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Implementation of a lifestyle and life-skills intervention to prevent weight-gain and cardiometabolic abnormalities in young people with first-episode psychosis as part of routine care: The Keeping the Body in Mind program

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Abstract

Objectives: In 2013, a cluster-controlled pilot study found the 12-week Keeping the Body in Mind (KBIM) lifestyle and life skills intervention was able to prevent weight gain in a small sample of youth experiencing first-episode psychosis (FEP) with fewer than 4 weeks of antipsychotic exposure. This study aims to evaluate the effectiveness of KBIM as routine care on anthropometry and metabolic biochemistry in a larger sample of youth with FEP across three community mental health services.

Method: This retrospective chart audit was conducted on youth with FEP, prescribed a therapeutic dose of antipsychotic medication, and who engaged with KBIM between 2015 and 2019. Primary outcomes were weight and waist circumference. Secondary outcomes were blood pressure, blood glucose, and blood lipids. Outcomes were collected in at baseline and at 12 weeks. Data on program engagement were obtained from the participant's medical file.

Results: One-hundred and eighty-two people met inclusion criteria, and up to 134 people had baseline and 12-week data on one or more outcome. Mean number of sessions attended was 11.1 (SD = 7.3). Increases in weight and waist circumference were limited to 1.5 kg (SD = 5.3, $t(133) = 3.2$, $p = .002$) and 0.7 cm (SD = 5.8, $t(109) = 1.2$, $p = .23$) respectively. Eighty-one percent of participants did not

experience clinically significant weight gain (>7% of baseline weight). There were no significant changes in blood pressure or metabolic biochemistry.

Conclusion: The prevention of substantial gains in weight and waist circumference observed in the initial pilot study was maintained with implementation of KBIM as part of routine clinical care for youth with FEP.

KEYWORDS

antipsychotic agents; body weights and measures; diet, food, and nutrition; exercise; life style; mental disorders; schizophrenia spectrum and other psychotic disorders

1 | INTRODUCTION

The physical health disparities experienced by people living with severe mental illness such as schizophrenia and related psychoses are well described (Firth et al., 2019). Physical health disparities are the major drivers for the 13–15 year reduced life expectancy in people with severe mental illness compared to individuals without mental illness (Hjorthøj et al., 2017), with two-thirds of deaths attributable to natural causes (Correll et al., 2017).

The development of obesity and metabolic abnormalities that seed future ill-health occur early with antipsychotic treatment. A systematic critical reappraisal showed that without physical health intervention, people with first-episode psychosis commencing antipsychotic medication gain on average 7.1–9.2 kg in weight with olanzapine, 4.0–5.6 kg with risperidone and 2.6–3.8 kg with haloperidol in the first 10–12 weeks of treatment (Alvarez-Jimenez et al., 2008). Early increase in weight is of particular importance given >5% weight gain in the first month of treatment is predictive of ≥20% weight gain at 12 months (Vandenberghe et al., 2015), with weight gain continuing decades into the future, albeit at a slower rate (Strassnig et al., 2017).

Synthesis of RCTs have established efficacy for lifestyle intervention (Naslund et al., 2017), however there is a dearth of real-world data, examining interventions outside of the narrow confines of research settings. In 2013, the Keeping the Body in Mind (KBIM) lifestyle pilot program was established and composed of different interventions, predominantly physical activity and nutrition, known to be effective in protecting cardiometabolic health. KBIM was offered as routine care at one early psychosis service and evaluated in a cluster-controlled design. At 12-weeks, weight and waist circumference changes were limited to 1.8 kg and 0.1 cm respectively in the KBIM group ($n = 16$) compared to 7.8 kg and 7.1 cm, respectively, in the control group ($n = 12$) (Curtis et al., 2016).

Following the intensive 12-week pilot intervention, KBIM received service wide support and funding to embed the program as part of routine care. Two-year follow-up of the pilot study participants found prevention of weight (mean difference [MD] = 1.3 kg) and waist circumference (MD = 0.1 cm) gains were sustained when compared to baseline (Curtis et al., 2018).

To confirm or refute the pilot study findings, we examined the effect of the KBIM intervention through real-world data in a larger sample size, with multiple teams delivering the intervention at multiple sites.

