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REVIEW

A Systematic Review and Meta-Analysis of Implicit Stigma Toward People with Mental Illness Among Different Groups: Measurement, Extent, and Correlates

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Introduction: Implicit association tests have been extensively applied to reveal socially unacceptable and concealed stigma. Studies have explored the implicit stigma toward mental illness in specific groups, with limited comparisons across different groups. To investigate the implicit stigma toward mental illness among different groups, along with the interaction between implicit and explicit measurements.

Methods: Based on PRISMA guidelines, Web of Science, Embase, PubMed/MEDLINE, Cochrane Library, and PsycINFO were searched from 1998 to April 18, 2024. Searches were updated through February 12, 2025. The Medical Education Research Quality Instrument (MERSQI) served as the quality evaluation framework, and Stata 12.0 facilitated the conduct of a meta-analysis.

Results: The analysis included fifty studies in the systematic review and thirty in the meta-analysis. Most studies used "mental illness" or related physical illness terms as concept words, paired with emotionally contrasting attribute words. Twenty-eight studies calculated the implicit effect using an improved algorithm, while thirty-eight examined the correlations between implicit and explicit measures. The pooled standardized mean differences (SMDs) revealed that the lowest *D* scores were observed in the general population (SMD = 0.79, $P < 0.001$), followed by healthcare providers (SMD = 1.09, $P = 0.054$), students (SMD = 1.17, $P < 0.001$) and people with mental illness (SMD = 1.20, $P < 0.001$).

Conclusion: The findings indicated that the selection of concept and attribute words, as well as the processing of data measuring implicit stigma, was not standardized. No reliable correlation was found between implicit and explicit measures. Despite the heterogeneity of included studies, the general public demonstrated the most positive attitudes, while individuals with mental illness exhibited negative attitudes. Further research is required to develop personalized anti-stigma interventions for different groups and regions based on these results, particularly from the perspective of implicit stigma.

Keywords: mental illness, implicit stigma, implicit association test, systematic review, meta-analysis

Introduction

Mental illnesses are among the most prevalent health conditions worldwide, affecting approximately one in eight people, equivalent to 970 million individuals.[1] The landscape of mental health has evolved significantly in recent years, with the COVID-19 pandemic exacerbating existing challenges and also bringing increased attention to mental health concerns related to stress, anxiety, and depression.[2] Compounding these issues, stigma associated with mental illness seems to gain broader societal approval than that of any other illness, due to deeply ingrained stereotypes. An online survey conducted across 229 countries revealed that 15% to 16% of individuals in developing countries and 7% to 8% in developed countries believed that people with mental illness exhibited greater tendencies toward violence compared to others.[3] Stigma often leads people with mental illnesses to be reluctant to discuss their conditions and less likely to seek treatment.[4,5] Furthermore, research has shown that healthcare professionals, students,[6] and even family caregivers hold stigmatizing views about mental illness.[7]

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To advance the accumulation of scientific knowledge and enhance the efficacy and accuracy of interventions targeting stigma, a comprehensive exploration of mental illness stigma is essential. Historically, stigma assessment primarily relied on self-reported measures that directly captured perspectives or experiences. A critical review by Fox et al identified the emergence of over 400 novel measures of mental illness stigma since 2004.[8] While explicit measures provide valuable initial insights into stigmatizing attitudes, a significant portion of the literature may underestimate the true extent of stigma owing to social desirability bias and exhibit weak correlations with behavioral discrimination.[9]

The Implicit Association Test (IAT), developed in 1998, serves as a complementary assessment to the aforementioned self-report scales, measuring attitudes unconsciously and indirectly. In contrast to explicit measures, which are considered products of unconscious processes and employ direct assessment,[10] implicit measures take a more indirect approach (eg, IAT) to assess subtle self-associations, emotional reactions, and attitudes toward a given concept or group.[11] This approach can uncover associations formed by individuals in the absence of introspective access, as well as deliberately concealed attitudinal tendencies in explicit measures.[12] Previous work has indicated that an individual's implicit attitude toward people with mental illness may better predict their practice. For example, a study by Peris et al examined implicit and explicit stigma among healthcare providers and showed that both were associated with negative patient prognoses and that implicit stigma in particular was associated with over-diagnosis.[13] Similarly, research carried out by Vertilo et al revealed that implicit stigma among undergraduates can significantly influence the willingness to help individuals with mental illness.[14]

The application of implicit measures in mental health research has recently garnered significant interest and attention, particularly in quantifying unconscious biases toward mental illness. The IAT is the most widely used measure of implicit stigma, having been applied across various studies among health professionals,[15,16] students,[17,18] individuals with mental illness, and family members. Social Role Theory provides a crucial theoretical framework for deconstructing group-level variations in implicit stigma and underscores the necessity of comparative research. Differential societal roles (eg, therapeutic neutrality for clinicians vs emotional bonding for people with family caregivers) may engender distinct patterns of discrepancy between attitudes and behaviors,[19] informing the development of more focused and effective interventions. Additionally, current research lacks a comprehensive understanding of how individuals internalize and express their attitudes toward mental illness, particularly among specific societal groups.

In discussions of the relationship between implicit and explicit attitudes, much attention has been devoted to their correlation. Based on correlational analyses, two major perspectives have emerged: the high-correlation convergence theory and the low-correlation dissociation theory. The convergence theory posits that implicit and explicit attitudes are essential components of the same psychological construct, exhibiting a high degree of congruence.[10] One example is Greenwald et al,[20] who unified the theory of implicit attitudes, stereotypes, self-esteem, and self-concept, including an implicit dimension among their explanatory variables and establishing parallels with Heider's balance theory.[21] Conversely, implicit social cognition research advocates that they represent independent internal structures, characterized by a dissociated nature and low correlation.[22] The Dual Attitude Model (DAM), proposed by Wilson et al, further elaborates on this dissociation, proposing that individuals simultaneously possess two distinct attitudes toward the same object or phenomenon.[23] For instance, an individual may experience an implicit reaction of fear upon meeting a person with mental illness, but nevertheless treat that person with kindness.[24]

To date, some reviews have explored the effect size of mental illness stigma within a single group, focusing on explicit measures,[25,26] but no literature reviews comparing different groups have been published. A review of the evidence indicates that only one review on implicit bias was performed in 2016.[27] Although there has been some discussion on the correlation between implicit and explicit stigma, the explanations provided are generally limited to broad overviews of the included studies, failing to offer a comprehensive, integrated theoretical framework to explain the relationship between the two. To our knowledge, no review has been conducted on insights into implicit-explicit correlations. Based on the existing literature, the present systematic review aims to summarize the application of implicit measures in assessing the implicit stigma of mental illness across various groups and to examine the association between implicit and explicit measures. In this study, "implicit stigma" is defined as implicit negative attitudes (associations between concepts and negative valence) and stereotypes (associations between groups and negative traits). The specific research questions are as follows: (1) How has implicit stigma toward individuals with mental illness been measured in

different groups? (2) What is the extent of implicit stigma toward people with mental illness exhibited by different groups? (3) What are the relationships between implicit stigma and explicit variables correlated with stigma?

Methods

This systematic review complied with the Preferred Reporting Items of Systematic Reviews and Meta-Analyses (PRISMA) statement. The protocol was pre-registered with PROSPERO (ID: CRD42022337832).

Data Sources and Search Strategy

We comprehensively searched the Web of Science, Embase, PubMed/MEDLINE, Cochrane Library, and PsycINFO databases for English-language articles from 1998 to April 18, 2024. On February 12, 2025, we updated searches from April 19, 2024 to February 12, 2025. Moreover, we reviewed pertinent research bibliographies until no new studies were identified. The search terms were combined using Boolean operators with keywords, including implicit; mental, psychia*, psycho*, mood disorder, personality disorder, schizophren*, depress*, anxiety, bipolar disorder; stigma*, stereotyp*, discriminat*, prejudice, bias, attitude, and belief. Table 1 illustrates the retrieval strategy employed in the PubMed database. Additionally, we performed a manual screening of the bibliographies of the selected studies to identify potentially relevant research that may have been overlooked in the initial search.

Inclusion and Exclusion Criteria

The study's inclusion criteria comprise: (1) original, peer-reviewed quantitative research, including cross-sectional surveys, prospective studies, cohort studies, and baseline results from intervention studies; (2) articles published in English; and (3) the utilization of implicit measures, such as the IAT, Single Category IAT (SC-IAT), Go/No-go Association Task (GNAT), Brief IAT (BIAT), or Implicit Relational Assessment Procedure (IRAP), to investigate mental illness stigma. Exclusion criteria encompass: (1) reviews, commentaries, letters, and case reports; (2) duplicate publications or articles with unavailable full texts; and (3) studies with incomplete or inaccessible data.

