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Outcomes of a pilot feasibility study of comprehensive geriatric assessment for younger frail patients with severe mental illness

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Abstract

Background Individuals with severe mental illness (SMI) are at risk of early-onset frailty, leading to adverse outcomes. Effective interventions for reducing frailty in this population are currently lacking.

Aims To assess the feasibility, acceptability, and preliminary efficacy of Comprehensive Geriatric Assessment (CGA), delivered by an Advanced Trainee in Geriatric Medicine, as an intervention for individuals with co-occurring frailty and SMI.

Method Participants, aged 18–64, with frailty and SMI were recruited from public community outpatient clinics between July 2022 and January 2023. Feasibility of CGA was evaluated through mixed methods. Secondary outcomes included a range of mental and physical health factors.

Results Out of 38 eligible individuals, 17 were enrolled and 14 completed the study; three dropped out post-baseline assessment and CGA. 86% were male, average age was 48.4, Body Mass Index 34.6, and Frailty Index 0.35. Participants expressed high acceptability and perceived benefits of CGA, including increased insight about one's health and receipt of multidisciplinary holistic care. While this study was inadequately powered to show statistically significant changes in secondary outcomes, positive trends were observed in overall psychosis symptoms and weekly physical activity engagement which increased by 56.6 min, reaching the recommended levels to achieve health benefits.

Conclusion The findings of this study support the feasibility of CGA as an intervention in routine care of people with SMI and provide evidence for designing future trials of frailty interventions in this population. The study underscores the significance of tailored, multidisciplinary, and individualised approaches, though further research is required to substantiate its efficacy in this priority population.

Keywords Schizophrenia, Severe mental illness, Frailty, Comprehensive geriatric assessment, Physical comorbidity

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Background

Individuals with severe mental illness (SMI), such as schizophrenia, bipolar affective disorder, and major depression, experience a high prevalence of physical comorbidities, leading to an average of 15 years shorter life expectancy compared to the general population [1, 2]. These comorbidities are exacerbated by adverse effects of antipsychotic drugs, sedentary lifestyle, poor diet, psychosocial stressors, and other lifestyle factors [3] that, cumulatively, accelerate biological ageing. Therefore, people living with SMI experience the negative effects of ageing at a younger age than the general population [4]. The multidimensional nature of these disorders, with physical and mental health issues compounding, makes treatment and prioritisation of an individual's needs quite challenging. In response, an assessment of frailty has been proposed as a potentially useful approach to inform the selection of and referrals for relevant interventions.

This hypothesis is based on the concept of frailty which denotes a state of poorer health marked by age-related changes in various body systems, leading to increased susceptibility to stressors and negative health events [5, 6]. It encompasses biological ageing, comorbidity, and psychosocial impairments. As such, the assessment of frailty can provide a multidimensional view of health, addressing biological, social, and psychological aspects of health. While there has been considerable research into frailty associations with late-life depression and anxiety [7], it has been minimally investigated in people with SMI. Our group has previously reported that people with SMI have higher prevalence rates of frailty and become frail at a younger age when compared to the general population [8, 9].

To 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) [10]. CGA is a validated tool which offers a holistic assessment process of all aspects of an individual's life, including a comprehensive evaluation of medical, social, and functional needs, medication optimisation, and referrals to a multidisciplinary team [11, 12]. Among older inpatients, CGA has been shown to prevent a decline in function [13] and also shows promise for preventing hospital admissions among older adults at risk of poor health outcomes [13]. However, CGA has not been studied in adults with SMI who are also at high risk for adverse health outcomes [3]. To advance knowledge on how to mitigate frailty-related negative outcomes in this vulnerable population, our aim was to investigate the feasibility and acceptability of CGA as an add-on to routine health care in frail younger people with SMI. We hypothesised that the implementation of CGA in routine health care could enable clinicians to

individualise care and resources to address the complex health needs of this population.

Method

Study design and procedures

The study followed a pre-developed published protocol [14] and employed a pre-post, mixed-methods design. Individuals were invited by their treating psychiatrist to participate in the study and were recruited from the Metro South Addiction and Mental Health Service (MSAMHS) outpatient clinic, which is a public community outreach specialist care clinic in Brisbane, Australia. All participants provided written informed consent, including consent to publish their de-identified information related to this study. 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 the Metro South Human Research Ethics Committee (HREC/2022/QMS/82272). The recruitment and data collection were conducted between July 2022 and January 2023.

To be eligible for the study, participants had to meet the DSM-V criteria for schizophrenia, bipolar disorder, or major depression, be clinically stable and aged between 18 and 64 years. The frailty inclusion criterion was a score of ≥ 0.25 on the Frailty Index (FI) Short Form, consistent with previous research [15]. Exclusion criteria included current acute relapse of psychiatric symptoms, inability to provide informed consent or to engage with CGA due to transport or acute physical health issues. Eligible participants received gift cards to a total value of AU\$75 in remuneration for their time.

Intervention and measures

The intervention involved a face-to-face CGA conducted by a Geriatric Medicine Advanced Trainee under the supervision of a senior geriatrician, and subsequent recommendations tailored to individual's needs. Participants were accompanied by a support person if required. CGA covered physical health, psychological health, functioning, and social supports. The assessment, which lasted on average 51.5 min, was informed by an individual's chart review prior to the assessment which took on average 41.4 min. The Geriatric Medicine Advanced Trainee created a report with an individualised care plan and shared it with the participant, their general practitioner (GP), treating psychiatrist, and two nurse navigators who were engaged for the purposes of this study. The nurse navigators contacted all participants within 2–4 weeks via phone to discuss the report and facilitate referrals. A follow-up appointment with the same Geriatric Medicine

(Registrar) was scheduled 3–4 months after CGA by the Research Manager.

