**ABSTRACT**

**Introduction** Individuals with severe mental illness are at risk of becoming prematurely frail. There is a critical unmet need for an intervention that reduces the risk of frailty and minimises the associated negative outcomes in this population. This study aims to provide novel evidence on the feasibility, acceptability and preliminary effectiveness of Comprehensive Geriatric Assessment (CGA) to improve health outcomes among people with co-occurring frailty and severe mental illness.

**Methods and analysis** Twenty-five participants with frailty and severe mental illness, aged 18–64 years, will be recruited from Metro South Addiction and Mental Health Service outpatient clinics and provided with the CGA. Primary outcome measures will include the feasibility and acceptability of the CGA embedded in routine healthcare. Other variables of interest will include frailty status, quality of life, polypharmacy, and a range of mental and physical health factors.

**Ethics and dissemination** All procedures involving human subjects/patients were approved by Metro South Human Research Ethics Committee (HREC/2022/QMS/82272). Study findings will be disseminated through peer-reviewed publications and conference presentations.

**STRENGTHS AND LIMITATIONS OF THIS STUDY**

- This is the first study examining the feasibility, acceptability and preliminary effectiveness of Comprehensive Geriatric Assessment (CGA) in people with severe mental illness who show premature signs of ageing, resulting in a state of frailty.
- Treatment Acceptability Questionnaire will be used following CGA and semistructured interviews at endpoint to assess the acceptability and feasibility of the CGA and subsequent recommendations.
- Preliminary effectiveness of the CGA will be inspected through a range of mental and physical health indicators, including frailty, quality of life, physical activity engagement, nutrition, sleep and polypharmacy, using validated clinical assessment tools such as Positive and Negative Syndrome Scale.
- Mixed-methods design employed in this pilot study will allow identification of any issues with the implementation of CGA in routine healthcare for people with severe mental illness that may be important to address in future larger trials.
- The small sample size and single-size recruitment may limit the generalisability of the findings.

**INTRODUCTION**

People living with severe mental illness, including schizophrenia, bipolar affective disorder and major depression, have an average of 15 years shorter life expectancy. One of the key contributors to years of life lost for this population is the notably higher prevalence of physical comorbidities such as metabolic and cardiovascular disorders, which occur at a rate of up to twice that of the general population. The risk of physical comorbidities is significantly increased by severe metabolic adverse effects of antipsychotic drugs, which is further compounded by lifestyle factors, including sedentary lifestyle and poor diet, as well as high rates of psychosocial stressors, including homelessness, unemployment and loneliness. As such, it has been hypothesised that individuals with severe mental illness such as schizophrenia show accelerated biological ageing and thus experience the negative effects of ageing at a younger chronological age than age-matched controls in the general population.

Frailty is an ageing-related syndrome of reduced physiological reserve that results in increased vulnerability to adverse health events. The largest population study of frailty to date, including 297 380 participants with a lifetime history of depression, bipolar disorder and anxiety disorders from the UK Biobank data, found increased levels of frailty in people with any of these three mental health conditions compared with...
those without mental disorders, with cross-sectional analysis suggesting that these group differences remain stable from the ages of 40–70 years. Further, this study also found greater all-cause mortality risk across all three mental disorders compared with those without mental disorders.6 8 Interestingly, the risk of all-cause mortality was increased the most (3.65 times higher than the non-frail non-psychiatric comparison group) in those with frailty and bipolar disorder, which is usually considered under the umbrella of a severe mental illnesses group.6 8 This finding is consistent with a large body of evidence that highlights the increased prevalence of physical comorbidities specifically in people with severe mental disorders.6 8

Frailty can represent a useful clinical tool in vulnerable populations, including those with mental illness. By encapsulating a multidimensional view of health, frailty assessments can help clinicians to address biological, social and psychological aspects of health. In the context of mental illness, frailty has been explored in those with late-life depression and anxiety. This has led to the development of multimodal interventions effective in targeting lifestyle factors and multidisciplinary care.11–13 Despite people with severe mental illness showing higher overall prevalence rates of frailty and a higher likelihood of becoming prematurely frail than the general population, frailty has been minimally investigated in this group.8 14

