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Probability of major depression diagnostic classification based on the SCID, CIDI and MINI diagnostic interviews controlling for Hospital Anxiety and Depression Scale – Depression subscale scores: An individual participant data meta-analysis of 73 primary studies

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ABSTRACT

Objective: Two previous individual participant data meta-analyses (IPDMAs) found that different diagnostic interviews classify different proportions of people as having major depression overall or by symptom levels. We compared the odds of major depression classification across diagnostic interviews among studies that administered the Depression subscale of the Hospital Anxiety and Depression Scale (HADS-D).

Methods: Data accrued for an IPDMA on HADS-D diagnostic accuracy were analysed. We fit binomial generalized linear mixed models to compare odds of major depression classification for the Structured Clinical Interview for DSM (SCID), Composite International Diagnostic Interview (CIDI), and Mini International Neuropsychiatric Interview (MINI), controlling for HADS-D scores and participant characteristics with and without an interaction term between interview and HADS-D scores.

Results: There were 15,856 participants (1942 [12%] with major depression) from 73 studies, including 15,335 (97%) non-psychiatric medical patients, 164 (1%) partners of medical patients, and 357 (2%) healthy adults. The MINI (27 studies, 7345 participants, 1066 major depression cases) classified participants as having major depression more often than the CIDI (10 studies, 3023 participants, 269 cases) (adjusted odds ratio [aOR] = 1.70 (0.84, 3.43)) and the semi-structured SCID (36 studies, 5488 participants, 607 cases) (aOR = 1.52 (1.01, 2.30)). The odds ratio for major depression classification with the CIDI was less likely to increase as HADS-D scores increased than for the SCID (interaction aOR = 0.92 (0.88, 0.96)).

Conclusion: Compared to the SCID, the MINI may diagnose more participants as having major depression, and the CIDI may be less responsive to symptom severity.

1. Introduction

Different types of standardized diagnostic interviews are commonly used to classify major depression in research. Semi-structured interviews, for example, the Structured Clinical Interview for DSM (SCID) [1], are designed to be administered by clinically trained professionals with experience in diagnosis; they allow evaluators to ask additional questions and to use their judgement to determine whether or not symptoms are present [2–4]. Fully structured interviews, on the other hand, such as the Composite International Diagnostic Interview (CIDI) [5], were designed specifically to address the costliness of using clinician-administered interviews in epidemiological surveys and can be administered by trained lay interviewers. The CIDI is fully scripted, and thus interviewers are instructed not to explain or rephrase symptoms; its developers emphasized that they were hoping to achieve a high level of reliability for large-scale survey work with the possible loss of validity of diagnoses [5]. The Mini International Neuropsychiatric Interview (MINI) [6,7] is a very brief fully structured interview that was originally designed for potential use as a screening instrument [7]. As described by its developers, it is intended to be over-inclusive in classifying disorders [7].

Despite the different designs and intended uses of semi-structured interviews, fully structured interviews (MINI excluded), and the MINI, these instruments are typically treated as equivalent reference standards for major depression classification in research, including in evidence syntheses [8]. Only five small studies, which each included only 6–22 cases of major depression based on semi-structured interviews and

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8–61 cases based on fully structured interviews, have directly compared different types of diagnostic interviews for major depression [3,9–12]. In the three studies that included >100 participants, prevalence of major depression was substantially higher based on fully structured interviews compared to semi-structured interviews [3,9,12]. Only in a study of patients from an alcoholic treatment unit, where depressive symptoms would be expected to be much more severe, major depression prevalence was similar when assessed with semi-structured and fully structured interviews [11].