Acceptability measures

Acceptability of CGA within routine clinical care was assessed using mixed methods. First, within two weeks following CGA, the participants were asked over the phone about their perceptions of their personalised recommendations using the Treatment Acceptability Questionnaire (TAQ) [16]. TAQ includes six questions assessing an individual's perceived knowledge and trustworthiness of the clinician and their views about the acceptability, ethics, likely effectiveness, and the likelihood of negative side effects using a 6-point Likert scale. Additionally, semi-structured interviews were conducted with all participants (in one case a spouse was also present) within four weeks following the follow-up appointment, comprising of six questions addressing participants' perspectives and experiences of CGA conducted by the Geriatric Medicine (Registrar), and the subsequent personalised recommendations.

Clinical assessments

Preliminary effectiveness of CGA was explored using a wide range of assessments which were administered at baseline (within 4 weeks prior to CGA), midpoint (midpoint between CGA and follow-up appointment), and endpoint (within 4 weeks after the follow-up appointment). A detailed schedule of visits and assessments is reported in the protocol [14]. The assessments covered the following areas:

- i. physical health, including frailty status measured using the FI based on a list of 58 variables representing functional, cognitive, physiological, and psychosocial domains [17], and weight;
- ii. mental health, including psychosis symptoms measured using the Positive and Negative Syndrome Scale (PANSS) [18] and global functioning measured with Global Assessment of Functioning (GAF); [19]
- iii. lifestyle behaviours, including physical activity measured using Simple Physical Activity Questionnaire (SIMPAQ) [20], nutrition measured using Part 1 of the Food-frequency questionnaire of the Five-a-day Community Evaluation Tool (FACET) [21], and sleep measured with the Pittsburgh Sleep Quality Index (PSQI); [22]
- iv. acute service use (based on review of medical records);
- v. health-related quality of life measured with the Medical Outcomes Scale Short Form-36 (SF-36), which produces a Physical Component and Mental Component Summary; [23] and,

- vi. pharmacology, assessed using the Drug Burden Index (DBI) which sums the burden from each anticholinergic and sedative medicine used by an individual [24], and by recording an individual's concurrent use of five or more (polypharmacy) [25], or nine or more regular medications (high polypharmacy) [26].

A detailed overview of the study assessments and the scales used in the analysis is provided in Supplementary Material, Table 1.

Statistical analysis

The intention of the current feasibility study was to inform the development of future studies that will be sufficiently powered to detect any meaningful or statistically significant differences in outcome variables. For all assessments, both total scale and subscale scores have been aggregated at a group level, and their characteristics depicted through descriptive statistics (mean, standard deviation, median, and range). As per the protocol [14], no inferential statistical tests were conducted due to lack of power to show a significant difference. For SF-36, linear transformation of scores to a mean of 50 and standard deviation of 10 was performed to enable comparison of scores across eight scales, as documented previously [27]. Participants' scores on each of the six questions included in the TAQ were combined across all recommendations for an individual and averaged for each of the six TAQ domains. Descriptive statistics for other assessments across measurement points are reported in Supplementary Material, Tables 2, 3 and 4.

Regarding the qualitative data, all interviews were conducted by UA face to face and audio-recorded with permission of the participants. The interview material was then transcribed verbatim and data management and coding conducted by RS in NVivo [28], following the six-phase method of thematic analysis, proposed by Braun and Clarke [29], including: transcription of audio files; data familiarisation through initial transcript readings; preliminary code identification; analysis into overarching themes; and final deliberation on theme definitions. Thematic mapping was used to explore the themes in more depth, with the themes being defined collaboratively with UA through an iterative process. Upon analysis of the final few interview transcripts, it was determined that no new or relevant information was present in the data. It was, therefore, concluded that data saturation had been achieved around the ninth interview, which falls within the suggested range for achieving saturation in qualitative research [30].

Table 1 Participant characteristics at baseline ($n = 14$)

Variable	N	%
Demographic and clinical characteristics		
Male	12	85.7
White/Caucasian	13	92.8
Australian born	13	92.8
ATSI descent	0	-
Unemployed	13	92.8
Primary diagnosis		
Schizophrenia	1	7.1
Paranoid schizophrenia	7	50.0
Schizoaffective disorder	4	28.6
Bipolar affective disorder	2	14.3
Prescribed medications		
Clozapine (mean dosage; mg) ^a	8 (403.1)	57.1
Polypharmacy (≥ 5) ^a	13	92.8
High polypharmacy (≥ 9) ^a	11	78.6
Physical characteristics		
Current smoking	4	28.6
Metabolic health		
Normal weight ^b	1	5.9
Pre-obesity (overweight) ^b	5	29.4
Obesity ^b	11	64.7
	M	SD
BMI	34.6	8.4
Waist circumference (cm)	120.4	15.0
Frailty Index at screening	0.35	0.08
Clinical assessments		
Psychosis symptoms (PANSS total scale)	66.6	13.1
Physical component (SF-36)	55.6	26.1
Mental component (SF-36)	62.4	20.4
Global functioning (GAF total score)	47.8	6.1
Quality of life (AQOL-8D total score)	64.8	14.8
Physical activity (min; SIMPAQ) ^c	184.6	217.9
Sedentary time (min; SIMPAQ)	588.6	256.3
Fruit & vegetable intake (portions; FACET)	4.4	2.4
Sleep (PSQI global score)	6.8	4.0

ATSI, Aboriginal and Torres Strait Islander; BMI, Body Mass Index; SD, standard deviation; SF-36, Medical Outcomes Scale Short Form-36; PANSS, Positive and Negative Syndrome Scale; GAF, Global Assessment of Functioning; MVPA, moderate-to-vigorous physical activity; PSQI, Pittsburgh Sleep Quality Index; SIMPAQ, Simple Physical Activity Questionnaire; FACET, Five-a-day Community Evaluation Tool; AQOL-8D, Assessment of Quality of Life

^a Other prescribed medications were: aripiprazole (2 participants), allopurinol (1 participant), amisulpride (1 participant), allopurinol (1 participant), brexpiprazole (1 participant), and sertraline (1 participant). Polypharmacy was defined as concurrent use of 5²⁵ and of 9 or more regular medications [26].

