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Integrated Screening for Mental and Metabolic Health Risks

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Abstract

Mental and metabolic health conditions frequently coexist, yet screening systems in primary and community care often assess psychological symptoms and cardiometabolic risk through separate clinical pathways. Such fragmentation may delay recognition of people who simultaneously experience depressive or anxiety symptoms and metabolic abnormalities such as central adiposity, elevated blood pressure, dysglycemia, or dyslipidemia. The present study develops a simulation-based framework for integrated mental–metabolic risk screening in adults attending community and primary-care services. The proposed model combines brief validated mental-health case-finding instruments with measurement of selected metabolic risk indicators, followed by stratified referral and coordinated follow-up. A hypothetical sample of 600 adults was modeled, with 300 participants assigned to an integrated screening pathway and 300 to a conventional separate or opportunistic screening pathway. Because no empirical patient-level dataset was supplied, all numerical outcomes are explicitly synthetic and serve only to demonstrate an evaluative methodology.

The integrated pathway identified a larger simulated proportion of participants with mental-health risk, metabolic risk, and simultaneous mental–metabolic risk and achieved higher completion of indicated follow-up. Dual-risk identification reached 19% in the integrated pathway compared with 10% in the separate pathway, while follow-up completion was modeled at 68% and 44%, respectively. The proposed approach is supported by evidence demonstrating bidirectional associations between depression and diabetes, depression and metabolic syndrome, and depression and obesity, as well as prior evidence supporting integrated management of physical and mental conditions. The study concludes that integrated screening may improve early recognition of overlapping health risks when accompanied by clinical confirmation, patient-centered counseling, clear referral procedures, and adequate follow-up capacity. Screening should remain a case-finding process rather than being interpreted as definitive psychiatric or metabolic diagnosis.

Keywords: integrated screening; mental health; metabolic health; depression; anxiety; metabolic syndrome; diabetes risk; primary care; preventive health; multimorbidity

1. Introduction

Mental and metabolic disorders constitute overlapping challenges for contemporary primary and community health services. Depression and anxiety can affect health behavior, physical activity, sleep, dietary patterns, medication adherence, and engagement with preventive services, while obesity,

diabetes, hypertension, and other chronic metabolic conditions can create substantial psychological burden. The resulting interaction means that a patient presenting with a predominantly physical complaint may have an important but unrecognized mental-health concern, whereas a patient receiving mental-health treatment may simultaneously carry untreated cardiometabolic risk. Pan and colleagues reported a bidirectional relationship between depression and type 2 diabetes, indicating that the clinical overlap cannot be adequately understood through a one-directional disease model.

Evidence also extends beyond diabetes. Luppino and colleagues' systematic review and meta-analysis demonstrated a reciprocal relationship between depression and obesity, while Pan and colleagues later identified a bidirectional association between depression and metabolic syndrome. Vancampfort and colleagues subsequently reported that individuals with major depressive disorder constitute a high-risk population for metabolic syndrome and related cardiovascular morbidity. These findings provide an important rationale for considering mental and metabolic health jointly at the stage of early risk detection.

Despite this overlap, health-care delivery has historically separated many psychological and physical-health processes. Mental-health screening may occur only when emotional symptoms are explicitly reported, whereas blood pressure, glucose, adiposity, or lipid assessment may proceed without systematic evaluation of psychological distress. Such separation can be especially problematic in primary care, where multimorbidity rather than isolated single disease is common. Evidence from integrated team-based primary-care models suggests that combining physical and behavioral health processes can improve selected measures of care quality, including depression screening and diabetes-related care.

Brief validated instruments make integrated screening operationally feasible. Kroenke and colleagues demonstrated the validity of the two-item Patient Health Questionnaire for identifying probable depressive disorders, while the PHQ-9 provides a more comprehensive measure of depressive symptom severity. The GAD-7 and its two-item core version provide similarly concise approaches for anxiety case finding. Metabolic risk can likewise be assessed through routinely obtainable measures such as waist circumference, blood pressure, glucose status, triglycerides, and high-density lipoprotein cholesterol, consistent with established international approaches to metabolic-syndrome characterization.

The present study therefore proposes an integrated mental–metabolic screening pathway in which psychological and metabolic indicators are assessed during the same preventive-care encounter and interpreted within a coordinated referral system. The objective is not to collapse psychiatric and metabolic diagnosis into a single construct, but to recognize overlapping risk earlier and reduce loss between separate service pathways. Since real clinical data were not supplied for the present manuscript, the analytical component uses transparent simulation. The findings should therefore be interpreted as methodological illustrations and testable hypotheses rather than observed treatment effects or prevalence estimates.

