NSW TAG

Report of the multi-site quality improvement study using the National Quality Use of Medicines Mental Health Indicator 7.4:

Percentage of patients taking antipsychotic medicines who receive appropriate monitoring for the development of metabolic side effects.

NSW HREC Reference No: LNR/15/SVH/468

September 2022

NSW Therapeutic Advisory Group Inc.

Advancing quality use of medicines in NSW

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Disclosure
The development of this report was funded by NSW Health.

Suggested citation
NSW Therapeutic Advisory Group. *Report of the multi-site quality improvement study using the National Quality Use of Medicines Mental Health Indicator 7.4*. Sydney, NSW TAG, 2022.

This document is available on the NSW Therapeutic Advisory Group website at www.nswtag.org.au.

ISBN 978-0-6480174-7-9 (Online)

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List of abbreviations, acronyms, terms and definitions

Abbreviation/acronym/term	Definition
ACSQHC	Australian Commission on Safety and Quality in Health Care
AP	Antipsychotic
"Appropriate monitoring"	All of the following parameters are measured and recorded: • waist circumference* • blood pressure • fasting lipids (including triglycerides and HDL cholesterol) • fasting blood glucose (or HbA1c in patients with pre-existing diabetes mellitus) * waist circumference is the recommended measure for adults. In adolescent and paediatric patients, weight or BMI is acceptable.
BMI	Body mass index: weight (kilograms) divided by height (metres) squared
Cerner PowerChart®	Cerner brand of Electronic Medical Record system
EMM	Electronic Medication Management
eMR	Electronic Medical Record
HREC	Human Research Ethics Committee
LAG	Local Advisory Group
MRN	Medical Record Number, assigned to a patient by a hospital/facility
NQUM indicator	National quality use of medicines indicator
NSW TAG	New South Wales Therapeutic Advisory Group
"Patients taking antipsychotic medicines"	Defined as those patients admitted to an inpatient mental health bed for greater than 72 hours taking one or more regular antipsychotic medicine by any route for any indication. See also Appendix 1
QI	Quality improvement
QUM	Quality use of medicines
SG	Steering Group
SSA	Site specific assessment
TAG Mail	A NSW TAG newsletter distributed weekly via email to NSW TAG members and others across Australia interested in medicines/therapeutics; its purpose is to assist members identify and share relevant information for their professional practice.

EXECUTIVE SUMMARY

Antipsychotic medicines are the mainstay of schizophrenia treatment. Their use increases the risk of weight gain, diabetes, high blood pressure and high cholesterol and contributes to early development of cardiovascular disease (CVD) and premature mortality. Regular monitoring for these adverse effects is recognised as an important component of care that should result in the early detection and treatment of these complications.

The National Quality Use of Medicines (NQUM) Indicator 7.4: *Percentage of patients taking antipsychotic medicines who receive appropriate monitoring for the development of metabolic side effects,* provides a means by which hospitals can evaluate provision of metabolic monitoring to hospital inpatients prescribed regular antipsychotic medicines. Field-testing of the indicator during the pre-publication 2013 indicator validation study suggested poor adherence to metabolic monitoring. As a result, in 2016, the NSW Therapeutic Advisory Group (TAG) embarked on a multi-site project guided by an interdisciplinary project expert Steering Group.

The aims of the project were to:

1. investigate the baseline adherence to best practice guidance regarding monitoring of metabolic parameters in patients occupying an inpatient mental health bed (for 72 hours or longer) who are taking regular antipsychotic medicines by any route for any indication and the subsequent impact of any interventions, feedback, and education on changes to adherence,
2. investigate the subsequent impact of any interventions on changes to guidance adherence; and,
3. familiarise Australian clinicians caring for mental health patients with the NQUM indicators and the methodologies used to measure clinical performance, develop and implement quality improvement (QI) strategies and evaluate the success of QI interventions in clinical settings.

A mixed methods multi-site study with a quality improvement framework using a pre-post design with four phases was conducted. The 4 phases comprised 1) a baseline audit and feedback of results; 2) development and implementation of interventions, which varied across participating sites but could include: feedback of audit results; multidisciplinary teamwork and collaboration; electronic solutions; changes in service delivery; normalisation of recommended practice; and addressing gaps in knowledge; 3) a post-intervention audit and feedback of results to evaluate changes to indicator adherence; and, 4) follow up semi-structured interviews to identify intervention challenges and effectiveness.

This project was co-ordinated by NSW TAG and led by an interdisciplinary project expert Steering Group. Members of the NQUM Indicator 7.4 NSW TAG Project Expert Steering Group are provided on page 66 of this report.

Results & discussion

Adherence to best practice metabolic monitoring using the NQUM Indicator 7.4 demonstrated median indicator adherence of 11% (IQR=13%) at baseline (n=17) and 8% (IQR=46%) post-intervention (n=8). The clinical services assessed the barriers and enablers to baseline adherence and developed interventions to implement at their clinical services. Interventions were categorised and included:

- Feedback of audit results,
- Establishment/improvement of multidisciplinary teamwork and collaboration,
- Electronic solutions,
- Changes to service delivery,
- Normalising recommended practice, and
- Targeting gaps in knowledge.

Despite implementation of multifaceted interventions to improve the rates of metabolic monitoring, only four of the eight clinical services demonstrated improved overall adherence to metabolic

monitoring in the post-intervention phase. Due to competing priorities, nine clinical services were unable participate in post-baseline activities.

Perceived barriers and enablers to implementing chosen interventions and impacting intervention effectiveness revealed the importance of the following factors: health service organisation culture, climate, and service delivery; human resources; and the need for defining and standardising practices and prompts that influence metabolic monitoring.

This report describes the challenges and gaps identified in performing appropriate metabolic monitoring and provides strategies for quality improvement proposed by front-line clinicians involved in the study. The following recommendations to improve and prioritise the physical health of patients taking antipsychotics to reduce unjustified variation in care include:

- Routine real-time metabolic monitoring for individual mental health care patients in HSOs; (ideally via automated data collection using electronic medical records.)
- Prioritisation of activities that address the low metabolic monitoring rates using a quality improvement framework. Within this framework there is a need for:
    - Strategic leadership and commitment from the executive level for the appropriate resources, protected time or funding arrangements to support improvement strategies and activities for metabolic monitoring and metabolic syndrome;
    - Allocation of designated roles to lead and facilitate the improvement process;
    - Embedded models of care that will ensure sustainability of interventions including champion succession planning, automated audit using eMR and feedback, dashboard display of performance, and inclusion in orientation and ward-based training programs;
    - Promoting, conducting and repeating educational campaigns at relevant time periods or cycles.[1]
    - Development and/or update of targeted learning modules which address system-wide and individual patient-based strategies that promote metabolic monitoring and consider mandating during orientation to mental health clinical services.
    - HSOs to ensure that the correct equipment is available for clinicians to undertake physical health checks and that metabolic parameter measurements are included in admission forms, follow-up and discharge documentation to ensure continuity of care during transitions between services.
- Liaise with eMR programs for facilitation of strategies such as pathology documentation improvements, electronic decision support tools, electronic prompts, dashboard presentation of indicator adherence and ongoing performance.[2]
- Ideally, all treating team clinicians should ensure that metabolic monitoring is conducted. If clinicians are not themselves in a position to undertake metabolic monitoring, they are still responsible for ensuring that it is done, and ensuring appropriate referral.

Additionally, the following would also assist improvement in quality use of medicines in the acute mental health care sector:

- Consider convening multidisciplinary local networks to progress measurement and innovations related to NQUM Indicators 7.1-7.5. The findings of Phases 2 and 4 of this project will inform the work of these groups and any supporting networks of these groups.
- Partner with professional bodies such as universities and specialty colleges to ensure that postgraduate education and continuing professional development for clinicians working in mental health includes modern competency based teaching on psychopharmacology and the physical health risks faced by people with schizophrenia.[3]
- Consider implementing or adapting for local use the "Lester UK Adaptation: Positive Cardiometabolic Health Resource: an intervention framework for patients with psychosis and schizophrenia (2014 update)"[4]

- Partner with Government to conduct ongoing national quality improvement study that involves primary care and implementation science principles.[3,5]

In summary, adherence to the recommended metabolic monitoring set of parameters remained low in this study despite implementation of a variety of interventions by several clinical services. Importantly, multidimensional challenges to appropriate metabolic monitoring were identified ranging from local individual practices, to the level of human resources and health service organisation culture. For the broader diffusion of healthcare innovations and strategies as proposed by several of the clinical services in this study, the acute mental health care sector requires greater maturity of systems, sustained resources and the collective efforts of clinicians, managers, and health executives. A greater prioritisation of activities that should be core services within the safety and quality culture and environment of mental health services is required.

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INTRODUCTION

Antipsychotic medicines are the mainstay of schizophrenia treatment.[6] They are also important in the management of bipolar mania, unipolar and bipolar depression and have extensive off-label use. Their use however increases the risk of developing the metabolic syndrome, a set of collective and closely related cardiovascular risk factors, the key components of which are visceral obesity, dyslipidaemia, hyperglycaemia and hypertension.[7] The metabolic syndrome is more prevalent in patients with schizophrenia than in population controls and is a predictor for the early development of cardiovascular disease and type 2 diabetes mellitus.[8,9] CVD is a major cause of excessive mortality and premature death in people with schizophrenia.[10] The causes of the metabolic syndrome and increased cardiovascular risk in patients with schizophrenia are complex. Apart from antipsychotic use, schizophrenia is itself is a risk factor and those affected are more likely to exhibit risky lifestyle behaviours such as smoking and inadequate exercise. The general medical needs of these patients are often overlooked.[8,11]

Regular monitoring for the metabolic syndrome in patients taking antipsychotics is recognised as an important component of the overall care of these patients that should result in the early detection and treatment of these complications and therefore impact on a major cause of excessive morbidity, mortality and premature death.[12] Guidelines recommend monitoring of metabolic parameters at baseline and every three to six months throughout antipsychotic treatment.[11,13,14] However, a number of barriers to the recognition and diagnosis of the syndrome have been described,[8] resulting in the metabolic complications of antipsychotic therapy being neglected.

The NQUM Indicators for Australian Hospitals 2014 (https://www.nswtag.org.au/qum-indicators/) is a series of sets of process indicators developed for use by health professionals in Australian hospitals. They are designed to measure the safety and quality of medicines use, direct health care practice and drive quality improvement (QI). All indicators are field tested and evaluated for validity, measurability, clarity, usefulness and comparability. Collaboration between NSW TAG and the Australian Commission on Safety and Quality in Health Care (ACSQHC) led to the 2014 update of the original QUM Indicators[15] and the addition of seven new indicators, five of which focussed on QUM issues in acute mental health care. The NQUM Indicators provide specifications for each indicator and are accompanied with guidance for using the indicators based on QI methodology. Data collection tools (DCTs) also accompany each indicator. Until the 2014 release of the NQUM Indicators[15], there was a paucity of validated indicators to measure quality use of medicines in acute mental health care in Australian hospitals.
The 5 NQUM Indicators for acute mental health care are[15]:

- 7.1 Percentage of as required (PRN) psychotropic medication orders with documented indication, dose (or dose range), frequency and maximum daily dose specified
- 7.2 Percentage of patients taking lithium who receive appropriate monitoring during their inpatient episode
- 7.3 Percentage of patients who receive written and verbal information on regular psychotropic medicines initiated during their admission
- 7.4 Percentage of patients taking antipsychotic medicines who receive appropriate monitoring for the development of metabolic side effects
- 7.5 Percentage of patients prescribed two or more regular antipsychotic medicines at hospital discharge.

NSW TAG is committed to promoting uptake of the NQUM Indicators and assisting Australian health care professionals gain the knowledge and skills to undertake QI projects using the NQUM Indicators and their associated data tools.

In response to member requests from the NSW TAG community, a multi-site study of one of the mental health NQUM Indicators was proposed. The NQUM Indicator 7.4: *Percentage of patients taking antipsychotic medicines who receive appropriate monitoring for the development of metabolic side effects* was chosen. NQUM Indicator 7.4 measures the effectiveness of processes for ensuring adherence with best practice recommendations for monitoring of metabolic adverse effects occurring as a result of antipsychotic use. The indicator specifications as well as DCT are located in Appendix 1 and Appendix 2 respectively. This indicator had been field-tested by four Australian hospitals prior to publication of the NQUM Indicators in 2014. Adherence to recommended best practice metabolic monitoring (as specified by the NQUM Indicator) during the pre-publication field-testing ranged from 0-12.5%, with a mean adherence of only 4%, indicating an alarming low rate of adherence to such a significant health issue.[16]

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AIMS

The aims of the project were to:

- investigate pre-intervention adherence to best practice guidance regarding monitoring of metabolic parameters in patients who are taking regular antipsychotic medicines;
- investigate the subsequent impact of any interventions on changes to indicator adherence; and,
- familiarise Australian clinicians caring for mental health patients with the NQUM Indicators, and the methodologies used to measure clinical performance, develop and implement QI strategies and evaluate the success of QI interventions in clinical settings.

See also Figure 1 for the project outline.

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STUDY DESIGN

The study used a mixed methods multi-site quality improvement framework using a pre-post design with four phases as described below and in Figure 1.

Phase 1: Pre-intervention baseline audit using NQUM Indicator 7.4 and results feedback**.**
Phase 2: Intervention**.** The development and implementation of locally determined multi-faceted QI interventions.
Phase 3: Post-intervention audit. A re-audit after a locally determined time period deemed reasonable enough to allow for changes of practice and adoption of potentially new management strategies (determined by the Local Advisory Group and the Expert Steering Group (a minimum 2 month Phase 2 period suggested). The same sampling, data collection and feedback methodologies as used in Phase 1 were used.
Phase 4: Follow-up semi-structured interviews with the participating sites principal investigators (PIs) of the Phase 3 sites to identify improvement strategies that were implemented at each local site, their effectiveness and challenges to their implementation.

Following Phase 4, it was up to the individual facilities to determine whether they continue to measure the indicator and undertake further quality improvement activities.

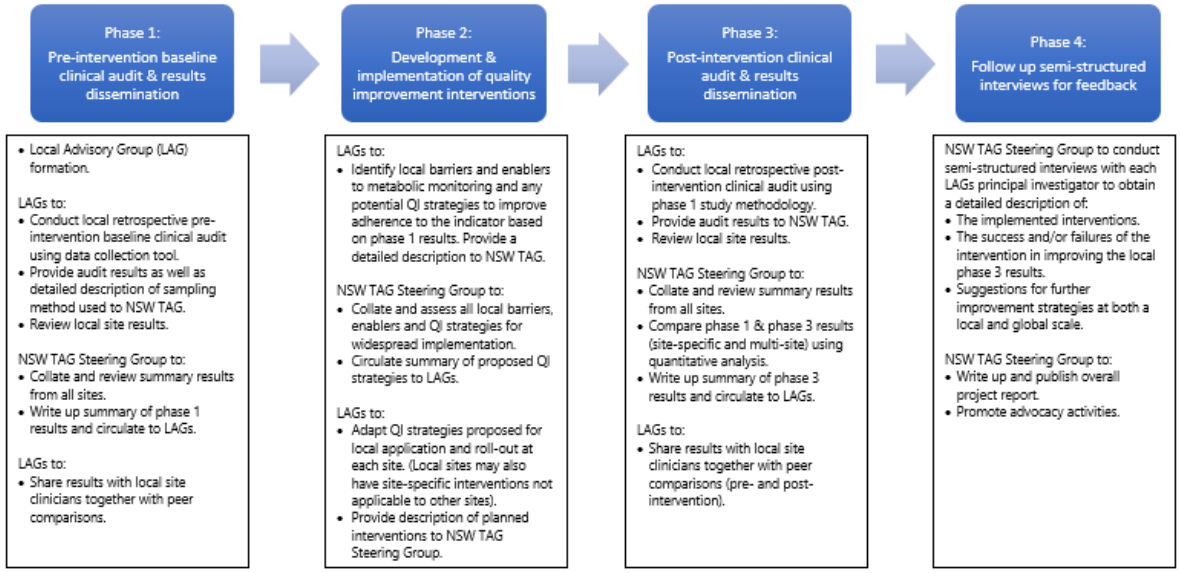

Figure 1 Project outline

NSW TAG Expert Steering Group

NSW TAG established an interdisciplinary expert Steering Group (SG) to oversee and provide advice regarding the project. The SG was composed of psychiatrists, mental health pharmacists and registered nurses practicing in NSW, and three members of the NSW TAG secretariat (two Quality Use of Medicines (QUM) project officers and the Executive Officer), see page 66.
The SG was responsible for overarching decisions made in the design and implementation of the study and for responding to questions from PIs at each clinical service. The roles and responsibilities of the NSW TAG secretariat and the SG are outlined in Appendix 3.
The responses to questions from the field were communicated to all participating PIs in the form of Newsletters and "Question and Answer" documents (see Appendix 4, Appendix 5 and Appendix 6, Appendix 7) and regular email correspondence.

Site participation and formation of Local Advisory Groups

Facilities who expressed interest in the project were required to meet the following criteria in order to participate in the multi-site study:

- The site had a sufficient turnover rate in acute mental health care beds to enable data collection from 20-30 patient records in a reasonable time period[*].
- The site had approval for local participation by the relevant local Heads of Departments; i.e., Head of Psychiatry/Mental Health Unit and Director of Pharmacy.
- A multidisciplinary local advisory group (LAG) with a minimum representation of at least one medical professional working in mental health care (preferably a psychiatrist or advanced trainee in psychiatry), a pharmacist with mental health and/or medication safety expertise and a nurse or other relevant allied health practitioners would be formed to guide the local project.

The detail of the site investigators and composition of each LAG was forwarded to NSW TAG.

The roles and responsibilities of the NSW TAG secretariat, the SG and the LAGs of the participating clinical services throughout the phases of the study are outlined in Appendix 3.

The patient population, Australian peer group ranking, and remoteness area of the participating clinical services (using de-identified site codes) are shown in Appendix 8.

Setting

The settings for this multi-site study are Australian public hospitals with acute mental health beds for adult, adolescent or paediatric patients.

Site recruitment

All NSW Health hospitals with dedicated acute mental health beds were invited to respond to a NSW TAG Expression of Interest for project participation, distributed through TAG Mail newsletters and professional networks during 2015/2016. In addition, the invitation was extended to other jurisdictions through the Council of Australian Therapeutic Advisory Groups (CATAG).

Population

As per NQUM Indicator 7.4 specifications, the inclusion criteria for Phases 1 and 3 involved **p**atients:

- who had occupied an acute mental health bed for at least 72 hours; and
- who on discharge were prescribed a regular antipsychotic agent.

Patients who were eligible could only be included once in the study; i.e., the index (first occasion) inpatient episode of patients with more than one discharge within the recruitment period was the only entry point into the study.

Patients discharged taking one or more regular antipsychotic for any reason were included.
All principal investigators (PIs) that submitted Phase 2 and 3 data were eligible and invited to participate in the semi-structured interviews of Phase 4, i.e., PIs that did not submit Phase 2 and 3 data were excluded from Phase 4.

NQUM Indicator 7.4 specifications (Appendix 1) provides details about inclusion and exclusion criteria for Phases 1 and 3.

[*] Sites with small bed numbers were included although potential limitations regarding intra- and inter-comparison of results were noted.

Sampling method

The sampling method was purposive. Identification of eligible patient records could differ depending on the tools that were available to clinicians (e.g. paper or electronic medical records, medication charts and pharmacy records). Consecutive, retrospective patient medical record selection was used until the required sample size was obtained. The time period for data collection at each facility varied according to the time taken to collect the LAG-nominated sample size.

Sample size

Each LAG could determine by judgment their own sample size depending on their local requirements. The preferred minimum sample size recommended by the NSW TAG expert SG was 30 patients, unless this number could not be collected within the recommended time-frame allowed for data collection or bed numbers in clinical service limited data collection. Statistician advice noted that sample size calculations may not be useful because the sample sizes required would be too large to be practical within the scope and nature of this study.

Data collection

Any readily available clinical data utilised in normal clinical practice was available for data collection in Phases 1 and 3. Data sources included the patient's electronic or paper-based clinical files for physical observations and biochemistry results (see patient data collected below). Antipsychotic use was ascertained from medication charts and discharge prescriptions.
Relevant data were collected, using the Microsoft Excel DCT for the NQUM Indicator 7.4 (Appendix 2) with data point definitions provided to participating sites (Appendix 9). Identifiable patient details were not included in the DCT. A coding system was made available to sites, which linked a study patient code with the medical record number (MRN) of the patient to maintain patient confidentiality and to allow follow-up of any patient during data collection (Appendix 10). Data collection occurred only after the patient was discharged from hospital; i.e. retrospectively.

Phase 1 feedback was gathered through written qualitative feedback forms (Appendix 11) completed prior to the start of implementation activities in Phase 2.

Phase 3 data was collected after a locally determined time period (ranging between 5 and 15 months), deemed reasonable enough to allow for changes of practice and adoption of potentially new management strategies to evaluate any changes in NQUM Indicator 7.4 adherence.

For Phase 4, semi-structured telephone interviews with the eligible participating sites PIs was conducted using the template provided in Appendix 12. Our template was developed based on the template for intervention description and replication (TIDieR) checklist and guide.[17] All interviews were recorded with PI permission.

Patient data collected

NQUM Indicator 7.4 uses the International Diabetes Federation definition for metabolic syndrome[7] for screening, which is endorsed in Australian recommendations[18] therefore, the patient-related parameters requiring collection were:

- waist measurement;
- Body Mass Index (BMI) or weight for paediatric or adolescent patients;
- blood pressure (BP);
- fasting lipids (triglycerides and high density lipoprotein (HDL)-cholesterol); and,

- fasting Blood Sugar Level (BSL) or glycated haemoglobin (HbA1c) in a patient with pre-existing diabetes.[†]

BMI or weight was used as a primary parameter for sites with paediatric and adolescent patients. However, these are not the recommended parameters to indicate the development of metabolic syndrome in an adult and waist circumference is preferred.[‡]

The results must have been obtained from records that are part of normal clinical practice and able to be normally reviewed by the clinical team. The parameters must also have been measured within the 6 months before discharge. See Appendix 9 for further explanation and description of these parameters.

NB. The NQUM indicators are calculated on the basis that if a parameter is not documented, it is recorded as not having been done. In this way, they are intended to promote effective documentation and communication of medication management.

Other information could be collected in the 'Comments' section of the DCT if required by a site's LAG. This information was entered as free text and was not reported in the summary results sheet of the DCT.

Alternative measures of monitoring for metabolic syndrome

Alternative measures and therefore adherence calculations to Indicator 7.4 were also provided in this this study for BMI or weight *in lieu* of waist circumference, as well as triglycerides and lipids in patients with an unknown fasting state.

Use of BMI or weight

As a result of feedback from the participating sites, BMI or weight was used *in lieu* of waist circumference, in order to calculate one alternative measure of monitoring of metabolic syndrome. It was noted, that these are not the recommended parameters to indicate the development of metabolic syndrome according to the International Diabetes Federation[19] upon which the NQUM Indicator 7.4 is based.

Fasting and non-fasting lipid results

Due to feedback of LAG discussions and research in the medical literature regarding the monitoring of triglycerides and lipids in fasting versus non-fasting states[20] the DCT was modified and an additional column was included to record whether a result was in a non-fasting or unknown fasting state (Appendix 2). Results that were of unknown fasting state were recorded in some hospitals, when the timing of pathology testing could not be determined.

Calculations of adherence to NQUM Indicator 7.4

Adherence to metabolic monitoring recommendations was automatically calculated using the DCT. In addition, adherence to metabolic monitoring according to NQUM Indicator 7.4 was automatically calculated for "baseline" therapy (defined as no prior antipsychotic medication use, if the antipsychotic

[†] Although HbA1c is available as an MBS-subsidised item for general screening for type 2 diabetes, the screening for and diagnosis of metabolic syndrome currently recommends fasting BSLs. The recommended screening frequency for metabolic syndrome is 3 – 6 monthly when patients are receiving antipsychotics. HbA1C cannot be used as a monitoring parameter for metabolic syndrome unless the patient has already been diagnosed with diabetes.

[‡] The NQUM Indicator 7.4 uses the International Diabetes Federation definition for metabolic syndrome for screening, which is endorsed in Australian recommendations. A person is diagnosed as having metabolic syndrome when they have central obesity, plus any two of:

- Raised triglycerides: ≥1.7mmol/L
- Reduced HDL cholesterol: <1.03 mmol/L in males; <1.29 mmol/L females
- Raised BP: systolic ≥130 mmHg or diastolic ≥85mmHg

therapy had been altered on admission, or after a period of known non-compliance) or "ongoing" (if the antipsychotic medication use was unchanged on or during admission).
Monitoring using alternative measures (BMI/weight instead of waist circumference for adults and non-fasting lipids instead of fasting lipids) discussed above were also automatically calculated. These alternative calculations were undertaken to provide insight into current work practices and inform the design of future QI interventions. See sheet 2 of the DCT (Appendix 2).

Data analysis

The characteristics of the participating hospitals and the patients whose records were reviewed are presented using descriptive statistics. For Phases 1 and 3, adherence to metabolic monitoring recommendations for each service was automatically calculated when using the DCT and these results were provided to NSW TAG project co-ordinator. The median and interquartile range (IQR) of all participants' results of adherence as well as the monitoring of each parameter was calculated. Unfortunately, due to the dropout rate of sites participating in Phase 3 and the feasibility of collecting data for larger sample sizes, initially planned comparisons of the difference between Phases 1 and 3 results using chi-square tests and odds ratios, with 95% confidence limits was not calculated and the number of sites with statistically significant ($p<0.05$) adherence rate changes was not reported.

Developmental formative evaluation and feedback was sought from participating clinical services during Phase 2 to provide information about current practices, barriers and enablers to monitoring, key issues, and potential solutions in addressing study goals, including when they planned to re-audit. This qualitative feedback was obtained prior to implementation activities and was thematically analysed by grouping into common themes and subthemes, summarised, and shared with LAGs to assist in development of local implementation strategies (refer to Phase 2 results). LAGs determined which combination of interventions they would employ at their clinical service(s).

For Phase 4, data obtained from interviews was thematically analysed using Braun and Clarke's six stage approach.[21] Thematic analysis codes were assigned and organised with the assistance of the program NVIVO 12[22]. These were then synthesised and classified into themes and sub-themes.

Ethical considerations

Ethics approval for a low negligible risk study was obtained from the St Vincent's Hospital Sydney Human Research and Ethics Committee (HREC), SVH file number 15/309, HREC reference number: LNR/15/SVH/468 on the 16th of December 2015. An amendment was also approved by the St Vincent's Hospital Sydney HREC on the 22nd November 2017 to include a semi-structured phone interview of the PI at each participating site (methodology Phase 4). Site Specific Assessment (SSA) applications for local hospital participation in the study was facilitated by NSW TAG and approvals obtained for all participating hospitals.

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1. RESULTS PHASE 1: PRE-INTERVENTION AUDIT

Participating hospitals

Sixteen individual hospitals from 14 local health districts or jurisdictions across NSW, Victoria and the Northern Territory (NT) participated in Phase 1 of the study (pre-intervention). The hospitals were predominantly from metropolitan, regional and rural centres in NSW. One hospital collected and provided data of 2 distinct patient populations, providing 17 clinical services (units of analysis) in total. Table 1 provides details of the Australian peer group ranking of the 16 hospitals (based on service profile characteristics) and the remoteness descriptors of these organisations. The clinical services have been de-identified and will only be referred to by their codes in the following results.

Table 1 Australian Peer Group ranking and remoteness description of Phase 1 hospitals

Australian peer group ranking*	Number of hospitals Phase 1#	Remoteness area*	Number of hospitals Phase 1#
Acute public hospitals			
Principal referral hospitals	6	Major cities	6
Public acute group A hospitals	6	Major cities Inner regional Remote	3 2 1
Public acute group B hospitals	2	Inner regional Outer regional	1 1
Psychiatric hospitals			
Public acute psychiatric hospitals	1	Major cities	1
Children's hospitals			
Children's hospital	1	Major cities	1

* Australian Government: Australian Institute of Health and Welfare; *Australian Hospital Peer Groups, 2015*. Accessed 28th November, 2016 from http://www.aihw.gov.au/publication-detail/?id=60129553446

#16 participating hospitals provided a total of 17 clinical service datasets

Patient population

Sixteen hospitals collected data from 670 patient records in 17 clinical services, with an average of 39 patients per clinical service. The average age for the total multi-site study patient group was 40 years with a range of 8 to 90 years. Descriptions of the populations at the participating clinical services are detailed in Table 2, as well as the number of mental health dedicated beds, the Peer Ranking and the remoteness area of the hospital providing the clinical service.

