Table 1: Tools to facilitate screening

Study	Year	Country	Population Studied	Intervention	Screening			Method(s) applied	Results	Main study weaknesses
					Type of screening (targeted or with multiple parameters)	When, how and where in the care pathway was screening offered	Screening health professional(s) and type of service			
Bressington et al28	2014	Hong Kong	148 community based psychiatric service users	Training for community psychiatric nurses on how to use the HIP and how to conduct the required physical examinations	The Health improvement screening tool (HIP) contains 27 gender specific items designed to highlight indicators of physical health risk in people with SMI. Items are divided into four categories: measurements, blood tests, screening and lifestyle	The HIP was used as a screening tool at baseline and repeated at 12 months follow-up during routine clinical practice	Community psychiatric nurses trained to use the HIP in a community mental health clinic in Hong Kong	Consecutive prospective case series design Pre-post evaluation of structured questionnaire as a screening tool for physical health problems	Significant improvement in self-reported levels of exercise and reduced prescriptions for mean waist circumference increased at follow-up but may be due to measurement error (87.32 to 89.90) Lack of deterioration in most areas of cardiovascular risk (BMI mean: 25.79 to 25.66, weight	No randomization, no control group Selection bias

									mean: 66.76 to 66.49) Reduction in medicines prescribed for physical health problems: diabetes medication (p = 0.04) and prescriptions for hypertension reduced at follow-up from 21% to 14% of patients General improvements in health behaviours over the 12 month period: 7% increase in number of patients eating sufficient fruit and vegetables, but only exercise improved to a statistically	

									significant level (p = 0.02)	
Castillo et al[33]	2015	USA	141 community based assertive outreach service users	Systematic screening protocol for MS and educational sessions for staff and service users	Metabolic syndrome screening (waist circumference, blood pressure, fasting blood glucose, triglycerides, and high density lipoprotein cholesterol)	Blood tests were ordered for metabolic monitoring when clinicians prescribed scheduled second generation antipsychotics (SGAs) to their inpatients. During routine clinical practice, patient waist circumference was measured and blood pressure was measured using the standard	Nurses and psychiatrists working in three Assertive Community Treatment (ACT) teams in New York. ACT social workers and case managers facilitated patient screenings as needed by scheduling and accompanying patients to appointments, arranging transportation and liaising with primary care providers and blood test clinics	Quality Improvement	75 (53%) participants met criteria for MS Five of these diagnoses came from use of adapted diagnostic criteria using random glucose measurements Of the 66 participants who did not have MS, only 9 had no metabolic risk factors 34 met 2 criteria and the remaining 23 met 1 criterion for MS	No randomization, no control group

						size adult blood pressure cuff available at each ACT site. Measurements were typically conducted in patients' homes				
Delmonte et al[47]	2012	USA	Service users on SGAs on a general psychiatric inpatient unit – 171 at pre alert and 157 post alert. Patients receiving SGAs on an as-needed basis only were excluded	Use of computerized electronic patient alerts to enhance metabolic monitoring	Metabolic monitoring (fasting blood glucose and lipid). Patient weight, blood pressure, information regarding family history and waist circumference were not collected as part of this study	Prescribers entering an SGA order assess the need for metabolic monitoring, and facilitate ordering of appropriate blood tests directly via the electronic pop-up alert	Clinicians prescribing scheduled SGAs at a University Hospital inpatient psychiatry unit in Michigan	Retrospective chart review of notes and tests ordered to assess for MS Pre-post study design	Significant difference in availability of metabolic monitoring data post intervention: 12.9% to 47.8% in number of service users with both fasting glucose level & fasting lipid panel	No randomization, no control group Open to time bias

Gonzalez et al[34]	2010	UK	Male and female community based service users taking regular antipsychotic medication Inner city London population First audit N=126 Second audit N=106 No significant difference in demographic details of both samples	Local adaptation of clinical guidelines Implementation of monitoring tool: A4 page filed in the patients' records, both as a prompt to doctors regarding their patients' need for the physical monitoring and as an instrument to facilitate later data collection	Blood tests for patients taking first-generation antipsychotics (full blood count, urea and electrolytes, liver function test, thyroid function test, glycosylated haemoglobin, prolactin, glucose and lipids)	Routine blood testing ordered by psychiatrist every six months for patients on first generation antipsychotics	Psychiatrists in an inner city London borough community mental health centre	Retrospective audit of patients' clinical records for physical health monitoring Systematic randomization by selecting every 4th file in alphabetical order until 25% of caseload was selected	Post intervention: significant improvement in all tests (glucose: 24.6% to 72.6%, lipids: 7.1% to 52.8%, liver function: 38.9% to 79.2%) except HbA1c (3.2 to 5.7%) and Prolactin (0.8% to 0) Implementation of the monitoring tool achieved in 48% of re-audit sample	No randomization, no control group Did not include other measure for detection of MS and did not include ECG Limited time between audits to allow embedding of the intervention Other factors may have resulted in improvements seen due to increased awareness within the service due to local policy and national guidelines or other potential factors
Hardy et al[35]	2014	UK	400 community based service	Two-hour training for practice nurses to	Screening for cardiovascular (CVD) risk factors (blood	Screening for CVD risk factors were	Practice nurses in five primary care centres in Northampton	Repeat audit to monitor how well primary care	Training practice nurses on CVD prevention	No randomization, no control group