Data Extraction

All records were exported to Mendeley software and duplicate records were excluded. Initially, two researchers independently reviewed titles and abstracts to identify preliminary articles for inclusion. If the literature was identified as potentially eligible by at least one reviewer, it was considered for full-text review. Subsequently, the complete texts of the potentially eligible studies were independently reviewed by two reviewers. Any discrepancies between the two reviewers were re-examined through discussion with a third reviewer. Finally, information for data synthesis was extracted and recorded by two reviewers independently, which included the first author, publication year, country, relevant aim(s), participants, features of implicit measurements (eg, task, concept words, attribute words), relevant explicit measure(s), and data processing and main findings. Some studies reported whole sample or average effect sizes, as well as additional effect sizes for separate social groups (eg, male and female attitudes toward mental illness), in which case only whole sample or

Table 1 Retrieval Strategy for PubMed Database

Retrieval Procedure	Retrieval Strategy
#1	"implicit" [Title/Abstract]
#2	"mental" [Title/Abstract] OR psychia* [Title/Abstract] OR "psycho*" [Title/Abstract] OR "mood disorder" [Title/Abstract] OR "substance use disorder" [Title/Abstract] OR "personality disorder" [Title/Abstract] OR "schizopren*" [Title/Abstract] OR "depress*" [Title/Abstract] OR "anxiety*" [Title/Abstract] OR "bipolar disorder" [Title/Abstract]
#3	"stigma*" [Title/Abstract] OR "stereotyp*" [Title/Abstract] OR "discriminat*" [Title/Abstract] OR "prejudice" [Title/Abstract] OR "bias" [Title/Abstract] OR "attitude" [Title/Abstract] OR "belief" [Title/Abstract]
#4	#1 AND #2 AND #3
#5	#4 Filters: English, Humans, from 1998–2025

Notes: Taking PubMed as an example. Search strategies for other databases are presented in Supplementary Figures S1-S5.

average effect sizes were used. Studies that reported different effect sizes for different groups (eg, psychology students and medical students, psychiatry residents, and psychiatrists) were incorporated into the meta-analyses.

Quality Assessment

The literature on this topic focuses on the study of psychological experiments. Most studies employ a cross-sectional design, emphasizing descriptive statistics rather than causal inferences. Consequently, conventional tools developed for clinical trials, such as the Cochrane Collaboration's tool and ROBINS-I, are not appropriate for quality assessment in this systematic review. Instead, the Medical Education Research Quality Instrument (MERSQI) was utilized to highlight objective design aspects.[28,29] While it has seen limited application in mental health stigma research, its applicability extends to medical education and healthcare quality assessments.[30,31] The MERSQI evaluates six key dimensions: study design, sampling, type of data, validity of evaluation instrument, data analysis, and outcomes. The MERSQI score ranges from 5 to 18, with study quality classified into the following categories: insufficient quality (≤12.25), low quality (12.26–12.63), moderate quality (12.64–12.88), and high quality (≥12.89). Two reviewers independently assessed each included study, documenting supporting information and justifications for judgments to substantiate the risk of bias. Any discrepancies were resolved through discussion between the two reviewers, with the involvement of a third reviewer when necessary.

Data Analysis

In the included studies, for those that reported Cohen's D as a measure of performance on the implicit test, a standardized mean difference (SMD) served as the pooled effect size, providing an indicator of the strength of the implicit stigma present in the studied participants. Analyses were conducted using random-effects models with 95% confidence intervals (*CI*), as it can be expected that the true effect of each study differs due to methodological differences such as participant groups, regions, and implicit measures.[32] Egger's regression asymmetry test was applied to assess publication bias within this effect. Cochrane Q-test and I^2 statistics were used to examine heterogeneity. If the Q statistic was statistically significant ($P < 0.10$), the I^2 statistic was used to estimate the percentage of variation across the samples attributable to heterogeneity. I^2 values of 0% to 40% (low), 41% to 60% (medium), and 61% to 100% (high) were used to categorize heterogeneity levels.[33]

Results

Literature Search

The preliminary search of the database yielded 7240 articles, and 4011 remained after duplicates were removed. Following title and abstract screening, 132 articles were identified as eligible for full-text screening. Finally, 50 articles (65,975 participants) were included in the systematic review. These consisted of 37 cross-sectional studies, 12 intervention studies, one longitudinal study, and one mixed-methods study. The studies were published between 2006 and 2024, with 25 conducted in the United States, 6 in Asia, and the remaining primarily in Europe. The results of the literature search are presented in Supplemental Table 1-5 and summarized in Figure 1. The basic information of the included studies is provided in Table 2.

Quality Appraisal of the Studies

The MERSQI scores ranged from 10 to 16, with an average score of 12.93±1.20, indicating a high level of study quality (≥12.89). The quality assessment results are summarized in Table 3.

Design of Implicit Measure

Implicit attitudes are reflected through the relationship between concept words and attribute words. Under congruent conditions (eg, mental illness + negative word), there is typically a close pairing relationship with a short reaction time. Conversely, incongruent conditions (eg, mental illness + positive word) require more complex cognitive processing, resulting in a longer response time. As shown in Table 4, the included studies utilized various types of implicit measures: 29 studies

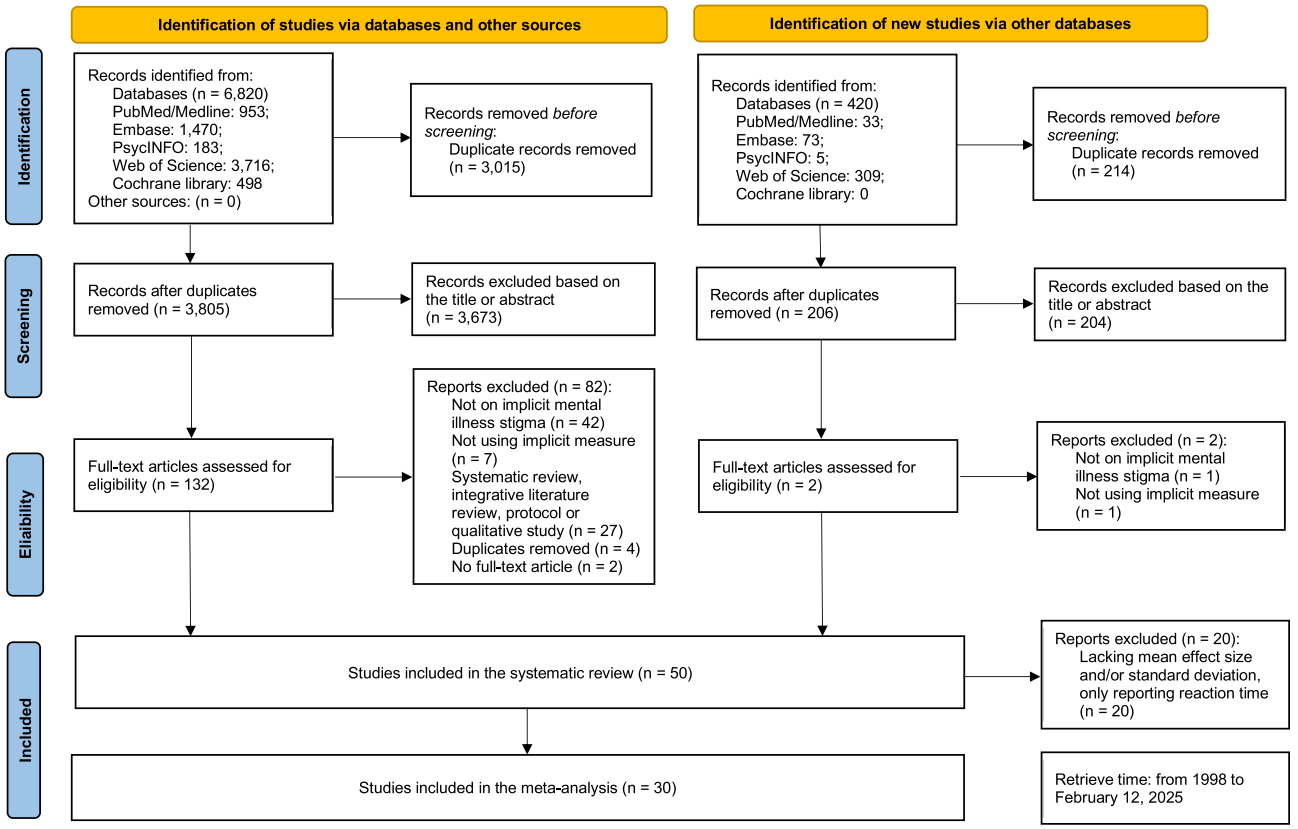

Figure 1 PRISMA diagram. Adapted from Page M J et al (2021). PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. BMJ, n160 10.1136/bmj.n160.[79]

examined implicit mental illness bias using the IAT, 9 studies employed the Brief Implicit Association Test (BIAT), 5 studies used the Single Category Implicit Association Test (SC-IAT), 5 studies utilized the Go/No-Go Association Task (GNAT), and 2 studies employed the Implicit Relational Assessment Procedure (IRAP). Among the included studies, 48 used text-based target categories, while only 2 studies incorporated image-based stimuli in their selection of stimulus material.[18,50]

Concept Words

The concept words were differentiated based on the specific mental illness investigated (see Table 4). A total of 30 studies explored implicit attitudes toward mental illness, utilizing the terms "mental illness", "people with mental illness", and "mentally ill" as the categorical stimulus labels. Eighteen studies focused on individuals with a particular type of mental illness, such as "schizophrenia", "depression", "depressed", or "substance user".