Table 2 Phase 1 – patient characteristics and type of mental health care service

Study code	Patient population	MH[§] beds; clinical service description	Number of patients audited	Patient age, years: mean (range)
A	acute adult	73 MH beds in principal referral hospital	60	40 (19-63)
B	acute adult	30 bed acute mental health unit in principal referral hospital	30	43 (23-75)
C	acute adult	20 bed acute mental health unit in principal referral hospital	30	42 (21-67)
D	majority acute adult	174 MH beds in centre for MH in principal referral hospital	99	43 (15-83)
E[#]	SMHSOP*	10 bed SMHSOP - Acute Inpatient Unit in a public acute hospital	14	71 (57-90)
F[#]	acute adult	20 MH inpatient unit in a public acute hospital	39	36 (17-63)
G	acute adult	6 acute MH beds and 2 high dependency unit beds in public acute hospital	12	51 (27-68)
H	acute adult & SMHSOP*	76 mixed MH beds: public sub- and non-acute public hospital and public acute hospital	38	40 (19-79)
I	paediatrics - adolescent	14 MH paediatric and adolescent beds in a Children's Hospital	31	14 (8-18)
J	acute adult	50 MH beds in acute MH unit in public acute hospital	30	39 (17-76)
K	adolescent - adult	10 MH beds in principal referral hospital	30	32 (15-52)
L	acute adult	32 MH beds in principal referral hospital	48	38 (18-61)
M	acute adolescent - adult	157 MH beds in principal referral hospital	55	36 (15-65)
N	acute adult	33 MH beds in principal referral hospital	35	42 (27-68)
O	acute adult	100 MH beds in public acute psychiatric hospital	20	46 (18-72)
P	paediatric - adolescent	12 MH paediatric and adolescent beds in principal referral hospital	27	15 (9-17)
Q	acute adult & aged	72 MH beds (adult & aged) in principal referral hospital	72	42 (19-78)
		Total	670	40 (8-90)

§ MH = Mental health

*SMHSOP = Specialist Mental Health Services for Older People

[#] Results are from the same hospital but represent two distinct patient populations.

Adherence to NQUM Indicator 7.4

Phase 1 adherence to all metabolic monitoring parameters (waist circumference or weight/BMI in paediatric populations, BP, fasting lipids and fasting BSLs or HbA1c in diabetics) across the 17 clinical services was a median of 11% (IQR=13%). Individual site adherence to NQUM Indicator 7.4 is displayed in Figure 2.

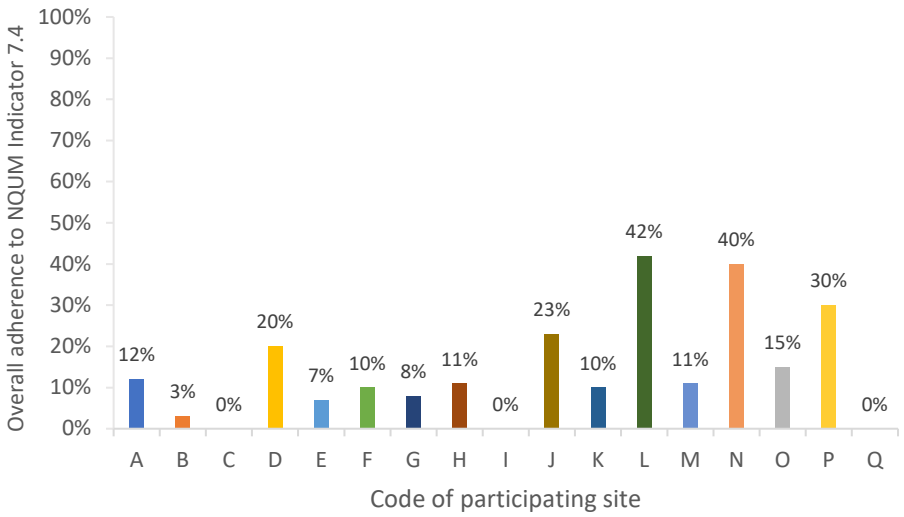

Figure 2 Phase 1 adherence to NQUM Indicator 7.4 across clinical services

Note: The results for clinical services at C, I and Q are 0%

Adherence to NQUM Indicator 7.4 according to whether the patient was initiating regular antipsychotic therapy (baseline monitoring), or continuing therapy (ongoing monitoring) was also calculated. The majority of patients (75%, 504 patients) required treatment initiation monitoring. No patients in clinical services J and K required ongoing treatment monitoring. Median adherence rate for monitoring at treatment initiation was 10% (IQR=18%) and at the 15 clinical services with patients requiring ongoing monitoring (166 patients) was 7% (IQR=27%). Adherence of monitoring according to baseline or ongoing antipsychotic use and overall adherence is shown in Table 3. Individual clinical service adherence to monitoring of each parameter and NQUM Indicator 7.4 is displayed in Appendix 13. The summary statistics are tabulated in Appendix 14.

Table 3 Phase 1 clinical service adherence to NQUM Indicator 7.4 for baseline, ongoing and total populations requiring monitoring

Study code	Adherence to NQUM Indicator 7.4 monitoring				
	In patients initiating antipsychotics*		In patients receiving maintenance antipsychotics*		Overall
	Total patients requiring baseline initiation monitoring	Number adherent (%)	Total patients requiring ongoing monitoring	Number adherent (%)	Number adherent (%)
Total number of patients	**504**	**-**	**166**	**-**	**670**
A	45	6 (13%)	15	1 (7%)	7 (12%)
B	6	0 (0%)	24	1 (4%)	1 (3%)
C	28	0 (0%)	2	0 (0%)	0 (0%)
D	96	17 (18%)	3	3 (100%)	20 (20%)
E	12	1 (8%)	2	0 (0%)	1 (7%)
F	36	4 (11%)	3	0 (0%)	4 (10%)
G	9	1 (11%)	3	0 (0%)	1 (8%)
H	34	3 (9%)	4	1 (25%)	4 (11%)
I	12	0 (0%)	19	0 (0%)	0 (0%)
J	30	7 (23%)	0	N/A	7 (23%)
K	30	3 (10%)	0	N/A	3 (10%)
L	36	15 (42%)	12	5 (42%)	20 (42%)
M	34	2 (6%)	21	4 (19%)	6 (11%)
N	16	8 (50%)	19	6 (32%)	14 (40%)
O	10	0 (0%)	10	3 (30%)	3 (15%)
P	10	5 (50%)	17	3 (18%)	8 (30%)
Q	60	0 (0%)	12	0 (0%)	0 (0%)
Median (IQR)	10% (18%)		7% (27.5%)		11% (13%)

** See Appendix 9 for definitions of baseline and ongoing monitoring*

Adherence to Metabolic Syndrome monitoring using alternative parameters

The SG recognised that weight or BMI is not considered best practice except in the paediatric and adolescent population. In addition, despite recognition that non-fasting lipid parameters are not considered best practice parameters for metabolic monitoring, non-fasting HDL-cholesterol and triglycerides measurements may be recorded at some clinical services. As a result, adherence to Metabolic Syndrome monitoring examined the use of these alternative parameters.

Weight or BMI

Adherence to NQUM Indicator 7.4 was calculated using the alternative parameters of weight or BMI *in lieu* of waist circumference. Median adherence was 3% (IQR=0-20%). Five sites had improved indicator adherence results when weight or BMI was used. It made no difference to indicator results at 3 clinical services. The indicator result was worse at the remaining 9 clinical services. The adherence by each clinical service to the alternative parameters, that is, if weight or BMI is accepted, is displayed in Table 4.

Non-fasting HDL-cholesterol and triglycerides

Non-fasting HDL-cholesterol and triglycerides measurements were also recorded in some participating clinical services, which appeared not to document fasting status. Adherence to alternative metabolic monitoring was therefore calculated using these alternative parameters of non-fasting HDL-cholesterol and triglycerides. (Non-fasting designation also included lipid results where the fasting status was unknown)**.** Median adherence was 0% (IQR=0%). One clinical service had improved indicator adherence results when non-fasting lipids were used. It made no difference to indicator results in 3 clinical services. The indicator result was worse in the remaining 7 clinical services. The adherence by each clinical service to the alternative parameter, that is, if recording of non-fasting lipids is accepted, is displayed in Table 4.

Table 4 Adherence to NQUM Indicator 7.4 if alternative measurements were accepted

Study code	Adherence using weight or BMI*, %	Adherence using non-fasting lipids #, %
A	2	0
B	0	N/A**
C	13	0
D	33	0
E	7	0
F	3	0
G	0	8
H	0	37
I	0	0
J	3	N/A**
K	7	0
L	2	0
M	43	2
N	0	0
O	20	0
P	30	0
Q	22	0
Median (IQR)	**3% (20%)**	**0% (0%)**

* *in lieu* of recommended waist circumference
# *in lieu* of recommended fasting lipids
¥ with all recommended parameters measured
** N/A as data not collected

Monitoring of individual parameters

Figures 3-8 below display the adherence to measurement of individual parameters across the 17 clinical services.

Blood sugar levels (BSLs) or glycated haemoglobin (HbA1c) measurement

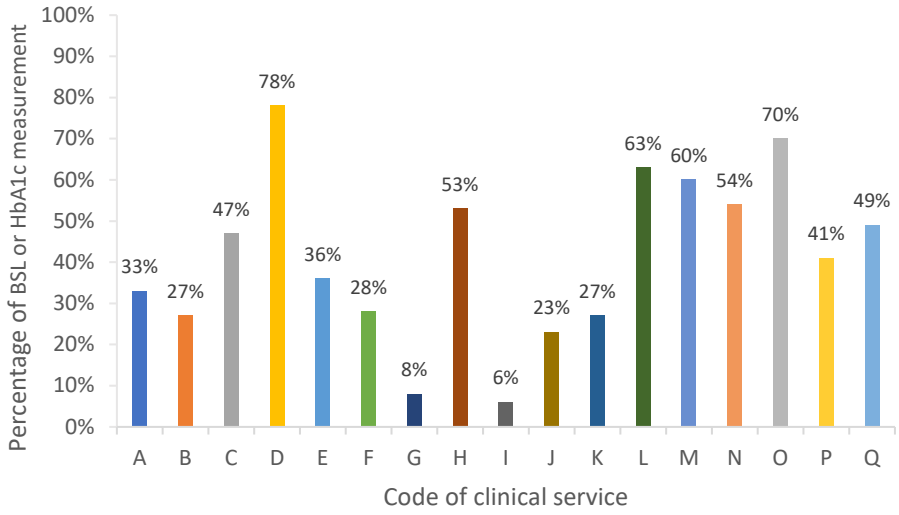

Figure 3 Phase 1 measurement of fasting BSL or HbA1c across clinical services

Blood pressure measurement

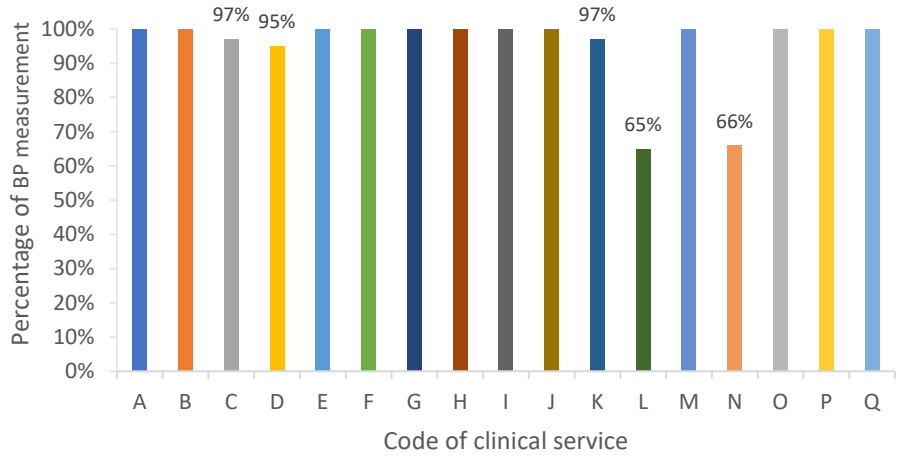

Figure 4 Phase 1 measurement of blood pressure across clinical services

Fasting lipids: HDL-cholesterol and triglyceride measurements

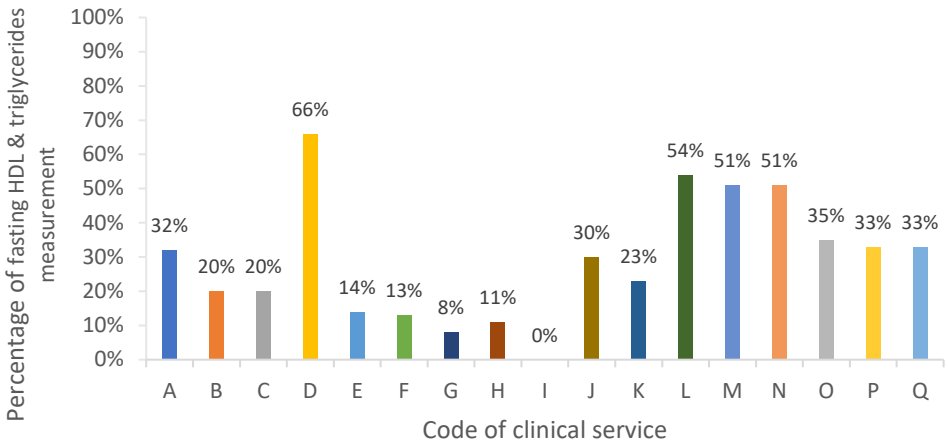

Figure 5 Phase 1 measurement of fasting HDL-cholesterol and triglycerides across clinical services

Fasting or non-fasting lipids: HDL cholesterol and triglyceride measurements

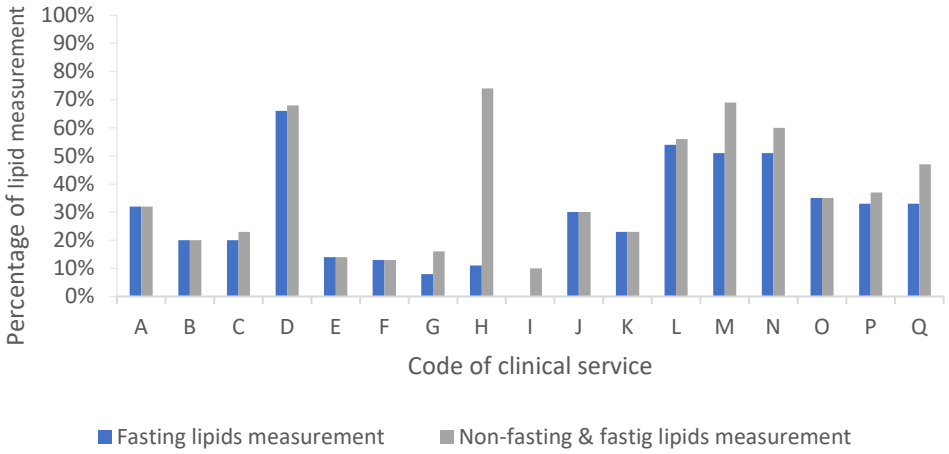

Figure 6 Phase 1 comparison of fasting or any HDL-cholesterol and triglycerides across clinical services

**Results for B and J represent the measurement of fasting lipids only.*

Waist circumference measurements

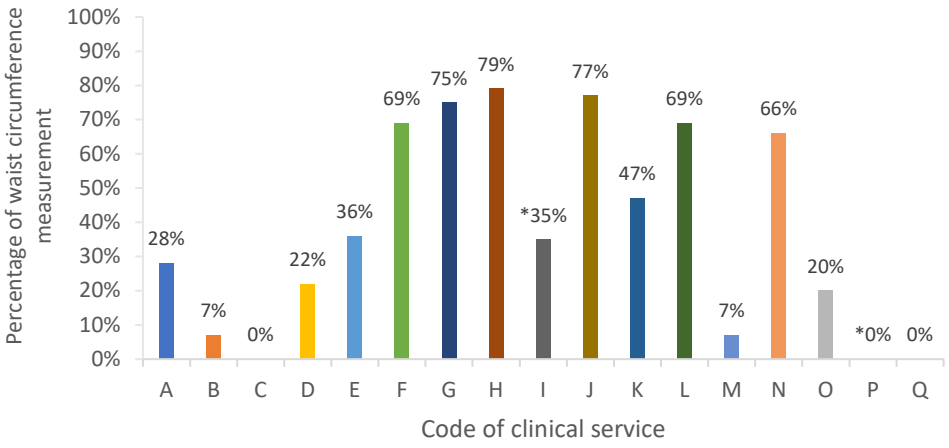

Figure 7 Phase 1 measurement of waist circumference across clinical services

**Hospitals I and P had paediatric and adolescent patients only. Monitoring of weight is the recommended measurement for metabolic monitoring in these patients.*

The median result was 36% (IQR=55%) when the 2 paediatric/adolescent population were excluded.

BMI or weight

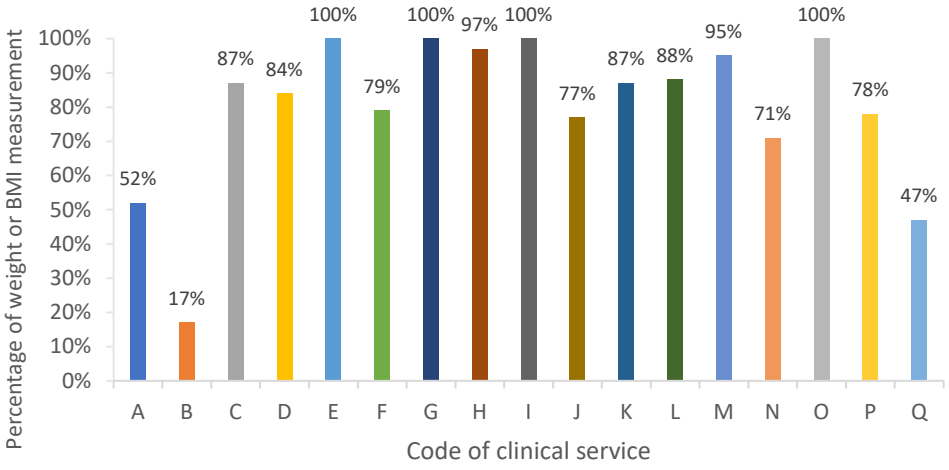

Figure 8 Phase 1 measurement of weight or BMI across clinical services

Monitoring of weight is the preferred parameter for metabolic monitoring in paediatric/adolescent patients. BMI or weight monitoring at the 2 hospitals with paediatric and adolescent populations (I and P) was 100% and 78%, respectively.

Summary

Adherence to measurement of individual parameters across the 17 clinical services are summarised below (see Appendix 13 for individual clinical service results):

- Fasting BSL or HbA1c for diabetics: median result of 41% (IQR=27%).
- Blood pressure: median result of 100% (IQR=3%). All except 5 achieved 100% with BP monitoring.
- Fasting HDL-cholesterol and triglycerides: median result of 30% (IQR=21%).
- HDL-cholesterol or triglyceride concentrations irrespective of fasting status: median result of 32% (IQR=36%). Results for clinical services B and J represent the measurement of fasting lipids only.
- Inclusion of non-fasting HDL-cholesterol and triglyceride measurements made little difference to the adherence to lipid monitoring, except for clinical service H.
- Waist circumference measurement: median result of 35% (IQR=62%). The median result was 36% (IQR=55%) when the two paediatric/adolescent population were excluded. Hospitals I and P had paediatric and adolescent patients only. Monitoring of weight is the recommended measurement for metabolic monitoring in these patients.
- BMI or weight: median result of 87% (IQR=90%). BMI or weight monitoring at the 2 hospitals with paediatric and adolescent populations (I and P) was 100% and 78%, respectively.

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2. RESULTS PHASE 2: FEEDBACK AND PROPOSED INTERVENTIONS

Barriers and enablers to best practice metabolic monitoring

LAGs were encouraged to provide written feedback to the Expert Steering Group regarding barriers and enablers and potential improvement strategies to achieve best practice metabolic monitoring after their experiences collecting data in Phase 1 and the results of their clinical service performance. (Further details are provided in Appendix 15).

Barriers

Several common themes regarding barriers emerged from the LAG feedback. These are summarised in Table 5 under workflow and service provision barriers, patient-related barriers and barriers related to knowledge gap.

Table 5 Summary of barriers to best practice metabolic monitoring

Barriers to best practice metabolic monitoring in inpatients taking regular antipsychotics	
Workflow and service provision barriers	
Electronic impediments	Streamlining and centralisation of all relevant parameters unavailable.
	Requirement for duplication of results documentation in medical record.
	Variance in presentation of pathology results: relevant details included in pathology requests are absent in results, e.g. fasting status.
Service shortfalls	Breakdown of lipid components not routinely available via local pathology providers despite requests.
	Lack of routine pathology servicing in mental health wards.
	Responsibility of general versus mental health care staff; e.g., junior medical officers providing insufficient details to pathology requests, for instance, the accurate timing of sample collection.
	Lack of clinician responsibility/clinical ownership for metabolic monitoring or lack of coordination of staff/ clinicians to ensure all aspects of metabolic monitoring are completed.
	Continuum of care not realised – community results not accessible.
Recommended practice not normalised	Waist circumference measurements not integral part of nursing staff observations.
	Lack of routine location in documentation to record waist measurement result.
	Perception of waist circumference measurement as intrusive to the patient.
	Standardisation and streamlining the technique of measuring waist circumference.
	Absence of an alert or reminder system to ensure metabolic monitoring is completed (electronic and/or paper-based).
Patient-related barriers	
Individual patient factors	Refusal to have blood tests.
	Refusal to have waist circumference measured.
	Lack of cooperation – not being engaged in the process or rationale.
	Acute mental health concerns take priority.
Barriers related to knowledge gaps	
Gaps in knowledge	Failure to routinely request/measure recommended parameters as not considered necessary practice.

	Misconception regarding recommended lipid components to be monitored.
	Complacency with a normal total cholesterol result.
	BMI or weight viewed as valid parameter *in lieu* of waist circumference.
	Misconception by mental health clinicians that the options available for management of cardiovascular (CV) risk factors in this population, if present, differ from those appropriate to a population without mental health conditions, but with similar CV risk factors (e.g., criteria for commencing a "statin" for dyslipidaemia).
	Recommended technique for waist measurement.

Enablers

Enablers were identified under the themes of workflow and service provision enablers, patient-related enablers and enablers related to knowledge gap and are summarised in Table 6.

Table 6 Summary of enablers to best practice metabolic monitoring

Enablers to best practice metabolic monitoring in inpatients taking regular antipsychotics	
Workflow and service provision enablers	
Electronic solutions	CareCompass^ tasks are a function of electronic medical records (eMR) used in NSW Health organisations. These can be predetermined and require attention when a patient's file is selected electronically. The CareCompass bundle has the potential to prompt for specific tasks that require completion; in this context, completion of the metabolic monitoring recommendations. The nuances of this system and the application for a systemised approach warrant investigation. ^ Clinical workload includes daily items in the form of activities, orders, and referrals to services or individuals. These items have been identified as being core clinical activity items across all disciplines and through all phases of care. They are based on the result of each individual patient's diagnosis, age, treatment, outcome of treatment, assessments, and results of diagnostic tests or a combination of any of these criteria. They will vary for every patient. Several workshops across NSW identified key requirements such as the need for automation of activities, orders and referrals based on information documented in the form of observations, results or relevant assessments. The viewing and management of these clinical activities has been developed in the eMR via CareCompass in Cerner Millennium, which provides a one-page interactive view of a selected patient list with the ability to drill down at an individual patient level. The design incorporates adult and paediatric requirements. The CareCompass is a nursing summary workflow solution that helps the Nurse organise, prioritise and plan patient care. It provides a summary of the activities that are due for each patient. Managing activities in Care Compass allows nurses to mark them as completed throughout the system.
	Creation of a PowerForm (an electronic template for clinical data entry according to a strict specification based queries) specific for metabolic monitoring is required to collate all the required information. The electronic capability for automatic population of the parameters in a PowerForm requires further investigation.
	Standardisation of reporting of relevant results will establish reliability in equivocal results; for instance of BSLs, HDL cholesterol and triglycerides that have been drawn at the appropriate times (fasting).
Service delivery	Local health districts/managers investigate routine pathology service availability to mental health wards, if not currently available. State-wide standardisation of lipid reporting so that HDL-cholesterol, LDL-cholesterol and triglycerides are measured and reported, rather than total cholesterol only.
Normalisation of recommended practice	• Waist circumference added to all nursing assessments and observations • Embed measuring of waist circumference into a weekly regimen; e.g., to perform by a specific shift on a specific day of the week • Have waist measurements performed in privacy.
	Nomination/ appointment of "champions" to ensure all metabolic monitoring parameters are completed.

Patient-related enablers	
Patient refusal	Ensure privacy when having weight or waist measured.
	Develop or source patient-appropriate information that includes the rationale for the recommended procedures so patients engage in the process.
	Consumer/peer support involvement.
Other priorities	Establish prompts at a time prior to discharge to ensure tasks are completed. Investigate how CareCompass could assist this.
Enablers related to knowledge gaps	
Target gaps in knowledge	Adopt/endorse and circulate the Jacquie Curtis flow charts[23,24] for metabolic monitoring of adults and paediatric/adolescent populations. For example, the Royal College of Psychiatrists has adopted this model[4], visit this webpage – link[25] This was further endorsed by the UK National Institute of Clinical Excellence (NICE) which included management options in its clinical management guidelines, for adults https://www.nice.org.uk/guidance/cg178[26]; and for younger people https://www.nice.org.uk/guidance/cg155[27]
	Develop a "how-to" guide for waist measurement, with associated resources; e.g. a video and posters.
	Inclusion of specific information about metabolic monitoring to both doctors and nurses on orientation and more intense orientation for new doctors rotating into the unit.

Interventions implemented

With consideration of Phase 1 performance results and the collated barriers and enablers shared by the Expert SG, each LAG, determined which interventions they would implement within their clinical service. Table 7 presents a summary of the interventions implemented by the different clinical services.

Table 7 Summary list of implemented interventions

Intervention category	Summary of intervention	Clinical services that implemented the intervention
Feedback of audit results	Feedback of Phase 1 results to various clinicians in various settings.	A, B, C, D, H, K, L, O
Multidisciplinary teamwork and collaboration	Liaison and involvement of other clinicians including dieticians, exercise physiologists, occupational therapists, clozapine coordinators, other specialties such as general medicine and endocrinology.	B, C, D, K, L
	Leveraging existing work practices and motivated clinicians.	K, L
Electronic solutions	Use of, or optimisation of electronic medical record (eMR) systems and other digital methods	A, D, L
Service delivery	Allocation/purchase of required resources/equipment.	A, B, C, D, K, O
	Pathology improvements.	C, H, K, L
Normalising recommended practice	Adopting existing guidelines or development of local guidelines for best practice metabolic monitoring and/or treatment of metabolic syndrome.	D
	Visual reminders to monitor metabolic parameters e.g. journey board use, poster displays and equipment to monitor placed in prominent areas.	A, B, K, L, O
	Standardising and improving documentation location and requirements.	A, C, L
	Allocation of a clinician champion and/or responsibilities.	A, B, C, D, K, L, O
	Allocation of a dedicated day for measurement of metabolic parameters.	A, B, C, D, O
	Agenda item at meetings.	B, K, O
Targeting gaps in knowledge	Education with/without ongoing feedback and involvement of staff.	A, B, C, D, K, L, O
	Decision support provision.	A, D, K

For further details of all implemented interventions see Appendix 16.

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3. RESULTS PHASE 3: POST-INTERVENTION RE-AUDIT

Participating hospitals

Eight individual hospitals from 8 local health districts or jurisdictions across NSW and the NT participated in Phase 3 of the study (re-audit data collection). The hospitals were predominantly from metropolitan, regional and rural centres in NSW. Unfortunately, there was loss to follow up of 9 clinical services in this phase.

Patient population

Eight hospitals collected Phase 3 data from 385 patient records in 8 clinical services, with an average of 48 patients per clinical service. The average age was 40 years (the same as Phase 1) with a range of 16 to 89 years. Descriptions of the patient population, number of mental health dedicated beds, the Peer Ranking and the remoteness area at the participating clinical services are detailed in Table 8.

Table 8 Phase 3 re-audit^ –patient characteristics and type of mental health care service

Study code	Patient population	MH§ beds; clinical service description	Number of patients audited	Patient age, years: mean (range)
A	acute adult	73 MH beds in principal referral hospital	45	40 (19-67)
B	acute adult	30 bed acute mental health unit in principal referral hospital	30	n/a – data not collected
C	acute adult	20 bed acute mental health unit in principal referral hospital	30	37 (18-61)
D	majority acute adult	174 MH beds in centre for MH in principal referral hospital	99	41 (17-89)
H	acute adult & SMHSOP*	76 mixed MH beds: public sub- and non-acute public hospital and public acute hospital	32	46 (17-83)
K	adolescent - adult	10 MH beds in principal referral hospital	30	33 (16-60)
L	acute adult	32 MH beds in principal referral hospital	99	42 (17-71)
O	acute adult	100 MH beds in public acute psychiatric hospital	20	41 (23-83)
		Total	385 patients	40.2 (16-89)

^Clinical services with study codes E, F, G, I, J, M, N, P and Q did not participate in phase 3.
§ MH = Mental health
*SMHSOP = Specialist Mental Health Services for Older People

Adherence to NQUM Indicator 7.4

Phase 3 adherence to all metabolic monitoring parameters (waist circumference or weight/BMI in paediatric populations, BP, fasting lipids and fasting BSLs or HbA1c in diabetics) across the 8 clinical services was a median of 8% (IQR= 47%). Site adherence to NQUM Indicator 7.4 is displayed in Figure 9 and Table 9.

