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# *A narrative review of metabolic monitoring of adult prescribed second-generation antipsychotics for severe mental illness*

**Short title: Strategies to enhance metabolic monitoring rate**

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Not applicable

Journal Pre-proof

1 *A narrative review of metabolic monitoring of adult prescribed second-generation*  
2 *antipsychotics for severe mental illness*

3 ABSTRACT

4 *Introduction:* Patients with severe mental illness (SMI) have poor physical wellbeing, leading  
5 essentially shorter lives, compared with the general population. Routine metabolic monitoring  
6 is proposed as a strategy for recognizing risk factors for metabolic variations in this population.  
7 This narrative review aimed to identify interventions at enhancing uptake of metabolic  
8 monitoring parameters in adults prescribed second generation antipsychotics (SGAs) for  
9 patients with Severe Mental Illness.

10 *Method:* A literature search was performed through SCOPUS, PubMed, and CINAHL  
11 databases using a combination of keywords. We included primary studies published in the  
12 English language until December 2021 that provided evidence on interventions to increase the  
13 rate of SGAs related metabolic monitoring in patients with SMI.

14 *Results:* A total of 21 studies were identified among which in 13 studies frequency of metabolic  
15 monitoring ranged between 40 % to 80% after implementation of various strategies. These  
16 include multi-layer intervention model such as: (A) Reminders (e.g., paper-based prompts,  
17 invitation letter); (B) Electronic system of documentation (computer-based intervention,  
18 electronic medical records); (C) Healthcare practitioner specific role (Nurse-led intervention,  
19 pharmacist-led intervention, barrier focused strategies) and (D) Physical-mental health  
20 awareness (Education, quality improvement programme).

21 *Conclusion:* This review provides evidence that studies involving the reminders such as paper  
22 based prompts and education to the patients as well as healthcare professionals could help in  
23 enhancing the rate of metabolic monitoring in patients prescribed SGAs.

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## 33        **1. Introduction**

34    Adverse cardio metabolic outcomes are worrisome in patients with mental illness, due to  
35    different variables, including lifestyle, hereditary predisposition, and medication adverse  
36    effects. Second-generation antipsychotics (SGA) are prescribed to manage number of  
37    psychiatric conditions in severe mental health disorders. SGAs are safer and more preferred  
38    over their first generation predecessors, due to less incidence of extrapyramidal side effects.  
39    However, SGAs use has been related to metabolic sequelae, such as hypertension, weight gain,  
40    diabetes and, dyslipidemia.<sup>1</sup> The prevalence of the metabolic disorder in individuals on SGA  
41    treatment is around 30% or higher, expanding the risk for cardio metabolic syndrome.<sup>2</sup> Youth  
42    are at higher risk than elderly people for weight gain and metabolic variations identified with  
43    antipsychotic treatment.<sup>3</sup> Since metabolic syndrome can rapidly develop to SGAs, the best way  
44    to prevent it is by initial identification through a thorough monitoring plan.<sup>4</sup>

45    Healthcare provider and patient outreach are important for effective metabolic monitoring in  
46    patients prescribed with SGAs. Attempts to extend the patient and provider awareness about  
47    the risk of metabolic syndrome will probably increase rates of referral, thereby improving  
48    patient health. Though published research is scarce, studies have shown that multi-disciplinary  
49    healthcare team involvement with patients taking SGAs improves monitoring rates for  
50    metabolic syndrome.<sup>1</sup> Physical illness is more predominant in patients with mental illness when  
51    compared to the general population. Even though it is because of the modifiable way of lifestyle  
52    risk factors, the screening of physical health remains low in developed nations. The barriers to  
53    the identification and management of physical problems in individuals with severe mental  
54    illness (SMI) includes patient, clinician, treatment, and service-related factors such as financial  
55    issues, lack of access to health care, lack of clarity about responsibility of managing physical  
56    health etc.<sup>5</sup> Stigma related to weight gain hinders non-adherence to undergo physical screening  
57    as a component to metabolic monitoring. Evidence suggests specific role of different

58 pharmacological and non-pharmacological strategies to counteract treatment induced weight  
59 gain.<sup>6</sup>

60 Patients with complex and severe mental health disorders warrant multilayer model of care to  
61 enhance metabolic monitoring.<sup>4</sup> Studies on benefit of metabolic monitoring in promoting  
62 quality use of antipsychotics are required.<sup>7</sup> Present guidance on physical health monitoring for  
63 people with SMI is not supported by any evidence from randomised controlled trials.<sup>8</sup> The  
64 mounting evidence of the risks suggests regular physical health monitoring for early detection  
65 and management of metabolic syndrome.

66 The objective of this narrative review is therefore to present an overview of the literature on  
67 interventions in clinical practice that aim to demonstrate and enhance the rate of metabolic  
68 monitoring in patients suffering from SMI.

