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Being Equally Well: Ending the neglect of physical health for people with serious mental illness

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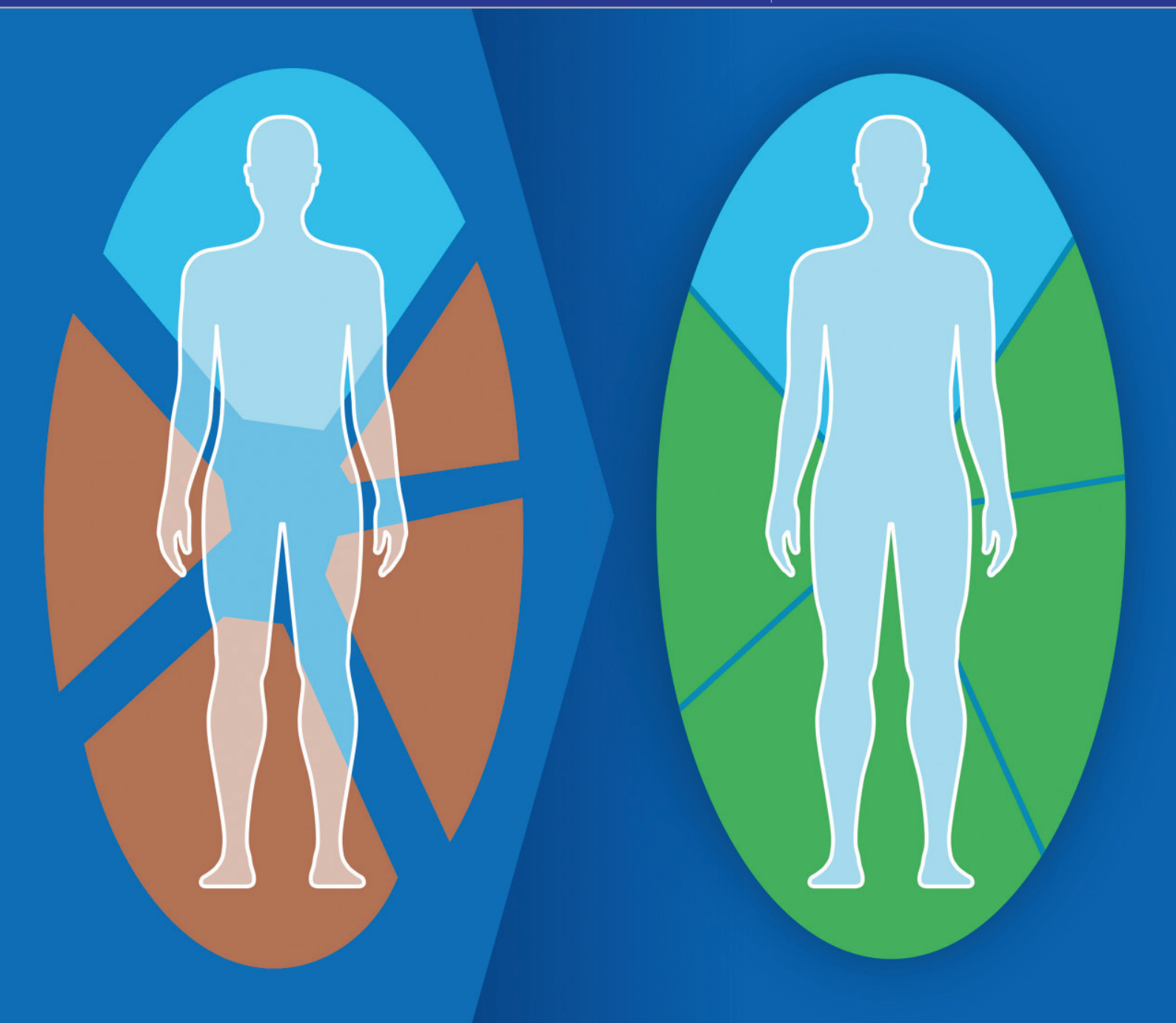

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Being Equally Well: Ending the neglect of physical health for people with serious mental illness

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The Being Equally Well project has been partially supported by grant funding from the Australian Government Department of Health and Aged Care to the Mitchell Institute at Victoria University for the Australian Health Policy Collaboration, a network of chronic disease and population health academics, clinicians, experts, and advocates who have participated in this project. This supplement was financially supported by the Mitchell Institute, Victoria University, and by grant funding from the Australian Government Department of Health and Aged Care for the Australian Health Policy Collaboration.

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The Being Equally Well national policy roadmap: providing better physical health care and supporting longer lives for people living with serious mental illness

We have the knowledge and tools required to end the systemic neglect that contributes to the shorter life expectancy of people with serious mental illness

There is a stark divide of up to 23 years between the life expectancy of people living with serious mental illness, and that of their age peers in the population. More than 400 000 Australian people live with serious mental illness.[1] Their life expectancy is 50–59 years.[2] Between 80% and 95% of the causes of early death relate to physical illnesses such as cardiovascular disease, cancer, respiratory illnesses, and diabetes.[2,3]

This has been recognised as a national priority. In 2017, the Fifth National Mental Health and Suicide Prevention Plan,[4] agreed to by all health ministers, acknowledged that the quality of life and recovery of people with mental illness is impeded by serious physical illness. The Plan acknowledged that these outcomes are often "system driven, with unnecessary barriers within health services and unclear delineation between professional roles hindering a consumer's ability to get the care they need".[4]

The National Preventive Health Strategy 2021–2030[5] also includes a commitment to improving the preventive health care of people with serious mental illness. There are a range of initiatives in some state and territory mental health services and in some Primary Health Networks (PHNs) that are endeavouring to put these aims into effect. These are pockets of innovative work, but there is no universal or national approach or model, and the pockets of work are not consistent with each other.

Good work has not been enough

There is a lack of structured support for frontline staff and consumers to enable reductions in premature mortality from physical disease.

The Being Equally Well project aimed to create a strong, evidence- and consensus-based suite of recommendations for health service and system improvements to enable consistent and effective health care improvements for all who live with serious mental illness.[6] Being Equally Well is an innovative joint venture between actors in primary care, chronic diseases, population health, mental health, and consumers and carers to develop implementable clinical service and system improvements. The project has been led by the Mitchell Institute at Victoria University, with the Australian Health Policy Collaboration, a national network of chronic disease and population health experts, and Equally Well Australia, a network of over 90 organisations working collectively to make the physical health of people living with mental illness a priority throughout the health system. The results are a suite of recommendations in the Being Equally Well national policy roadmap,[6] launched in August 2021 by the then Australian Government Minister for Health, the Hon. Greg Hunt.[7]

A clinical microsystems approach was chosen for the project because clinical microsystems are the teams at the frontlines of care. General practices and mental health teams are clinical microsystems. It is at the frontline and only at the frontline that improvements in health outcomes are made.[8] At the macro system level are the federal and state governments and agencies. The meso system level includes acute health services and PHNs. The Being Equally Well project focused on quality across and within these system levels. The meso and macro systems can facilitate outcomes produced by the clinical microsystems. We chose this approach because most previous and current policies have meant little to people at the frontlines of care where consumers and their families meet the system. Consequently, little has changed. In Being Equally Well, frontline clinicians and consumers have designed changes which will lead to improvements in physical health.

An expert group of consumers and carers worked collaboratively with clinical system level and quality improvement working groups. They identified barriers and frustrations they had experienced, and developed a suite of measures of success from the consumer perspective. These comprise five domains for success: improved physical health; management of medication impact; relationships with health professionals; system navigation, support/equity of access and care quality; and peer support. Each of these has three indicators.[6] This framework provides a valuable checklist for health services, practitioners and policymakers as they engage with the roadmap recommendations.[9]

Primary care and shared care are crucial

General practice will need additional resources and enhanced capability practice-based registers and recall systems for people with serious mental illness. These will enable general practitioners to actively engage and support people to participate in screening and monitoring investigations and health checks — focused

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particularly on regular assessment and management of cardiovascular risk, blood pressure, cholesterol levels and smoking — and to promote participation in regular cancer screening programs.

At the heart of our recommendations is a system for learning and improvement at every level from general practices and mental health services to the national level (Box).[6] This will occur through monitoring and feedback in a similar way to the Australian Primary Care Collaboratives from 2004 to 2014, which covered nearly one-third of general practices.[9]

Data on risk factor management from practice registers would be fed into a National Mental Health Clinical Quality Register, with results fed back to practices showing how they compared against national averages. PHNs would belong to a national collaborative to support practices to learn from each other. An annual report and quality improvement plan on the outcomes for physical health conditions would be prepared and reported to the Australian Health Council. These would ensure national supervision at the highest level.[9]

Data sharing is contentious for GPs, but they were prepared to submit data to the Australian Primary Care Collaboratives. The central organisation hosting the National Mental Health Clinical Quality Register would need to be chosen with care. The prime candidate is the Australian Commission on Safety and Quality in Health Care.

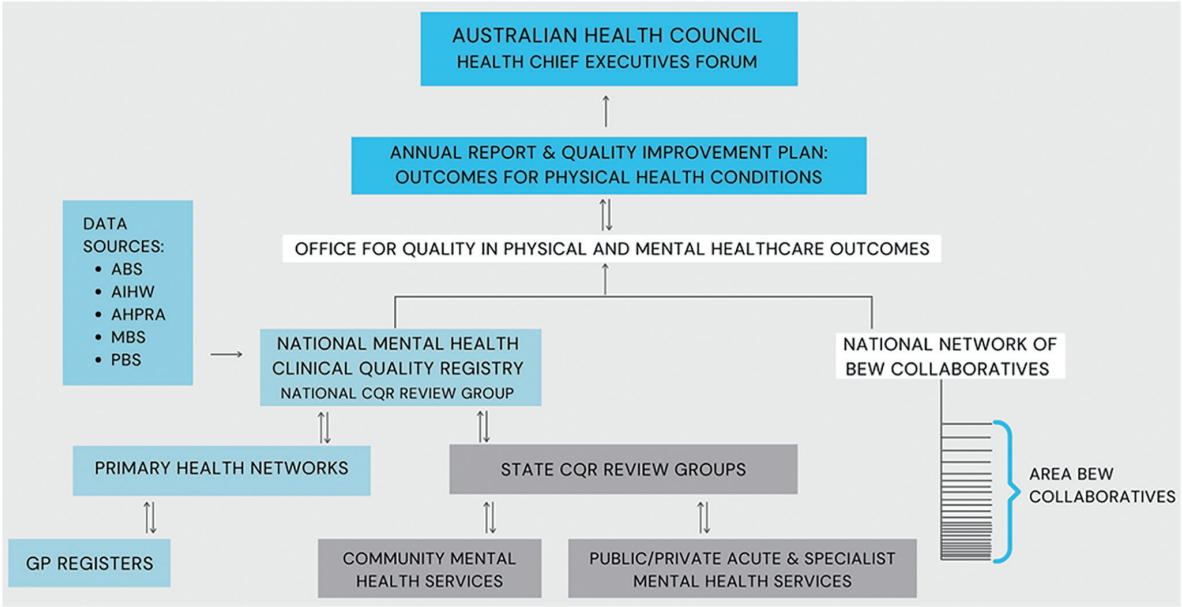
A new workforce of clinical navigators would support practices, liaise with mental health and local preventive services, and ensure that all consumers have a general practice home. Shared care arrangements have long been in place for aspects of health care where specialists and GPs need to work closely together, and where patient and consumer engagement is recognised as essential to good health care and outcomes. Intercollegiate clinical guidelines to support shared care by GPs, psychiatrists and consumers working collaboratively are strongly recommended. Shared care protocols would support implementation of guidelines.

The articles published in this *MJA* supplement support these efforts in several ways. First, a multifaceted change management approach would support care providers in applying shared care protocols.[10,11] Without supporting levers and incentives, nothing will happen. The impact on workload and the cost of more comprehensive care could be recognised through the introduction of bundled care payments, better electronic clinical records, and real-time computer decision support.

Further, community pharmacists provide readily accessible health services, are underutilised, and could contribute more to better management of psychotropic drugs. There are also significant potential roles for other allied health professionals and services.[12]

Finally, peer worker support for physical health care is strongly endorsed by consumers and carers. A systematic review of peer-facilitated interventions for physical health outcomes in individuals with schizophrenia spectrum disorders has identified benefits to physical health and mental health

Organisational chart for improved physical health outcomes among people with serious mental illness



ABS = Australian Bureau of Statistics; AHPRA = Australian Health Practitioners Regulation Agency; AIHW = Australian institute of Health and Welfare; BEW = Being Equally Well; CQR = Clinical Quality Registry; GP = general practitioner; MBS = Medical Benefits Scheme; PBS = Pharmaceutical Benefits Scheme.

outcomes.[13] However, there are structural barriers to implementation that need to be addressed.

Nutrition and medication impacts

Consumers and carers are concerned about the impact of antipsychotic medication on weight, leading to a systematic review and meta-analysis of interventions with a nutrition component. A meta-analysis published as part of this supplement found that dietitian-delivered, individualised interventions might be an effective approach.[14] In addition, a review that considered the cardiometabolic effects of using antidiabetic medications in people with serious mental illness supports a recommendation that these drugs be made available through the Pharmaceutical Benefits Scheme.[15]

A resource for clinicians, health services and governments

The Being Equally Well roadmap[6] is a resource for GPs, for other primary health care and mental health professionals and services, for PHNs, and for local hospital and health districts and networks. It is also a map for governments and health system administrators, as frontline health professionals cannot achieve sustainable change without system improvements to support them.

The roadmap details other system enhancements that are needed to support the frontline of care in doing more to improve the physical health of individuals. These include:

- funding for shared care service provision;
- removal of financial barriers for medication, such as gap payments for cardiovascular risk reduction medication including metformin, and for nicotine replacement therapy;
- Medical Research Future Fund support for research into health system design and delivery for people living with serious mental illness, including further clinical trials of peer worker impact on physical health; and
- development and dissemination of targeted education materials for all relevant health professions informed by the proposed shared care protocol and guidelines.

Being Equally Well has focused on improving the physical health care and life expectancy for people living with serious mental illness. This supplement fills gaps in our knowledge needed for policy formation. This knowledge is being integrated with the Being Equally Well roadmap through a series of roundtable meetings with stakeholders. The Being Equally Well roadmap and contributions from these roundtables will mean that policies to reduce preventable physical conditions among people with serious mental illness will be readily implementable.

It is hoped that this supplement will heighten awareness, at all levels of the health system and within government, of the recommended service and policy enhancements. Full implementation of these recommendations will end the systemic neglect that contributes to the shorter life expectancy of people with serious mental illness.

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Effectiveness of nutrition and dietary interventions for people with serious mental illness: systematic review and meta-analysis

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Abstract

Objective: To review recent published trials of nutrition and dietary interventions for people with serious mental illness; to assess their effectiveness in improving metabolic syndrome risk factors.

Study design: Systematic review and meta-analysis of randomised and non-randomised controlled trials of interventions with a nutrition/diet-related component delivered to people with serious mental illness, published 1 January 2010 – 6 September 2021. Primary outcomes were weight, body mass index (BMI), and waist circumference. Secondary outcomes were total serum cholesterol, low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol, triglyceride, and blood glucose levels.

Data sources: MEDLINE, EMBASE, PsycINFO, CINAHL, and CENTRAL databases. In addition, reference lists of relevant publications were examined for further additional studies.

Data synthesis: Twenty-five studies encompassing 26 intervention arms were included in our analysis. Eight studies were at low or some risk of bias, seventeen were deemed to be at high risk. Eight of seventeen intervention arms found statistically significant intervention effects on weight, ten of 24 on BMI, and seven of seventeen on waist circumference. The pooled effects of nutrition interventions on metabolic syndrome risk factors were statistically non-significant. However, we identified small size effects on weight for interventions delivered by dietitians (five studies; 262 intervention, 258 control participants; standardised mean difference [SMD], −0.28; 95% CI, −0.51 to −0.04) and interventions consisting of individual sessions only (three studies; 141 intervention, 134 control participants; SMD, −0.30; 95% CI, −0.54 to −0.06).

Conclusions: We found only limited evidence for nutrition interventions improving metabolic syndrome risk factors in people with serious mental illness. However, they may be more effective when delivered on an individual basis or by dietitians.

PROSPERO registration: CRD42021235979 (prospective).

Compared with the general population, people with serious mental illness are at significantly greater risk of physical health problems, including metabolic syndrome, which comprises obesity, high blood pressure, dyslipidaemia, and hyperglycaemia.[1] This cluster of risk factors is associated with greater risk of cardiovascular disease and premature mortality among people with serious mental illness.[2]

This poorer physical health is multifactorial in origin, stemming from fragmented health services and diagnostic overshadowing,[3] illness characteristics and medication side effects,[4,5] greater use of tobacco,[6] alcohol, and other substances,[7] excessive and poor quality dietary intake,[8,9] high levels of sedentary behaviour,[10] and low levels of cardio-respiratory fitness.[11] In response, the World Health Organization has published management guidelines,[12] and a *Lancet Psychiatry* Commission was established to develop strategies for protecting the physical health of people with mental illness.[13] Both documents highlight dietary intervention as a critical element.

Targeting diet for preventing cardiovascular disease in general is supported by extensive research.[14] However, people living with serious mental illness experience specific additional challenges that may require the adjustment of dietary interventions, including increased appetite as a side effect of psychotropic medication (especially second generation antipsychotics),[15] less sensitive neural reward systems and poor cognitive control,[16] high rates of disordered eating behaviour (eg, binge eating, emotional eating),[17] high rates of food insecurity,[18] and lack of motivation to engage with treatment and implement dietary recommendations.[19]

A 2020 systematic review of published randomised controlled trials (to 2017) found that dietary interventions were effective for improving weight, body mass index (BMI), waist circumference, and blood glucose levels in people with schizophrenia, related psychoses, or bipolar disorder.[20] Despite considerable differences between intervention elements and their effects, interventions delivered by a dietitian or delivered during the early stages of illness and antipsychotic therapy were identified as most effective. As the review did not include interventions for people with clinical depression, the Being Equally Well (www.vu.edu.au/mitchell-institute/health-systems-change/being-equally-well-roadmap) expert working group recommended an update. We have therefore reviewed recently published dietary intervention trials that aimed to reduce metabolic syndrome risk in people with serious mental illness.