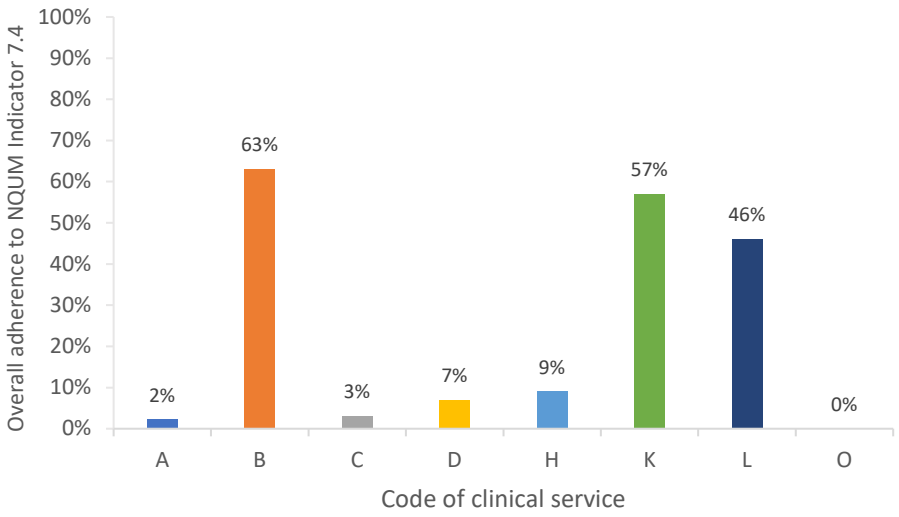

Figure 9 Phase 3 re-audit: adherence to NQUM MH indicator 7.4 across clinical services

Adherence to recommended metabolic monitoring using NQUM Indicator 7.4 for patients initiating or continuing antipsychotic agents

Adherence to NQUM Indicator 7.4 according to whether the patient was initiating regular antipsychotic therapy (baseline monitoring) or continuing therapy (ongoing monitoring) was also calculated. (See further definition details in Appendix 9). Antipsychotic prescriptions were initiated for 301 patients and were ongoing for a further 84 patients. Adherence of monitoring according to baseline or ongoing antipsychotic use and overall adherence is shown in Table 9.

Table 9 Phase 3 clinical service re-audit^ adherence to NQUM Indicator 7.4 for baseline, ongoing and total populations requiring monitoring

Study code	Adherence to NQUM Indicator 7.4 monitoring				
	In patients initiating antipsychotics*		In patients receiving maintenance antipsychotics*		Overall
	Total patients requiring baseline initiation monitoring	Number adherent (%)	Total patients requiring ongoing monitoring	Number adherent (%)	Number adherent (%)
Total number of patients	**301**	**-**	**84**	**-**	**385**
A	41	1 (2%)	4	0 (0%)	1 (2%)
B	24	16 (67%)	6	3 (50%)	19 (63%)
C	24	1 (4%)	6	0 (0%)	1 (3%)
D	93	6 (6%)	6	1 (17%)	7 (7%)
H	27	2 (7%)	5	1 (20%)	3 (9%)
K	11	7 (64%)	19	10 (53%)	17 (57%)
L	71	37 (52%)	28	9 (32%)	46 (46%)
O	10	0 (0%)	10	0 (0%)	0 (0%)
Median (IQR)	**7% (51%)**		**19% (37%)**		**8% (47%)**

* *See Appendix 9 for definitions of baseline and ongoing monitoring.*
^Clinical services with study codes E, F, G, I, J, M, N, P and Q did not participate in phase 3.

The majority of patients (78% (301/385 patients)) required treatment initiation monitoring. Median adherence rate for monitoring at treatment initiation was 7% (IQR=51%) and 19% (IQR=37%) for ongoing monitoring.

Individual clinical service adherence to monitoring of each parameter and NQUM Indicator 7.4 is displayed in Appendix 17. The summary statistics are tabulated in Appendix 18.

Adherence to Metabolic Syndrome monitoring using alternative parameters

The adherence results by each clinical service to the alternative parameters, that is, if weight or BMI is accepted, or if non-fasting lipids are accepted, are displayed in Table 10.

Table 10 Phase 3 re-audit^ adherence to NQUM Indicator 7.4 if alternative measurements are accepted

Study code	Adherence using weight or BMI*, %	Adherence using non-fasting lipids #, %
A	2	0
B	3	N/A**
C	0	0
D	39	0
H	0	33
K	14	0
L	5	0
O	0	N/A**
Median (IQR)	**3% (7%)**	**0% (0%)**

* *in lieu* of recommended waist circumference; # *in lieu* of recommended fasting lipids; ¥ with all recommended parameters measured; ** N/A as data not collected
^Clinical services with study codes E, F, G, I, J, M, N, P and Q did not participate in phase 3.

Only one clinical service had improved indicator adherence results when weight or BMI was used. It made no difference to indicator results at one clinical service and was worse at the remaining 6 clinical services.

Another clinical service had improved indicator adherence results when non-fasting lipids were used. The indicator result was worse in 5 clinical services and unknown for 2 services as data was not collected.

Monitoring of individual parameters

See Appendix 19 for figures displaying the adherence to measurement of individual parameters across the 8 clinical services.

Summary

Adherence to measurement of individual parameters across the 8 clinical services are summarised below (see Appendix 17 for individual clinical service results):

- Fasting BSL or HbA1c for diabetics: median result of 56% (IQR=39%).
- Blood pressure: median result of 100% (IQR=1%). All except 2 sites achieved 100% with BP monitoring.
- Fasting HDL-cholesterol and triglycerides: median result of 38% (IQR=54%).
- HDL-cholesterol or triglyceride concentrations irrespective of fasting status (data available for 6 clinical services): median result of 1% (IQR=3%).
    - Inclusion of non-fasting HDL-cholesterol and triglyceride measurements made little difference to the adherence to lipid monitoring, except for clinical service H.
- Waist circumference measurement: median result of 60% (IQR=39%).
- BMI or weight: median result of 84% (IQR=75-91%).

Comparison of metabolic monitoring adherence results from clinical services who conducted both Phase 1 and Phase 3 audits

The median overall adherence to metabolic monitoring using the parameters in the NQUM Indicator 7.4 decreased from 12% (IQR=41%) pre-intervention to 8% (IQR=46%) at the post-intervention stage for the 8 clinical services that conducted both phase 1 and 3 audits (loss of participation at 9 sites in the post-intervention phase). Of note, clinical services B, C, K and L had improved overall adherence to metabolic monitoring using the parameters in the NQUM Indicator 7.4. Clinical services A, D, H and O had a decline in their overall adherence to NQUM Indicator 7.4. Pre-post-intervention adherence to recommended metabolic monitoring using NQUM Indicator 7.4 for each clinical service is shown in Figure 10 and

Table 11 provides a summary of the data including the alternative parameters. Table 12 provides a summary of the sites combined indicator measurement of individual parameters, adherence to alternative parameters and adherence overall.

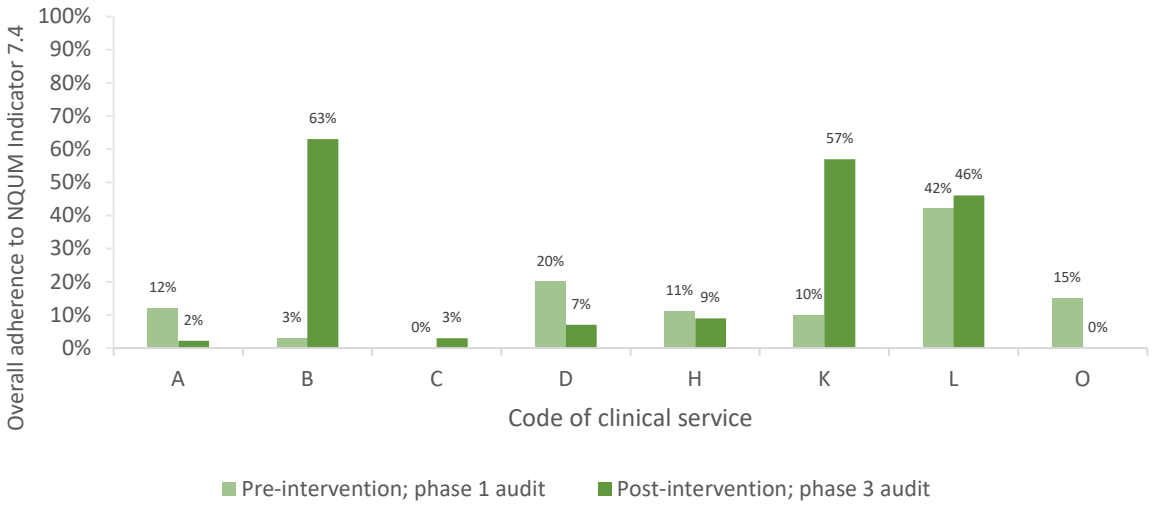

Figure 10 Comparison of site adherence to NQUM Indicator 7.4 in Phase 1 (pre-intervention) and Phase 3 (post-intervention)

Comparison of the adherence to Metabolic Syndrome monitoring using alternative parameters

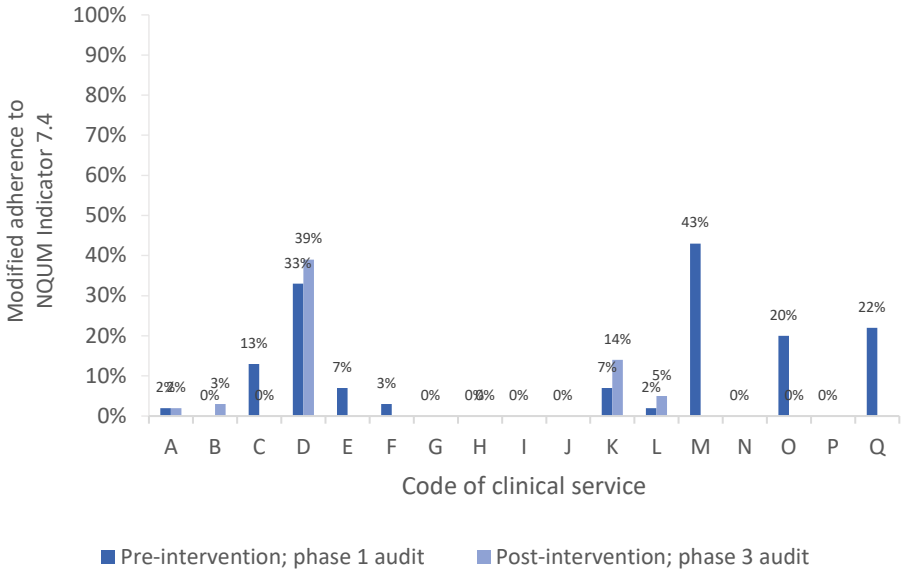

Figure 11 Pre-post intervention comparison of site adherence to modified NQUM Indicator 7.4 (weight/BMI instead of waist circumference measurement)

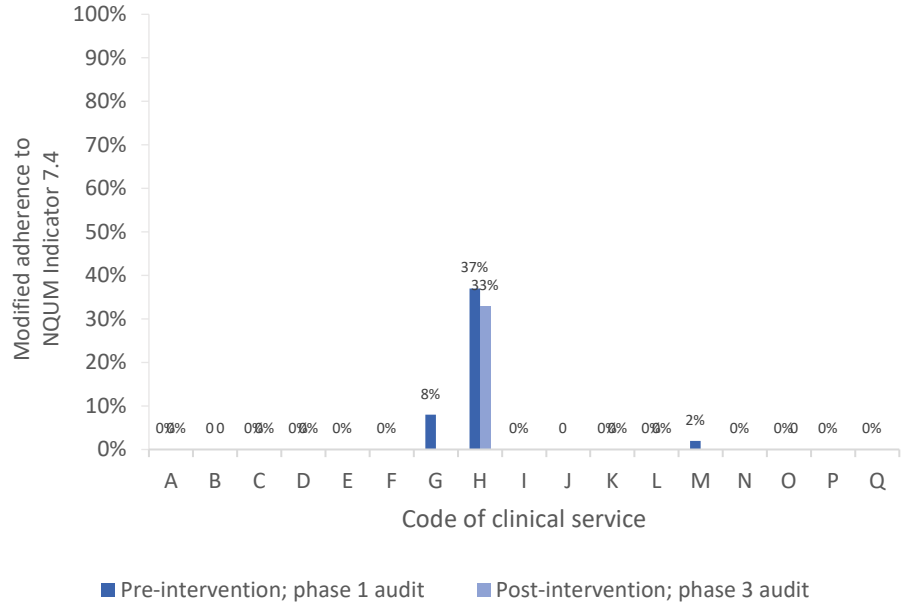

Figure 12 Pre-post intervention comparison of site adherence to modified NQUM Indicator 7.4 (non-fasting lipids instead of fasting lipids measured)

Table 11 Summary table of results of individual clinical service NQUM Indicator 7.4 adherence and modified adherence with alternative parameters

			Overall adherence	Modified adherence	
Site code	**Phase**	**Number of Patients Audited**	NQUM Indicator 7.4: % of patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects	% of patients that received the four parameters of monitoring, but weight/BMI was measured rather than waist circumference	% of patients that received four parameters of monitoring, but non-fasting lipids was measured rather than fasting lipids
A	1	60	12 (n=7)	2 (n=1)	0 (n=0)
A	3	45	2 (n=1)	2 (n=1)	0 (n=0)
B	1	30	3 (n=1)	0 (n=0)	Not measured
B	3	30	63 (n=19)	3 (n=1)	Not measured
C	1	30	0 (n=0)	13 (n=4)	0 (n=0)
C	3	30	3 (n=1)	0 (n=0)	0 (n=0)
D	1	99	20 (n=20)	33 (n=32)	0 (n=0)
D	3	99	7 (n=7)	39 (n=38)	0 (n=0)
H	1	38	11 (n=4)	0 (n=0)	37 (n=14)
H	3	32	9 (n=3)	0 (n=0)	33 (n=10)
K	1	30	10 (n=3)	7 (n=2)	0 (n=0)
K	3	30	57 (n=17)	14 (n=4)	0 (n=0)
L	1	48	42 (n=20)	2 (n=1)	0 (n=0)
L	3	99	46 (n=46)	5 (n=5)	0 (n=0)
O	1	20	15 (n=3)	20 (n=4)	0 (n=0)
O	3	20	0 (n=0)	0 (n=0)	Not measured
Combined Median (IQR)	1	34 (29) patients	12% (41%)	5% (6%)	0% (0%)
Combined Median (IQR)	3	31 (69) patients	8% (46%)	3% (7%)	0% (0%)

Comparison of the monitoring of individual parameters

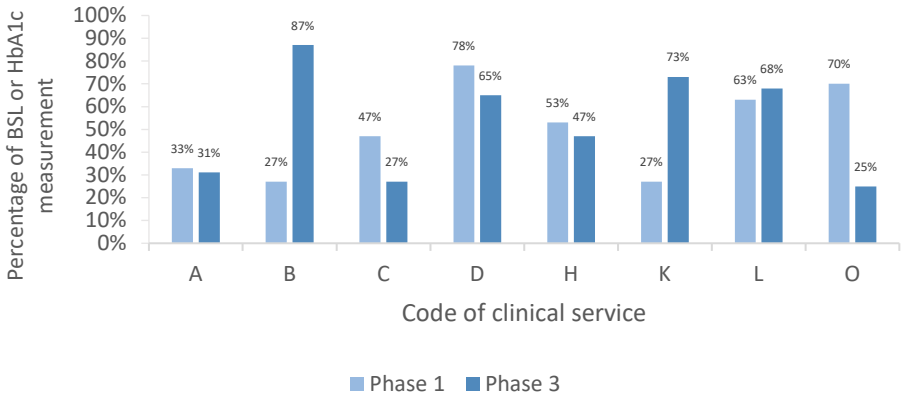

Figure 13 Pre-post intervention percentage of BSL or HbA1c measurement

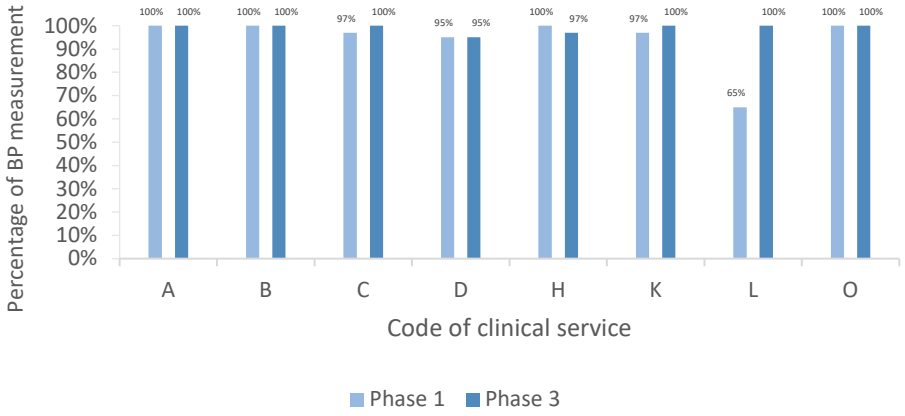

Figure 14 Pre-post intervention percentage of BP measurement

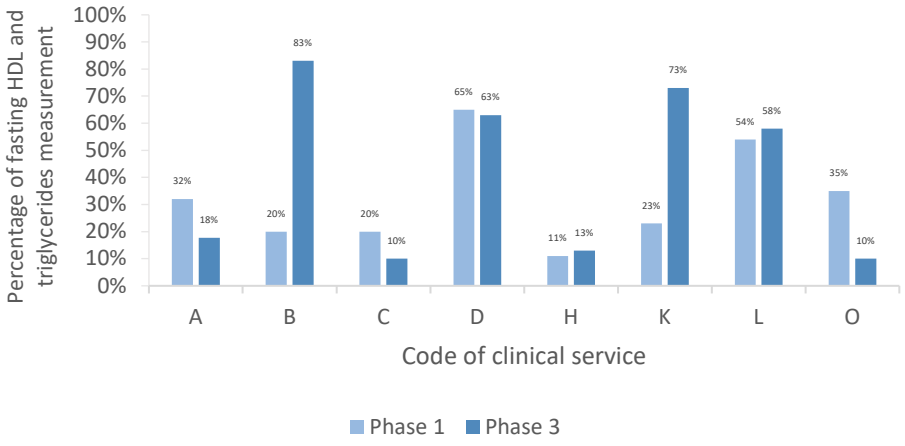

Figure 15 Pre-post intervention percentage of fasting HDL and triglycerides measurement

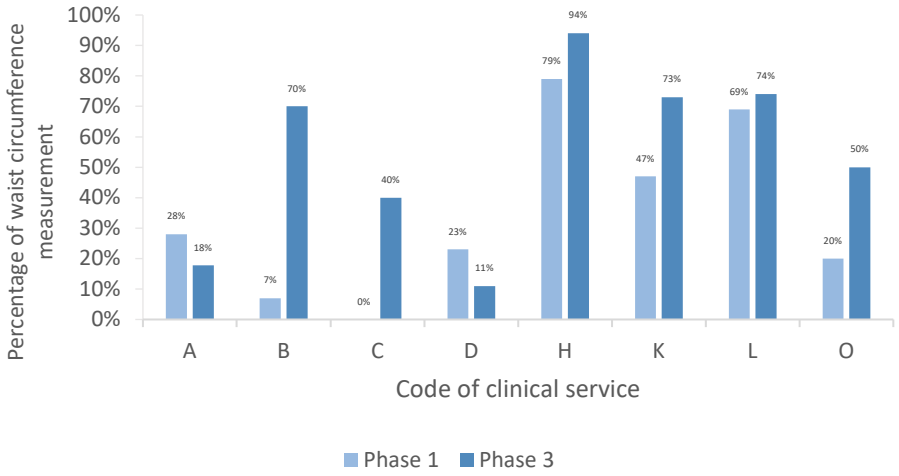

Figure 16 Pre-post intervention percentage of waist circumference measurement

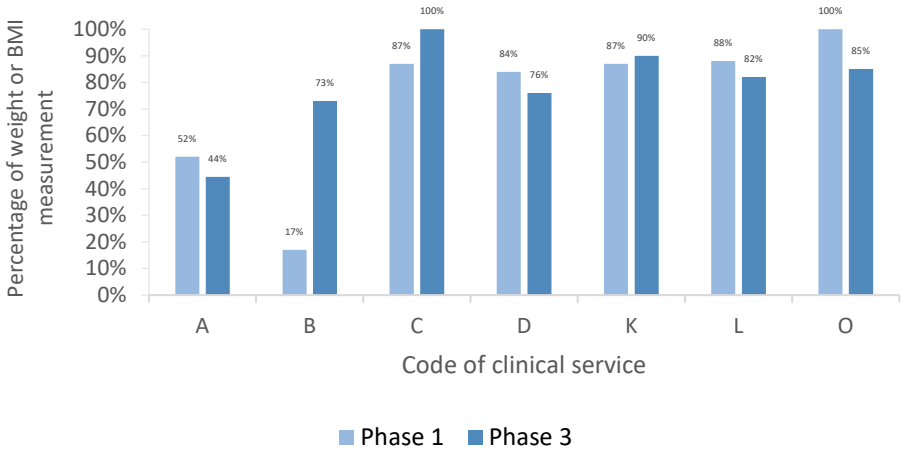

Figure 17 Pre-post intervention percentage of weight or BMI measurement

Table 12 Summary table of results of combined clinical service indicator individual parameters, adherence alternative parameters and adherence (overall)

Overall results combined for the 8 participating clinical services who completed both Phases 1 & 3:	Phase 1 Median (IQR), %	Phase 3 Median (IQR), %	Adherence change:
Patients with BP recorded	99% (3.5%)	100% (1%)	Improved
Patients with fasting BSL recorded	50% (38%)	56% (39%)	Improved
Patients with fasting lipids recorded	28% (46%)	38% (54%)	Improved
Patients with fasting OR non-fasting lipids (or status is not known)	2% (3%)	1% (3%)	Worsened
Patients with waist circumference recorded	26% (57%)	60% (39%)	Improved
Patients with BMI / weight recorded	87% (15%)	84% (16%)	Worsened
Patients that received 4 parameters of monitoring, but weight/BMI measured rather than waist circumference	5% (6%)	3% (7%)	Worsened
Patients that received 4 parameters of monitoring, but non-fasting lipids was measured rather than fasting lipids	0% (0%)	0% (0%)	No change
Adherence to NQUM Indicator 7.4: Percentage patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (BASELINE)	10% (55%)	7% (51%)	Worsened
Adherence to NQUM Indicator 7.4: Percentage patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (ONGOING)	16% (34%)	19% (37%)	Improved
Overall adherence to NQUM Indicator 7.4: Percentage patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (OVERALL)	12% (41%)	8% (46%)	Worsened

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4. RESULTS PHASE 4: FEEDBACK INTERVIEWS WITH LAG INVESTIGATORS

Six Principal Investigators (PIs) from 6 of the eligible 8 clinical services were interviewed. The 6 PIs were from the clinical services with the study code A, C, D, K, L and O. Clinical services C, K and L demonstrated improvements post-intervention while clinical services A, D and O demonstrated a decline. Interview duration ranged between 30 to 60 minutes.

The interventions implemented by LAGs in Phase 2 were provided and categorised into:
- Feedback of audit results
- Improvement in multidisciplinary teamwork and collaboration
- Implementation of electronic solutions
- Improvement/change in service delivery
- Strategies to normalise recommended practice
- Targeting of identified gaps in knowledge.

See Appendix 16 for a summary description of the interventions implemented.

Thematic analysis revealed the feedback could be categorised into the following overarching themes:
- HSO culture[§], climate[**], and service delivery[28-30],
- Human resources, and
- Defining and standardising practices and prompts that influence metabolic monitoring.

See Figure 18 for a summary of themes and subthemes and Appendix 20 for some indicative quotes under each theme and subtheme.

In addition, site PIs reported that they valued the study for the information sharing activities (common ground issues sharing, newsletters, and SG support) provided by the multi-site project coordinators as well as the value of local clinician engagement and multidisciplinary collaboration.

[§] HSO culture may be defined as the "personality" of the organisation, the work environment of shared behavioural norms, values, and expectations within an organisation that can take time to develop, sometimes even years, and can remain unchanged for a long time.

[**] HSO climate may be defined as the "mood" of the organisation, the work environment at a snapshot in time and may include employees shared perceptions of an organisational culture and the psychological impact of their work environment on their own personal well-being and functioning.

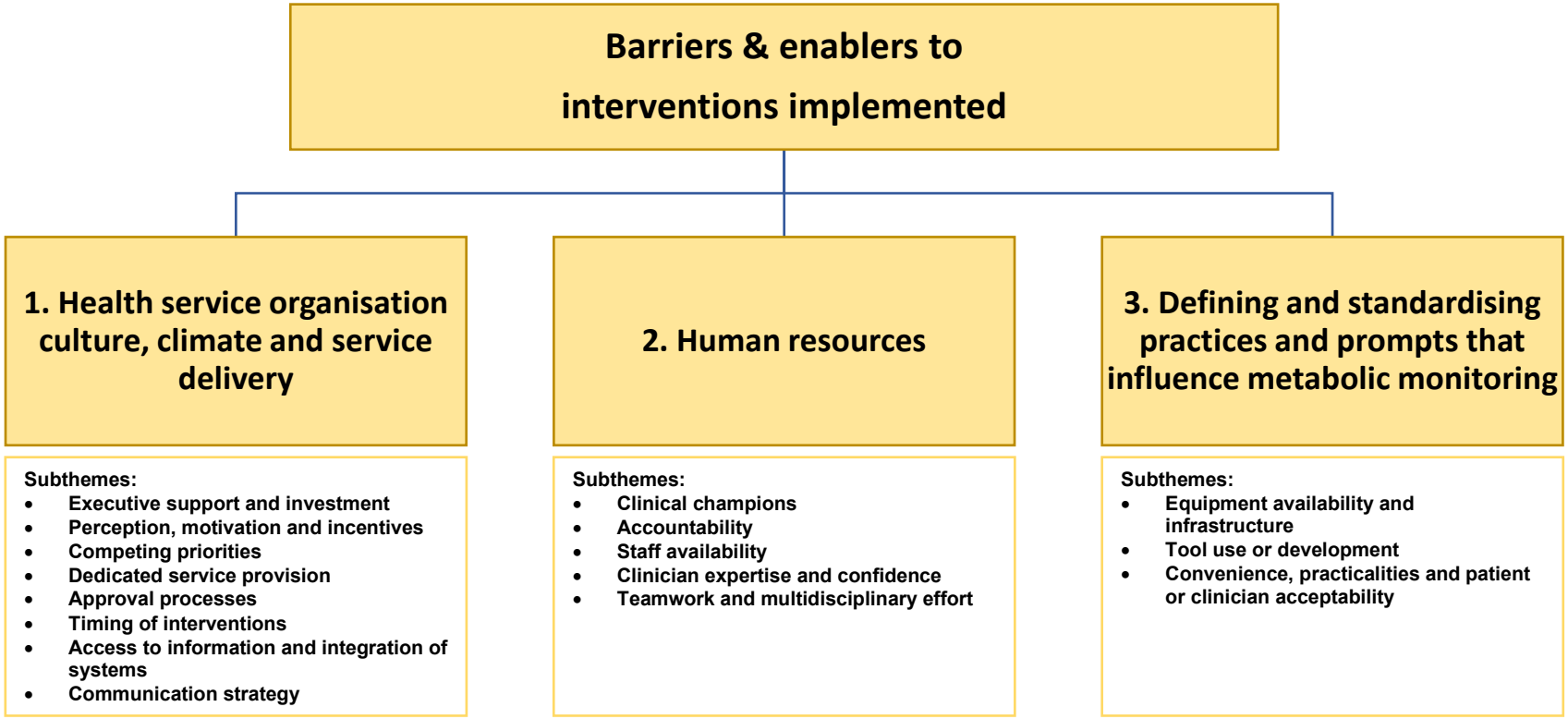

Figure 18 Overall themes and subthemes of encountered barriers and enablers for the implemented interventions

Details of the overarching themes, subthemes and some indicative quotes are provided below.

Theme 1: Health service organisation culture, climate, and service delivery

This theme comprises the perspectives of the individuals within the HSO (from leadership to front-line clinician level) and the resources and support available for the activities of the project. Health leadership is centred on the ability to identify priorities, provide strategic direction to multiple actors within the health system, and create commitment across the health sector to address those priorities for improved health services.[31] Effective leadership has been recognised as crucial in shaping organisational culture and is required to prioritise, lead and drive changes at all levels of the health system to actualise the goals of the ongoing reforms in health care organisations.[32]Leaders have been described to influence by what they systematically pay attention to. This can mean anything from what they notice and comment on, to what they measure, control, incentivise and deal with (which can encompass any number of things).[33]

Subtheme: Executive support and investment

The social context of the service including the opinions of colleagues, the culture of the HSO as well as organisational context of staff capacity and staff structure was identified by several investigators as presenting both barriers and enablers to metabolic monitoring activity in relevant patients.

Investigators highly regarded the commitment by executives and senior management to support and resource major activities from the start to the end of the project, especially the interventions implemented. "*[Management level] perception that metabolic monitoring is done well [but results show it is not] and so therefore [the issue of actual low metabolic monitoring is] not prioritised for education to improve it"* and *"Considerable amount of clinical director support with baseline audit and also intervention phase was particularly useful"*.