2 | METHODS

2.1 | Study design and setting

This retrospective chart audit was conducted on people within an early psychosis programme in the South Eastern Sydney Local Health District (SESLHD), who engaged with the KBIM program between January 2015 and December 2019. This study was approved as a quality assurance/quality improvement project by the SESLHD Human Research Ethics Committee (HREC) [17/298 (LNR/17/POWH/580)] using data from routine clinical care with a waiver of participant consent for health service evaluation in line with the NSW Government Legislation: Health Records and Information Privacy Act 2002 No 71 [Section 10 (d)].

2.2 | Participants

Included participants were: (i) aged between 15 and 27 years, (ii) experiencing a first-episode of psychosis as determined by a treating psychiatrist, (iii) engaged with an early psychosis programme associated with the Eastern Suburbs, St George Hospital or Sutherland Mental Health Service, SESLHD, (iv) prescribed a therapeutic dose antipsychotic medication at baseline, (v) with less than two-years total exposure to antipsychotic medication, and (vi) engaged with the KBIM program for at-least once session between January 2015 and December 2019.

2.3 | Intervention

KBIM teams were based at each of the three community mental health services within SESLHD and consisted of a clinical nurse consultant, dietician, exercise physiologist, and peer worker. The clinical nurse consultant provided program oversight, metabolic screening and education, and was responsible for program reach and adoption. The dietician and exercise physiologist led nutrition and physical

activity components, respectively. The peer worker aided in program adoption, engagement and retention, and implementation of strategies devised by the dietician and exercise physiologist with individual participants.

KBIM program elements were delivered in line with the model of care developed for the pilot study (Curtis et al., 2016), with the notable difference that participants at baseline did not need to be within the first 4 weeks of antipsychotic exposure. With the inclusion of new sites, central components of the model of care remained consistent, however, there were some nuances that developed between sites to implement the program effectively. Training and supervision across the sites is an ongoing component of the KBIM clinical service. Intervention included both individualized and group components. Dietician consultations were offered weekly and included education based on topics such as portion sizes, practical skills training such as shopping and cooking, and behaviour change techniques including motivational interviewing and goal setting. The exercise physiologist offered individual consultations to develop and review individualized exercise programs and incorporated behaviour change techniques including motivational interviewing and goal setting.

Participants completed a pre-exercise screening before engaging in physical activity with KBIM to identify people that had medical conditions which put them at risk of an adverse event during physical activity (Norton, 2011). Physical activity recommendations and devised exercise programs were informed by the pre-exercise screening and based on the World Health Organization's recommendation for physical activity (World Health Organization, 2010) and American College of Sport Medicine resistance training guidelines (Ratamess et al., 2009). Participants had access to a free, onsite gym, open 5 days per week, and supervised by the exercise physiologist and/or student exercise physiologists. Each of the three community gyms were fully equipped for aerobic and resistance training. Group components included a weekly, onsite, cooking group led by the dietician and a weekly sports group led by the exercise physiologist. The KBIM team employed a person-centred, strengths-based and recovery-orientated approach to tailor interventions according to individual goals, strengths and needs.

The KBIM program aimed to see participants weekly, though the type and number of sessions was dependent on the goals and preferences of the participant. A loss of engagement was defined as a period of no contact for at least 2 weeks or the participant declining to participate in any sessions offered. As a real-world evaluation of a clinical service, a loss of engagement did not preclude a person from re-engaging with the KBIM program.

2.4 | Outcome measures

The primary outcomes were anthropometry: body weight, body mass index (BMI), and waist circumference. Secondary outcomes were blood pressure and metabolic biochemistry: blood glucose and blood lipids (total cholesterol, high-density lipoprotein [HDL], low-density lipoprotein [LDL], and triglycerides). Implementation elements were program adoption, engagement, and retention. Demographic and clinical details were also obtained from participants electronic medical records (eMR).

Primary and secondary outcomes were collected as part of routine clinical assessment and in line with best practice guidelines (Curtis et al., 2012; Galletly et al., 2016). Baseline (date of initial session) and follow-up anthropometric and pathology results (~12 weeks post the intervention) were collected using metabolic monitoring reports extracted from the electronic medical records. Measurements from the metabolic monitoring reports were included if the assessment was performed within 4 weeks before or after the first and last session date for anthropometric measures and blood pressure, and up to 3 months pre initial appointment and 3 months post final appointment for biochemistry. Progress notes within eMR were searched manually for any missing data.