			users with SMI	increase level of screening for cardiovascular disease (CVD) risk factors with lifestyle counselling (health check includes seven elements)	pressure, body mass index (or waist circumference), blood glucose, serum cholesterol, diet advice, exercise recommendations and smoking cessation guidance)	carried out by practice nurses as part of their routine clinical role		practitioners are screening people with SMI for CVD following training	increased number of service users receiving wide ranging health check Pre-training: *n* = 33, 8% Post-training: *n* = 60, 15%, *p* = .01 Increase in number of service users receiving lifestyle interventions	Unclear why other 26 primary care centres did not participate Did not look at any other factor (e.g. other training, professional development, targets by the organisation) which could have influenced staff Possible Hawthorne effect and no exploration of whether increased screening improves patient outcomes
Kioko et al[32]	2016	USA	100 notes of community mental health service users aged	Recommended MS monitoring and screening tool to improve	Metabolic syndrome screening (blood pressure, weight, height, lipid panel,	During routine consultation at the clinic with patients on SGA, blood	Mental health clinicians in a local community mental health	Pre-post intervention design to evaluate the effectiveness of using a recommende	Percentage of blood tests ordered were 62% post-intervention compared to	No randomization, no control group Difficulty obtaining waist circumference - parameter

			19 years and above on second generation antipsychotics	identification of patients at risk of MS	fasting glucose and/or glycated hemoglobin parameters)	tests were ordered and vital signs obtained and the results recorded in the patient electronic health system	facility in a southwestern state	d MS monitoring and screening tool to improve identification of MS risk for service users	22% pre-intervention	frequently omitted Lack of agreement over who is responsible for ordering blood tests and following up results Small sample size - difficult to generalize results
Shuel et al[36]	2010	UK	31 community based psychiatric service users 9 Mental Health Nurses 4 Psychiatrists 12 GPs	Paper sheet screening instrument (HIP)	The Health improvement screening tool (HIP) contains 27 gender specific items designed to highlight indicators of physical health risk in people with SMI. Items are divided into four categories: measurements, blood tests,	The HIP was filled out during a consultation with patients on antipsychotics who were invited to attend an outpatient medication management clinic at the hospital	Mental health nurses trained to use the HIP in a nurse-led outpatient medication management clinic, for community adult patients with serious mental illness in Scotland	Retrospective audit of patient and clinician views using semi-structured interviews	Thirty-one patients participated in Audit Mean number of parameters per patient requiring intervention was 6.1 and a total of 189 physical health issues were identified At least one physical health issue was identified per patient	No randomization, no control group One-year FU assessment planned to assess changes in modifiable factors identified by the HIP

					screening and lifestyle				High prevalence of obesity, poor diet (41% of patients) and lack of exercise 14 referrals for potentially serious conditions including raised glucose and lipids, hypertension and cardiac problems	
Vasudev et al[37]	2012	UK	15 male inpatients on a medium secure forensic psychiatric rehab unit diagnosed with SMI and on antipsychotics	Introduction of a physical health monitoring sheet by the Trust to prompt staff to do the checks	Physical health monitoring (weight, BMI, waist circumference, BP, results of blood tests and ECG, diabetic status if suffering from cardiovascular disease, smoking status, calculated	Six-monthly physical health monitoring of all patients in a secure long stay psychiatric unit	The key nurse took responsibility for completing the section on weight, BMI, waist circumference, BP and smoking status while the rest of the information was completed by the junior	Pre-post audit of physical health monitoring (twelve months apart)	At re-audit 100% of service users had up to date records on the physical health monitoring sheet At follow-up increased number of service users prescribed hypolipidaemic agents Significant	No randomization, no control group Small male-only sample Type of ward and environment could influence patient engagement and motivation

					cardiovascular risk over the next ten years, and use of alcohol in units per week)		doctor in a male medium secure forensic psychiatric rehabilitation unit		reduction in CVD risk at follow up	
Wiechers et al[38]	2012	USA	206 adult service users of a psychiatric resident outpatient clinic who were prescribed any antipsychotics	Metabolic Screening Bundle template Three one-hour education sessions conducted to review antipsychotic medication-associated metabolic abnormalities	Metabolic syndrome screening (blood pressure, BMI, glucose and lipid panel)	Documentation in the last 12 months of any individual element of the Metabolic Screening Bundle (blood pressure, BMI, glucose and lipid panel) for patients on antipsychotic medication	Psychiatry residents in an academic medical centre outpatient psychiatry clinic	Audits of the Electronic Medical Record completed at baseline and each quarter for the following year Quality Improvement	Rates component parts of the Metabolic Screening Bundle in the preceding 12 months increased from baseline audit through the Quarter 4 audit: BMI 5% to 44%; BP 4% to 39%; Fasting glucose 15% to 55%; Fasting lipid panel 14% to 55%	No randomization, no control group Chart audit unable to capture undocumented results/results documented other than psychiatry notes that may have been reviewed by the resident but not remarked on in the progress-note Unclear whether gains made with intervention and cohort of residents can be sustained without a dedicated group

										of residents championing change
Yeomans et al[39]	2014	UK	335 service users on the primary care SMI register	GP practices received 30-minute staff training on how to use a computerized physical screening template designed for annual health checks	Physical health review (systolic blood pressure, BMI, high-density lipoprotein: cholesterol ratio, smoking status)	Annual physical health review performed in primary care during annual check up	GPs performed the review in primary care in the Bradford and Airedale region	Retrospective evaluation of computerized template designed for annual physical health check	23% service users with a computerized template review had data rich QRisk2 compared QRisk2 scores above 20% seen in 3.9% of template based reviews Use of template increased detection risk for CVD	No randomization, no control group Method dependent on accurate record keeping and clinician behaviour No record of unrecorded activity taking place which would contribute to annual patient review GPs selected patients for review: possible bias acknowledged but considered unlikely Quality and Outcomes Framework incentive for annual health checks removed

										and replaced by CQUIN.