## 69 **2. Methodology**

70 A literature search was performed through SCOPUS, PubMed, and CINAHL databases using  
71 a combination of keywords such as “metabolic syndrome”, “antipsychotics”, “severe mental  
72 illness”, “intervention”, “physical health”, “monitoring” to recognize articles dealing with  
73 strategies, chosen by various mental health providers worldwide, to implement monitoring for  
74 physical health improvement in patients with SMI. For the purpose of this narrative review  
75 following definitions and outcome measures were considered:

76 Metabolic Syndrome: SGAs are associated with metabolic complications such as central  
77 obesity, insulin resistance and dyslipidaemia. This collection of symptoms is known as  
78 metabolic syndrome and is diagnosed when a patient has three of the five risk factors; abnormal  
79 waist circumference (WC), triglycerides (TG), high-density lipoproteins (HDL), fasting blood  
80 glucose (FBS) and high blood pressure (BP).<sup>9</sup>

81 Frequency of metabolic monitoring/screening among adults prescribed SGAs: According to  
82 American Diabetic Association/ American Psychiatric Association (ADA/APA) guidelines,  
83 weight should be monitored at 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> month after starting SGAs and quarterly  
84 thereafter. FBS, lipid levels and BP should be checked 3 months after the initiation of these  
85 drugs. Thereafter, BP and glucose levels should be monitored annually, whereas, in the patients  
86 with abnormal lipid levels, testing should be done once in 5 years thereafter.<sup>10</sup>

87 Since the release of these guidelines, steps have been taken to increase the monitoring of these  
88 laboratory values. In this review we focused to look for improvement in metabolic parameters  
89 such as FBS, BP, lipids and WC before and after intervention. Among the studies with best  
90 reported monitoring rates lower cut off has been taken as the best practice. Monitoring rates  
91 above 70 % were considered good practice.<sup>9,11</sup>

### 92 *2.1. Eligibility criteria*

93 We included primary studies published in the English language until December 2021 that  
94 provided evidence on interventions to increase the rate of SGAs related metabolic monitoring  
95 in patients with SMI aged 15 years and above. The main outcome of interest was the rate of  
96 metabolic monitoring undertaken before and after the intervention. Relevant reviews were also  
97 retrieved for other appropriate studies through snowball search technique.

98 Exclusion criteria were review articles, research articles with no full text, patients below 15  
99 years of age group and lack of information on rate of SGA related metabolic monitoring.

## 100 **3. Findings**

### 101 *3.1. Electronic system of documentation*

102 Electronic prompts like computer-based intervention helped in providing alert services for  
103 documentation of metabolic parameters or when the monitoring was due. Four studies<sup>2,12,13,14</sup>  
104 in USA and UK implemented computer-based intervention for providing alert services or

105 documentation of metabolic parameters such as either computerized system with pop-up alert  
106 for metabolic screening or a metabolic screening bundle template in the electronic medical  
107 records. DelMonte *et al.*, conducted a retrospective chart audit to evaluate the impact of a  
108 computerized-based alert to increase the monitoring for metabolic parameters in patients  
109 treated with SGAs. The authors evaluated the number of requests for suitable metabolic  
110 monitoring rate for patients admitted in six months span pre and post alert implementation. The  
111 alert reminded the clinicians to request fasting lipid and glucose levels. After alert  
112 implementation, the number of patients with FBS and lipid panel monitoring improved from  
113 12.9 % to 47.8 %. The rates of overall monitoring for these parameters were inferior, suggesting  
114 a need for the use of supplementary strategies to further enhance metabolic monitoring for  
115 patients on these drugs.<sup>2</sup>

116 A quality improvement intervention was conducted Wiechers *et al.*, to assess the impact of  
117 metabolic screening bundle on metabolic syndrome screening rates in the psychiatry resident  
118 OP clinic. The main components of the intervention were focus groups, education to the  
119 residents, and the development of a metabolic screening bundle template in electronic medical  
120 records. Following the intervention, documentation rates of the metabolic screening bundle  
121 components increased between 3.5- and 10-fold (31 %). BP was the least documented  
122 component at the start and end of the study. This may be related to many barriers to  
123 implementation such as lack of proper-sized cuffs for larger patients, the limited availability of  
124 blood-pressure cuffs, and provider discomfort with physical contact with patients.<sup>12</sup>

125 A cross- sectional retrospective study conducted by Yeomans D *et al.*, to assess the physical  
126 health monitoring quality of all registered SMI patients in the Bradford and Airedale area of  
127 UK by the standards suggested by The National Institute for Health and Care Excellence  
128 (NICE). The authors developed and implemented a computer-based screening template to help  
129 in the standard yearly physical health examination for SMI patients. This template was used by



130 75% of GP practices and was related to good quality screening than standard care, increasing  
131 the detection of cardiovascular risk.<sup>13</sup>

132 A randomized controlled trial was conducted by Kreyenbuhl *et al.*, in US to check whether  
133 computerized intervention that educated patients with SMI about the side effects of  
134 antipsychotics and motivated them to support for receipt of monitoring would enhance rates of  
135 monitoring when compared to enhanced treatment as usual(ETAU) group. ETAU group was  
136 provided with printed educational pamphlet about metabolic side effects and the recommended  
137 frequency of monitoring. When compared with the computer program, this printed pamphlet  
138 did not provide personalized information on their monitoring status or metabolic monitoring  
139 test results. No significant difference was seen in the mean proportion of days adherent to  
140 monitoring guidelines between the 2 treatment groups. Participants in the intervention group  
141 were interested in getting personalized information about their cardiometabolic status and were  
142 responsive to such interventions.<sup>14</sup>

143 The findings of these above-mentioned studies indicate that, computerised based tool can help  
144 the health care teams to carry out higher-quality physical health monitoring and identify more  
145 patients at risk of early metabolic syndrome and cardiovascular death. Implementation and use  
146 of the above-mentioned approaches were found to increase the metabolic screening rates in  
147 individuals with SMI and provides alert services to the psychiatrists when monitoring was due.