General terms related to physical diseases, such as "physical illness" and "physical disability", were the most commonly used comparison categories for the term "mental illness", appearing in a total of 20 studies. Among these, 8 studies focused on more specific physical diagnoses, including "diabetes", "hypertension", and "obesity." Healthy individuals were also chosen as comparison target categories, with terms such as "health", "healthy person", and "mental health." Furthermore, due to the utilization of the BIAT, SC-IAT, or GNAT, 10 studies did not employ comparison categories. The characteristics of the concept words are presented in Table 4.

Attribute Words

A total of 32 studies (see Table 4) employed attribute words that evoke clear emotional contrasts, such as "good vs bad", "liked vs disliked", "pleasant vs unpleasant", "gloomy vs cheerful", or "positive vs negative". Nineteen studies investigated stereotypical perceptions regarding the moral judgments and role positioning of individuals with mental illness, utilizing attribute words like "criminal vs victim", "innocent vs blameworthy", "capable vs incompetent", or "strange vs normal". Five studies assessed stigma

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Table 2 Characteristics of the Included Studies (n = 50)

First author (Year), Country	Relevant aim(s)	Participants (Simple size)	Implicit measure			Relevant explicit measure(s)	Data processing	Main findings	
			Task	Concept words	Attribute words			Implicit Measure Result(s)	Implicit-Explicit Correlations
Teachman (2006),[34] US	Study 1&2: To assess implicit and explicit attitudes toward PMI	Study 1: Undergraduate students (n = 119) Study 2: PMI in community (n = 35), General population (n = 36)	3 IATs	Study 1and2: Mental illness vs Physical illness	Study 1&2: IAT_1: Good vs Bad; IAT_2: Innocent vs Blameworthy; IAT_3: Competent vs Helpless	Semantic differential scales, PDS	Data were excluded if the error rate was above 40% or response times were unusually fast or slow	Undergraduate students: D_{IAT1} = 0.85 D_{IAT2} = 0.46 D_{IAT3} = 1.02 PMI in community and general population: D_{IAT1} = 1.42 D_{IAT3} = 0.58	Study 1&2: No significant correlations
Thomas (2007),[35] US	Study 1: To assess implicit and explicit attitudes toward individuals with mental illness Study 2: To assess the correlations between implicit and explicit measurements	Undergraduate students (n_1 = 129, n_2 = 69)	IAT	Study 1&2: Mental illness vs No mental illness	Study 1&2: Pleasant vs Unpleasant	IDP	Participants were excluded if the error rate was above 27%	RT_1 = 249.6±208.8ms[a] RT_2 = 296.9±205.1ms[a]	Correlation between implicit and explicit measure was significantly positive (r = 0.25)
Lincoln (2008),[36] Germany	To assess implicit and explicit attitudes toward schizophrenia	Psychology students (n = 61), Medical students (n = 60)	3 IATs	Schizophrenia vs Depression	IAT_1: Safe vs Threatening; IAT_2: Victim vs Culprit; IAT_3: Healable vs Unhealable	Sentence evaluation task, SDS	Data were excluded if response times exceeded 10,000 ms, and participants were excluded if more than 10% fast (< 300ms) responses	Psychology students: D_{IAT1} = 0.17±0.31 D_{IAT2} = 0.15±0.29 D_{IAT3} = 0.07±0.35 Medical students: D_{IAT1} = 0.11±0.33 D_{IAT2} = 0.14±0.27 D_{IAT3} = 0.02±0.30	Correlation between IAT_1 and explicit stereotype responsibility was significantly negative (r = −0.21)
Peris (2008),[13] US	To assess implicit and explicit attitudes toward PMI	Clinical psychology graduate students (n = 275), Professional clinicians (n = 407), Undergraduate students (n = 204), General public (n = 112), Other health services group (n = 541)	3 IATs	Mentally ill people vs Welfare recipients	Good vs Bad	Semantic differential scales	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	Total participants: D_{IAT} = −0.09±0.36 General population: D_{IAT} = −0.02±0.34 Undergraduate students: D_{IAT} = −0.03±0.36 Other health services group: D_{IAT} = −0.02±0.34 Clinical psychology graduate students and professional clinicians: D_{IAT} = −0.17±0.37	Correlation between explicit measure and IAT was significantly positive (r = 0.12)
Takahashi (2009),[37] Japan	To assess implicit and explicit attitudes toward schizophrenia	Non-medical Undergraduate students (n = 68)	IAT	Schizophrenia (old vs new term) vs Diabetes	Victim vs Criminal	PDD	-	The old term version: RT_{CC} = 844ms RT_{IC} = 927ms The new term version: RT_{CC} = 871ms RT_{IC} = 892ms	Correlations between implicit (for both new and old terms) and explicit measures were significantly negative (r = −0.252, −0.281)

Monteith (2011),[38] US	To assess implicit and explicit attitudes toward people with depression	Undergraduate students (n = 162)	4 IATs	Depressed vs Physically ill	IAT_1: Permanent vs Temporary IAT_2: Controllable vs Uncontrollable; IAT_3: Psychological vs Biological; IAT_4: Good vs bad	Semantic differential scales	Data were excluded if response times were unusually fast or slow, and incorrect responses were replaced with the mean response time of that block plus 600ms	D_{IAT1} = −0.20±0.39 D_{IAT2} = −0.03±0.31 D_{IAT3} = 0.37±0.38 D_{IAT4} = −0.21±0.38	No significant correlations
Omori (2012),[39] Japan	To assess implicit and explicit attitudes toward schizophrenia	Clinical medical residents (n = 51)	IAT	Schizophrenia (old vs new term) vs Hypertension	Victim vs Criminal	PDD	Data were recorded to 300ms if response times were less than 300ms and to 3,000ms if those were above 3,000ms, and then the results were log-transformed	The old term version: RT_{CC} = 837ms RT_{IC} = 900ms The new term version: RT_{CC} = 878ms RT_{IC} = 890ms	No significant correlations
Stull (2013),[40] US	To assess implicit and explicit attitudes toward mental illness	Mental health practitioners (n = 154)	3 IATs	Mental illness vs Physical illness	IAT_1: Good vs bad; IAT_2: Innocent vs Blameworthy; IAT_3: Competent vs Helpless	Semantic differential scales	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	D_{IAT1} = −0.20±0.42 D_{IAT2} = −0.07±0.37 D_{IAT3} = −0.19±0.40	No significant correlations
Vertilo (2014),[14] US	To assess implicit and explicit attitudes toward mental illness	Undergraduate students (n = 40)	IAT	Mental illness vs Mental health	Good vs Bad	AQ, Character strengths scales, Sentence evaluation task, Social distance task	-	RT_{CC} = 797±181ms RT_{IC} = 1772±767ms	Correlation between IAT and helping behavior was significant (r = −0.38), whereas no significant correlations between IAT and participant character strengths
Sabin (2015),[41] US	To assess implicit and explicit attitudes toward mental illness	Mental health professionals in the community (n = 584)	2 IATs	Mental illness vs Physical illness	IAT_1: Competence vs Incompetence; IAT_2: Curable vs Incurable	CAI, Self-reported attitude measures	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	D_{IAT1} = 0.01±0.53 D_{IAT2} = 0.03±0.57	Correlation between IAT_2 and self-reported stereotypes about recovery from mental illness was weakly positive (r = 0.09), whereas no significant correlation between IAT_1 and explicit stereotypes about competence

(*Continued*)

Table 2 (Continued).

First author (Year), Country	Relevant aim(s)	Participants (Simple size)	Implicit measure			Relevant explicit measure(s)	Data processing	Main findings	
			Task	Concept words	Attribute words			Implicit Measure Result(s)	Implicit-Explicit Correlations
Dabby (2015),[42] Canada	To assess implicit and explicit attitudes toward PMI	Psychiatry residents (n = 35), Psychiatrists (n = 68)	IAT	Schizophrenia vs Diabetes mellitus	Positive vs Negative	SDS, OMS-HC	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	$D_{\text{Psychiatry residents}}$ = -0.028±0.439 $D_{\text{Psychiatrists}}$ = -0.118±0.340	No significant correlations
Zvonkovic (2015),[43] US	To assess implicit and explicit attitudes toward PMI	Undergraduate students (n = 94)	IAT	Schizophrenia vs Mental health	Peacefulness vs Violence	SDS	Data were recorded to 300ms if response times were less than 300ms and to 3,000ms if those were above 3,000ms, and then the results were log-transformed	The control group: RT = 670.73±475.68ms The experimental group: RT = 718.46±316.29ms	No significant correlations
Wang (2016),[44] China	To assess implicit and explicit attitudes toward PMI	Medical undergraduate students (n = 72), Non-medical undergraduate students (n = 64)	IAT	Mental illnesses vs Physical chronic illnesses	Liked vs Disliked	T-SAS	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	$D_{\text{Medical undergraduate students}}$ = −0.07±0.75 $D_{\text{Non-medical undergraduate students}}$ = −0.20±0.70	No significant correlations
Barney (2017),[45] US	Study 1&2&3: To assess implicit and explicit attitudes toward PMI	Undergraduate students (n_1 = 29, n_2 = 26, n_3 = 38)	IAT	Study 1&2&3: Mentally ill vs Physically ill	Study 1&2and3: Positive vs Negative	CAMI	-	D_{Study1} = 5.65±1.11 [b] D_{Study2} = 4.35±1.94 [b] D_{Study3} = 4.50±1.24 [b]	N/A
Silke (2017),[46] Ireland	To assess implicit and explicit attitudes toward PMI	Adolescents (n = 570)	IAT	The names of the vignette characters [c]	Good vs Bad	Tripartite model of Stereotypes, Prejudice and Discrimination, Descriptive/ Injunctive Norms scale, BES	-	D = 0.34±0.34	No significant correlations
Crapanzano (2018),[47] US	To assess implicit attitudes toward depression	Internal medicine residents (n = 51), Psychiatry residents (n = 35)	4 IATs	Depression vs Physical illness	IAT_1: Good vs Bad; IAT_2: Controllable vs Uncontrollable; IAT_3: Psychological vs Biological; IAT_4: Permanent vs Temporary	-	Participants were excluded if the error rate was above 40%, or if more than 10% of their response times were below 300ms or above 2,000ms	Internal medicine residents: D_{IAT1} = 0.37±0.39 D_{IAT2} = 0.27±0.34 D_{IAT3} = 0.51±0.41 D_{IAT4} = 0.16±0.34 Psychiatry residents: D_{IAT1} = −0.08±0.37 D_{IAT2} = −0.05±0.44 D_{IAT3} = 0.36±0.08 D_{IAT4} = 0.03±0.37	N/A