Recently, we used an individual participant data meta-analysis (IPDMA) approach in two studies to compare the probability of major depression classification across diagnostic interviews [13,14]. In the first, which included 17,158 participants from 57 primary studies, participant characteristics and depressive symptom severity were controlled using Patient Health Questionnaire-9 (PHQ-9) scores. Among fully structured interviews, the MINI classified depression approximately twice as often as the CIDI. Compared to semi-structured interviews, fully structured interviews (MINI excluded) classified more patients with low-level depressive symptoms but fewer participants with high-level symptoms as depressed [13]. Similar findings were observed in a second IPDMA of 46 studies that included 12,759 women who were pregnant or had recently given birth [14]. Controlling for Edinburgh Postnatal Depression Scale (EPDS) scores, the MINI classified more participants as having major depression than the CIDI, while as EPDS scores increased, both the CIDI and MINI classified fewer participants as having depression than the SCID [14]. These findings highlight that different diagnostic interviews may classify different proportions of patients with major depression or be more or less responsive to symptom levels in samples comprised of a range of participants, including women in pregnancy and postpartum.

Neither of the two previous IPDMAs focused on diagnosis primarily in people with medical conditions. Because only two large studies have been conducted to date it is important to test the generalizability of findings in different populations, including people with medical conditions. The Depression subscale of the Hospital Anxiety and Depression Scale (HADS-D) [15] is commonly used to assess depressive symptom severity in medically ill patients. The HADS was designed specifically for use in people with physical health problems and to avoid somatic items that are common in both depression and many other medical conditions [15]. The objective of the present study was to use an IPDMA approach to examine patterns between diagnostic interviews and the proportion of participants classified as having major depression among studies that administered the HADS-D. As in previous studies [13,14], first we compared major depression classification odds within fully structured interviews (MINI vs. CIDI), and then between fully structured and semi-structured interviews (CIDI vs. SCID and MINI vs. SCID), to determine if different interviews influenced the odds of being classified as having major depression. In each case, we controlled for participant characteristics and depressive symptom severity based on HADS-D scores. Second, we tested whether differences in the probability of classification across the three types of interviews were associated with depressive symptom severity by including an interaction term.

2. Methods

We registered the main analyses of the HADS-D IPDMA in PROSPERO (CRD42015016761) and published a protocol [16]. We reported the results of the present study following PRISMA-DTA [17] and PRISMA-IPD [18] reporting guidelines. We did not plan at the time of registration and publication of our protocol to conduct analyses that compared diagnostic interviews, but results from previous studies [13,14] indicated that there may be important differences between interviews and that this should be tested before evaluating diagnostic test accuracy.

2.1. Inclusion criteria

For the main IPDMA, datasets from articles in any language were eligible for inclusion if (1) they included diagnostic classification for current Major Depressive Disorder (MDD) or Major Depressive Episode (MDE) using Diagnostic and Statistical Manual of Mental Disorders (DSM) [19–22] or International Classification of Diseases (ICD) [23] criteria based on a validated semi-structured or fully structured interview; (2) they included total scores for the HADS-D; (3) the diagnostic interview and HADS-D were administered within 2 weeks of each other, because DSM and ICD major depression diagnostic criteria specify that symptoms must have been present in the last 2 weeks; (4) participants were ≥ 18 years of age; and (5) patients were not from psychiatric settings or already identified as having symptoms of depression, since screening is done to identify unrecognized cases. Datasets where not all participants were eligible were included if primary data allowed selection of eligible participants. For the present study, we only included studies that assessed major depression using the SCID [1], CIDI [5], or MINI [6,7], because the majority of identified studies (i.e., >90%) utilised these interviews.

2.2. Data sources and study selection

We searched Medline, Medline In-Process & Other Non-Indexed Citations and PsycINFO via OvidSP, and Web of Science via ISI Web of Knowledge from inception to June 14, 2016, using a peer-reviewed [24] search strategy that was developed by an experienced medical librarian (Appendix A). We additionally reviewed reference lists from relevant reviews and queried authors who contributed datasets about non-published studies. We uploaded search results into RefWorks (RefWorks-COS, Bethesda, MD, USA); after de-duplication, unique citations were uploaded into DistillerSR (Evidence Partners, Ottawa, Canada) to manage the search process and data extraction.

