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Susan Magorno

University of San Diego, smagorno@sandiego.edu

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Metabolic Syndrome Screening Among Inpatient Psychiatric Patients

Susan Magorno

Hahn School of Nursing and Health Science University of San Diego

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## Abstract

**Background:** More than 50% of patients with severe mental illness carry undiagnosed Metabolic Syndrome (MetS) comorbidities of hypertension, hyperlipidemia, or diabetes. These patients are three times more likely to die of cardiovascular-related causes; however, this population is not routinely assessed for MetS and frequently lack appropriate treatment.

**Objective:** The objective is to implement a screening tool to designed to identify risk for MetS and trigger appropriate treatment.

**Design:** The screening tool triggers the provider to address positive criteria through interventions such as further evaluation, medical and/or diabetes educator consultations.

**Results:** Although overall rates of screening improved significantly, follow-up interventions were inconsistently addressed by the providers.

**Conclusion:** Life expectancy of psychiatric patients is 25 years less than their non-psychiatric counterparts and although there are many factors that contribute to this incongruity, consistent screening and appropriate treatment of MetS may turn the tide in leveling the playing field.

*Keywords:* metabolic syndrome, cardio-metabolic syndrome, psychiatric, mental health

### Metabolic Syndrome Screening Among Inpatient Psychiatric Patients

Severe mental illness often overshadows other medical diagnoses and literature indicates more than 50% of patients with severe mental illness carry undiagnosed metabolic syndrome comorbidities such as hypertension, hyperlipidemia, and diabetes (Correll, et al., 2017). These patients are three times more likely to die of cardiovascular-related causes; however, this population is not routinely assessed for metabolic syndrome and furthermore, patients with known hypertension, hyperlipidemia, and diabetes in this population frequently lack appropriate treatment. Missed or untreated metabolic syndrome diagnoses are associated with increased length of stay, mortality during hospitalization, and 30-day all-cause readmission rates (Castillo, Rosati, Williams, Pessin, & Lindy, 2015).

The project is predicated on the absence of current screening to identify metabolic syndrome in this high-risk inpatient psychiatric population at a university medical center. To validate the impact of this deficiency, a patient list was derived from the project site's electronic medical record (EMR) from the target adult inpatient psychiatric unit over a two-month period prior to intervention. Fifty-eight patient charts were audited for the presence of lipid levels, blood pressure values, and fasting blood glucose levels. Waist circumference measurements are currently not a standard procedure so no values were present for this measurement in pre-data. Additionally, diagnosis lists were audited for presence of pre-existing metabolic syndrome diagnoses and the medication administration record (MAR) was audited for corresponding presence of treatment. Although the presence of most antipsychotic and mood stabilization medications poses greater risk for metabolic syndrome, screening was designed to target all new admissions regardless of medication treatment, opting for standardization versus specificity.

Of all the risk indicators, blood pressure was the only consistent measurement for all patients at the project site. Blood draws for basic metabolic panels (BMP) were fairly routine so fasting blood glucoses were also highly prevalent though lipid panels were rare despite the lipid panel's ability to be tested on the same blood tube as the BMP. Evaluation of the presence of predictive values in conjunction with corresponding diagnoses and treatments yielded noteworthy results. Pre-data indicates a significant deficiency in diagnosis and treatment of suspected hypertension, hyperlipidemia, and diabetes.

### **Literature Review**

Evidence presented are the results of searches in PubMed, CINAHL Complete, ProQuest Health & Medicine, PsycARTICLES, and PsycINFO using the MeSH terms metabolic syndrome, cardiometabolic syndrome, antipsychotics, psychiatric, and mental health. Literature is presented based on the hierarchy of evidence where Level I is the strongest evidence and Level VII the weakest (O'Mathuna & Fineout-Overholt, 2015).