Methods

This systematic review and meta-analysis was pre-registered with the PROSPERO database (CRD42021235979; 10 April 2021) and is reported in accordance with the PRISMA guidelines.[21]

Search strategy

We searched MEDLINE Complete, APA PsycInfo, and CINAHL Complete (via EBSCOhost), EMBASE (at Embase.com), and CENTRAL (via the Cochrane Library) for studies published since 1 January 2010. Our searches on 26 March 2021 and 6 September

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2021 used a comprehensive strategy developed by a health librarian in consultation with the review team (Supporting Information, tables 1–5). We examined the reference lists of identified publications for further relevant items.

We included studies in our analysis that evaluated nutrition-related interventions (as sole interventions or as part of broader interventions) for people with a serious mental illness (major depressive disorder, bipolar affective disorder, schizophrenia and related psychoses), had a primary aim of improving body mass, blood pressure, or metabolic biochemistry measures, included a control group (standard mental health care), and were published in English (Supporting Information, table 6). We included full original research articles and brief reports, but not review articles, letters to the editor, dissertations, conference abstracts, or other grey literature.

After removing duplicates, five reviewers (TR, CF, CY, GH, BK) screened the titles and abstracts of the identified records, and then the full text of relevant articles. Disagreements about including studies were resolved by consensus, and reasons for excluding articles during the full-text screening phase recorded.

Data extraction

Data were independently extracted from each eligible article by two of four reviewers (TR, CF, CY, GH) and disagreements resolved by consensus. We extracted data for year and country of study; primary and secondary aims; inclusion and exclusion criteria; population description and diagnoses, including numbers in intervention and control groups at each stage; medications; intervention description, including length, type (diet-only or diet/nutrition program as part of a broader intervention), delivery method and personnel, and components; control group conditions; baseline and post-intervention metabolic syndrome indicators; and limitations.

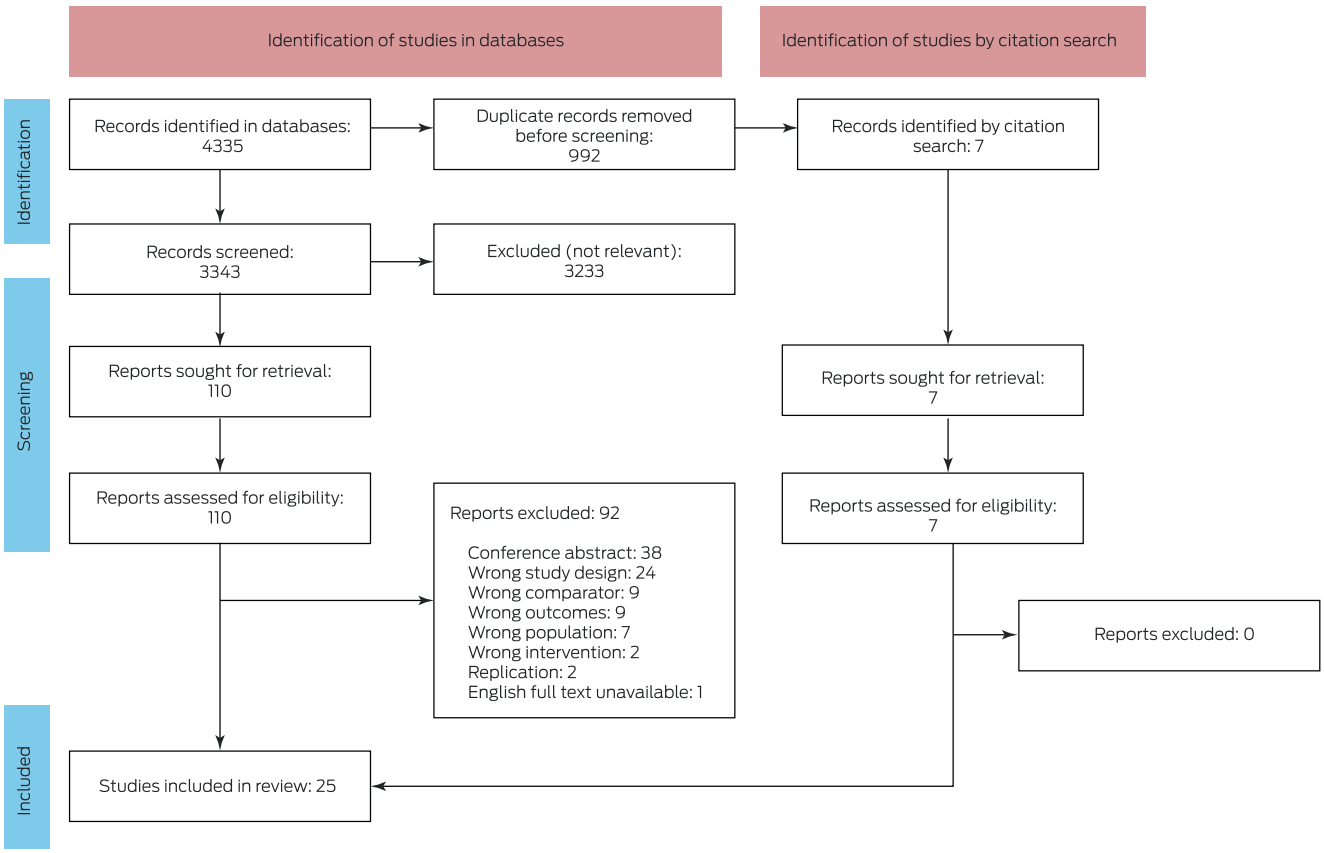
Outcomes

The outcomes were physical parameters relevant to the metabolic syndrome. Primary outcomes were weight, BMI, and waist circumference. Secondary outcomes were total serum cholesterol, low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol, and triglyceride levels, and blood glucose levels.

Bias risk

We assessed risk of bias with the modified Cochrane risk of bias in randomised controlled trials (RoB2)[22] and risk of bias in cluster randomised trials tools (RoB2 Cluster),[23] and with the risk of bias in non-randomised studies of interventions tool (ROBINS-I).[24] For randomised controlled and cluster randomised trials, overall risk of bias was deemed high if risk was high in at least one domain; for non-randomised interventions, the risk of bias was deemed serious when a serious risk was determined in at least one domain. For randomised controlled and cluster randomised trials, the "effect of adhering to intervention" was used for the "bias due to deviations from intended interventions" domain; correspondingly, the "effect of starting and adhering to intervention" was used for non-randomised studies. Risk of bias was assessed by four reviewers (TR, CF, CY, GH) and disagreements were resolved by consensus. Assessments were grouped by included study type with figures created with Risk-of-bias VISualization (robvis).[25]

1 PRISMA flow diagram for selection of publications for inclusion in our analysis



Certainty of evidence

Certainty of evidence for each outcome was assessed by two reviewers (SLD, TR) using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework.[26] The GRADE assessment comprises four dimensions: overall risk of bias, inconsistency, indirectness, and imprecision. Certainty for an outcome was reduced if based on studies with serious bias according to the RoB2, RoB2 Cluster, and ROBINS-I assessments, or if the outcome was derived from highly heterogeneous studies. Inconsistency was evaluated as heterogeneity in study design with respect to participants (inclusion and exclusion criteria), intervention, control group definition, and outcomes, and was quantified by estimating I^2 for each outcome in the meta-analysis. Certainty was reduced if the outcome was an indirect or secondary outcome of a study; that is, according to whether the study was designed to measure the outcome as the main or a primary study outcome. Imprecision was reduced if study sample sizes were small and confidence intervals consequently wide, or if there was marked variation in dietary intervention and adherence.

Data synthesis

In our primary meta-analysis, we assessed the effects of dietary interventions on metabolic outcomes (compared with the comparator management). We report standardised mean differences (SMDs) for continuous outcome measures, using post–post means with 95% confidence intervals (CIs). SMD effect size was deemed small at 0.2, medium at 0.5, and large at 0.8. Analyses were performed in Review Manager (RevMan) 5.4 (Cochrane Collaboration). Because of heterogeneity in study characteristics, we applied a random effects model. Heterogeneity was quantified with the I^2 statistic. Publication bias was assessed by inspection of funnel plots. Subgroup analyses assessed the effect of mode of delivery (individual, group, mixed) and of the professional delivering the intervention (dietitian, other).

Results

Our systematic database and citation search identified 3350 unique titles; we excluded 3233 after title and abstract screening, and 92 after full text screening. We included 25 publications in this review (Box 1).[27-51]

Study characteristics

Twenty studies were randomised controlled trials,[27-29,31-42,44,46,47,49,50] three were cluster randomised controlled trials,[43,48,51] and two were non-randomised controlled trials.[30,45] Twenty-four studies included intervention and control arms.[27-48,50,51] One study[49] was a three-arm trial (two intervention arms and one control group); for our review and analysis, we separately compared each intervention arm with the control arm, yielding a total of 26 comparisons of intervention arms with control arms (Box 2).

Ten studies enrolled people with schizophrenia and related psychoses,[27,29,38-40,44,45,47,49,51] seven studies people with schizophrenia, related psychosis, or bipolar disorder,[28,32-34,43,46,48] three studies people with bipolar affective disorder,[36,42,50] one study people with depression,[41] and four studies enrolled people with any serious mental illness.[30,31,35,37] Study sample sizes (intervention and control arms total) ranged from 15[40] to 416.[35]

All studies included both men and women. Twenty studies enrolled people living in the community,[27,28,30,31,33-42,44,46,48-51] four studies both psychiatric hospital inpatients and people dwelling in the community,[32,43,45,47] and one study inpatients only.[29] Twenty-one studies included participants whose mean age was greater than 30 years.[27-29,31,33-40,42,43,45-51] Three studies delivered nutrition interventions only,[33,34,49] 22 studies delivered nutrition interventions as part of a broader lifestyle intervention.[27-32,35-48,50,51] Fourteen interventions were implemented as combinations of group and individual sessions,[28,30,31,33,34,36-39,41,43,44,47,51] six only in group sessions,[27,29,40,42,45,46] and five as individual-level interventions only.[32,35,48-50] In eight studies, specialist clinicians (dietitian or equivalent) delivered the nutrition intervention;[27-30,33-35,49] the other studies used non-specialist clinicians or other workers for this purpose. The duration of nineteen studies exceeded twelve weeks.[28,29,31-39,41-45,48-50]

Risk of bias and certainty of evidence

Eight studies were deemed to be at low or some risk of bias,[37-39,41,44,46,47,50] seventeen were deemed to be at high risk.[27-36,40,42,43,45,48,49,51] Risk was generally linked with low adherence by participants to intervention measures (Supporting Information, figures 1–5). Certainty of evidence was low for all outcome measures except LDL-cholesterol (very low certainty) (Supporting Information, table 7).

Strength and consistency of intervention effect on primary outcomes

Eight of seventeen intervention arms found statistically significant intervention effects on weight,[28,30,31,34,38,47,49,51] ten of 24 intervention arms on BMI,[30,31,33,34,36,38,45,47,49,51] and seven of seventeen on waist circumference.[29-31,33,47,49,51] Two of the eight studies with low or some risk of bias found statistically significant effects of interventions on weight, BMI, or waist circumference.[38,47]

Longer term follow-up

Three studies that undertook longer term follow-up after the intervention each found statistically significant intervention effects on a primary outcome.[27,29,51] In one study, the difference between intervention and control group was not statistically significant at the end of the 3-month intervention but was significant at the 6-month follow-up.[27] A second study found a significant effect on waist circumference at the end of the 24-week intervention and also at 48 weeks; further, blood glucose levels were lower in the intervention group at 48 weeks, but there was no effect on weight at either time point.[29] A third study found significant effects on weight and BMI, waist circumference, and body fat at the end of the 10-week intervention, but only in body fat at 6-month follow-up.[51]

Pooled effect of nutrition interventions on metabolic syndrome risk factors

Meta-analysis did not identify statistically significant intervention effects on weight (eleven studies; 810 intervention, 682 control participants; SMD, −0.11; 95% CI, −0.29 to 0.06), BMI (16 studies; 1605 intervention, 1258 control participants; SMD, 0.01; 95% CI, −0.32 to 0.33), or waist circumference (12 studies; 1197 intervention, 1044 control participants; SMD, −0.02; 95% CI, −0.17 to 0.13) (Box 3).

2 Characteristics of the published trials included in our systematic review and meta-analysis

Study	Participants (women); age (years), mean (SD)			Intervention group			Control group	
	Control	Intervention	Diagnoses	Type,* length, delivery mode, personnel	Description	Adherence/ attendance	Description	Primary outcomes
Attux 2013[27] (Brazil; RCT)	81 (33) 36.2 (9.9)	79 (31) 38.3 (10.7)	SCH, other psychosis	• Multiple • 12 weeks • Group • Dietitian	12 sessions: introduction, four sessions on diet/nutrition; three sessions on physical activity; sessions on self-esteem, motivation, management of anxiety; session with relatives; wrap-up	Mean, 9.1 (SD, 3.5) sessions 49 (72%) attended at least eight sessions.	Standard care	Mean weight change: 3 months: intervention, −0.48 kg (95% CI, −0.65 to +1.13); control, +0.48 kg (95% CI, 0.13–0.83; $P = 0.06$). 6 months: intervention, −1.15 kg (95% CI, −2.11 to +0.19); control, +0.5 kg (95% CI, −0.42 to +1.42; $P = 0.017$).
Brown 2011[28] (USA; RCT)	68 (54) 44.6 (10.9)†	68 (54) 44.6 (10.9)†	SCH, BPD, other psychosis	• Multiple • 52 weeks • Mixed • Dietitian	3-month intense phase (weekly 3 h sessions on nutrition, physical activity, goal setting); 3-month maintenance phase (monthly meetings, weekly phone calls); 6-month intermittent support phase	21/68 (31%) discontinued within 6 months; no information for 12 months	Standard care, including voluntary day program	Mean weight change (completers only): Intervention, −2 kg; control, −0.4 kg ($P = 0.005$).
Cordes 2014[29] (Germany; RCT)	38 (11) 35.8 (10.9)	36 (21) 38.2 (11.2)	SCH	• Multiple • 24 weeks • Group • Dietitian	12 fortnightly sessions. Four modules: assessment of eating, physical activity; healthy isocaloric diet; practical lessons in skill building; behavioural techniques, stress management, coping strategies.	25/36 (64%) intervention group discontinued within 24 weeks	Standard care	Weight change (24 weeks): No difference between groups. Waist circumference (48 weeks): intervention, +4.6 cm (SD, 8.3); control, +10.1 cm (SD, 7.3) ($P = 0.019$). Fasting plasma glucose (48 weeks): smaller increase in intervention group ($P = 0.031$)
Curtis 2016[30] (Australia; nRCT)	12 (2) 21.7 (1.9)	16 (9) 20.0 (2.3)	SCH, BPD, MDD	• Multiple • 12 weeks • Mixed • Dietitian	Individualised program with three components: health coaching, weekly dietetic support (education [weight management, labels, food quality], and practical skills [shopping, cooking]), supervised physical activity sessions.	Mean, 8 diet sessions (range, 5–10); 11 physical activity sessions (range, 3–25)	Standard care	Mean weight change (12 weeks): Intervention, +1.8 kg (95% CI, −0.4 to +2.8); control, 7.8 kg (95% CI, 4.8–10.7; $P < 0.001$).

(Continues)

2 Characteristics of the published trials included in our systematic review and meta-analysis (Continued)

Study	Participants (women); age (years), mean (SD)			Intervention group			Control group	
	Control	Intervention	Diagnoses	Type,* length, delivery mode, personnel	Description	Adherence/ attendance	Description	Primary outcomes
Daumit 2013[31] (USA, RCT)	147 (72) 44.1 (11.0)	144 (74) 46.6 (11.5)	SCH, BPD, MDD, other‡	• Multiple • 78 weeks • Mixed • Health educator/ coach	1–6-month intensive phase: group classes (weight management 1/week; physical activity, 3/week); monthly individual visits. 7–18 month maintenance phase: group classes (weight management 1/month; physical activity 1/week); monthly individual visits. Weight management topics: tracking; food choices; portions, snacking; fruit, vegetables. Behavioural techniques, goal setting and strategies.	Median, 46 (IQR, 19–63) of 82 (77–90) sessions offered. Absent from program for 30 days or more: 1–6 months, (39/144, 27%); 7–18 months, (75/144, 52%).	Standard care, including education and health classes unrelated to weight	Mean between-group weight difference: −3.2 kg (P = 0.002). 5% weight decline: Intervention, (55/144, 38%); control, (34/147, 23%) (P = 0.009).
Detke 2014[32] (USA, Russia, Poland, Germany; RCT)	102 (50) 15.9 (1.5)	101 (47) 15.7 (1.5)	SCH, BPD, other‡	• Multiple • 52 weeks • Individual (children, carers) • Trained site personnel	Counselling sessions (education, problem solving, motivation); components: food, physical activity logs; healthy food diet; pedometers; review, goal setting; behaviour modification strategies.	No information	Baseline 15-minute information session on healthy eating and exercise	Mean change in BMI (52 weeks): No differences between groups. 15% or greater weight gain: Intervention, (31/101, 31%); control, (41/102, 40%; P = 0.19).
Erickson 2016[33] (USA; RCT)	48 (6) 49.6 (9.1)	60 (6) 49.7 (6.9)	SCH, BPD, other‡	• Diet/nutrition • 52 weeks • Mixed • Dietitian/ health instructor	Eight weekly education classes (with monthly boosters): dietary monitoring; recommendations for calorie deficit (food, physical activity logs); individual coaching on nutrition, lifestyle; optional group physical activity classes.	Mean: 13.7 of 19 sessions. Completed program: 25/60 (42%).	Standard care	Predicted mean weight change: Intervention, −4.6 kg; control, +0.6 kg.
Erickson 2017[34] (USA; RCT)	42 (10) 50.4 (9.0)	62 (10) 51.9 (9.3)	SCH, BPD, other‡	• Diet/nutrition • 52 weeks • Mixed • Dietitian	Eight weekly classes (with monthly boosters): effects of medications; stress management; motivation, goal setting; diet, nutrition (mindful eating, portion sizes, calories, food groups, variety); physical activity. Food, physical activity journals.	Completed initial program: 8 weeks, 53/62 (86%); 12 months, 33/62 (53%). Completed journals: 57/62 (92%).	Sessions with study team, including anthropometric measurements and health-related education.	Waist circumference, mean change: intervention, −1.04 cm; control, −0.25 cm (P < 0.001) Body fat, mean change: Intervention, −0.4 percentage points; control, +0.2 percentage points (P = 0.038).
Errichetti 2020[35] (USA; RCT)	167 (93) 40.7 (13.4)	249 (137) 41.0 (12.5)	SCH, BPD, MDD, other‡	• Add on service • 52 weeks • Individual • Dietitian	Referral process with care coordinator based on individual needs and comorbid conditions.	Retention rates: intervention 154/249 (62%); control 115/167 (69%).	Standard care	Systolic blood pressure, HbA_{1c}: Improvement greater for intervention: mean differences, −3.86 mmHg (SD, 1.89), P = 0.04; −0.36% (SD, 0.11), P = 0.001.