^b BMI was classified into groups based on World Health Organization classification of nutritional status.³⁷ Among the participants with Obesity, 4 had a BMI that corresponded with 'Obesity class I' (23.5%) category, 3 with BMI of 'Obesity class II' (17.6%), and 4 whose BMI corresponded with 'Obesity class III' category

^c Physical activity was assessed using moderate-to-vigorous physical activity domain of the SIMPAQ, which includes time spent walking and time spent exercising

Results

Cohort description

Participants were recruited over a period of three months (July–September 2022). During this period, the clinic's team had 80 outpatients on the books of whom 38 patients with SMI, aged 18–64, were identified by their treating psychiatrist as potentially eligible for the study. These 38 potentially eligible participants were then referred further to the clinical trial team and screened for eligibility. Of these, 13 patients declined participation due to lack of interest in participating in this study. An additional three were excluded because they did not meet the frailty threshold ($FI \leq 0.25$) and five were excluded for other reasons (Fig. 1). Seventeen patients gave informed consent and underwent the baseline assessment, resulting in a recruitment rate of 44.7%.

Three participants voluntarily withdrew during the duration of the study; two withdrew following the baseline assessment and one after CGA. No specific reasons were provided for their withdrawal other than they no longer wished to participate in the study. The subsequent analysis of data was, therefore, conducted on the remaining 14 participants, resulting in a retention rate of 82.4%. One participant was not able to be contacted for the TAQ assessment and additional two participants were not able to complete the midpoint assessments due to worsening of their physical health. One participant requested to break the endpoint assessment into two appointments due to time constraints but was later unwilling to complete the remaining assessments.

The mean age of the 14 participants who completed the study was 48.4 years ($SD = 11.4$). Mean FI score at screening was 0.35 ($SD = 0.08$). Mean DBI score at baseline was 5.54 ($SD = 2.06$), with majority of participants (11; 78.6%) being classified as 'high polypharmacy' users (i.e., 9 or more prescribed medications) [26]. Frequency of prescribed medications is reported in Supplementary Material, Table 5, while other participants' characteristics are presented in Table 1.

Acceptability of CGA and subsequent recommendations

Based on CGA, seven participants received five recommendations about their health, two received four, and one participant received three recommendations. A review of reports including these recommendations revealed that all the 14 participants were recommended strategies related to weight management such as engaging in regular physical activity and consuming a nutritious and balanced diet, and over two thirds (10; 71.4%) were recommended to adjust or adhere to their medications. Referrals to allied health professionals were undertaken in nine cases (64.3%) and referrals to medical sub-specialists in four cases (28.6%). The specialist referrals were for chronic migraine, for hepatitis C treatment, and two

Table 2 Themes and subthemes generated from analysis of qualitative interviews

Theme	Sub-theme	Illustrative examples
Perceptions of the CGA	Reflecting on research participation	<i>I didn't find it intrusive... wasn't pushed into anything, I thought it was good. I think it went extremely well... there was no negativity. There was no, I, thought it was umm... there was no negative aspects. [I] enjoyed the feeling of helping people... I hope it's beneficial to others.</i>
	Accessibility	<i>I know that usually outside of the study, I could be wrong, but it can be hard to access all those services for someone who is not in this study. I like how it was just like a free pass to check everything rather than if the study wasn't on, I would have to get referral after referral which is inconvenient. So, like, if this could be done for people in general, I think it'd save time and that it would probably even keep a lot of people out of hospital and the public health system.</i>
	Clinician-consumer interaction	<i>[Clinician name] doesn't overwhelm us. Just talking to us at our level. Some of it goes over the top [gestures overhead] but you explain things, you don't hit us with the scientific stuff. You probably understand what we don't but put it in layman's terms, it makes it very easy. [Clinician] was very nice. You know, very good at her job... If we didn't understand, she didn't mind explaining it to us... I liked her, very nice and thorough. I would say you can do the study and you don't have no one judging you, you don't have anyone judging what you say.</i>
Increased knowledge and insight	Mind-body connection	<i>Get a good feeling, um, of how your body is working. You know, what's wrong with it and what isn't wrong with it. What you can do to change things that are not working properly. When you go there, you're green, you're not aware of anything. Well, it's going to help me too. Makes you aware of things you know, what the doctor's been saying to [participant's name] about general health. Some people say ignorance is bliss but not in some cases. Not when it's your health. Remind myself, if I don't look after my physical self I won't be looking after the mental. Or If I'm not looking after the mental, I'm not looking after the physical. It's a balance. I've been noticing that every... most things in life have balance.</i>
Provision of multi-disciplinary holistic care	Holistic care	<i>I got a chance to speak to different types of doctors, which I thought was positive. Found out a little bit about my umm personal health... it was good getting a bit more umm in depth umm analysis into what's happening in my body, so I thought that was good and yeah, interesting. Because she came up with things that I didn't know what the matter with me was, you know. And I knew that they were there, but I've never had a real good health check like that you know. Like I've had issues with doctors and things like that but not like that. Not like they have a look at everything, you know what I'm saying.</i>
	Formal and informal caregiver support	<i>[Partner/Carer's name] comes everywhere with me. Partner/Carer's: Cus sometimes [participant name]'s got a lot of things going on in her mind and she's not always focussed. I go there to be an extra set of ears- I'm not there to be the gatekeeper- I just listen to the doctors. And if [participant name] asks me something I can say what she said and what she meant. Cus sometimes you do get a bit forgetful. I am forgetful. Partner/Carer's: Sometimes you get overwhelmed with doctors. You go into your shell a bit... I've always asked doctors questions.</i>
	Empowering action	<i>She said she was happy with how I'm going. Yeah, I'm sure she would recommend that everything just keeps going the same. Yeah, she said I was going pretty well. Yeah. Pretty good praise. I'm not used to that. [There] were things that I had to encourage myself to do. If I had the doctor there and she said OKAY we are going to go and do this together it would be like, yeah alright, you know. But otherwise, you're at home, you got to sort of get yourself motivated, yeah.</i>