Two investigators reviewed titles and abstracts for eligibility, independently. If either identified a study as potentially eligible, full-text review was done by two investigators, also independently. Any disagreements were resolved by consensus, with a third investigator consulted as necessary. Translators were consulted for languages for which team members were not fluent.

2.3. Data extraction and synthesis

We invited authors of eligible datasets to contribute de-identified primary data. As necessary, we emailed corresponding authors of eligible primary studies up to three times. If we did not receive a response, we emailed study co-authors and attempted to contact corresponding authors by phone.

Diagnostic interview used, health care setting, and country of primary studies were extracted from published articles by two investigators independently, and disagreements were resolved by consensus. Countries were categorized as “very high” or “high” development based on the United Nations' Human Development Index. This is a statistical composite index that includes indicators of life expectancy, education, and income (no included studies had “low” or “medium” status) [25]. Participant-level data included age, sex, health care setting (when studies included participants from multiple settings), HADS-D scores, and major depression status (major depression case or non-case). For major depression classification, we considered MDD or MDE based on the DSM or ICD, and if more than one was reported, we prioritized DSM over ICD. We prioritized DSM since it was more commonly used in included studies, and we prioritized MDE over MDD, because screening is done to attempt to detect depressive episodes, and further assessments must be done to determine if the episode is related to MDD, bipolar disorder or persistent depressive disorder [22].

We converted individual participant data to a standard format and synthesized with study-level data into a single dataset. We compared

published participant characteristics and screening accuracy results with results from raw datasets, and we resolved any discrepancies in consultation with the original investigators. For the present study, we only included data from participants with complete data for all variables in analyses.

2.4. Statistical analyses

We estimated the association between the diagnostic interview used and probability of major depression using binomial generalized linear mixed models (GLMMs) with a logit link function. Models controlled for depressive symptom severity using continuous HADS-D scores, age (continuous), sex, country Human Development Index (very high or high), and health care setting (inpatient specialty care, outpatient specialty care, non-medical care, or mixed inpatient and outpatient). These covariates were chosen due to their potential influence on depression status and availability in primary studies. To account for correlation between participants within the same primary study, a random intercept was fit for each study. Fixed slopes were estimated for HADS-D score, diagnostic interview, age, sex, Human Development Index, and patient care setting.

First, we estimated GLMMs among fully structured interviews, to compare odds of major depression classification for the MINI vs. the CIDI. Second, we estimated GLMMs to compare odds of major depression classification for the CIDI vs. the SCID and the MINI vs. SCID, separately. Third, we investigated possible interactions between depressive symptom severity (based on continuous HADS-D scores) and 1) MINI vs. CIDI, 2) CIDI vs. SCID, and 3) MINI vs. SCID by adding an interaction term to each model.

All analyses were run in R (R version R 3.5.1 and R Studio version 1.1.463) (R [26]; RStudio [27]) using the glmer function within the lme4 package [28].

3. Results

Of 10,015 unique titles and abstracts identified from the database search, 9584 were excluded after title and abstract review, and 264 were excluded after full text review, leaving 167 eligible articles with

