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Defining and Evaluating Overdiagnosis in Mental Health: A Meta-research Review

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ABSTRACT

Background: Overdiagnosis is thought to be common in some mental disorders, but it has not been defined or examined systematically. Assessing overdiagnosis in mental health requires a consistently applied definition that differentiates overdiagnosis from other problems (e.g., misdiagnosis), as well as methods for quantification.

Objectives: Our objectives were to (1) describe how the term 'overdiagnosis' has been defined explicitly or implicitly in published articles on mental disorders, including usages consistent (*overdefinition*, *overdetection*) and inconsistent (*misdiagnosis*, *false positive test results*, *overtreatment*, *overtesting*) with accepted definitions of overdiagnosis; and (2) identify examples of attempts to quantify overdiagnosis.

Method: We searched PubMed through January 5, 2019. Articles on mental disorders, excluding neurocognitive disorders, were eligible if they used the term 'overdiagnosis' in the title, abstract, or text.

Results: We identified 164 eligible articles with 193 total explicit or implicit uses of the term 'overdiagnosis'. Of 9 articles with an explicit definition, only one provided a definition that was partially consistent with accepted definitions. Of all uses, 11.4% were consistent, and 76.7% were related to misdiagnosis and thus inconsistent. No attempts to quantify the proportion of patients who were overdiagnosed based on overdetection or overdefinition were identified.

Conclusions: There are few examples of mental health articles that describe overdiagnosis consistent with accepted definitions and no examples of quantifying overdiagnosis based on these definitions. A definition of overdiagnosis based on diagnostic criteria that include people with transient or mild symptoms not amenable to treatment (overdefinition) could be used to quantify the extent of overdiagnosis in mental disorders.

> Over-diagnosis of any sort is bad; bad for the patient physically, financially, and psychically; bad for the physician mentally and morally; bad for the country economically.
>
> J. D. Adamson (1924)

INTRODUCTION

The term ‘overdiagnosis’ has been used in the medical literature as far back as 1924.[1] Nonetheless, the lack of a standard definition and challenges in its quantification continue to complicate research, policy, and communication between health care providers and patients.[2-4] One important challenge for quantification and communication is that overdiagnosis occurs in individuals, but its presence and magnitude can only be evaluated in aggregate.[4]

Overdiagnosis has been most frequently described in the context of screening to detect early-stage asymptomatic cancers, [2] where it is said to occur when an asymptomatic person is diagnosed with a condition that would have remained unrecognized and would not have gone on to cause symptoms or death in the person’s lifetime in the absence of screening.[2-12] Generally, overdiagnosis is understood to reflect the application of a diagnosis based on agreed upon standards to a person who cannot benefit from the diagnosis and who may be harmed.[2-4, 12]

In mental health, unlike cancer, overdiagnosis may occur when people do experience symptoms, but where definitions of disorders include potentially transitory or mild symptoms that reflect ordinary life experiences that, as such, are not amenable to improvement or management benefits through medical intervention. Symptoms of depression, for example, including sad mood, insomnia, and fatigue, are experienced by most or all people at some point. Overdiagnosis occurs not in the absence of these symptoms, but rather when symptoms occur as part of normal experiences and are transformed into disease and diagnosed in people for whom diagnosis and subsequent treatment will do more harm than good.[2, 4, 12-16]

There is concern that expanded definitions of mental disorders have in some cases medicalized ordinary life experiences [12-17] and that many people diagnosed with some disorders, such as mild cases of depression, recover quickly without treatment.[18, 19] This is problematic because those who are diagnosed, nonetheless, are exposed to possible harms from the diagnosis and treatment. Iatrogenic effects from mental health treatments include adverse medication effects but are increasingly recognized to also include negative experiences with psychological treatments for some patients.[20]

Despite the negative consequences of overdiagnosis, there is little research, however, on the topic. Determining the extent to which overdiagnosis may be present requires that it is defined consistently and differentiated from other problems, such as misdiagnosis, and that there are methods for assessing the extent to which it may be present. Defining overdiagnosis is not straightforward, particularly in mental health, and even beyond mental health, there is definitional uncertainty.[2-4] In mental health, an important complication is the subjective nature of symptom reporting and assessment and in interpreting diagnostic criteria. Nonetheless, on a population level, it is important to be able to understand how common overdiagnosis may be, and a framework put forward by Brodersen et al. is helpful to clarify phenomena that reflect overdiagnosis and other phenomena that are sometimes described as overdiagnosis but are distinct.[2]

Brodersen et al. [2] have categorized overdiagnosis into two types: (1) *overdetection*, which refers to the testing and identification of asymptomatic people with abnormalities that would not have led to symptoms or death because they would have resolved spontaneously, would not have progressed, or would have progressed too slowly to cause harm; and (2) *overdefinition*, which occurs when definitions of risk factors are expanded without evidence of improved quality of life or longevity or when disease definitions are expanded to include patients with fleeting or mild symptoms who would not be expected to gain meaningfully from diagnosis, either through symptom reduction or improved management and coping, but who would be exposed to negative physical, social, psychological, or financial consequences.

