH. Primary care clinics vary widely in how they integrate psychologists and behavioral health services (Brown et al., 2021). Due to the COVID pandemic, ACC and Hayes transitioned their behavioral health services to telemedicine (Perrin et al., 2020).

Prior to COVID, clinicians often received referrals from PCPs via warm hand-offs, but since COVID referrals have been made electronically which could have reduced the amount of information exchanged across professions. Another reason for disagreement is that the PCBH model focuses on brief intervention (<30 minutes) and patients often attend only one to three appointments. Due to brevity, sessions are often focused on addressing the referral question rather than on broader assessment which can lead to underdetection. For example, a patient might be referred to behavior health for smoking cessation which would be the focus of one or two sessions. The clinician and patient would work on strategies for reducing smoking and might not have time to assess and treat additional mental health symptoms, leading to underdetection of comorbid mental health symptoms. The ADCI might be a helpful tool for assessing whether patients have other concerns or disorders present and reduce burden on clinicians to assess and diagnose patients within a brief model of care. Additional diagnostic information can create a fuller appreciation for and conceptualization of patients' presenting concerns. The ADCI could also help determine patients' needs for community referrals due to comorbidity or increased severity of mental health symptoms that would benefit from more than a few behavioral health appointments. Nonetheless, it remains to be determined if the ADCI is overdetecting rates of diagnosis, which is another possible explanation of the discrepancy.

The reasons for disagreement on somatic disorders may come from two additional sources: perception of somatic symptoms among mental health professionals and the impact of the COVID pandemic. The diagnosis of somatic disorders has long elicited strong opinions from mental health providers and medical doctors. The revision of somatic disorders for DSM-5 attempted to reduce the number of disorders to avoid problematic overlap and make the criteria more useful to medical providers (Lehmann et al., 2019; Scamvougeras & Howard, 2020).

Somatic Symptom Disorder (SSD) became the new core disorder that is characterized by persistent and clinically significant somatic complaints accompanied by excessive health-related thoughts, feelings, and behaviors regarding symptoms (American Psychiatric Association, 2013). Since the DSM-5 revisions, psychologists and medical providers have expressed difficulty with the ambiguity and potential oversensitivity of the term "excessive" for psychological distress and concerns about medical symptoms (Lehmann et al., 2019; Scamvougeras & Howard, 2020). These concerns might account for the disagreement between the ADCI and clinicians. Also, viewing the characteristics of SSD in the context of the COVID pandemic, it is apparent how more patients might meet criteria due to widespread concerns about contracting the virus, changes in individual behavior, public safety guidelines to prevent it , and increased self-monitoring for symptoms. Additionally, patients who attend PCBH likely have health conditions that could increase their risk for complications if they contracted COVID. However, the ADCI's detection rate of SSD was comparable to prevalence rates in primary care before the pandemic. Assessing for SSD should be more routine in PCBH due to ease of screening, availability of brief interventions that improve quality of life and reduce health care costs, and anticipated increase in patients with somatic concerns following the COVID pandemic. There are several screening measures for SSD, such as the Patient Health Questionnaire-15 (PHQ-15) or Somatic Symptom Scale-8 (SSS-8), and somatic concerns have been shown to respond well to brief cognitive-behavioral interventions (Barsky & Ahern, 2004; Bourgault-Fagnou & Hadjistavropoulos, 2013; Toussaint et al., 2019).

The COVID pandemic has significantly impacted the way primary care clinics operate as they are transitioning behavioral health intervention to telemedicine (Perrin et al., 2020; Sadicario et al., 2021). Recent findings suggest that due to the pandemic, significantly fewer

patients are receiving diagnoses of anxiety, depression, circulatory system diseases, and type 2 diabetes, and fewer first time prescriptions were prescribed due to reduced patient load at primary care clinics (Williams et al., 2020). A systematic review of the impact of COVID on mental health demonstrated a pattern of patients with preexisting mental health disorders experiencing an exacerbation of symptoms (Vindegaard & Benros, 2020). In the general population, patients reported lower psychological well-being and higher levels of anxiety, depression, illness anxiety, and somatization (Kecojevic et al., 2020; Vindegaard & Benros, 2020). Based on the COVID and mental health literature, it is more than likely that the ADCI diagnostic rate is accurate with elevated somatization comorbid with depression or anxiety (Ran et al., 2020; Shangguan et al., 2020).

Limitations

An unavoidable limitation of the study is that data collection occurred during the COVID pandemic; however, the study provided a rare opportunity to assess how patients receiving PCBH services were coping during the pandemic. The COVID pandemic not only impacted participants' mental health, but also limited recruitment. As a result, the study had difficulty reaching an adequately powered sample size. Safety protocols due to COVID, including remotely conducting the study, likely negatively impacted participant recruitment due to a reduced number of patients being seen at primary care and to patients having difficulty utilizing telemedicine. Remote interviews also limited the direct supervision of interview administration and scoring.