for cognition-related concerns to a memory clinic. Other recommendations included ensuring sufficient sleep and reducing or quitting smoking.

Participants' ratings of each of their personalised recommendations, as obtained with TAQ, are presented in Fig. 2. The average score of the 13 participants who completed the TAQ across six acceptability domains was 4.6 (SD=0.4), reflecting a high level of overall acceptability of the recommendations received. The perceived likelihood of suggested recommendations having any negative effects was low (M=1.8, SD=1.0). The recommendations were perceived as acceptable (M=5.0, SD=0.7), potentially effective (M=4.9; SD=1.0), and highly ethical (M=5.2, SD=0.7). The clinician (Geriatric Medicine Registrar) was perceived as trustworthy (M=5.4; SD=0.8) and knowledgeable (M=5.2; SD=0.8).

Preliminary effectiveness of CGA

Overall, the inspection of the changes in assessment scores from baseline to endpoint indicated no notable

changes in scores. Some improvements were detected in psychosis symptoms and lifestyle behaviours (for details, refer to Supplementary Material, Tables 2, 3 and 4).

There were no statistically significant changes in total PANSS, nor in the subcomponent scales. While there was reduction of 23.6 min in the amount of sedentary time from baseline to follow-up, and an increase in weekly moderate-to-vigorous physical activity of 56.6 min, neither of these changes were statistically significant given the small sample size. Similarly, regarding nutrition, the number of fruit portions in the preceding 24-hour period increased from 2.5 to 3.2 portions, while the vegetable portions reduced from 1.9 to 1.3 portions, but these did not reach statistical significance.

A review of medical records showed that three participants were hospitalised during the 3-month period prior to CGA (their length of stay ranged from 3 to 210 days), and out of these three, two were hospitalised again in the 3-month period after the follow-up appointment (their length of stay ranged from 1 to 2 days). No