Bai, et al. (2016) performed a quasi-experiment with 143 patients treated with atypical antipsychotics plus mood stabilizers and atypical antipsychotic monotherapy. These patients were evaluated for the prevalence of metabolic syndrome and found dual therapy led to significantly more adverse patient outcomes in number of hospitalizations, number of psychotic episodes, severity in side effects such as tardive dyskinesia, and global functioning in the presence of metabolic syndrome compared to those with dual therapy without metabolic syndrome. This is a Level III evidence due to its well-designed quasi-experiment without randomization however due to its cross-sectional design, direct correlation is unclear so causal relationship remains in question. Despite this flaw, results do indicate a need for integrated collaborative care for this complex patient type.

Correll, et al. (2017) performed a retrospective data analysis that further supported the above findings by concluding those with bipolar disorder, more frequently treated with dual therapy, had more negative outcomes than those with schizophrenia, which is usually treated with monotherapy in the presence of metabolic syndrome (Level IV). These negative outcomes were significant in 30-day readmission rates, longer lengths of stay, and mortality. This was an exceptionally large study sample of 57,506 patients with schizophrenia and 124,803 patients with bipolar disorder. This study indicated progressively worse outcomes based on the number of metabolic comorbidities present. This retrospective study also provided financial impact based on 2014 dollars. Average costs for a patient treated for schizophrenia or bipolar disorder without metabolic syndrome was \$7126 - \$10,606 however with every one metabolic comorbidity present, an additional \$2000-3000 cost was incurred. Among this sample, over 60% had at least one metabolic comorbidity. Another study supported this outcome and found among 67 patients with bipolar disorder, 53.7% had co-occurring metabolic syndrome (Kumar, et al., 2017) while Castillo, Rosati, Williams, Pessin, & Lindy (2015) found a 52% prevalence among 10,084 psychiatric outpatients with varying diagnoses.

Although most literature available indicates antipsychotics are the primary culprits of increasing metabolic syndrome risk, Kahl, et al. (2017) found that patients with Major Depressive Disorder (MDD) primarily treated with selective serotonin reuptake inhibitors were four times more likely to develop pericardial adipose tissue, which increases prevalence of coronary artery disease (Level IV). Fifty patients were included and split between MDD less than two years and MDD greater than two years. A control group of 25 participants were recruited without any psychiatric disorders. Extensive measurements were collected to account for confounding factors and interestingly, smoking was not a statistically significant impact.

Physical activity, severity of the Beck Depression Inventory, cortisol levels, and tumor necrosis factor- $\alpha$  were statistically significant. Although there were four patients who received an antipsychotic or mood stabilizer for the treatment of their depression, the majority of the patients received a serotonin reuptake inhibitor or some kind. This study supports metabolic syndrome screening for all psychiatric population, not just for those prescribed antipsychotics or mood stabilizers.

While there is a plethora of evidence indicating the value of metabolic syndrome screening, very little was found in the resulting indicated treatments provided and its effects on patient outcomes, which indicates a need for more definitive outcome research for this disadvantaged population.

### **Framework**

The framework for this evidence-based project is the Iowa model. This model is practice-oriented with a focus on improving health outcomes by providing simplistic guidance on evidence use specifically to the practitioner in the acute care setting (Dang, et al., 2015). The question of metabolic syndrome screening and its impact on the inpatient psychiatric population is an acute problem-based question where the practitioner can take direct action. The Iowa model essentially starts with a problem or question (trigger) and builds the step-by-step process in a decision-tree algorithm. The model poses three major questions and offers correlating actions based on the nature of the answers assessed. The first question establishes a shared priority between the implementer and the organization. The second question establishes adequate evidence in literature for the project. Within this segment of the model, the pilot practice change is implemented based on evidence found. The model provides components of the pilot practice change to include outcome selection, baseline data collection, development of

project guidelines, implementation on the designated unit, evaluation of the process and outcomes, and modifications of the guideline based on the evaluation. The third question determines success or failure. If successful, the model continues to the house-wide practice change implementation, monitoring process, and dissemination process. This decision point format allows pertinent questions to drive the project in the appropriate direction and provides a simplistic step-by-step list of actions for each point (Dang, et al., 2015).