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2 Characteristics of the published trials included in our systematic review and meta-analysis (Continued)

Study	Participants (women); age (years), mean (SD)			Intervention group			Control group	
	Control	Intervention	Diagnoses	Type,* length, delivery mode, personnel	Description	Adherence/ attendance	Description	Primary outcomes
Frank 2015[36] (USA; RCT)	61 (NR) 41.4 (9.7)	61 (NR) 41.8 (9.5)	BPD	• Multiple • 104 weeks • Mixed • Lifestyle coach	Fifteen individual sessions (with monthly group sessions): 3 × psychoeducation (risks, lifestyle); 4 × healthy sleep (relationship with mood, habits, lifestyle, social rhythmicity, relapse prevention); 4 × weight loss/nutrition (healthy eating; calories, physical activity, alcohol, relapse prevention); 4 × weight loss/physical activity (regular physical activity, variety; motivation, relapse prevention); 2 × optional smoking cessation.	At least one study visit: 58/61 (95%).	Standard care with medical monitoring	Between-group difference in mean BMI reduction: Greater for intervention (0.51; 95% CI, 0.14–0.91).
Goldberg 2013[37] (USA; RCT)	56 (8) 53.5 (8.1)	53 (13) 50.5 (9.9)	SCH, BPD, MDD, other‡	• Multiple • 26 weeks • Mixed • Research assistant	Weekly individual (first month) and group sessions (2-4 months, weekly; 5-6 months, fortnightly): healthy eating (history, planning); motivation, engagement; physical activity for weight loss; goal setting; successes, challenges; review of concepts, strategies, skills.	Completed 6-month assessment: 30/53 (57%). Completed all individual sessions: 37/53 (70%). Competed 12 or more group sessions: 18/53 (34%); fewer than 4: 19/53 (36%).	Basic information on diet and exercise and monthly weight check	Reduction in weight > 5%: Overall: 7/109 (6%); no difference between groups. No difference between participants who completed at least eight sessions and those who completed fewer sessions.
Green 2015[38] (USA; RCT)	96 (69) 48.3 (9.7)	104 (75) 46.2 (11.4)	SCH, BPD, other‡	• Multiple • 52 weeks • Mixed • Facilitators (mental health counsellor, nutrition interventionist, group leader)	Weekly 2 h group meetings (incl. 20 min physical activity) for 6 months; 6-monthly group sessions; monthly phone calls. Individual records (dietary intake, daily physical activity, nightly sleep) with goals for daily moderate physical activity, increase fruit, vegetable, low-fat dairy intake, improve sleep. Personalised plans, group work to improve skills, overcome barriers.	Attendance during first 6 months: mean, 14.5 (SD, 7.2) of 24 sessions (60%).	Standard care	Mean weight change: 6 months: intervention *v* control, –4.4 kg (95% CI, –6.96 kg to –1.78kg) 12 months: –2.6 kg (95% CI, –5.14 kg to –0.07 kg). During maintenance (6–12 months): no difference.
Holt 2019[39] (UK; RCT)	205 (110) 40.1 (11.5)	207 (92) 40.0 (11.3)	SCH	• Multiple • 52 weeks • Mixed • Trained facilitator	Four weekly 2.5 h group sessions; fortnightly individual contact (mostly phone) 10 min; 2.5 h group booster sessions at 4, 7, 10 months. Topics: weight control (healthy drinks, snacks, calories, portions, food choices); physical activity, sedentary behaviour. Tools: water bottle, pedometer, cookbook/food scale; weight scale/ tape measure.	Attended three or more sessions and at least one booster session: 111 (54%); 47 (23%) attended all sessions, 36 (17%) no sessions.	Basic printed advice on lifestyle and weight-related risk factors	Mean between-group difference in weight loss (12 months): No difference: 0.0 kg (95% CI, –1.6 to 1.7).

(Continues)

2 Characteristics of the published trials included in our systematic review and meta-analysis (Continued)

Study	Participants (women); age (years), mean (SD)			Intervention group			Control group	
	Control	Intervention	Diagnoses	Type,* length, delivery mode, personnel	Description	Adherence/ attendance	Description	Primary outcomes
Iglesias-Garcia 2010[40] (Spain; RCT)	7 (3) 39.9 (11.3)†	8 (3) 39.9 (11.3)†	SCH	• Multiple • 12 weeks • Group • Nurse	12 weekly 1 h group sessions for 3 months: education on nutrition, exercise, healthy habits, self-esteem; group discussions.	One participant withdrew consent.	Weekly anthropometric assessments	Waist circumference: Similar decline in both groups. BMI, weight: No difference within or between groups.
Jelalian 2019[41] (USA; RCT)	9 (7) 14.4 (1.7)	24 (17) 15.3 (1.5)	MDD	• CBT and lifestyle • 24 weeks • Mixed • Multiple- team	Weekly 60 min sessions (weeks 1–12), fortnightly sessions (weeks 13–24); weekly 60 min physical activity sessions. CBT protocol: problem solving, cognitive restructuring, affect regulation, behavioural activation (additional modules as needed). Diet component: body image; food craving/choices; individualised recommendations.	Mean, nine physical activity sessions and two diet/ nutrition sessions	CBT protocol only	Expected change in BMI over 12 months: Intervention, +0.6 kg/m^2; control, +2.1 kg/m^2.
Kilbourne 2013[24] (USA; RCT)	59 (10) 52.4 (9.2)	57 (10) 53.1 (10.6)	BPD	• Multiple • 52 weeks • Group • Health specialist	Four weekly 90–120 min sessions: blood pressure; personal and behavioural risk factors for CVD; personal goals; coping strategies; engagement and communication. Two sessions specifically on behavioural changes: avoiding over-eating; using physical activity for stress reduction. Follow up monthly for 12 months.	Completed three or more weekly sessions: 39/57 (68%); mean, 4.6 (SD, 3.6) follow-up sessions.	Standard enhanced care, including regular discussion of wellness	Blood pressure: Greater declines in intervention group: systolic: beta = –3.1, P = 0.04; diastolic: beta = –2.1, P = 0.04.
Looijmans 2019[43] (Netherlands; CCT)	104 (50) 48.6 (10.2)	140 (74) 44.3 (10.9)	Psychosis, other‡	• Multiple • 52 weeks • Mixed • Nurse	Screening phase: appraisal of lifestyle behaviour (Traffic Light Method); development of a plan with SMART goals (diet/physical activity based on guidelines). Follow-up phase: fortnightly 15 min visits for 6 months for assessment of progress. After 6 months: screening/ adjustment goals/plans. Overall: 26 visits (23 reports) in 12 months.	Completed lifestyle screening, developed plans, goals: 108/140 (77%). No further reports for 13; 60 with median 4 reports, 35 with median 14 reports.	Standard care inclusive of lifestyle guidance if requested by participant	Waist circumference change: No between-group differences in change at 6 months (−0.15 cm; (95% CI,−2.49 to −2.19) or 12 months (−1.03 cm; 95% CI, −3.42 to −1.35).
Lovell 2014[44] (UK; RCT)	51 (21) 25.9 (6.0)	54 (21) 25.6 (5.5)	SCH, other‡	• Multiple • 52 weeks • Mixed • Trained recovery worker	Seven sessions over 6 months; booster session at 9 or 10 months: psychoeducation for motivation; facilitation of changes in physical activity, diet with goals/reviews. Cooking groups; booklet, website (plans, goals, recipes).	At least one session: 54/56 (96%); 42/56 (78%) completed 6–8 sessions.	Standard early intervention care. If part of the care plan, control participants received some physical health support from their case manager	Change in BMI: No significant differences.

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2 Characteristics of the published trials included in our systematic review and meta-analysis (Continued)

Study	Participants (women); age (years), mean (SD)			Intervention group			Control group	
	Control	Intervention	Diagnoses	Type,* length, delivery mode, personnel	Description	Adherence/ attendance	Description	Primary outcomes
Magni 2017[45] (Italy; nRCT)	26 (11) 41.8 (10.1)	59 (32) 43.1 (9.0)	SCH	• Multiple • 16 weeks • Group • Multiple (team)	32 twice weekly 1 h sessions: nutrition psychoeducation (information and recommendations for calorie-restricted diet); cognitive bias regarding food habits; self-observation of eating behaviour and emotional eating; alternative behaviours. Mediterranean diet-based diet plan, physical activity plan.	No information.	Standard care, including information on food and nutrition	Mean change in BMI: Intervention, −1.9% (from 32.6 to 32.0); control, +0.6% (from 35.0 to 35.2; $P = 0.021$).
Masa-Font 2015[46] (Spain; RCT)	163 (74) 47.1 (9.9)	169 (76) 46.3 (8.9)	SCH, BPD	• Multiple • 12 weeks • Group • Nurse	24 twice weekly physical activity sessions for 3 months: 8 × 40 min sessions on intensity, safety of physical activity; 16 × 60 min walking sessions. 6 × 20 min twice weekly healthy dietary habits sessions (Mediterranean diet, review of food consumption).	Intervention participation at 3 months: 142/169 (84%). Attended 60% of sessions: 83/169 (49%); attended no sessions: 21 (6%).	Standard care	Mean change in BMI: Intervention, +0.04 kg/m^2 (95% CI, −0.15 to +0.22); control, −0.23 kg/m^2 (95% CI, −0.39 to −0.07).
Methapatara 2011[47] (Thailand; RCT)	32 (14) 37.6 (10.8)	32 (9) 43.2 (9.3)	SCH	• Multiple • 12 weeks • Mixed • Researcher	Five 1 h sessions: motivational interviewing; adequate physical activity; education on nutrition, physical activity; SMART goal setting; supervised walking; feedback, coping strategies.	All participants completed all sessions.	Standard care, including informational leaflet on healthy lifestyle	Mean between group difference in weight loss: Intervention *v* control: 2.2 kg (95% CI, 0.29–4.12).
Osborn 2018[48] (UK; CCT)	172 (84) 51.0 (10.0)	155 (88) 51.0 (10.0)	SCH, BPD	• Multiple • 52 weeks • Individual • Nurse/ health care assistant	Weekly or fortnightly appointments for 6 months to set goals/health care plans (medication adherence, improving diet, increase physical activity, reduce alcohol, quit smoking)	Attended six or more appointments: 72/155 (46%); 36 (23%) attended 2–5; 15 (10%) one appointment and 32 (21%) none.	Standard care	Mean serum triglycerides (12 months): Intervention, 5.4 mmol/L (SD, 1.1); control, 5.5 mmol/L (SD, 1.1); estimated mean difference, 0.03 mmol/L (95% CI, −0.22 to 0.29).
Sugawara 2018[49] (Japan; RCT)	85 (26) 44.0 (10.3)	Group 1: 67 (36) 47.6 (9.6) Group 2: 61 (29) 46.6 (10.9)	SCH	• Diet/nutrition • 52 weeks • Individual • Dietitian/ doctor	Two intervention groups: 1. Weight loss advice from psychiatrist (record book, target body weight). 2. Twelve monthly sessions with dietitian, four phases, each 3 × 30–40 min sessions: balanced diet; food choices; food requirements; revision and discussion of food records.	Completed intervention: group 1, 67/93; group 2, 61/87.	Standard care	Mean weight change: Greater decline for group 2 (−3.2 kg; SD, 4.5) than group 1 (−0.4 kg; SD, 3.9) and control (+0.5 kg; SD, 5.1).
Sylvia 2019[50] (UK; RCT)	19 (12) 44.3 (11.9)	19 (13) 39.7 (12.5)	BPD	• Multiple • 20 weeks • Individual • Senior students	Three modules: nutrition (sessions 1–6: education, skills to improve choices, portion control); exercise (sessions 7–12: moderate physical activity goals); wellness (sessions 13–18: healthy decisions, problem solving).	Attended sessions: 13/19 (67%)	Standard care	Mean weight change: No significant change in either group.

(Continues)

2 Characteristics of the published trials included in our systematic review and meta-analysis (Continued)

Study	Participants (women); age (years), mean (SD)			Intervention group			Control group	
	Control	Intervention	Diagnoses	Type,* length, delivery mode, personnel	Description	Adherence/ attendance	Description	Primary outcomes
Verhaeghe 2013[15] (Belgium; CCT)	83 (28) 46.6 (11.9)	201 (82) 46.2 (12.5)	SCH, other‡	• Multiple • 10 weeks • Mixed • Nurses	Weekly group sessions: physical activity, healthy eating, problem solving; written exercises /plans. Weekly 30 min group walking. 10 min individual sessions to follow up group activities, discuss challenges, arrange next session.	Attended 8 of 10 sessions: 103/201 (51%).	Standard care	Mean weight change: Intervention, −0.35 kg; control, +0.22 kg; $P = 0.04$), Mean BMI change: Intervention, −0.12 kg/m^2; control, +0.08kg/m^2; $P = 0.04$), Mean waist circumference change: Intervention, −0.29 cm; control, +0.55 cm; $P < 0.01$) Mean percentage body fat change: Intervention, −0.99 percentage points; control; −0.12 percentage points; $P < 0.01$). All differences, except for body fat, lost by 6-month follow-up.

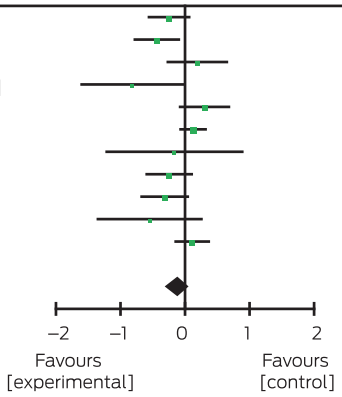
BMI = body mass index; BPD = bipolar disorder; CBT = cognitive behavioural therapy; CCT = cluster controlled trial; CI = confidence interval; MDD = major depressive disorder; NR = not reported; nRCT = non-randomised controlled trial; RCT = randomised controlled trial; SCH = schizophrenia or schizoaffective disorder; SD = standard deviation. * Type (diet/nutrition only or multiple component only intervention). † Age data were reported for both samples combined; ie, age data by group unavailable. ‡ Includes mood disorders, post-traumatic stress disorder, other psychotic disorders. ◆

3 Forest plots for trials that assessed the impact of diet or nutrition-based interventions on primary outcomes (inverse variance, random)

A. Weight

Study or subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Standardised mean difference (95% confidence interval)
Attux 2013[27]	80.7	14.1	81	84.7	17.9	79	11.6%	−0.25 [−0.56, 0.06]
Brown 2011[28]	99.4	18.5	68	10.97	27.5	68	10.8%	−0.44 [−0.78, -0.10]
Cordes 2014[29]	81.9	15.1	36	79	15	38	8.3%	0.19 [−0.27, 0.65]
Curtis 2016[30]	69.9	13.9	16	83.6	19	12	4.0%	−0.82 [−1.60, -0.03]
Goldberg 2013[37]	109.23	18.19	53	103.46	19.69	56	9.9%	0.30 [−0.08, 0.68]
Holt 2019[39]	104.1	21.1	207	101.3	23.7	205	14.8%	0.12 [−0.07, 0.32]
Iglesias–Garcia 2010[40]	92.3	8.6	7	95.3	22.7	7	2.5%	−0.16 [−1.21, 0.89]
Sugawara 2019[49]	79.5	11.8	67	82.4	11.7	61	10.7%	−0.25 [−0.59, 0.10]
Sugawara 2019[50]	77.9	16.3	61	82.4	11.7	61	10.4%	−0.32 [−0.67, 0.04]
Sylvia 2019[50]	90.31	16.6	13	102.51	25.85	12	3.9%	−0.55 [−1.35, 0.25]
Verhaeghe 2013[51]	87.6	20.77	201	85.41	16.49	83	13.1%	0.11 [−0.14, 0.37]
			810			682	100%	−0.11 [−0.29, 0.06]

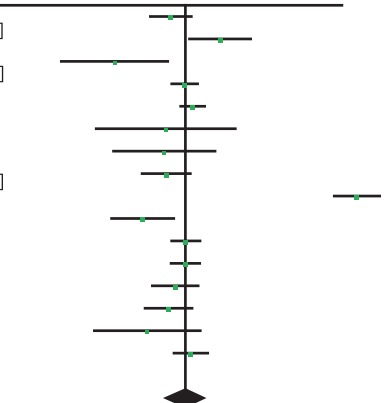
Total (95% CI)
Heterogeneity: Tau² = 0.05; Chi² = 24.12, df = 10 (*P* = 0.007); I^2 = 59%
Test for overall effect: Z = 1.26 (*P* = 0.21)



B. Body mass index

Study or subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Standardised mean difference (95% confidence interval)
Attux 2013[27]	28.9	4.7	81	30	5.2	79	6.8%	−0.22 [−0.53, 0.09]
Cordes 2014[29]	28.4	2.7	36	26.7	3.6	38	6.3%	0.53 [0.06, 0.99]
Curtis 2016[30]	23.9	3.2	16	27.4	3.1	12	5.0%	−1.08 [−1.88, −0.27]
Errichetti 2020[35]	34.1	8.2	249	34.2	9.7	167	7.0%	−0.01 [−0.21, 0.18]
Holt 2019[39]	35.6	7.2	270	34.8	7.3	205	7.0%	0.11 [0.07, 0.29]
Iglesias–Garcia 2010[40]	32	4	7	33.7	6.4	7	4.1%	−0.30 [−1.35, 0.76]
Jelalian 2019[41]	36.1	7.5	24	38.4	5.3	9	5.2%	−0.32 [−1.09, 0.45]
Kilbourne 2013[42]	32.3	5.9	57	34	5.7	59	6.6%	−0.29 [−0.66, 0.07]
Loojimans 2019[43]	32.78	0.6	140	31.12	0.68	104	6.7%	2.60 [2.26, 2.95]
Magni 2017[45]	32	4.6	59	35.2	5.5	26	6.3%	−0.65 [−1.12, -0.18]
Masa-Font 2015[46]	32.38	6.19	1639	32.34	5.44	163	7.0%	0.01 [−0.21, 0.22]
Osborn 2018[48]	32	7	155	32	7	172	7.0%	0.00 [−0.22, 0.22]
Sugawara 2019[49]	29.7	4.7	67	30.4	4.3	61	6.7%	−0.15 [−0.50, 0.19]
Sugawara 2019[49]	29.2	5	61	30.4	4.3	61	6.6%	−0.26 [−0.61, 0.10]
Sylvia 2019[50]	32.6	4.1	13	36.1	7.3	12	5.0%	−0.58 [−1.38, 0.23]
Verhaeghe 2013[51]	30.1	6.18	201	29.6	5.56	83	6.9%	0.08 [−0.17, 0.34]
			1605			1258	100%	0.11 [−0.32, 0.33]