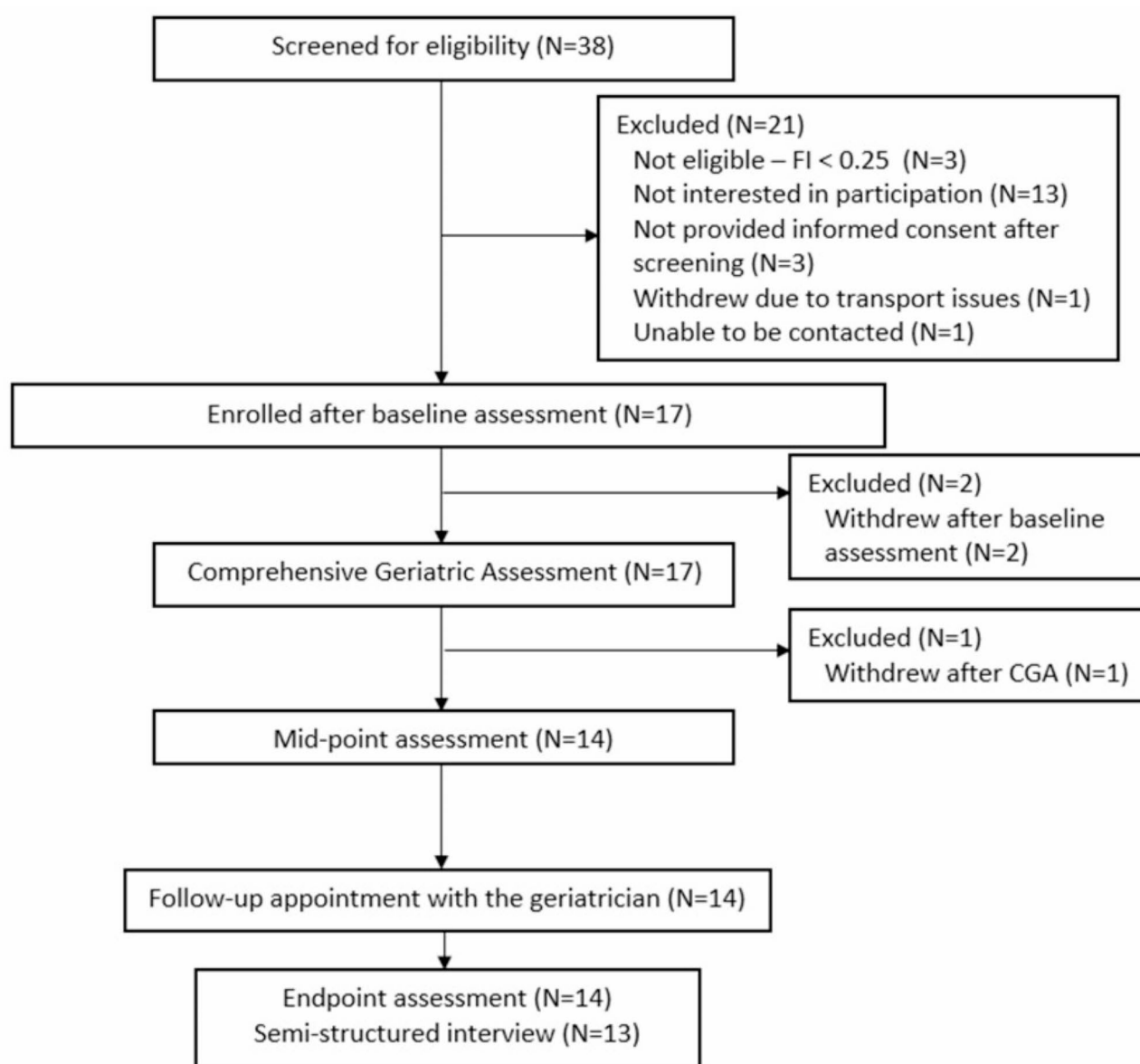


Fig. 1 Participant flow

hospitalisations were recorded for other participants. While there were no presentations to the ED in the 3-months prior CGA, there were two after the follow-up; both of which resulted in a short hospitalisation.

Perceptions of CGA as embedded within routine care

Table 2 summarises the themes generated from the analysis of qualitative interviews conducted at study completion. The themes were more finely deconstructed into sub-themes, as outlined and supported with participants' direct quotations. A summary of the main three themes (*Perceptions of CGA*, *Increased knowledge and insight*, and *Provision of multi-disciplinary holistic care*) is provided below.

Perceptions of CGA

Reflecting on research participation Participants provided positive and constructive feedback on CGA intervention, indicating overall satisfaction as expressed by one participant: "I didn't find it intrusive... wasn't pushed into anything. I think it went extremely well...there was no negativity". When reflecting on their involvement, participants expressed enthusiasm for future or repeat participation, and would recommend it to others. Beyond the specific benefits of the research itself, participants highlighted the altruistic benefits of their participation, such as a sense of purpose and fulfillment, and contributing to the advancement of scientific knowledge, which may ultimately improve the lives of others.