Brodersen et al. [2] also described phenomena that do not constitute overdiagnosis but are often confused with overdiagnosis, including (1) *false-positive* test results, which occur when test results identify possible abnormalities that are determined not to be diseases upon further investigation; (2) *overtreatment*, which occurs in the context of overdiagnosis, or, more generally, when a treatment is applied for a correctly diagnosed condition, even though the best available evidence indicates that the treatment does not provide benefit for the condition (e.g., overtreatment of middle ear infections in children with ineffective antibiotics); (3) *overtesting*, which refers to the overly frequent use of a test or the use of a test when not indicated; and (4) *misdiagnosis*, which occurs when the wrong diagnosis is applied rather than the correct diagnosis or when a diagnosis is improperly applied to a person who does not meet standard diagnostic criteria for any diagnosis.

The objectives of our study were (1) to describe how the term 'overdiagnosis' has been defined explicitly or implicitly in published articles on mental disorders, including usages that are consistent with the essence of overdiagnosis (*overdefinition*, *overdetection*) and usages that are inconsistent (*misdiagnosis*, *false positive test results*, *overtreatment*, *overtesting*); and (2) to identify examples where attempts have been made to quantify overdiagnosis in a way consistent with its intended meaning. We focused exclusively on how overdiagnosis has been defined and on attempting to identify examples of studies that have evaluated the extent that it may be present, but we did not address other related topics, such as disease mongering or drivers of overdiagnosis, for example.

MATERIALS AND METHODS

Identification and Selection of Eligible Articles

The authors of a 2017 scoping review searched Medline via PubMed to August 2017 and identified 1,851 eligible articles that discussed overdiagnosis, which they categorized based on type of article (e.g., primary study, review) and medical discipline area.[21] There were 171 included articles classified as related to mental disorders.

Articles were included in the scoping review [21] if (1) they were articles in English on humans, (2) included a full-text version, and (3) it was determined based on review of the title and abstract that overdiagnosis was likely a "dominant theme" of the article. Overdiagnosis was considered a dominant theme if it was clearly a focus of discussion in the article or was investigated by the study described in the article. The review did not evaluate how the term 'overdiagnosis' was used in included articles, and inclusion was not restricted to articles that used the term in a manner consistent with its intended meaning.

For the present study, we used the same eligibility criteria as the scoping review, except we excluded articles if they focused only on neurocognitive disorders (e.g., Alzheimer's disease, dementia, Parkinson's disease); if they mentioned a mental disorder along with other types of disorders in a more general discussion on overdiagnosis, but did not focus primarily on a mental disorder or disorders; or if they did not use the actual term 'overdiagnosis' or a derivative of the term (e.g., 'over-diagnosed') in the article title, abstract, or text.

We initially reviewed the 171 articles from the original scoping review, using a database provided by the authors. We then updated the search on January 5, 2019, using the same search query: overdiagnos*[tw] OR over diagnos*[tw] OR overdetect*[tw] OR over detect*[tw] OR 'insignificant disease'[tw] OR overscreen*[tw] OR over screen*[tw] OR overtest*[tw] OR over test*[tw] OR overmedical*[tw] OR over medical*[tw] OR 'pseudodisease'[tw] OR 'pseudo disease'[tw] OR 'inconsequential disease'[tw] OR 'Quaternary prevention'[tw]. Additionally, to identify any possibly eligible articles that were not captured by the search, we queried the corresponding authors of all articles identified through the scoping review database or our updated search that included explicit definitions of overdiagnosis.

In both our review of articles included in the original scoping review and in our updated search, we first screened titles and abstracts for potential inclusion using a liberal accelerated approach.[22] Thus, articles were included in the full-text review stage if one reviewer deemed them potentially eligible in the

title and abstract review, but two reviewers were needed to exclude an article. At the full-text review stage, two reviewers independently reviewed all articles with any disagreements resolved by consensus.

Data Extraction

For each eligible article, in addition to article characteristics provided in the scoping review database (first author last name; year of publication; journal; type of article coded as primary study, systematic review, narrative review, or commentary or letter), we coded whether the article included an explicit definition or implicit definition of the term 'overdiagnosis'. Articles were considered to have included an explicit definition if they labelled a definition as such or otherwise clearly defined overdiagnosis (e.g., "overdiagnosis is…."; "overdiagnosis occurs when"). Explicit definitions were extracted from the articles.

Articles were considered to have implicitly defined overdiagnosis if they did not provide an explicit definition but if overdiagnosis was operationalized in the procedures of a primary research study or if the definition had to be inferred based on its use in a review, commentary, or letter. For example, if a primary study reported the percentage of false-positive screening tests and labelled this the percentage of patients overdiagnosed, it was considered that overdiagnosis was implicitly defined as the percentage of false positive screening tests.

For all included articles, we classified explicit and implicit definitions of 'overdiagnosis' that were consistent or inconsistent with the intended meaning of the term, using the framework described by Brodersen et al.[2] See Supplementary Table 1 for coding definitions. If a single article used the term 'overdiagnosis' in multiple ways or in a way that reflected more than one category, each type of usage was extracted.