### 148 *3.2.Measures for ease in accessibility to monitoring for practitioners and patients*

149 Two studies<sup>15,16</sup> were conducted in UK to explore whether an invitation letter providing an  
150 appointment with a specified date and time for patients as well as General Practitioners (GP)  
151 would be effective in increasing the attendance of patients with SMI to attend a primary care  
152 health check.

153 A retrospective audit was conducted by in UK to compare the response rate of patients with  
154 SMI and diabetes where the authors adopted an invitation appointment letter to prompt the  
155 patients with SMI to attend a physical health check. The study found that around 70 % of the  
156 patients with SMI visited the health check on the date and time mentioned in the invitation  
157 letter. There was no information on the rate of monitoring.<sup>15</sup>

158 An audit cycle in UK was completed on patients with SMI under the consideration of an early  
159 intervention in psychosis (EIP)service to assess and improve physical health monitoring.  
160 Letters were sent for GPs reminding them to conduct physical health checks, interventions  
161 included increasing awareness within the multidisciplinary EIP mental health group regarding  
162 the significance of physical health monitoring of patients with SMI and contact with primary  
163 care health services. The patients who underwent at least once yearly physical health check  
164 improved from 20% to 58%.<sup>16</sup>

165 The response rate was higher in the invitation letter provide to the patients as this letter provided  
166 details about predetermined date and time who would be doing the health check rather than  
167 appointment with an unnamed person. Similar response was also observed when the reminders  
168 were provided to the GPs regarding physical monitoring.

### 169 *3.3.Paper-based reminders*

170 Prompts such as paper based were incorporated into routine clinical practice to improve the  
171 memory and attention of healthcare providers for monitoring in 6 interventions.<sup>17,18,19,20,21,22</sup>

172 A retrospective audit was conducted in UK to improve the monitoring for physical health of  
173 outpatients on antipsychotic medications. The strategy incorporated the introduction of  
174 information locally, 3 meetings with local consultants and 2 brief educational talks to junior  
175 doctors. A basic local adaptation of clinical guidelines was designed, and a tool for monitoring  
176 was executed. This tool was an A4 page filed in the patients' records, which was designed both

177 as a reminder to doctors regarding the need for the physical monitoring of patients and as a tool  
178 to aid in the data collection. Following which, baseline FBS tests improved from 40.5 % in the  
179 first audit to 81.1% in the second audit and baseline lipid tests from 7.1% to 52.8%.<sup>17</sup>

180 A quality improvement project was conducted in US to improve the screening for metabolic  
181 syndrome in patients on antipsychotic drugs. Around 100 patient charts were reviewed pre and  
182 post intervention to check whether the metabolic syndrome was carried out. The intervention  
183 included the provision of paper based monitoring and screening tool to the mental health care  
184 providers. The ordering of lab tests in the post-intervention (62 %) was found to be greater than  
185 in the pre-intervention (22%). Blood tests ordered for fasting glucose levels and lipid panel  
186 increased from 32 % in the pre-intervention to 88 % in the post-intervention.<sup>18</sup> Kioko *et al.*,  
187 recommend options such as automatic reminders for monitoring which will remind the  
188 physicians when the lab tests are scheduled. They also recommend follow up calls to the  
189 patients to remind them of undergoing metabolic monitoring and integration of mental health  
190 services with primary care services.<sup>18</sup>

191 An audit was conducted in Australia to assess the frequency of documentation of waist  
192 circumference pre and post intervention. The intervention included education to the  
193 participating nurse on the significance of WC measurement for 20 min and also space for WC  
194 measurement was added to the patient's files. At baseline, there was no documentation of WC,  
195 which improved to 58% and 42% at the 3-month and 9-month follow-up respectively.<sup>19</sup>

196 Vasudev *et al.*, conducted an audit in UK to check the usefulness of maintaining a physical  
197 health monitoring sheet for placed in the patients' records on a forensic psychiatric  
198 rehabilitation unit for a period of 12 months. Audit after a year, these sheets were adopted in  
199 all the patients' records. The cardiovascular risk over the next 10 years decreased over time but  
200 no significant change was observed on central obesity, BMI, BP, and smoking.<sup>20</sup>

201 A project was conducted by in USA showed that the introduction of cardiovascular disease  
202 (CVD) screening tool increased the frequency of CVD screenings and communication with  
203 primary care providers through letters which could result in significant process improvement  
204 in the practices of psychiatric providers. The organization significantly increased its rate of  
205 CVD screening and almost doubled the rate of communicating screening results to primary  
206 care. Specifically, TGs were recorded 32.3% of the time in the first chart review and 63.1% of  
207 the time in the second chart review, HDL from 31.5% to 62.3%, WC from 3.8% to 56.9%, BP  
208 from 52.3 % to 82.3% and FBS was documented in 40% of charts at the time of first chart  
209 review and 70% at second chart review.<sup>21</sup>

210 A quality improvement initiative was conducted in a community mental health facility to  
211 enhance the frequency of metabolic monitoring parameters for patients SGAs. The intervention  
212 involved developing a metabolic monitoring tool and uploading it to the electronic medical  
213 record for the practitioner to view during the consultation in order to help with lab test orders.  
214 The ADA/APA guidelines were used to construct the metabolic monitoring tool, which  
215 included an annual assessment of individual and family diagnosis of diabetes and CVD,  
216 assessment of BMI, WC, BP, FBS and fasting lipids. An 8-week chart review was done for two  
217 prescribers at 2 clinics (Clinic A as intervention site and Clinic B as comparison site) within  
218 the mental health agency. After implementation of the tool, metabolic monitoring parameters  
219 increased from 1 to 59 at 8 weeks' post-implementation for Clinic A.<sup>22</sup>

220 The results of these studies show that the use of the paper based monitoring tool improved the  
221 rate of metabolic monitoring in patients on antipsychotic medications.