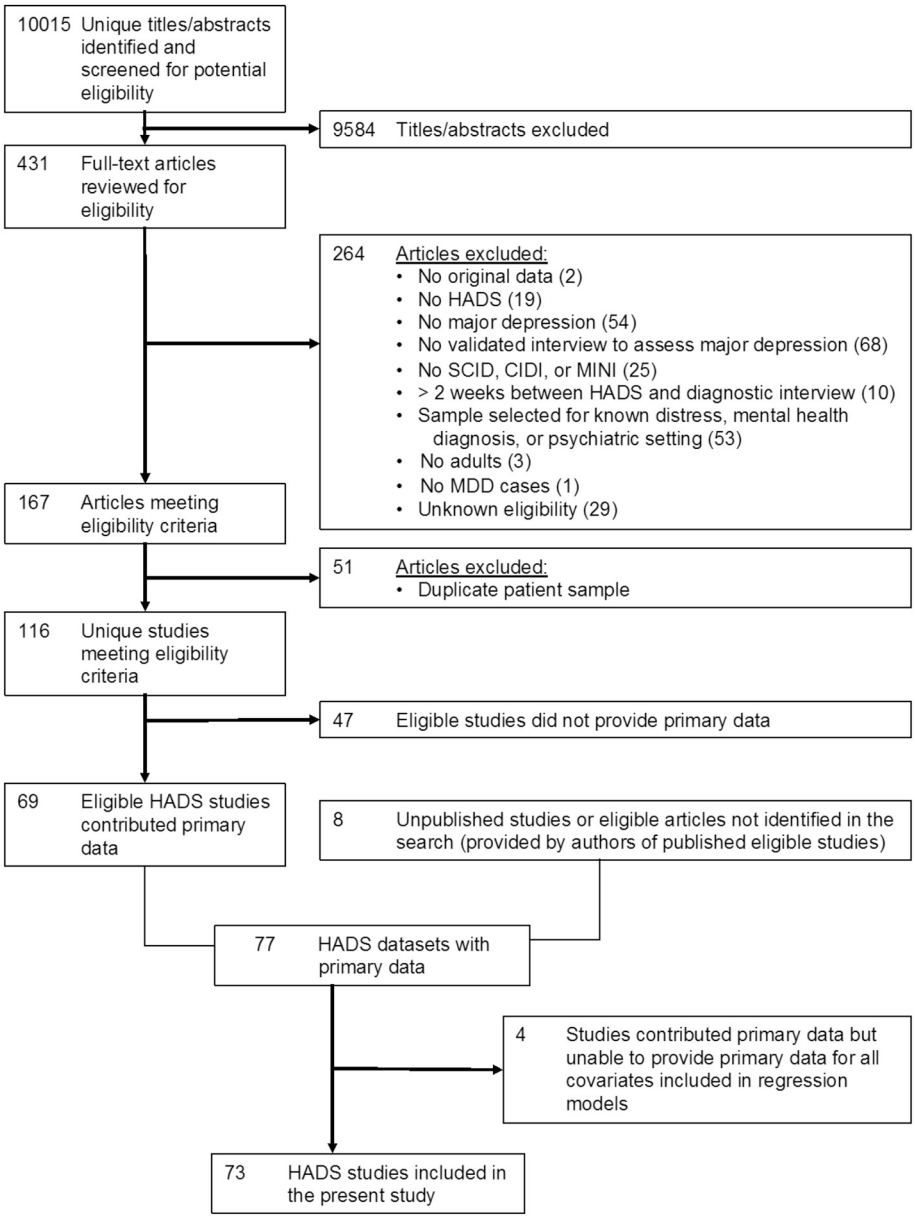

Fig. 1. Flow diagram of study selection process.

data from 116 unique samples, of which 69 (59% of datasets; 71% of participants) contributed data (Fig. 1). Reasons why articles were excluded at the full-text level are provided in Appendix B. Authors of included studies contributed data from an additional five unpublished studies and three additional eligible studies not identified in the search, for a total of 77 datasets. However, four primary datasets did not include data for key covariates included in analyses (age, sex) and were excluded, leaving 73 primary datasets included in the present study. Included study characteristics are shown in Appendix C. Table C.1. Characteristics of eligible studies that did not provide data for the present study are shown in Appendix C. Table C.2.

In total, 15,856 participants (1942 [12%] with major depression) were included (Table 1). Of the 73 included studies, there were 36 SCID studies (5488 participants, 11% major depression), 10 CIDI studies (3023 participants, 9% major depression), and 27 MINI studies (7345 participants, 15% major depression). As shown in Table 2, of the 15,856 included participants, 15,335 (97%) were non-psychiatric medical patients, 164 (1%) were partners of medical patients, and 357 (2%) were healthy adults.