To diagnose and manage frailty, the Best Practice Guidelines, issued by the British Geriatrics Society, Age UK and the Royal College of General Practitioners, recommend Comprehensive Geriatric Assessment (CGA).15 CGA is a validated tool which offers a holistic assessment process of all aspects of an individual’s life, including physical, mental and social aspects, and has been found helpful in the context of older adults health research.16 The key elements of CGA include: a comprehensive evaluation by a geriatrician to identify medical, social and functional needs, optimisation of medication prescribing and (if needed) referrals to a multidisciplinary team.17 18 CGA has been shown to prevent a decline in function for older inpatients.19 Further, a recent systematic review of studies using CGA in community-dwelling frail, older adults at risk of poor health outcomes found that CGA may decrease the risk of unplanned hospital admissions while the effects of CGA on emergency department visits remain uncertain.20 However, there is an absence of evidence on the feasibility and effectiveness of such multimodal CGAs for adults with severe mental illness. This is concerning because high prevalence of physical comorbidities (eg, cardiovascular disease, metabolic syndrome and neurocognitive disorders) predisposes this population to experience frailty at a younger chronological age than the general population. Thus, although chronologically younger, CGA could offer an effective approach to address frailty and mitigate the associated negative outcomes in this vulnerable population.

Amidst a lack of evidence on the management of frailty in those with severe mental illness, this pilot study will investigate CGA as a potential intervention to address frailty in people with severe mental illness, as per the current protocol. The primary aim is to evaluate the feasibility and acceptability of CGA as an add-on to their routine healthcare in patients with severe mental illness. In addition, this study will investigate exploratory outcomes, including changes in participants’ perceptions of their health/well-being, quality of life, medication burden, mental health and physical health factors, including sleep, physical activity and diet, and acute service use between CGA and follow-up. The outcomes will inform the value and design of a randomised controlled trial (RCT) sufficiently powered to provide evidence on the efficacy of CGAs in those with severe mental illness. This study will also inform the development of training programmes to assist clinicians in adopting a person-centred approach to treatment.

METHODS AND ANALYSIS
Study design
This study employs a repeated-measures, pre/post, mixed-methods intervention design. The study started in July 2022 and is expected to be completed by July 2023.

Patient and public involvement
Patients who are seen by DS and NW at the Metro South Addiction and Mental Health Service outpatient clinics were not directly involved in setting the research questions or the outcome measures, but their presenting concerns, which highlighted the need for a more holistic treatment of their complex mental and physical health problems, inspired the research team to design and implement the study.

Setting and study population
Twenty-five participants, aged 18–64 years, will be recruited from Metro South Addiction and Mental Health Service outpatient clinics. Most of the patients attending these clinics have a primary diagnosis of schizophrenia spectrum disorder. Participants will be eligible for the study if they have a diagnosis of severe mental illness (schizophrenia, bipolar disorder or major depression) and are frail (≥0.25 on the Frailty Index (FI) Short Form). Participants will be excluded if they are currently experiencing an acute relapse of psychiatric symptoms, are unable to provide informed consent or are unable to engage with the CGA intervention.

Patient screening and enrolment
Potential participants who agree to be contacted by the research team will be provided with information about the study and asked for consent for an assessment of inclusion and exclusion criteria to be completed. Eligible patients will then be invited to participate in the study, and a formal consent process will be conducted.

Intervention procedures
CGA will be conducted by a registrar (advanced trainee) in geriatric medicine, under the supervision of a senior doctor.
geriatrician. CGA will occur face-to-face and is expected to take approximately 1 hour. Where appropriate, patients may be accompanied by a support person who can provide additional information on the patient’s history.

CGA will include an assessment of multiple health domains, such as physical health (eg, comorbidities, medication review, nutrition), psychological health (eg, mood, cognitive function), function (eg, falls and mobility, activities of daily living) and social supports (eg, support networks, financial assistance, accommodation). A pharmacist will conduct a medication review and generate a list of current medications and recommendations. The registrar in geriatric medicine will discuss the patient with the senior geriatrician and create a CGA report, which will include a comprehensive problems list and recommendations for an individualised care plan. The domains covered by the care plan will be determined based on the individual’s problems list and needs.