Successful implementation of this project is reliant on consistent and persistent education and reinforcement of staff performance. Bandura's Theory of Self Efficacy consists of four elements: successful performance, vicarious experience, verbal persuasion, and emotional arousal (McLeod, 2011). In successful performance, the clinician must experience success in order to develop self-efficacy. In vicarious experience, the clinician can experience success through modeled behavior. In verbal persuasion, the clinician receives encouragement and praise from the coach, peers, or trainer. In emotional arousal, consistent support of the first three elements will continue to support readiness to learn (McLeod, 2011). Extensive education on use of the screening tool as well as this learning theory was taught to primary staff trainers referred as super-users of the target unit. These super-users were trained to model the procedure as well as coach each staff person through the process until proper procedure was demonstrated.

### **Purpose**

Metabolic syndrome criteria require measurements of waist circumference, serum lipid levels, blood pressure, and fasting blood glucose (National Institute of Health, 2016). This project implements a screening tool primarily designed to identify patients at high risk for metabolic syndrome and trigger treatment of positive indicators of hypertension, hyperlipidemia, and

diabetes. A secondary goal is to focus attention to patients with pre-existing metabolic syndrome diagnoses who are not currently receiving treatment.

### **Methods**

The project design encompassed direct-care staff and physician education, utilization of a screening tool, completion of all measurements indicated by the tool, and treatment response based on positive criteria. Education focused on metabolic syndrome and its impact on the inpatient psychiatric population, specifically its physiologic impact and overall impact on patient outcomes. In addition, physicians were educated on the suggested treatment goals based on National Institute of Health's (NIH) recommendations (U.S. Department of Health and Human Services, 2001).

The applied setting is a university teaching hospital with multiple psychiatric units primarily staffed by medical residents rotating through different units every three to six weeks. This model presented challenges with training, making frequent training sessions vital to the project's success. The diagnoses of the target unit are diverse, encompassing primarily depressive and anxiety disorders with suicidal or psychotic features, bipolar disorders, and various psychotic disorders and although the presence of antipsychotics is generally accepted as higher risk for metabolic syndrome, as Kahl et al. (2017) indicated, depressive disorders may have a strong correlation with metabolic syndrome as well. The screening tool was implemented for all new admissions regardless of diagnosis to incur consistency in practice and performance of the screening process. Due to the diversity in diagnoses, the generalizability in this setting is fair.

**Interventions**

The screening tool was developed (see Appendix) using NIH criteria and treatment options to provide a one-page tool for both direct-care staff and physicians to facilitate ease of use (National Institute of Health, 2016). The tool was designed as a checkbox system for quick response in the assessment process. Education sessions were offered twice weekly for one month prior to implementation regarding the evidence for screening and the screening process itself. The target audiences included direct care nursing and psychiatric tech staff and provider staff during beginning-of-shift huddles for direct care staff and case conceptualization huddles for provider staff. Upon implementation of the screening tool, staff were instructed to page this writer to provide assistance and support during the admission and screening process.

**Monitoring.** A primary process indicator was monitoring, guidance, and facilitation three days per week during the two-month intervention phase to ensure appropriate utilization. A second process indicator was weekly monitoring and chart audits for completion of measurements for each patient within 36 hours after admission and appropriate completion of the screening tool. This indicator also monitored for treatment follow-up based on completed screens. This is a crucial indicator due to the prevalence of diagnoses without treatment (Castillo, Rosati, Williams, Pessin, & Lindy, 2015).

**Measures.** Current practice does not actively identify patients at high risk for metabolic syndrome so project outcome indicators included screening for metabolic syndrome risk criteria for 80% of admitted patients and treatment initiation of 50% of positively screened patients. A second outcome indicator is the identification of patients with current diagnoses of metabolic syndrome without current appropriate treatment, which is a discrepancy Zimmerman & Maher (2013) highlights. A third outcome indicator is the delivery of treatment associated with newly

found conditions implicated by the screening tool. Treatment of these conditions lead us to expected long-term outcomes such as decreased length of stay, mortality during hospitalization, and 30-day all-cause readmission rates. Because metabolic anomalies are not often resolved or managed in the acute phase of care, expected long-term outcomes require at least six months to one year to determine effect of risk identification and treatment (Barnes, Bhatti, Adroer R, & Paton, 2015).