2. Objectives of the Study

2.1 Identification of Coexisting Mental and Metabolic Risks

The first objective is to determine whether an integrated screening encounter could increase the identification of adults presenting with mental-health risk, metabolic risk, or both. Conventional disease-

specific screening may identify one problem while failing to investigate another clinically relevant domain. An integrated approach deliberately asks whether psychological symptoms and metabolic abnormalities coexist and therefore warrant coordinated clinical review.

Particular attention is given to dual-risk identification, because it represents the population most likely to be overlooked when mental and physical health are treated independently. Prior evidence shows bidirectional associations between depression and metabolic syndrome as well as between depression and diabetes, making simultaneous case finding a reasonable preventive-health strategy. The study does not assume that one condition necessarily causes the other; instead, it treats their coexistence as clinically relevant.

2.2 Evaluation of Screening Accessibility and Referral Continuity

The second objective is to examine whether a single coordinated screening encounter can reduce fragmentation between risk identification and subsequent care. Screening itself has limited value if a positive result is not followed by diagnostic confirmation, counseling, repeat measurement, or appropriate referral. Accordingly, the proposed framework evaluates not only positive-screen rates but also completion of indicated follow-up.

Integrated team-based models provide precedent for this approach. Reiss-Brennan and colleagues found that integrated team-based primary care was associated with higher rates of selected quality measures, including active depression screening and adherence to a diabetes-care bundle, compared with traditional practice management. The present model extends this logic to the screening stage by connecting psychological and metabolic risk detection to a shared follow-up process.

2.3 Development of a Preventive Multimorbidity Framework

The third objective is to position integrated screening within preventive multimorbidity management rather than within a disease-specific program. Mental and metabolic risks may share behavioral, social, treatment-related, and physiological determinants, but individual patients will differ substantially in their combinations of risk. A useful program therefore needs to classify participants into clinically meaningful pathways rather than apply an identical intervention to everyone.

This objective is consistent with the broader principle that physical health should not be neglected in people receiving mental-health care. WHO's 2018 guidance specifically addressed recognition and management of physical health conditions among adults with severe mental disorders, reflecting concern about physical-health disparities within mental-health populations. Although the present framework includes a broader primary-care population rather than only people with severe mental disorders, the same principle supports systematic attention to both domains.

3. Review of Literature

3.1 Evidence Linking Mental and Metabolic Health

Pan and colleagues examined the relationship between depression and type 2 diabetes and reported compelling evidence of a bidirectional association. This finding is important because it moves beyond the assumption that psychological distress develops only as a consequence of chronic disease. Depression may precede diabetes in some individuals, while diabetes may increase subsequent risk of

depression in others. Such bidirectionality strengthens the case for screening across both domains rather than waiting for one established diagnosis to trigger investigation of the other.

Luppino and colleagues similarly synthesized longitudinal evidence relating obesity and depression. Their meta-analysis concluded that obesity increased the risk of subsequent depression and that depression increased the probability of later obesity. These observations are clinically relevant because weight-related metabolic risk can be influenced by behavioral patterns, socioeconomic circumstances, biological mechanisms, treatment effects, and emotional well-being. They also caution against simplistic assumptions that psychological and metabolic outcomes can be addressed through isolated interventions.

Pan and colleagues subsequently examined depression and metabolic syndrome more directly and reported a bidirectional association. Vancampfort and colleagues' later meta-analysis likewise concluded that people with major depressive disorder represent a population at elevated metabolic-syndrome risk. Together, these findings provide the principal evidence base for the integrated case-finding model proposed in the present study.

3.2 Brief Screening Instruments and Metabolic Risk Assessment

Kroenke, Spitzer, and Williams validated the PHQ-9 as a brief measure capable of assessing depressive symptom severity, while Kroenke and colleagues subsequently established the utility of the PHQ-2 as an even shorter case-finding instrument based on depressed mood and loss of interest or pleasure. In an integrated screening system, an ultra-brief first-stage instrument can reduce administration burden, with a more detailed instrument or clinical interview used following a positive initial screen.

Anxiety assessment can follow a similar staged design. Spitzer and colleagues validated the seven-item GAD-7, and Kroenke and colleagues later demonstrated the value of its two core questions as a brief anxiety-screening approach in primary care. The purpose of these tools is case finding rather than independent psychiatric diagnosis. Positive scores require interpretation in relation to functional impairment, clinical history, differential diagnosis, safety considerations, and patient circumstances.