Subtheme: Perception, motivation and incentives

Individual professionals' attitude, motivation to change, behavioural routines and scope of practice were amongst some of the factors that influenced clinicians or services in sustaining or implementing changes. "*Perception that it is someone else's responsibility was challenging and a large barrier. Institutions responsible versus individuals responsible"* and *"NUMs [were] on board [with the interventions] because [they] did not want a zero result"*.

Subtheme: Competing priorities

Competing priorities, that is, differences in the perceived key concerns of the service where not all issues are treated as equally important were raised by several investigators as impacting on the success of the interventions. It was apparent that the project did not achieve recognition as an organisational priority at a number of sites given the drop out of several clinical services during Phase 3. "*Pre-intervention baseline poor results [were] not deemed a priority by our director of the unit; director new to the role at the time"* and *"Poor baseline audit results when sent to heads of departments, had little impact or feedback because it just added to the list of other competing issues in acute mental health care that needs to be addressed just as urgently"*.

Subtheme: Dedicated service provision

Service delivery of a specified set of functions provided by designated providers to designated consumers was identified as critical to improvement of metabolic monitoring. "*Phlebotomist resources limited as they are very busy and have a lot of work, they come early first thing in the morning and if there are too many bloods, sometimes they have to skip some. This also creates issues around getting correctly fasted bloods"* and *"With the dedicated position description and joint roles, direct follow up of individuals who haven't attended [the new clinic] based off the ward patient list meant that many patients were captured"*.

Subtheme: Approval processes

A requirement for formal approval steps were identified as a barrier to implementation of interventions. "*Guideline not approved yet due to all the red tape in approval processes and lack of executive support"* and *"[We] attempted to share the resources with another site as part of same mental health network but unfortunately can only be shared if someone writes it up and it is approved by the district mental health service"*.

Subtheme: Timing of interventions
The timing of interventions or service delivery were identified as important contributing factors to the success or failure of metabolic monitoring improvement. "*Conflicting education sessions and other mandatory training or staff continuing professional development (CPD)"* and *"People need notice for education slots to come prepared with questions and so they are more engaged"*.

Subtheme: Access to information and integration of systems
Access to the information held in the electronic medical records as well as how systems were integrated to access information related to metabolic monitoring had an influence on how well metabolic monitoring could occur. "*We had many locum doctors and sometimes these doctors didn't even have access to the system to monitor etc."* and *"The whiteboard monitoring has been a success and nursing staff find it easy to use. Although our site has a poor eMR integration system, our whiteboard intervention was an integrating system in itself"*.

Subtheme: Communication strategy
How the project related education and materials were made available across the service as well as what information they contained in their delivery had varying effects on the metabolic monitoring efforts. "*Posters and other quality improvement activities did not include how to action abnormal results. This is especially required given there is also a lot of variance and because Australian psychiatric units are often reluctant or uncomfortable in prescribing [for abnormal metabolic parameters]"* and *"NUMs using patient stories for patients who have died from complications of metabolic syndrome may have been helpful/impactful"*.

Theme 2: Human resources
The HSOs staff are key to any change in activities that are aimed at improving metabolic monitoring.

Subtheme: Clinical champions
A clinical champion, "defined as an individual within an organisation who has a responsibility to advocate for change, motivate others and use their position and expert knowledge to facilitate the adoption of a particular innovation"[34] was identified as a critical factor in improving metabolic monitoring. "*Champion often rotated out of the unit or left the organisation"* and *"With the dedicated position description and joint roles, direct follow up of individuals who haven't attended [the new clinic] based off the ward patient list meant that many patients were captured. Part of their role was to monitor metabolic syndrome which meant that they were ideal champions"*.

Subtheme: Accountability
Clear descriptions of responsibilities, objectives, performance expectations and measures and reporting requirements were emphasised as important to several investigators. *"Junior Medical Officer (JMO) perception that it is the GPs responsibility"* and *"The responsibility was shared and more floor staff were trained to take blood to avoid having to wait for a phlebotomist. This team approach has shared responsibility and I think improved outcomes"*.

Subtheme: Staff availability
Sufficient staff availability to participate in the interventions was important to the interventions impact and success. "*ECT/clozapine co-ordinator role is not covered during periods of leave", "Need champion on*

a weekend too" and *"Phlebotomist comes first thing in the morning to try and ensure fasting bloods taken prior to breakfast being served"*.

Subtheme: Clinician expertise and confidence
Aspects of a clinician's expertise and their level of confidence was uncovered as factors influencing metabolic monitoring. "*JMOs views that because it is a specialty area that they rotate briefly through they are unsure of how to do things in those specialised areas"*, and *"A strategy used and encouraged in the community to make tape measuring less awkward, to avoid the 'bear hug', is [getting the] patient holding the tape and [asking them] do a spin. Outpatients are used to doing this and now inpatients need to do the same"*.

Subtheme: Teamwork and multidisciplinary effort
Shared teamwork and multidisciplinary activities were identified as enablers by several investigators. "*Major emphasis placed on that it is everyone's responsibility to ensure metabolic monitoring is done. So, if not done, nurses must remind doctors and request a form and vice versa"* and *"JMO feedback that inpatient diets are poor and access to junk food such as 7-Eleven is easy. Our dietician is interested in this area and it is a possible area to explore to adjust inpatient diets"*.

Theme 3: Defining and standardising practices and prompts that influence metabolic monitoring
Policies, processes and non-human resources were identified as both barriers and enablers to the interventions aiming to improve metabolic monitoring.

Subtheme: Equipment availability and infrastructure
Availability of items such as measuring tapes and scales was an obvious but important factor to ensure monitoring could occur. Infrastructure components such as sufficient existing information technology (IT) systems, adequate physical space, and the availability of on-site pathology services were also important. "*If equipment required for monitoring not all kept together than often can get missed and also a barrier to all parameters being measured"*, and *"A well-equipped dedicated space for metabolic monitoring to occur"*.

Subtheme: Tool use or development
The appropriate use of visual prompts or standardised form templates either in electronic format or hard copy were identified as important foundations to improving metabolic monitoring. It was highlighted that policies and procedures are required to standardise and support recommendations about actioning of abnormal results and any required appropriate treatment. "*The whiteboard monitoring has been a success and nursing staff find it easy to use. Although our site has a poor eMR integration system, our whiteboard intervention was an integrating system in itself"* and *"Doctors at our site found the posters did assist in reminding them to complete adequate monitoring"*.

Subtheme: Convenience, practicalities and patient or clinician acceptability
Various individual clinician and patient factors were identified by investigators as barriers and enablers to several of the interventions. "*Clinicians may find it unnecessary to screen or monitor [for metabolic abnormalities] in a patient who is already known to have the abnormalities"* and *"Habits addressed, including the issue of making a patient wait before they could eat to take a fasting blood level. Instead, the blood was to be taken by anyone trained as soon as possible as a priority, [it] just needed to be done. In an attempt to allow this/overcome the issue, more floor staff also trained to take blood"*.

Other interview findings

The interviews also elicited several investigators visions and suggestions to improve metabolic monitoring itself and more globally, to improve overall metabolic health of all patients presenting to the mental health units with any mental illness through implementation of preventative measures. This included strategies such as modification of hospital food and drink provision processes and items and liaison and involvement of other clinicians including dieticians, exercise physiologists, occupational therapists, clozapine coordinators, other specialties such as general medicine and endocrinology. A summary is provided below.

Modification of hospital food and drink provision processes and items:

- Investigation of reducing access to additional serves of food.
- Covering the hot food Bain Marie while serving food to inpatients (visibility of leftovers obscured): liaison with the Work Health and Safety Department about the feasibility as it is a heated surface, for now closing shutters after food is served.
- Reducing quantity of sliced bread available at meals (currently patients can eat up to 6 slices with each meal).
- Looking at taking pictures of what a serving size should be and having this available to assist the food services staff. This may also involve allocating a nurse to supervise the meal distribution, and plating food prior to the mealtime to ensure consistency.
- Acquiring a hot water urn for the water to provide herbal teas as a substitute for soft drinks.

Liaison and involvement of other clinicians including dieticians, exercise physiologists, occupational therapists, clozapine coordinators, other specialties such as general medicine and endocrinology:

- Liaison with dietitians and food services staff to focus on inpatient menu options available.
- Maintain what the dietician has already worked hard on to structure the diet on the ward. I.e. morning tea is a big fruit platter, so is afternoon tea. Patients cannot have raisin toast until supper etc. There is also a cooking group on Fridays where nutrition is highlighted.
- Consultation with dietician regarding change in hospital inpatients' diet, not meant to starve patient and must ensure they get enough kilojoules e.g. consideration of patients making their own foods, options of soup and sandwiches for lunch.
- We have been in touch with general medicine to discuss recommended actions when abnormal parameters are reported.
- Consideration of a once-a-week service for nutrition counselling. Nutrition group can be added to the list of groups already in place.
- Dieticians' potential role in diets and access to healthy foods identified after JMO feedback that food served on ward is on unhealthy quality and access to snacks in between meals was also poor in what was available to choose from and what was sold in surrounding shops or vending machines.
- To explore how dietitians, exercise physiologists and occupational therapists can be involved in improving physical health.

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Discussion

Our study investigated the pre-post-intervention adherence to best practice guidance regarding monitoring of metabolic parameters as specified in the NQUM Indicator 7.4 and the subsequent impact of interventions, feedback, and education on changes to adherence. This is the first study to the best of our knowledge using NQUM Indicator 7.4 in the mental health care clinical setting to familiarise Australian clinicians caring for mental health patients with the NQUM Indicators and the methodologies used to measure clinical performance, develop and implement quality improvement (QI) strategies and evaluate the success of QI interventions. Overall, the results of this study showed that adherence to NQUM Indicator 7.4 for best practice metabolic monitoring remained low despite interventions implemented by participating clinical services.

Phase 1 pre-intervention baseline audit results discussion

Overall results

Phase 1 of the study demonstrated suboptimal metabolic monitoring with NQUM Indicator 7.4 with a median adherence of 11% (IQR= 13%) from 17 clinical services. A similar result was achieved in the first of 6 audits across 21 jurisdictions in the United Kingdom (UK), where the mean adherence was 11% (range 0-40%) for approximately 1,500 patients.[35] Despite increased risk for metabolic and cardiovascular disease in individuals with mental illness taking antipsychotic medication, metabolic screening and monitoring practices are often incomplete or inconsistent.[36] Although metabolic monitoring does not guarantee intervention, it is a necessary step in identifying those at risk of metabolic syndrome and in the overall management of patients with a mental health condition, with the use of the NQUM Indicators specifically recognised as of value in this process.[37]

At the time of the study, NSW Health provided the following policy and guidance.

1. GL2014_002: Mental Health Clinical Documentation Guidelines
2. PD2017_033: Physical Health Care within Mental Health Services
3. GL2017_019: Physical Health Care of Mental Health Consumers (Recently replaced by GL2021_006: Physical Health Care for People Living with Mental Health Issues)

The guidance for clinical documentation advised for use by NSW Health Mental Health Services (GL2014_002: Mental Health Clinical Documentation Guidelines)[38] recommends metabolic monitoring as a component of the physical health assessment of patients under the care of a mental health service. The guideline classifies documentation of metabolic monitoring as an 'additional module', completion of which is "as appropriate to the clinical situation" and that Local Health Districts (LHDs) should develop local policies regarding which staff record this monitoring or how information is shared with GPs. The guideline recommends that, "to assist care planning and monitoring, the [metabolic monitoring] module is intended to be used at baseline (drug naïve if possible), at three monthly reviews and more frequently when abnormalities are identified, or medication or dose is changed. As a result, it is expected that the module will be used in conjunction with the Care Plan and Review modules".

Although metabolic monitoring *per se* is not specifically required, the minimum requirements of the policy directives concerned with the physical health care of mental health patients in NSW (2017 and previous 2009 policy directive)[39,40] mandate a few core components in the physical examinations of patients: blood pressure, weight and waist circumference or waist-hip ratio (this latter parameter was stated in the 2009 policy directive but removed in the 2017 policy directive).

The NSW guidelines have steadily improved with respect to outlining the parameters that need to be measured to ensure best practice metabolic monitoring and their necessity. The lower standard applied to physical health in previous NSW guidelines and policy directives may have caused clinician confusion regarding appropriate metabolic monitoring. Some clinicians may interpret variation in guideline recommendations as representing evidence uncertainty. The current guideline, GL2021_006: Physical Health Care for People Living with Mental Health Issues[41] states that, "Physical health screening involves the person with lived experience where possible' and summarises minimum standards for physical health screening which incorporates all of the metabolic monitoring components specified in NQUM Indicator 7.4. The 2021 guideline[41] now provides a more cohesive summary of the screening factors and how and when they apply to inpatient and community care and clearly outlines action areas which may support future improved indicator adherence results.

The NQUM Indicator specifies measurement of waist circumference as the preferred parameter, rather than BMI or weight in adult patients, consistent with the recommendations of the International Diabetes Federation[19] and Australian consensus guideline recommendations[18,42] During the development of NQUM Indicator 7.4, feedback from field testing sites was that if the parameters of BMI or weight for adult populations were permitted, *in lieu* of waist circumference, overall adherence may improve. The final NQUM Indicator 7.4 was adjusted to include an alternative option for BMI or weight noting they are less preferable parameters. In this study, 5 sites showed improvement in indicator adherence when waist circumference, BMI or weight measurement for adult populations was permitted. This may indicate sites found it easier to measure or record BMI or weight. However, the overall adherence result for all sites did not improve. This suggests that other issues are likely to act as barriers to routine screening practices. Similarly, overall lipid monitoring adherence did not improve when lipid parameter monitoring was relaxed (allowed the fasting status to be unknown). The decision to allow this less stringent parameter reflected changes in cardiovascular practice[20], but also was a pragmatic decision based on feedback from the field testing sites as to the unreliability of the patient's fasting status in their patients' records.

The feedback received at the end of Phase 1 yielded information about a series of obstacles to screening in routine practice. Less than half of the participating sites expressed confidence in the interpretation of abnormal screening results. The questionable results or unreliability of results was a frequent barrier and were also findings in the UK audit[35] and Owen et al[12]. The format of electronic selection of pathology requests, the reporting of results and the individual work practices all potentially contribute to this unreliability. Local solutions including changes to work practices were sought to mitigate this barrier in Phase 2 of the study. A more systemic consistent approach in pathology requests across the public hospital system is recommended. Regardless of the state of fasting or non-fasting of the patient when their blood was drawn for sampling, the monitoring of the recommended lipids was poor, with only 1 in 3 patients receiving the recommended monitoring of their lipids. One of the barriers may be the differing recommendations for which lipid parameters should be screened and this was highlighted by NSW TAG in its presentation of the multisite study results at the Royal Australian and New Zealand College of Psychiatrists (RANZCP) 2017 Congress held in Adelaide and was noted by the RANZCP. Table 13 displays the differing recommendations current at the time of the multisite study.

Table 13 Variation in guidance recommendations for metabolic monitoring

Reference	Random BSL	Fasting BSL	Waist circum-ference	BP	HDL-C	Triglyceride (TG)	Total cholesterol	LDL-C	TG: HDL-C **	Weight and /or BMI
IDF metS parameters for diagnosis[19]	×	✓*	✓	✓	✓	✓	×	×	×	×
NQUM indicator 7.4[15]	×	✓*	✓	✓	✓	✓	×	×	×	×
Therapeutic Guidelines Psychotropic 2014[18]	×	✓	✓	✓	✓	✓	✓	✓	×	✓
Lambert et al. 2017[43]	¥	✓	✓	✓	✓	✓	✓	✓	✓	✓
Galletly et al. 2016[44]	×	✓	✓	✓	×	×	✓	×	×	✓
Curtis et al. Positive Cardiometabolic Health 2011[23]	×	✓*	✓	✓	×	✓	✓	×	×	×

*or HbA1c for established diabetes ¥Two random BSLs if fasting BSL is not available **Indicator of insulin resistance
IDF= International Diabetes Federation; metS=metabolic syndrome

Current recommended practice is to measure the metabolic parameters at, or prior to initiation of antipsychotic treatment and periodically thereafter (at least every 6 months after the first year of treatment).[45] In this study, adherence rates for metabolic monitoring were low in both those on newly initiated therapy and those with ongoing therapy. Adherence ranged from 0-50% with a median result of 10% (IQR=18%) at treatment initiation. Adherence ranged from 0-100% with a median result of 7% (IQR= 28%) for patients requiring ongoing monitoring. A systematic review of 39 studies found routine baseline screening was also generally low with measurements of blood pressure reported in approximately 70% of patients, of triglycerides in 60%, of cholesterol in 41.5%, of glucose in 44% and of weight in 48%.[46] In another study, investigators found metabolic monitoring frequency was greater at baseline (within 30 days before and after the new prescription date) than at initial follow-up (within, 60 to 120 days after prescription date), although at both times monitoring remained suboptimall.[47] Our study consistently showed poor results for those on ongoing therapy as compared to those newly initiated: 67% in newly initiated versus 50% in ongoing therapy for weight, 46% versus 27% for glucose or haemoglobin A1c, and 32% versus 16% for LDL-cholesterol.[47] Further research is required to identify and characterise specific barriers to metabolic monitoring both before commencement of an antipsychotic and during the recommended follow up periods. It has been suggested that low baseline monitoring is dependent on the context, where during acute care, the focus may be to ensure the safety of the patient and others rather than monitoring for metabolic abnormalities.[47] Clinicians may rely on previous laboratory values rather than obtain new metabolic results; however, this may not be documented. Moreover, patients who are agitated or psychotic may refuse laboratory testing[1] and refusal may not be documented or easily found in the medical records.[47]

A study of the rates of metabolic syndrome and monitoring in clozapine users reported a 45% prevalence of metabolic syndrome amongst the 43.4% of clozapine users with complete metabolic monitoring. This study also identified key gaps in collection of, and treatment for, metabolic syndrome and its individual parameters, along with limited collaborative work in correspondence between mental health services, primary care providers and clozapine users to ensure appropriate physical health interventions.[48] However, in recent years, improved outcomes in dedicated clozapine clinics

have been achieved through the development of a state-wide approach to documentation, adverse event monitoring and training of staff in nurse-led clinics.[49] The need to incorporate metabolic monitoring into routine mental health care would ideally follow a similar, systematic and standardised approach as exemplified by these clozapine clinic work practices.[50] There is some evidence to suggest that a dedicated metabolic clinic and systematised approach to use such clinics can also improve monitoring rates in non-clozapine treated patients.[51,52]

In summary, Phase 1 of our study showed that prior to implementation of quality improvement interventions, best practice metabolic monitoring rates were suboptimal and several areas for improvement were identified by LAGs.

Phase 2 development and implementation of interventions discussion

Phase 2 required the knowledge and expertise of LAGs in order that sites develop and tailor improvement strategies to local needs, priorities and resources to achieve best practice metabolic monitoring.[47]

Identified barriers

Despite the availability of a number of policies and guidelines and increased awareness about the issue, metabolic monitoring was suboptimal. Barrier themes included lack of resources or time, low organisational support, clinicians' reluctance to change, concerns over the quality of the guidelines and lack of ownership.[53]

Barriers identified by LAGs included issues with workflows, pathology systems and services. The lack of basic equipment (e.g. tape measures and scales) was identified, similar to other studies[25,35,54]. A survey of psychiatrists reported their willingness to measure most parameters in more than half of patients but reported that they were frequently confronted with lack of equipment, particularly tape measures.[55] Sites also reported cumbersome medical records for documentation, lack of prompts or alerts and inconsistent or non-existent exchange of information between systems as contributory to inconsistent monitoring practices. HSOs need to ensure that the correct equipment is available for clinicians to undertake physical health checks and that metabolic parameter measurements are included in admission forms, follow-up and discharge documentation to ensure continuity of care.

A significant barrier that was highlighted by LAGs was related to a lack of responsibility and accountability for physical health care, a finding also commonly reported in other studies.[8,35,56-58] Clear responsibility and accountability is required for success in integrating physical and mental health care.[25,59] Ideally, all clinicians should ensure that metabolic monitoring is conducted. If clinicians are not themselves in a position to undertake metabolic monitoring, they are still responsible for ensuring that it gets done, and ensuring appropriate referral.[60]

A consistently reported barrier from LAGs was the lack of consideration of other supports for patients' physical health, such as appropriate diets and exercise and guidance of how to intervene once a patient has abnormal metabolic parameters. A 2020 systematic review also describes this care gap once an abnormal metabolic parameter result is obtained.[58]

Identified enablers

Several enablers at the system, clinician and patient level were identified during the NQUM Indicator 7.4 multisite study. As with many other studies, adopting or endorsing tools or flow charts for metabolic monitoring as well as tailored training and education to target gaps in knowledge were identified as important educational enablers,.[25,57,61] This is important in empowering the clinician and providing clarity about their responsibilities in relation to physical health care.[50,57,59] Many of the factors identified

as enablers either empowered individuals and/or minimised the effort needed for individuals to conduct metabolic monitoring, consistent with the findings by Rodgers et al.[59]

While our study specifically examined metabolic monitoring rates, it was heartening to see that several LAGs considered both improving monitoring and more global interventions for improving physical health of all patients whether they are taking antipsychotic medicines or not. This highlights the importance of cohesive multidisciplinary and person centred care.

While a number of the barriers and enablers required local redress and support, a number required state-wide interventions or were best addressed jurisdictionally in order for substantial improvement to be achieved and sustained while avoiding duplicated effort.

The interventions implemented in Phase 2 of this study (outlined in Appendix 16) are similar to ones implemented in other studies aiming to improve metabolic monitoring in patients on antipsychotics.[50,56,57,60,61]

Phase 3 post intervention audit results discussion

Despite a multifaceted implementation strategy undertaken by LAGs, the median overall adherence to NQUM Indicator 7.4 did not show improvement in the post-intervention phase.

When comparing individual parameters between Phases 1 and 3 for the 8 Phase 3 sites, adherence to blood pressure measurement was consistently high (99% Phase 1,100% Phase 3) . Similar findings have been reported in a meta-analysis[46] by Mitchell et al. as well as other recent studies.[1,57] High BP measurement compliance could be explained by the ease of measurement and its familiarity given its inclusion in the basic vital observation measurements set.

Adherence to waist circumference measurement also improved (median 26% Phase 1, 60% Phase 3). This improvement may be attributed to the improvement strategies implemented by sites such as purchase of tape measures, placement of tape measures in prominent locations and training of techniques to measure waist circumference acceptable to consumers. Consumer-acceptable techniques for measuring waist circumference is relevant as clinicians report feeling uncomfortable conducting a waist measurement, consumers may not be comfortable with the close contact involved in placing a measuring tape around the body, and there may consumer anticipation of criticism or judgement.[60]

A possible explanation for the consistently low level of adherence to best practice metabolic monitoring is that individual clinicians may target specific patient groups for metabolic assessments as opposed to screening all patients routinely. For example, patients with diabetes would have more frequent BSL tests, or as highlighted by one LAG, “Clinicians may find it unnecessary to screen or monitor [for metabolic abnormalities] in a patient who is already known to have the abnormalities”. As our study did not collect data about patient comorbidities, we were unable to evaluate this proposition and future studies may wish to examine the effect of comorbid conditions or previous abnormal results on metabolic monitoring rates. While the overall adherence result remained low, there was slight improvement in metabolic monitoring in those who were receiving ongoing therapy (median 16% Phase 1, 19% Phase 3).

Our results are consistent with other research and reports highlighting the ongoing challenges in improving metabolic monitoring practices in mental health care.[8,25,46,50,56,61-65] For example, the Second National Audit of Schizophrenia (NAS2) in 2014 of over 5,500 people in community mental health services in England and Wales showed minimal improvement in the monitoring of physical health parameters compared with the first audit in 2012.[25,66]

Our study highlights that t significant deficiencies in the provision of metabolic monitoring remain despite efforts to implement improvement strategies, increased awareness of the issue and the availability of policies and guidelines.

Phase 4 follow up interview feedback results discussion

Clearly the provision of metabolic monitoring needs to be sustainably improved and in Phase 4, we obtained in-depth feedback from LAGs representatives to gain insight into what future work should be recommended. A number of potential factors which affect metabolic monitoring were identified and key themes of these factors are discussed below.

Health service organisation culture, climate, and service delivery

The importance of executive support and investment identified in this study is also reflected more broadly in the conduct of any project where this support underpins the success or failure of a project to achieve its aims.[67,68] HSOs must strive to provide a culture and climate in which clinicians and the services they deliver are well supported and resourced to identify areas for improvement and implement solutions for durable changes.[61]

Many mental health clinicians may not ask patients about medical issues or screen for them because of limited confidence in their assessment, lack of awareness of this health care aspect, and/or limited time or lack of resources directly available to them. Provision of a dedicated service or dedicated role was implemented by some services in our study to overcome this issue and ensure that the metabolic monitoring takes place, in intervention supported by other research.[46]

Allocating specific monitoring days was a popular intervention and described as easy to roll out across a ward. Similarly, designating a clinician or clinic to ensure completion of monitoring is considered an effective QI component. This intervention is included in the 'A Study of Strategies for Improving Schizophrenia Treatment' (ASSIST) study.[47] The concept of making metabolic monitoring "everyone's responsibility" was reported to result in "no one's responsibility", a finding also reported in previous research.[60,65] On the other hand, one LAG was able to make this concept effectively explicit with use of a whiteboard task list which served as a visual daily reminder for everyone during multidisciplinary rounds.

Regular auditing cycles[61,69] to track performance as well as ongoing and tailored education[1,50,57] using real cased based education demonstrating both poor and good practice was suggested by clinical services as enablers that motivate clinicians. Academic detailing to standardise clinical care is an important educational strategy that can be implemented as part of a multifaceted effort to improve metabolic monitoring practices.[2,70]

However, competing priorities, were often evident in participating sites with conflicting education sessions and difficulty in scheduling audit and feedback or clinician education. A similar barrier was also experienced by Viglione and Short in their education campaign delivered by a psychiatry register who was required to manage this on top of their regular clinical duties. In particular, a lack of organisational priority was a key factor that meant some LAGs felt their interventions were not adequately supported. This may be context specific as in the acute care setting there are several other acute mental health issues that may need to be addressed in the care of patients in the first instance, however this is not an excuse to avoiding metabolic monitoring all together.

Human resources

It was clear that the use of front-line clinical champions as strong advocates for improving metabolic monitoring was favoured by most of the LAGs and also consistent with research in this area.[61] Pannick,

Sevdalis and Athanasiou also identified that a sustainable and effective champion can be just as important as a dedicated service and can help promote local ownership and local solutions leading to durable changes.[71] Enablers included the champions' ability to train others in QI and availability within and outside of usual business hours. Measurement of QI opportunities at regular intervals such as those using the NQUM Indicators can help to bolster the efforts of the clinical champions as well as those who are responsible for strategic planning and implementation.

A common side effect of antipsychotic therapy is increased appetite and making patients wait for a blood test before eating may be considered unreasonable and lead to variable results. One study site upskilled more clinicians to be able to take blood to overcome logistical barriers of waiting for pathology services before eating. This was identified as a significant factor in improving results by one LAG and a successful strategy in a recent Australian study.[57]. This approach has several implicit benefits because it made metabolic monitoring a priority task, it emphasised the message that it's everyone's responsibility and importantly it also reflects patient centred care.

Inadequate systems in place for delegating responsibility for monitoring and sharing of laboratory results was identified as a longstanding barrier, which have also been reported in many other studies.[35,62,72,73] Psychiatrists may expect primary care physicians to monitor metabolic parameters for patients, whereas primary care clinicians may expect psychiatrists to monitor.[47] In our study, it was reported that JMOs perceived this to be the GPs responsibility. To overcome this, the provision of a dedicated service with amended position descriptions was reported.[63,74] For example, one LAG reported updating the clozapine coordinators position description to conduct metabolic monitoring on top of their usual related role of pathology management for patients on clozapine treatment, thereby not relying on different individuals to try and obtain the monitoring. In a study by Brown and colleagues, the implementation of a nurse practitioner role led to a considerable increase in metabolic screening as well as referrals being forwarded to patients' GPs to act upon abnormal results.[74] Like other studies, another approach taken was to increase staff capacity for phlebotomy tasks by upskilling them to take the appropriate bloods.[46,57]

On a more global level, there is a need for more formal arrangements regarding collaboration between primary and secondary care for management of physical health.[46,75] Policy in Australia does not currently mandate this responsibility for monitoring to be done by a particular clinician. NSW guidelines for example state that "LHDs should develop local policies regarding which staff record this monitoring or how information is shared with GPs."[38] In contrast, NICE guidelines with regards to lead accountability for the metabolic monitoring, specifies in more detail that: "a) Specialist mental health teams to assume lead responsibility for the first 12 months or until the service user's condition has stabilised. b) Thereafter primary care to assume lead responsibility, unless there are well developed local agreements. This will require clear agreements to be reached with local primary care services. This requires supporting the rapid sharing of the results of routine physical health monitoring between primary and secondary care."[27] The advent of the digital My Health Record in Australia should be able to overcome some of the communication and transfer of information barriers that affect continuity of care.

Defining and standardising practices and prompts that influence metabolic monitoring.
Availability of appropriate facilities, equipment and tools were identified as important to metabolic monitoring practices as well as functioning as a prompt to conducting measurement of the metabolic parameters. Equipment checklists are available in the NSW guideline[40] (page 5) and could be updated to provide advice with respect to recommended equipment storage locations (such as keeping the tape measures and scales together with the BP cuffs) to maximise the visual prompt.