As shown in Fig. 2 and Appendix D, across interviews, the proportion of participants classified with major depression generally increased as HADS-D scores increased. Model coefficients for each analysis are reported in Table 3 and Appendix E (Tables E.1 to E.6). Among fully structured interviews, controlling for HADS-D scores, the MINI was more likely to classify participants as having major depression than the CIDI, but there was some imprecision in estimates (adjusted odds ratio [aOR] = 1.70; 95% confidence interval [CI] = 0.84–3.43). Compared with the semi-structured SCID, the MINI classified major depression more often (aOR for MINI vs. SCID = 1.52; 95% CI = 1.01–2.30). Odds of major depression classification were similar for the CIDI and the SCID (aOR for CIDI vs. SCID = 1.09, 95% CI = 0.56–2.13).

As HADS-D scores increased, the odds of major depression classification increased more for the MINI than for the CIDI (interaction aOR = 1.07, 95% CI = 1.03–1.12), but increased less for the CIDI than for the SCID (interaction aOR for CIDI = 0.92, 95% CI = 0.88–0.96). The interaction was not statistically significant for the comparison between the MINI and the SCID (interaction aOR for MINI = 0.99, 95% CI = 0.96–1.02).

4. Discussion

We compared the odds of being classified as having major depression according to three diagnostic interviews, controlling for participant characteristics and depressive symptom severity using IPDMA. Although different types of diagnostic interviews are used in research, semi-structured interviews, which allow queries with clinical judgement, such as the SCID, most closely replicate standard diagnostic criteria administered by a trained evaluator [2–4]. Our study found that, first, compared with the SCID, the MINI, which is a very brief fully structured diagnostic tool, classifies significantly more participants as having major depression. Second, the CIDI, which is also fully structured, classifies a similar proportion of people as having major depression overall as the SCID; however, it is less sensitive to increases in symptom levels, and the odds of diagnosis do not increase as much as symptoms increase.

These findings among the HADS-D studies in the population of medically ill patients are similar to findings from two previous IPDMAs which examined the PHQ-9 and EPDS. In the first, which included 17,158 participants from 57 studies who were administered the PHQ-9, the MINI classified substantially more patients as depressed than other fully structured interviews, primarily the CIDI. Compared to semi-structured interviews, fully structured interviews (MINI excluded) were less sensitive to increases in depressive symptoms [13]. The study did not directly compare the MINI and semi-structured interviews, including the SCID.

In the second IPDMA, which included data from 12,759 women in pregnancy or postpartum from 46 studies who were administered the EPDS [14], the odds of depression classification were again greater for the MINI than the CIDI; the CIDI and MINI tended to classify major depression less often than the SCID, but there was high uncertainty in estimates. Neither the CIDI or MINI was as responsive as the SCID to higher symptom levels in terms of increased odds of diagnosis. Only 3 included studies, however, used the CIDI, which was a limitation.

Based on results from the present study and the two previous studies, it appears that the MINI may classify higher proportion of people as having major depression than the semi-structured SCID and that the CIDI may be less responsive to symptom increases than the SCID. These findings may be associated with characteristics of the different interviews. The MINI was originally designed as a screening instrument and was intended to be over-inclusive in classifying psychiatric disorders [7]. For the CIDI, the lack of sensitivity to different levels of depressive symptoms could be that, rather than specifically addressing symptoms in the last 2 weeks, the CIDI evaluates symptoms in the last 12 months and lifetime, then asked respondents if those symptoms, generally, have been present recently using a single question.