Metabolic assessment can also be structured around a small number of routinely obtainable indicators. The international harmonized metabolic-syndrome statement identified abdominal obesity, elevated triglycerides, reduced HDL cholesterol, elevated blood pressure, and elevated fasting glucose as central components of metabolic risk clustering. A community or primary-care screening pathway need not label every participant with metabolic syndrome during the screening encounter; instead, abnormal findings can trigger repeat measurement, laboratory confirmation, clinical risk assessment, and treatment according to appropriate guidelines.

3.3 Integrated Care Evidence and Remaining Research Gap

Katon and colleagues evaluated collaborative care among patients with depression and poorly controlled diabetes, coronary heart disease, or both. Their randomized study examined a coordinated intervention that addressed depression alongside disease-control indicators rather than treating psychological care as an unrelated service. The study is an important precedent because it demonstrates that clinically meaningful integration can occur across psychiatric and chronic-disease domains.

Reiss-Brennan and colleagues later studied integrated team-based primary care at substantial scale and found associations with improvements in several quality measures and reductions in selected acute-care utilization outcomes. Their integrated practices had higher active depression-screening rates and higher adherence to a diabetes-care bundle than traditional practices. These results do not prove that integrated screening itself produces better clinical outcomes, but they demonstrate the operational feasibility of reorganizing primary care around combined physical and behavioral health needs.

The remaining research gap lies in the front end of the care pathway. Much of the literature addresses comorbidity after one or more disorders have already been diagnosed. Less emphasis has been placed on designing a simple preventive encounter that identifies mental and metabolic risk simultaneously and then measures what happens between screening, confirmation, referral, and follow-up. The present simulation addresses this service-design gap by proposing an integrated case-finding framework suitable for prospective testing.

4. Research Methodology

4.1 Study Design and Hypothetical Population

The study adopts a simulation-based comparative design involving 600 hypothetical adult participants, divided equally between an integrated screening pathway and a separate or opportunistic screening pathway. The integrated group contains 300 modeled participants undergoing mental and metabolic risk assessment during a coordinated encounter. The comparison group contains 300 modeled participants exposed to usual processes in which mental and metabolic screening may occur independently.

A future empirical study could recruit adults aged 18 years or older from primary-care clinics, community health centers, preventive-health camps, workplace health programs, or chronic-disease services. Exclusion criteria would depend on the study purpose but could include inability to provide informed consent, acute medical instability requiring emergency care, or circumstances in which immediate psychiatric assessment takes precedence over routine screening.

The present analysis does not claim that the simulated groups represent a specific population prevalence. Synthetic proportions were selected to illustrate how integrated screening performance can be analyzed. In a real study, baseline demographic and clinical characteristics would need to be recorded and statistically compared to determine whether differences between pathways could be attributed to screening design rather than participant characteristics.

4.2 Integrated Screening Protocol

Mental-health case finding would begin with validated brief screening. The PHQ-2 could be used as an initial depression screen, with the PHQ-9 administered when further assessment is indicated. Anxiety risk could be assessed using the GAD-2 followed, where necessary, by the GAD-7 or appropriate clinical evaluation. These measures have established validity for case finding and symptom assessment in primary-care populations. Any indication of imminent self-harm risk or acute psychiatric instability would bypass the routine research pathway and require urgent clinical assessment according to local safety procedures.

Metabolic screening would assess waist or central adiposity, blood pressure, glycemic risk, and lipid status where laboratory facilities permit. The structure is informed by the harmonized definition of

metabolic syndrome, although the screening encounter would identify risk indicators rather than establish a definitive metabolic-syndrome diagnosis. Participants with abnormal measurements would proceed to appropriate confirmation and medical review.

The core operational feature is that both domains are documented within the same risk profile. Individuals may therefore be classified as having no current positive screen, predominant mental-health risk, predominant metabolic risk, or concurrent mental–metabolic risk. Each category leads to a defined follow-up pathway rather than simply generating an informational report.