222 *3.4.Barrier focused strategies*

223 Some studies analysed the barrier against effective monitoring and based on the responses,  
224 strategies were developed. For example, lack of monitoring equipment's in clinic rooms, are  
225 also one of the barriers to monitoring.

226 Pena *et al.*, conducted a quality improvement initiative to enhance the baseline monitoring rates  
227 for metabolic syndrome in patients on SGAs by executing strategies to overcome the identified  
228 monitoring obstacles and approaching the metabolic syndrome monitoring clinic. Appropriate  
229 tools such as provision of more stable and higher weight limit machine, tape measures for  
230 obtaining WC to improve monitoring, a computerized consult which included the recent  
231 monitoring parameters was incorporated into the SGA ordering menu of the electronic health  
232 record .Also pamphlets which included information on metabolic syndrome, the risks  
233 associated and methods to decrease it was provided to the patients and presentations were  
234 provided to the mental health providers on the need for monitoring and the monitoring  
235 parameters. Information about free transportation was provided to patients. Around 37.5%  
236 improvement in overall referral rates to the monitoring clinic was observed following an  
237 intervention. The monitoring of BP increased from 28% to 40 % and weight increased from 26  
238 % to 62% after intervention but a decrease in fasting blood sugar and fasting lipid levels.<sup>1</sup>

239 An audit based quality improvement programme(QIP) was conducted by Barnes *et al.*, in UK.  
240 Poster with normal ranges for test results of metabolic syndrome parameters, lifestyle  
241 management pack for providers and patients and reminder card for physical health check were  
242 given to the patients. The audit showed a statistically significant improvement over 6 years in  
243 the proportion of patients with all the aspects of the metabolic syndrome documented in the  
244 clinical records from 1 in 10 patients in 2006 to 1 in 3 by 2012. The proportion of patients with  
245 no evidence of any screening also decreased.<sup>23</sup>

246 A study was conducted by Hor *et al.*, among 300 outpatients on antipsychotic drugs in a general  
247 hospital setting where baseline file audit was conducted to check the frequency of metabolic  
248 monitoring. A new local protocol on monitoring frequencies was designed, and a re-audit was  
249 conducted after implementation, in a small sample of patients. Focus group discussion was also  
250 conducted to explore the staff perspectives, 6 months post-implementation. Re-audit after the  
251 implementation of the new protocol showed increased monitoring but persisting deficits. Focus  
252 group discussion showed positive perceptions of the initiative, but persisting implementation  
253 barriers, and local religious issues with respect to WC measurement. These findings support  
254 previous literature which recommends that effective metabolic monitoring of patients  
255 prescribed with antipsychotic drugs requires communication with clinicians, in order to  
256 identify and overcome multiple local service-related and cultural barriers to implementation.<sup>24</sup>

257 Thompson *et al.*, carried out an audit to examine if a focused intervention will increase  
258 monitoring in a first episode psychosis clinic in Australia. A review of both rates of metabolic  
259 screening and specific monitoring of weight and metabolic parameters was conducted before  
260 the intervention and after starting the antipsychotic drugs. The interventions included barrier  
261 analysis, development of local guideline, provision of monitoring equipment, educational  
262 intervention such as seminars highlighting the long-term effects of metabolic disturbance and  
263 in young patients taking SGAs, paper-based monitoring sheet prompts were placed in every  
264 patients' file. The audit was repeated after 18 months, following an intervention based on  
265 barriers analysis to perform monitoring within the clinic. Significant improvements of 81.4 %  
266 and 39.5 % were seen in the screening and the monitoring of metabolic parameters respectively  
267 after starting antipsychotics. Improvements (29.3%) were also observed in the number of active  
268 interventions provided to patients by clinicians.<sup>25</sup>

269 A randomized control trial was conducted by Druss *et al.*, to enhance primary medical care in  
270 community mental health settings. Patients with SMI were randomized into two groups either

271 care management or standard care at an urban community mental health center. The care  
272 coordinators offered communication and advocacy with medical providers, health training for  
273 patients, and assistance in dealing with system-level fragmentation and obstacles to primary  
274 health care. Follow-up after a year demonstrated that, the intervention group obtained an  
275 average of 58.7% of preventive services assessing the quality of primary care, when compared  
276 to 21.8% in the standard care group and significantly greater extent of indicated services for  
277 cardiometabolic problems (34.9% vs. 27.7%,  $p=0.03$ ), and more probable to have a primary  
278 care provider (71.2% vs. 51.9%,  $p=0.003$ ).<sup>26</sup>

279 Metabolic syndrome monitoring clinic, pharmacist inputs, and patient, dedicated resources and  
280 providing awareness about the importance of metabolic monitoring is crucial to increase the  
281 monitoring rates.<sup>1,27</sup>

### 282 *3.5. Nurse-led intervention*

283 Nurse-led intervention adopted by two studies<sup>11,28</sup> were found to be effective, increasing in the  
284 number of people with SMI obtaining screening for cardiovascular risk.