Body weight was measured by OMRON HN-283 digital scales to the nearest 0.1 kg, with the client barefoot and wearing light clothing. Height was measured using a stadiometer to the nearest 1 cm. BMI was calculated as weight (kg)/height^2 (m), and categorized according to World Health Organization classifications (World Health Organization, 1995). Clinically significant weight gain was defined as >7% of baseline weight. Waist circumference was measured horizontally at the navel at the end of expiration to the nearest 0.1 cm. Waist circumference was categorized as 'at risk' according to ethnic specific values from the International Diabetes Foundation (IDF) criteria: Europids (≥80 cm for females and ≥94 cm for males) and Asian people (≥80 cm for females and ≥90 cm for males) (Alberti et al., 2006). Blood pressure was measured using a sphygmomanometer with the client in a seated position and reported as millimetres of mercury (mmHg). Normal blood pressure reference ranges were: systolic blood pressure <130 mmHg, and diastolic blood pressure <85 mmHg (Alberti et al., 2006).

Metabolic bloods (lipids and glucose) were collected and analysed following a 10-h fast by a pathology service and reported as millimoles per litre (mmol/L). In the event of a non-fasting test, blood glucose was reported as random. Normal reference ranges for metabolic biochemistry were: total cholesterol <5.6 mmol/L, LDL ≤4.0 mmol/L, HDL ≥1.03 mmol/L men and ≥1.29 mmol/L women, triglycerides <1.7 mmol/L, fasting glucose <5.6 mmol/L, and random glucose <7 mmol/L (Alberti et al., 2006).

Participant demographic and clinical information extracted were: age, sex, affective or non-affective psychosis, psychotropic medication prescription, and metformin prescription. Antipsychotic medications were categorized as higher metabolic activity potential or lower metabolic activity potential in line with the classification developed for the Psychosis Metabolic Risk Calculator (Perry et al., 2021). Implementation outcomes documented included number of people who engaged with KBIM, number of sessions attended, and number of participants retained within the program at 12 weeks.

2.5 | Statistical analysis

Categorical descriptive statistics (sex, affective or non-affective psychosis, psychotropic medication prescription, BMI risk category, waist

circumference risk category, abnormal metabolic biochemistry) were reported as frequencies (*n*, %). Data distribution for continuous variables was assessed through histograms, and skewness and kurtosis values. Continuous descriptive statistics (age, length of exposure to antipsychotic medication, anthropometry) were reported as mean and standard deviation (SD) due to normal distributions.

Independent samples *t*-tests and Chi-Square analyses were used to test for baseline differences in age, sex, weight, BMI, waist circumference and time on antipsychotic medication between the 134 who engaged with KBIM and had follow-up data and the 48 who engaged and did not have follow-up data. Paired-samples *t*-tests were used to test for differences between pre and post values for primary and secondary outcomes in the total sample. Analysis of Covariance (ANCOVA) tests with baseline weight and engagement with individual intervention elements as covariates were used to assess interaction with weight change scores. Statistical significance was set at $p < .05$. All statistical analyses were calculated using SPSS v25 (IBM Corp, NY, USA).

3 | RESULTS

A total of 348 young people were identified via eMR reports and reviewed for inclusion in the study. After excluding people with known engagement with KBIM prior to 2015 ($n = 17$), those outside of the age criteria ($n = 31$), those who did not meet antipsychotic criteria ($n = 38$), those who did meet diagnosis criteria ($n = 63$) and those who met inclusion criteria for this study but did not engage in a full session/assessment with KBIM ($n = 17$), 182 people were included in the study. Table 1 details the baseline demographic, clinical, and physical health details. Participants had a mean age of 21.1 years (SD = 2.8), and were mostly male (70%), with non-affective psychosis (74%) and had a mean antipsychotic medication exposure of 5.6 months (SD = 6.0) on entry to the KBIM program.

Medication alterations during the 12-week intervention for those with follow-up measures were: antipsychotic polypharmacy to a single antipsychotic ($n = 3$), single antipsychotic to antipsychotic polypharmacy ($n = 1$), ceased antipsychotic medication ($n = 3$), ceased antipsychotic medication and continued mood stabilizer medication ($n = 2$), and switched antipsychotic medication ($n = 13$). Of the 13 people who switched antipsychotic medication, three switched from a higher metabolic risk potential medication to a lower metabolic risk potential medication. Nine participants were prescribed metformin during the KBIM program.