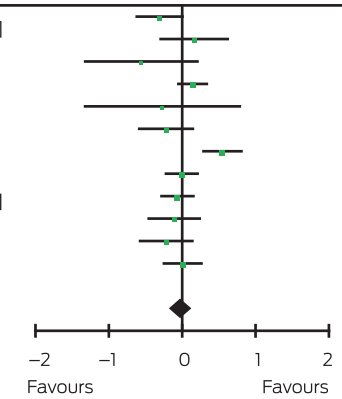
Total (95% CI)
Heterogeneity: Tau² = 0.39; Chi² = 245.64, df = 15 (*P* < 0.00001); I^2 = 94%
Test for overall effect: Z = 0.04 (*P* = 0.97)



C. Waist circumference

Study or subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Standardised mean difference (95% confidence interval)
Attux 2013[27]	100.5	11	81	104.4	14.1	79	9.1%	−0.31 [−0.62, 0.00]
Cordes 2014[29]	96.9	13.1	36	94.8	12.4	38	6.2%	0.16 [−0.29, 0.62]
Curtis 2016[30]	84.4	10.3	16	90.1	9.4	12	3.0%	−0.56 [−1.32, 0.21]
Holt 2019[39]	116.4	16.1	207	114	17.7	205	12.0%	0.14 [−0.05, 0.33]
Iglesias–Garcia 2010[40]	107.1	8.5	7	111	17.2	7	1.8%	−0.27 [−1.32,0.79]
Kilbourne 2013[42]	110.24	13.97	57	113.54	15.75	59	7.9%	−0.22 [−0.59, 0.15]
Loojimans 2019[43]	113.4	2	140	112.2	2.4	104	10.4%	0.55 [0.29, 0.81]
Masa-Font 2015[46]	109.17	14.74	169	109.25	13.15	163	11.5%	−0.01 [−0.22, 0.21]
Osborn 2018[48]	106	16	155	107	15	172	11.4%	−0.06 [−0.28, 0.15]
Sugawara 2019[49]	100.1	9.9	67	101.2	10.2	61	8.3%	−0.11 [−0.46, 0.24]
Sugawara 2019[49]	98.7	12.5	61	101.2	10.2	61	8.1%	0.22 [−0.57, 0.14]
Verhaeghe 2013[51]	105.87	16.7	201	105.76	14.72	83	10.4%	0.01 [−0.25, 0.26]
			1197			1044	100%	−0.02 [−0.17, 0.13]

Total (95% CI)
Heterogeneity: Tau² = 0.04; Chi² = 29.25, df = 11 (*P* < 0.002); I^2 = 62%
Test for overall effect: Z = 0.22 (*P* = 0.83)



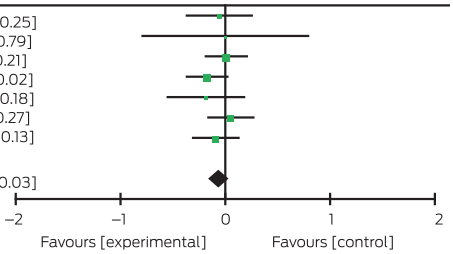
df = degrees of freedom; SD = standard deviation. ◆

4 Forest plots for trials that assessed the impact of diet or nutrition-based interventions on secondary outcomes (inverse variance, random)

A. Total cholesterol

Study or subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Standardised mean difference (95% confidence interval)
Attux 2013[27]	4.96	1.08	81	5.02	1	79	9.0%	−0.06 [−0.37, 0.25]
Curtis 2016[30]	4.5	1.1	16	4.5	1.1	10	1.4%	0.00 [−0.79, 0.79]
Errichetti 2020[35]	4.84	1.02	249	4.83	1.09	167	22.6%	0.01 [−0.19, 0.21]
Holt 2019[39]	4.9	1.2	207	5.1	1.1	205	23.2%	−0.17 [−0.37, 0.02]
Kilbourne 2013[42]	4.49	1.09	57	4.7	1.16	59	6.5%	−0.19 [−0.55, 0.18]
Masa-Font 2015[46]	5.23	0.95	169	5.18	0.93	163	18.8%	0.05 [−0.16, 0.27]
Osborn 2018[48]	5.4	1.1	155	5.5	1.1	172	18.4%	−0.09 [−0.31, 0.13]
Total (95% CI)			934			855	100%	−0.06 [−0.16, 0.03]

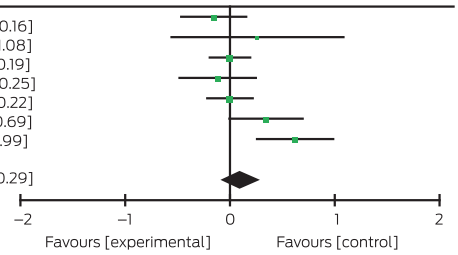
Heterogeneity: Tau² = 0.00; Chi² = 3.41, df = 6 (*P* = 0.76); I^2 = 0%
Test for overall effect: Z = 1.31 (*P* = 0.19)



B. HDL-cholesterol

Study or subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Standardised mean difference (95% confidence interval)
Attux 2013[27]	1.15	0.33	81	1.2	0.31	79	15.3%	−0.16 [−0.47, 0.16]
Curtis 2016[30]	1.4	0.4	16	1.3	0.3	9	4.5%	0.26 [−0.56, 1.08]
Holt 2019[39]	1.2	0.6	207	1.2	0.3	20.5	20.4%	0.00 [−0.19, 0.19]
Kilbourne 2013[42]	0.96	0.21	57	0.99	0.29	59	13.3%	−0.12 [−0.48, 0.25]
Osborn 2018[48]	1.3	0.5	155	1.3	0.4	172	19.3%	0.00 [−0.22, 0.22]
Sugawara 2019[49]	1.25	0.32	67	1.15	0.25	61	13.8%	0.34 [−0.01, 0.69]
Sugawara 2019[49]	1.37	0.43	61	1.15	0.25	61	13.3%	0.62 [0.26, 0.99]
Total (95% CI)			644			646	100%	0.10 [−0.09, 0.29]

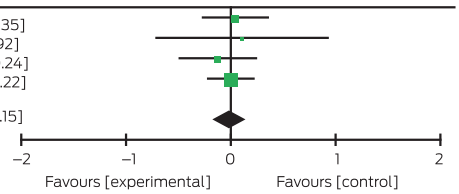
Heterogeneity: Tau² = 0.04; Chi² = 15.35, df = 6 (*P* = 0.02); I^2 = 61%
Test for overall effect: Z = 1.05 (*P* = 0.29)



C. LDL-cholesterol

Study or subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Standardised mean difference (95% confidence interval)
Attux 2013[27]	2.98	0.94	81	2.94	0.89	79	25.6%	0.04 [−0.27, 0.35]
Curtis 2016[30]	2.7	0.9	16	2.6	0.9	9	3.7%	0.11 [−0.71, 0.92]
Kilbourne 2013[42]	2.67	0.83	57	2.78	0.93	59	18.5%	−0.12 [−0.49, 0.24]
Osborn 2018[48]	3.3	1	155	3.3	0.9	172	52.2%	0.00 [−0.22, 0.22]
Total (95% CI)			309			319	100%	−0.01 [−0.16, 0.15]

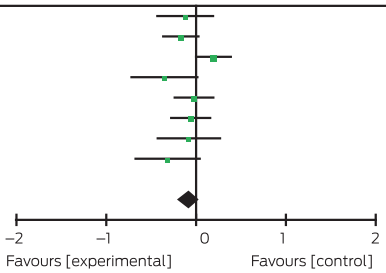
Heterogeneity: Tau² = 0.00; Chi² = 0.58, df = 3 (*P* = 0.90); I^2 = 0%
Test for overall effect: Z = 0.10 (*P* = 0.92)



D. Systolic blood pressure

Study or subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Standardised mean difference (95% confidence interval)
Attux 2013[27]	114.1	12.2	81	115.6	12.4	79	10.2%	−0.12 [−0.43, 0.19]
Errichetti 2020[35]	117.3	17.7	249	120.3	17.5	167	16.8%	−0.17 −0.37, 0.03]
Holt 2019[39]	125	15	207	122	16	205	17.0%	0.19 [−0.00, 0.39]
Kilbourne 2013[42]	127.7	17.7	57	134.2	18.9	59	8.1%	−0.35 [−0.72, 0.01]
Masa-Font 2015[46]	123.13	16.82	169	123.54	18.49	163	15.5%	−0.02 [−0.24, 0.19]
Osborn 2018[48]	125	16	155	126	17	172	15.3%	−0.06 [−0.28, 0.16]
Sugawara 2019[49]	126.9	14.7	67	128.1	15	61	8.7%	−0.08 [−0.43, 0.27]
Sugawara 2019[49]	123.3	15.1	61	128.1	15	61	8.4%	−0.32 [−0.67, 0.04]
Total (95% CI)			1046			967	100%	−0.08 [−0.20, 0.04]

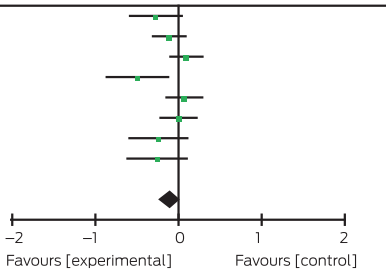
Heterogeneity: Tau² = 0.01; Chi² = 12.47, df = 7 (*P* = 0.09); I^2 = 44%
Test for overall effect: Z = 1.33 (*P* = 0.18)



E. Diastolic blood pressure

Study or subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Standardised mean difference (95% confidence interval)
Attux 2013[27]	75.9	10.3	81	78.8	10.9	79	10.4%	−0.27 [−0.58, 0.04]
Errichetti 2020[35]	73.4	10.9	249	74.6	10.5	167	16.5%	−0.11 [−0.31, 0.08]
Holt 2019[39]	82	10	207	81	11	205	16.7%	0.09 [−0.10, 0.29]
Kilbourne 2013[42]	75.3	10.6	57	80.5	10.3	59	8.3%	−0.49 [−0.86, -0.12]
Masa-Font 2015[46]	80.47	10.52	169	79.71	11.11	163	15.3%	0.07 [−0.15, 0.29]
Osborn 2018[48]	80	10	155	80	10	172	15.2%	0.00 [−0.22, 0.22]
Sugawara 2019[49]	78.9	14	67	82.1	12.1	61	9.0%	−0.24 [−0.59, 0.11]
Sugawara 2019[49]	78.1	11	61	82.1	12.1	61	8.7%	−0.26 [−0.61, 0.10]
Total (95% CI)			1046			967	100%	-0.11 [−0.23, 0.02]

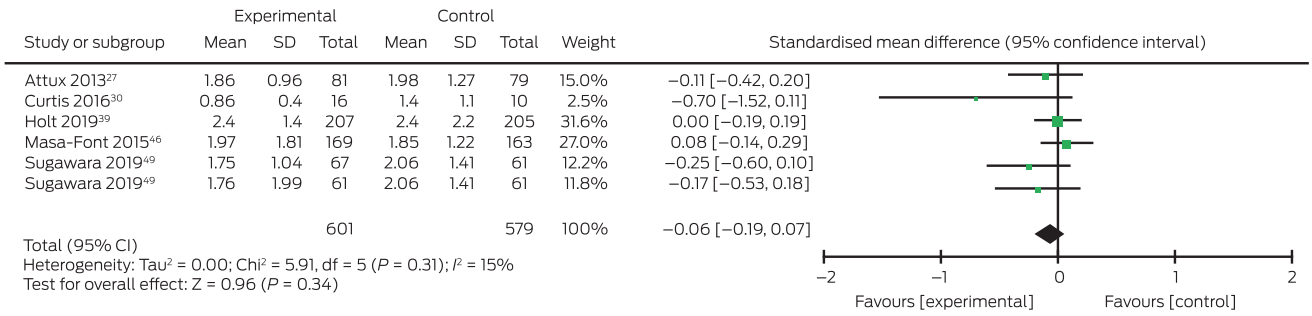
Heterogeneity: Tau² = 0.02; Chi² = 13.69, df = 7 (*P* = 0.06); I^2 = 49%
Test for overall effect: Z = 1.61 (*P* = 0.11)



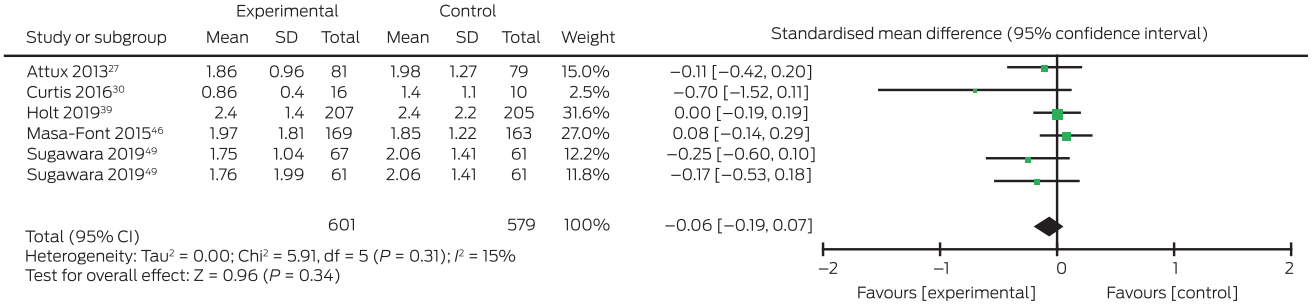
(Continues)

4 Forest plots for trials that assessed the impact of diet or nutrition-based interventions on secondary outcomes (inverse variance, random) (Continued)

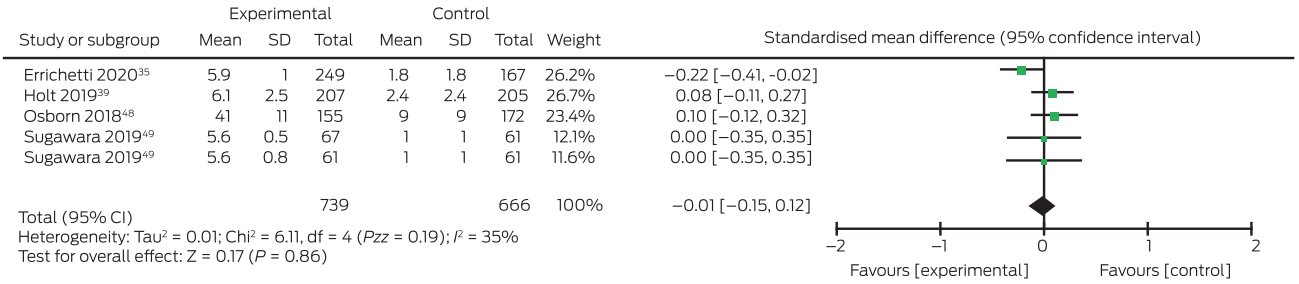
F. Triglycerides



G. Glucose



H. Glycated haemoglobin



df = degrees of freedom; HDL = high-density lipoprotein; LDL = low-density lipoprotein; SD = standard deviation. ◆

Subgroup analysis found a small effect size on weight for interventions delivered by dietitians (five studies; 262 intervention, 258 control participants; SMD, –0.28; 95% CI, –0.51 to –0.04) (Supporting Information, figure 6) and interventions based on individual sessions only (three studies; 141 intervention, 134 control participants; SMD, –0.30; 95% CI, –0.54 to –0.06) (Supporting Information, figure 7). Despite some asymmetry in the funnel plot, publication bias was not significant (Supporting Information, figure 8).

Meta-analysis did not identify statistically significant effects of interventions on blood pressure, serum lipid, or blood glucose levels (Box 4). For the three interventions delivered by dietitians (391 intervention, 307 control participants; I^2 = 0%),[27,35,49] subgroup analysis identified small effects on systolic (SMD, –0.18; 95% CI, –0.34 to –0.03) and diastolic blood pressure (SMD, –0.18, 95% CI, –0.33 to –0.02) (Supporting Information, figure 9).

Discussion

Our review of 25 randomised and non-randomised trials published during 2010–2021 found limited evidence that nutrition interventions improve metabolic syndrome risk factors in people with serious mental illness. However, such interventions may be more effective when delivered on an individual basis or by dietitians.

Individualised and dietitian-delivered sessions may be effective because dietitians can assess and respond to the unique nutrition-related challenges experienced by people living with serious mental illness. Moreover, dietitians can provide appropriate interventions that incorporate behaviour change techniques, specific goals, and self-monitoring. Each of the individualised (completely individual-based, or including both individual and group components) and dietitian-delivered interventions we reviewed found at least one favourable effect on a metabolic syndrome risk factor. Our finding complements that of an earlier systematic review and meta-analysis,[20] which found that nutrition interventions delivered by dietitians or early in the course of antipsychotic medication use were the most effective.

The poorer physical health and reduced life expectancy of people living with serious mental illness in high income countries has been labelled a "scandal",[52] and it is a priority area for action for all governments in Australia.[53] The 2019 *Lancet Psychiatry* commission

report[13] provided recommendations on multidisciplinary approaches to managing physical and mental multimorbidity, including six elements for effective lifestyle interventions:

- include both dietary modification and exercise;
- use behaviour change techniques, including specific and measurable goals, and self-monitoring;
- be delivered by staff with professional qualifications in nutrition, dietetics, and exercise;
- offer supervised exercise sessions at least twice a week;
- familiarise mental health staff with the lifestyle intervention; and
- include peer support.

Several of these elements were missing from most interventions we reviewed, perhaps explaining why they were not effective. The 2020 Australian Mental Health Productivity Commission Inquiry Report[54] stated that the mental health system needs to provide holistic and person-centred care focused on the individual and their life circumstances to effectively improve the physical health of people with serious mental illness.