Table 1: Proposed Integrated Mental–Metabolic Screening Framework

Screening domain	Proposed assessment	Screening purpose	Action following positive finding
Depressive symptoms	PHQ-2 followed by PHQ-9 where indicated	Identify probable depressive symptom burden	Clinical mental-health assessment and appropriate follow-up
Anxiety symptoms	GAD-2 followed by GAD-7 where indicated	Identify probable anxiety symptom burden	Clinical assessment, counseling, or referral
Central adiposity	Waist circumference and/or BMI	Identify adiposity-related metabolic risk	Lifestyle and medical risk assessment
Blood pressure	Standardized blood-pressure measurement	Detect elevated blood-pressure risk	Repeat/confirm and evaluate clinically
Glycemic risk	Fasting glucose, HbA1c, or locally appropriate testing	Identify abnormal glucose regulation	Confirmatory testing and medical review
Lipid risk	Triglycerides and HDL cholesterol where available	Identify dyslipidemic risk	Clinical cardiovascular-risk assessment
Combined risk	Integrated interpretation of mental and metabolic screens	Detect coexisting vulnerability	Coordinated physical and mental-health follow-up

Source/Note: Author-developed methodological framework informed by validated mental-health screening instruments and internationally established metabolic-risk concepts.

4.3 Outcome Measures, Questionnaire, and Statistical Analysis

The primary outcome is identification of concurrent mental and metabolic risk. Secondary outcomes include mental-health risk identification, metabolic-risk identification, successful referral, follow-up

completion, participant acceptability, and time between screening and indicated clinical review. In a real dataset, additional covariates would include age, sex, socioeconomic status, smoking, alcohol use, physical activity, pre-existing diabetes or hypertension, psychiatric history, medication exposure, and health-care access.

Exactly five proposed participant-experience questions are included for future empirical testing:

- The combined mental and physical health screening was easy for me to understand.
- I felt comfortable discussing emotional and metabolic health during the same screening encounter.
- The screening helped me understand how different aspects of my health may require attention.
- I clearly understood what follow-up was recommended after the screening.
- I would be willing to participate in integrated mental and metabolic health screening again.

Responses could use a five-point scale ranging from strongly disagree to strongly agree. These questions are proposed research items and have not been administered or psychometrically validated. Future use would require expert review, pilot testing, cultural adaptation where necessary, and assessment of reliability and construct validity.

Statistical analysis in an empirical study could use chi-square tests for categorical outcomes and independent-sample procedures or nonparametric alternatives for continuous variables. Logistic regression could estimate the association between integrated screening and successful dual-risk detection or referral completion after adjustment for demographic and clinical characteristics. Where participants are clustered within clinics or communities, multilevel regression or generalized estimating equations would be more appropriate. Sensitivity analyses should examine the influence of screening thresholds and pre-existing diagnoses on estimated intervention effects.

5. Analysis

5.1 Simulated Risk Detection

The simulated integrated pathway identified mental-health risk in 28% of participants compared with 18% in the separate screening pathway. Metabolic risk was identified in 47% and 36%, respectively. Because these percentages were deliberately generated for methodological illustration, they should not be interpreted as epidemiological prevalence. Their purpose is to illustrate how coordinated case finding could affect the proportion of individuals recognized as requiring further assessment.

The most important modeled difference concerns concurrent risk. Nineteen percent of participants in the integrated pathway were classified as having both mental and metabolic indicators compared with 10% in the separate pathway. This difference represents the theoretical mechanism of the intervention: when both domains are evaluated within the same encounter, fewer individuals with overlapping problems are expected to be recognized in only one clinical silo.

The analytical relevance of dual-risk identification is supported by previous literature showing relationships between depression and diabetes, obesity, and metabolic syndrome. Nevertheless, a positive result in both domains would still require separate diagnostic reasoning. Integrated screening identifies coexistence; it does not establish that one condition caused the other.

Table 2: Simulated Outcomes of Integrated Versus Separate Screening

Outcome	Integrated pathway (n = 300)	Separate/usual pathway (n = 300)	Simulated difference
Mental-health risk identified	28%	18%	+10 percentage points
Metabolic risk identified	47%	36%	+11 points
Concurrent mental–metabolic risk identified	19%	10%	+9 points
Participants receiving clear referral recommendation	79%	57%	+22 points
Indicated follow-up completed	68%	44%	+24 points
Participants reporting integrated screening as acceptable	83%	69%	+14 points

Note: All values are synthetic and were generated for methodological demonstration. No real participants were screened and no clinical efficacy is claimed.

5.2 Follow-Up and Care-Pathway Performance

Follow-up completion was modeled at 68% in the integrated pathway compared with 44% in the separate pathway. The simulated 24-percentage-point difference is larger than the difference in initial risk identification. This is intentional because the conceptual model proposes that integration may influence not only whether risk is detected but also whether the person receives one coherent follow-up plan instead of multiple disconnected recommendations.