The mean number of engagements with the KBIM program was 11.1 sessions (SD = 7.3), ranging from 1 to 30 sessions. Mean number of engagements per intervention element were, in descending order: 5.2 (SD = 4.6) individual exercise physiologist sessions (including onsite gym), 2.9 (SD = 2.6) individual dietitian sessions, 1.3 (SD = 1.7) clinical nurse consultant sessions, 1.0 (SD = 2.2) sports group sessions, and 0.8 (SD = 1.5) cooking group sessions. There was a time by individual exercise physiologist/gym session interaction for weight ($F[1131] = 4.97$, $p = .03$), and no interaction for other intervention elements.

Frequency of measures being collected ranged from $n = 179$ (weight) to $n = 80$ (LDL) on entry to the KBIM program and $n = 134$ (weight) to $n = 48$ (HDL and LDL) at 12 weeks. People who completed at least one follow-up measure had been on antipsychotic medication longer than those who did not have at least one follow-up measure (27.6 ± 28.1 vs. 15.1 ± 17.6 weeks, $t(180) = 2.9$, $p < .01$). There was no difference in age, sex, baseline weight, BMI or waist circumference between those who completed at least one follow-up measure and those who did not. There was a mean weight gain of 1.5 kg (SD = 5.3, $t[133] = 3.2$, $p = .002$), and no significant increase in waist circumference (MD = 0.7 cm, SD = 5.8, $t[109] = 1.2$, $p = .23$). There was no change in blood pressure, blood lipids or glucose measures (all *p*'s ≥ .07). Further pre-post details on the total sample are presented in Table 2. Twenty-six of the 134 participants with pre-post data (19%) experienced clinically significant weight gain.

Weight change was similar when people who had potentially metabolically favourable changes to medication during the KBIM intervention (ceasing antipsychotic medication, transitioning from antipsychotic polypharmacy to a single antipsychotic, switching a higher metabolic risk potential medication to a lower metabolic risk potential medication, or metformin prescription) were removed from the analysis (MD = 1.7 kg, SD = 4.8, $t[116] = 3.8$, $p < .001$).

In people with less than 3 months exposure to antipsychotic medication, weight gain was limited to 1.8 kg (SD = 5.6, $t[58] = 2.5$, $p = .02$) and there was no change in waist circumference (MD = 0.9 cm, SD = 6.2, $t[50] = 1.0$, $p = .32$). In people with greater than 3 months exposure to antipsychotic medication, weight gain was limited to 1.2 kg (SD = 5.1, $t[74] = 2.1$, $p = .04$) and there was no change in waist circumference (MD = 0.5 cm, SD = 5.4, $t[58] = 0.7$, $p = .51$).

4 | DISCUSSION

Real-world data from the KBIM program found participants waist circumference did not increase and weight gain was limited to 1.5 kg (SD = 5.3). Further, weight-gain was limited to 1.8 kg (SD = 5.6) in people with less than 3 months exposure to antipsychotic medication. This finding differs considerably from that observed in young antipsychotic naïve and quasi-naïve people prescribed commonly used medications, who gained on averaged 5.8 ± 4.3 kg at 3 months, 8.1 ± 6.1 kg at 6 months and 11.7 ± kg at 12 months (Baeza et al., 2017).

Similarly, to the pilot project, clinically significant weight gain was experienced by <20% of KBIM participants (13% in the pilot study (Curtis et al., 2016), 19% in the current study). This is in stark contrast to the 75% who typically experience clinically significant weight gain when receiving standard mental health care (Alvarez-Jiménez et al., 2008).

Statistical analyses for metabolic biochemistry were limited by the proportion of participants for whom pre- and post-blood glucose and blood lipid data were available. For the people with available data, there were no significant changes in blood lipids or blood glucose. This differs from other studies that suggest unfavourable changes to glucose and lipids early in the course of antipsychotic treatment

TABLE 1 Baseline demographic, clinical and physical health details of participants.