285 A quality improvement initiative included nurse-led intervention which involved upskilling of  
286 nurses to ensure the patients undergo monitoring, education to the staff about the importance  
287 of metabolic monitoring, introduction of some interventions like monitoring of ward diet, close  
288 relationship with endocrinology department, and consumer involvement like explaining about  
289 the monitoring, performing activities like walking, yoga, exercise games, etc. A statistically  
290 significant increase was seen in monitoring rates of lipids 23 to 69.5 %, BP from 88.5 % to 100  
291 %, glucose from 74% to 82.5%, BMI from 33 % to 63 %, and waist circumference from 44.2  
292 % to 65.2 % post-intervention.<sup>11</sup>

293 A nurse- led intervention was conducted by Osborn *et al.*, in community mental health teams.  
294 The intervention group included communication with primary and secondary care to prompt

295 them to provide screening for CVD and the unscreened patients were screened by nurse plus  
296 education on screening for CVD risks. The usual treatment group was provided with only an  
297 education pack which included information on CVD, its risk factors and appropriate screening.  
298 Following the trial, screening for CVD had improved in both the groups but the intervention  
299 group received screening significantly more for BP (96% vs 68%; cholesterol (66.7% vs 26.9  
300 %), glucose (66.7% vs 36.5%), BMI (92.5% vs 65.2%), and smoking status (88.2% vs 57.8%)  
301 and have a 10 year CVD risk score.<sup>28</sup>

302 Rosenbaum et al. found that a file-based reminder had a positive impact on rates of nurse-  
303 assessed waist circumference measurement in patients with SMI.<sup>19</sup>

304 There is a requirement not only to develop education for nurses and other healthcare providers  
305 to provide physical health checks for people with SMI, but it is also important to demonstrate  
306 that providing this education will enhance patient outcomes. Despite promising statistics on  
307 the role of mental health nurses in physical health monitoring, nurses continue to lack proper  
308 training, which is a barrier to achieving optimal physical health results.<sup>19</sup>

### 309 *3.6. Pharmacist led intervention*

310 Despite scarcity of published data, studies have found that pharmacist participation with  
311 patients using SGAs increases monitoring rates for metabolic parameters.

312 A pharmacist-led metabolic syndrome monitoring clinic (MSMC) was available to  
313 outpatients in mental health which was underutilised by providers. The goal of this research  
314 was to improve the baseline metabolic syndrome monitoring rates in patients on SGAs by  
315 developing interventions such as monitoring tools, awareness in form of pamphlets, free  
316 transportation to address monitoring and hurdles in accessing MSMC. About 24 patients  
317 were referred to the clinic over the 4-month period previous to the intervention's  
318 implementation. Following the intervention, 33 patients were referred to the clinic over the



319 4-month period, representing a 37.5 percent increase in total referral rates. Surveys from  
320 the mental health providers showed significant benefit from the MHMC.<sup>1</sup>

321 In another study, the authors evaluated the effect of a computerised physician order entry  
322 (CPOE) pop-up alert aimed to improve rates of laboratory metabolic monitoring of patients  
323 treated with SGAs in an inpatient psychiatry unit within a 6-month period before and after  
324 the implementation. A clinical psychiatric pharmacist had been reminding prescribers  
325 about the need for metabolic monitoring with SGAs on a regular basis. To facilitate  
326 systematic reminders, the clinical psychiatric pharmacist collaborated with information  
327 technology to develop a new pop-up alert following the introduction of CPOE. The major  
328 goals of the CPOE pop-up alert were to alert prescribers placing an SGA order to assess  
329 the requirement for metabolic monitoring and to enable ordering necessary labs easier by  
330 allowing them to do so straight from the pop-up window. Significant increases in  
331 monitoring both random and fasting glucose levels, as well as random and fasting lipid  
332 panels, were reported after the warning was implemented.<sup>2</sup>

### 333 *3.7. Education based intervention*

334 Educating mental health providers about the importance of monitoring for metabolic syndrome  
335 in patients taking SGAs will help to prevent problems associated with use of SGAs and enhance  
336 the patient's outcome. The type of education provided to health care providers differed in  
337 studies ranging from half day interactive workshops, PowerPoint presentations or metabolic  
338 guidelines poster.

339 A quality improvement intervention was conducted by Wiechers *et al.*, where one of the core  
340 components of the intervention included resident education. Three 1-hour educational sessions  
341 were conducted for approximately 45 residents to review antipsychotic drug-associated  
342 metabolic issues, and residents were provided with literature on the current standards and

343 practice guidelines. Following the intervention rates of documenting the full metabolic  
344 screening bundle improved around 31 %.<sup>12</sup>

345 An audit cycle in UK was completed on patients with SMI under the consideration of an early  
346 intervention in psychosis (EIP) service to assess and improve physical health monitoring. A  
347 half-day interactive workshop , participated by all members of the team, to see the importance  
348 of physical health monitoring in the patient group. A significant improvement was seen in the  
349 physical health monitoring of patients from 20% to 58 % under the care of the EIP service.  
350 This can be due to the improvement in awareness among the multidisciplinary staff of the EIP  
351 team regarding the importance of physical health in patients with SMI which may have led to  
352 the staff prioritising the physical health of their patients and encouraging them to book and  
353 attend appointments with their GP.<sup>16</sup>

354 A study conducted in Australia provided a brief educational intervention of around 20 min  
355 regarding the importance of waist circumference measurement, cut off values, how to measure  
356 a patient's WC with less physical contact was delivered to the participating nursing staff by an  
357 exercise physiologist following which the documentation of WC increased from 0 % to 42  
358 %. The results of the study indicate that providing short educational intervention and file-based  
359 reminder can have a lasting effect on clinical practice.<sup>19</sup>