A copy of the report, along with the medication review, will be sent to the individual’s treating general practitioner, the psychiatrist, the nurse navigator and the individual. These will also be uploaded to the electronic medical record, which contains clinical information about patients in contact with a public mental health system. The nurse navigator will further discuss the report with the individual. Necessary referrals will be facilitated by the nurse navigator. A follow-up appointment with the same geriatrics registrar will be booked 3–6 months following CGA.

**Trial visits, assessments and outcome measures**

Study visits and assessments will follow the schedule outlined in table 1. Study assessments will occur within 4 weeks prior to CGA (baseline assessment), at the midpoint between the baseline and follow-up appointment (midpoint assessment), and within 4 weeks after the follow-up appointment (final assessment). Baseline and final assessments will be undertaken by research staff in the outpatient setting face-to-face and are anticipated to take between 1 and 1.5 hours, while the midpoint assessment will be shorter (15–20 min) and conducted by phone.

**Outcome variables**

The assessment of preliminary effectiveness of the CGA will be based on the comparison between baseline and follow-up on a range of physical and mental health indicators. These indicators will include physical health (ie, frailty status and physical health status), mental health and functioning (ie, mental health status, psychosis symptoms, global functioning, acute service use, weight), lifestyle behaviours (ie, sleep, physical activity, diet) and quality of life. The outcome variables will be measured

<table>
<thead>
<tr>
<th>Table 1 Schedule of visits and assessments</th>
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<td>Verbal consent (chart review for eligibility)</td>
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<td>AQoL-8D</td>
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<td>CGA*</td>
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<tr>
<td>Medication review by pharmacist</td>
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<td>TAQ (within 4 weeks of CGA)</td>
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<tr>
<td>Follow-up appointment by physician†</td>
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<td>Semistructured interview (optional)</td>
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*Within 4 weeks of baseline assessment.†Between 3 and 6 months following CGA.

AQoL-8D, Australian Quality of Life Scale; CGA, Comprehensive Geriatric Assessment; FACET, Five-a-day Community Evaluation Tool; GAF, Global Assessment of Functioning; PANSS, Positive and Negative Syndrome Scale; PSQI, Pittsburgh Sleep Quality Index; SF-36, Medical Outcomes Scale Short Form-36; SIMPAQ, Simple Physical Activity Questionnaire; TAQ, Treatment Acceptability Questionnaire.
using validated tools that have been previously used in people with mental illness, as outlined below.

Frailty status

Frailty status will be quantified using an FI, which conceptualises frailty as a multidimensional risk state. A well-defined method will be employed to derive a score from a list of variables representing functional, cognitive, psychological and psychosocial domains. Deficits, including a wide range of areas such as cognition, sleep, motivation, mood, strength, mobility, nutrition, activities of daily living and medical history, will be summed and divided by the total number of variables (here, 58) to give an index score (eg, someone with 20 deficits out of the 58 possible deficits has an FI of 0.34). Consistent with previous studies, patients will be categorised as frail and eligible for study inclusion if they have an FI of >0.250.

Health status

Health status will be assessed using the Medical Outcomes Scale Short Form-36, a self-rated survey that covers general health, activity level and emotional and somatic complaints with associated disability. The measure produces two component scores: Physical Component Summary and Mental Component Summary.

Psychosis symptoms

Psychosis symptoms will be assessed using the Positive and Negative Syndrome Scale, which measures symptom severity of patients with schizophrenia and is considered the ‘gold standard’ for assessment of antipsychotic treatment efficacy.

Global functioning

Global functioning will be assessed with the Global Assessment of Functioning, a clinician-rated scale that assesses the severity of psychological, social and occupational disability over the past month, using a scale from 0 (most severe) to 100 (no symptoms/disability).

Sleep

Sleep will be assessed using the Pittsburgh Sleep Quality Index (PSQI), a 19-item self-reported measure of overall sleep quality. The PSQI assesses seven sleep subcategories: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction.