Sandhu (2019),[48] Canada	To assess implicit and explicit attitudes toward mental illness	Undergraduate students (n = 382), Medical students (n = 118), Psychiatrists (n = 38)	IAT	Schizophrenia vs Diabetes mellitus	Good vs Bad	OMS-HS	-	$D_{\text{Undergraduate students}}$ = 0.27±0.47 $D_{\text{Medical students}}$ = 0.33 ±0.43 $D_{\text{Psychiatrists}}$ = 0.06±0.43	Correlation between implicit and explicit measures was negligibly positive (r = 0.11)
González-Sanguino (2019),[17] Spain	To assess implicit and explicit attitudes toward mental illness	Psychology students (n = 49), General population (n = 53)	IAT	Mental Illness vs Physical illness	Good vs Bad	AQ-9, SDS	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	$D_{\text{Psychology students}}$ = 0.32 ±0.30 $D_{\text{General population}}$ = 0.38 ±0.35 $D_{\text{Total participants}}$ = 0.35 ±0.33	No significant correlations
Thibodeau (2019),[18] US	To assess implicit and explicit attitudes toward schizophrenia	Undergraduate students (n = 103)	IAT	Dennis vs Somebody else [d]	Safe vs Dangerous	SDS, Emotional reactions, Semantic differential scales	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	D = 0.23±0.50	Correlation between IAT and group semantic differential sales was significantly positive (r = 0.28), whereas no significant correlation between IAT and self-reported semantic differential sales
Arora (2019),[49] Canada	To assess implicit and explicit attitudes toward PMI	Medical students (n = 118)	IAT	Schizophrenia vs Diabetes mellitus	Good vs Bad	OMS-HC	-	D_{male} = 0.33 D_{female} = 0.33	Correlation between implicit and explicit measures was negligibly positive (r = 0.08)
Kang (2020),[50] US	To assess implicit attitudes toward substance use disorder	People with substance use disorder (n = 132)	IAT	Images that depict people using drugs vs Images that depict non-drug-using [e]	Positive vs Negative	-	Data were excluded if response times were above 10,000ms. Participants were excluded if more than 10% of response times were below 300ms	D = 0.61±0.39	N/A
Beltzer (2020),[51] US	To assess implicit and explicit attitudes toward PMI	General population (n = 17,312)	IAT	Mentally ill people vs Physically ill people	Harmless vs Dangerous	PDS	Data were excluded if response times were above 10,000ms or below 300ms on more than 10% of trials overall or more than 25% of trials in a critical block. Participants were excluded if the error rate was more than 30% of trials overall or 40% of trials in a critical block	-	Correlation between implicit and explicit measures was positive (r = 0.20)

(*Continued*)

https://doi.org/10.2147/PRBM.S503942

Table 2 (Continued).

First author (Year), Country	Relevant aim(s)	Participants (Simple size)	Implicit measure			Relevant explicit measure(s)	Data processing	Main findings	
			Task	Concept words	Attribute words			Implicit Measure Result(s)	Implicit-Explicit Correlations
Sandhu (2021),[52] Canada	To assess implicit and explicit attitudes toward PMI	Undergraduate students (n = 382)	IAT	Schizophrenia vs Diabetes mellitus	Good vs Bad	OMS-HC	-	D = 0.27±0.47	Correlation between implicit and explicit measures was weakly significant (r = 0.10)
Tergesen (2021),[53] US	Study 1: To assess implicit attitudes toward depression Study 2: To assess implicit and explicit attitudes toward depression and mental illness	Medical students (n_1 = 87, n_2 = 182)	2 IATs	Mental illness vs Physical illness	IAT_1: Harmlessness vs Harmfulness; IAT_2: Burdenless vs Burdensome	SDS, Sentence evaluation task	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	Study 1: D_{IAT1} = 0.15±0.32 D_{IAT2} = 0.20±0.31 Study 2: D_{IAT1} = 0.01±0.31 D_{IAT2} = 0.06±0.29	Correlation between IAT_1 and the statement of being uncomfortable in public near someone with mental illness was significantly negative (r = −0.19), whereas no significant correlation between IATs and SDS
FitzGerald (2022),[54] Switzerland	To assess implicit and explicit attitudes toward mental illness	Psychiatrists (n = 53), Internists (n = 80)	IAT	Mental illnesses vs Physical illnesses	Positive vs Negative	Feeling Thermometer	Data were recorded to 300ms if response times were less than 300ms and to 3,000ms if those were above 3,000ms, and then the results were log-transformed	$D_{All\ participants}$ = 0.09±0.50 $D_{Psychiatrists}$ = −0.23±0.42 D *Internists* = 0.31±0.44	N/A
Girod (2022),[55] US	To assess implicit and explicit attitudes toward mental illness	Genetic counseling students (n = 141)	IAT	Mentally Ill People vs Physically Ill People	Harmless vs Dangerous	SDS, Stereotype Endorsement Scale	Data were excluded if responses with any missing data	D = −0.089±0.47	N/A
Beltzer (2023),[56] US	To assess implicit and explicit attitudes toward PMI	General population (n = 38,094)	IAT	Mentally ill people vs Physically ill people	Harmless vs Dangerous	PDS	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	Z_{Aurora} = −1.38 $Z_{Sandy\ Hook}$ = 2.16 $Z_{DC\ Navy\ Yard}$ = −0.02 $Z_{Sutherland\ Springs}$ = −0.97 $Z_{Parkland}$ = −0.44 $Z_{Thousand\ Oaks}$ = −0.22	N/A.

Benau (2024),[57] US	To assess implicit and explicit attitudes toward people with substance use disorder	General population (n = 394)	IAT	Substance user vs Non-substance user	Good vs Bad	AMIQ, ATIDU, PCDU, PSAS, SDS	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	D = 0.59±0.43	Correlations between implicit measure and AMIQ-H (r = 0.274), AMIQ-S (r = 0.137), PSAS (r = 0.114), ATIDU (r = 0.261), PCDU (r = 0.127) were significantly positive, whereas no significant correlations between implicit measure and AMIQ-D or SDS
O'Driscoll (2012),[58] Ireland	To assess implicit and explicit attitudes toward ADHD and depression	Children (n = 203), Adolescents (n = 182)	2 Child IATs	Child IAT1: ADHD vs Normal issues; Child IAT2: Depression vs Normal issues	Good vs Bad	AQ, SAQ	Data were excluded if more than 10% of response times were below 300ms	D = 0.23	N/A
Rüsch (2010),[59] US	To assess implicit and explicit attitudes toward PMI	PMI (n = 85)	BIAT	Mental illness vs Physical disability	Good vs Bad	Self-esteem decrement subscale of SSMIS	Participants were excluded if the error rate was above 30%	-	No significant correlations
Rüsch (2010),[60] US	To assess implicit and explicit attitudes toward PMI	PMI (n = 85), General population (n = 50)	BIAT	Mental illness vs Physical disability	Innocent vs Guilty	AQ, SDS	Participants were excluded if the error rate was above 30%	D_{PMI} = 0.15±0.44 $D_{General\ population}$ = 0.19 ±0.46	No significant correlations
Denenny (2014),[61] US	To assess implicit and explicit attitudes toward schizophrenia	Undergraduates (n = 97)	BIAT	Schizophrenia vs Obesity	Safe vs Dangerous	AQ-27, SDS, SSMIS, Semantic differential scales	-	D = 0.16±0.32	Correlations between implicit measure and AQ-27 (r = 0.202), Dangerous (r = 0.359), Social distance (r = 0.245), SDS (r = 0.228) were significantly positive
Kashihara (2015),[62] Japan	To assess implicit and explicit attitudes toward depression	Undergraduate and graduate students (n = 130)	2 BIATs	Depression	$BIAT_1$: Weak-willed vs Strong-willed; $BIAT_2$: Safe vs Dangerous	Blameworthy and dangerous subscales of AQ-27	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	D_{BIAT1} = 0.39 D_{BIAT2} = −0.35	Correlation between $BIAT_1$ and dangerous attribution was significantly negative (r = −0.18), whereas no significant correlations between $BIAT_2$ and explicit measures

(*Continued*)

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Table 2 (Continued).