Other tools such as educational resources in the form of posters and the use of the whiteboard task list[57] were identified as useful and effective because increasing eMR system use meant that "it's not always at the forefront of someone's mind compared to a blank paper form that needs to be filled in"

according to one PI. Other studies also support the use of checklists[50,57] and posters[56,69,73,76,77] as a way to improve metabolic monitoring rates via a visual prompt, addressing memory and attention barriers. However, in an increasingly digital world where little remains on paper records, HSOs and their clinicians need to embrace and adapt to this environment with novel techniques and use technology to its full potential.[78] Computerised reminders to identify patients due for monitoring is worth exploring further[47,69,78-81]

Happell et al. found that there is a lack of policy interconnection between national and state jurisdictions, that state policies across the country are inconsistent, and that there is little evidence of consistent policy implementation for the physical health of people with mental illness.[82] Policies and procedures to standardise and support recommendations about actioning of abnormal results and any required appropriate treatment was identified as an enabling tool for mental health services. The simple assessment and intervention framework such as the Lester Positive Cardiometabolic Health Resource[4] encourages collaborative and evidence-based approaches to protect cardiometabolic health and is an example of such a tool that could be included in policy and procedures. The "Don't just SCREEN – INTERVENE…" tagline[4] that accompanies this resource is an empowering way of delivering the message to clinicians about a problem and providing ways that they can do something about it.

Lessons learned and a summary of recommendations

Our study demonstrates there is substantial work to be done in improving metabolic monitoring in patients taking antipsychotic medicines. There is a need to embed metabolic monitoring practices into routine care (and act on abnormal results) and assign responsibility and accountability supported by a multidisciplinary team approach. This opportunity is supported by the Lancet Commission on global mental health and sustainable development[78]; the WHO's Comprehensive Mental Health Action Plan[83]; the Equally Well National Consensus Statement[84] on improving the physical health of people living with mental illness; the Healthy Active Lives (HeAL) statement[85] reflecting an international consensus on key principles, processes and standards to reverse the trend of people with severe mental illness dying early; and more recently a report by the Pharmaceutical Society of Australia[86]. The Lancet describes the "Collective failure to respond to this global health crisis results in monumental loss of human capabilities and avoidable suffering".[78]

Screening and prevention must be made a priority and receive significant investment in order to harness whole of system expertise, research, and data to ensure a lasting impact. The case for practice change and quality improvement activity is complex and needs to account for HSO, clinician and patient preferences. We experienced a loss to follow up of 9 sites. This is suggestive that there is a need to elevate and make QI a priority in mental health care and ensure that QI initiatives are embedded sustainably so that they can be repeated for continuous improvement cycles.

The Equally Well National Consensus Statement[84] on improving the physical health of people living with mental illness launched in 2017 is a statement that has been endorsed by every state and territory government, most Primary Health Networks, the National Rural Health Alliance and key professional organisations, including Exercise and Sport Science Australia, the Dieticians Association of Australia, the Royal Australian and New Zealand College of Psychiatrists and The Royal Australian College of General Practitioners, amongst many others. These organisations 'commit to making the physical health of people living with mental illness a priority at national, state/territory and regional'. The Equally Well Consensus Statement could be the conduit that connects all the initiatives and influential organisations to advance policy and mobilise resources. It is a larger body/substantial collective force that may elicit successful action/further traction.[87] In addition, the Healthy Active Lives (HeAL) statement[85], reflecting an international consensus on a set of key principles, processes and standards aims to reverse the trend of people with severe mental illness dying early by tackling risks

for future physical illnesses pro-actively and much earlier in life and encourages services to give equal priority to physical health and mental health through audit and professional development.

In 2009, Professor Tim Lambert recommended that in order the situation to improve, service reorganisation, communication enhancement, improved training and education, better incentives, accreditation rigour, and government leadership were required[8]. While these recommendations are still relevant and required, translation to real-world impact has been slow and minimal despite substantial research, promotional activities, and advocacy efforts to increase care for mental health patients.

This research has resulted in several key recommendations to all mental health clinical services in Australia including:

- Perform ongoing measurement using NQUM Indicator 7.4 and identify areas for improvement and support action.
- Form networks and multidisciplinary relationships and together, review enablers identified in Phases 2 and 4 of this project.
- Understand and engage in the opportunity to measure metabolic parameters in new or refreshed ways and act on these results.
- Demand strategic leadership and commitment from the executive level for the appropriate resources, protected time or funding arrangements to support improvement strategies and activities for metabolic monitoring and metabolic syndrome management.
- Allocate designated roles to lead and facilitate the implementation process.
- Embed models of care that will ensure sustainability of interventions including champion succession planning, automated audit using eMR and feedback, dashboard display of performance, and inclusion in orientation and ward-based training programs.
    - NSW TAG has developed a generic presentation template after feedback from LAGs that it would be useful for education to mental health clinicians and for use during audit and feedback activities or campaigns (available upon request or also here: https://www.nswtag.org.au/qum-indicators-set-7/).
    - Consider promoting and conducting educational campaigns at repeated at relevant time periods or cycles.[1]
- Develop and/or update targeted learning modules which address system-wide and individual patient-based strategies that promote metabolic monitoring and consider mandating during orientation to mental health clinical services.
- HSOs to ensure that the correct equipment is available for clinicians to undertake physical health checks and that metabolic parameter measurements are included in admission forms, follow-up and discharge documentation to ensure continuity of care during transitions between services.
- Liaise with eMR programs for facilitation of strategies such as pathology improvements, electronic decision support tools, electronic prompts, measurement and monitoring of indicator adherence and ongoing performance.[2]
- Ideally, all clinicians should ensure that metabolic monitoring is conducted. If clinicians are not themselves in a position to undertake metabolic monitoring, they are still responsible for ensuring that it gets done, and ensuring appropriate referral.
- Partner with professional bodies such as universities and specialty colleges to ensure that postgraduate education and continuing professional development for clinicians working in mental health includes modern competency based teaching on psychopharmacology and the physical health risks faced by people with schizophrenia.[3]
- Consider implementing or adapting for local use the "Lester UK Adaptation: Positive Cardiometabolic Health Resource: an intervention framework for patients with psychosis and schizophrenia (2014 update)"[4]
- Partner with Government leadership to conduct an ongoing National quality improvement study that involves primary care and implementation science principles.[3,5]

We wish to improve care in relevant clinical services that have not been involved in the project. To achieve this and many of the recommendations above, we recognise that it is essential to communicate our findings to other agencies and relevant bodies such RANZCP, eHealth NSW, jurisdictional Chief Psychiatrists, relevant Agency for Clinical Innovation networks, Taskforces and Institutes (Mental Health network, Cardiac network, Diabetes and Endocrine network, NSW Diabetes Taskforce, Primary Healthcare Institute, Reducing Unwarranted Clinical Variation Taskforce), Bureau of Health Information and Equally Well Alliance.

Other future considerations

There are other strategies that may be considered to improve metabolic monitoring that were not considered by LAGs in this study. For example, expanding the role of the formal consumer/peer support worker to include metabolic monitoring within their functions may be of benefit given many health services employ a mental health peer workforce.

Emerging methods of service delivery, such as telemedicine and online mental health education and therapies, may be especially helpful for people living in rural and remote communities and should be included in future research endeavours in this area. Although our study did not collect this data, we are aware that vulnerable and disadvantaged populations such as rural, and remote, and Aboriginal Torres Strait Islander communities have a higher burden of diseases and other disadvantageous social determinants of health leading to a greater vulnerability to metabolic syndrome and adverse effects on morbidity and mortality.[87] Standardising metabolic monitoring as part of routine practice will help ensure that no single patient or patient population misses out and is put at risk, or further at risk of harm. Once identified as at risk of suboptimal physical health, the evidence supports a multi-pronged strategy, delivering a range of preventive health interventions to help people make the lifestyle changes they need to improve their physical health.[88]

Another area for future research and intervention includes the development and use of tailored Patient Reported Experience Measures (PREMs) and Patient-Reported Outcome Measures (PROMs) that ensure that HSOs and clinicians meet patient expectations and needs and make effective interventions.[3,89-91] This focus area is also supported in a recent publication by the Pharmaceutical Society of Australia, Medicine Safety Forum: informing Australia's 10th National Health Priority Area, which recommends system changes to include the aforementioned patient reported measures and also highlights people living with mental ill-health as higher risk populations requiring priority for implementation of health system changes.[86]

NSW TAG hopes that the project outcomes help to inform QI activities in clinical settings across Australia (both mental and non-mental health care) and that it provides the starting point for a state and national strategy to mobilise and energise the many key stakeholders, health care professionals, policy makers, and patients to contribute to the future coordination of upstream population approaches to metabolic screening and prevention activities to deliver a healthier future for all patients taking antipsychotic medicines. Contemporary investment in resources for metabolic monitoring can benefit the health care system in the short and long term by reducing the burden on acute care and the adverse complications that result from untreated or undiagnosed metabolic syndrome.

Study limitations

Although mental health services may be the main source of antipsychotic initiation or up-titration, it is possible that some patients had metabolic monitoring carried out by their own General Practitioners and our results may underrepresent the rates of metabolic monitoring that has occurred. This data was not captured in our study mainly due to data collection challenges, however this limitation does reinforce the importance of seamless integration of a shared electronic system between primary and secondary/tertiary care[50] and a standardised process of documenting that relevant information in the system has been reviewed. In Australia, the My Health Record system is designed to address the information gap between these care settings by increased accessibility to patient information, however several access and utility challenges exist[92,93] and standardised work processes to easily capture the metabolic monitoring parameters if conducted by primary care are still required. In addition, this study focussed solely on the process indicator of monitoring rates and did not investigate rates of subsequent support or interventions when patients screened positively for metabolic syndrome or returned abnormal parameters, which could have also been conducted by GPs.[50] The intervention that would be required when metabolic syndrome is detected and then diagnosed was not included in the project scope and there is potential for future research to examine this using the NQUM Indicator 7.4. Studies determining which outcomes, facilitators, and barriers are likely to be context-specific and which might be generalisable would be ideal.

A limitation of the second phase of our study is the varying duration of the design and implementation phase across sites. This may have been attributed to resource constraints as well as contributed to the loss to follow up of some sites. However, our experience ultimately reflects the real-world experience of conducting multisite mixed methods studies where clinicians participating in the project are also required to manage their clinical caseloads. Several of the barriers and enablers to optimal metabolic monitoring that were identified at the end of Phase 1 to inform improvement strategies continued to be identified again later in Phase 3 indicating the need to explore into these factors in Phase 4.

Although it was disheartening that significant improvement was not achieved at several clinical services, it is important to note that our study experienced a loss to follow up of 9 sites in Phase 3, specifically resulting from challenges with the competing priorities of hospital wide electronic medication management (EMM) roll out (particularly affecting NSW services), other local projects, staffing and resourcing issues. Staffing resource reasons included one site reporting change in unit director and others reporting staffing turnover including a position secondment without replacement. Project momentum and motivation may have been dampened by this with enablers and success stories only shared amongst a smaller number of clinical services. This impact on the project reflects the experience of research conducted in the real-world clinical setting.

In Phase 4 of the study, we acknowledge that the views may not be representative of all LAGs due to loss to follow up and ultimately only representing views from 6 LAGs. Future research is needed to gain more detail into how interventions can be optimised locally and globally to improve metabolic screening rates.

Other procedural limitations involving governance and timing of data collection

Sites were able to start collecting data once site SSA approvals were obtained. Unfortunately, there were significant differences in the time it took sites to obtain these approvals. Some sites were able to commence collecting data or complete data collection for Phase 1 well in advance of other sites. The lack of synchronicity between sites posed challenges for the NSW TAG project team, members of LAGs and project progression. Whilst it is acknowledged that ethics and governance of research projects are of great importance and fundamental to the conduct of any research, the barriers to undertake this project meant that already scarce resources were consumed and potentially exacerbated the drop-out

rates in our study. It is recommended that national and state organisations consistently facilitate the national harmonisation of ethical review for low and negligible risk projects such as this one.

Study strengths

A strength of our study is the mixed methods research approach and rich qualitative data obtained from the multisite participation. The methodology of Phase 4 was an appropriate choice to provide rich information to policy makers about the views of frontline clinicians. This study offers detailed insight into barriers and enablers experienced by multiple sites of differing demographics and provides detailed recommendations as well as serves as a platform for future studies to be conducted on this important topic.

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Conclusion

Adherence to best practice guidance regarding monitoring of metabolic parameters with antipsychotic medicines according to NQUM Indicator 7.4 remained low despite implementation of a variety of interventions by several clinical services. Multidimensional challenges to appropriate metabolic monitoring were identified, ranging from local individual practices, to the level of human resources and HSO culture. Although attempts at addressing some of these challenges were made, through multi-faceted implementation interventions including feedback of audit results, multidisciplinary collaboration, improvements in service delivery and equipment availability, utilising clinical champions, staff training and education, we were unable to demonstrate their impact with certainty. One of the biggest hurdles experienced during this study was the apparent lack of prioritised resource support in this area of mental health care which also contributed to loss of study participation by 9 sites in the post-intervention phase, hampering our efforts to be able to effectively evaluate post-intervention implementation effects. While delivering health care is increasingly complex and demanding, particularly in the acute mental health care sector, health service organisations need to make metabolic health care in acute mental health care a priority and take both short and long term perspectives to the resultant adverse outcomes. For broader diffusion of healthcare innovations and strategies as proposed by several of the clinical services in this report, the mental health care sector requires greater maturity of systems and the collective efforts of clinicians, managers, and health executives to enable greater prioritisation of such practices to be embedded in the culture and environment of service provision.

Although the results of this study were not able to demonstrate an improvement in adherence to the NQUM Indicator 7.4, the study was able to achieve its other aim which was to introduce and familiarise Australian clinicians caring for mental health patients with the NQUM Indicators and the methodologies used to measure clinical performance, develop and implement QI strategies and evaluate the success of QI interventions in clinical settings. Applied more broadly across all healthcare functions, the improvement journey is essential for healthcare transformation and reducing unacceptable variations in health care. Many motivated clinicians appreciated the ability to be part of a multisite QI study and to work collaboratively together. We hope that our study informs subsequent efforts to improve care and safety for patients prescribed antipsychotic medications. NSW TAG wishes to thank the many people and HSOs who have been involved in the multisite study. NSW TAG recommends measurement of the NQUM Indicators mental health set to all health care practitioners interested in ensuring that patients living with mental illnesses realise the best outcomes they can from their use of medicines.

Acknowledgements

This project was co-ordinated by the New South Wales Therapeutic Advisory Group (NSW TAG) and led by an interdisciplinary Expert Steering Group. NSW TAG thanks the Steering Group for overseeing the overall project. We gratefully acknowledge the contribution of all the clinical services, the Local Advisory Groups and the local principal investigators and thank them for their participation in the project.

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NSW TAG wishes to thank Mr Stephen Hancock (Statistician, School of Medicine and Public Health, University of Newcastle) for his advice and input about statistical considerations of the project.

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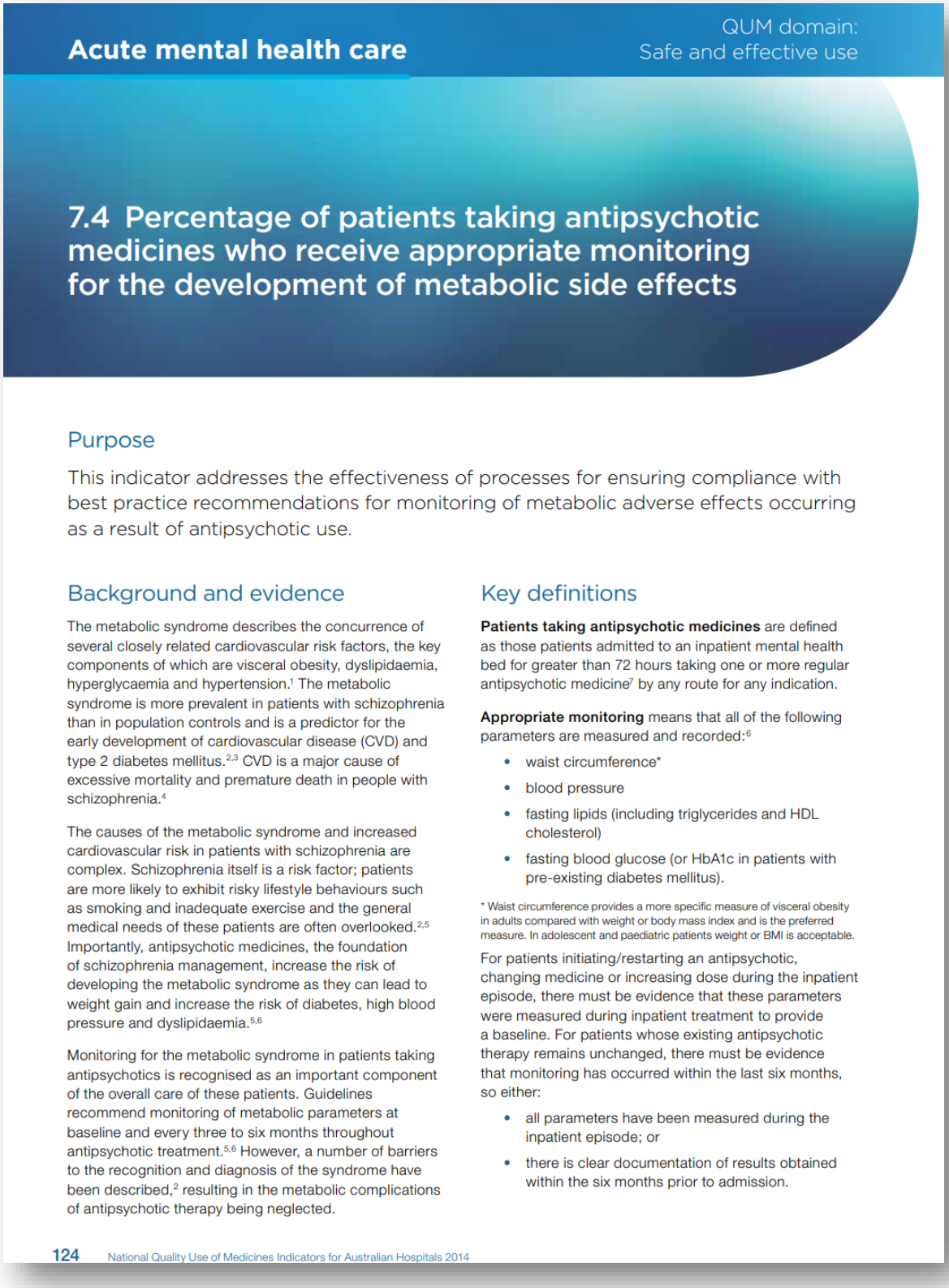
Appendices

Appendix 1: NQUM Mental Health Indicator 7.4



Acute mental health care

QUM domain:
Safe and effective use

7.4 Percentage of patients taking antipsychotic medicines who receive appropriate monitoring for the development of metabolic side effects

Purpose

This indicator addresses the effectiveness of processes for ensuring compliance with best practice recommendations for monitoring of metabolic adverse effects occurring as a result of antipsychotic use.

Background and evidence

The metabolic syndrome describes the concurrence of several closely related cardiovascular risk factors, the key components of which are visceral obesity, dyslipidaemia, hyperglycaemia and hypertension.[1] The metabolic syndrome is more prevalent in patients with schizophrenia than in population controls and is a predictor for the early development of cardiovascular disease (CVD) and type 2 diabetes mellitus.[2,3] CVD is a major cause of excessive mortality and premature death in people with schizophrenia.[4]

The causes of the metabolic syndrome and increased cardiovascular risk in patients with schizophrenia are complex. Schizophrenia itself is a risk factor; patients are more likely to exhibit risky lifestyle behaviours such as smoking and inadequate exercise and the general medical needs of these patients are often overlooked.[2,5] Importantly, antipsychotic medicines, the foundation of schizophrenia management, increase the risk of developing the metabolic syndrome as they can lead to weight gain and increase the risk of diabetes, high blood pressure and dyslipidaemia.[5,6]

Monitoring for the metabolic syndrome in patients taking antipsychotics is recognised as an important component of the overall care of these patients. Guidelines recommend monitoring of metabolic parameters at baseline and every three to six months throughout antipsychotic treatment.[5,6] However, a number of barriers to the recognition and diagnosis of the syndrome have been described,[2] resulting in the metabolic complications of antipsychotic therapy being neglected.

Key definitions

Patients taking antipsychotic medicines are defined as those patients admitted to an inpatient mental health bed for greater than 72 hours taking one or more regular antipsychotic medicine[7] by any route for any indication.

Appropriate monitoring means that all of the following parameters are measured and recorded:[6]

- waist circumference*
- blood pressure
- fasting lipids (including triglycerides and HDL cholesterol)
- fasting blood glucose (or HbA1c in patients with pre-existing diabetes mellitus).

* Waist circumference provides a more specific measure of visceral obesity in adults compared with weight or body mass index and is the preferred measure. In adolescent and paediatric patients weight or BMI is acceptable.

For patients initiating/restarting an antipsychotic, changing medicine or increasing dose during the inpatient episode, there must be evidence that these parameters were measured during inpatient treatment to provide a baseline. For patients whose existing antipsychotic therapy remains unchanged, there must be evidence that monitoring has occurred within the last six months, so either:

- all parameters have been measured during the inpatient episode; or
- there is clear documentation of results obtained within the six months prior to admission.

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7.4

Data collection for local use

Please refer to the section *Using the National Quality Use of Medicines Indicators for Australian Hospitals* for guidance on sample selection, sample size, measurement frequency and other considerations.

Inclusion criteria: All adult, adolescent and paediatric patients taking at least one regular antipsychotic medicine during their inpatient episode should be included. Patients receiving regular antipsychotic medicine for indications other than psychosis should be included.

Exclusion criteria: Patients with a length of stay less than 72 hours.

Recommended data sources: Medical and pharmacy records including medication charts and pathology results.

The data collection tool for QUM Indicator 7.4 assists data collection and indicator calculation.

Data collection for inter-hospital comparison

This indicator may be suitable for inter-hospital comparison. In this case, definitions, sampling methods and guidelines for audit and reporting need to be agreed in advance in consultation with the coordinating agency.

Indicator calculation

$$\frac{\text{Numerator}}{\text{Denominator}} \times 100\%$$

Numerator = Number of patients taking regular antipsychotic medicines who receive appropriate monitoring for development of metabolic side effects

Denominator = Number of patients receiving regular antipsychotic medicines

Limitations and interpretation

This indicator requires a number of separate parameters to be monitored in order for metabolic monitoring to be deemed appropriate. It is recommended that individual components of the indicator are collected to inform post-audit interventions. The accompanying data collection tool assists the collection of these components. Barriers to appropriate monitoring such as patient refusal for blood tests may also be collected to inform post-audit interventions. The local indicator oversight group may also wish to collect data that allows consideration of this indicator in the broader context of practice intended to improve other health outcomes e.g. smoking, relevant family history.

Determination of whether appropriate monitoring has occurred may be dependent on the extent of documentation in the patient's records. Good documentation supports quality patient care.[8] Poor communication can result in adverse drug events.[9] Thus it is assumed that absence of explicit evidence means that monitoring did not take place.

This indicator looks at whether monitoring occurred, but does not assess whether abnormal results are followed up appropriately. It is acknowledged that whilst metabolic syndrome is a long term complication of antipsychotic therapy, this indicator does not assess the continued monitoring of patients post-discharge. It is strongly recommended that results of inpatient monitoring and a plan for continued monitoring be communicated to ongoing care providers and to the patient or their carer at discharge.

Further information

An evidence-based algorithm for metabolic syndrome screening and example monitoring template has been developed by Waterreus and Langharne at the University of Western Australia and published in the Medical Journal of Australia.[6] These and other tools[10,11] may assist hospitals to implement routine monitoring for metabolic syndrome in patients taking antipsychotics.

Medication Safety Self Assessment in Australian Hospitals[12] (MSSA) can help identify potential strategies for improvement with this and other indicators. MSSA encourages development of robust systems for safe prescribing, dispensing, administration and monitoring of medicines. MSSA is available at **www.cec.health.nsw.gov.au**

This indicator can be used to assist hospitals in meeting the National Safety and Quality Health Service Standard 1 [items 1.2.1, 1.2.2, 1.5.2, 1.6.1, 1.6.2, 1.7.2], Standard 4 [items 4.2.1, 4.4.2, 4.5.1, 4.5.2, 4.7.2, 4.11.1].[13]

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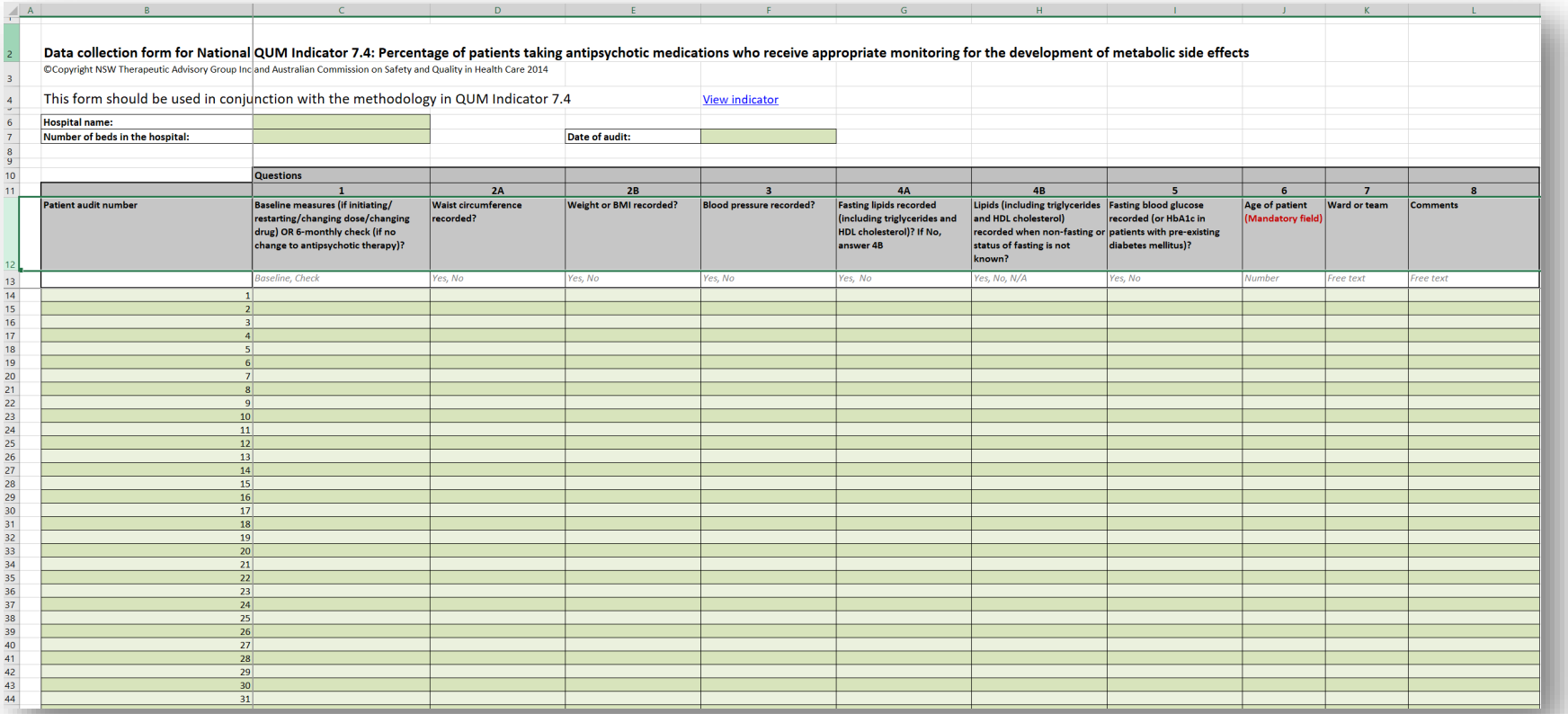
Appendix 2: NQUM Indicator 7.4 Data Collection Tool

Also available to download here: https://www.nswtag.org.au/qum-indicators-set-7/



Data collection form for National QUM Indicator 7.4: Percentage of patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects

This form should be used in conjunction with the methodology in QUM Indicator 7.4 — View indicator

Hospital name:			
Number of beds in the hospital:		Date of audit:	