Each patient record with a completed screen was evaluated for confirmation of appropriate screening and provision of any missing screening data as well as treatments continued or initiated during the hospital stay. As every patient was subject to screening, there were little ethical concerns related to withholding of assessment or treatment.

### **Results**

For pre-intervention comparison, a list of patients admitted during a two-month period prior to intervention elicited 58 patients. Each patient record was evaluated for results of lipid panel, blood pressure, fasting blood glucose, admitting diagnoses, newly recorded diagnoses during their current stay, and treatments continued or initiated during their stay. The total number of eligible patients during the intervention months was 43 and although 17 screens were lost during the intervention process, a total of 38 screens were at least partially performed, indicating 88% completion of screens for all new admissions, surpassing the 80% completion goal. Of the 21 collected screens, increases in completion percentages were significant across the board with the exception of blood pressure monitoring which remained at 100%.

Table 1

*Percentage of Measurements Completed During Pre-Intervention and Intervention*

	Lipid Panel	BP	FBG	waist
PRE: Adult IP Psych Unit (n=58)	30%	100%	82%	0%
INT: Adult IP Psych Unit (n=21)	71%	100%	100%	38%

*Note:* BP is blood pressure; FBG is fasting blood glucose; waist is waist circumference.

Furthermore, 33% - 62% were screened to be at positive risk for metabolic syndrome compared to 21% in the pre-data collection. The range of percentage is attributed to the missing criteria that may or may not indicate a positive screen. For evaluation purposes, missing waist circumference data with a body mass index  $\geq 25$  was accepted as a positive criterion.

Table 2

*Results of Risk Criteria Screens*

	NO RISK	UTA	POSITIVE RISK
0 Risk Criteria	3	1	0
1 Risk Criteria	2	2	0
2 Risk Criteria	3	3	0
3 Risk Criteria	0	0	3
4 Risk Criteria	0	0	3
5 Risk Criteria	0	0	1
# Criteria Missing	3	10	3
BMI $\geq 25$	2	4	3

*Note:* Assumptions: 1. BMI  $\geq 25$ = POSITIVE criteria for waist circumference; 2. UTA = based on pre-existing and missing criteria, it is possible that either positive or negative result may occur.

Another measure evaluated was the identification of metabolic syndrome diagnoses and its subsequent addition to the problem list. Among hyperlipidemia, hypertension, and diabetes, hyperlipidemia was the most significantly increased from the pre-data collection. Hypertension also increased almost two-fold compared to pre-data collection as well. The identification of

diabetes has challenges inherent to the disease in that it requires multiple abnormal fasting blood glucoses and measurements of HgbA1c to confirm the diagnosis. Because the fasting blood glucose measurement is often singular in a typical admission, it is not surprising that the identification of diabetes is not significant. In both diagnosis identification and treatment delivery, diabetes does not appear to have any significant impact in context of this project.

Table 3  
*Prevalence of Diagnoses and its Subsequent Addition to Problem List*

	PRE-DATA: Corresponding Dx (n=58)	INTERVENTION: Corresponding Dx (n=21)	The final measure evaluated
Hyperlipidemia	11%	50%	
Hypertension	41%	75%	
Diabetes	68%	30%	

was the presence of treatment based on a positive screen for the indicated comorbidity. With the exception of diabetes, both hyperlipidemia and hypertension treatment increased significantly. Treatments for hyperlipidemia and hypertension include anti-hyperlipidemia or antihypertensive medications as well as instructions for lifestyle modifications in activity and/or diet attributed specifically to address hyperlipidemia or hypertension in the problem list. Treatments for diabetes include oral or subcutaneous anti-hyperglycemic medications, instructions for lifestyle modifications in activity and/or diet attributed specifically to address diabetes in the problem list, or diabetes educator consultation during hospitalization.