We classified whether overdiagnosis, as defined explicitly or implicitly by the article authors, was (1) the main focus of the article; (2) addressed by the article, but not the main focus; or (3) mentioned, but not addressed directly. See Supplementary Table 2 for classification rules on the degree of focus for primary studies, systematic reviews, narrative reviews, and commentaries or letters.

Among primary research studies that used an explicit or implicit definition of overdiagnosis consistent with its intended meaning, we determined if analyses were conducted to evaluate whether overdiagnosis was present or to attempt to quantify the extent of overdiagnosis. If analyses were conducted, we extracted a description of what was done.

One investigator initially extracted all data, and a second investigator reviewed and validated all extracted data. Any disagreements were resolved by consensus, including a third reviewer if necessary.

Descriptive Analyses

We described how the term 'overdiagnosis' was defined explicitly and implicitly in included articles and how often it was used in each category of consistent and inconsistent uses. We additionally described examples of attempts to operationalize overdiagnosis by estimating the extent to which it occurred.

RESULTS

Characteristics of Included Articles

Of the 171 articles in the original scoping review that were classified as related to mental disorders,[21] 15 were excluded after title and abstract review because they were about neurocognitive disorders, and an additional 9 were excluded after full-text review, leaving 147 included articles. The updated search identified 879 unique citations, of which 847 were excluded after title and abstract review and 20 after full-text review, resulting in an additional 12 articles for inclusion. Our query of authors from included articles that used explicit definitions of overdiagnosis resulted in 5 additional eligible articles for a total of 164 included articles. See Supplementary Figure 1.

As shown in Supplementary Table 3, of the 164 included articles, there were 35 commentaries or letters (21.3%), 36 narrative reviews (22.0%), 4 systematic reviews (2.4%), and 89 primary studies (54.3%). Overdiagnosis, regardless of how defined, was the main focus of 90 articles (54.9%), was addressed but was not the main focus of 48 articles (29.3%), and was mentioned but not the focus of 26 articles (15.9%). There were 9 articles (5.5%) that explicitly defined overdiagnosis and 155 (94.5%) coded as using an implicit

definition.

Explicit and Implicit Definitions of 'Overdiagnosis'

As shown in Supplementary Figure 2, among the 193 total explicit or implicit uses, there were 22 uses consistent with the intended meaning of overdiagnosis, including 21 (10.9%) that described overdefinition and one (0.5%), a commentary on the possibility that imaging could be used in the future to diagnose mental disorders, related to overdetection. There were 171 (88.6%) uses that were inconsistent with the meaning of overdiagnosis, including 148 (76.7%) related to misdiagnosis, either due to the application of a diagnosis of the wrong mental disorder or the application of a diagnosis when criteria were not met for any mental disorder; 5 (2.6%) related to false-positive test results; and 18 (9.3%) that were either too vague to categorize or that described other phenomena. Usage of the term to describe the application of one diagnosis instead of another included both "overdiagnosis" of potentially more severe disorders (e.g., bipolar rather than unipolar depression) and vice versa. Supplementary Table 3 shows the number of included articles with explicit and implicit definitions by type of consistent and inconsistent usage and by article focus and type of article.

As shown in Table 1, there were 9 articles, all published between 2007 and 2017, that provided an explicit definition of overdiagnosis.[15, 23-30] Of these, one article [15] defined overdiagnosis as occurring when patients without significant impairment who would not be expected to benefit from treatment are diagnosed. The definition indicated that this could occur "even when diagnostic criteria are met." Thus, the definition reflected both a consistent use of overdiagnosis (overdefinition) but also suggested an inconsistent use (misdiagnosis of people who do not meet diagnostic criteria).

The other 8 articles all included definitions that reflected misdiagnosis (inconsistent usage). In 2 cases, this reflected diagnosing the incorrect mental disorder,[23, 24] and in 6 cases this reflected the application of diagnoses to people who did not meet diagnostic criteria.[25-30]

In the 155 articles that included only an implicit definition, there was a total of 183 uses, since some articles used the term in a way consistent with more than one category of consistent and inconsistent usage.

See Supplementary Table 4 for representative examples of implicit definitions [31-39] and Supplementary Table 5 for the coding for all 155 articles.

Quantifying Overdiagnosis

No primary research studies included an explicit definition consistent with the intended meaning of overdiagnosis. There were 4 included primary research studies with a main focus on overdiagnosis and a consistent implicit definition (overdefinition).[31, 40-42] Of these, one [40] surveyed psychiatrists and family doctors about their views on the diagnosis and treatment of depression and anxiety. Another study [31] compared prevalence of attention deficit hyperactivity disorder based on a revised version of the Diagnostic and Statistical Manual (DSM-5), which required fewer symptoms than the DSM-IV. The authors reported a higher prevalence with the DSM-5 and suggested that this could increase overdiagnosis but reduce missed cases; however, no evaluation was done to determine the proportion of patients who only met DSM-5 criteria who could have benefitted and the proportion who were likely overdiagnosed. A third study compared comorbidity profiles of patients who met DSM-IV criteria for attention deficit hyperactivity disorder versus those who only met DSM-5 criteria. The authors found that there were similar comorbidity profiles in both groups and concluded that broadening diagnostic criteria was not associated with overdiagnosis [41]. The fourth study [42] reported that approximately 10% of major depression diagnoses based on the Composite International Diagnostic Interview were deemed mild cases and concluded that this was not consistent with the idea that depression is overdiagnosed. None of these studies attempted to quantify the proportion of patients with a diagnosis of a mental disorder who might be overdiagnosed.