The sample was also limited due to the data collection method and the remote nature of the study. Only patients with email addresses and cellphones, and those who could afford cellular data, were able to participate in the study; there were a few patients without email addresses who

could not receive the gift card compensation. Additionally, conducting the interview via telephone reduced the ecological validity of the ADCI. This has implications for how the ADCI will be used in person. For example, administering and scoring the ADCI might be easier due to additional response data and interviewer observations when conducting the interview in person. Rapport and body language can be helpful sources of information during an interview and for scoring that are not accessible during telephone interviews. Last, data collection was completed by primarily undergraduate psychology students. Only one interviewer had experience working in primary care clinics. PCBH providers were only part of the development process and have yet to have the opportunity to use the measure in the clinics.

Clinical Implications

The primary outcome of the study was the creation of the ADCI, a brief clinical diagnostic tool that mental health providers would be able to implement in PCBH clinics. The ADCI fills a gap in PCBH tools to improve diagnosis of patients' mental health concerns that could contribute to rates of underdiagnosed minority patients. Disparities in health for racial minority, low socioeconomic status (SES), or underserved populations are well documented and contribute to disproportionate rates of these individuals experiencing mental health conditions. Better detection of mental health symptoms has the potential to reduce the burden of these symptoms on minority patients. The ADCI can also help clinical settings gain a better understanding of their patients' needs and improve mental health services by providing information about the mental health disorders present in these communities.

Expert reviewers and the pilot trial using the ADCI both demonstrated that this measure is feasible and acceptable to diagnose mental health concerns in PCBH. Also, the above findings from the ADCI revealed ways to improve screening and intervention at our primary care clinics.

The ADCI was designed for ease of use and does not require a psychologist to administer. Any well-meaning, empathetic medical provider with an interest in mental health (e.g., nurse, medical assistant, primary care provider) could learn to administer the ADCI. However, the ADCI does require the interviewer to make decisions and use clinical judgement to score patients' symptoms as either present or absent. Our undergraduate-level psychology research assistants demonstrated good interrater reliability after one three-hour training session and two practice interviews completed with a peer. For providers with more clinical experience, less training would likely be sufficient, such as a one-hour abbreviated training session and one or two peer supervised administrations.

Future Directions

Future research on the ADCI should focus on clinical implications and continued evaluation of its diagnostic accuracy and validity. At present, the ADCI's validity is associated with the validity of the screening tools and diagnostic criteria that were used to develop it. However, formal validity studies could help determine whether the questions and the diagnostic algorithm should be revised. Although the ADCI has implications for addressing racial health disparities, future research should assess its ability to accurately diagnose and detect differential rates of disorders among racial minorities.

Future research could also focus on the training and administration of the ADCI in PCBH. The current study was limited in scope and impacted by the COVID pandemic; thus, we were unable to implement the ADCI in the physical PCBH settings. For example, formally assessing the necessary amount of for interviewers to learn to administration and score accurately, whether booster trainings are needed, and the development of a credential or certification program would be beneficial for implementation. Additionally, it would be useful to

explore the relationship between implementing the ADCI at a clinic and tracking patients' outcomes. Ideally, improvements in detection of mental health concerns would translate into reductions of disorders and symptoms.

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Appendix A
Telephone Interview Script

Hello [Mr./Ms. patient's name], my name is [RA's name] and I'm calling from VCU to follow up on the behavioral health appointment you attended at [ACC/ Hayes]. We are conducting a research study and were hoping to talk with you to better understand your behavioral and emotional health symptoms. This is a one-time phone interview that will take about 60 minutes and participation is completely voluntary. Since the interview would be for research purposes only, there is monetary compensation available your time and effort in this study. Do you have time now to talk and hear more about the interview?

If patient needs more information:

- *Reidentify the clinic they received care at and its affiliation with VCU and that follow-up phone interviews about services are standard of care*
- *If they ask about your credentials: "I am a psychology research assistant supervised by Dr. Keeley. If you have questions or concerns you can talk to him or our research coordinator Julia Brechbiel at [research lab number]"*
- *If they would like to discuss details related to their appointment or clinical care at VCU Health Services, please advise them to contact their provider. For example: "It sounds like you have questions about your care or would like to talk to your provider, I recommend that you contact the clinic or the provider directly."*

In case we get disconnected, what's the best number to reach out at: [collect phone number]

Do you have time now to talk and hear more about the interview?

- Yes
- Schedule follow-up phone call
- No – Declined to participate

[Review consent form]

Would you like me to email you a copy of the information I reviewed so you have our contact information?
[If yes, collect email address]

Verbal Consent
Do you consent to participate?

- **Yes**
- **No**

IF YES:

Just as a reminder, you attended a behavioral health psychology session in the past two weeks. For this research study, what I'd like to do today is check in and see how you're doing by asking you questions about your thoughts and emotions. Everything you tell me today will be confidential and won't be shared with anyone without your permission. If you

would prefer to skip or not answer a question, please let me know and you are welcome to discontinue the interview at any time.