This interpretation is consistent with collaborative-care evidence showing that coordinated management of depression and chronic medical conditions can improve several disease-management and depression outcomes compared with usual care. Similarly, large-scale team-based primary-care evidence has associated integrated physical and behavioral care with improvements in selected quality indicators. These studies support the organizational concept but do not validate the specific synthetic percentages generated here.

An empirical evaluation should therefore distinguish screening efficiency from clinical effectiveness. Higher identification and follow-up rates would demonstrate improved process performance, whereas improvement in depressive symptoms, glycemic control, blood pressure, lipid levels, quality of life, or cardiovascular outcomes would require longitudinal clinical measurement.

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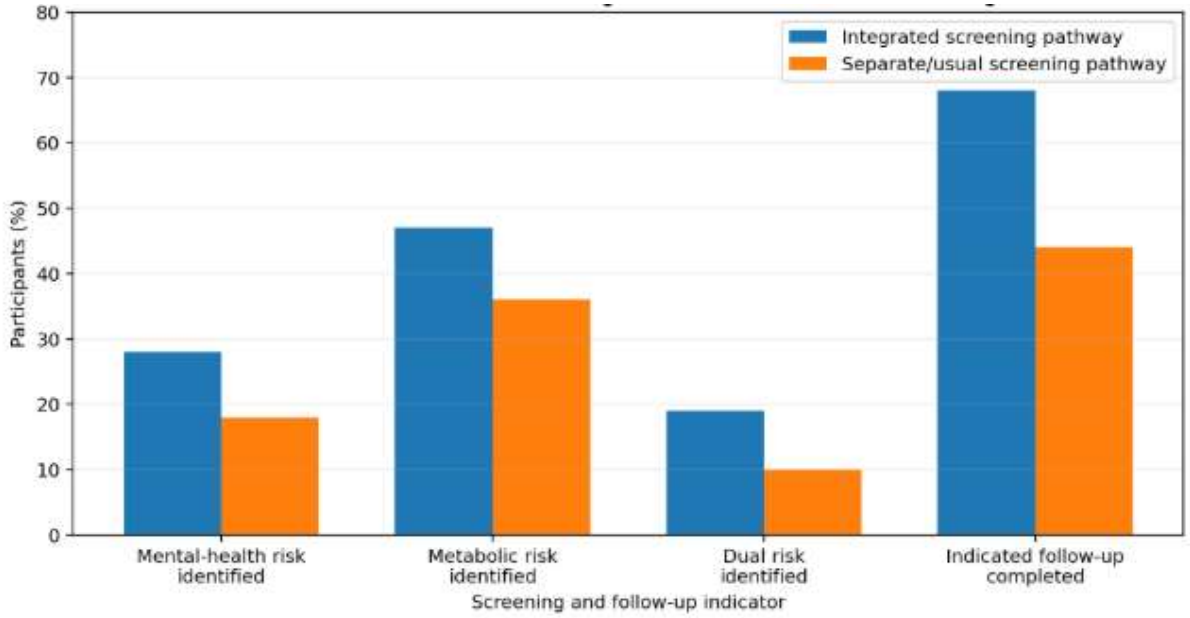
5.3 Comparative Pattern of Integrated Screening

Graph 1: Simulated Performance of Integrated Mental–Metabolic Screening



The graph shows a consistently higher modeled proportion for the integrated pathway across all four indicators. The largest separation appears in completion of indicated follow-up, emphasizing that the conceptual benefit of integration extends beyond simultaneous testing. A coordinated pathway can potentially reduce confusion regarding which service is responsible for the next clinical step.

The comparatively smaller difference in initial risk identification indicates that integrated screening should not be expected to create an unrealistically large increase in disease prevalence. Its more plausible effect is improved detection of overlap and better navigation after a positive result. This distinction prevents the model from conflating the presence of disease with the organization of screening services.

6. Discussion

6.1 Clinical Value of Recognizing Mental–Metabolic Overlap

The central implication of the study is that psychological and metabolic risks should not always be approached as independent clinical phenomena. Depression has documented bidirectional associations with diabetes and metabolic syndrome, while obesity and depression have also been shown to influence one another prospectively. An integrated screening encounter is therefore particularly valuable when the objective is to identify multimorbidity before each condition has independently progressed to a stage that attracts specialist attention.

This does not imply that depression, anxiety, obesity, dysglycemia, or hypertension share a single mechanism. Their relationships may involve physical activity, diet, sleep, socioeconomic stress, inflammation, medication effects, neuroendocrine processes, treatment burden, stigma, and other

pathways. Individual patients will also differ substantially. The purpose of integrated screening is consequently clinical visibility, not etiological simplification.