First author (Year), Country	Relevant aim(s)	Participants (Simple size)	Implicit measure			Relevant explicit measure(s)	Data processing	Main findings	
			Task	Concept words	Attribute words			Implicit Measure Result(s)	Implicit-Explicit Correlations
Stolzenburg (2017),[63] Germany	To assess implicit and explicit attitudes toward PMI	People with untreated mental illness (n = 183)	BIAT	Mental illness	Different vs Normal	PHQ-9, SELF-I, SDS, Sentence evaluation task	Participants were excluded if the error rate was above 25%	-	Correlation between implicit measure and SELF-I was significantly negative (r = −0.18), whereas no significant correlations between implicit measure and PHQ, SDS or sentence evaluation task
Kashihara (2018),[64] Japan	To assess implicit and explicit attitudes toward depression	Undergraduates (n = 105)	3 BIATs	Depression vs Health	$BIAT_1$: Gloomy vs Cheerful; $BIAT_2$: Mentally weak vs Mentally strong; $BIAT_3$: Good vs Bad	Semantic differential scales, Level of Contact Report, IMS/EMS	Error trials were replaced with mean response times for correct trials in the corresponding block plus 600ms	D_{BIAT1} = 0.52±0.37 D_{BIAT2} = 0.21±0.30 D_{BIAT3} = 0.35±0.35	No significant correlations
Freitag (2019),[65] Germany	To assess implicit and explicit attitudes toward PMI	Untreated community-dwelling adults with depressive symptoms (n = 266)	2 BIATs	BIAT1&2: Mental Illness vs Physical Disability	$BIAT_1$: Innocent vs Guilty; $BIAT_2$: Different vs Normal	PHQ-9, Contact questions	Participants were excluded if the error rate was above 25%	D_{BIAT1} = 0.020±0.28 D_{BIAT2} = −0.059±0.30	No significant correlations
Hazell (2021),[66] UK	To assess implicit and explicit attitudes toward PMI	General population, Police, Ambulance and accident and emergency staff (n = 172)	BIAT	Mental illness vs Physical disability	Safe vs Dangerous	CAMI, SDS, AQ, RIBS	Participants were excluded if the error rate was above 30%, and data were excluded if they were during practice trails	$D_{\text{accident and emergency}}$ = 0.42±0.45 $D_{\text{Ambulance}}$ = 0.32±0.43 D_{Police} = 0.30±0.46 $D_{\text{General population}}$ = 0.25 ±0.44	N/A
Kumble (2022),[67] US	To assess implicit and explicit attitudes toward PMI	General population (n = 78)	BIAT	Mental illness vs Physical illness	Stability vs Instability	PDD	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	D = −0.13	N/A
Wang (2012),[24] China	To assess implicit and explicit attitudes toward mental illness	Undergraduate students (n = 56)	SC-IAT	Mental illness	Positive words vs Negative words	SDS, Feeling Thermometer Scale	Data were excluded if response times were below 350ms and incorrect responses were replaced with the mean response time in that block plus 400ms	D = 0.10	No significant correlations

Brener (2013),[68] Australia	To assess implicit and explicit attitudes toward mental illness	Mental health practitioners (n = 74)	SC-IAT	PMI	Positive vs Negative	Feeling Thermometer Scale, Sentence evaluation task	Data were excluded if responses were below 300ms, above 10,000ms, or incorrect	D = 0.28±0.40	Correlations between implicit measure and feeling thermometer (r = −0.24), emotional measurement (r = −0.29) were significantly negative, whereas significantly positive between implicit measure and willingness to help PMI (r = 0.32)
Lund (2014),[69] UK	To assess implicit and explicit attitudes toward mental illness	Undergraduate students (n = 156)	SC-IAT	Mentally ill	Danger vs Sick	Sentence evaluation task	Participants were excluded if error rates and/or response time over two interquartile ranges from the median on the IAT	D = 0.07±0.27	Correlation between implicit and explicit measures was significantly positive (r = 0.364)
González-Sanguino (2021),[70] Spain	To assess implicit and explicit attitudes toward PMI	Mental illness and serious mental illness healthcare providers (n = 160)	SC-IAT	Mental illness	Good vs Bad	ISMI, RSE, WHOQOL-BREF	Data were excluded if the error rate was above 40% or response times were unusually fast or slow	D_{male} = 3.90±0.11 [f] D_{female} = 3.91±0.14 [f]	No significant correlations
González-Sanguino (2022),[71] Spain	To assess implicit and explicit attitudes toward PMI	People with distinct mental illness diagnoses (n = 160)	SC-IAT	Mental illness	Good vs Bad	ISMI, AQ-27, RSE, WHOQOL-BREF, BFI	Data were excluded if the error rate was above 40% or response times were unusually fast or slow	D = 3.91±0.14 [f]	Correlation between implicit measure and RSE was significantly negative (r = −0.17), whereas no significant correlations between implicit measure and other explicit measures
Cheon (2012),[72] US	To assess implicit and explicit attitudes toward mental illness	Caucasian American and Asian American undergraduate students (n = 80)	GNAT	Mental illness vs Physical illness	Good vs Bad	SDS	Data were excluded if response times exceeded 10,000ms, participants were excluded if more than 10% fast (< 300ms) responses	d'_{AA} = −0.08±0.23 d'_{CA} = 0.08±0.45	No significant correlations
Kopera (2015),[73] Polish	To assess implicit and explicit attitudes toward mental illness	First-year medical students (n = 28), Psychiatrists and psychotherapists (n = 29)	GNAT	Mental illness	Pleasant vs Unpleasant	Emotion Scale, OMI	-	Non-professionals: d'_{CC} = 2.40±0.89 d'_{IC} = 1.73±0.77 Professionals: d'_{CC} = 2.21±0.78 d'_{IC} = 1.89±0.71	N/A

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Table 2 (Continued).

First author (Year), Country	Relevant aim(s)	Participants (Simple size)	Implicit measure			Relevant explicit measure(s)	Data processing	Main findings	
			Task	Concept words	Attribute words			Implicit Measure Result(s)	Implicit-Explicit Correlations
Ashford (2018),[74] US	To assess implicit and explicit attitudes toward substance use disorder	General population (n=1,288)	4 GNATs	GNAT1: SUD vs SA; GNAT2: SUD vs Addict; GNAT3: AUD vs Alcoholic; GNAT4: OUD vs OA	Good vs Bad	BSDS	Data were excluded if d' scores were 0 or below	GNAT1: d'_{SA} = −0.947±0.087 d'_{SUD} = −0.525±0.085 GNAT2: d'_{Addict} = −0.811±0.106 d'_{SUD} = −0.484±0.068 GNAT3: $d'_{Alcoholic}$ = −0.888 ±0.093 d'_{AUD} = −0.407±0.046 GNAT4: d'_{OA} = −0.733±0.068 d'_{OUD} = −0.477±0.064	N/A
Young (2019),[75] Canada	Study 1&2: To assess implicit and explicit attitudes toward PMI	Introductory psychology students (n_1 = 65, n_2 = 195)	3 GNATs	Mental illness	$GNAT_1$: Positive vs Negative; $GNAT_2$: Harmless vs Dangerous; $GNAT_3$: Competent vs Helpless	MISS, SDS, LCR, MCSDS, Helping behavior	-	Study 1: d'_{GNAT1} = 0.17±0.49 d'_{GNAT2} = 0.44±0.54 d'_{GNAT3} = 0.39±0.60 Study 2: d'_{GNAT1} = 0.38±0.31 d'_{GNAT2} = 0.23±0.57 d'_{GNAT3} = 0.51±0.59	Study 1: Correlation between $GNAT_2$ and social distance were significantly positive (r = 0.25) Study 2: Correlation between GNATs and social distance was significantly positive (r = 0.17)
Gomez (2023),[76] US	To assess implicit and explicit attitudes toward PMI	Undergraduate criminal justice and psychology majors who intend/desire to become law enforcement officers (n = 33)	3 GNATs	Mental illness	$GNAT_1$: Positive vs Negative; $GNAT_2$: Harmless vs Dangerous; $GNAT_3$: Competent vs Helpless	PPMI, MCSDS, Toronto Empathy Questionnaire	Data were excluded if responses were incorrect responses, incongruent trials or no-go trial	GNAT1: RT_{CC} = 604.90±30.3 RT_{IC} = 604.50±35.1 GNAT2: RT_{CC} = 604.54±36.6 RT_{IC} = 603.29±35.1 GNAT3: RT_{CC} = 596.95±37.6 RT_{IC} = 600.54±35.9	N/A
Pennington (2016),[77] UK	To assess implicit and explicit attitudes toward PMI	General population (n = 48)	IRAP	Mentally ill person vs Physically ill person	Positive vs Negative	CAMI-SR	Data were excluded if response times were above 10,000ms, and participants were excluded if error rate was above 10% with RTs below 300ms	D-IRAP = 0.23±0.48	Correlations between the CAMI-SR and IRAP trial type of mentally ill person-dangerous (r = −0.36), IRAP trial type of mentally ill person-harmless (r = −0.39) were negative

Drake (2018),[78] US	To assess implicit and explicit attitudes toward substance use disorder	Mental health practitioners (n = 60)	IRAP	Drug addict vs Healthy person	Positive vs Negative	DUSS, SDS-SU, Therapy Experience Questionnaire	Participants were excluded if error rate was more than 30% or not complete	Healthy-positive: *D*-IRAP = 0.32±0.39 Healthy-negative: *D*-IRAP = 0.13±0.34 Addict-positive: *D*-IRAP = −0.17±0.43 Addict-negative: *D*-IRAP = 0.03±0.42	Correlations between DUSS and the addict-positive trial-type (r = 0.401), the addict-negative trial-type (r = 0.273) was significantly positive, whereas no significant between DUSS and the healthy-positive trial-type or the healthy-negative trial-type

Notes: [a] The difference in average reaction time between compatible and incompatible tasks; [b] Calculating IAT scores based on a modified Guttmann; [c] a vignette describing the behavioral characteristics of people with depression; [d] 10 photos from the Karolinska Directed Emotional Faces (KDEF); [e] from the International Affective Picture System (IAPS) image database; [f] a constant of 5 was added. N/A, Not applicable, namely this study did not compare the relationship between implicit and explicit stigma.