Table 4  
*Prevalence of Treatment Based on Positive Screening Criteria*

	PRE-DATA: Corresponding Tx (n=58)	INTERVENTION: Corresponding Tx (n=21)
Hyperlipidemia	28%	63%
Hypertension	63%	92%
Diabetes	61%	60%

This project had multiple challenges to overcome in virtually every step of the project progression. The organization was in the midst of transitioning from one electronic medical record system to another so paper screening tools were used for nursing staff to complete at the time of admission. Individual screening tools had distinct identifiers to de-identify data and allow for unbiased review of information, however, despite instructions to notify this writer for additional screening tools, staff photocopied the tool so there were multiple completed screens with the same identifier. Multiple tape measures were provided to staff to ensure waist circumference was measured upon admission, however, loss of the tape measures was a constant challenge despite its single location on the unit. Because of the frequent inability to measure waist circumference, “eye balling” was encouraged about three weeks into the project with an in-service with visual aids to assist in improving accuracy. The admission process can be a chaotic time in context of the patient being acutely distressed. The act of physically measuring waist circumference was often challenging as well so “eye balling” was frequently the only avenue of assessment. Another challenge was the completion of the screening tool itself. Because the information required to indicate risk was often in the electronic medical record, nursing staff did not always pursue the information immediately, rather waiting up to 48 hours post admission if at all, so many completed screens were partial assessments of risk. Communication between nursing staff and providers was also inconsistent and was often met with delayed or assigned low priority leading to poor follow-up. Despite these challenges, virtually every new admission was at least partially screened, however 17 completed screens were lost during the intervention process thus losing about half the intervention data, making the intervention sample 21 versus 43.

### Discussion

There is extensive evidence that screening for metabolic syndrome is essential to address the high rate of complications for the psychiatric population. With the exception of diabetes, screening for the presence and detection of hyperlipidemia and hypertension was followed by increased occurrences of corresponding additions to the problem list and treatments. The intervention phase had its challenges, specifically the loss of more than half the patients actually screened, and because the screens were unavailable for review, there was no way to determine the extent of the screen completion. Anecdotally, staff reported increased awareness of metabolic syndrome and its impact on their patients and often recalled times where they encouraged more outdoor activities or sought out diabetes educators for their patients if the opportunity and ability arose. This quasi-Hawthorne effect may partially account for the increased treatment delivery despite multiple incomplete screenings. As mentioned earlier, diabetes screening continued to be a challenge since the majority of patients received a single fasting blood glucose evaluation and many who had single abnormal initial fasting glucose levels did not have follow-up assessments done.

Screening produced a range of 33%-62% of patients with positive risk for metabolic syndrome, which aligns with Bai, et al's (2016) finding that more than 50% of psychiatric patients have metabolic syndrome comorbidities. Long term evaluation would be necessary to determine the screening's effects on length of stay, readmission rates, and mortality.

Volatility in today's health care market makes it difficult to assess true cost of multi-system conditions such as metabolic syndrome. According to Zimmerman and Mehr (2013), metabolic syndrome increases average cost of healthcare by 60% per year, however, that does not take into account the additional financial impact of concurrent psychiatric diagnoses. The

average non-psychiatric patient will have an increased cost of \$1860 per year but for each additional positive criteria of metabolic syndrome, costs increase by 24% (Zimmerman & Mehr, 2013). For the psychiatric population, Correll, et al. (2017) posits every singular metabolic comorbidity present incurs an additional \$2000-\$3000 per year indicating an average patient with bipolar disorder with three comorbidities could incur a \$19,606 hospital bill per annum, nearly doubling the cost of managing bipolar disorder alone. Initial cost of project implementation was minimal; however, additional time was spent by the direct-care staff to take additional measurements indicated by the screening tool. The tool was designed for ease of use but may potentially take no longer than 30 minutes for measurements and completion of the tool questions. The average RN pay is \$50/hour so each encounter would cost \$25 per patient. Subsequent treatments indicated by the screening tool may vary but daily medication management is a requirement among psychiatric medical staff so no or minimal additional costs were incurred at that stage. With the stipulation that both costs of metabolic syndrome and services rendered by staff are underestimated, it is highly likely that there would still be a net gain per patient per year. The ultimate benefit would be improved patient outcomes and extended life span, which cannot often be projected in dollars.