The model may be especially useful in primary care because it enables a clinician to recognize combinations that require different forms of intervention. A participant with mild psychological distress and elevated metabolic risk may require counseling and preventive follow-up, whereas severe depressive symptoms accompanied by poorly controlled diabetes may require coordinated medical and mental-health management. Integrated case finding can therefore support more appropriate stratification.

6.2 From Screening to Coordinated Preventive Care

The analysis indicates that referral continuity may be as important as screening sensitivity. A fragmented system may accurately identify abnormal blood pressure while failing to address depressive symptoms, or identify psychological distress without reviewing metabolic risks that influence long-term physical health. WHO's guidance concerning physical-health conditions in adults with severe mental disorders highlights the importance of actively recognizing and managing physical comorbidity rather than allowing mental-health services to operate in isolation.

Collaborative-care research provides an important service-delivery precedent. Katon and colleagues demonstrated that coordinated management of depression alongside diabetes and cardiovascular risk factors can be operationalized within clinical care. Reiss-Brennan and colleagues' large observational study similarly showed that integrated team-based care was associated with improvements in several quality measures and reductions in some categories of acute-care utilization.

Integrated screening should therefore be designed backward from available care rather than forward from the availability of screening questionnaires or measurement devices. If a service can detect depression but has no pathway for assessment, treatment, or crisis response, additional screening may simply reveal unmet need. The same principle applies to abnormal glucose, blood pressure, or lipid findings. Ethical screening requires the capacity to explain results and provide a reasonable route to appropriate follow-up.

6.3 Implementation, Equity, and Interpretation of Positive Screens

Implementation should protect privacy and avoid stigmatizing participants. Asking mental-health questions within a metabolic-health encounter can normalize psychological assessment, but it can also create discomfort when confidentiality is inadequate. Screening staff therefore require communication skills, clear consent procedures, private assessment arrangements, and training in managing positive responses. A mental-health screening instrument should never be treated as a substitute for professional assessment when clinically significant symptoms or safety concerns are identified.

Metabolic measurements likewise require technical quality. Blood pressure is affected by measurement conditions, while glucose and lipid interpretation depends on testing method and clinical context. Waist circumference can provide useful information but requires standardized measurement. The internationally harmonized metabolic-syndrome framework demonstrates that metabolic risk is multidimensional rather than reducible to body weight alone. This is important for avoiding an excessively weight-centered screening program.

Equity should be considered at both stages. Integrated screening can reduce the number of separate appointments required, which may benefit people facing transportation, cost, or time barriers, but screening alone cannot correct unequal access to medications, laboratory testing, psychological therapies, healthy food, safe opportunities for physical activity, or specialist services. The model should therefore be evaluated not merely according to the number of positive screens but according to whether participants from different social groups can complete the resulting care pathway.

7. Conclusion

Integrated screening for mental and metabolic health risks represents a clinically plausible approach to preventive care in populations where psychological distress and cardiometabolic vulnerability frequently overlap. The evidence available through 2020 demonstrates meaningful relationships between depression and diabetes, obesity, and metabolic syndrome, while validated brief screening tools make initial mental-health case finding practical within general health services.

The simulation developed in this study illustrates the potential organizational benefits of such integration. Compared with a hypothetical separate screening pathway, the integrated model produced higher simulated identification of mental-health risk, metabolic risk, and particularly concurrent risk. Follow-up completion was modeled at 68% compared with 44% under separate screening. These percentages are not clinical observations and should not be interpreted as evidence that integrated screening will produce the same effect in actual practice.

The principal value of the model lies instead in defining what should be measured in a real implementation study. Screening programs should evaluate dual-risk detection, referral clarity, follow-up completion, patient acceptability, equity, and ultimately clinical outcomes. They should also differentiate an initial positive screen from a confirmed psychiatric or metabolic diagnosis. This distinction is essential for methodological validity and responsible communication.

Integrated screening is therefore best understood as the entrance to coordinated care rather than as an intervention sufficient in itself. When embedded within accessible primary or community health services, supported by validated tools, reliable measurement, trained staff, referral capacity, and patient-centered follow-up, it may reduce the clinical separation between mental and metabolic health. Prospective empirical studies are needed to determine its effectiveness, cost-effectiveness, acceptability, and long-term influence on both psychological and cardiometabolic outcomes.

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