Abbreviations: IAT, Implicit Association Test; BIAT, Brief Implicit Association Test; SC-IAT, Single Category Implicit Association Test; Child-oriented Version of the Implicit Association Test, Child IAT; Go/No-go Association Task, GNAT; IRAP, Implicit Relational Assessment Procedure; RT, Response Time; *D*, Implicit effect *D* value; CC, Congruent condition; IC, Incongruent condition; PMI, people with mental illness; SUD, Substance Use Disorder; SA, Substance Abuser; AUD, Alcohol Use Disorder; OA, Opioid Addict; OUD, Opioid Use Disorder; ADHD, Attention Deficit Hyperactivity Disorder; AA, Asian American undergraduate students; CA, Caucasian American undergraduate students; PDS, Perceived Dangerousness Scale; IDP, Interaction with Disabled Persons Scale; SDS, Social Distance Scale; AQ, Attribution Questionnaire; CAI, Competency Assessment Instrument; OMS-HC, Opening Minds Scale for Health Care Providers; T-SAS, Taiwanese version of the Stigma Assessment Scale; CAMI, Community Attitudes toward the Mentally Ill; BES, Basic Empathy Scale; AMIQ, Attitudes Toward Mental Illness Questionnaire; ATIDU, Attitudes Toward Injection Drug Use; PCDU, Perceived Controllability of Drug Use Scale; PSAS, Perceived Stigma of Addiction Scale; SAQ, Shared Activity Questionnaire; SSMIS, Self-Stigma of Mental Illness Scale; SELF-I, Self-Identification as Having a Mental Illness Scale; PDD, Perceived Devaluation and Discrimination Scale; IMS/EMS, Internal and External Motivation to Respond Without Prejudice Toward People With Depression Scale; PHQ-9, Patient Health Questionnaire Depression Module; ISMI, Internalized Stigma of Mental Illness; RIBS, Reported and Intended Behavior Scale; RSE, Rosenberg's Self-Esteem Scale; WHOQOL-BREF, World Health Organization Quality of Life Scale; BFI, Big Five Inventory; OMI, Opinions about Mental Illness Scale; MISS, Mental Illness Stigma Scale; BSDS, Bogardus Social Distance Scale; LCR, Level of Contact Report; MCSDS, Marlowe-Crowne Social Desirability Scale; PPMI, Prejudice Towards People with Mental Illness Scale; CAMI-SR, Social Restrictiveness Scale of Community Attitudes toward the Mentally Ill Scale; DUSS, Drug Use Stigmatization Scale; SDS-SU, Social Distance Scale for Substance Users.

Table 3 MERSQI Domain and Item Scores for Implicit Stigma Studies

Domain	Item (Score)	Study		Score (M±SD)	
		n	Constituent ratio (%)	Item	Domain
Study design	1. Study design			1.60±0.65	1.60±0.65
	Single group cross-sectional or single group posttest only (1)	23	46		
	Single group pretest and posttest (1.5)	4	8		
	Nonrandomized, 2 group (2)	18	36		
	Randomized controlled trial (3)	5	10		
Sampling	2. No. of institutions studied			1.06±0.40	0.99±0.44
	1 (0.5)	13	26		
	2 (1)	18	36		
	>2 (1.5)	19	38		
	3. Response rate, %			0.92±0.47	
	Not applicable	0	0		
	<50 or not reported (0.5)	27	54		
	50~74 (1)	4	8		
	≥75 (1.5)	19	38		
Type of data	4. Type of data			3.00±0.00	3.00±0.00
	Assessment by study participant (1)	0	0		
	Objective measurement (3)	50	100		
Validity of evaluation instrument	5. Internal structure			0.60±0.49	0.79±0.41
	Not applicable	0	0		
	Not reported (0)	20	40		
	Reported (1)	30	60		
	6. Content			1.00±0.00	
	Not applicable	0	0		
	Not reported (0)	0	0		
	Reported (1)	50	100		
	7. Relationships to other variables			0.77±0.42	
	Not applicable	2	4		
	Not reported (0)	11	22		
	Reported (1)	37	74		
Data analysis	8. Appropriateness of analysis			0.94±0.24	1.46±0.56
	Inappropriate for study design or type of data (0)	3	6		
	Appropriate for study design or type of data (1)	47	94		
	9. Complexity of analysis			1.98±0.14	
	Descriptive analysis only (1)	1	2		
	Beyond descriptive analysis (2)	49	98		
Outcomes	10. Outcomes			1.09±0.34	1.09±0.34
	Satisfaction, attitudes, perceptions, opinions (1)	46	92		
	Knowledge, Skills (1.5)	1	2		
	Behaviors (2)	2	4		
	Patient/health care outcome (3)	1	2		
Total Score					12.93±1.20

related to the controllability, etiology, and stability of mental disorders, using attribute words such as "controllable vs uncontrollable", "curable vs incurable", "stable vs unstable", "psychological vs physiological", and "permanent vs temporary". The remaining studies focused on potential risks associated with mental illnesses, employing attribute words like "dangerous vs safe", "danger vs sick", and "peacefulness vs violence" to evaluate the extent of attribution bias.

Table 4 List of Studies (by Characteristic) Included in the Systematic Review

Characteristic	n	Included studies
Implicit measures		
IAT	29	13,14,17,18,34–58
BIAT	9	59–67
SC-IAT	5	24,68–71
GNAT	5	72–76
IRAP	2	77,78
Relevant aim groups-Mental illness as a whole		
Mental illness, People with mental illness	36	13,14,17,24,34,35,40–46,48,49,51–56,59,60,63,65–73,75–77
Relevant aim groups-Specific psychiatric diagnoses		
Schizophrenia, Depression, People with depression, SUD, ADHD	15	18,36–39,47,50,53,57,58,61,62,64,74,78
Concept words-Target categories- Mental illness as a whole		
Mental illness, Mentally ill, People with mental illness	30	13,14,17,24,34,35,40,41,44,45,51,53–56,59,60,63,65–73,75–77
Concept words-Target categories-Specific psychiatric diagnoses		
Schizophrenia	9	36,37,39,42,43,48,49,52,61
Depressed, Depression	5	38,47,58,62,64
SUD, AUD, OUD, Substance user, Drug addict	3	57,74,78
ADHD	1	58
Concept words-Target categories-Others	1	58
Images	2	18,50
Names of the vignette characters	1	46
Concept words-Comparison categories- Physical illness as a whole		
Physical illness, Physically ill, Physical chronic illnesses, Physically ill people, Physically ill person, Physical disability	20	17,34,38,40,41,44,45,47,51,53–56,59,60,65–67,72,77
Concept words-Comparison categories-Specific physical diagnoses		
Diabetes (mellitus), Hypertension, Obesity, Normal issues	8	37,39,42,48,49,52,58,61
Concept words-Comparison categories-Healthy individuals		
Health, Healthy person, Mental health, No mental illness, Non-substance user, Welfare recipients	7	13,14,35,43,57,64,78
Concept words-Comparison categories-Others	1	13
Depression	1	36
Images	2	18,50
Names of the vignette characters	1	46
SA, OA, Addict, Alcoholic	1	74
- (BIAT)	2	62,63
- (SC-IAT)	5	24,68–71
- (GNAT)	3	73,75,76
Attribute words-Emotional		
Good vs Bad, Positive (words) vs Negative (words), Pleasant vs Unpleasant, Liked vs Disliked, Gloomy vs Cheerful	32	13,14,17,24,34,35,38,40,42,44–50,52,54,57–59,64,68,70–78
Attribute words-Stereotype		
Competent vs Helpless, Competence vs Incompetence, Victim vs Culprit, Victim vs Criminal, Innocent vs Blameworthy, Innocent vs Guilty, Burdenless vs Burdensome, Weak-willed vs Strong-willed, Mentally weak vs Mentally strong, Different vs Normal	15	13,34,36,37,39–41,53,60,62–65,75,76
Attribute words-Controllability, etiology, and stability		
Controllable vs Uncontrollable, Healable vs Unhealable, Curable vs Incurable, Stability vs Instability, Psychological vs Biological, Permanent vs Temporary, Peacefulness vs Violence	5	36,38,41,47,67
Attribute words-Risks		
Safe vs Threatening, Safe vs Dangerous, Harmless vs Dangerous, Harmlessness vs Harmfulness, Dangerous vs Safe, Danger vs Sick	13	18,36,43,51,53,55,56,61,62,66,69,75,76

Data Processing of Implicit Effect

As illustrated in Table 4, the implicit effect of the *D* value was determined using the enhanced algorithm introduced by Greenwald et al in 18 IAT studies.[12] Among these, Beltzer et al further refined the exclusion criteria.[51] Five studies employed different methodologies for data processing. The remaining six studies did not provide specific details regarding the data processing methods utilized.