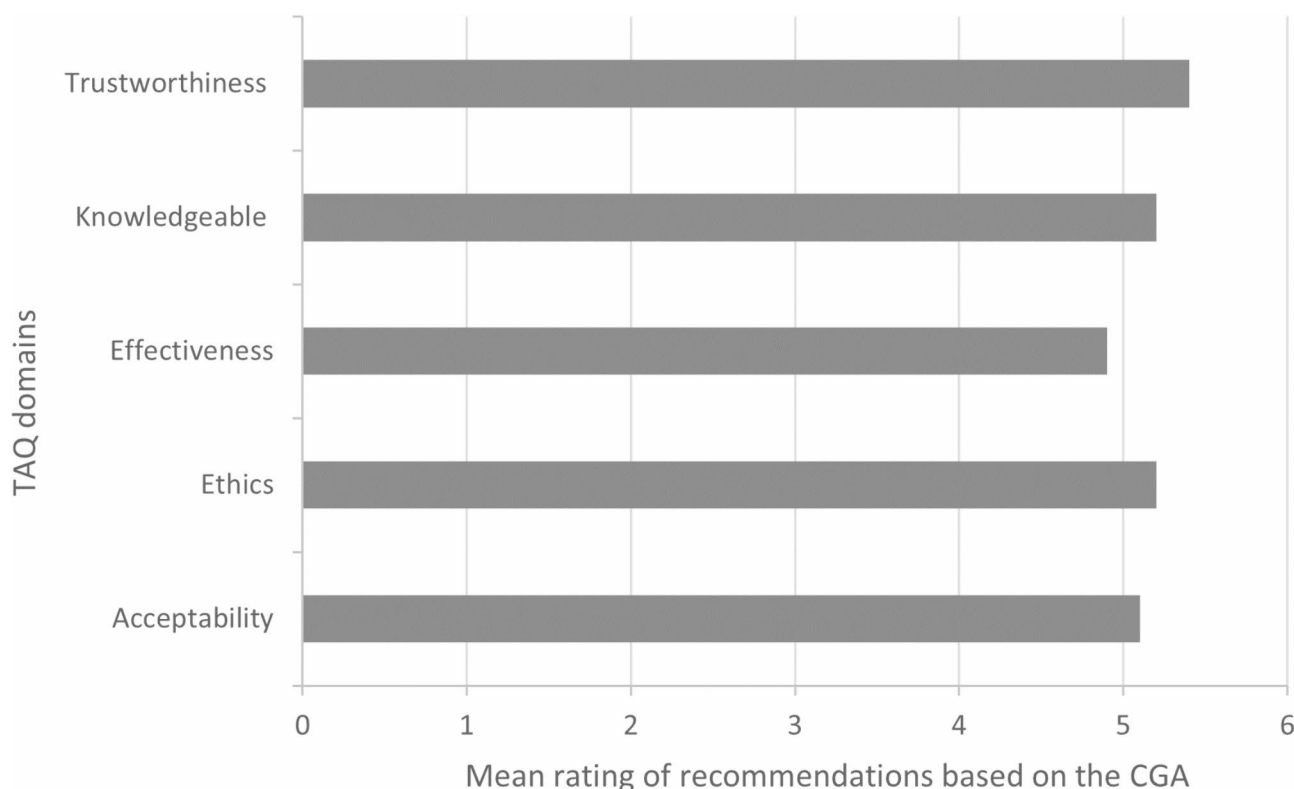


Fig. 2 Mean treatment acceptability scores

Accessibility In addition, participation in research conducted within one convenient location granted some participants improved and more comprehensive access to healthcare services that they may have otherwise been unable to afford or access or would have been too disjointed. One participant also noted the problem of usual care where “[they would] have to get a referral after referral which is inconvenient”, which was addressed by the co-location of the geriatrician within the mental health team who, in the words of one participant provided “a free pass to check everything”.

Clinician-consumer interaction Overall, the feedback regarding clinician-consumer interactions was positive, with participants expressing that the care they received was personalised, compassionate, and tailored to their unique needs and circumstances. Moreover, clinician-consumer interaction was found to mitigate communication and attitudinal accessibility barriers, as expressed by one participant: “[she] put it in layman’s terms, it makes it very easy” and “you don’t hit us with the scientific stuff”. The clinician’s ability to elucidate aspects of care was noted by another participant who commented: “if we didn’t understand, she didn’t mind explaining it to us”.

Increased knowledge and insight

Participants expressed a deeper understanding of how the body and mind work, and a greater appreciation for importance of maintaining good physical and mental health. In addition to benefiting the participants themselves, increased knowledge and insight gained through CGA was also observed to positively impact partners and carers.

Mind-Body connection For some, participation in CGA also highlighted the interdependent relationship between an individual’s mental and emotional states and physical health and wellbeing. As one participant reflected: “Remind myself, if I don’t look after my physical self I won’t be looking after the mental. Or If I’m not looking after the mental, I’m not looking after the physical. It’s a balance”. Another participant acknowledged the benefit of such a holistic approach by saying: “Well, it’s going to help me too. Makes you aware of things you know, what the doctor’s been saying.. about general health. Some people say ignorance is bliss but not in some cases. Not when it’s your health.”

Provision of multi-disciplinary holistic care

Participation in CGA facilitated a multidisciplinary approach to healthcare, involving various disciplines, which resulted in a more comprehensive and integrated

approach to care. This approach more fully addressed the unique and bespoke needs of the participants, enhancing the provision of holistic care, as expressed by one participant: *"I got a chance to speak to different types of doctors, which I thought was positive. [I] Found out a little bit about my personal health... it was good getting a bit more in depth analysis, into what's happening in my body, so I thought that was good"*.

Holistic care The participants appreciated a chance to speak with a physical health doctor and other referring professionals and felt that such a multidisciplinary approach provided them with a thorough check up. For some participants, this experience was new: "I've never had a real good health check like that you know. Like I've had issues with doctors and things like that but not like that. Not like they have a look at everything." The implementation of health behaviour change was supported by various strategies, including increasing participants' self-efficacy, addressing outcome expectancies and risk perceptions, and addressing barriers that may impede success.

Formal and informal caregiver support To enhance the quality of care received, some participants acknowledged the importance of involving their formal and informal caregivers in the care team and said who helpful it is that their spouse/carer "comes everywhere with me [them]". Here, caregivers provided practical support by helping them navigate the healthcare system and offering valuable information about the person's medical history and current symptoms. Moreover, they assisted with communication and advocated for the person's needs, contributing to a more comprehensive and person-centred approach to care. As one partner/carer expressed: "I'm not there to be the gatekeeper— I just listen to the doctors. And if [participant name] asks me something I can say what she said and what she meant."

Empowering action Participation in CGA also provided some individuals with the resources and support in particular encouragement to empower action and enhance intrinsic motivation for change. One participant commented: "If I had the doctor there and she said OKAY we are going to go and do this together it would be like, yeah alright, you know. But otherwise, you're at home, you got to sort of get yourself motivated".

Discussion

Despite people with SMI being at high risk of becoming prematurely frail, there is a paucity of evidence on the potential feasibility and acceptability of frailty interventions for this population. To the best of our knowledge, this is the first study to evaluate the feasibility of

CGA among people living with SMI who face significant physical comorbidity and are at high cardiometabolic risk leading to premature mortality. Specifically, the current pilot study aimed to explore the utility of CGA as a potentially effective intervention to improve health outcomes among people with SMI who are frail. We found that CGA was feasible, required on average 92.9 min to be completed, and the personalised recommendations arising from CGA were highly acceptable for people with comorbid SMI and frailty.

Consistent with evidence from epidemiological studies showing that the prevalence of obesity among people with SMI is up to 3-times greater compared to the general population [31], all participants undergoing CGA in the current study were recommended strategies related to weight management. The recommendations to manage weight were aligned with empirical evidence within SMI populations, underscoring the importance of lifestyle behaviours such as engaging in regular physical activity [32], consuming a nutritious and balanced diet [33], as well as reducing excess energy intake [34]. In addition, CGA also prompted recommendations around sufficient sleep and reducing smoking for a few participants, while the majority received a referral to an allied health professional and a recommendation to adjust or adhere to their medications. Participants' high ratings of their acceptability and perceived effectiveness of these individualised recommendations indicates that CGA is potentially a useful intervention for informing person-centred patient treatment plans. These findings also support the utility of CGA in prompting the engagement of other health professionals and sub-specialists and assisting with the identification of health issues, including modifiable lifestyle behaviours that are relevant to an individual's wellbeing and overall functioning, within an outpatient mental health setting. Such a multidisciplinary approach, incorporating a doctor collaborating with other health professionals along with nurse navigators to streamline these referrals, could prove particularly effective in addressing the prevalent issue of low motivation for physical activity characteristic for people living with SMI such as schizophrenia [35].