Such programs have high attrition and low adherence rates,[55] but intervention acceptance, adherence, and retention could be enhanced by incorporating the elements outlined by the *Lancet Psychiatry* commission:[13] embedding the intervention in mental health services to avoid disconnection from other health services, familiarising mental health staff with the intervention, integrating peer workers to help people navigate the health service and lifestyle intervention and to assist with health coaching and follow-up, and providing affordable supervised exercise sessions. Further, our analysis indicates that nutrition interventions should include individualised components and be delivered by a nutrition professional (eg, a dietitian).

A recent scoping review[56] of economic studies of dietary interventions for people with a variety of mental disorders included five cost-effectiveness studies[48,57-60] associated with five trials[31,38,39,48,51] we included in our review. The findings and the strength of conclusions that could be derived from the scoping review were limited, but provided some preliminary information. For example, the cost analysis for the successful ACHIEVE trial of a behavioural weight loss intervention in the community found that it could be offered at a cost of $US65 to $US85 per person per month.[60] If dietitian-led and individualised interventions are effective for reducing metabolic syndrome risks, employing these interventions more widely could achieve net cost savings for healthcare systems. Without comprehensive economic evaluations, however, it is unclear whether the investment would meet accepted cost-effectiveness/utility thresholds.

Strengths and limitations of our review

Strengths included our rigorous search strategy; the identification of a reasonable number of relevant trials; the independent screening, data extraction, and study and outcome appraisal by several review authors; our assessments of risk of bias, GRADE, and study data strength and consistency; and our identification of elements associated with favourable intervention outcomes that could guide future trials and clinical practice.

However, as we restricted our review to studies published since 2010, our conclusions are limited to understanding the elements and effectiveness of more recent interventions. We excluded studies published in languages other than English, potentially biasing our findings. The small proportion of studies that could be pooled for meta-analysis suggests that the estimated effect sizes may not properly reflect the findings of all publications included in our review. We therefore assessed the proportion of studies that reported significant intervention effects. Study quality was generally poor; most were found to be at high risk of bias, and risk was low for only one study.[44] Study heterogeneity was marked with respect to the primary analyses, in part because of variation in study design and intervention delivery, and low study quality. Heterogeneity was much lower and not statistically significant in subgroup analyses of dietitian-delivered interventions and individualised interventions.

Conclusion

Our results provide only limited evidence for nutrition interventions improving metabolic syndrome risk factors in people with serious mental illness, but they could be effective when delivered on an individual basis or by dietitians. Further trials could explore this question, and also assess the cost-effectiveness of such interventions.

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Supporting Information

Additional Supporting Information is included with the online version of this article.

Peer-facilitated interventions for improving the physical health of people with schizophrenia spectrum disorders: systematic review and meta-analysis

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Abstract

Objectives: To evaluate the efficacy of peer-facilitated interventions for improving the physical health of people with schizophrenia spectrum disorders.

Study design: Systematic review and random effects meta-analysis of peer-facilitated interventions for people with serious mental illness, including schizophrenia spectrum disorders, in which physical health outcomes were assessed.

Data sources: MEDLINE, PsycINFO, EMBASE, CINAHL, Web of Science, Scopus, CENTRAL, and PubMed. In addition, reference lists of reviews were examined for further relevant studies published to 10 November 2021.

Data synthesis: We included fourteen publications (thirteen randomised controlled trials of ten peer-facilitated interventions, and one secondary analysis; total of 2099 participants) that assessed physical health outcomes for people with mental health conditions, including schizophrenia spectrum disorders. Intervention duration ranged from three to eighteen months; peers were involved as sole or co-leaders of the programs in group or individual sessions. Meta-analysis identified a statistically significant pooled effect on physical activity and capacity (various measures; six studies; 468 intervention, 461 control participants; standardised mean difference, +0.19 standard deviation [SD]; 95% CI, +0.06–0.32 SD; I^2 = 0%); overall GRADE certainty of evidence was low. Marked study heterogeneity precluded secure conclusions regarding intervention effects on self-rated physical health, healthy eating, and body mass index.

Conclusions: Peer-facilitated interventions for improving physical outcomes are feasible for people with schizophrenia spectrum disorders, a group at particular risk of certain physical health conditions. Further research is required to assess the effects of such interventions on other health-related parameters.

PROSPERO registration: CRD42021283578 (retrospective).

Worldwide, about 20 million people have schizophrenia.[1] They are more frequently affected than other people by several chronic physical health conditions, including obesity, diabetes, hypertension, and dyslipidaemia, the consequences of lifestyle, physiological, and social factors.[2] As a result, their relative mortality risk is 2–3 times as high as for the general population and their life expectancy is lower.[3] There are barriers to good physical health care for people with psychotic disorders at the patient, clinician, and system levels. To improve the health of people with schizophrenia, feasible and accessible specific physical health interventions are imperative.

To enhance care for people with schizophrenia, increased attention is given to incorporating peer support into psychoeducation, social support, and specific interventions, including those related to physical health. In this context, peers are defined as people with lived experience of schizophrenia who draw on this personal experience to empower others with similar conditions. A peer-facilitated intervention is one delivered by people with experience in living with mental illness who are trained to provide support services that promote wellness, recovery, and patient activation.[4] Peers can be involved in individual interventions or group-based services using in-person or remote (eg, online, phone) modalities.[4-6] Peer interventions are more effective than standard care for improving some physical and mental health outcomes, including severity of illness, empowerment, hope, and self-efficacy.[7] However, barriers associated with these interventions include the indefinite scope of peer work, integration with existing programs, and workforce stigmatisation.[8,9] Despite the benefits of peer support, these concerns must be taken into account when implementing peer-facilitated programs within mental health services.

In this review, we identify and critically examine peer-facilitated interventions and their effect on physical health outcomes for people with schizophrenia spectrum disorders.

Methods

The reporting of our systematic review and meta-analysis conforms with the Preferred Reporting of Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[10] The protocol was retrospectively registered with the PROSPERO registry (CRD42021283578; 8 December 2021).

Search strategy

We searched MEDLINE, PsycINFO, EMBASE (all Ovid), CINAHL (EBSCOhost), Web of Science, Scopus, CENTRAL, and PubMed on 10 November 2021. The search was conducted in accordance with the PICOS framework (participants, intervention, comparator, outcomes, study design), using the following combinations of keywords: ("schizophrenia" OR "schizoaffective disorder" OR "serious mental illness" OR "severe mental illness") AND ("peer"* OR "consumer" OR "peer-to-peer" OR "lived experience") AND ("physical" OR "fitness" OR "health"* OR "exercise").

We searched for peer-reviewed publications in English that reported randomised controlled studies of interventions in which the participants included people with schizophrenia spectrum disorders; at least one peer or person with lived experience acted in a leadership role (ie, peer or peer-supported interventions);

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and at least one physical health outcome — cardio-metabolic (eg, blood pressure) or anthropometric (eg, weight, body mass index [BMI]) measures — or lifestyle and health behaviour (eg, diet, physical activity) was assessed. No limits were applied with regard to publication date. The reference lists of reviews identified by the search were examined for additional relevant studies. Publications that reported only subjective measures, the subject of a recent systematic review/meta-analysis,[11] were not included in our analysis.

Two reviewers (AC, KM) independently screened item titles and abstracts for relevance, followed by full text review. Disagreements with regard to inclusion of publications were resolved at each stage by discussion.

Data extraction

Two authors (AC, KM) extracted data to a data extraction form including study identifiers, intervention descriptions, and the outcomes of interest. Means and standard deviations were collected for continuous outcome measures, counts and odds ratios for dichotomous outcomes. The accuracy of data extraction was checked independently by the same authors and inconsistencies were resolved by discussion and reference to the original articles.

Outcomes

The primary outcomes were differences in change in physical health-related outcomes between intervention and control groups, or change from baseline in physical outcomes for the intervention group.

Risk of bias assessment

Risk of bias with respect to the outcomes of interest was independently assessed with the Cochrane Risk of Bias[12] tool by two authors (AC, KM); disagreements were resolved by discussion. Attrition bias was defined as more than 20% of participants not completing the full term of the study intervention. Studies were deemed to be at high risk of bias when three of more domains were flagged as "high risk" by reviewers.

Certainty of evidence

The certainty of evidence for each physical health outcome was assessed with the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) framework.[13] Rankings were assigned independently by two authors (AC, KM) and disagreements resolved by discussion.

Data synthesis

In our primary random effects meta-analysis, we assessed the effect of interventions on physical health-related outcomes (compared with comparator management) in Review Manager (RevMan) 5.4 (Cochrane Collaboration). Outcomes assessed at the end of the intervention were included in the meta-analysis; if multiple follow-ups were reported, outcomes from the follow-up time point closest to intervention end or intended program length were included in the meta-analysis. Other follow-up outcomes were summarised in the text, as applicable. For pooled effects, mean differences (MDs) were estimated for outcomes assessed with the same scales or measures, and standardised mean difference (SMDs; in standard deviations, SDs) was used to account for heterogeneity in scales measuring similar outcomes of interest. If applicable, the mean effect size was multiplied by –1 to ensure consistency in reporting the direction of intervention effects. Individual meta-analyses were conducted for each physical health outcome reported by two or more studies. Endpoint and change from baseline to post-intervention data were combined in the final analyses. Heterogeneity was quantified with the I^2 statistic. For sensitivity analyses, studies at high risk of bias were omitted to reduce study heterogeneity. If physical outcome data could not be included in the meta-analysis, they were reported qualitatively.

Results

Our systematic database and citation search identified 6214 unique titles; we excluded 5818 after title and abstract screening, and a further 382 after full text screening (Box 1). We included fourteen publications (thirteen randomised controlled trials of ten distinct interventions[14-20,22-27] and one secondary analysis[21]) that included people with serious mental illness, including schizophrenia spectrum disorders (Box 2).

In total, 2099 people with mental health disorders, including schizophrenia spectrum disorders, were enrolled in the thirteen original studies of peer or peer-supported interventions, which ranged in duration from three[23,24] to 15 months,[27] and with follow-up for as long as 18 months.[23] Statistically significant intervention effects were reported in eight trials[15-17,20,22,23,26] and the one secondary analysis[21] of peer intervention programs for people with serious mental illness. No adverse intervention-associated events were reported. Our evaluation of intervention effects on physical outcomes is summarised in the Supporting Information, table 2.

Quality assessment

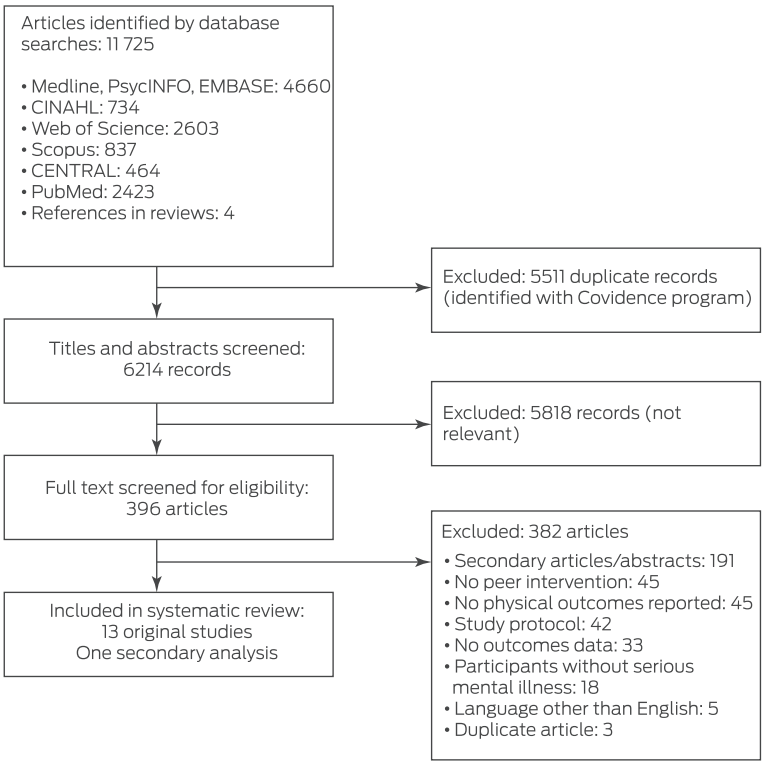
The risk of bias was high for two trials,[22,25] and moderate or low for the other studies.[14-21,23,24,26,27] Study heterogeneity was high for each of three intervention effects, precluding the drawing of robust conclusions: physical health, healthy eating, and BMI (Supporting Information, figure 1).

Physical activity and capacity

Meta-analysis identified a statistically significant pooled effect on physical activity and capacity (various measures; six studies; 468 intervention, 461 control participants; SMD, +0.19 SD; 95% confidence interval [CI], +0.06–0.32 SD; I^2 = 0%); the overall GRADE certainty of evidence was low (Box 3). The sensitivity analysis omitting one study with high risk of bias[25] yielded similar results (Supporting Information, figure 2).

Statistically non-significant intervention effects were reported for the Health and Recovery Program (weekly physical exercise, 6-month follow-up),[14] Peer-Led Group Lifestyle Balance (cardiorespiratory fitness measured with 6-minute walk test, 12-month follow-up),[25] and Living Well (physical activity management, intervention end).[16] At the 2-month Living Well follow-up, however, the mean physical activity score (Instrument to Measure Self-Management; range, 1–5) was significantly higher for the intervention than the control group (intervention: 3.2 [SD, 1.2] points; control: 2.2 [SD, 1.4] points; effect size, 0.56; P = 0.048).[16] In the Better Health Choices trial, total physical activity (measured as metabolic equivalent task [MET] minutes per week) increased for both the control and the treatment groups, but the difference between the two groups was not significant at 12 weeks (intervention: 1510 [SD, 1345] MET min/week; control: 1369 [SD, 1150] MET min/week; P = 0.77). Similarly, the between-group differences for moderate and vigorous physical activity at the end of the intervention were not statistically significant.[24] Statistically significantly higher mean physical activity for the intervention than the control group was reported

1 PRISMA flow diagram for selection of publications for inclusion in our analysis



for Living Well (weekly physical activity as MET minutes) at the 3-month follow-up (intervention: 2.8 [SD, 1.3] MET min/week; control: 2.2 [SD, 1.3] MET min/week; effect size, 0.29; $P = 0.011$), but not immediately after the intervention.[17] In a secondary analysis of the MOVE (Weight Management Program for Veterans) study,[20] the increases in mean total MET time/week between baseline and 6-month follow-up recorded for both MOVE SMI (baseline: 838 [SD, 1096] min; six months: 1183 [SD, 1773] min; $P = 0.002$) and WebMOVE participants (baseline: 1277 [SD, 1544] min; six months: 1316 [SD, 1675] min; $P = 0.044$) were larger than for the usual care group (baseline: 1586 [SD, 2686] min; six months, 916 [SD, 1563] min).[21] Weekly vigorous exercise also increased to a greater degree for both intervention groups between these time points (MOVE SMI, baseline: 1353 [SD, 1267] min; six months: 1737 [SD, 1911] min; $P = 0.015$; WebMOVE, baseline: 1453 [SD, 1543] min; six months, 1653 [SD, 2145] min; $P = 0.033$) than for the usual care group (baseline: 2372 [SD, 2741] min; six months, 2344 [SD, 4337] min).[21]

Physical health

The pooled effect for physical activity was not statistically significant (various measures; ten studies; 617 intervention, 622 control participants; SMD, +0.20 SD; 95% CI, –0.01 to +0.41 SD; $I^2 = 65\%$); because of the high degree of study heterogeneity, overall GRADE certainty of evidence was very low (Supporting Information, figure 1A).

Statistically significant intervention effects (compared with control care) on self-rated physical health were reported for the Peer Intervention Mentorship (Brief Psychiatric Rating Scale)[22] and the Peer Navigator programs (TCU Health Form).[26]

Mean self-rated medical health was higher for the intervention than the control group at the end of the Whole Health Action Management intervention and at the 6-month follow-up (single-item World Health Organization Disability Assessment Scale).[23] The change in physical health ratings from baseline were statistically higher for the intervention than the control group at the end of Living Well, but not at the 2-month follow-up;[16] in a separate trial, improvement was greater for the active control group than the intervention group after treatment (12-item Short Form Health Survey).[17] Changes in physical health were not significantly different between the intervention and control groups in the Health and Recovery Program pilot study,[14] but were statistically significant in the full randomised controlled trial (36-item Short Form Health Survey–Physical Component Summary).[15] Physical health outcomes were not improved in the intervention group in either Bridge trial (chronic health diagnosis checklist),[18,19] and more health problems were reported in the larger trial at follow-up by the intervention group than the waiting list control participants, which may reflect improved self-monitoring of symptoms.[19] Finally, the Targeted Training in Illness Self-Management trial did not report significant improvements in physical health outcomes (36-item Short Form Health Survey–Physical Component Summary).[27]

Healthy eating

The pooled effect for healthy eating was not statistically significant (various measures; four studies; 322 intervention, 330 control participants; SMD, –0.03 SD; 95% CI, –0.30 to +0.24 SD; $I^2 = 56\%$); because of the high degree of study heterogeneity, overall GRADE certainty of evidence was very low (Supporting Information, figure 1B).

For the Living Well intervention, statistically significant improvements in healthy eating (compared with control care) were reported at the 2-month follow-up but not at the end of the intervention;[16] in another study improvements were not reported at the end of the intervention or at 3-month follow-up.[17] Better Health Choices did not significantly improve the quality or amount of fruit and vegetable intake.[24] No statistically significant changes in diet (compared with baseline or control group) were reported for the Health and Recovery Program intervention participants.[15]

Metabolic measures

The pooled effect for BMI was not statistically significant (three studies; 194 intervention, 204 control participants; MD, –0.6 kg/m^2; 95% CI, –2.2 to + 1.0 kg/m^2; $I^2 = 99\%$); because of the high degree of study heterogeneity, overall GRADE certainty of evidence was low (Supporting Information, figure 1C).