In BIAT studies, four studies calculated the implicit effect of *D* scores using the modified algorithm introduced by Greenwald et al,[12] while the remaining five studies employed different algorithms for data processing.

Among the five studies that employed the SC-IAT, four referenced the revised algorithm proposed by Greenwald et al for data analysis.[12] Interestingly, several other studies modified the effect size calculation by adding a constant value of 5 to enhance the interpretability of their findings.[70,71] Furthermore, Wang et al utilized the data processing approach developed by Karpinski et al,[24,56] which specifically addresses short response times and incorrect responses within the dataset.

Five studies employed the GNAT to measure implicit stigma. Of these, three adhered to Nosek's guidelines for data processing,[80] which involved deleting responses from incorrect, incongruent trials, or no-go trials. However, the remaining two studies utilized differing methodologies: one[72] followed the criteria established by Greenwald et al,[12] and the other[75] did not specify the data processing criteria. The IRAP was used in two studies to evaluate implicit stigma, referring to the algorithmic criteria outlined by Greenwald et al and Barnes-Holmes et al,[17,69] respectively. Table 4 presents a comprehensive overview of these details.

Implicit-Explicit Correlations

Except for two studies,[47,50] almost all studies analyzed both participants' implicit and explicit attitudes, with 38 of these investigations reporting correlations between these measures (see Table 4). Of these studies, only 22 reported a significant correlation, with 13 demonstrating positive correlations between implicit and explicit measurements and 9 showing negative correlations. The remaining 16 studies observed a non-significant statistical association between implicit and explicit attitudes.

In an examination of the relationship between implicit stigma and explicit affective experiences, researchers conducted 11 studies, 5 of which demonstrated a significant correlation in the Implicit-Explicit correlations (IEC). Conversely, 6 additional studies did not reveal a significant association with IEC. The relationship between implicit stigma and explicit behavioral tendencies in mental illness was investigated in a total of 19 studies. Notably, 11 of these studies provided substantial evidence supporting a significant correlation between the two variables. Table 4 presents the details of these findings.

Meta-Analysis Results

Of the 50 studies included in this review, 20 were excluded from the meta-analysis due to the absence of necessary data, such as the mean effect size and/or standard deviation, or because they only reported reaction time.

Subgroup Analysis

The meta-analysis encompassed 30 articles covering 83 studies. The results revealed significant heterogeneity among subgroups ($I^2 = 99.9\%$, $P < 0.001$), indicating substantial variations in implicit attitudes toward mental illness across different populations. The random-effect model meta-analysis outcomes showed that the findings for two subgroups (see Supplemental Figure 1-4), students and the general population, were statistically significant. Healthcare providers (SMD = 1.09, $P = 0.054$) and the general population (SMD = 0.79, $P < 0.001$) exhibited demonstrably more positive implicit attitudes toward mental illness compared to students (SMD = 1.17, $P < 0.001$) and individuals with mental illness (SMD = 1.20, $P < 0.001$).

This study conducted subgroup analyses to investigate variations in effect sizes across diverse experimental paradigms and geographical regions (see Table 5). Meta-analysis was not performed for subgroups consisting of a single study, resulting in the exclusion of the following categories: individuals with mental illness under the IAT, all groups under the SC-IAT, the general population group under the IRAP, and all groups in Asia except for students.

The meta-analysis of student and healthcare provider groups in the IAT yielded statistically significant results ($P < 0.05$) (see Supplemental Figure 5). Healthcare providers exhibited the smallest effect size (SMD = 1.05, $P = 0.049$), followed by students (SMD = 1.11, $P = 0.032$) and the general population (SMD = 1.37, 95% CI = 0.91 ~ 2.06, $P = 0.127$). In the BIAT (see Supplemental Figure 6), the pooled SMD revealed a higher *D* score among healthcare providers, indicating a stronger association with negative attitudes (SMD = 1.43, $P = 0.001$). The remaining groups, in descending order of effect size, were students (SMD = 1.36, $P = 0.023$), the general population (SMD = 1.29, $P < 0.001$), and individuals with mental illness (SMD = 1.03, $P = 0.005$). The GNAT results demonstrated a statistically significant pooled SMD (see Supplemental Figure 7), with the general population having a lower *D* score (SMD = 0.52, $P = 0.043$) compared to student groups (SMD = 1.30, $P = 0.045$), and both exhibited negative implicit stigma. Within the IRAP paradigm (see Supplemental Figure 8), the healthcare provider group showed statistical significance (SMD = 1.08, $P = 0.036$). However, due to the limited number of studies utilizing IRAP, a comparison with other groups was not feasible.

In addition to the measure variation, we also investigated the potential influence of geographical region on the perception of mental illness stigma among different study populations. In North America (see Supplemental Figure 9), the general population exhibited the lowest pooled SMD for implicit attitudes toward mental illness (SMD = 0.66, $P = 0.045$), followed by healthcare providers (SMD = 1.05, $P = 0.047$), students (SMD = 1.17, $P = 0.038$), and individuals with mental illness (SMD = 1.48, $P = 0.104$). In Europe (see Supplemental Figure 10), the pooled SMD for students (SMD = 1.17, $P = 0.020$) was lower than those of the general population (SMD = 1.35, $P = 0.002$) and healthcare providers (SMD = 1.23, $P = 0.078$) but higher than that of individuals with mental illness (SMD = 0.98, $P = 0.003$). The analyses revealed a significant pooled SMD in the student group within Asia (SMD = 1.19, $P = 0.044$) (see Supplemental Figure 11).

Table 5 Subgroup Analysis of Implicit Stigma Attitudes in Mental Illness

Subgroup	Included studied	Heterogeneity Test		Meta-Analysis Results			Egger's test (*P*)
		I^2	*P*	SMD	95% CI	*P*	
IAT							
General population	3	99.2	< 0.001	1.37	[0.91, 2.06]	0.127	-
Student	24	97.2	< 0.001	1.11	[1.13, 1.19]	0.032*	0.143
Healthcare provider	20	98.3	< 0.001	1.05	[0.95, 1.16]	0.049*	0.912
BIAT							
General population	3	0.0	0.438	1.29	[1.21, 1.37]	< 0.001*	-
Student	4	94.9	< 0.001	1.36	[1.17, 1.59]	0.023*	-
Healthcare provider	2	20.9	0.261	1.43	[1.30, 1.58]	0.001*	-
People with mental illness	3	90.6	< 0.001	1.03	[0.94, 1.12]	0.005*	-
GNAT							
General population	8	100.0	< 0.001	0.52	[0.45, 0.60]	0.043*	-
Student	8	95.8	< 0.001	1.30	[1.12, 1.51]	0.045*	-
IRAP							
Healthcare provider	4	93.3	< 0.001	1.08	[0.89, 1.31]	0.036*	-
North America							
General population	11	100.0	< 0.001	0.66	[0.58, 0.75]	0.045*	0.660
Student	23	97.4	< 0.001	1.17	[1.08, 1.27]	0.038*	0.509
Healthcare provider	22	98.1	< 0.001	1.05	[0.96, 1.16]	0.047*	0.972
People with mental illness	2	98.4	< 0.001	1.48	[0.95, 2.30]	0.104	-
Europe							
General population	4	36.9	0.190	1.35	[1.26, 1.44]	0.002*	-
Student	9	95.5	< 0.001	1.17	[1.06, 1.28]	0.020*	-
Healthcare provider	4	96.0	< 0.001	1.23	[0.93, 1.62]	0.078	-
People with mental illness	2	89.9	0.002	0.98	[0.91, 1.06]	0.003*	-
Asia							
Student	5	96.0	< 0.001	1.19	[0.99, 1.45]	0.044*	-

Note: * $P < 0.05$.

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Sensitivity Analysis and Publication Bias

A sensitivity analysis was conducted using the leave-one-out method for groups with 10 or more studies, including the student and healthcare provider groups in the IAT, as well as the general population, student, and healthcare provider groups in North America. The results of Egger's test, presented in Table 5, demonstrated relative stability, indicating no significant publication bias in any of the analyzed groups.

Discussion

This systematic review examined the selection of concept and attribute words, the operationalization of data processing, the correlations between implicit and explicit measures, and the extent of implicit stigma toward mental illness across various populations. The insights gained from these studies may inform strategies for reducing stigma among different groups, either through awareness initiatives or within clinical settings.