DISCUSSION

The main finding of this study was that there were few examples in the academic mental health literature where the term overdiagnosis has been used in a way that is consistent with its intended meaning of applying a diagnosis that will not lead to benefit, either through reducing symptoms or improving management and coping skills, but will expose a patient to possible harms.[2-4] Only 22 of 193 uses of the

term (11.4%) in the 164 articles reviewed were related to overdefinition (N = 21) or overdetection (N = 1), and only one of those articles [14] included an explicit definition, but that definition was only partially consistent because it included an element related to misdiagnosis.

Because of the subjective nature of mental health diagnosis, on an individual level, there is some degree of diagnostic uncertainty, and the line between overdiagnosis and misdiagnosis is not always clear cut. Nonetheless, it is important that the concepts are understood and definitions applied correctly if we are to address overdiagnosis. In essence, overdiagnosis occurs with correctly applied diagnoses, whereas misdiagnosis occurs with incorrectly applied diagnoses. In the articles we reviewed, over 75% (148 of 193) of uses of the term overdiagnosis were related to misdiagnosis, either the incorrect diagnosis of people who did not meet criteria for a mental disorder or the misdiagnosis of one mental disorder instead of another. Misdiagnosis is an important problem in mental health care. Most patients who receive treatment for depression in non-psychiatric settings, for example, do not meet criteria for a depressive disorder and would not likely benefit from depression treatment.[37, 43-45] Among patients receiving care in psychiatric settings, many are diagnosed incorrectly and do not receive treatment that best matches their presenting problem. For example, large percentages of patients diagnosed with bipolar disorder do not appear to meet diagnostic criteria for that disorder, but may meet criteria for other disorders, such as major depressive disorder or borderline personality disorder.[46, 47] Similarly, it is possible that people with major depression or borderline personality disorder could be misdiagnosed with bipolar disorder. Possible solutions to the problem of misdiagnosis include strategies such as improved diagnostic tools and training. Reducing overdiagnosis, which occurs in the context of correctly applied diagnoses,[2-4] presents a different type of challenge.

Several studies included in our review quantified how many people would be diagnosed based on one set of diagnostic criteria versus another. None of these studies, however, attempted to determine if this reflected overdiagnosis based on diagnosing people who could not benefit from the diagnosis. A shift in

diagnostic criteria can lead to overdiagnosis, but it can also benefit some people. Thus, it is important that future studies evaluate the number of people who could benefit and those who could not benefit and would therefore be overdiagnosed.[48]

Since people who are diagnosed in clinical practice are typically treated, evaluation of the extent of overdiagnosis that might be present requires counterfactually attempting to determine how many patients would not have experienced consequences of the disease without diagnosis and intervention. Thus, the identification and quantification of overdiagnosis can only be evaluated in aggregate.[4] In cancer, the extent of overdiagnosis is often examined by comparing increases in early-stage disease detected via screening programs to reductions in late-stage cancer or by comparing incidence in screened and non-screened populations.[4, 49]

In mental health, tests are not used to identify asymptomatic people who have early-stage conditions that can be detected through imaging or blood tests, for instance (overdetection). But, the concept of overdefinition can guide how to identify when overdiagnosis may be present and how many patients may be affected. Patients who would not be expected to benefit from a properly applied diagnosis of a mental disorder, in the context of overdefinition, include (1) those with transitory symptoms that resolve quickly without treatment and (2) those with symptoms that are very mild and, although possibly stable, will not be improved by medical treatment.

Non-benefit, or non-improvement, from diagnosis and treatment is less easily encapsulated in mental health than in the diagnosis of asymptomatic cancer, since symptoms of mental disorders are present across a spectrum that ranges from normal to pathological with levels that fluctuate in virtually all people and are, thus, more difficult to dichotomize. Furthermore, people can benefit from diagnoses in ways other than symptom reduction. For instance, some people with severe mental illness who do not experience measurable symptom reduction may benefit from better management and developing skills or obtaining services to reduce the impact of the disorder. It is important to point out that overdiagnosis occurs not when any given

individual fails to benefit from a potentially beneficial treatment, but when people are diagnosed even though they cannot benefit because their symptoms are so mild as to reflect normal function or transitory and would resolve without treatment.