Physical activity

Physical activity will be measured using the Simple Physical Activity Questionnaire (SIMPAQ). Using a five-item scale and an interview format, SIMPAQ estimates time in bed, structured exercise participation, and incidental or non-structured physical activity.

Diet

Diet will be assessed using a food frequency questionnaire of the Five-a-day Community Evaluation Tool (FACET). The FACET contains 14 questions that ask about the frequency of consumption of certain foods during the last 24 hours using a 5-point scale (0–4+ portions).

Quality of life

Quality of life will be evaluated using the Australian Quality of Life Scale (AQoL-8D). AQoL-8D is a 15-item instrument that measures five broad domains: psychological well-being, physical senses, social relationships, independent living and illness.

Acceptability of the CGA

Acceptability of the CGA intervention will be assessed using the Treatment Acceptability Questionnaire (TAQ). Using a 6-point Likert scale, TAQ assesses a person’s perceived knowledge and trustworthiness of the clinician (two questions) and their views about the acceptability and ethics of the proposed treatment, likely effectiveness and the likelihood of negative side effects of the treatment (four questions). For the purposes of this study, the four questions about treatment will be asked separately for each recommendation that will follow the CGA (it is anticipated that each individual will receive from three to five recommendations).

Acceptability will also be assessed with qualitative methods using semistructured qualitative interviews and conducted within 4 weeks following the follow-up appointment. The interview questions will focus on a participant’s experience of the intervention, specifically their perceptions of the CGA and the subsequent personalised recommendations for interventions, with a particular focus on the person’s met and unmet needs. This semistructured interview is optional and will be audio-recorded (as per standard practice in qualitative research) to enable a word-by-word analysis of the data, which results in the identification of themes that may emerge from the participants’ narratives.

Additionally, acceptability of the CGA and subsequent recommendations will be inspected from the perspective of any potential attrition between study enrolment and follow-up. Reasons for withdrawal of any participants will be provided to inform the development of future frailty interventions in this population.

Comorbidity

Comorbidity will be assessed using the Charlson Comorbidity Index (CCI). The CCI will be used to cross-check an individual’s frailty risk and will be calculated by summing weighted ICD-10 (International Classification of Diseases 10th Edition) codes of 17 comorbidities, based on their disease severity and mortality risk.

Acute service use

Acute service use will be measured by the number of hospital admissions, length of stay and number of emergency department visits for physical and mental health reasons. The data on these indicators will be obtained from the electronic medical record.
Demographic and clinical characteristics

Demographic and clinical characteristics will be obtained from the patient’s hospital medical record. Demographic information will include sex, age, ethnic origin, smoking status, education and employment status. Clinical characteristics will include primary and secondary diagnoses and prescribed medications. Patients will be eligible for study if they will fulfill the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) criteria for schizophrenia, bipolar disorder or major depression.

Complete physical examination will be documented. These observations will be done as part of routine care and as part of the CGA, with the treating clinician providing routine blood test results to the physician prior to the CGA. Medical history, including presenting symptoms, medical history, drug history, family history, social history and allergies, will also be assessed as part of the CGA. Physical health measures such as a person’s blood pressure and weight will be assessed as part of the CGA, both at baseline and at follow-up appointment.

Medication burden

Medication burden will be measured using the Drug Burden Index (DBI).\textsuperscript{33} DBI is calculated by summing the burden from each anticholinergic and sedative medicine that is used by an individual. We will also record polypharmacy, defined as the concurrent use of five\textsuperscript{34} and nine or more (high polypharmacy) regular medications.\textsuperscript{35} To provide a more granular account of our sample, we will present a summary table of all (including psychiatric) medications used by the participants.

Statistical methods

Sample size

This is a pilot feasibility study and no power calculations have, therefore, been made. Instead, this study is intended to inform the development of future studies that will be sufficiently powered to detect statistically significant differences.

To support further intervention optimisation, varied participant experiences will be sought for qualitative analysis by encouraging all 25 participants to conduct the interview. It is anticipated that the subsample will include 15–20 participants with a mix of gender, age, physical comorbidities and clinical symptoms.