	Questions									
	1	2A	2B	3	4A	4B	5	6	7	8
Patient audit number	Baseline measures (if initiating/ restarting/changing dose/changing drug) OR 6-monthly check (if no change to antipsychotic therapy)?	Waist circumference recorded?	Weight or BMI recorded?	Blood pressure recorded?	Fasting lipids recorded (including triglycerides and HDL cholesterol)? If No, answer 4B	Lipids (including triglycerides and HDL cholesterol) recorded when non-fasting or status of fasting is not known?	Fasting blood glucose recorded (or HbA1c in patients with pre-existing diabetes mellitus)?	Age of patient (Mandatory field)	Ward or team	Comments
	Baseline, Check	*Yes, No*	*Yes, No*	*Yes, No*	*Yes, No*	*Yes, No, N/A*	*Yes, No*	*Number*	*Free text*	*Free text*
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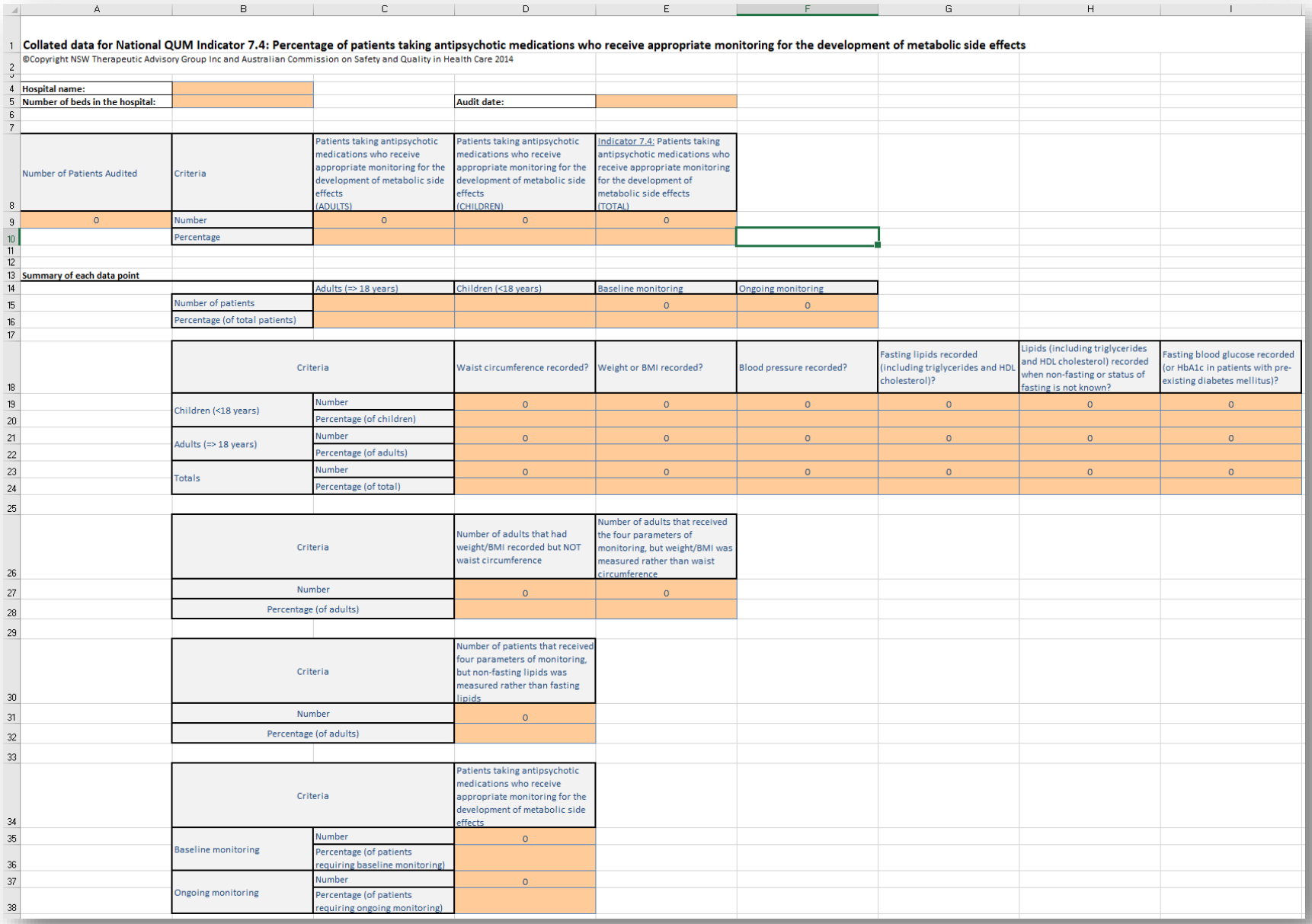


Collated data for National QUM Indicator 7.4: Percentage of patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects

Hospital name:	
Number of beds in the hospital:	
Audit date:	

Number of Patients Audited	Criteria	Patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (ADULTS)	Patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (CHILDREN)	Indicator 7.4: Patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (TOTAL)
0	Number	0	0	0
	Percentage			

Summary of each data point

	Adults (=> 18 years)	Children (<18 years)	Baseline monitoring	Ongoing monitoring
Number of patients			0	0
Percentage (of total patients)				

Criteria		Waist circumference recorded?	Weight or BMI recorded?	Blood pressure recorded?	Fasting lipids recorded (including triglycerides and HDL cholesterol)?	Lipids (including triglycerides and HDL cholesterol) recorded when non-fasting or status of fasting is not known?	Fasting blood glucose recorded (or HbA1c in patients with pre-existing diabetes mellitus)?
Children (<18 years)	Number	0	0	0	0	0	0
	Percentage (of children)						
Adults (=> 18 years)	Number	0	0	0	0	0	0
	Percentage (of adults)						
Totals	Number	0	0	0	0	0	0
	Percentage (of total)						

Criteria	Number of adults that had weight/BMI recorded but NOT waist circumference	Number of adults that received the four parameters of monitoring, but weight/BMI was measured rather than waist circumference
Number	0	0
Percentage (of adults)		

Criteria	Number of patients that received four parameters of monitoring, but non-fasting lipids was measured rather than fasting lipids
Number	0
Percentage (of adults)	

Criteria		Patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects
Baseline monitoring	Number	0
	Percentage (of patients requiring baseline monitoring)	
Ongoing monitoring	Number	0
	Percentage (of patients requiring ongoing monitoring)	

Appendix 3: Roles and responsibilities of LAGs and the NSW TAG Steering Group

The establishment of a Steering Group to oversee all phases of the project.
The establishment of a Local Advisory Group (LAG) at each participating site to reflect local experience and needs, and to oversee all phases of the project at the local site.

Phase 1: Pre-intervention baseline clinical audit
Roles and responsibilities of the LAG of each site:

- Ensure that local project processes are robust and timely. This will include:
  - Determine the most appropriate, feasible and valid method of data collection/patient identification for that site.
  - Ensure the collection of data is rigorous and uses the fit-for-purpose data collection tool that has been provided (see Data collection). The data may be collected by healthcare personnel who are not LAG members. It is important however, that the integrity of the data be assured.
  - Provide the NSW TAG Steering Group with a description of the sampling method used.
  - Provide the NSW TAG Secretariat with summary results and feedback regarding data collection and local results.
  - Share the local and collated results (obtained from NSW TAG) to local clinicians.

Roles and responsibilities of the NSW TAG Secretariat and Steering Group:

- Provide guidance to sites, such as sampling methodological advice, responses to data collection queries, as required.
- Collate summary results.
- Provide regular updates and responses to site specific questions to all participants.
- Provide results and reports to all sites for review and comparisons.
- Review of comments and feedback from sites regarding data collection and results in order to inform Phases 2 and 3.

Phase 2: Development and implementation of QI interventions
The interventions will be informed by the individual site result and multi-site result obtained in Phase 1, the literature regarding quality improvements strategies, identification of enablers and barriers at each site and the site's resources and capabilities. It is likely that more than one intervention will be required at sites to achieve significant improvement.
Roles and responsibilities of the LAG of each site:

- Identification of the barriers and enablers for adherence to metabolic monitoring recommendations during Phase 1 and potential QI interventions for reporting back to NSW TAG Steering Group.
- Development and implementation of local QI interventions, including any interventions developed by the NSW TAG Steering Group for multi-site implementation, as appropriate.
- Timely implementation of all planned QI interventions; and,
- Detailed documentation of the site's resources and capabilities, all the local interventions that were developed and the interventions that were implemented for reporting back to the Steering Group.

Roles and responsibilities of the NSW TAG Secretariat and Steering Group:

- Review of the summary results from Phase 1 and identification of common gaps;
- Identify common barriers and enablers for adherence to metabolic monitoring recommendations and QI strategies;
- Provide assistance to local sites in the development and implementation of local quality improvement interventions; and,
- Lead the development of a specific intervention with consultation of sites, where an intervention is likely to be implemented by all/most sites.

Phase 3: Post-intervention clinical re-audit
The timing of Phase 3 will depend on the time taken for implementation in Phase 2 as well as a reasonable time period to allow for changes of practice and adoption of potentially new management strategies (determined by the LAG and Steering Group).

Re-audit and feedback:
This phase will include a re-audit of eligible patients by each LAG. The same sampling, data collection and feedback methodologies as used in Phase 1 are planned. See Phase 1 for details of methodologies and the roles and responsibilities of LAGs and the NSW TAG Steering Group.

Analysis of results:
NSW TAG Steering Group will undertake quantitative analysis to compare summary results (adherence with metabolic monitoring recommendations) in Phase 1 (pre-intervention) with those achieved in Phase 3 (post-intervention) at each local site and between sites.

Phase 4: Follow up semi-structured interviews for feedback
Feedback reflecting on the successes and shortcomings of interventions implemented and how these could be altered for better outcomes will be sought from each LAG via a semi-structured interview conducted by the NSW TAG secretariat and results analysed by the Steering Group.

Publications and presentations:
Local sites are able to report and publish the outcomes of the local project for academic requirements, publication in peer-reviewed journals and conference presentations. The NSW TAG Steering Group will be documenting the outcomes of the multi-site project in a report that will be available on the NSW TAG website and hopes to publish in peer-reviewed journals and present at conference meetings.

Appendix 4: Study related questions received from LAGs and answers provided by NSW TAG Steering Group

Questions received up to December, 2016

Question	Response
1. Is Phase 1 of the study *(retrospective data collection and collation; with results forwarded to NSW TAG*) required to be completed by 6th June 2016, as per checklist circulated in the 'Aims and research design of study' document?	No. Although it was planned to have the data collection completed by then, there have been delays in receiving ethics approvals at all sites.
2. Is it necessary to have a *fasting* BSL recorded for adherence to the indicator, or is HbA1c sufficient (in a patient who is NOT a known diabetic?)	• Yes, a fasting BSL is required in non-diabetic patients. Although HbA1c is MBS-funded as a once a year screening for type 2 diabetes, it is not appropriate for the purposes of metabolic monitoring where testing of a fasting BSL is required every 3 months in a patient currently receiving antipsychotics. • The *fasting* BSL requirement for adherence to the metabolic screening NQUM Indicator 7.4 will remain.
3. There have been discussions regarding the requirement for the use of *fasting* triglycerides and lipids, as in practice this may not be always occurring. The present Cerner PowerChart® for Metabolic Monitoring does not distinguish between fasting and non-fasting. It may not be obvious if a blood sample was drawn in the fasting or non-fasting state.	• The requirement will remain for the sample to be a fasting sample. • There will be a small change to the Data Collection Tool (DCT) with an additional column to collate information about whether any lipid results (including HDL cholesterol and triglycerides) exist. • This column will be used when the lipid results are non-fasting or the fasting /non-fasting status is unknown. • The modified DCT will be circulated.
4. If a patient receiving an antipsychotic is already prescribed and receiving a medicine, e.g., a statin, can they be included in the study?	• Yes. There is no exclusion based on a patient's medication regimen. The only medicine that is relevant to inclusion is the current use of an antipsychotic. • If your Local Advisory Group (LAG) wishes to record other medications in use, it is possible to note these in the "comments" column as free text; however, there will be no 'results' from this column on page 2 of the DCT.
5. When will the multi-site study commence?	Data collection has commenced at two sites. For the remainder, it is ideal to wait until the next version of the modified DCT is circulated (see Q.3, above)
6. What is the sample size required for each site?	• The minimum number of patients required for Phase 1 and Phase 3 of the study is 30. The LAG can decide that their site will have a sample size of more than 30 patient cases, which can increase the precision of the results. • For smaller sites, if this is not feasible, please contact NSW TAG.
7. Does the sample size or sampling methodology need to be adjusted if a site has more than one type of patient demographic in its sample (e.g. a facility with separate beds/units for acute adult patients and psychogeriatric patients)?	• Consideration and documentation of the patient demographics (and the usual care that these patients receive if different) by the LAG is important for benchmarking purposes and as the interventions may have some slight differences. • Depending on the number of the patients in the different demographic cohorts, sites can either collect a minimum of 30 patients in each demographic OR ensure that the sample size for the demographic cohorts is similarly proportional in the pre-intervention and post-intervention audits. • For example, a site with both acute adult and psychogeriatric patients using a sample size of 30, may collect data from 20 acute adult and 10 psychogeriatric patients at the baseline and then at the post-intervention audits. (If they had a post-implementation sample size of 45, they would need to collect 30 and 15 patients respectively for their comparisons between baseline and post-intervention so as to avoid bias from demographics). • As there are sites with psychogeriatric patients and sites with adolescent patients in this multi-site study, being able to identify these groups/subgroups, will enable benchmarking. Hence the collection of age data on the DCT is mandatory for this multi-site study.

Question	Response
8. How are known non-compliant patients recorded in the DCT? That is, as baseline or ongoing "check"?	• Decision made when these were field tested to clarify this in indicators as a "restart"; that is insert into "baseline" category. • This decision has been ratified by the NSW TAG steering group.
9. If BSL result recorded at 8.30am was 4.2 and lipids taken at the same time, can these be recorded as "fasting"?	Probably – have to make sensible decisions regarding this. These are some of the limitations of a multi-site, real-life study.
10. If patient has had AP changed on admission, is this baseline check?	Yes
11. If patient is to have AP ceased at discharge (or soon after) e.g. in case of acute drug-induced psychosis, should the patient be included in the sample?	Yes, their data are to be included. An inclusion criterion is that the antipsychotic is used for any purpose.
12. If a patient refuses to have a measurement taken, is that still considered "No" on the data collection tool?	The NQUM Indicator 7.4 specifically mentions the case of non-adherence due to patient refusal. Suggestion to site is to make a note in the comments column, as it may be an opportunity for intervention.
23. Do the results of tests (e.g. fasting BSL) all have to be from laboratory results, for "yes"?	Yes. A finger-prick result, for instance, is not acceptable.

Appendix 5: Study Newsletter 1

NSW tag
NSW Therapeutic Advisory Group Inc.
Promoting the quality use of medicines in public hospitals

MENTAL HEALTH QUM INDICATOR MULTI-SITE STUDY - UPDATE

Newsletter 1 July 2016

Final recruitment of sites

As of July, 2016, sixteen different sites have been recruited to participate in the study: two from interstate (see table). Of these, twelve have had local governance approval and can begin Phase 1 data collection.

So far, **four sites have completed Phase 1 data collection**: Bega, Goulburn, Wagga Wagga and Bankstown and a further four have commenced.

Questions from the field

1. **Is it necessary to have a fasting BSL recorded for adherence to the indicator, or is HbA1c sufficient (in a patient who is NOT a known diabetic?)**

Yes, a fasting BSL is required to be recorded in non-diabetic patients. Although HbA1c is MBS-funded as a once a year screening for type 2 diabetes, it is not appropriate for the purposes of metabolic monitoring where testing of a fasting BSL is required **every 3 months** in a patient currently receiving antipsychotics.

2. **It is not always obvious if the sampling for LDL and triglycerides is in the fasting state. Is acceptance of non-fasting lipids OK?**

For adherence to the indicator, the sample is to be drawn in the non-fasting state, although this may not be easily determined. A second version of the data collection tool is available which will accept both measures and provide two tallies (contact nswtag@stvincents.com.au if you have not received this).

3. **If a patient known to be non-adherent is admitted and to be included in the study, are their details noted to be "baseline" or "6-monthy check?"**

A final decision on this has not been made. If you have feedback or evidence to offer for this decision, please contact NSWTAG.

Sites recruited to NSW TAG mental health QUM indicator multi-site study (July 2016)

- Bankstown- Lidcombe
- Bega
- Bloomfield Campus, Orange
- Alice Springs, Central Australia Health Service
- Children's Hospital at Westmead
- Concord
- Goulburn
- John Hunter Hospital Nexus (adolescent) unit
- Manly
- Mater Mental Health, Hunter New England
- Royal North Shore
- Royal Prince Alfred
- St Vincent's, Sydney
- The Alfred, Melbourne
- Wagga Wagga Rural Referral
- Wollongong

Benchmarking survey

Thank you for those who have completed the bench-marking survey already. If you haven't can you please go to:
https://www.surveymonkey.com/r/LB7W65V

Feedback from your Local Advisory Group (LAG)

Please keep a record of your meetings and decisions made by members of your local expert advisory group, for sharing and quality improvement purposes.

Thank you to all principal investigators and members of the local advisory groups for your input so far. Please contact us at NSW TAG on 02 8382 2852 or nswtag@stvincents.com.au if you have any questions, suggestions or feedback.

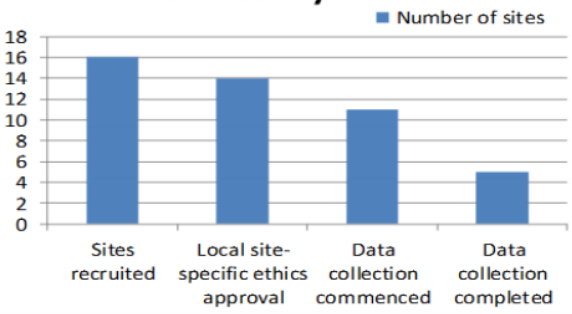
Appendix 6: Study Newsletter 2

NSW Therapeutic Advisory Group Inc.
Promoting the quality use of medicines in public hospitals

MENTAL HEALTH QUM INDICATOR 7.4
MULTI-SITE STUDY - UPDATE

Newsletter 2 **August 2016**

Mental health QUM indicator multi-site study: Phase 1



The role of the NSW TAG Mental Health steering committee

The role of this multi-disciplinary committee has been to:

- design and oversee the roll-out of our multisite study;
- consider and make decisions on questions that have arisen from the field (ie; from you as the clinicians involved in the collection and collating the data); and
- provide expertise in the area of research and quality improvement and how this relates to provision of mental health.

If you have any questions about data collection or the design of our study, please forward them to
Margaret.Jordan@svha.org.au

Questions from the field

1. ***During phase 1 data collection, it was noticed that often total cholesterol had been recorded, but not HDL. Is this sufficient?***

The National QUM indicator 7.4 uses the International Diabetes Federation definition for metabolic syndrome[1] for screening, which is endorsed in Australian recommendations[2].

That is, for a person to be **defined as having the metabolic syndrome** they must have:

Central obesity, *plus any two of:*

- *Raised triglycerides: ≥ 1.7mmol/L*
- *Reduced HDL cholesterol : < 1.03 mmol/L in males; < 1.29 mmol/L females*
- *Raised BP: systolic ≥ 130 or diastolic ≥ 85mmHg*
- *fBSL≥ 5.6mmol/L (or previously diagnosed type 2 diabetes)*

Action required: please record **only if HDL has been measured** in column 4A or 4B (as appropriate). If only total cholesterol has been reported, answer "no" & make a note in the "Comments" column.

2. ***If a patient is admitted and is known to be non-adherent to antipsychotic medicines, how is the patient classified; that is, as "baseline" or "check"?***

For a consistent approach, please record as "baseline".

3. ***If it is anticipated that antipsychotic therapy will not be included in ongoing treatment after discharge, is that patient still to be included in the sample, and their data collected?***

These patients are still to be included in the dataset.

1. Albert K, et al. Lancet 2005; 366:1059–1062.
2. eTG Complete [Internet]. Melbourne: Therapeutic Guidelines LTD; 2013 July.

Introducing our NSW TAG Mental health steering committee

Dr Nick O'Connor	Clinical Director, North Shore Ryde Mental Health Service
Dr Greg Carter	Conjoint Professor, Centre for Translational Neuroscience and Mental Health, University of Newcastle
Aoife Davis	Mental Health Pharmacist, Manly Hospital
Seniha Karacete	Mental health pharmacist, Concord Hospital
Angela Meaney	Mental Health RN, Concord Centre for Mental Health
Veta Peereboom	Mental Health Pharmacist, Royal North Shore Hospital
Paul de Carlo	Mental Health Nursing and Midwifery Office, NSW DoH
Dr Sasha Bennett	Executive Officer, NSW TAG Principal Investigator
Margaret Jordan	QUM project Officer, NSWTAG Coordinating Investigator

Feedback from your site

Don't forget to keep a record of your meetings of your expert advisory group, for sharing and quality improvement purposes. Email nswtag@stvincents.com.au

RANZCP 2017 Congress—May 2017

NSW TAG has been invited to submit an abstract for a pre-conference workshop. If any psychiatrist involved in the multi-site study would like to partner in a proposal, with the focus on the potential use of indicators for scholarly projects for advanced trainees, please contact Dr Sasha Bennett on 02 83822852.

Appendix 7: Study Newsletter 3

NSW TAG — NSW Therapeutic Advisory Group Inc. | Advancing quality use of medicines in NSW

NEWSLETTER 3

SEPTEMBER 2017

MENTAL HEALTH QUM INDICATOR 7.4 – A MULTI-SITE STUDY

Update: Baseline audit results using the National QUM indicator 7.4: appropriate metabolic monitoring in patients taking regular antipsychotics

1. SITES

Seventeen clinical services from 16 hospitals in 12 NSW Local Health Districts and 2 jurisdictions, Victoria and the Northern Territory, participated in the baseline audit using the NQUM Indicator 7.4. Most hospitals were from NSW metropolitan, regional and rural centres.

2. SAMPLE AND POPULATION

Data from 670 patient records was collected, with an average of 39 patients per clinical service. The mean age was 40 years (range: 8-90 years).

3. RESULTS

Overall, the audit identified suboptimal metabolic monitoring with mean Indicator 7.4 adherence of 14% (range: 0 to 42%). See Figure 1.

Adherence to the indicator using *alternative parameters* did not improve the results:

- Mean indicator adherence of 11% when weight or BMI used instead of waist circumference.
- Mean indicator adherence of 3% when any lipid result used (i.e. fasting or non-fasting) instead of recommended fasting lipids only.

Adherence to *individual parameters* summarised in Figure 2.

- Blood pressure (BP) only parameter consistently recorded.

Results analysis

- Monitoring gaps varied between clinical services.
- Local work practices differed.
- Locally developed and driven quality improvement intervention strategies required.
- Advocacy to NSW Health pillars and stakeholders required for common gaps.

Figure 1: Clinical service adherence to NQUM MH indicator 7.4, n=17

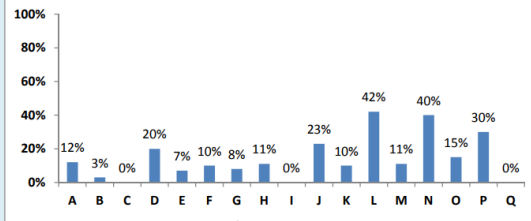
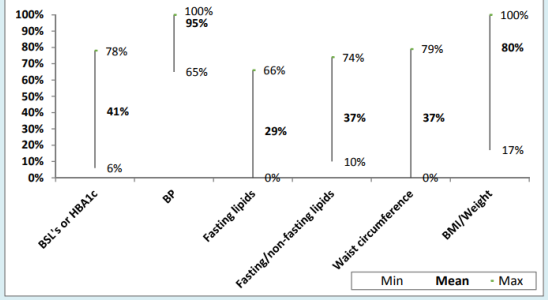


Figure 2: Adherence to individual parameters, mean and range



4. FEEDBACK AND FUTURE DIRECTION

Systems & Services

- Pathology services either limited or not provided to MH areas
- Improved systems for obtaining fasting blood samples and pathology reporting required
- Unavailable equipment (e.g. tape measures and scales)

Medical Records

- Variable quality of records
- Cumbersome paper & electronic medical records (EMR)
- Lack of alerts
- Need for multiple data entries
- Suboptimal information exchange at admission and discharge

Local Advisory Group discussions of gaps & barriers

Knowledge gaps

- Confusion about which parameters need to be measured
- Unclear who is responsible for measuring and actioning results
- Consideration of other supports for patients' physical health e.g. diet, exercise etc.

Staffing & patients

- Current work practices and resourcing
- Concerns of increased workload
- Patient barriers

Since baseline audit, hospitals have been developing and implementing local interventions and re-auditing.

Next steps

- **Publish detailed report of baseline audit**
- **Implement multifaceted QI strategies**
- **Re-audit using same NQUM indicator 7.4**
- **Advocacy to relevant state and/or national organisations**

Thank you to all principal investigators and members of the local advisory groups for your input so far. Please contact NSW TAG if you have any questions or feedback.

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Appendix 8: Study site codes, patient population, Australian peer group ranking and remoteness

Code of site	Patient population whose results were audited for the NQUM Indicator 7.4 study	Australian Peer Group*	Remoteness area*
A	acute adult	Principal referral hospitals	Major cities
B	acute adult	Public acute group A hospitals	Major cities
C	acute adult	Principal referral hospitals	Major cities
D	Adult intensive care & high dependency, acute care, acute recovery and rehabilitation	Principal referral hospitals	Major cities
E	SMHSOP#	Public acute group A hospitals	Major cities
F	acute adult	Public acute group A hospitals	Major cities
G	acute adult	Public acute group B hospitals	Outer regional
H	acute adult & SMHSOP#	Public acute group B hospitals	Inner regional
I	paediatrics	Children's hospital	Major cities
J	adult	Public acute group A hospitals	Inner regional
K	adolescent - adult	Public acute group A hospitals	Remote
L	acute adult	Principal referral hospitals	Major cities
M	adolescent & adult	Public acute group A hospitals	Inner regional
N	acute adult	Principal referral hospitals	Major cities
O	adult and aged	Public acute psychiatric hospitals	Major cities
P	paediatric - adolescent	Principal referral hospitals	Major cities
Q	adult & aged	Principal referral hospitals	Major cities

* Australian Government: Australian Institute of Health and Welfare; *Australian Hospital Peer Groups, 2015*. Accessed 28th November, 2016 fromhttp://www.aihw.gov.au/publication-detail/?id=60129553446

SMHSOP = Specialised Mental Health Services for Older People

Appendix 9: NQUM Indicator 7.4 Data Collection Tool Definitions

Criteria for answers to questions in data collection tool for NQUM Mental Health Indicator 7.4.

Indicator parameter	Definition or options		
Patient audit number	Assigned using coding sheet (**Error! Reference source not found.**)		
Question	**Possible answers and definitions**		
1. Baseline measures *or* 6-monthly check?	*Baseline* If initiating/ restarting/ changing dose/ changing drug **OR** if the patient is known to have been non-compliant with antipsychotic medicines.	*Check* If there has been no change to therapy for at least 6 months.	
2A. Waist circumference recorded?	*Yes* If the result is recorded in the patient's medical record, ***and*** this is within the previous 6 months.	*No* If there is no current result recorded (from within the previous 6 months).	
2B. Weight or BMI recorded?	*Yes* If the result is recorded in the patient's medical record ***and*** is within the previous 6 months. Relevant for paediatric or adolescent patients.	*No* If the result is not recorded in the patient's medical record or was recorded but not within the previous 6 months). Relevant for paediatric, adolescent patients.	
3. Blood pressure recorded?	*Yes* If the result is recorded in the patient's medical record ***and*** is within the previous 6 months.	*No* If there is no result recorded within the previous 6 months.	
4A Fasting lipids recorded?	*Yes* If the triglyceride and HDL results are recorded in the patient's medical notes ***and*** *the results* are fasting, ***and*** are within the previous 6 months.	*No* • if there are no results for triglycerides & HDL, *or* • the results are non-fasting or the time the sample was drawn indicates that it is non-fasting (later than 8am), *or* the lipid profile is older than 6 months.	
4B Lipids non-fasting OR status of fasting unknown?	*Yes* If the triglyceride and HDL results are recorded in the patient's notes ***and*** the results are non-fasting or the fasting state is unknown, ***and*** results are within the previous 6 months.	*No* • if there are no results for triglycerides & HDL, *or* • the lipid profile is older than 6 months.	N/A If 4A has "YES"
5. Fasting blood glucose recorded (or HbA1c in patients with pre-existing diabetes mellitus)?	*Yes* If there is a BSL result recorded in a non-diagnosed diabetic ***and*** it is a fasting BSL ***and*** is within previous 6 months **OR** If the patient is a diagnosed diabetic, there is a result for HbA1c recorded in the medical record ***and*** within the previous 6 months.	*No* In patients who are not diabetic if there is no result for a BSL • within the previous 6 months, *or* • the BSL is not fasting, *or* • in a patient with known diabetes if there is no result for HbA1c recorded in the medical record within the previous 6 months.	
6 and 7	**Age** in years *(mandatory)* **and ward or team** *(free text).*		
Comments	Include relevant details as to why **NO** options have been selected; or include free-text or remarks as per local advisory group requests.		

Appendix 10: Patient code and Medical Record Number

NQUM Mental Health Indicator 7.4 Project: patient code and Medical Record Number (MRN)
(For use by local advisory group only. Patient code is to be used in Excel data collection tool)

Patient code	MRN	Team
1		
2		
3		
4		
5		
6		
7		
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11		
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30		
And so on if required		

Appendix 11: Phase 1 Feedback form

NSW TAG National QUM (NQUM) indicator 7.4: metabolic monitoring multi-site study.

Phase 1 feedback

Hospital:	
Principal Investigator *(name):*	
Feedback of results of Phase 1: *(please describe briefly how this has been done; who to; any relevant information)*	
Barriers identified to adherence to NQUM indicator 7.4	**Local response to barrier** *(strategies implemented or in planning)*
Please add extra space if needed	
Enablers identified: *(for adherence to metabolic monitoring or to strategies planned or implemented)*	
Please include any other feedback regarding the study at your hospital	
Planned date in 2017 for re-audit after interventions implemented (if decided):	

Thank you for your participation and your feedback on phase 1 of the study.