Despite these complexities, we do have access to evidence that could be used to estimate how common overdiagnosis may be. In depression, the main goal of treatment is symptom reduction. But, evidence from depression treatment trials, for instance, shows that many patients who meet diagnostic criteria recover quickly without treatment.[50] A meta-analysis of 177 trials and over 44,000 patients reported that 38% of patients with major depression assigned to the placebo arms of trials were classified as treatment responders compared to 54% assigned to receive antidepressants.[18] This, however, may overestimate overdiagnosis because placebo can be a beneficial intervention.[51] Evidence from diagnosed patients who do not receive treatment, however, leads to similar conclusions. A meta-analysis of psychotherapy trials found that 48% of patients who received usual care only (no psychotherapy) no longer met criteria for major depression post-trial compared to 62% of those assigned to treatments.[19] These rates suggest a high degree of overdiagnosis, but they may actually underestimate the extent of the problem, since many trials include "washout periods" to eliminate early responders pre-randomization or require that trial participants meet severity criteria beyond diagnostic thresholds.[52]

It may also be possible to identify classes or groups of patients beyond those with short-lived symptoms who are not likely to benefit from diagnosis. It has been suggested, for instance, that this might include people with uncomplicated episodes of depression without suicidal ideation, psychotic ideation, psychomotor retardation, or feelings of worthlessness.[53]

As with other conditions, screening for mental disorders has the potential to lead to overdiagnosis. Depression screening, which involves the use of self-report symptom questionnaires to identify patients with unrecognized depression,[54, 55] is recommended by the United States Preventive Services Task Force.[56] The Canadian Task Force on Preventive Health Care [57] and the United Kingdom National Screening

Committee [58], on the other hand, recommend against screening and have advised that there are no well-conducted trials that have demonstrated benefit from screening and that it would lead to overdiagnosis of some people. Mental health screening, is designed to detect patients whose symptoms are not sufficiently severe or recognizable that they would be reported or identified by health care providers. Thus, many people correctly diagnosed with depression after being identified via screening would have mild symptoms that may be transitory and that would not be addressable by treatment. The extent of overdiagnosis that would occur due to screening could be evaluated by comparing the number of patients who receive diagnoses in screened and unscreened groups in trials to the number of patients who meet diagnostic criteria for the disorder in each group at the end of the trials. We do not know, however, of any existing trials that have provided this information.

Having a better understanding of overdiagnosis in mental disorders is important because of the potentially serious harms involved. One set of possible harms relates to the consequences of labelling, which may include stigma, implications for insurability and employment, and nocebo effects, which can occur when expectations created by a diagnosis lead to negative health effects.[20, 59, 60] A second area of concern relates to exposure to adverse medication effects or, in some cases, negative experiences with psychological treatments. A third concern is that many people with mental health disorders who could be helped by medical treatment cannot access the services that they need. Overdiagnosis diverts mental health resources away from these people. All of these harms, if present, are generated without creating health benefits for patients who are overdiagnosed.

One step that could be undertaken to reduce the risk of overdiagnosis would be to review and, as indicated, revise diagnostic thresholds based on evidence of benefit and harms. The number of disorders and the thresholds of disorders included in the DSM have expanded dramatically in recent iterations.[52,53,61] There is a recognition, beyond psychiatry, that disease definitions are expanding and causing more and more generally healthy people to be diagnosed and labelled as having a medical condition, even though many or

most of these will be overdiagnosed and not benefit from the diagnosis. Recently, an international group of leading researchers proposed a series of steps to move disease definition into the realm of evidence and away from specialist and industry-driven definitions [62]. As argued by the members of that group, "There is a need for estimates of how many people are currently being diagnosed unnecessarily—across common conditions—accompanied by estimates of the consequent burden of harm and waste" (p. 2). Leaders in mental health are encouraged to adapt the steps proposed by this group and address the unnecessary expansion of definitions of mental disorders. Additionally, current approaches to mental health diagnosis have been criticized as reductionistic and decontextualized,[63] and it is possible that better integration of individual factors and context could help to reduce the adverse effects of overdiagnosis that occur with current approaches.

Another step would be to only implement screening programs if there is evidence from well-conducted trials of sufficient benefit to justify harms, including overdiagnosis. In the context of existing diagnostic criteria, clinicians could use a stepped approach to diagnosis and treatment to reduce harms from overdiagnosis for patients with potentially transitory or mild symptom presentations. This would include an active monitoring stage rather than immediate diagnosis; initially using minimally intensive supportive interventions, and applying a definitive diagnosis only when problems persist.[52, 64] The United Kingdom's National Institute for Health and Care Excellence guidelines for diagnosis and management of depression and attention deficit hyperactivity disorder support such an approach.[65, 66]

There are limitations that should be considered in evaluating the results of our study. One is that we only included articles listed in PubMed and did not search other databases. Another is that there are no well-defined search strategies to identify articles that discuss overdiagnosis, and it is possible that we may have failed to identify some articles that have defined overdiagnosis in mental disorders, either explicitly or implicitly. A third is that we only included articles published in English. A fourth is that we applied one definition of overdiagnosis, delineated as occurring via overdetection and overdefinition, but there are other

definitions that have been described.[2-4] Given the robustness of the findings from the study, we do not believe that applying an alternative definition would have altered conclusions substantively. Finally, we only identified 9 articles that explicitly defined overdiagnosis; although, rather than a limitation, this may be understood to reflect the lack of research on overdiagnosis in mental health.