In the MOVE study, BMI declined significantly between baseline and the 6-month follow-up for the WebMOVE intervention group (corresponding to mean 6.2 lb [2.8 kg] weight loss), but not for the MOVE SMI intervention or control groups.[20] Neither the proportion of intervention group participants who recorded clinically significant weight loss (at least 5% of baseline weight) at the 12- and 18-month follow-ups nor the mean weight change from baseline for the intervention group differed from those for the control group.[25] Group × time interactions for BMI, glycated haemoglobin (HbA_{1c}) level, and systolic blood pressure were all statistically non-significant in the Targeted Training in Illness Self-Management trial.[27]

2 Characteristics of the published studies and secondary analysis included in our systematic review and meta-analysis

Intervention, publication*	Participants	Design, assessment point	Control group	Peer role	Outcomes assessed	Findings: summary
Health and Recovery Program						
Druss 2010[14]	80: SMI and chronic health problems, incl. 23 with SSD	Randomised controlled pilot study, 6-month follow-up	TAU	Peer-facilitated intervention	Physical activity, physical health	Intervention *v* control: no significant differences.
Druss 2018[15]	400 with SMI, incl. 114 with SSD	RCT, 3-, 6-month follow-ups	TAU	Peer-facilitated intervention	Physical health, diet	Intervention *v* control: significant better improvement in physical health; no difference with respect to diet.
Living Well						
Goldberg 2013[16]	63 with SMI and chronic disease diagnosis, SSD=ND	RCT, post-intervention and 2-month follow-ups	TAU	Peer-facilitated intervention (two peers) or co-facilitated by a peer and mental health clinician	Physical activity, healthy eating, physical health functioning	Physical activity, healthy eating: no significant change from baseline at study end, but at 2-month follow-up. General and physical health functioning: significant intervention effect (*v* control) at end of intervention, but not at 2-month follow-up.
Muralidharan 2019[17]	242 veterans with SMI and a chronic disease diagnosis, incl. 79 with SSD	RCT, post-intervention and 3-month follow-ups	ACC	Peer-facilitated intervention (two peers) or co-facilitated by a peer and mental health clinician	Physical activity, physical health, healthy eating	Physical activity: no significant intervention effects at end of intervention; significant intervention effect at three months. Physical health: greater improvement in control group at end of intervention. Healthy eating: no significant changes post intervention or at 3-month follow-up.
The Bridge						
Kelly 2014[18]	24 SMI, SSD=ND	RCT, 6-month follow-up	WLC	Peer-facilitated intervention	Reported health problems	Intervention *v* control: Fewer reported health problems than control (not significant).
Kelly 2017[19]	151 with SMI, incl. 56 with SSD	RCT, 6-, 12-month follow-up	WLC	Peer-facilitated intervention	Reported health problems	Intervention *v* control: More reported health problems than control (statistically significant).
MOVE (MOVE SMI, WebMOVE)						
Young 2017[20] Muralidharan 2018[21]	276 with SMI and obesity, SSD=ND	Three-armed RCT, 3-, 6-month follow-ups	TAU	Peer facilitated intervention (MOVE SMI) or one-on-one peer support online (WebMOVE)	Physical activity, BMI	6-month follow-up *v* baseline: significant increase in total MET minutes and vigorous physical activity for WebMOVE and MOVE SMI groups; significant reductions in BMI and weight for WebMOVE group.
Peer Mentorship Intervention Program						
O'Connell 2018[22]	93 with SMI and substance misuse, SSD=ND	RCT, 9-month follow-up	TAU	One-on-one peer support	Physical health	Intervention *v* control: significantly greater improvement.
Whole Health Action Management						
Cook 2020[23]	146 with SMI and chronic disease diagnosis, incl. 63 with SSD	RCT, post-intervention, 6-month follow-ups	TAU	Peer-facilitated intervention	Self-rated physical health	Intervention *v* control: non-significant higher scores post-intervention; significantly greater improvement from baseline to 6-month follow-up.
Better Health Choices						
Kelly 2020[24]	43 with SMI, incl. 19 with SSD	Randomised controlled feasibility study, 12-, 16-week follow-ups	TAU	Peer-facilitated intervention	Physical activity, daily fruit/vegetable intake	Intervention *v* control: no significant difference between weekly total, moderate, or vigorous physical activity, or in diet post-intervention or at follow-up.
Peer-Led Group Lifestyle Balance						
Cabassa 2021[25]	314 with SMI and obesity, incl. 178 with SSD	RCT, 6-, 12-, 18-month follow-ups	TAU	Peer-facilitated intervention	Changes in weight (via physical activity), CRF, CVD risk	Intervention *v* control: No statistically significant differences in proportions with clinically significant weight loss or in CRF or CVD risk (6-, 12-, 18-month follow-ups).

Continues

2 Continued

Intervention, publication*	Participants	Design, assessment point	Control group	Peer role	Outcomes assessed	Findings: summary
Peer Navigator Program						
Corrigan 2017[26]	67 African-Americans with SMI, incl. six with SSD	RCT, 4-, 8-, 12-month follow-ups	TAU	Peer-facilitated intervention	Physical health	Intervention *v* control: significantly greater improvement over 12 months.
Targeted Training in Illness Self-Management (TTIM)						
Sajatovic 2017[27]	200 with diabetes (type II) and SMI, incl. 49 with SSD	RCT, 13-, 30-, 60-week follow-ups	TAU	Co-facilitated by a peer and mental health clinician	Physical health, blood pressure, HbA_{1c}, BMI	Intervention *v* control: no significant differences over the 60-week period.

ACC = active control condition; BMI = body mass index; CRF = cardiorespiratory fitness; CVD = cardiovascular disease; HbA_{1c} = glycated haemoglobin; MET = metabolic equivalent task; ND = not reported; RCT = randomised controlled trial; SMI = serious mental illness; SSD = schizophrenia spectrum disorder; TAU = treatment as usual; WLC = waiting list control. * More details regarding the interventions are included in the Supporting Information, table 1. ◆

Discussion

We critically examined thirteen randomised controlled trials and one secondary analysis (fourteen publications) that assessed the effects on physical health outcomes of peer-facilitated interventions for people with serious mental illness, including schizophrenia spectrum disorders. Eight studies and the secondary analysis each found statistically significant improvements in at least one outcome.

Significant improvements were achieved in four of six trials that assessed physical activity as an outcome, including three[16,17,20] in which the effects were statistically significant at a follow-up assessment but not at the end of the intervention. Peer-facilitated interventions may require time to have a significant impact on physical activity, as new behaviours become routine gradually, or measurable effects may develop only with delay, as reported for psychological interventions for people with schizophrenia spectrum disorders.[28]

Interventions that targeted other outcomes, such as physical health, healthy eating, and metabolic measures, yielded mixed results. Some trials reported significant intervention effects,[15-17,20-23,26] but not for all time points, studies, or treatment versions, and the certainty of evidence was low or very low. These findings were consistent with those of other reviews of peer-facilitated interventions for people with serious mental illness,[29,30] but their potential for modifying physical health outcomes requires further investigation.

The effect of peer facilitation was compared with another delivery format (joint facilitation by peers and clinicians) only for the Living Well intervention.[16,17] Significantly greater improvements in general self-management behaviour were reported for the co-facilitated intervention than for delivery by two peer specialists, suggesting that participants may see greater benefit in the co-facilitation approach. Peer facilitation is based on shared experience, empowerment, and hope, but interventions with a medical focus may be enhanced by the addition of a clinical perspective.

Despite their benefits, certain forms of peer-facilitated intervention have their limitations. Firstly, approaches to improving physical outcomes such as weight and cardio-metabolic factors in people without mental health problems may not be as effective or acceptable for people with serious mental illness, including schizophrenia spectrum disorders. Personalised interventions may be required, with various degrees of peer involvement and tailoring to the participants' abilities and limitations.[29] Further, it is difficult to monitor the support offered to patients in individual peer-facilitated interventions, as lived experience differs between peers. Despite training sessions for peer support workers, intervention delivery may vary according to their own experiences, making it difficult to ensure consistency and reliability.

Strengths and limitations of our review

Including only randomised controlled trials lent our analyses rigour. We focused on physical health outcomes because they contribute most significantly to the reduced life expectancy of people with schizophrenia spectrum disorders.

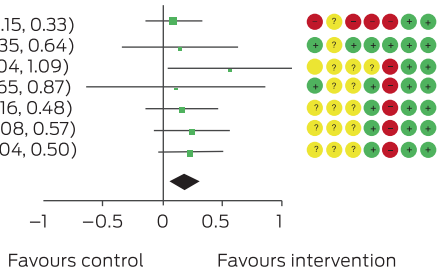
However, physical health outcomes varied considerably between studies and were often not the primary trial outcomes. Our definition of physical health outcome may have excluded potentially relevant articles from our analysis. The included studies applied various definitions and types of mental illness, and data aggregation in some studies precluded conclusions about specific disorders. For example, some studies included people with post-traumatic stress disorder and depression as well as those with schizophrenia spectrum disorders, and we could not assess the specific intervention impact on people with schizophrenia spectrum disorders. Further, differences in included diagnoses may have affected intervention efficacy because of the differing needs, resources, and abilities of the participants.

The included studies differed with regard to follow-up duration, ranging from two to 18 months. This is particularly important because significant treatment effects developed in some studies only after completion of the active intervention. Intervention duration also differed between studies. Our findings should consequently be interpreted with caution; future trials should aim to standardise the lengths of both intervention and follow-up as far as is practical. Most outcomes were participant-reported and therefore subject to reporting bias; they may not accurately reflect intervention effects.

Some studies provided considerable pre-trial training for peer facilitators, while others required little or no pre-training, which may have influenced the efficacy of the interventions. The fidelity of intervention implementation, a general problem, was not systematically assessed or reported in most trials, a shortcoming that should be corrected in future studies. Peers need to work

3 Forest plots and risk of bias assessment for six trials that assessed the impact of peer or peer-supported interventions on physical activity (inverse variance, random)

Study	Intervention Mean	Intervention SD	Intervention Number	Control Mean	Control SD	Control Number	Weight	Standardised mean difference (95% confidence interval)	Risk of bias A B C D E F G
Cabassa 2021[25]	2	97.1	129	−6.4	89.9	136	28.7%	0.09 (−0.15, 0.33)	
Druss 2010[14]	191	278	37	152	249	28	6.9%	0.14 (−0.35, 0.64)	
Goldberg 2013[16]	3.3	1.4	28	2.5	1.4	30	6.0%	0.56 (0.04, 1.09)	
Kelly 2020[24]	1510	1345	13	1369	1150	14	2.9%	0.11 (−0.65, 0.87)	
Muralidharan 2018 (MOVE SMI)[21]	1183	1773	81	916	1563	73	16.6%	0.16 (−0.16, 0.48)	
Muralidharan 2018 (WebMOVE)[21]	1316	1675	75	916	1563	73	15.9%	0.25 (−0.08, 0.57)	
Muralidharan 2019[17]	2.7	1.3	105	2.4	1.3	107	22.9%	0.23 (−0.04, 0.50)	



SD = standard deviation.
Risk of bias: A. random sequence generation (selection bias); B. allocation concealment (selection bias); C. blinding of participants and personnel (performance bias); D. blinding of outcome assessment (detection bias); E. incomplete outcome data (attrition bias); F. selective reporting (reporting bias); G. other bias. ◆

together with the broader care team and empower people with mental illness to manage social determinants of health by facilitating links with primary health and social services. Given the multiplicity of duties involved, the roles of professionals and peers should be better defined in intervention studies. It was also not clear whether interventions were developed by peers and therefore consistent with peer values and principles, which may have affected the efficacy of peer facilitation.

Finally, most studies used a usual treatment or waiting list control condition; few incorporated active control groups for directly comparing interventions with each other or with similar interventions not delivered by peers.

Conclusions

Our analysis indicates that peer-facilitated interventions for improving physical outcomes are feasible for people with schizophrenia spectrum disorders, a group at particular risk of certain physical health conditions. Investigations using complex intervention methodology[31] are required to assess the evidence that such programs can increase life expectancy and reduce physical health risk factors. Specific attention should be paid to outcomes relevant to the cardiovascular disease risk factors associated with reduced longevity in people with schizophrenia spectrum disorders.

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Supporting Information

Additional Supporting Information is included with the online version of this article.

Should antidiabetic medicines be considered to reduce cardiometabolic risk in patients with serious mental illness?

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Summary

- Substantially reduced life expectancy for people with serious mental illness compared with the general population is primarily driven by physical health issues, of which cardiovascular disease is the leading cause.
- In this narrative review, we examine the evidence base for use of metformin and other antidiabetic agents as a means for reducing this excess cardiometabolic disease burden.
- Evidence from randomised controlled trials (RCTs) suggests substantial potential for metformin to prevent or manage weight gain and glycaemic impairment induced by atypical antipsychotic medications, whereas the impact of metformin on other cardiometabolic risk factors is less consistent.
- Evidence from RCTs also suggests potential benefits from glucagon-like peptide-1 receptor agonists (GLP-1RAs), particularly for addressing cardiometabolic risk factors in people using atypical antipsychotic medications, but this is based on a small number of trials and remains an emerging area of research.
- Trials of both metformin and GLP-1RAs suggest that these medications are associated with a high prevalence of mild–moderate gastrointestinal side effects.
- The heterogeneous nature of participant eligibility criteria and of antipsychotic and antidiabetic drug regimens, alongside short trial durations, small numbers of participants and paucity of clinical endpoints as trial outcomes, warrants investment in definitive trials to determine clinical benefits for both metformin and GLP-1RAs. Such trials would also help to confirm the safety profile of antidiabetic agents with respect to less common but serious adverse effects.
- The weight of RCT evidence suggests that an indication for metformin to address antipsychotic-induced weight gain is worth considering in Australia. This would bring us into line with other countries.

Life expectancy is considerably reduced for people with serious mental illness when compared with the general population; worse, this gap appears to be widening in many countries.[1] A study that used Western Australian data found that for people who had been inpatients for psychiatric conditions, the gap in life expectancy increased between 1985 and 2005 — from 13.5 years to 15.9 years for male participants, and from 10.4 years to 12.0 years for female participants.[2]

Far from being solely a direct consequence of mental illness, much of this excess disease burden is a consequence of chronic physical health issues. The two leading areas of excess mortality among the Western Australian study participants were cardiovascular disease (CVD; 26% of excess burden for male participants and 35% for female participants) and cancer (14% of excess burden for male participants and 13% for female participants).[2] For people with serious mental illness, the risks of diabetes and CVD are approximately double those for people without serious mental illness, and the outcomes and complications associated with these conditions are worse.[3,4]

A complex range of interrelated factors contributes to the excess CVD risk in this population. First, certain aspects of health behaviour, including physical activity, diet and smoking status, are considerably worse than for the general population. A 2012 survey of 774 community mental health clients from New South Wales suggested that about half used tobacco (51%), a majority had inadequate fruit intake (60%) and vegetable intake (78%), and about one-third consumed alcohol at chronic risk levels (35%).[5] A more recent study of 301 community mental health service clients in Sydney who were prescribed long-acting injectable antipsychotics reaffirmed these concerns, with 44% meeting the criteria for metabolic syndrome.[6] Suboptimal health behaviour and excess risk factors among people with serious mental illness have been observed internationally, and are compounded by inadequate preventive care.[7] Frequently reduced cognition, motivation and self-esteem for individuals,[8] who are often of lower socio-economic status and therefore may have poorer access to health care than the general population,[7] add further to the challenges of lifestyle modification.

Some direct biological mechanisms associated with serious mental illness also contribute to increased cardiometabolic risk, including sympathovagal imbalance and increased prevalence of low grade inflammation.[7] These factors are further exacerbated by antipsychotic-induced weight gain and diabetes. While all antipsychotic medications may cause clinically meaningful weight gain (≥ 7%) and diabetes, particular concern relates to the atypical antipsychotic agents clozapine and olanzapine, and to a lesser extent risperidone, quetiapine and paliperidone.[9,10] Mean weight gain observed following olanzapine use in first-episode psychosis is about 7–9 kg over 10–12 weeks and 10–15 kg over 1–2 years.[11]

The precise pharmacological mechanisms for antipsychotic-induced weight gain are unclear, but the level of affinity for the muscarinic M3 receptor (high for olanzapine and clozapine) appears to be a particularly influential factor related to metabolic dysregulation and development of type 2 diabetes.[10] Effects on serotonin, histamine and other pathways also appear to influence cardiometabolic outcomes.

Overall, the scale of weight gain and metabolic risk associated with serious mental illness and its treatment suggests that many individuals, and perhaps most, will struggle to negate this burden via lifestyle modification. Antidiabetic medications might be an effective adjunct to lifestyle modification in reducing risk; however, despite advocacy and integration into Australian guidelines,[12,13] there is no evidence of antidiabetic prescribing

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being widely adopted for these patients in Australia. Thus, in this literature review, we scope the relevant evidence, with a particular focus on informing Australian clinicians.

Metformin pharmacology

Metformin is the antidiabetic medicine with the strongest evidence base for diabetes prevention. It is a biguanide agent that has been used as an antidiabetic medicine since the 1950s and was derived from the herbal remedy *Galega officinalis*.[14] Metformin's safety and efficacy have since been well established,[15] but its molecular mechanisms of action remain debated — suppression of hepatic blood glucose production, achieved by enhancing insulin effects in the liver, is likely to be the major pathway by which metformin effects are achieved.[14] Other potential pathways include: increase of anaerobic glucose metabolism in enterocytes and subsequent inhibition of glucose uptake to the liver; reduction in peripheral insulin resistance; suppression of proinflammatory cytokines; and modification of the gut microbiome.[16] Metformin is also thought to have actions that directly support weight loss or prevention of weight gain, but the pathways for this are still being elucidated.[17]

Metformin to prevent diabetes

The effectiveness of metformin for diabetes prevention in the broader at-risk population has been evident since the 1990s, although the level of risk reduction observed varies between trials.[18,19] The largest trial of metformin for diabetes prevention is the Diabetes Prevention Program/Diabetes Prevention Program Outcomes Study (DPP/DPPOS), which included 3234 adults in the DPP, and 2776 participants in the subsequent DPPOS follow-up; it was conducted in the United States during the period 1996–2001.[20] The DPP/DPPOS compared diabetes onset among participants who had a high baseline risk of diabetes and were allocated to one of three trial arms: metformin 850 mg twice daily, placebo, or intensive lifestyle modification. Participants in all trial arms received basic lifestyle support. At 2.8 years, there was a 31% reduction in risk in the metformin arm and a 58% reduction in risk in the intensive lifestyle modification arm, compared with placebo. It is important to note that the DPP intensive lifestyle intervention may not be feasible in many Australian settings (eg, it involved a minimum of 16 individual sessions over 24 weeks initially).