Strengths of the present study were that we used a very large IPDMA dataset, that findings were generally consistent with results from two other large studies that used IPDMA [14, 15, and that the study was done in a sample largely comprised of medically ill patients. Although two previous IPDMAs identified some patterns of the performance of different diagnostic instruments, estimates of association were somewhat imprecise. Therefore, it is critical to understand if the patterns identified for the SCID, CIDI, and MINI in other participant groups hold for medically ill patients, which is the most common group for which the HADS is used. There are, nonetheless, limitations to consider. First, we could not include primary data for just under 30% of eligible participants. Second, across all interviews, especially the CIDI, there were few participants who had HADS-D scores at the higher end of the score spectrum. Finally, about one fifth of SCID studies did not provide descriptions of interviewer qualifications. It is possible that the use of less qualified interviewers could have possibly reduced performance differences across interviews. However, in present study, there were not enough data points for us to adjust for this.

5. Conclusion

Among primary studies that administered the HADS-D, we found that compared with the SCID, the MINI and CIDI may misclassify major depression, which is generally consistent with findings from previous studies that were conducted with similar methods in other populations [14, 15]. The MINI and CIDI are the most commonly used fully structured interviews for major depression. They are fully scripted and can be administered by lay research staff, but they may not perform equivalently to SCID, which is a semi-structured interview and more closely replicates diagnostic procedures as administered by a qualified health care professional. The findings from the present study and previous IPDMAs suggest that the MINI may diagnose more participants as having major depression and that the CIDI may be less sensitive to increases in depressive symptoms. In research, including in clinical trials, investigators should take into consideration the advantages and

Table 1
Participant data by diagnostic interview.

Diagnostic interview	N studies	N participants	N (%) major depression
SCID	36	5488	607 (11)
CIDI	10	3023	269 (9)
MINI	27	7345	1066 (15)
Total	73	15,856	1942 (12)

Abbreviations: CIDI: Composite International Diagnostic Interview; MINI: Mini International Neuropsychiatric Interview, SCID: Structured Clinical Interview for DSM Disorders.

Table 2
Categorizations of diseases of included patients[a].

Disease type	N studies	N participants	N (%) major depression
Cancer	16	4048	292 (7)
Cardiovascular disease	16	2299	248 (11)
Neurological disease	12	1477	397 (27)
General medicine: ambulatory	6	3437	478 (14)
General medicine: inpatients	4	1169	142 (12)
Infectious disease	4	750	110 (15)
Other[b]	3	521	27 (5)
Renal disease	3	293	69 (24)
Traumatic injury	2	1013	156 (15)
Endocrinology	2	428	63 (15)
Dermatology	2	138	22 (16)
Autoimmune disease	1	128	28 (22)
Sleep disorder	1	100	30 (30)
Lung disease	1	55	1 (2)
Total	73	15,856	1942 (12)

[a] More specific information on each included study characteristics are provided in Appendix C. Table C.1.
[b] Other includes spouses of medical patients and health adults.

Table 3
Comparison of major depression classification odds across diagnostic interviews.

Diagnostic interview comparison	Adjusted odds ratio[a] OR (95% CI)	Adjusted odds ratio OR for interaction[b] (95% CI)
MINI vs. CIDI	1.70 (0.84, 3.43)[c]	1.07 (1.03, 1.12)[c]
CIDI vs. SCID	1.09 (0.56, 2.13)	0.92 (0.88, 0.96)[c]
MINI vs. SCID	1.52 (1.01, 2.30)[c]	0.99 (0.96, 1.02)[c]

Abbreviations: CIDI: Composite International Diagnostic Interview; HADS-D: Depression subscale of Hospital Anxiety and Depression Scale; MINI: Mini International Neuropsychiatric Interview; SCID: Structured Clinical Interview for DSM Disorders.
[a] No interaction; adjusted for HADS-D score, age, sex, country human development index, and patient care setting.
[b] Including an interaction between diagnostic interview and HADS-D score; adjusted for HADS-D score, age, sex, country human development index, and patient care setting.
[c] In these models, the default optimizer in glmer failed to converge, thus bobyqa was used instead.

disadvantages of different diagnostic interviews, including resources required to use each of them, when choosing different instruments and interpreting findings.