There has been very little scholarly work on overdiagnosis in mental health despite its important implications for individual well-being and for our ability to utilize health care resources wisely and provide effective mental health care to people who need treatment or other supports. There are still many unanswered questions, some of which relate to the nature of some diagnoses themselves. For example, the category of adjustment disorder, which was introduced in DMS-III-R but was previously known as "transient situational disturbance" has been criticized for medicalizing problems of living consistent with normal but not disordered experiences, for being a poorly defined "wastebasket diagnosis", and for being unstable diagnostically with the main intent to serve as a justification for service reimbursement.[67] Consistent with this, it is not known whether there is benefit from applying the diagnosis and available interventions compared to not applying the diagnosis.[68] In this and other areas, consideration of the concept of overdiagnosis and how it can help us to improve our understanding of disorders and to provide more effective and less harmful health care is needed.

In summary, we found few articles related to mental disorders that defined the term 'overdiagnosis', either explicitly or implicitly, in a manner consistent with general definitions of overdiagnosis. We did not identify any studies that attempted to quantify the extent to which overdiagnosis may be present among people diagnosed with a mental disorder. Most articles that used the term 'overdiagnosis' used it to mean other things, most commonly misdiagnosis. Development of a framework to conduct effective research on overdiagnosis in mental health and to communicate effectively with policy makers, clinicians, and the public will require the adaptation of a definition consistent with general understandings of overdiagnosis. Many symptoms of mental disorders are experienced at some point by most or all people. Criteria and thresholds

for diagnosis of mental disorders are based primarily on expert consensus rather than evidence of benefit to patients who receive diagnoses.[13] Using the idea of overdefinition as a guide, studies are needed that evaluate the proportion of people diagnosed with mental disorders who are likely overdiagnosed, either because their symptoms are transient and resolve quickly without treatment or are mild and not amenable to improvement by diagnosis and mental health treatment.

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Ethics Statement: As this study involved only the review of published articles, research ethics approval was not required.

Transparency Declaration: The manuscript's guarantor affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Data Sharing: All extracted data are available in the main tables or in Supplementary File 1. No additional data were extracted.

REFERENCES

1. Adamson JD. Over-diagnosis of pulmonary tuberculosis. Can Med Assoc J. 1924;14:610-613.
2. Brodersen J, Schwartz LM, Heneghan C, et al. Overdiagnosis: what it is and what it isn't. BMJ Evid Based Med. 2018;23:1-3.
3. Carter SM, Rogers W, Heath I, et al. The challenge of overdiagnosis begins with its definition. BMJ. 2015;350:h869.
4. Carter SM, Degeling C, Doust J, Barratt A. A definition and ethical evaluation of overdiagnosis. J Med Ethics. 2016;42:722-724.
5. Welch HG, Schwartz L, Woloshin S. Overdiagnosed: making people sick in the pursuit of health. Beacon Press; 2011.
6. Welch HG, Black WC. Overdiagnosis in cancer. J Natl Cancer Inst. 2010;102:605-613.
7. Marcus PM, Prorok PC, Miller AB, DeVoto EJ, Kramer BS. Conceptualizing overdiagnosis in cancer screening. J Natl Cancer Inst. 2015;107:pii:djv014.
8. Carter JL, Coletti RJ, Harris RP. Quantifying and monitoring overdiagnosis in cancer screening: a systematic review of methods. BMJ. 2015;350:g7773.
9. Moynihan R, Nickel B, Hersch J, et al. Public opinions about overdiagnosis: a national community survey. PLOS ONE. 2015;10:e0125165.
10. Hofmann B. Diagnosing overdiagnosis: conceptual challenges and suggested solutions. Eur J Epidemiol. 2014;29:599-604.
11. Moynihan R, Doust J, Henry D. Preventing overdiagnosis: how to stop harming the healthy. BMJ. 2012;344:e3502.
12. Moynihan R, Henry D, Moons KGM. Using evidence to combat overdiagnosis and overtreatment: evaluating treatments, tests, and disease definitions in the time of too much. PLoS Med. 2014;11:e1001655.