360 A quality improvement initiative in Australia where education was provided to staff, after  
361 identifying the unawareness of the staffs about guidelines regarding the importance of  
362 metabolic monitoring provided in regular orientation to junior medical officers, both through  
363 PowerPoint given to the registrars as well as part of the discussion which took place with the  
364 more-junior resident medical officers who started every 10–12 weeks. These orientations  
365 included the importance of metabolic monitoring, tests to be done, and some alternatives for  
366 pharmacological and non-pharmacological treatment. Nursing staff was educated through

367 nursing in-services, involving a similar presentation with more information on the performance  
368 of the actual measurements. Metabolic guidelines posters were also put up on the ward for the  
369 ease of access for all staff. One of the limitations of this was, no formal assessment of the  
370 quality of education was done. A statistically significant increase was seen in monitoring rates  
371 of lipids 23 to 69.5 %, BP from 88.5 % to 100 %, glucose from 74% to 82.5%, BMI from 33  
372 % to 63 %, and waist circumference from 44.2 % to 65.2 % post-intervention.<sup>11</sup>

373 Viglione et al conducted a study to determine the rates of metabolic monitoring in patients on  
374 antipsychotic drugs in a psychiatric inpatient setting, as well as the impact that education can  
375 have on monitoring compliance. Pre-education and post education audits to educate the mental  
376 health staffs on the need for metabolic monitoring were conducted. Monitoring rates for BMI,  
377 WC, BP, FBS and lipid profile were compared pre and post audit. The educational campaign's  
378 content included results of the pre-education audit, identification of basic standards from the  
379 guidelines and clinical significance of metabolic monitoring from the literature. Consultants,  
380 registrars, resident medical officers, allied health personnel, and nurses were among the mental  
381 health practitioners who received education. Plasma glucose monitoring rates improved from  
382 21.7 percent to 78.8 percent (p 0.01), while plasma lipid monitoring rates improved from 20.8  
383 percent to 73.7 percent (p 0.01). BMI (83.0 percent and 77.1 percent, respectively), WC (36.8  
384 percent and 43.2 percent, respectively), and BP (99.1 percent and 100 percent, respectively).  
385 monitoring rates did not show statistically significantly difference.<sup>29</sup>

386 A pilot study was conducted to see how effective a practical resource (Let's Get Physical-  
387 Improved Physical Health in Mental Health Services-A Practical Toolkit) was in assisting the  
388 practitioners in managing metabolic syndrome. The research looked into practitioners'  
389 knowledge and attitudes, confidence in screening and intervening in metabolic syndrome and  
390 improving their documentation. This Toolkit was implemented into the pilot site through a  
391 variety of tactics, including face-to-face and video education focused at increasing knowledge

392 of the toolkit. The first video serves as an introduction to the toolkit, while the second video  
393 educates viewers on metabolic syndrome, need of screening and intervention. Components of  
394 metabolic monitoring improved from 5% to 80% at 3<sup>rd</sup> month follow-up. The nursing team's  
395 assessments increased from 35% to 80% at the 3-month follow-up. The metabolic monitoring  
396 pathology rate by the medical officer increased from 5% to 55–75% of patients.<sup>30</sup>

397 However, Osborn concluded that a nurse-led intervention in UK along with the education pack  
398 has far more impact on rates of screening than an education pack alone.<sup>28</sup> Results of Maki et al  
399 clearly showed the importance of education and consensual goals to ease the process  
400 improvement.<sup>21</sup>

#### 401 4. **Implications**

402 This narrative review focused on strategies to aimed at enhancing the rate of metabolic  
403 monitoring in patients taking SGAs. The most common interventions were electronic  
404 based/paper-based prompts along with education. Studies showed increase in pre and post  
405 intervention monitoring from 40 to 80 % respectively. Despite the awareness of the metabolic  
406 side effects of antipsychotic drugs among the psychiatrists, widespread adoption of the  
407 guidelines is still lacking. Very few patients prescribed with SGAs are screened according to  
408 best-practice recommendations.<sup>12</sup> Various strategies have been used to disseminate and execute  
409 guidelines into clinical practice. The literature in this area does not recommend a single  
410 intervention as most useful but highlights the significance of using multifaceted interventions  
411 targeting practitioners, consumers and their carers, decision makers that are driven theoretically  
412 and specific to the setting. The importance of recognising and addressing particular barriers  
413 and enablers for behaviour change is very important. Based on the barriers identified through  
414 interviewing the targeted population, a multifaceted intervention where initial pilot feasibility

415 trial could be extended for randomisation studies to implement routine monitoring should be  
416 developed.

417 Frequent audits of the current practice, incorporating monitoring tool within the patient files,  
418 sufficient education programmes for the health care professionals, adequate communication  
419 with primary care, allowing for multidisciplinary health care team involvement can improve  
420 physical health monitoring among outpatients.