Inconsistencies of Concept Words, Attribute Words, and Data Processing

The analysis reveals a lack of consistency in the conceptual and attribute terms employed for measuring implicit stigma. As Nosek et al noted,[80] stimulus categories can be presented in various forms, including text, sound, or images, and combined based on the specific requirements of different studies. However, among the 50 studies included in this review, only two utilized images as stimuli.[18,50]

Our study found that the concept words for stimulus categories are categorized into two distinct groups: one encompassing general terms related to mental illnesses (eg, "mental illness" and "mental disorder") and another targeting specific mental illness categories (eg, "schizophrenia" and "depression"). The comparison categories comprise general terms related to physical illnesses, specific physical illnesses, and healthy individuals. While the stimulus and comparison categories are established based on conceptual relevance, they lack a clear complementary relationship, potentially impacting the reliability and accuracy of the results due to semantic information. Furthermore, some studies have employed the SC-IAT, BIAT, or GNAT paradigm to investigate implicit stigma, solely including concept words for stimulus categories. However, such research remains relatively limited, and the validity of these measurements requires further verification. Inconsistencies in the inclusion of words within the same category of concept words have been observed across different studies, and the word selection process has not been well-documented. To ensure the robustness and comparability of findings in this field, future research should adopt a more scientific approach for word selection, develop a standardized "mental illness-related word bank", and validate its reliability and validity in implicit measurements.

Numerous researchers have employed the tripartite theory of attitudes to posit that the stigma of mental illness comprises three components: individuals' cognitive structures, emotional experiences, and behavioral tendencies toward discrimination.[81] Based on this theory, attribute words can be categorized into three types: those reflecting participants' automated cognitive evaluations, emotional responses, and behavioral tendencies toward mental illnesses. However, the literature included in this systematic review primarily encompasses attribute words that reflect cognitive evaluations and emotional responses. The selection of these words is largely derived from researchers' subjective judgments, lacking standardized screening or participant-driven generation of words. Furthermore, the attribute words within individual studies are primarily adjectives that convey similar meanings, undermining the ability of the theory to capture the multifaceted and dynamic nature of stigma as a psychosocial construct.

A refined scoring algorithm, proposed by Greenwald et al,[12] has emerged as the preferred approach for calculating implicit effect scores in research endeavors. This algorithm enhances the scoring process by considering factors such as participants' prior experience with the implicit measure and the impact of response speed variations across the task. Our findings indicate that the majority of the literature employed the modified algorithm proposed by Greenwald et al,[12] while three studies[39,43,54] utilized the original algorithm[11] to calculate the effect size. Seven studies did not explicitly report their processing standards, and the remaining studies referred to varying exclusion criteria.[14,37,46,48,49,52,75] Although the original algorithm can provide an interpretable effect strength *D*, it lacks theoretical support due to the absence of systematic validation of its psychometric properties.[12] Furthermore, despite some studies adopting the same reference basis, differences in the threshold settings for

reaction time and error rate were observed, highlighting the need for improvements in the exclusion criteria for reaction time to enhance the standardization of implicit measurement effect size calculations.

The Correlation Between Implicit and Explicit Measures Remains to Be Validated

The findings of this systematic review indicate that the majority of studies did not find a statistically significant association between explicit and implicit measurements, suggesting that they represent distinct components of the construct. Several studies conceptualize implicit measures as independent and different from explicit ones. They can be present even in the absence of explicit stigma and have been shown to predict clinical decision making and more restrictive interventions.[15,70] Additionally, some studies have provided further support for the convergence theory, suggesting that the implicit measurement of stigma attitudes toward mental illness has distinct predictive effects on automated behavioral responses. For instance, Thibodeau et al found that higher levels of implicit stigma predicted greater social distance.[18] However, Vertilo et al did not find a significant correlation between the two, further highlighting the complexity of the relationship between implicit and explicit measurements, which warrants further investigation.[14] Similarly, Brener et al found that while correlations between implicit measures and a feeling thermometer were significantly negative, a positive correlation was observed between implicit attitudes and the willingness to help individuals with mental illness.[68] These findings underscore the intricate interplay between unconscious biases and conscious intentions regarding mental illness stigma. Elucidating the mechanisms underlying this dissociation or convergence is of utmost importance, as it has significant implications for stigma reduction and mental health promotion.

Implicit Stigma Attitudes in Different Groups

This study assessed implicit stigma toward mental illness across thirty included studies. While widespread efforts to reduce negative stereotypes persist, such as Opening Minds in Canada[82] and Time to Change in England and Wales,[83] misconceptions regarding the incompetence and culpability of individuals with mental illness continue to persist. The findings indicate that implicit stigma is evident across groups,[60,66] with both members and non-members of the stigmatized group (eg, those with or without a psychiatric diagnosis) holding similarly negative evaluations of individuals with mental illness, thus reinforcing the notion that stigma toward people with mental illness is a pervasive issue spanning cultures and professions. This observation aligns with previous research on explicit stigma.[25,26] The levels of implicit stigma toward mental illness vary significantly among different social groups, with individuals with mental illness exhibiting the most intense implicit attitudes, followed by students, healthcare providers, and the general population. Several factors may contribute to these disparities in attitudes. First, recent efforts by various societal sectors have achieved notable progress in reducing the stigma surrounding mental illness, positively influencing the general population's implicit attitudes, which are shaped by social culture, media coverage, and personal experiences. Second, despite receiving some education, students' attitudes toward mental illness may remain superficial. Although healthcare providers are professionals in the field, their clinical experience, often involving patients who do not fully recover or frequently relapse, can lead to a clinical bias, which is a key factor contributing to pessimistic views about recovery.[42] The limited sample size under similar conditions or the influence of different implicit measurement paradigms may explain the lack of statistical significance in the differences in effect sizes observed between the general population in IAT and people with mental illness in North America. Furthermore, the present research includes a limited number of studies assessing the implicit stigma toward individuals with mental illness. One study involves an untreated depression group, which may lack sufficient self-awareness of their condition.[65] The implicit stigma attitudes exhibited by this group differ significantly from those with severe mental illnesses, given the concealed or atypical nature of their symptoms, potentially affecting the generalizability of the results.

When comparing implicit attitudes toward mental illness across different regions, the general populace in North America exhibited the most positive implicit attitudes, whereas in Europe, individuals with mental illness themselves demonstrated the most positive stance. These discrepancies may be attributed to several factors. First, the limited number of studies and their representativeness in each region may have influenced the results, as only two studies involving individuals with mental illness from North America and Europe were included. Second, sociocultural and individual differences across regions may have contributed to the observed variations. Additionally, discrepancies in effect sizes can

arise from variations in attribute words, concept words, and data processing methods employed in implicit measurement paradigms. Even when utilizing the same paradigm, studies adhering to different error rate thresholds may yield discrepant effect sizes. Consequently, to achieve a more comprehensive understanding of the implicit stigma among individuals with mental illness, further research, such as comparing the impact of individualistic cultures (eg, North America) and collectivist cultures (eg, East Asia), is necessary to verify and supplement the existing findings.

Implication And Limitations

Implications for Future Research

This study is the first to comprehensively evaluate implicit stigma toward mental illness among various groups using international databases, representing a significant contribution to the field. By employing the dual attitude model, this research offers a unique perspective for assessing stigma. Furthermore, the incorporation of subgroup analyses, which explore potential influential variables and conduct in-depth examinations of implicit stigma, facilitates a more comprehensive understanding of the subject matter. Based on research findings, future interventions could be customized for different groups and regions to guide anti-stigma efforts, such as educational interventions aimed at normalizing conversations around mental illness, various forms of contact interventions, or anti-stereotyping strategies. These interventions could also focus on the extent of implicit stigma among individuals with mental illness and the European population.

Limitations for Current Research

This study has several limitations that should be considered. First, we did not include grey literature and language constraints led to the inclusion of reviews only in English. Future research should also incorporate Chinese literature to compare whether mental illness stigma varies between Eastern and Western countries, depending on sociocultural or healthcare system factors. Second, there is significant heterogeneity among the included studies, and the source of this heterogeneity remains unclear, which may impair the comprehensiveness of the analysis. Finally, in the subgroup analysis, the small number of studies in certain subgroups may have reduced the accuracy of the results, and not all studies reported sufficient information to draw definitive conclusions regarding specific features of the sample or to distinguish between subgroups within the sample. Emerging research (eg, investigating longitudinal changes in implicit stigma over time) is recommended for future studies to fill in the data gaps.

Conclusions

This study reveals discrepancies in implicit attitudes toward mental illness among diverse populations. However, the correlation between implicit and explicit measurements remains inconclusive. The inconsistent use of conceptual and attribute words in implicit measurements across the literature warrants attention, and there is a need for increased standardization of data processing protocols. To enhance the credibility and generalizability of future findings, researchers should establish standardized implicit measurement protocols. Furthermore, factors influencing and elucidating implicit attitudes should be further investigated to understand mechanisms underlying negative implicit attitudes and to design outcome-based interventions. This research would also provide critical evidence for incorporating an implicit perspective within the campaign of anti-stigma interventions, which are essential steps toward reducing the stigma associated with mental illness across various societal groups.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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