13. Frances A. Saving normal: an insider's revolt against out-of-control psychiatric diagnosis, DSM-5, big pharma, and the medicalization of ordinary life. William Morrow; 2014.
14. Paris J. Overdiagnosis in psychiatry: how modern psychiatry lost its way while creating a diagnosis for almost all of life's misfortunes. Oxford University Press; 2015.
15. Paris J, Bhat V, Thombs B. Is adult attention-deficit hyperactivity disorder being overdiagnosed? Can J Psychiatry. 2015;60:324-328.
16. Thomas R, Mitchell GK, Batstra L. Attention-deficit/hyperactivity disorder: are we helping or harming. BMJ. 2013;347:f6172.
17. Horwitz AV, Wakefield JC. The loss of sadness: how psychiatry transformed normal sorrow into depressive disorder. Oxford University Press; 2007.
18. Levkovitz Y, Tedeschini E, Papakostas GI. Efficacy of antidepressants for dysthymia: a meta-analysis of placebo-controlled trials. J Clin Psychiatry. 2011;72:509-514.
19. Cuijpers P, Karyotaki E, Weitz E, et al. The effects of psychotherapies for major depression in adults on remission, recovery and improvement: a meta-analysis. J Affect Disord. 2014;159:118-126.
20. Fava GA, Rafanelli C. Iatrogenic factors in psychopathology. Psychother Psychosom. 2019;88:129-140.
21. Jenniskens K, de Groot JAH, Reitsma JB, et al. Overdiagnosis across medical disciplines: a scoping review. BMJ Open. 2017;7:e018448.
22. Khangura S, Konnyu K, Cushman R, Grimshaw J, Moher D. Evidence summaries: the evolution of a rapid review approach. Syst Rev. 2012;1:10.
23. Chilakamarri JK, Filkowski MM, Ghaemi SN. Misdiagnosis of bipolar disorder in children and adolescents: a comparison with ADHD and major depressive disorder. Ann Clin Psychiatry. 2011;23:25-9.

24. Peris TS, Teachman BA, Nosek BA. Implicit and explicit stigma of mental illness: Links to clinical care. J Nerv Ment Dis. 2008;196:752-60.

25. Bruchmüller K, Margraf J, Schneider S. Is ADHD diagnosed in accord with diagnostic criteria? Overdiagnosis and influence of client gender on diagnosis. J Consult Clin Psychol. 2012;80:128-138.

26. McMillan GP, Timken DS, Lapidus J, et al. Underdiagnosis of comorbid mental illness in repeat DUI offenders mandated to treatment. J Subst Abuse Treat. 2008;34:320-325.

27. Merten EC, Cwik JC, Margraf J, Schneider S. Overdiagnosis of mental disorders in children and adolescents (in developed countries). Child Adoles Psychiatry Ment Health. 2017;11:5.

28. Partridge B, Lucke J, Hall W. Over-diagnosed and over-treated: a survey of Australian public attitudes towards the acceptability of drug treatment for depression and ADHD. BMC Psychiatry. 2014;14:74.

29. Sciutto MJ, Eisenberg M. Evaluating the evidence for and against the overdiagnosis of ADHD. J Atten Disord. 2007;11:106-13.

30. Wang LJ, Lee SY, Yuan SS, et al. Prevalence rates of youths diagnosed with and medicated for ADHD in a nationwide survey in Taiwan from 2000 to 2011. Epidemiol Psychiatr Sci. 2017;26:624-634.

31. Rigler T, Manor I, Kalansky A, et al. New DSM-5 criteria for ADHD - Does it matter? Compr Psychiatry. 2016;68:56-9.

32. Doerr-Zegers O, Irarrázaval L, Mundt A, Palette V. Disturbances of embodiment as core phenomena of depression in clinical practice. Psychopathology. 2017;50:273-281.

33. Nucifora PG. Overdiagnosis in the era of neuropsychiatric imaging. Acad Radiology. 2015;22:995-999.

34. Richman LC, Ryan S, Wilgenbusch T, Millard T. Overdiagnosis and medication for attention-deficit hyperactivity disorder in children with cleft: diagnostic examination and follow-up. Cleft Palate-Craniofac J. 2004;41:351-354.

35. Zimmerman M, Ruggero CJ, Chelminski I, Young D. Psychiatric diagnoses in patients previously overdiagnosed with bipolar disorder. J Clin Psychiatry. 2010;71:26-31
36. Aragonès E, Piñol JL, Labad A. The overdiagnosis of depression in non-depressed patients in primary care. Fam Pract. 2006;23:363-368.
37. Mojtabai R. Clinician-identified depression in community settings: concordance with structured-interview diagnoses. Psychother Psychosom. 2013;82:161-169.
38. Flynn PM, McCann JT, Fairbank JA. Issues in the assessment of personality disorder and substance abuse using the Millon Clinical Multiaxial Inventory (MCMI-II). J Clin Psychol. 1995;51:415-421.
39. Scott JD, Wang CC, Coppel E, et al. Diagnosis of depression in former injection drug users with chronic hepatitis C. J Clin Gastroenterol. 2011:45:462-467.
40. Lawrence RE, Rasinski KA, Yoon JD, Curlin FA. Psychiatrists' and primary care physicians' beliefs about overtreatment of depression and anxiety. J Nerv Ment Dis. 2015;203;120-125.
41. Lin YJ, Yang LK, Gau SS. Psychiatric comorbidities of adults with early- and late-onset attention-deficit/hyperactivity disorder. Aust N Z J Psychiatry. 2016;50:548-556.
42. Scott KM, Browne MAO, Wells JE. Prevalence, impairment and severity of 12-month DSM-IV major depressive episodes in Te Rau Hinengaro: New Zealand Mental Health Survey 2003/4. Aust N Z J Psychiatry. 2010;44:750-8.
43. Mojtabai R, Olfson M. Proportion of antidepressants prescribed without a psychiatric diagnosis is growing. Health Aff. 2011;30:1434-1442.
44. Olfson M, Blanco C, Marcus SC. Treatment of adult depression in the United States. JAMA Intern Med. 2016;176:1482-1491.
45. Mojtabai R. Diagnosing depression in older adults in primary care. NEJM. 2014;370:1180-1182.
46. Zimmerman M, Morgan TA. Problematic boundaries in the diagnosis of bipolar disorder: the interface with borderline personality disorder. Curr Psychiatry Rep. 2013;15:422.