421 In majority of the studies, a paper based or electronic prompts for metabolic monitoring have  
422 used targeting healthcare providers which has been known to influence their behaviour. In this  
423 review in most of the studies, a paper prompt to document metabolic monitoring was added  
424 into patients' charts which served as a clinical reminder for monitoring in accordance with  
425 guidelines as well as a sheet for recording result and showed better responses compared to  
426 computerized system of documentation. Electronic prompts for monitoring within an electronic  
427 medical record (EMR) providing alert services for documentation of metabolic parameters or  
428 when monitoring was due. The practices that obtained the assistance of the computerized  
429 physical health check template were limited (4 studies<sup>2,12,13,14</sup>) and hence could not provide  
430 proper evidence on enhancing the uptake of monitoring when compared to paper-based  
431 prompts.<sup>13</sup> Due to the studies lacking randomized controlled trials, it cannot be ruled out if the  
432 change was not simply an effect of time, additional research is required to evaluate the impact  
433 of electronic pop-up alert on the clinical decision-making process and patient health outcomes.<sup>2</sup>  
434 Due to the revolution in technology and era of pandemic, presently computerized health check  
435 is getting more importance and easier to manage the documentation process. However due to  
436 lack of studies not able to provide enough insight regarding its utilization on physical health  
437 monitoring, studies available in the literature supports paper based prompts. The limitation of  
438 paper-based prompt in the literature was the inability to capture undocumented results or results  
439 documented places other than psychiatry notes, patients did not remember to get blood testing

440 done after the physician ordered it, despite follow-up calls.<sup>12,18</sup> However, proper RCTs  
441 comparing the paper based and electronic system of documentation along with training to the  
442 healthcare professionals and education to the patients will provide clear insight.

443 The intervention that targeted patients included patient education on metabolic syndrome in  
444 the form of pamphlets, invitation letter for physical health checks, lifestyle management pack,  
445 patient involvements in monitoring, physical activities. The studies that support the inclusion  
446 of nurse-assessed/pharmacist led intervention can help in the routine screening of metabolic  
447 parameters and showed that a short educational intervention to the healthcare professionals and  
448 file-based reminder can have a good significance on clinical practice. The main barriers raised  
449 by the nurses in obtaining waist circumference are patient refusal and minimization of physical  
450 contact.<sup>19</sup>

451 Key barriers identified to the implementation of physical health monitoring among  
452 psychiatrists include unclear responsibilities, time constraints lack of protocols about  
453 monitoring, lack of reminders and knowledge on monitoring, limited resources to perform  
454 monitoring.<sup>11,17</sup>

## 455 5. Conclusion

456 Metabolic monitoring rates for SGA remain suboptimal, suggesting a need for site- and region-  
457 specific strategies to promote safe use of these medications and to minimise treatment related  
458 adverse effects. Researchers need to think about how strategies may function when planning  
459 and implementing them to target this population in the most suitable setting. Behaviour-change  
460 strategies to decrease recognized barriers of patient and health professional resistance from  
461 screening in this population are needed. Lack of resources, clarity over professional  
462 responsibilities and good coordination with primary care should be taken care. Additionally, it  
463 is important that abnormal results must be sufficiently managed when identified, either by the

464 psychiatry group or by working in a joint effort with primary care providers. Through improved  
465 observing, suitable management, and communication of abnormal results to outpatient  
466 suppliers, psychiatrists and pharmacists can assume a key job in the management of metabolic  
467 abnormalities. This review provides evidence that studies involving the strategies such as paper  
468 based prompts and education to the patients as well as healthcare professionals could help in  
469 enhancing the rate of metabolic monitoring in patients prescribed SGAs.

#### 470 **Declaration of Interest**

471 All authors report no conflicts of interest to declare. The listed authors are solely responsible  
472 for the originality and content of the manuscript. The authors have no relevant affiliations or  
473 financial involvement with any organization or entity with a financial interest in or financial  
474 conflict with the subject matter or materials discussed in the manuscript.

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## Tables

**Table 1** Studies included in this review.

Author	Year	Country	Target Population	Interventions	Results
Barnes et al <sup>23</sup>	2015	UK	Patients prescribed antipsychotic medications under the care of assertive outreach community psychiatric service	An audit-based Quality improvement programme, poster with normal ranges for test results metabolic syndrome parameters, lifestyle management pack for providers and patients; physical health check reminder card given for patients	There was a statistically significant increase in the proportion of patients with all 4 aspects of the metabolic syndrome test result documented from 11 % to 34 %.
Bomboy KT et al <sup>22</sup>	2021	USA	Patients prescribed SGAs in rural community mental health centre	Metabolic monitoring tool development and uploading it to the Electronic medical record	Statistically significant association was observed with Clinic A (only one lab was ordered during the pre-implementation vs 59 lab orders during post-implementation)
DelMonte et al <sup>2</sup>	2012	USA	Adult psychiatry inpatients aged 18 years, prescribed with SGA	Computer-based pop-up alert was developed to increase metabolic monitoring in patients treated with SGA	Following implementation significantly increased rates of monitoring fasting blood sugar and lipid levels 12.9 % to 47.8 %) for inpatients on SGAs.
Druss et al <sup>26</sup>	2010	U.S	Patients with SMI aged 18 years and older at an urban community mental health settings	RCT-Health education to patients, care coordinator worked as an advocate and a supporter with medical suppliers, overcoming barriers to primary medical care and system-level barriers	Follow-up after a year, the group receiving intervention obtained an average of 58.7% of preventive aids, whereas the standard care group obtained 21.8% and a significantly greater quantity of evidence-based services for cardiometabolic problems.
Gonzalez et al <sup>17</sup>	2010	UK	Outpatients on antipsychotics	Retrospective audit, presentation of data locally. Basic local modification of clinical guidelines was designed, and a tool for monitoring was implemented	Pre intervention audit (FBS and lipid -40.5% & 7.1 %), Post intervention audit (FBS 81.1 % & lipids 52.8 %)
Hardy S and Gray R <sup>15</sup>	2012	UK	Patients with SMI and diabetes	A retrospective audit to compare the response rate of patients with SMI and diabetes to an appointment letter for attending a primary care health examination	66% of SMI and. 81% diabetic patients visited the health check up on the date specified in the letter. Attendance rates were lower in patients with SMI.
Hor et al <sup>24</sup>	2015	Malaysia	Psychiatric outpatients aged 18-65 years prescribed with antipsychotics for atleast 1 year	Baseline file audit, new local protocol, Focus group discussion	Re-audit after the implementation of the new protocol showed improvement but still monitoring of all parameters remains sub-optimal.
Kioko et al <sup>18</sup>	2016	US	Outpatients on SGAs aged 19 years and above	Metabolic Syndrome screening and monitoring tool	Ordering of lab tests in the post-intervention (62 %) was greater compared to pre- intervention (22%)
Kreyenbuhl et al <sup>14</sup>	2017	US	Outpatient veteran-participants 18 to 70 years of age, diagnosed with a psychotic disorder on SGAs	RCT- Computerized patient-centered intervention	No significant difference in the proportion of days adherent to monitoring guidelines between 2 treatment groups.
Maki M and Bjorklund P <sup>21</sup>	2013	USA	SMI patients from community mental health center	Educational workshop and CVD screening tool	TGs were recorded 32.3% in the first chart review and 63.1% in the second chart review, HDL from 31.5% to 62.3%, WC from 3.8%