Subsequent DPPOS findings suggested sustained benefits 15 years after trial completion.[21] Although diabetes incidence reduced in both placebo and metformin arms — from 11.0 cases and 7.8 cases per 100 person-years respectively during the trial to 5.6 and 4.9 cases per 100 person-years (comparable to the lifestyle intervention group) after trial completion — the difference in cumulative incidence persisted between placebo and metformin, which the research team attributed to possible "exhaustion of susceptibles".[21] This suggestion is supported by DPP findings of greatest impact in younger, overweight individuals, which is highly pertinent considering the profile of patients with serious mental illness when they are starting antipsychotic therapy.[18] Limited evidence exploring the potential of combining metformin therapy and lifestyle modification has not demonstrated a significantly reduced rate of diabetes onset compared with either intervention individually.[22]

Metformin use in serious mental illness

To scope studies of antidiabetic medicine use in patients with serious mental illness, we searched the PubMed and Embase (including an integrated MEDLINE search) databases to identify systematic reviews published on the topic between 2008 and November 2021. From these searches, we identified 20 systematic reviews, including 17 with meta-analyses, to include in our review. The literature search process and details of included reviews are presented online (Supporting Information, supplementary material 1). Individual trials involving metformin and other antidiabetic agents were smaller than general at-risk population studies. The reviews included between 205 and 4052 participants derived from between 4 and 61 studies, in accordance with their search and eligibility criteria. Most reviews focused on metformin and considered a variety of relevant perspectives in terms of patient subgroups and clinical outcomes. In addition, most reviews measured weight change and related parameters as their primary outcome. Broader CVD-related outcomes such as lipid profile and glycaemic management variables were more comprehensively examined in reviews published since 2014.

Most trials included in the systematic reviews involved small participant numbers (eg, 30–70 per trial) and short follow-up periods (mostly 3–4 months). A few randomised controlled trials (RCTs) had a larger sample (> 100 participants) or longer follow-up period (24–26 weeks), but not both. Several Chinese language studies were included in some reviews, but important shortcomings were reported for many of these, including lack of intention-to-treat analyses, failure to specify funding sources, and lack of double blinding.[23,24] One review identified substantially greater reductions in weight and body mass index (BMI) in Chinese RCTs compared with non-Chinese trials,[23] but it is unclear whether these findings reflect younger patients in the Chinese trials, study design issues, or other factors.

Metformin trial outcomes in serious mental illness

Key meta-analytic findings from the systematic reviews involving people with serious mental illness that we identified are provide online (Supporting Information, supplementary material 2). Although trial parameters such as participant profile, antipsychotic of interest and follow-up period varied across studies, the consistent messages for metformin were:

- Metformin seems to be an effective and sufficiently safe option to prevent or reverse some of the weight gain associated with antipsychotic use, with a typical mean weight loss of 3–5 kg compared with placebo or usual care.
- Metformin, with or without adjunctive lifestyle modification, achieved a net weight loss across multiple reviews; however, the combination may be more effective than metformin alone.[25]
- Factors associated with increased weight loss included the use of atypical antipsychotic agents, younger patients, and initiation of metformin very early in or during, or before initiation of, antipsychotic therapy.[25,26]
- The evidence in favour of metformin was largely consistent across outcomes that are directly related to weight loss and glycaemic management such as BMI, waist circumference, glycated haemoglobin (HbA_{1c}) level and fasting blood glucose level, but inconsistent for other outcomes.

A point of difference for most serious mental illness trials when compared with trials on diabetes prevention in the general population was the absence of dysglycaemia as an eligibility criterion. Typically, only trials seeking to reverse weight gain due to use of atypical antipsychotic agents would regularly

require some cardiometabolic risk factor, usually including excess bodyweight or a minimum weight gain since initiation of atypical antipsychotics.[27-29] Trials to prevent weight gain on initiation of atypical antipsychotic therapy often excluded individuals with chronic physical health problems, including CVD and diabetes, but several international trials still achieved significant improvements in weight or BMI (or both) despite most participants being normal weight.[27-29] The relatively low prevalence of classical risk factors in such trials suggests that intrinsic risk of cardiometabolic disease and weight gain among people with serious mental illness who are using atypical antipsychotic therapies may be sufficient to justify intervention in the absence of baseline dysglycaemia or other risk factors.

A majority of metformin trials in this area focused on weight management rather than prevention of weight gain. Such trials typically used metformin dosages of 1000–1500 mg daily; dose-dependent weight loss was suggested, and one study that included 55 participants reported significantly reduced weight at 12 weeks for participants taking 1000 mg daily but not those taking 500 mg daily.[27] A further important finding from an intention-to-treat analysis that included 128 participants was that, in contrast to evidence from the general population, a combined metformin–lifestyle intervention among people with established antipsychotic-induced weight gain (> 10% bodyweight) may significantly affect weight and waist circumference when compared with either intervention component individually.[28] However, translating these findings to an Australian setting could be challenging, as the population was quite young and healthy, and the intervention involved close monitoring and supervision of participants.

Prevention trials have typically used daily metformin doses ranging from 750 mg to 2000 mg, with conflicting outcomes. In two trials, initiation of metformin at the same time as olanzapine reduced adverse effects on bodyweight and insulin resistance.[29,30] By contrast, another study found no significant benefit with metformin versus placebo among inpatients switched from conventional antipsychotic to olanzapine;[31] this may have been a consequence of recruiting older patients and switching from a conventional antipsychotic to low dose olanzapine (10 mg daily). Of the trials demonstrating benefit, one applied a naturalistic antipsychotic treatment regimen and the other was an inpatient trial that used olanzapine 15 mg daily in younger first episode patients.[29,30]

Across the trials, there were several common methodological strengths and weaknesses. Weaknesses included small sample sizes, lack of a priori primary outcomes or sample size calculations based thereupon, and failure to use intention-to-treat analyses. Comorbidities were often poorly defined, while only a few trials rigorously evaluated adverse events. Also, reliance on intermediate cardiometabolic outcomes rather than cardiovascular endpoints was a substantial limitation of the short duration trials that included people with serious mental illness.

Trial design factors affecting trial outcomes should be considered when reflecting on how interventions could be translated to Australian practice settings. These include the intensity of some lifestyle modification support, standard atypical antipsychotic dosages (often low dose olanzapine [10 mg daily]) for the trial duration, exclusion of patients with other mental illnesses or treatments, and sometimes substantial levels of patient oversight to maintain medication adherence and health-related behaviours. Most prevention trials clarified their exclusion of people with diabetes, whereas trials to mitigate antipsychotic-induced weight gain often included such patients. Trials aimed at reversing weight gain typically recruited patients who experienced weight gain of at least 10% bodyweight, although results from a recent pilot RCT conducted in Singapore that included 17 participants suggest that there may be benefits following first episode psychosis for patients with weight gain as low as 5% bodyweight.[32]

A caveat for interpreting meta-analysis results is that many do not provide subgroup analyses for those without (and with) diabetes at baseline. Indeed, ten of 17 meta-analyses did not provide baseline descriptions of diabetes status (Supporting Information, supplementary material 1). One review identified potentially weaker reductions in HbA_{1c} and fasting blood glucose levels when people with diabetes were excluded.[33]

Evidence for other antidiabetic medicines

Several reviews examined other antidiabetic drugs — most notably glucagon-like peptide-1 receptor agonists (GLP-1RAs) and rosiglitazone. All these reviews identified promising results, but findings from each were based on a limited pool of studies and small numbers of participants, so further research is needed before firm conclusions can be drawn (Supporting Information, supplementary material 1 and 2).

GLP-1RAs have generated substantial interest in recent years. The three initial trials, examined in several reviews, involved treatment for antipsychotic-induced weight gain using standard maximum GLP-1RA dosages recommended for diabetes (all given subcutaneously): one double-blind, placebo-controlled RCT using exenatide 2 mg once weekly; one open-label RCT using exenatide 2 mg once weekly; and one double-blind, placebo-controlled RCT using liraglutide 1.8 mg once daily.[34-36] These trials varied in terms of participant eligibility; notably, they had different inclusion and exclusion criteria relating to diabetes, glycaemic status and antipsychotic medications used.

In the only trial that was not restricted to atypical antipsychotics (exenatide versus placebo, $n = 40$), there was no significant improvement in the weight-related primary outcome at 3 months.[35] Conversely, in the trial in which participants had prediabetes, had a BMI of ≥ 27 kg/m^2 and were using atypical antipsychotics, participants in the liraglutide group (compared with those in the placebo group) had significantly greater improvements in bodyweight after 16 weeks (mean weight loss difference, –5.3 kg [95% CI, –7.0 to –3.7 kg]), significantly greater achievement of normal glucose tolerance after 16 weeks (64% versus 16%, $P < 0.001$) and greater improvements for several other cardiometabolic parameters.[36] In a follow-up of this study, there was evidence of continued significant weight benefits 12 months after the end of the trial (mean weight loss difference, –3.8 kg [95% CI, –7.3 to –0.2 kg]; $n = 88$) but glycaemic benefits seen at 16 weeks did not persist.[37]

The importance of better understanding the apparent benefits of GLP-1RAs is clear and is a major focus of current research in this area. Since publication of the three trials on GLP-1RAs, a pilot RCT testing higher dose liraglutide (3 mg subcutaneous daily [dosage for obesity]) has been published.[38] This trial recruited participants with a BMI of ≥ 30 kg/m^2 (or a BMI of 27–29 kg/m^2 plus a weight-related complication) who had schizophrenia, schizoaffective disorder or first episode psychosis. It identified significantly improved weight (mean decrease, –6.0 kg [95% CI, –10.8 to –1.36 kg]; $P = 0.015$), weight loss as a percentage of bodyweight (mean decrease, –4.6% [95% CI, –8.4% to –0.7%]; $P = 0.021$), BMI (mean decrease, –1.76 kg/m^2 [95% CI, –3.31

to –0.20 kg/m^2]; P = 0.028), HbA_{1c} levels (mean decrease, –3.6 mmol/mol [95% CI, –5.9 to –1.3 mmol/mol]; P = 0.003) and waist circumference (mean decrease, –7.2 cm [95% CI, –12.3 to –2.1 cm) among intervention group participants at 6 months compared with those in the placebo group. A key limitation of this pilot study is that the analysis was only performed on data for 34 out of 47 people randomly assigned to a study arm; further, 321 eligible patients were invited to participate in the trial in order to recruit the 47 participants. There are therefore questions about the representativeness of the final participant group, and the practicality and feasibility of daily dosing.

Adverse events associated with antidiabetic medicines

Three reviews described the safety and tolerability of antidiabetic agents (Supporting Information, supplementary material 2). In individual trials, the extent to which adverse events were systematically assessed was variable,[39] and most trials lacked statistical power for comparative analysis of adverse events. One review (a meta-analysis) found that only nausea and vomiting were significantly increased by metformin compared with placebo.[40] Another review, which specifically examined outcomes for patients with schizophrenia, identified that metformin was associated with significantly higher rates of nausea, vomiting and diarrhoea compared with placebo.[23] All three GLP-1RA trials reported high levels of gastrointestinal side effects among participants, but these may diminish over time.[36] Determining the prevalence of serious but less common side effects (eg, lactic acidosis) will require trials with larger sample sizes.

Translating evidence into policy and practice

Australia is arguably lagging behind other countries when it comes to endorsing metformin as an option for supporting improved cardiometabolic health in people with serious mental illness — or indeed for diabetes prevention generally. In light of mounting evidence, metformin is now indicated for the prevention or delay of type 2 diabetes in at-risk individuals in over 65 countries, but not in Australia.[18] Similarly, many influential guidelines and organisations in Australia and overseas have provided specific guidance and recommendations advocating the use of metformin for diabetes prevention or weight management in people with serious mental illness. Organisations that have provided such guidance and recommendations include the Royal Australian and New Zealand College of Psychiatrists, the American Diabetes Association, the National Institute for Health and Care Excellence (in the United Kingdom), the World Health Organization and Obesity Canada (Supporting Information, supplementary material 3). Although specific recommendations and criteria for use vary, the principle of using metformin for prevention and management of antipsychotic-induced weight gain, and for prevention of diabetes, seems broadly accepted.

Conclusion

Metformin is reasonable to consider as adjunctive therapy with lifestyle modification among people who are at risk of or have established antipsychotic-induced weight gain, particularly where lifestyle modification is not feasible or is inadequately effective. There seems little justification for use of metformin as an alternative approach without attempting lifestyle modifications. Evidence for other agents reviewed here is limited, but GLP-1RAs show promise. In Australia, the Therapeutic Goods Administration currently only indicates metformin for use in the treatment of type 2 diabetes if lifestyle modification is deemed insufficient for diabetes management.[41] Ultimately it is time to question whether the absence of an approved indication in Australia relating to diabetes prevention means that patients at elevated risk of diabetes, including those with serious mental illness, are being denied access to effective medication that might help enhance their longevity.

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Supporting Information

Additional Supporting Information is included with the online version of this article.

Shared guidelines and protocols to achieve better health outcomes for people living with serious mental illness

Shared guidelines and protocols are needed to overcome evidence-to-practice gaps in the care of patients living with serious mental illness

People living with serious mental illness have poor physical health leading to many years lived with chronic diseases and an average loss of 20 years' life expectancy. Most of this excess morbidity and mortality is avoidable through the implementation of well accepted preventive measures. Fragmentation of care between hospital, specialist and general practice services was identified as a key barrier to better physical health care by consumers and health experts in the Being Equally Well roadmap.[1] Intersectoral service and care planning with collaborative agreements, clinical information exchange and patient recall systems have been identified as successful components of better care.[2] This article outlines how intersectoral coordinated care could be improved by intercollegiate co-designed clinical guidelines and implementation of formalised shared care protocols that address evidence-to-practice gaps in the care of patients living with serious mental illness.

Clinical guidelines provide an accepted and accessible set of evidence-based recommendations and consensus statements that describe best-practice. The Royal Australian and New Zealand College of Psychiatrists (RANZCP) published clinical guidelines in 2016 to help psychiatrists manage and monitor schizophrenia and related disorders.[3] These guidelines include a recommendation that patients see their general practitioner to manage physical health risks and chronic diseases. There are recommendations about smoking cessation, choice of antipsychotic medication, and frequency of monitoring for cardiometabolic risks. The Royal Australian College of General Practitioners (RACGP) also produces guidelines for preventive activities in general practice including screening interventions, smoking cessation, and the management of diabetes.[4] The Being Equally Well roadmap calls for the RANZCP and RACGP to co-design a single clinical guideline that makes evidence-based recommendations for the management of physical health risks in people living with serious mental illness. The Box describes the current Australian delivery of clinical activities demonstrating both overlap and gaps identified by members of clinician working groups in the Being Equally Well project.[1]

Clinical protocols outline how to implement the recommendations from clinical guidelines. Protocols describe who does what, when, where and how at a local level. Shared care protocols are specifically designed to allocate responsibility across different services so that monitoring and clinical interventions do not fall in the gaps between fragmented services. Shared care protocols have been long established for maternity care and increasingly there are shared care protocols for use of specific high risk medications, including clozapine for schizophrenia. The features of successful shared care protocols include co-design between providers and patients, agreed monitoring

Typical Australian provision of clinical activities identified by the Being Equally Well project[1]

Clinical activity*	General practitioner†	Community Mental Health Service and mental health nurses‡	Hospital	Private or public outpatient psychiatrist§
Diagnosis of severe mental illness	++		++	++
Initiation of psychiatric medication			++	++
Monitoring psychiatric medication	+	++		++
Adjusting psychiatric medication				++
Managing medication related side effects	+	+	+	+
Managing acute exacerbations of mental illness	+	+	++	++
Managing long-term physical health risks	+			+
Facilitating and tracking regular follow up	+	++		+

* + = clinical activity conducted for some patients; ++ = clinical activity conducted for most patients. † Not all patients access GP services. ‡ Many areas lack these services. § Many access barriers including cost and availability. ◆

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frequency, clear delineation of responsibilities for parts of the care package, shared or accessible clinical records, and pre-planned actions for emerging problems.[5,6]

The existence of intercollegiate clinical guidelines and agreed carefully constructed shared care protocols is not enough to ensure uptake by the providers of patient care.[7] There is a need for a multifaceted change management approach so that care providers are aware of the protocols and educated about how to apply them.[8] Improved care often comes at the expense of increased workload for individuals. Direct financial incentives for completion of bundles of care is one way to overcome the cost of providing more comprehensive care.[9] Novel use of real-time computer decision support can provide prompts to follow protocols.[10] Templates for recording patient data can also improve adherence to protocols.[11] Performance indicators in the form of audit and feedback can be provided to individual clinicians and clinical microsystems to encourage continuous quality improvement. Iterative plan–do–study–act cycles backed by audit data, leadership training, and sharing of innovations have been shown to improve care quality in the Australian Primary Care Collaboratives.[12]

Here, we have described the rationale for intercollegiate clinical guidelines and shared care protocols tailored to local context for the care of people with serious mental illness. We have briefly listed some of the components required to implement guidelines and protocols. Now, investments are needed to support people with serious mental illness to be equally well.

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Clozapine shared care: mental health services and GPs working together for better outcomes for people with schizophrenia

Less restrictive care that provides greater autonomy for patients can be achieved when primary and secondary services form strong partnerships

Clozapine is the most effective and efficacious antipsychotic for people with treatment-resistant schizophrenia,[1,2] and its use appears to reduce long term all-cause mortality rates compared with other antipsychotics.[3] Its use is associated with severe neutropenia, which occurs in fewer than 1% of people who begin treatment with clozapine.[4] This has led to stringent haematological testing protocols in many jurisdictions.[5] In Australia, white blood cell and neutrophil monitoring is mandated weekly for the first 18 weeks of clozapine treatment and 4-weekly thereafter.[6] In addition, clozapine is associated with several other adverse drug reactions, including weight gain, diabetes, myocarditis, cardiomyopathy, sialorrhoea, postural hypotension, gastro-oesophageal reflux, nocturnal enuresis and seizures.[7] As a result, this is a drug that requires special care and medical oversight. It is important that patients undergo regular physical health checks before and during clozapine treatment, including monitoring of blood pressure, body mass index and other cardiovascular risk parameters.[6]

Clozapine is underutilised globally.[5] Barriers to use include concern about managing adverse drug reactions, and service-related barriers such as absence of a dedicated clozapine clinic.[8] Despite these barriers, there has been a slow but steady increase in clozapine use in Australia over the past 20 years.[9,10] While this is a positive trend in providing evidence-based treatment for patients with treatment-resistant schizophrenia, it places further strain on already overstretched public mental health services.