While no notable changes in various mental and physical health indicators were detected between CGA and follow-up, the small size of this pilot study meant that we were not adequately powered to detect changes. The study findings provide preliminary evidence on the capacity of CGA to increase physical activity engagement and reduce sedentary time. It is noteworthy that at follow-up, participants engaged in nearly an hour more of moderate-to-vigorous physical activity, compared to baseline physical activity assessment prior to CGA, reaching an average of total 241 min (4 h) of moderate-to-vigorous activity in a week. This increase is significant

because the Australian [36] and global physical activity guidelines [37] state that, to achieve health benefits, adults should engage in at least 150 min of moderate-intensity physical activity throughout the week [37], and be active on most days, preferably every day [36]. While the participants living with SMI and frailty in the current study were not meeting these guidelines at baseline, they were compliant with the recommended levels of weekly physical activity at follow-up.

The improvement in physical activity engagement also coincided with changes in self-reported sedentary time [38]. Specifically, a reduction of 23.6 min from CGA to follow-up, reaching a total of 565 min per day was observed. While this reduction is an encouraging finding, such an extended period of daily sedentary time is concerning given evidence of the associated of high sedentary time with poor mood, stress and sleep problems [39]. Indeed, the sedentary time of participants in this study, both at baseline and follow-up, is higher compared to the levels observed in people with SMI generally. A review of 69 studies [38] found that people with SMI spend on average 476 min per day being sedentary during waking hours, which is nearly 1.5 h less than our participants following the reduction from baseline. This discrepancy is likely due to the frail nature of the participants in this study, further highlighting the importance of designing interventions to increase physical activity engagement that would also aim to influence sedentary habits in this population. Similarly to physical activity interventions [35, 40], efforts to decrease sedentary time could target individual- (e.g., breaking up sedentary activities with standing), environmental- (e.g., displaying signposts to take stairs instead of the lift within mental health settings), and socio-cultural factors (e.g., providing monetary incentives to people of low socio-economic status).

Addressing lifestyle factors such as physical activity, sedentary behaviour, and nutrition is especially important for people living with SMI to protect and improve the metabolic health, which tends to be significantly impacted in this population [3]. Importantly, there is accumulating evidence of the beneficial effects of such behaviours on neuropsychiatric and cognitive outcomes [41]. In the current study, participants' total PANSS scores reduced by an average of three points following CGA, however, given the small sample size, this was not statistically significant. Given the high use of prescribed medications as well as the high DBI score, the changes in psychosis symptoms could also be a result in adjusted medications. Further research is needed to disentangle the effects of lifestyle behaviour, changes in medication, and mental health symptoms following complex intervention such as CGA. Indeed, it could be argued that physical comorbidity in this population remains vastly

undertreated, due to a combination of physical and mental health factors. These include cognitive and motivational deficits, sub-optimal lifestyle choices related to diet [34] and physical activity [38], limited access to general healthcare and reduced opportunity for cardiovascular risk screening and prevention [42]. All of which can be exacerbated by socio-economic factors that further impede healthy lifestyle choices [43]. To address this complex array of factors impacting the quality of life and wellbeing of people living with SMI who are frail or at risk of frailty, multi-modal, multi-disciplinary interventions tailored to the unique needs of this population are needed. This study provides preliminary evidence for the capacity of CGA to address some of these factors, which is also supported by participants' qualitative appraisal of CGA.

Participants provided positive and constructive feedback regarding CGA intervention, expressing high satisfaction with the intervention, as a whole, and the personalised recommendations stemming from CGA. Their enthusiasm for potential future involvement and willingness to recommend CGA to others underscored the acceptance of its integration into routine care. Moreover, participants recognised an altruistic dimension to their participation, perceiving their involvement as a contribution to scientific progress and the advancement of knowledge. The convenience of accessing healthcare in a centralised location was highlighted as an additional advantage, circumventing issues of affordability and fragmented care. However, it is noteworthy that 13 out of 38 referred patients were not interested in taking part in this study. This low recruitment rate is common in studies including people with schizophrenia [44], which is reflective of psychosis symptoms such as paranoia and amotivation. In our study, the reluctance to participate may be further compounded by the nature of the sample. Participants were recruited from a clinic which mostly serves patients with treatment resistant schizophrenia. Eight out of 14 participants were prescribed clozapine, the gold standard treatment for treatment-resistant schizophrenia).

Further, participants underscored the impact of CGA on their understanding of the interconnectedness between physical and mental health. This newfound knowledge extended beyond the individual, positively influencing partners and caregivers. The concept of the mind-body connection [45] emerged, emphasizing the importance of the interplay between mental and physical well-being. Understanding the intricate connections between mental and physical health could be a valuable treatment focus for patients with SMI. Providing education to individuals with SMI such as schizophrenia can help them gain a deeper understanding of their health. Enhancing 'illness-insight', which is the cognitive process

of consciously reflecting and reasoning about one's condition [46], can empower patients to navigate their unique challenges, furthering recovery even beyond traditional treatment.