### **Limitations**

Multiple barriers developed over the course of this project that may have impacted the final results in both under-estimating and over-estimating its effects. Lengths of stay ranged from 2 to 50 days with a mode of 4 days. Shorter lengths of stay may prompt greater focus on the primary psychiatric concern regardless of other existing comorbidities, which essentially is the nature of this project's concern. Utilizing paper screens was an unavoidable barrier that led to a couple issues such as a significant data loss resulting in a sample size less than expected and

inconsistent completion by the user resulting in many incomplete individual screens. Implementation through an electronic medical record would improve generalizability and more comprehensive screening. Another limitation of the screen was the ability to perform waist circumference measurements. The very nature of the rationale for admission for this population is primarily psychiatric distress, which often precludes the ability for staff to take waist circumference measurements without risking their own safety. Within the first three weeks of intervention, instructions were modified to allow for initial “eye-balling” waist circumference as either positive or negative criteria with the stipulation that the measurement be done at a later time. This risk criteria indication was greatly diminished due to the lack of follow-up with only a 38% completion, however, body mass index was later used to assess that criteria with some accuracy. The nature of the provider model at this facility also lent itself to challenges in that the providers rotated every several weeks, requiring frequent education throughout the process. Unfortunately, all providers have individual schedules so rotations ended and began at varying times so education was often provided too late in the process or not at all. Another daunting challenge was that of consistent communication between nursing staff and provider staff. There was no consistent way to ensure information of positive screens was followed up in a timely manner by the physicians and given the length-of-stay mode was 4 days, many possible interventions indicated may have fallen by the wayside in light of impending discharge.

***Conclusions.*** There are a multitude of factors impacting quality and longevity of life among individuals with severe mental illness. One major factor is not only the presence of metabolic syndrome but the lack of screening for its presence and appropriate treatments in situ. A simple screening tool embedded into the existing electronic medical record could consistently identify patients at high risk for metabolic syndrome and focus attention on additional treatment

goals thereby improving delivery of those treatments. Potential next steps would be to design an automatic triggering system within the electronic medical record to notify providers directly of positive screening criteria and allow for repeated reminders to address positive criteria until follow-up was documented. This has the potential to mitigate barriers in screening efficacy and communication barriers between nursing staff originally assigned the screening role and the provider staff awaiting information to implement indicated treatments. Further study in long term effects of enhanced evaluation and treatment of psychiatric patients with risk for metabolic syndrome would be valuable for future implementations of goal setting. Quality provision of care is strongly enhanced with core measure requirements in the medical setting thus further study may be able to contribute to applications of core measure requirements in the psychiatric setting for improved patient outcomes for this disadvantaged population.

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Appendix

Patient Sticker

DATE: \_\_\_\_\_

**Metabolic Syndrome<sup>1</sup> considered positive for MetS if 3 or more risk criteria present**

Measure	Risk Criteria	Positive Criteria
Waist circumference	Men > 40 inches; Women > 35 inches	
Triglycerides	≥ 150 mg/dL	
HDL Cholesterol	Men < 40 mg/dL; Women < 50 mg/dL	
Blood Pressure	≥ 130 / ≥85 mmHg	
Fasting Blood Glucose	≥ 100 mg/dL	

Waist circumference:

- Waist measurement is at the level of the umbilicus
- If patient is uncooperative, visual assessment is acceptable but must be re-attempted when patient is cooperative

Triglycerides/HDL: **Request a new order or an add-on lab if available**

Blood Pressure: Per protocol; two consecutive readings for confirmation

Fasting Blood Glucose: **Request a one-time order or an add-on lab if available**

Does the patient meet **3 or more** risk criteria for MetS?

Yes  No

Does the patient have a history/current use of antipsychotic medications?

Yes  No

Does the patient have a current diagnosis of the following?

- Hypertension
- Hyperlipidemia
- Diabetes

Is the patient currently on any of the treatment below?

- Antihypertensive
- Statin
- Insulin/oral antihyperglycemics

If ANY box has been checked, has the physician been notified?

Yes  No

Physician name \_\_\_\_\_

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