Dedicated clozapine clinics can improve quality and rates of prescribing in mental health services.[8] Although such clinics can save services money through reducing psychiatric hospitalisations among people who begin treatment with clozapine,[1] they are resource intensive. To enhance safe use of clozapine, several jurisdictions have introduced shared care programs with general practitioners.[11] A shared cared model is most suitable during the 4-weekly monitoring phase, because the most concerning adverse drug reactions — severe neutropenia and myocarditis — generally occur early in treatment.[4]

Shared care aims to bring together general practitioners and psychiatrists for planned delivery of care for patients with chronic conditions. It is underpinned by enhanced information exchange that goes beyond routine referral and discharge letters.[12] Shared care programs for patients being treated with clozapine (hereafter referred to as GP clozapine shared care programs) aim to transition patients into a less restrictive model of care; this can not only improve quality of life for patients, but also allow for more individuals to be prescribed clozapine on an ongoing basis. Shared care also has broader potential applicability to people with severe mental illnesses who are not being treated with clozapine, to ensure that their physical health needs are addressed.

In this article, we describe an established GP clozapine shared care program run from an inner city public mental health service in Melbourne, Australia. The program commenced shortly after the re-introduction of clozapine in Australia, in 1993. It enables GPs to take over the majority of the work relating to clozapine prescribing and required monitoring for patients. GPs review the regular haematological results required for clozapine therapy and prescribe clozapine at a regular dose. Currently, 72 GPs are registered with the scheme, and 65 patients are receiving shared care through the scheme (46% of clozapine-treated patients who attend the service). Patients participating in this program are reviewed by a consultant psychiatrist attached to the service at least every 6 months. Since July 2020, only six patients (8.5%) were re-referred for case management.

Selection of suitable patients

Patients are offered the option of participating in the GP clozapine shared care program when they have maintained stability in their mental state on a clozapine dose that has not been altered for at least 6 months. This is required to maximise the chance of a smooth transition to GP shared care, particularly as only specialist psychiatrists can adjust clozapine dose. Thus, suitable patients will have already undergone (without incident) the mandatory 18 weeks of weekly white blood cell and neutrophil monitoring, and will have emerged beyond the main risk window for myocarditis.

Patient characteristics that are fundamental for a successful transition to the GP clozapine shared care program include adherence to clozapine therapy and the necessary haematological monitoring, and sufficient organisational skills to regularly attend medical reviews. Patients must also have no ongoing case management needs beyond prescription and monitoring required for treatment with clozapine. This requirement results in exclusion of some patients who require active case management support for substance

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misuse, outstanding forensic issues or both. These patient characteristics are aligned with those identified in the broader Australian medical literature as being essential selection criteria for shared care programs.[13,14]

The most important patient factor is obtaining informed patient consent for transition to the GP clozapine shared care program. Ideally, and with patient consent, families and carers are also consulted and informed about the processes.

Roles and responsibilities

Case managers

Because clozapine therapy is usually started in a hospital setting, patients who are new to clozapine are assigned case managers to address case management needs and enable follow-up relating to management of clozapine therapy and other psychotropic therapies through public mental health clinics. Case managers are responsible for identifying patients who might be suitable for transfer to a GP clozapine shared care program, using the selection criteria that we have described. Along with the program's clozapine coordinator, case managers attend meetings with the patient, GPs and carers to explore, discuss and facilitate transfer to the shared care program. This includes providing case review paperwork to GPs, including detailed psychiatric history and risk assessment documentation.

Case managers oversee a mandatory 3-month transition period after patients join the GP clozapine shared care program and provide extra support to patients and GPs during the transition period. For patients, the support comes from a familiar person with whom they have a pre-existing therapeutic relationship. Case managers also become the single point of contact for GPs during the transition period, and can work collaboratively with GPs to arrange public mental health clinic input and follow-up should problems arise during the transition.

Clozapine coordinators and pharmacists

Clozapine coordinators are clinicians who work in a dedicated role with a clinic-based pharmacist. They provide oversight of patients who have been transferred to the GP clozapine shared care program. Their responsibilities include ensuring that the necessary haematological monitoring is undertaken, reviewed and actioned, and facilitating the mandatory 6-monthly consultant psychiatrist reviews. Clozapine coordinators assist case managers and GPs in the initial transition period. This includes registering GPs with the clozapine manufacturer's centralised database to record clozapine doses and blood test results.

Clozapine coordinators play a pivotal part in providing education about clozapine protocols to GPs. They also serve as a point of contact to facilitate seamless re-entry into and/or support from the public mental health service for shared care patients should the need arise. Circumstances that may warrant this include abnormal haematological parameters, interruption to clozapine therapy, serious adverse events, and a mental state that requires active case management.

General practitioners

In the GP clozapine shared care program, GPs agree to accepting patients, which means providing them with usual GP care plus taking responsibility for the following tasks: undertaking reviews for mental state and clinical assessment; monitoring white blood cell and neutrophil counts; prescribing clozapine; and regularly monitoring metabolic and cardiac parameters as per the Royal Australian and New Zealand College of Psychiatrists clinical practice guidelines.[15] Regular assessment of mental state and overall functioning, and provision of care in a non-stigmatising environment, are additional benefits of GP shared care.

Consultant psychiatrists

A dedicated clozapine shared care consultant psychiatrist performs 6-monthly reviews of patients who have been transferred to the GP clozapine shared care program. The psychiatrist's roles are: assessing the patient's mental state, risks and progress during clozapine therapy; adjusting the clozapine dose if required; assessing for side effects of clozapine; and ensuring that physical health monitoring is up to date. Patients might sometimes need to be reviewed by the consultant psychiatrist more frequently — for example, if they have low white blood cell or neutrophil counts, or if their mental state deteriorates (both of which may warrant review of the clozapine dose).

For each patient, a clozapine clinic form (Supporting Information) is completed by the consultant psychiatrist at each 6-monthly review and forwarded to the patient's GP. The form serves as a standardised communication tool between specialists and GPs, which conveys pertinent information for guiding ongoing management of shared care patients.

Enablers and barriers

Having a dedicated clozapine coordinator and protected consultant psychiatrist time enables the success of the GP clozapine shared care program and strengthens partnerships between local primary and specialist services. In addition, the service's clozapine policy, which is shared between GPs and the specialist mental health service, enables a clear mutual understanding of roles and responsibilities and escalation protocols.

Barriers to the program's success include the lack of a shared information technology platform (for seamless data sharing between primary and specialist care) and enduring time constraints due to overstretched public mental health and GP services. Another barrier is lack of familiarity and confidence with clozapine prescribing in primary care, but the clozapine coordinator's role in providing education and support mitigates this.

Conclusion

The GP clozapine shared care program that we have described provides an example of how GPs and

specialist mental health services can work together to deliver comprehensive care to people with severe mental illness, encompassing both mental and physical health parameters. To our knowledge, little research on such programs has been undertaken in an Australian context, but at least one study has shown successful outcomes from a clozapine shared care program, with almost no re-hospitalisations in the year following transfer to the program.[14] Also, studies conducted in Australia and the United Kingdom have shown high degrees of satisfaction with clozapine shared care among patients and health care workers.[11,16] The program that we have described is successful due to the clear delineation of roles and responsibilities, contingency planning, and mutual partnerships between primary and secondary care, with all parties having access to the service's clozapine policy (which outlines the program in detail). However, an important caveat is that this program has not been formally evaluated, and this precludes definitive conclusions being drawn regarding its effectiveness.

The virtues of shared care, beyond reduced burden on mental health services and reduced costs,[14] lie in convenience for the patient and their family in terms of access to care with their chosen GP in an environment that does not carry the stigma of a mental health service. Shared care also promotes self-management of illness and autonomy for patients, and strengthens collaboration and communication between public mental health services and GPs to deliver greater choice and less restrictive care pathways for patients. A similar model could be developed to provide comprehensive and integrated health care for other patients with severe mental illnesses who are not treated with clozapine.

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Supporting Information

Additional Supporting Information is included with the online version of this article.

Workforce development for better management of physical comorbidities among people with serious mental illness

Collaborative and holistic care that addresses multimorbidity could reduce excess disease burden and improve life expectancy

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The health burden in people with serious mental illness is considerably greater than that for the general population, with average life expectancy as much as 20 years lower for people with serious mental illness.[1] Co-existing chronic physical illnesses (predominantly cardiometabolic diseases), rather than mental health issues, contribute the majority of excess disease burden leading to this life expectancy gap.[1] Factors that adversely affect quality of care and health outcomes for established physical health conditions include: poor coordination of care; "diagnostic overshadowing" leading to physical health issues being overlooked; failure to refer patients to lifestyle modification programs; and lack of support for medication management.[2]

The Being Equally Well initiative established a roadmap to provide effective and improved care for patients with serious mental illness and co-existing physical health problems.[2] For the purposes of Being Equally Well, serious mental illness was defined as including "conditions requiring antipsychotic therapy, those requiring shared care provided between psychiatrists and GPs and thought disorder conditions rather than neuroses".[3] The roadmap documented significant potential roles for nurse navigators, pharmacists and allied health professionals to support a model of care shared between general practice and mental health services in Australia.[2] In this article, we describe the rationale for greater involvement by these health professional groups, to support improved physical health for people with serious mental illness in Australia.

Nurse navigators

A shared concern of consumers and carers engaged in Being Equally Well, which was endorsed by other stakeholders, was that people living with serious mental illness and their closest carers receive little or no support to navigate the complexities of services and systems that provide mental health care, physical health care and social support.[3] Current guidelines indicate that intensive external support is needed to optimise outcomes.[4] Social needs that contribute to better mental and physical health, and which could benefit from external assistance, include financial and housing security, meaningful employment, education, and other opportunities to engage in society.[2,5] The Being Equally Well roadmap and technical report provide details on why an expanded workforce of nurse navigators is considered the best evidence-based, clinically effective and currently feasible approach to addressing some of the multifaceted needs of people living with serious mental illness.[2,3] Potential roles of nurse navigators, depending on initial and ongoing shared understanding of individual patients' needs, are described in the Box.

Potential roles of nurse navigators for shared and improved care of patients with serious mental illness

Potential role	Purpose
Navigating care (primary role)	To help patients access primary care, specialist care and social services, including the National Disability Insurance Scheme
Managing cases	To ensure service episodes align with care goals, and to ensure follow-through of recommendations
Coordinating care	To ensure information flow and timeliness of appointments across multiple providers
Planning care	To assist the general practice team to create meaningful patient-held plans (that comply with Medicare rebate requirements)
Coaching patients	To support patients with making lifestyle changes
Prescribing social services	To connect patients with local non-health activities and services, including support groups and peer workers
Liaising with carers	To give carers and next of kin a voice, while maintaining patients' rights to privacy and autonomy
Assisting with panel management	To ensure medication monitoring and physical health checks are offered to all patients on the practice register in line with national shared care guidelines and local protocols
Educating and advocating	To increase the capacity of service providers to respond to the needs of individuals with serious mental illness

A nurse navigator workforce would require experience or training in caring for people with serious mental illness together with knowledge about prevention and management options for associated physical illness. Community psychiatric nurses are ideally placed to take on this work due to their extensive social interactions with patients. To expand such a service, practice nurses, occupational therapists, social workers and psychologists could be included in the workforce with appropriate expertise and/or training to take on this multifaceted and central role to improve clinical care and social support.

Nurse navigators would ideally work as part of the primary care team, embedded in general practice, where patients access most health care.[2] The value proposition for general practice clinics is to have a valuable resource to help manage patients with chronic and complex care needs. The Being Equally Well working groups identified that some patients do not have a primary care "home".[3] General practice clinics with an embedded nurse navigator, or access to one, would be expected to accept these additional patients.

The role of nurse navigators in health has been investigated in the contexts of specific diseases and specific high risk populations.[6-9] Many investigations fail to measure the quadruple outcomes of good health care (health outcomes, financial value, patient experience, and provider experience).[6,7] Reported outcomes are mixed; it appears that the more successful programs are those where the nurse navigator has contractual and in-person connections to service providers, and where the intervention is more comprehensive.[6,7,9,10]

Some existing roles and funding mechanisms could be adapted, expanded or used in conjunction to support the roll-out of nurse navigator roles and services (eg, community mental health nursing and team care arrangements). A clinical nurse consultant role based on a case management model, incorporating strong clinical and mental health knowledge, could be used in a nurse navigator workforce. The funding could be covered by existing Medicare arrangements, but this would need some expansion.

Pharmacists

The need for more effective medication management was an overarching priority of Being Equally Well consumers with serious mental illness, consistent with international literature.[4] Potential adverse effects of antipsychotics and other medications, including the impact of antipsychotic agents on weight gain and cardiometabolic risk, were a major concern of the Being Equally Well consumers and carers group. Related to this was a strong expectation and desire for shared decision making and informed consent, and clinician respect for patient concerns about medications. Pharmacists represent a highly accessible and trusted source of expertise in medication management that could be better utilised.[11] More effective medication reconciliation and management within a shared care model should, compared with current practice, reduce unnecessary polypharmacy, improve the accuracy of medication records, increase patient engagement with medication management, and increase patient uptake of medications that prevent and control chronic diseases.

Australian and international evidence suggests that introducing structured pharmacist interventions in different settings can improve the effectiveness and cost-effectiveness of managing chronic diseases.[12-15] Common intervention components for patients with serious mental illness include medication reconciliation, patient education, adherence and self-monitoring interventions to support prescribing, medication reviews followed by medication-related recommendations to prescribers, therapeutic drug monitoring, dose titration, and screening and monitoring for cardiometabolic risk factors.[12] There is strong evidence that interventions by pharmacists are feasible and acceptable for people with serious mental illness in Australia and elsewhere.[16-18] Global evidence supports pharmacist interventions to reduce medication and documentation errors. In addition, international reviews show that pharmacists are already highly integrated into inpatient and outpatient care processes used by people with serious mental illness, and that they can support a range of improvements (eg, medication safety improvements).[16,17]

Existing schemes, such as the MedsCheck program in community pharmacy and the Home Medicines Review program, can be used to support people with serious mental illness. However, current remuneration might be inadequate given the complexity of medication management for many patients with serious mental illness. Pharmacists working in general practice, as well as hospital-based mental health pharmacists and outreach pharmacists who liaise with general practice and community pharmacy, are also well placed to provide leadership in these efforts where they exist, but availability and funding is inconsistent.

Allied health

In addition to the need for comprehensive lifestyle support for managing physical health needs, the roles of exercise, diet and nutrition as first line prophylactic treatments for severe mental illness are increasingly being recognised and recommended in Australian guidelines.[19] Allied health professionals are ideally placed to design and deliver lifestyle interventions that target modifiable risk factors, including suboptimal diet, physical inactivity and smoking in people with serious mental illness, hence the importance of ensuring access to relevant allied health professionals.

Evidence from meta-analyses has shown that lifestyle interventions delivered by tertiary qualified allied health professionals are associated with lower drop-out and greater efficacy compared with interventions delivered by those with less or non-specialised training.[20-22] For example, a meta-analysis of interventions aimed at reducing weight and cardiometabolic risk among people with serious mental illness determined that dietitian-led interventions had a larger effect size than interventions led by other

health professionals.[22] Similarly, recommendations made in a 2019 *Lancet Psychiatry* Commission report included integrating and embedding allied health professionals as routine members of the standard multidisciplinary mental health team.[23] Other recommendations in the report related to successful implementation of lifestyle interventions that are supported by Australian evidence. One such recommendation was to prioritise early lifestyle intervention to prevent deterioration of physical health; this was based on evidence such as study results showing that antipsychotic-induced weight gain in young people with early psychosis can be reduced or prevented during a 12-week program, with benefits maintained at 2-year follow-up.[24] Another such recommendation was to address staff and workplace culture to ensure that traditional mental health staff are aware of the roles, responsibilities and services provided by allied health staff as they increasingly integrate into multidisciplinary and shared care mental health teams.[25]

Australia provides funding for access to allied health interventions through the Medicare Benefits Schedule. People living with chronic disease are eligible for referral to allied health professionals under the arrangement known as Chronic Disease Management — GP services. Eligible patients, including people living with serious mental illness who might be eligible, have funding support for up to five sessions per calendar year which can be distributed between professions based on the unique needs of the individual. However, both the possibility that a gap fee is charged by the allied health service, and the limited number of visits funded, means that these arrangements can be insufficient to address the needs of people with multiple comorbidities.

Discussion

In summary, improved physical and mental health outcomes for people with serious mental illness depend on adequate and effective multidisciplinary and shared care that is resourced appropriately by relevant health professionals working within a shared care model. Reducing preventable deaths in people with serious mental illness requires mental and physical health services to incorporate treatment and care services that include the expertise and capacity of nursing, pharmacy and allied health professionals. To ensure that there is holistic and best practice care for people with serious mental illness, the health care team must have the capacity to:

- consider the needs of people with serious mental illness from the perspective of multimorbidity involving serious mental illness;
- provide multidisciplinary care and multifaceted lifestyle, psychological, medication and social support; and
- address the health and health care burden of serious mental illness through effective advocacy and care coordination.

International evidence and emerging Australian experience indicate that collaborative care for people with serious mental illness can improve physical and mental health care, can improve related health outcomes, and may reduce inequity related to socio-economic and ethnic background.[26]

Currently, a coherent national approach to multidisciplinary care appears challenging. Existing Medicare items and other funding sources might adequately fund appropriate services for some individuals, but they are limited in their relevance — in terms of financial and practical accessibility — to the complex needs of people with multiple and significant comorbidities. Similarly, inherent financial disincentives exist for allied health and pharmacy to engage comprehensively with the needs of patients with more complex needs, which entails increased workload, if funded by programs with standardised remuneration.[27] Moreover, many patients are from rural and regional areas and communities with low socio-economic status, where workforce capacity is already strained.[3] Equitable approaches to care will require policy and funding that supports relevant health professionals to engage adequately with vulnerable individuals and communities. This is needed to enable coordination of team-based and patient-centred care, and to overcome the many systemic barriers to effective care for people with serious mental illness and co-existing physical health issues.

In conclusion, there is sufficient and persuasive evidence on how to support coordinated multidisciplinary management of physical health for people with serious mental illness. Achieving this might not require substantial new investments but will require expanded and better targeted access to services for individuals and health professionals. Tailored policy settings and workforce programs would ensure equitable access to such care.

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