[Administer Diagnostic Clinical Interview]

If patient endorses suicidal ideation:

OK, so from what you've told me it looks like you are having thoughts [insert patient's language here**]. I want to make sure that you are safe and receiving support to cope with these thoughts. I am going to place you on a brief hold to consult with a colleague to make sure you receive the best support.**

- Place patient on hold/mute and discuss the case with Dr. Keeley and agree to a plan to provide patient with information for clinical services or directions to emergency care depending on the severity of thoughts, intent, and plan.
- If you are disconnected from a patient in active crisis and they are no longer reachable: Please notify Dr. Keeley who will follow clinical procedure by looking up their address in their medical record and contacting Richmond police who will conduct a wellness check

Thank you for holding, let me provide you with some helpful resources.
Here are 24/7 numbers for national suicide hotlines: 1-800-784-2433 or 1-800-273-8255. **Or if you need someone to talk but you are not having suicidal thoughts you can call the Virginia warm line**: 1-866-400-6428. **The warm line is available Mon-Fri 9am-9p, and 5pm-9pm Sat-Sun.**
If you are unsafe, it is always best to call 911 or go to the ER immediately.

You've completed the interview, thank you for your time! Let me make sure I have your email address to send you the $10 gift card.
[record email address below]

If you are interested in counseling, I can provide you with some local resources. Would you like the number of the clinic you recently visited (ACC: 804-828-9000 / Hayes: 804-230-7777), **or a referral number for somewhere else in the community** (see below referral numbers)?

Remember services at [ACC/Hayes] **are always available to you as long as you're a patient at** [ACC/Hayes]**. Again, thank you so much for your time,** [patient name]**.**

Counseling Services – Referral Information

Community Services Boards
Richmond Behavioral Health Authority (City of Richmond)
Counseling and psychiatry services: (804) 819-4000
Emergency services: (804) 819-4100
http://bewellva.com/richmond/

Hanover County
All Services (Emergency included): (804) 365-4200
https://www.hanovercounty.gov/358/Community-Services-Board

Henrico County
Counseling and psychiatry services: (804) 727-8500
Emergency services: (804) 727-8484
http://www.co.henrico.va.us/mhmr

District 19 (Petersburg and Tri-Cities)
Counseling and psychiatry services: (804) 862-8002
Emergency services: (804) 862-8000
http://www.d19csb.com

Chesterfield County
Counseling and psychiatry services: (804) 768-7318
Emergency services: (804) 748-6356
https://www.chesterfield.gov/878/Mental-Health-Support-Services

Therapy Clinics (Accept Medicaid or affordable sliding fee scale)
Center for Psychological Services and Development
612 North Lombardy Street, Richmond, VA 23284
(804) 828-8069 • http://www.has.vcu.edu/psy/cpsd/

Jewish Family Services: Accepts families of all faiths
6718 Patterson Ave, Richmond, VA 23226
(804) 282-5644 x 234 • http://www.jfsrichmond.org

Dominion Behavioral Healthcare
Midlothian: Courthouse Rd (804) 794-4482; Harbor Pointe (804) 639-1136
West End: Pembrooke Medical Center (804) 270-1124

If it is an emergency: CALL 911
Suicide Hotlines: 1-800-784-2433 or 1-800-273-8255
VA Warmline: 1-866-400-6428

Appendix B

Table 12.
Frequency of Patients Meeting Criteria for a Diagnosis

		Diagnosis from Clinicians		
		No Diagnosis	Meets Criteria	Total
ADCI	No Diagnosis	9	20	29
	Meets Criteria	18	35	53
	Total	27	55	82

Table 13.
Frequency for Diagnosis of Depression

		Diagnosis from Clinicians		
		No Depression	Depression	Total
ADCI	No Depression	34	16	50
	Depression	18	14	32
	Total	52	30	82

Table 14.
Frequency for Diagnosis of Generalized Anxiety Disorder (GAD)

		Diagnosis from Clinicians		
		No GAD	GAD	Total
ADCI	No GAD	38	17	55
	GAD	16	11	27
	Total	54	28	82

Table 15.
Frequency for Diagnosis of a Substance Use Disorder (SUD)

		Diagnosis from Clinicians		
		No SUD	SUD	Total
ADCI	No SUD	75	6	81
	SUD	1	0	1
	Total	76	6	82

Table 16.
Frequency for Diagnosis of Somatic Symptom Disorder (SSD)

		Diagnosis from Clinicians		
		No SSD	SSD	Total
ADCI	No SSD	51	0	51
	SSD	29	2	31
	Total	80	2	82

Table 17.
Frequency for Diagnosis of Psychosis

		Diagnosis from Clinicians		
		No Psychosis	Psychosis	Total
ADCI	No psychosis	76	0	76
	Psychosis	6	0	6
	Total	82	0	82

Table 18.
Frequency of Comorbid Disorders

		Diagnosis from Clinicians			
		None	One disorder	More than one	Total
ADCI	None	10	17	3	30
	One disorder	9	8	0	17
	More than one	10	14	11	35
	Total	2	39	14	82