47. Zimmerman M. A Review of 20 Years of Research on Overdiagnosis and Underdiagnosis in the Rhode Island Methods to Improve Diagnostic Assessment and Services (MIDAS) Project. Can J Psychiatry. 2016;61:71-9.
48. de Groot JAH, Naaktgeboren CA, Reitsma JB, Moons KGM. Methodologic approaches to evaluating new highly sensitive diagnostic tests: avoiding overdiagnosis. CMAJ. 2017;189:E64-E68.
49. Ripping TM, Ten Haaf K, Verbeek ALM, van Ravesteyn NT, Broeders MJM. Quantifying overdiagnosis in cancer screening: a systematic review to evaluate the methodology. J Natl Cancer Inst. 2017;109;10.
50. Cuijpers P. The challenges of improving treatments for depression. JAMA. 2018;320:2529-2530.
51. Evers AWM, Colloca L, Blease C, et al. Implications of placebo and nocebo effects for clinical practice: expert consensus. Psychother Psychosom. 2018;87:204-210.
52. Batstra L, Frances A. Diagnostic inflation: causes and a suggested cure. J Nerv Ment Dis. 2012;200:474-479.
53. Dowrick C, Frances A. Medicalising unhappiness: new classification of depression risks more patients being put on drug treatment from which they will not benefit. BMJ. 2013;347:f7140.
54. Thombs BD, Ziegelstein RC. Does depression screening improve depression outcomes in primary care? BMJ. 2014;348:g1253.
55. Thombs BD, Coyne JC, Cuijpers P, et al. Rethinking recommendations for screening for depression in primary care. CMAJ. 2012;184(4):413-418.
56. Siu AL, and the US Preventive Services Task Force (USPSTF). Screening for Depression in Adults: US Preventive Services Task Force Recommendation Statement. JAMA. 2016;315(4):380-387.
57. Joffres M, Jaramillo A, Dickinson J, et al. Recommendations on screening for depression in adults. CMAJ. 2013;185(9):775-782.

58. Allaby M. Screening for depression: A report for the UK National Screening Committee (Revised report). London, United Kingdom: UK National Screening Committee; 2010.
59. Benedetti F, Lanotte M, Lopiano L, et al. When words are painful: Unravelling the mechanisms of the nocebo effect. Neuroscience. 2007;147:260-271.
60. Webster RK, Weinman J, Rubin GJ. A systematic review of factors that contribute to nocebo effects. Health Psychol. 2016;35:1334-1355.
61. Frances A. The first draft of DSM-V. BMJ. 2010;340:c1168.
62. Moynihan R, Brodersen J, Heath I, et al. Reforming disease definitions: a new primary care led, people-centred approach. BMJ Evid Based Med. [Epub ahead of print].
63. Fava GA, Sonino N. From the lesson of George Engel to current knowledge: the biopsychosocial model 40 years later. Psychother Psychosom. 2017;86:257-259.
64. Batstra L, Hadders-Algra M, Nieweg E, et al. Childhood emotional and behavioral problems: reducing overdiagnosis without risking undertreatment. Dev Med Child Neurol. 2012;54:492-494.
65. National Institute for Health and Clinical Excellence. The treatment and management of depression in adults (updated edition). National Clinical Practice Guideline 90. https://www.nice.org.uk/guidance/cg90/evidence/full-guidline-pdf-4840934509 (Accessed April 12, 2019).
66. National Institute for Health and Clinical Excellence. Attention deficit hyperactivity disorder: diagnosis and management. National Clinical Practice Guideline 87. https://www.nice.org.uk/guidance/ng87/resources/attention-deficit-hyperactivity-disorder-diagnosis-and-management-pdf-1837699732933 (Accessed April 12, 2019).
67. Casey P, Bailey S. Adjustment disorders: the state of the art. World Psychiatry. 2011;10:11-18.
68. O'Donnell ML, Metcalf O, Watson L, Phelps A, Varker T. A systematic review of psychological and pharmacological treatments for adjustment disorder in adults. J Trauma Stress. 2018;31:321-331.

FIGURE LEGENDS

Supplementary Figure 1. Flow diagram of selection of eligible articles from existing scoping review [19], updated database search, and included article author query.

Supplementary Figure 2. Categories of explicit and implicit definitions or operationalization of overdiagnosis (N = 164 articles with 193 explicit or implicit uses); there were 137 articles with a single usage; 25 articles with uses in two categories; and 2 articles with uses in three categories.