					to 56.9%, BP from 52.3 % to 82.3% and FBS was documented in 40% of charts at the time of first chart review and 70% at second chart review.
Michael S, MacDonald K <sup>11</sup>	2020	Australia	Inpatient psychiatric patients	Nurse-led intervention, education to staff, patient involvement	A statistically significant increase was seen in monitoring rates of lipids 23% to 69.5 %, BP from 88.5 % to 100 %, glucose from 74% to 82.5%, BMI from 33 % to 63 %, and waist circumference from 44.2 % to 65.2 % post-intervention.
Osborn et al <sup>28</sup>	2010	UK	Severe mental illness community mental health team patients	Nurse-led screening programme and education about screening for cardiovascular risk	Following the trial, screening for CVD had improved in both arms but the intervention arm received screening significantly more for blood pressure (96% vs 68%); cholesterol (66.7% vs 26.9), glucose (66.7% vs 36.5%), BMI (92.5% vs 65.2%), and smoking status (88.2% vs 57.8%).
Pena A et al <sup>1</sup>	2018	U.S	Patients taking SGAs in the outpatient mental health clinic	Pharmacist led metabolic syndrome monitoring clinic, appropriate tools to improve monitoring. A presentation and pamphlet were designed to increase awareness for providers and patients, free transportation information was provided to the patients.	Around 37.5% improvement in overall rates of referral to the metabolic syndrome clinic was seen post intervention. The monitoring of BP (26% to 62%) and weight (28% to 40%) increased after intervention.
Porter C & Aggar C <sup>30</sup>	2021	Australia	Patients aged above 18 years with SMI accessing regional mental health inpatient unit	The Let's Get Physical-Improved Physical Health Care in Mental Health Services-A Practical Toolkit for the Clinicians	Monitoring for metabolic parameters improved from 5% to 80% at 3 <sup>rd</sup> month follow-up
Rosenbaum et al <sup>19</sup>	2014	Australia	Inpatient mental health consumers	File audit, educational intervention to nurse, waist circumference (WC) measurement added to forms within patient files	Improved monitoring of waist circumference from 0 % at baseline to 58 % at 3 months and 42 % at 9 months follow up.
Thompson et al <sup>25</sup>	2011	Australia	Patients with First episode psychosis taking antipsychotics	Barrier analysis, development of local guideline, provision of monitoring equipment, educational intervention such as seminars, prompts	Significant improvements of 81.4 % and 39.5 % were seen in the screening and the monitoring of metabolic parameters respectively after starting antipsychotics.
Vasudev K et al <sup>16</sup>	2012	UK	Severe mental illness patients	A sheet for physical health monitoring was placed in the patients' files	At re-audit after a year, the sheets for physical health monitoring were up to date in all of the files
Vasudev K et al <sup>20</sup>	2010	UK	Severe mental illness patients under the care of early intervention psychosis service	Baseline and re-audit involved increasing attention within the multidisciplinary EIP mental health team regarding the significance of monitoring and liaison with primary care health services.	The patients undergoing physical health checks at least once annually increased from 20% to 58%.
Viglione L and Short BL <sup>29</sup>	2020	Australia	Patients prescribed antipsychotic medications in the psychiatric inpatient setting	Education campaign for mental health clinicians	Rates of monitoring for lipids increased from 21.7% to 78.8% (p < 0.01) and for plasma glucose from 20.8% to 73.7% (p < 0.01)

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Wiechers et al <sup>12</sup>	2012	USA	Patients being prescribed antipsychotic medications of an outpatient psychiatry resident clinic	Quality improvement intervention: residents focus group and education , metabolic screening bundle for electronic medical records	Following the intervention, documentation rates of the metabolic screening bundle components increased between 3.5- and 10-fold. Rates of documenting the full bundle improved nearly 30-fold.
Yeomans et al <sup>13</sup>	2014	UK	SMI patients	Computer-based template for the primary care information system to assist a standard yearly physical health examination for patients with SMI.	The template was used by 75% of GP practices and resulted in greater quality screening than the standard treatment, increasing twofold the detection of cardiovascular risk.

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Journal Pre-proof