Contributors

YW, BLevis, JTB, PC, SG, DM, JPAI, LAK, SBP, IS, RCZ, MHenry, ZI, CGL, NDM, MT, ABenedetti and BDT were responsible for the study conception and design. JTB and LAK designed and conducted database searches to identify eligible studies. SA, ABeraldi, APBMB, NBD, ABunevicius, GCarter, CKC, GCheung, KC, RMC, DC, CED, ED, FMD, ED, MGD, AF, PPF, FHF, AJF, MF, PG, MG, SG, LG, MHärter, JJ, NJ, MJ, MKeller, SK, JMK, SWK, MKjærgaard, BLöwe, WLL, RMS, LMassardo, YM, AM, IM, LMisery, RN, MLO, MO, JP, LP, JLP, TJQ, SER, KR, AGR, RSG, MLS, VSC, JS, LSharpe, SSimard, SSinger, LStafford, IT, KYT, AT, JW, MW, LJW, and DKW contributed primary datasets that were included in this study. YW, BLevis, YS, AK, CH, KER, DBR, MA, YXW, DN, PMB, MI, TAS, MJC, and NS contributed to data extraction and coding for the meta-analysis. YW, BLevis, ABenedetti and BDT contributed to the data analysis and interpretation. YW, BLevis, ABenedetti, and BDT contributed to drafting the manuscript. All authors provided a critical review and approved the final manuscript. ABenedetti and BDT are the guarantors; they had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analyses.

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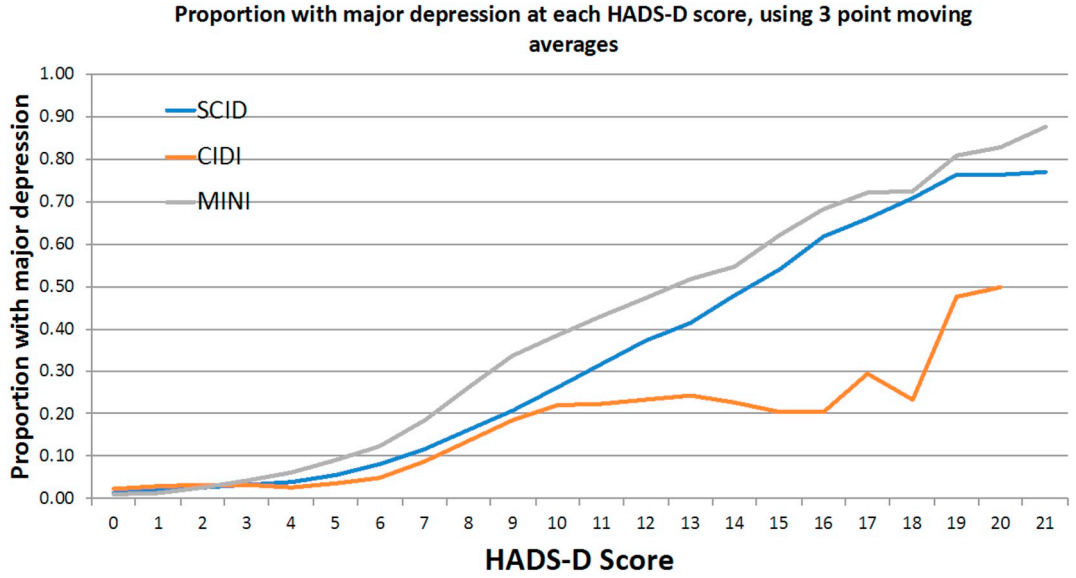

Fig. 2. Probability of major depression classification by HADS-D score for the SCID, CIDI, and MINI.
Abbreviations: CIDI: Composite International Diagnostic Interview; HADS-D: Depression subscale of Hospital Anxiety and Depression Scale; MINI: Mini International Neuropsychiatric Interview; SCID: Structured Clinical Interview for DSM Disorders.

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Declaration of competing interest

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Appendix A. Supplementary data

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