Please return responses to Margaret.Jordan@svha.org.au, by March 20, 2017.

Appendix 12: Phase 4 Interview Questions

NSW TAG NSW Therapeutic Advisory Group Inc. | Advancing quality use of medicines in NSW

Evaluation survey of the National Quality Use of Medicines Mental Health (NQUM MH) Indicator 7.4 Multi-site Study

Purpose: This survey seeks to identify improvement strategies that were implemented at each local site, their effectiveness and challenges to their implementation and effectiveness.
Who: The survey should be completed by the Local Advisory Group (LAG) that has had local oversight of the project.
How: The survey will be conducted as a scheduled and recorded telephone interview or as otherwise arranged.

Date interview conducted:
Persons present:

Section 1: Overview of Local NQUM MH Indicator 7.4 Project

1.1 Please provide the following site details:

Question	*Response*
Hospital Name	
LAG members' professions and roles	
Baseline audit - completion date	
Baseline audit - patient numbers	
Baseline audit - indicator result	
Intervention start date	
Re-audit - commencement date	
Re-audit - completion date	
Re-audit - patient numbers	
Re-audit - indicator result	

APPENDIX 1: NQUM MH Indicator 7.4_Survey of interventions_Oct2017

Section 2: Description of quality improvement strategies

In order to determine which strategies are effective as well as replicate successful strategies, details of each intervention are required.

2.1 Please list the improvement activities, procedures and/or processes that were implemented in your clinical service to improve metabolic monitoring under the following broad headings and whether you believe they were effective and any barriers/difficulties encountered during the interventions.

Ensure details below are covered:

- *Who delivered it and to what audience?*
  - *E.g. individuals/ group; nurses/prescribers such as JMOs, registrars, consultants; pharmacists, allied health?).*
  - *Detail clinician groups including their level of expertise*
- *How was it delivered?*
  - *E.g. face to face, telephone, email, letter, by appointment*
- *Where was it delivered?*
  - *E.g. on ward, grand rounds*
- *Frequency*
  - *How often was it provided?*
  - *Is it ongoing or a once-off intervention?*
  - *Are there plans to repeat it?*
- *Did it change during the course if the project?*

Improvement strategy category	**Detailed description** *Please put N/A in the description box if this strategy was not implemented.*	**Barriers/ difficulties encountered during interventions.** *Provide commentary on whether any of these barriers caused a delay in commencement of the intervention or of the re-audit.*	**Effectiveness in improving metabolic monitoring (NQUM Indicator 7.4 result) at your site.** *Provide commentary on whether the intervention should be routine and is sustainable.*
Education & training • What did the content include? E.g. reference to guidelines/local policy, case studies? • Who delivered it and to what audience? o How many attended/was attendance appropriate? o Were there missing clinicians/clinician groups? o Was it provided individually or in a group? • How was it delivered? • Where was it delivered? • Was additional educational material provided? (E.g. hand-outs with/without links to further information). • Frequency	Describe the general characteristics of the education provided at the local site. (E.g. didactic lectures, ward in-services, small group workshops, didactic presentations or interactive discussions at weekly ward meeting).		

○ How often was it provided? ○ Is it ongoing or a once-off? ○ Plans to repeat? • Did the education change during the course of the project? • What do you believe are the critical components of an education module if a module was to be available for all relevant clinicians working in NSW hospitals?			
Feedback of audit results			
Local policy/ procedure changes *e.g. development of or change to local policy* E.g. • Which policies/procedures were developed/impacted? Which staff were affected? • Was there acceptance of the changes: how well was the change complied with?			
Work practice changes *e.g. introduction of metabolic monitoring days; changes to pathology ordering and reporting* E.g. • Which work practices changed? • Which staff were affected? • Was there			

acceptance of the changes: how well was the change complied with?			
Allocation of responsibilities *e.g. appointment of clinical champion/ changes in position descriptions*			
Academic detailing (one-on-one sessions with individual clinicians)			
Decision support *e.g. reminders such as posters/electronic alerts, checklists*			
Incentives *e.g. part of accreditation activities/ part of larger research project/further qualification*			
Provision of resources/tools *e.g. tape measures/ scales on ward; increased staff; phlebotomist visits to ward*			
Other *Please provide details of other improvement strategies that have not been listed*			

Section 3: Other impacts to project	
Question	***Response***
3.1 Were there any enabling or support activities for the project overall? Examples include: • Clinicians' attendance at off-site clinician workshops. What did these workshops provide? • Introduction or expansion of physical activities for inpatients? • Changes to inpatients' diets? • Improved pathology services? • Introduction of electronic medication records and/or electronic medication prescribing? • Other?	
3.2 What limiting factors/barriers did you experience participating in the project overall?	

Section 4: Further improvement strategies	
Question	***Response***
4.1 What do you (and the rest of the LAG) consider would be further improvement strategies that should be implemented at your site?	
4.2 What do you (and the rest of the LAG) consider would be further strategies should be implemented across the state/nationally to improve metabolic monitoring?	

Thank you to all principal investigators and members of the local advisory groups for your input so far. Please contact NSW TAG (details below) if you have any questions or feedback.

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Appendix 13: Mental Health NQUM Indicator 7.4 - Phase 1 Overall Results

Site code	No of pts	Type of patient	Age range (years)	Mean age (years)	% of patients with BP recorded	% of patients with fasting BSL recorded	% of patients with fasting lipids recorded	% of patients with fasting **OR** non-fasting lipids recorded	% of patients with waist recorded	% of patients with BMI or weight recorded	% of patients that received 4 parameters of monitoring, but weight/BMI measured rather than waist circumference *	% of patients that received 4 parameters of monitoring, but non-fasting lipids was measured rather than fasting	% of patients taking AP medications who receive appropriate monitoring for the development of metabolic side effects **BASELINE** (number adherent/ number baseline)	% of patients taking AP medications who receive appropriate monitoring for the development of metabolic side effects **ONGOING** (number adherent/ number ongoing)	**Indicator 7.4: Patients taking AP medications who receive appropriate monitoring for metabolic side effects (OVERALL)**, %
A	60	adult	19 - 63	40	100%	33%	32%	32%	28%	52%	2%	0%	13% (6/45)	7% (1/15)	**12%**
B	30	adult	23 - 75	42.6	100%	27%	20%	20%**	7%	17%	0%	N/A**	0% (0/6)	4% (1/24)	**3%**
C	30	acute adult	21 - 67	42	97%	47%	20%	23%	0%	87%	13%	0%	0% (0/28)	0% (0/2)	**0%**
D	99	adolescent & adult	15 - 83	43.3	95%	78%	66%	68%	22%	84%	33%	0%	18% (17/96)	100% (3/3)	**20%**
E	14	SMHSOP	57 - 90	71.5	100%	36%	14%	14%	36%	100%	7%	0%	8% (1/12)	0% (0/2)	**7%**
F	39	acute adult	17 - 63	36.3	100%	28%	13%	13%	69%	79%	3%	0%	11% (4/36)	0% (0/3)	**10%**
G	12	acute adult	27 - 68	51.5	100%	8%	8%	16%	75%	100%	0%	8%	11% (1/9)	0% (0/3)	**8%**
H	38	acute adult, SMHSOP*	19 - 79	40	100%	53%	11%	74%	79%	97%	0%	37%	9% (3/34)	25% (1/4)	**11%**
I	31	paediatrics	8 – 18	14.2	100%	6%	0%	10%	35%	100%	0%	0%	0% (0/12)	0% (0/19)	**0%**
J	30	adult	17 - 76	39.4	100%	23%	30%	30%**	77%	77%	3%	N/A**	23% (7/30)	N/A (0/0)	**23%**
K	30	adolescent - adult	15 - 52	31.7	97%	27%	23%	23%	47%	87%	7%	0%	10% (3/30)	NA (0/0)	**10%**
L	48	acute adult	13 - 61	37.7	65%	63%	54%	56%	69%	88%	2%	0%	42% (15/36)	42% (5/12)	**42%**
M	55	adolescent & adult	15 - 65	36.4	100%	60%	51%	69%	7%	95%	43%	2%	6% (2/34)	19% (4/21)	**11%**
N	35	adult	27 - 68	42.2	66%	54%	51%	60%	66%	71%	0%	0%	50% (8/16)	32% (6/19)	**40%**
O	20	adolescent & adult	18 - 72	45.8	100%	70%	35%	35%	20%	100%	20%	0%	0% (0/10)	30% (3/10)	**15%**
P	27	paediatric adolescent	9 - 17	15.5	100%	41%	33%	37%	0%	78%	30%	0%	50% (5/10)	18% (3/17)	**30%**
Q	72	adult & aged	19 - 78	42.1	100%	49%	33%	47%	0%	47%	22%	0%	0% (0/60)	0% (0/12)	**0%**

* for paediatric patients, BMI or weight is acceptable

** used previous data collection tool

Appendix 14: Mental Health NQUM Indicator 7.4 - Phase 1 Summary Results

Overall results: **Monitoring of metabolic parameters at participant sites**	**Range**	**Median**	**25th percentile**	**75th percentile**
Number of patients audited / site (overall total = 670)	12 – 99 patients	31 patients	30 patients	48 patients
Patients with BP recorded	65 – 100 %	100%	97%	100%
Patients with fasting BSL recorded	6 – 78 %	41%	27%	54%
Patients with fasting lipids recorded	0 – 66 %	30%	14%	35%
Patients with fasting OR non-fasting lipids (or status is not known)	10 – 74 %	32%	20%	56%
Patients with waist circumference recorded	0 – 79 %	35%	7%	69%
Patients with BMI / weight recorded	17 – 100 %	87%	77%	97%
Patients that received 4 parameters of monitoring, but weight/BMI measured rather than waist circumference*	0 – 43 %	3%	0%	20%
Patients that received 4 parameters of monitoring, but non-fasting lipids was measured rather than fasting	0 – 37 %	0%	0%	0%
Adherence to NQUM Indicator 7.4: Percentage patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (BASELINE)	0 – 50 %	10%	0%	18%
Adherence to NQUM Indicator 7.4: Percentage patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (ONGOING)#	0 – 100 %	7%	0%	27.5%
Overall adherence to NQUM Indicator 7.4: Percentage patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (TOTAL)	0 – 42 %	11%	7%	20%

#Data from results of 15 sites only (2 sites did not have patients in this category)

Appendix 15: Phase 2: LAG feedback about barriers, enablers and potential interventions for optimal metabolic monitoring

Metabolic parameter to be monitored	Issue	Barrier	Current process	Enabler and/or intervention strategy (as per site PI)
All recommended monitoring	Pathology requests	Psychiatry does not use electronic orders.	Pathology orders are handwritten.	Investigating if possible, to get pathology slips pre-completed (e.g. a stamp of some sort).
		No regular round made by blood collection personnel.	Medical Officers take bloods; incomplete details included e.g. time of collection.	Negotiation of routine collection at appropriate times.
		Patient refusal.	If patient refuses test the request drops out of the system.	Consultation with local pathology regarding removal of any expiry of request.
		Recommended blood tests not routinely ordered. Uncertainty regarding who is responsible for completing metabolic monitoring form.	Ad hoc.	Senior MH medical officer to develop process guide for registrars for display on notice boards in the registrar rooms outlining: • necessary metabolic monitoring pathology required, and • requirement to request as soon as practicable within a week of admission.
		Recommended blood tests not routinely ordered.	Ad hoc.	• Investigate to see if a pro-forma 'bloods on admission' form can be generated in eMR. • Trial a new pre-printed form with all required parameters to be monitored.
	Results of blood tests	BSLs are recorded in a number of ways.	In the electronic record, this can be recorded as "glucose", "blood glucose" or as blood glucose level time (e.g. pre-meal/ random).	Ensure that only pathology results and fasting state are noted and used for metabolic monitoring purposes.
		It is unknown what the time recorded with the pathology results refers to (therefore can't be interpreted correctly).	Medical Officers take bloods; incomplete details included e.g. time of collection. Time recorded with the result is often the time that the request and blood was received at pathology.	• Resident Medical Officer education to stress importance of recording correct time of blood collection (important for all tests) • Negotiation by MH NUM for regular pathology services (at times appropriate for "fasting").
		Misreported results.	All results reported as "not stated" despite "fasting" option requested from drop-down menu, potentially an eMR issue? Medical Officers may not have access to all the options (depends on site specific eMR system).	Snapshot re-audit performed after feedback of phase 1 results, no improvement, problems with eMR and fasting unresolved. Detailed investigations to include: • colour of the tubes used when taking bloods, • whether doctors actually select fasting vs random lipids, and • the eMR itself – not yet solved.
		Permissions in the electronic system to sign off documentation of measurements.	Nurses can't sign off the physical measurements such as weight on Cerner PowerChart® as they need to have blood results as well.	To investigate a solution with IT department.
		Results do not autopopulate into the discharge summaries and there is no prompt in the discharge template.	Nurses and assistants in nursing manage metabolic monitoring and it may not be front of mind for the doctor to include results in the discharge documentation.	To investigate changes with the electronic medical record administration team. Due to state based build of the system changing the template will be difficult.
	Poor adherence with all recommended monitoring	No dedicated personnel with this role.	Ad hoc.	Snapshot re-audit that was performed after allocation of nurse champion has improved waist circumference, BP and fasting glucose monitoring (currently sitting at 95% compliance) but only a slight increase was noted in lipid monitoring ~12%). At the current stage, we have allocated the resident as the champion and we are seeing a continuous improvement. We plan to re-audit again.

Metabolic parameter to be monitored	Issue	Barrier	Current process	Enabler and/or intervention strategy (as per site PI)
		"Discrepancy between recommendations in the guidelines and what is subsidised in the community." "Discrepancy may lead to lack of follow-up of the extensive management started in hospital. One example is statins for hyperlipidaemia".		The medical team is working on non-prescriptive guidelines to describe what screening is recommended and feasible.
		"The audit findings on compliance with metabolic screening recommendations may be underreported due to the lack of access to tests carried out in the community."		Requires a local response to investigate access to community blood test results. Consider recording patient's results in the patient medication booklet. Explore options for including metabolic status in patient held discharge document.
		"Definition of 'baseline' and 'ongoing' check in the audit depends on any changes made to antipsychotic therapy. A 6 months test is accepted if no change to therapy was made after admission. It is a limitation but if we can't see the results then we can't act on it so it is as if it doesn't exist."		-
		If metabolic measurements are incomplete, there is no warning/ alert.	None.	Investigate how to include alerts in eMR for incomplete details. In the short term, pharmacist or dietician to include on handover sheet.
	Lack of systematic or systemised approach	No process for routine check.	Pharmacist check.	Develop a checklist to form part of the process. For instance, Sunday night staff on the mental health ward to check that all metabolic parameters are documented every 3 months.
			Ad hoc.	"Metabolic screening set" may be a good start.
				Electronic forcing functions planned when electronic medical records implemented. In the process of getting final approval to work with a computer programmer to develop an electronic tool to track metabolic data and parameters over time. We have different electronic patient management systems than the rest of the state and cannot use the tool that everyone else seems to have access to.
		Admission process does not define what are the expected bloods or to measure waist measurement, height, and weight.		-
Fasting lipids, specifically HDL and triglycerides	Pathology request	Handwritten requests require specifying all components of the lipid profile (i.e. total cholesterol, triglycerides, HDL, LDL).	Hand written request only for "lipids" will get results for total cholesterol and triglycerides only.	Consider pre-printed pathology request forms.
		Breakdown of results of lipid components is not reported when requested.	Fasting lipids requested but only total cholesterol and triglycerides reported as the LDL/HDL measurement capability is off-site.	Required local response with pathology department.
		Knowledge gap.	Clinicians check total cholesterol, if within normal range, HDL is not checked. Triglycerides not routinely checked.	Education required to target these gaps in knowledge that can influence adherence to recommended metabolic monitoring.
		HDL results not available.	"Cholesterol" requested without specific breakdown components, so none provided.	Consider pre-printed pathology request forms.

Metabolic parameter to be monitored	Issue	Barrier	Current process	Enabler and/or intervention strategy (as per site PI)
Waist circumference	Adherence with monitoring in Phase 1 was poor at the majority of sites	Not considered routine practice.	Not recorded as there is no designated area for this, either on the hospital observation chart or the psychiatry initial nursing assessment tool. Only the electronic Cerner PowerChart® Vital Signs has this specified, but this is only used in community psychiatry, not for inpatient use.	Investigate how an area can be added for recording of this information.
			Not routinely measured.	Weights/ heights and waist circumferences to be taken by nursing staff on nominated days of the week (day yet to be formalised). Order disposable tape measures for the wards (always difficult to find one when needed).
		Not routinely measured.		Ensure there is a constant supply of tape measures on ward and in each room. Waist circumference to be the role of specific shifts and recorded in designated spot in Cerner PowerChart®.
				'Weekly weight' sessions to be commenced on the ward, where every Sunday, patients are weighed and have their waist circumference measured.
		Knowledge gap *"Not all recommendations can be implemented as they may not be considered by the physician as relevant to a particular patient. A patient who is underweight doesn't need a waist circumference tested".* *"Guidelines are not a substitute for clinical judgment."*		Education required to target these gaps in knowledge that can influence adherence to recommended metabolic monitoring. Clinical judgement for specific scenarios require clear documentation of rationale behind clinical decision to deviate from guidelines.
		Waist circumference needs a long tape measure.		Consider purchases of the Ceca tape measure which has >200 cm length.
		Not routinely recorded in eMR.		Investigate how waist circumference measurement can be added to eMR.
		No tape measures on wards.		Ensure tape measure is available on wards.

APPENDIX 16: Phase 2: Summary of quality improvement interventions implemented by LAGs

Intervention category	Summary of intervention	Summary of LAG discussions of phase 1 results and implemented interventions
Feedback of audit results	Feedback of phase 1 results to various clinicians in various settings.	Feedback of phase 1 results delivered to various clinicians including: • nursing and medical managers, • nursing and medical staff on the ward including mental health trainees and consultants. • LAG members • dieticians, occupational therapists Feedback of phase 1 results delivered in various settings such as: • Committee meetings • Staff meetings • Continuing Education (CE) slots • Ad hoc education sessions
Multidisciplinary teamwork and collaboration	Liaison and involvement of other clinicians including dieticians, exercise physiologists, occupational therapists, clozapine coordinators, other specialties such as general medicine and endocrinology.	• A new nursing position combining electroconvulsive therapy (ECT) and clozapine co-ordinator developed. The duty of completing pathology slips for all new admissions was added to this role. • Approach Endocrinology to ask, given the current system of recording, how they interpret blood glucose results when fasting status not known. • Our dietician has sent around some education about how to standardise how we do waist measurements (forwarded from the Keeping Body In Mind group in Sydney) and reminded everyone about the state-wide form available. • Email from clinical director to clinicians to ensure routine bloods are available on admission to aid full lipid profile. • Creation of 'metabolic monitoring working party'; this working party has already surveyed patients on what is important to them, finding that weight gain is most important to them.
Multidisciplinary teamwork and collaboration	Leveraging existing work practices and motivated clinicians.	• We have an enthusiastic dietician and exercise physiologist; they are aware of the metabolic risks associated with psychotropic medication and were already running a weekly metabolic clinic within the inpatient unit. Originally, we identified all patients prescribed second-generation antipsychotics as appropriate for the baseline measurements. This was time consuming. Evidence is emerging that even patients on first generation antipsychotics and those on antidepressants may be at increased risk. We decided to extend our monitoring to all patients admitted to the inpatient mental health unit (noting that the project only captures the data for patients on antipsychotics). • Other things already in place are morning walks with patients who can have leave, and gym twice per week (once again patients need to have leave). The barrier there is that many patients do not get leave. We are getting the whole unit re-designed, and an exercise space will be part of the new unit.
Electronic solutions	Use of, or optimisation of electronic medical record (eMR) systems and other digital methods	• Use of an electronic assessment, in our eMR system. • Ensure all required information can be accessible electronically. • Duplication required of recording of metabolic monitoring parameters, to make it routine practice to record all parameters on the eMR. • Use of Microsoft Excel spreadsheets for tracking of some longer stay patients. • Local updates for eMR metabolic data entry to include waist circumference (this was omitted when we moved over to eMR)

Service delivery	Allocation/purchase of required resources/equipment.	• Tape measures
		  ○ Waist circumference needs a long tape measure, consider purchasing the Ceca tape measure which has >200 cm length.
		  ○ Ordering of disposable tape measures for the wards (always difficult to find one when you need it).
		• Weighing scales

Intervention category	Summary of intervention	Summary of LAG discussions of phase 1 results and implemented interventions
Service delivery	Pathology improvements.	• No routine blood collection system in place for the mental health unit, our NUM has negotiated regular blood collection via their networks. • At one site a phlebotomist is now available in mental health area • Creation of a metabolic screening set. Pre-printed pathology forms with metabolic requirements. Also included other clinically relevant pathology tests as agreed upon by psychiatrists working on the inpatient unit (e.g., electrolytes, urea, creatinine, liver function tests, thyroid function tests and baseline prolactin). These forms were added to the admission pack and when a patient was admitted, a patient label was stuck on it. • Dedicated blood collecting personnel have been advised on importance of accurately recording time of sampling. • Taking blood samples: This responsibility was shared and more floor staff were trained to take blood to avoid having to wait for a phlebotomist. • Discussed with staff accurate measuring habits and strategies to ensure people are adequately fasted for bloods as well as ensuring blood forms were ordered. • Updated phlebotomy procedures (tube colours) in all inpatient areas
Normalising recommended practice	Adopting existing guidelines or development of local guidelines for best practice metabolic monitoring and/or treatment of metabolic syndrome.	• Our medical team is working on non-prescriptive guidelines to describe what screening is recommended and feasible. • Fasting bloods not taken issue: streamline admission process with doctors on ward to make a clear process of what blood tests are required on admission. • One of our doctors is writing a guide for the registrars which covers the necessary metabolic monitoring pathology to be ordered as soon as practicable within a week of admission, which will be put up on the notice boards in the registrar rooms. • Medical staff reported that there was no consistency when metabolic monitoring should be performed. We made one of the criteria that if the medication was changed or dose was changed then the metabolic monitoring had to be redone.

Normalising recommended practice	Visual reminders to monitor metabolic parameters e.g. journey board use, poster displays and equipment to monitor placed in prominent areas.	• Use of markers on a journey board to indicate when patients still require blood tests etc.
		  ○ A system of coloured dots was employed on the main ward whiteboard – an extra column to the already existing multidisciplinary whiteboard was utilised to indicate if a person's metabolic status had been adequately monitored or not. This applied in particular to fasting bloods for glucose and cholesterol. This intervention was designed to apply to all staff on the ward – and implied a responsibility to check if the monitoring had taken place.
		  ▪ Red dot meant it had not yet been done. Red dot appears to have a major 'psychological' effect on HCP awareness and need to action/resolve.
		  ○ Ward had an existing Whiteboard meeting conducted at 8am everyday with about 9-10 staff members present. Informally, if a red dot was present for a patient, then staff would be allocated randomly to ensure the metabolic monitoring was completed for that patient.
		  ○ The whiteboard was utilised to ensure under the Mental Health Act the relevant forms etc. were completed for each patient, especially because of high turnover of patients. It was a good way to visualise what needs to be done for each patient.
		  ○ The nurse unit manager was on board with the changes and responsibility was spread across the team.
		• Posters around the unit and at the doctor's station to remind parameters to be measured and to ensure glucose and cholesterol are fasting.
		• ACI/NSW Health paper metabolic monitoring chart made available on the ward but noted to make sure referral is actioned is challenging.
		• Tape measure provided in prominent locations.
		• As part of a productive wards project, large BP cuff, kept next to a little reserved storage area for where the tape measure could be close by or otherwise within the BSL kit.

Normalising recommended practice	Standardising and improving documentation location and requirements.	• Use of a nursing admission form which ensures weight and blood pressure are recorded on admission.

Intervention category	Summary of intervention	Summary of LAG discussions of phase 1 results and implemented interventions
Normalising recommended practice	Allocation of a clinician champion and/or responsibilities.	• Allocation of a nursing champion to champion metabolic monitoring and drive the project at the local level. Ongoing education and feedback given to nurses in their weekly journal club by nursing champion. • Setting up a pharmacist champion: on a weekly basis, the mental health pharmacist assesses the results of the metabolic syndrome measurements and discusses the results with the medical officers during the ward meetings. This process flags "high risk" patients. This interaction engages the medical intern who would from there organise appropriate consults/investigations. • Other clinician champions: dietician, advanced trainee, LAG member(s) at their participating sites. • Champions encouraging referrals to be made to the community services.
Normalising recommended practice	Allocation of a dedicated day for measurement of metabolic parameters.	Allocation of a dedicated 'metabolic monitoring day'. E.g., implementing: • 'weekly weights' on Sunday mornings where patients are weighed and have their waist circumference measured. • completion of "waist circumference", "height/weight" and "blood pressure" at the end of each week. Every Saturday morning was set up as the "metabolic monitoring day" in the unit.
Normalising recommended practice	Agenda item at meetings.	• To address the lack of interest by resident medical officers (RMOs): a) Meeting with the consultants of the ward to ensure metabolic monitoring became a standing item on their weekly meetings. b) Meeting with registrars and RMOs; discussion on the importance of monitoring and strategies on how we can improve the monitoring of our clients. The discussed strategies from a round table meeting were introduced in the ward. • Presentation of study design and results at medical meetings
Targeting gaps in knowledge	Education with/without ongoing feedback and involvement of staff.	• Training all staff on getting the non-pathology parameters, including standardised waist measurement technique, and including allied health. • Attendance at the Keeping Body In Mind training (2 day workshop), as well as the site visit to the Bondi Clinic, has been incredibly motivating and informative. • Currently doing a survey of mental health unit staff understanding of the challenges and barriers they are encountering in monitoring of metabolic risk. • At one site, the education changed during course of intervention to include real ward examples from that ward (both good examples and bad examples taken from the eMR from that ward on the day, especially results in long stay patients and tracking the wright gain/loss since admission) • Provided informal support and knowledge sharing with JMOs. • Community staff trained on how to measure waist circumference 'spin' to avoid the bear hug – next steps is to get inpatient staff more comfortable in measuring waist circumference. • LAG members were available to answer any questions regarding the monitoring during working hours. • The Doctor at one site presented a guide for the psychiatry registrars on how to alter the setup in the eMR so registrars are reminded to order metabolic monitoring pathology within a week of admission or as soon as practicable.
Targeting gaps in knowledge	Decision support provision.	• Development of a physical health toolbox with resources on intranet (resources on topics such as diabetes, myocardial infarction signs, metabolic syndrome etc.) • Development of step-by-step guides/cheat sheets for all nursing and medical staff covering: ▪ how to access and record patient data in the metabolic monitoring sheet in the eMR; ▪ how to set up the eMR to show patient measurements and required bloods to more easily track whether these have been performed for specific patients.

Appendix 17: Mental Health NQUM Indicator 7.4 - Phase 3 Overall Results

^Site code	No of pts	Type of patient	Age range (years)	Mean age (years)	% of patients with BP recorded	% of patients with fasting BSL recorded	% of patients with fasting lipids recorded	% of patients with fasting **OR** non-fasting lipids recorded	% of patients with waist recorded	% of patients with BMI or weight recorded	% of patients that received 4 parameters of monitoring, but weight/BMI measured rather than waist circumference *	% of patients that received 4 parameters of monitoring, but non-fasting lipids was measured rather than fasting	% of patients taking AP medications who receive appropriate monitoring for the development of metabolic side effects **BASELINE** (number adherent/ number baseline)	% of patients taking AP medications who receive appropriate monitoring for the development of metabolic side effects **ONGOING** (number adherent/ number ongoing)	**Indicator 7.4: Patients taking AP medications who receive appropriate monitoring for metabolic side effects (OVERALL)**, %
A	45	adult	19 - 67	40.2	100%	31%	18%	2%	18%	44%	2%	0%	2% (1/41)	0% (0/4)	**2%**
B	30	adult	n/a	n/a	100%	87%	83%	n/a**	70%	73%	3%	n/a**	67% (16/24)	50% (3/6)	**63%**
C	30	acute adult	18 – 61	37.2	100%	27%	10%	3%	40%	100%	0%	0%	4% (1/24)	0% (0/6)	**3%**
D	99	adolescent & adult	17 - 89	41.3	95%	65%	63%	0%	11%	76%	39%	0%	6% (6/93)	17% (1/6)	**7%**
E															
F															
G															
H	32	acute adult, SMHSOP*	17 – 83	46.1	97%	47%	13%	50%	94%	94%	0%	33%	7% (2/27)	20% (1/5)	**9%**
I															
J															
K	30	adolescent - adult	16 – 60	33	100%	73%	73%	0%	73%	90%	14%	0%	64% (7/11)	53% (10/19)	**57%**
L	99	acute adult	17 – 71	42	100%	68%	58%	0%	74%	82%	5%	0%	52% (37/71)	32% (9/28)	**46%**
M															
N															
O	20	adolescent & adult	23 - 83	42.7	100%	25%	10%	n/a	50%	85%	0%	n/a	0% (0/10)	0% (0/10)	**0%**
P															
Q															

* for paediatric patients, BMI or weight is acceptable ** used previous data collection tool

^Clinical services with study codes E, F, G, I, J, M, N, P and Q did not participate in phase 3.