Data analysis

The analysis of feasibility and acceptability of the CGA will involve the proportion of participants’ agreement to undertake the CGA, qualitative appraisal of the intervention after the final follow-up and patients’ perceptions of their health at follow-up. Other variables of interest, including FI score, quality of life, mental illness burden, medication burden, sleep, physical activity and diet, and acute service use, will be presented using descriptive statistics only, given the lack of statistical power to detect any meaningful change. Total scores, or where applicable, subscores, of the assessments used to measure these domains will be used as outcome variables and will be presented at a group level for baseline and follow-up. Acute service burden will be expressed in the form of three continuous variables (ie, number of hospital admissions, average length of stay and number of emergency department visits for physical and mental health reasons), which will cover 3 months pre-CGA and 3 months after follow-up.

Participant safety

Participation in this study is low risk in terms of CGA being a safe intervention. Risks associated with participation include issues of confidentiality breach and discomfort from discussing mental illness. The Risk Identification, Evaluation and Management plan will ensure that risks and uncertainty are appropriately managed for the duration of the study.

Reimbursement

Participants will receive gift cards in remuneration for their time.

Ethics and dissemination

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by Metro South Human Research Ethics Committee (HREC/2022/QMS/82272). Study findings will be disseminated through peer-reviewed publications and conference presentations.

DISCUSSION

There is a paucity of evidence regarding frailty interventions in people with severe mental illness, a population at risk of becoming prematurely frail. To date, there are no known interventions that would directly address frailty and minimise associated negative outcomes in this vulnerable population.

This pilot study will explore CGA as a potentially effective intervention to improve health outcomes among people with severe mental illness who are frail. It will provide novel evidence on the feasibility, acceptability and effectiveness of CGA embedded within routine healthcare. Addressing indicators of premature frailty in this population is important because of unequal physical healthcare in those with severe mental illness compared with the general population.\textsuperscript{2} The inequality of physical healthcare is due to a range of reasons, including low screening rates for some specific cancers,\textsuperscript{36} higher rates of non-compliance with or discontinuation of the recommended therapy,\textsuperscript{37} as well as stigma which may contribute to individuals with severe mental illness being treated less thoroughly.\textsuperscript{38} As such, we anticipate that providing outpatients of a community mental health service who have a severe mental illness and are frail with a comprehensive...
assessment and an individualised management plan in the form of a CGA, as proposed in the current feasibility study, is likely to be helpful in identifying any unmet physical health needs and identifying key physical health needs to monitor or treat in the future.

Inherent to a pilot feasibility study is the limitation of having insufficient power to detect statistically significant differences in health-related outcomes and thus determine the efficacy of the CGA. Nonetheless, this feasibility trial is critical in providing preliminary evidence to inform the design and implementation of future frailty interventions in people with severe mental illness, including RCTs with sufficient power to establish an intervention's effectiveness.

This study has the potential to lead to further trials that could provide evidence to substantiate the implementation of frailty screening into routine care for those with severe mental illness, as well as a subsequent CGA for those assessed as frail. Management of frailty through the implementation of CGAs could enable clinicians to individualise care and thus provide the most appropriate and timely resources to the person. As such, this study has the potential to change the standard of care for people with severe mental illness, reducing premature mortality and improving quality of life in this population.

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Contributors NW, DS, RH, UA, EG and NR conceived the study. All authors contributed to the study design and planning. EP performed the first draft of the manuscript and UA, NW and DS reviewed and amended the early draft version. All authors (NW, UA, EP, AB, RH, NR, WWLK, EG and DS) edited and contributed to the final version of the manuscript, and all authors gave final approval to the submitted version. For the clinical trial, NW and DS are the principal investigators, AB is the trial coordinator, WWLK is the geriatrics registrar conducting the CGAs, and UA and RH are site principal investigators and will be actively involved in participant recruitment. UA and NR will develop the statistical analysis plan, with support from NW, DS and RH.

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Competing interests NW has received speaker fees from Otsuka, Lundbeck and Janssen.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

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REFERENCES
1 Lawrence D, Hancock KJ, Kisely S. The gap in life expectancy from preventable physical illness in psychiatric patients in Western Australia: retrospective analysis of population based registries. BMJ 2013;346:f2539.