In line with the importance of mind-body connection were participants' accounts highlighting the value of a multidisciplinary approach embedded in CGA. This approach provided them with comprehensive care that was tailored to participants' unique needs which enhanced individuals' intrinsic motivation for change. This finding is important as this corroborates theoretically- and empirically-predicted pattern of those who engage in healthy lifestyle behaviours having more intrinsic or self-determined forms of motivation [47]. The role of intrinsic motivation has also been highlighted in increasing the acceptability of lifestyle (diet and exercise) interventions within a residential rehabilitation setting for people with severe mental illness [48]. As such, given the person-centred approach of CGA, embedding CGA without routine mental health care could present a unique opportunity to increase these important, autonomous motivations for making the recommended changes in one's health, and especially in modifiable lifestyle behaviours such as nutrition and physical activity.

Regardless of these encouraging results, we acknowledge that some aspects of CGA—such as mobility and balance which are typically still preserved in younger people with SMI—may not be as useful to SMI populations as much as other parts. In choosing the best needs assessment tool, we therefore encourage clinicians to consider the specific needs of their patients and tailor the recommendations accordingly. By providing a comprehensive holistic account of one's health, CGA, however, can be considered a potentially beneficial assessment framework in addressing frailty in those with SMI who experience signs of premature ageing earlier in life [49].

Strengths and limitations

This study has several strengths and limitations that should be considered. One notable strength is that it is the first of its kind to examine the feasibility, acceptability, and preliminary effectiveness of CGA in people with SMI who show premature signs of ageing resulting in a state of frailty. By using a mixed-methods design, this study can offer valuable insights into the feasibility and acceptability of a frailty intervention, which—by providing a multidimensional view of health, addressing biological, social, and psychological aspects of health—can inform the development and implementation of future studies that address the combination of physical and mental health needs of people with SMI. In addition to its potential benefits for future research, this study can also be beneficial for clinicians by informing their education and training programs in adopting a more

person-centred approach to treatment. The need for adopting a more holistic (assessing physical health in the context of mental health issues) treatment approach is evidenced by participants' qualitative accounts which demonstrate their appreciation and perceived benefit from being provided with a multi-disciplinary holistic care. However, challenges recruiting people with SMI who are also frail, which can impede the recruitment process are acknowledged.

The study may be limited by small sample size, precluding generalisation of the study findings, and the fact that healthcare practitioners may not always follow up on the recommendations arising from an individual's CGA. Further, we were not able to monitor how many of the recommendations were actioned. In some cases, this was because the recommendation included a request to a person's GP to make a referral to sub-specialists (e.g., neurologist) and there was no confirmation from the GP on whether that was actioned. Similarly, tracking of referrals to allied health professionals was difficult as the patients were often unsure whether this was done by the follow-up appointment, while some of the recommendations were for long-term management, indicating that a longer follow-up period would be of benefit in future studies. Finally, it is noteworthy that the nurse navigators assisting with actioning the recommendations in the current study were not part of the same outpatient mental health care team from which the participants were recruited. This may have limited their familiarity with the individuals, and hence, their effectiveness in facilitating the personalised recommendations and referrals. Increased input from nurse navigators or other trainees within the treating team may provide an added value in following-up on the recommendations arising from the CGA assessment. Nonetheless, this study provides a crucial foundation for future research in this area which would also assess the cost-effectiveness of CGA, and highlights the need for holistic, individualised interventions that are tailored to the specific and complex health needs of this population.

Conclusion

This study supports the need for tailored interventions addressing the interconnectedness of physical and mental health in individuals with SMI who are at risk of or show signs of premature frailty. Our findings shed light on the feasibility and acceptability of CGA in this population, and—acknowledging the limitations of a small sample size—indicates its potential to inform person-centred treatment plans. Participants' positive feedback on CGA, combined with the observed possible improvements in physical activity and reductions in sedentary time, indicates a promising direction for future research. The insights from this research will hopefully pave the way for

more comprehensive studies of integrated care models to address the multifaceted health needs of people with SMI, aiming to improve their overall quality of life and health outcomes.

Abbreviations

CGA	Comprehensive Geriatric Assessment
DBI	Drug Burden Index
FACET	Five-a-day Community Evaluation Tool (FACET)
GFA	Global Assessment of Functioning
HREC	Human Research Ethics Committee
M	Mean
MSAMHS	Metro South Addiction and Mental Health Service
PANSS	Positive and Negative Syndrome Scale
PSQI	Pittsburgh Sleep Quality Index (PSQI)
SD	Standard deviation
SF-36	Medical Outcomes Scale Short Form-36
SIMPAQ	Simple Physical Activity Questionnaire (SIMPAQ)
SMI	severe mental illness
TAQ	Treatment Acceptability Questionnaire

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12888-025-06830-3>.

Supplementary Material 1

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Author contributions

NW, DS, RH, UA, EG and NR conceived the study. All authors contributed to the study design and planning. UA and RS prepared the first draft of the manuscript and NW, AB, and DS reviewed and amended the early draft version. All authors (NW, UA, RS, 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 Geriatric Medicine Registrar who undertook all CGAs and follow up assessments under supervision from REH, a specialist geriatrician. UA, AB, and DS were actively involved in participant recruitment and AB assisted with data collection. UA and NR developed the quantitative statistical analysis plan and UA and RS analysed qualitative data, with support from NW, DS and RH.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

All participants provided written informed consent. 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 the Metro South Human Research Ethics Committee (HREC/2022/QMS/82272).

Consent for publication

The participants provided written consent for the study results to be published in peer-reviewed journal articles in a de-identified format.

Competing interests

NW has received speaker fees from Otsuka, Lundbeck and Janssen. Other authors have no competing interests to declare.

Clinical trial number

Not applicable.

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