Appendix 18: Mental Health NQUM Indicator 7.4 - Phase 3 Summary Results

Overall results: Monitoring of metabolic parameters at participant sites	Range	Median	25th percentile	75th percentile
Number of patients audited / site (overall total = 385)	20 - 99 patients	31 patients	30 patients	99 patients
Patients with BP recorded	95 - 100 %	100%	99%	100%
Patients with fasting BSL recorded	25 - 87 %	56%	30%	69%
Patients with fasting lipids recorded	10 - 83 %	38%	12%	66%
Patients with fasting OR non-fasting lipids (or status is not known)	0 - 50 %	1%	0%	3%
Patients with waist circumference recorded	11 - 94 %	60%	34%	73%
Patients with BMI / weight recorded	44 - 100 %	84%	75%	91%
Patients that received 4 parameters of monitoring, but weight/BMI measured rather than waist circumference	0 - 39 %	3%	0%	7%
Patients that received 4 parameters of monitoring, but non-fasting lipids was measured rather than fasting	0 - 33 %	0%	0%	0%
Adherence to NQUM Indicator 7.4: Percentage patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (BASELINE)	0 - 67 %	7%	4%	55%
Adherence to NQUM Indicator 7.4: Percentage patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (ONGOING)	0 - 53 %	19%	0%	37%
Overall adherence to NQUM Indicator 7.4: Percentage patients taking antipsychotic medications who receive appropriate monitoring for the development of metabolic side effects (TOTAL)	0 - 63 %	8%	3%	49%

Appendix 19: Monitoring of individual parameters

Figures 19 - 24 below display the adherence to measurement of individual parameters across the 8 clinical services who participated in Phase 3 re-audit.

Blood sugar levels (BSLs) or glycated haemoglobin (HbA1c) measurement

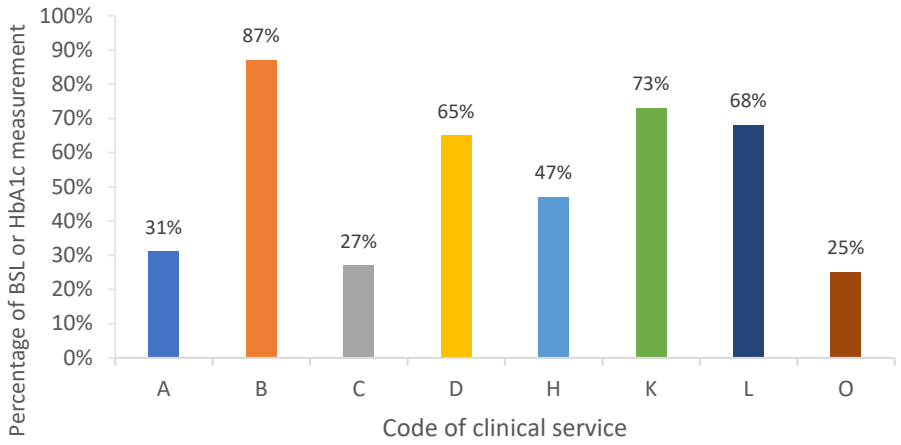

Figure 19 Phase 3 re-audit measurement of fasting BSL or HbA1c across clinical services

Blood pressure measurement

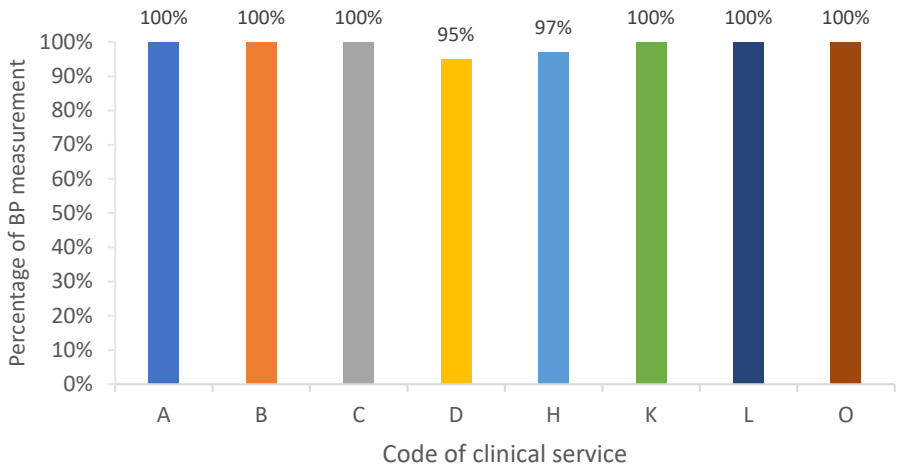

Figure 20 Phase 3 re-audit measurement of blood pressure across clinical services

Fasting lipids: HDL-cholesterol and triglyceride measurements

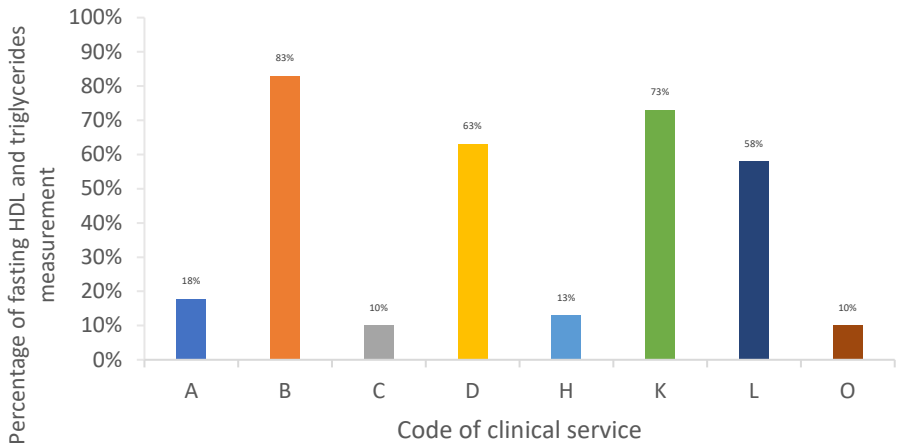

Figure 21 Phase 3 re-audit measurement of fasting HDL-cholesterol and triglycerides across clinical services

Fasting or non-fasting lipids: HDL-cholesterol and triglyceride measurements

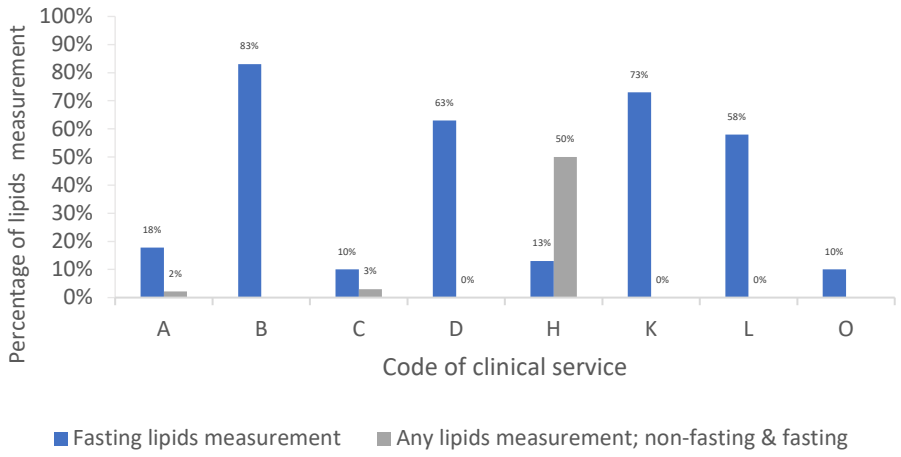

Figure 22 Phase 3 re-audit comparison of fasting or any HDL-cholesterol and triglycerides across clinical services

Note: results for clinical services B and O represent the measurement of fasting lipids only.

Inclusion of non-fasting HDL-cholesterol and triglyceride measurements made little difference to the adherence to lipid monitoring, with the exception of the clinical service H.

Waist circumference measurements

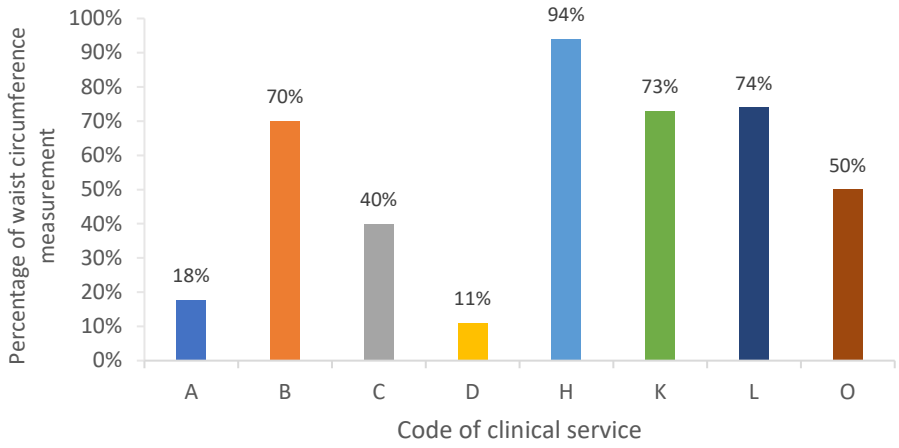

Figure 23 Phase 3 re-audit measurement of waist circumference across clinical services

BMI or weight

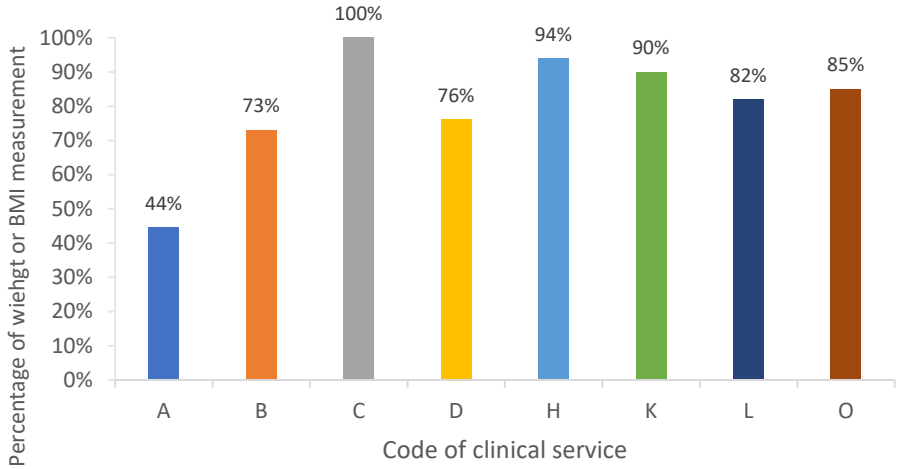

Figure 24 Phase 3 re-audit measurement of weight or BMI across clinical services

Phase 3 re-audit data was not available for the 2 hospitals with paediatric and adolescent populations (clinical services I and P). Monitoring of weight is the preferred parameter for metabolic monitoring in these patients.

Appendix 20: Phase 4 table of synthesised themes, subthemes and indicative quotes from interviews

Theme	**Subtheme**, explanation, *indicative quotes.*
Health service organisation culture, climate, and service delivery	**Executive support and investment**
	Investigators highly regarded the significance of commitment by executives and senior management to support and resource major activities from the start to the end of the project, especially the interventions.
	Barrier: [Management] perception that metabolic monitoring is done well and so therefore not prioritised for education to improve it.
	Barrier: Pre-intervention baseline poor results [were] not deemed a priority by our director of the unit; director new to the role at the time.
	Barrier: Potentially lack of dedicated time due to new director of unit role and also apparent lack of interest.
	Barrier: Allocation of a day can be dependent on the wards Nurse Unit Manager (NUM).
	Barrier: Guideline not approved yet due to all [of] the red tape in approval processes and lack of executive support.
	Enabler: Considerable amount of clinical director support with baseline audit and also intervention phase was particularly useful.
	Enabler: Even though there was a shared responsibility, the NUM kept a close eye on [the] outcome [of the intervention].
	Enabler: [The] poster displayed in [doctors] office on how to access mental health bloods and [an] email sent by [the] clinical director to the Junior Medical Officers (JMOs).
	Perception, motivation, and incentives
	Investigators highlighted the effect that empowerment or disempowerment of clinicians and units as well as motivating factors or performance incentives had on sustaining or implementing changes.
	Barrier: Potentially lack of dedicated time due to new director of unit role and also apparent lack of interest.
	Barrier: Perception that it is someone else's responsibility was challenging and a large barrier. Institutions responsible versus individuals responsible.
	Barrier: A clinician may pay less attention to the screening and monitoring for metabolic abnormalities once a referral [to the dedicated service] is made.
	Barrier: There is often no incentive so sometimes the bare minimum is done in a resource poor environment.
	Barrier: Clinicians may find it unnecessary to screen or monitor [for metabolic abnormalities] in a patient who is already known to have the abnormalities.
	Barrier: Not enough support to change practice as for some prescribers it is not a priority and screening is not prioritised because the risk is not imminent.
	Enabler: NUMs [were] on board [with the interventions] because [they] did not want a zero result.
	Enabler: Nursing staff responded well to what they could improve on in with their mildly poor results [for the parameters they measure] when they compared their results to the medical staff and how majorly poor they were monitoring some parameters.
	Enabler: Nursing staff were surprised with mortality figures due to metabolic syndrome and [that it is] not necessarily suicide as the biggest killer.
	Enabler: Benefit of having the LAG members actively also working within the unit. People felt that they understood why we were doing this intervention.
	Enabler: Education presentation focus placed on the end result of vascular disease and premature death.
	Enabler: Using a good real life patient example allowed reinforcement of the success stories of patients who had their metabolic parameters measured. [We used the] example of a 9 month long stay patient who lost 8kg from tracking food intake etc.
	Competing priorities
	Competing priorities, that is, differences in the perceived key concerns of the service where not all issues are treated as equally as important was raised by several investigators as impacting on interventions implemented.
	Barrier: Pre-intervention baseline poor results [were] not deemed a priority by our director of the unit; director new to the role at the time.
	Barrier: Pathology not a registrar's priority.
	Barrier: No response from this group [the mental health clinicians] could be related to the fact that this is just an additional competing area in mental health to be improved.

	Barrier: Poor baseline audit results when sent to heads of departments, had little impact or feedback because it just added to the list of other competing issues in acute mental health care that needs to be addressed just as urgently.
	Barrier: Clinicians may find it unnecessary to screen or monitor [for metabolic abnormalities] in a patient who is already known to have the abnormalities.
	Barrier: Conflicting education sessions and other mandatory training or staff continuing professional development (CPD).
	Dedicated service provision
	Service delivery through a specified set of functions provided to designated users to deliver to designated consumers was identified as critical to improvement.
	Barrier: Phlebotomist resources limited as they are very busy and have a lot of work, they come early first thing in the morning and if there are too many bloods, sometimes they have to skip some. This also creates issues around getting correctly fasted bloods.
	Barrier: Phlebotomist only has a 5 day service when a 7 day service is really required.
	Barrier: A clinician may pay less attention to the screening and monitoring for metabolic abnormalities once a referral [to the dedicated service] is made.
	Enabler: Having a dedicated service/centre of health in psychosis is a gold standard service that has the potential for peer support workers to encourage inpatients to utilise this service and to attend physical health sessions.
	A summary of the overlapping responses by multiple investigators under this subtheme is provided. *Enabler: Allocated monitoring days were utilised including:* • *Weigh in Wednesdays,* • *'Sunday' waist circumference day regardless of if on antipsychotics or not,* • *Weights, heights and waist circumferences to be taken by nursing staff on nominated days of the week (day yet to be formalised), easy enough to roll out on a ward.*
	Enabler: With the dedicated position description and joint roles, direct follow up of individuals who haven't attended [the new clinic] based off the ward patient list meant that many patients were captured.
	Enabler: Goal setting was useful in preparation for potential patients that required pharmacological management as it was evidence of a trial of non-pharmacological management first.
	Enabler: Fortunate to have good pathology services [located] close to the mental health unit.
	Enabler: Our electroconvulsive therapy (ECT)/clozapine co-ordinator who worked Monday to Friday) had added to their position description [roles and responsibilities] to manage the metabolic syndrome pathology monitoring for these patients in addition to their usual role to manage clozapine bloods. This process was systematic and not reliant upon different individuals.
	Enabler: [We] improved pathology services by trying to get the right bloods ordered by dedicated staff member.
	Approval processes
	Formal approval steps required were identified as barriers to implementation of interventions.
	Barrier: Guideline not approved yet due to all the red tape in approval processes and lack of executive support.
	Barrier: [We] attempted to share the resources with another site as part of same mental health network but unfortunately can only be shared if someone writes it up and it is approved by the district mental health service.
	Barrier: Even if electronic alerts are requested, they would take a long time to actually get changed.
	Timing of interventions
	The timing of several interventions or service delivery were identified as important contributing factors to the success or failure of improving metabolic monitoring.
	Barrier: Phlebotomist resources limited as they are very busy and have a lot of work, they come early first thing in the morning and if there are too many bloods, sometimes they have to skip some. This also creates issues around getting correctly fasted bloods.
	Barrier: Difficulty with scheduling an education session in a timely manner.
	Barrier: Conflicting education sessions and other mandatory training or staff continuing professional development (CPD).

	Barrier: Psychiatry registrars may not have had the chance to implement the suggested recommendations within the 2–3-month window between the educational presentation and the time of post-intervention audit.
	Barrier: Once weekly clinic may not capture patients in for less than one week if they miss the weekly clinic day.
	Barrier: Part-time roles and clinic being only once a week. Roles not backfilled during periods of leave.
	Barrier: One of the champions was on leave during the [post intervention] re-audit phase.
	Barrier: Strategies take time to trial and assess if they worked.
	Barrier: A single education intervention was performed which may have needed to be repeated.
	Barrier: Lack of appropriate follow-up to check the psychiatry registrars' agreement or disagreement with the strategies to improve monitoring that were presented in the education session.
	Barrier: Even if electronic alerts are requested, they would take a long time to actually get changed.
	Enabler: People need notice for education slots to come prepared with questions and so they are more engaged.
	Enabler: Phlebotomist comes first thing in the morning to try and ensure fasting bloods are taken prior to breakfast being served.
	Access to information and integration of systems
	Barrier: We had many locum doctors and sometimes these doctors didn't even have access to the system to monitor etc.
	Barrier: The electronic metabolic form itself had issues, couldn't enter double digits into triglycerides form, and the gender specific waist circumference measurement ranges to be corrected. Which took a long time to be corrected so an alert was used to flag the error. The alert was then often ignored due to alert fatigue.
	Barrier: Should be using the ad hoc electronic form, there is some inconsistency in who is recording where, resulting in both [documentation types] being used.
	Barrier: Having it within the electronic system means it's not always at the forefront of someone's mind compared to a blank paper form that needs to be filled in.
	Enabler: The whiteboard monitoring has been a success and nursing staff find it easy to use. Although our site has a poor eMR integration system, our whiteboard intervention was an integrating system in itself.
	Communication strategy
	Barrier: Posters and other quality improvement activities did not include how to action abnormal results. This is especially required given there is also a lot of variance and because Australian psychiatric units are often reluctant or uncomfortable in prescribing [for abnormal metabolic parameters].
	Barrier: When comparing to other wards often unfair comparisons anyway because of different patient population e.g. adolescent versus geriatric [patient population].
	Barrier: [The electronic] patient journey board in use is not easily able to accommodate any alerts.
	Barrier: The electronic metabolic form itself had issues…Which took a long time to be corrected so an alert was used to flag the error. The alert was then often ignored due to alert fatigue.
	Enabler: Doctors at our site found the posters did assist in reminding them to complete adequate monitoring.
	Enabler: NUMs using patient stories for patients who have died from complications of metabolic syndrome may have been helpful/impactful.
	Enabler: Mortality statistics surprised staff with some asking for a copy of the presentation.
	Enabler: Education presentation focus placed on the end result of vascular disease and premature death.
Theme	**Subtheme**, explanation, *indicative quotes.*
Human resources	**Clinical champions**
	A clinical champion, defined as an individual within an organisation who has a responsibility to advocate for change, motivate others and use their position and expert knowledge to facilitate the adoption of a particular innovation (Cranley et al., 2017) was identified as a critical factor in improving metabolic monitoring.
	Barrier: Champion often rotated out of the unit or left the organisation.
	Barrier: Pharmacist's screening of drugs contributing to metabolic complications often occurs on an ad hoc basis and there is lack of methodological and systematic screening for metabolic complications due to the large patient to pharmacist ratios (sometimes 1 pharmacist to 3 wards) and reduced time spent on wards due to requirements of dispensary cover etc.
	Enabler: Even though there was a shared responsibility, the NUM kept a close eye on [the] outcome [of the intervention].

	Enabler: With the dedicated position description and joint roles, direct follow up of individuals who haven't attended [the new clinic] based off the ward patient list meant that many patients were captured. Part of their role was to monitor metabolic syndrome which meant that they were ideal champions
	Enabler: Some wards had champions that were available on the weekend to provide support and education to the weekend staff.
	Enabler: Champions need training to upskill other staff including pharmacists in non-clinical skills and roles that they are not traditionally trained in, for example QI activities.
	Accountability
	Clear descriptions of responsibilities, objectives, performance expectations and measures and reporting requirements were emphasised as important to several investigators in improving metabolic monitoring.
	Barrier: JMO perception that it is the GPs responsibility.
	Enabler: Our electroconvulsive therapy (ECT)/clozapine co-ordinator who worked Monday to Friday) had added to their position description [roles and responsibilities] to manage the metabolic syndrome pathology monitoring for these patients in addition to their usual role to manage clozapine bloods. This process was systematic and not reliant upon different individuals.
	Enabler: With the dedicated position description and joint roles, direct follow up of individuals who haven't attended [the new clinic] based off the ward patient list meant that many patients were captured. Part of their role was to monitor metabolic syndrome which meant that they were ideal champions
	Enabler: The responsibility was shared and more floor staff were trained to take blood to avoid having to wait for a phlebotomist. This team approach has shared responsibility and I think improved outcomes.
	Staff availability
	A summary of the overlapping responses by multiple investigators under this subtheme is provided. *Barrier: The intervention of delivering education to all required staff was challenging due to:* • *shift changes and shift workers,* • *staffing rotations and staff leaving the organisation resulting in lack of planned repeat education sessions,* • *presentation at forums such as grand rounds for allied health have voluntary attendance,* • *timing, if delivered at handover time or shift change time staff are disengaged and just want to go home,* • *poor attendance from wards that were very busy,* • *poor attendance from medical staff during a general registrar education slot.*
	Barrier: ECT/clozapine co-ordinator role is not covered during periods of leave.
	Barrier: Need champion on a weekend too.
	Barrier: After academic detailing, unfortunately, staff members move on.
	Barrier: Pharmacist's screening of drugs contributing to metabolic complications often occurs on an ad hoc basis and there is lack of methodological and systematic screening for metabolic complications due to the large patient to pharmacist ratios (sometimes 1 pharmacist to 3 wards) and reduced time spent on wards due to requirements of dispensary cover etc.
	Barrier: More nursing students are involved in cardiometabolic monitoring which may reduce the nurse's commitment to monitoring when students are not available.
	Enabler: Phlebotomist comes first thing in the morning to try and ensure fasting bloods taken prior to breakfast being served.
	Enabler: In an attempt to allow this/overcome the issue, more floor staff also trained to take blood.
	Clinician expertise and confidence
	Barrier: JMOs views that because it is a specialty area that they rotate briefly through they are unsure of how to do things in those specialised areas.
	Barrier: Some pharmacist views that they are unable to do much in the way of improving monitoring.
	Barrier: Perceived passive pharmacist role.
	Barrier: Misunderstanding of and/or knowledge of metabolic risk, monitoring and how to mitigate risk and also action abnormal results.
	Barrier: Lack of awareness of the local policy.

	Barrier: Lack of appropriate follow-up to check the psychiatry registrars' agreement or disagreement with the strategies to improve monitoring that were presented in the education session.
	Enabler: [We] improved pathology services by trying to get the right bloods ordered by dedicated staff member.
	Enabler: Community staff trained on how to measure waist circumference 'spin' to avoid the bear hug. Next steps is to get inpatient staff more comfortable in measuring waist circumference.
	Enabler: A strategy used and encouraged in the community to make tape measuring less awkward, to avoid the 'bear hug', is [getting the] patient holding the tape and [asking them] do a spin. Outpatients are used to doing this and now inpatients need to do the same.
	Teamwork and multidisciplinary effort
	Enabler: Major emphasis placed on that it is everyone's responsibility to ensure metabolic monitoring is done. So, if not done, nurses must remind doctors and request a form and vice versa.
	Enabler: Benefit of having the LAG members actively also working within the unit.
	Enabler: The responsibility was shared and more floor staff were trained to take blood to avoid having to wait for a phlebotomist. This team approach has shared responsibility and I think improved outcomes.
	Enabler: JMO feedback that inpatient diets are poor and access to junk food such as seven eleven is easy. Our dietician is interested in this area and it is a possible area to explore to adjust inpatient diets.
Theme	**Subtheme**, explanation, *indicative quotes.*
Defining and standardising practices and prompts that influence metabolic monitoring	**Equipment availability and infrastructure**
	Availability of items such as measuring tapes, scales, etc. was an obvious but important factor to ensuring metabolic monitoring could occur.
	Barrier: If equipment required for monitoring not all kept together than often can get missed and also a barrier to all parameters being measured.
	Enabler: A well-equipped dedicated space for metabolic monitoring to occur.
	Enabler: [We were] fortunate to have good pathology services located close to the mental health unit.
	Enabler: Observations were electronically recorded and blood pressure results went up.
	Tool use or development
	The appropriate use of visual prompts or standardised form templates either in electronic format or hard copy were identified as important foundations to improving metabolic monitoring.
	Enabler: The whiteboard monitoring has been a success and nursing staff find it easy to use. Although our site has a poor eMR integration system, our whiteboard intervention was an integrating system in itself.
	Enabler: Doctors at our site found the posters did assist in reminding them to complete adequate monitoring.
	Enabler: [The] poster displayed in [doctors] office on how to access mental health bloods and [an] email sent by [the] clinical director to the Junior Medical Officers (JMOs).
	Enabler: When observations were electronically recorded, blood pressure results went up.
	Enabler: Local policy and procedure is required.
	Convenience, practicalities and patient or clinician acceptability
	Barrier: Nowhere to record where patient refused bloods/measurements of parameters.
	Barrier: Senior Resident Medical Officer (SRMO) views that it is easy enough for a patient to self-weigh and obtain that result compared to a waist circumference. .
	Barrier: Should be using the ad hoc electronic form, there is some inconsistency in who is recording where, resulting in both [documentation types] being used.
	Barrier: Having it within the electronic system means it's not always at the forefront of someone's mind compared to a blank paper form that needs to be filled in.
	Barrier: If equipment required for monitoring not all kept together than often can get missed and also a barrier to all parameters being measured.
	A summary of the overlapping responses by multiple investigators under this subtheme is provided.

	Enabler: Allocated monitoring days were utilised including: • *Weigh in Wednesdays,* • *'Sunday' waist circumference day regardless of if on antipsychotics or not,* • *Weights, heights and waist circumferences to be taken by nursing staff on nominated days of the week (day yet to be formalised), easy enough to roll out on a ward.*
	Barrier: Clinicians may find it unnecessary to screen or monitor [for metabolic abnormalities] in a patient who is already known to have the abnormalities.
	Barrier: Unfair on wards NUMs who already have a lot of KPI to report and meet so decided not to implement KPIs.
	Enabler: Fortunate to have good pathology services [located] close to the mental health unit.
	Enabler: The whiteboard monitoring has been a success and nursing staff find it easy to use. Although our site has a poor eMR integration system, our whiteboard intervention was an integrating system in itself.
	Enabler: The responsibility was shared and more floor staff were trained to take blood to avoid having to wait for a phlebotomist. This team approach has shared responsibility and I think improved outcomes. Especially patients on atypical antipsychotic where they wake up in the morning hungry and it makes it difficult if you are asking them to wait and not eat because fasting bloods need to be done.
	Enabler: A strategy used and encouraged in the community to make tape measuring less awkward, to avoid the 'bear hug', is [getting the] patient holding the tape and [asking them] do a spin. Outpatients are used to doing this and now inpatients need to do the same.
	Enabler: Patient acceptability to attend clinic once made aware of it was very good and they were happy to attend.
	Enabler: [Patient] goal setting was useful in preparation for potential patients that required pharmacological management as it was evidence of a trial of non-pharmacological management first.
	Enabler: [We] improved pathology services by trying to get the right bloods ordered by dedicated staff member.
	Enabler: Even though there was a shared responsibility, the NUM kept a close eye on [the] outcome [of the intervention].
	Enabler: Major emphasis placed on that it is everyone's responsibility to ensure metabolic monitoring is done. So, if not done, nurses must remind doctors and request a form and vice versa.
	Enabler: Habits addressed, including the issue of making a patient wait before they could eat to take a fasting blood level. Instead, the blood was to be taken by anyone trained as soon as possible as a priority, [it] just needed to be done. In an attempt to allow this/overcome the issue, more floor staff also trained to take blood.

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