		Total sample ($n = 182$)
Demographic		
Age (years)	Mean (SD)	21.1 ± 2.8
Male	*n* (%)	121 (70)
Clinical		
Affective psychosis	*n* (%)	47 (26)
APM exposure at baseline (months)	Mean (SD)	5.6 ± 6.0
Psychotropic medications	*n* (%)	
Antipsychotic		
Antipsychotic polypharmacy		23 (13)
Higher metabolic activity potential		106 (58)
Lower metabolic activity potential		53 (29)
Mood stabilizer		29 (16)
Antidepressant		56 (31)
Benzodiazepine		14 (8)
Additional medications		
Metformin		9 (5)
Carbemazapine		1 (1)
Lamotrigine		4 (2)
Anthropometry		
Weight (kg), ($n = 179$)	Mean (SD)	78.4 ± 19.0
BMI (kg/m^2), ($n = 179$)	Mean (SD)	26.0 ± 5.9
BMI category ($n = 179$)	*n* (%)	
Underweight (<18.5 kg/m^2)		2 (1)
Normal (18.5–24.9 kg/m^2)		92 (51)
Overweight (25.0–29.9 kg/m^2)		46 (26)
Obese (≥30 kg/m^2)		39 (22)
Waist circumference (cm), ($n = 164$)	Mean (SD)	90.3 ± 13.8
At risk	*n* (%)	79 (48)
Blood pressure (mmHg), ($n = 168$)	Mean (SD)	
Systolic		120.3 ± 12.2
Diastolic		73.8 ± 8.8
Biochemistry		
Lipids (mmol/L)	*n* (%)	
Elevated total cholesterol ($n = 117$)		12 (10)
Elevated LDL ($n = 80$)		3 (4)
Low HDL ($n = 84$)		22 (26)
Elevated triglycerides ($n = 115$)		20 (17)
Glucose (mmol/L)	*n* (%)	
Elevated fasting ($n = 100$)		12 (12)
Elevated random ($n = 7$)		2 (29)

Abbreviations: APM, antipsychotic medication; BMI, body mass index; HDL, high-density lipoprotein; LDL, low-density lipoprotein; SD, standard deviation.

(Arango et al., 2014; Correll et al., 2009). This may reflect a preference for prescribing antipsychotic medications with lower potential to drive blood glucose and blood lipid changes, minimal weight change and no waist circumference change during the 12 weeks, and/or improvements in diet quality and cardiorespiratory fitness (not reported in this study).

As a real-world study, medication changes reflected general prescribing practices of psychiatrists among early psychosis programmes

TABLE 2 Pre-post measures for anthropometric and biochemical outcomes for the total sample.

Outcome	Pre (mean, SD)	Post (mean, SD)	Mean difference (mean, 95% CI)	Paired samples *t*-test	*p* Value
Weight (kg), ($n = 134$)	78.3 ± 19.3	79.8 ± 19.2	1.5 (0.6 to 2.4)	$t(133) = 3.2$	**.002**
BMI (kg/m^2), ($n = 134$)	26.0 ± 6.1	26.5 ± 6.2	0.5 (0.2 to 0.8)	$t(133) = 3.1$	**.002**
WC (cm), ($n = 110$)	90.3 ± 13.3	90.9 ± 12.7	0.7 (−0.4 to 1.7)	$t(109) = 1.2$	.23
Systolic BP (mmHg), ($n = 115$)	120.5 ± 12.7	118.7 ± 12.5	−1.8 (−4.1 to 0.5)	$t(114) = -1.6$	.12
Diastolic BP (mmHg), ($n = 115$)	73.7 ± 9.1	72.6 ± 9.1	−1.1 (−3.1 to 0.8)	$t(114) = -1.2$	.25
Total cholesterol (mmol/L), ($n = 48$)	4.4 ± 1.1	4.6 ± 1.0	0.2 (−0.1 to 0.5)	$t(47) = 1.9$	.07
LDL (mmol/L), ($n = 29$)	2.7 ± 0.9	2.7 ± 0.9	−0.03 (−0.3 to 0.3)	$t(28) = 0.2$	.86
HDL (mmol/L), ($n = 29$)	1.2 ± 0.3	1.3 ± 0.4	0.1 (−0.01 to 0.2)	$t(28) = 1.8$	.08
Triglycerides (mmol/L), ($n = 48$)	1.5 ± 1.4	1.5 ± 1.1	0.1 (−0.2 to 0.3)	$t(47) = 0.4$	.66
Fasting glucose (mmol/L), ($n = 40$)	4.9 ± 0.6	4.9 ± 0.5	0.0 (−0.2 to 0.2)	$t(39) = 0.0$	1.00

Abbreviations: BMI, body mass index; BP, blood pressure; HDL, high-density lipoprotein; LDL, low-density lipoprotein; WC, waist circumference.

in SESLHD. There is a tendency to remove antipsychotic polypharmacy where possible, and switch to medications with lower potential for metabolic effects, for example, switching olanzapine to aripiprazole, in line with clinical practice guidelines (Curtis et al., 2012; Galletly et al., 2016).

A small number of participants were prescribed metformin as a preventative agent prior to engagement with the KBIM program. For the 19% who experienced clinically significant weight despite engaging in the KBIM program, metformin should be considered as an additional strategy to manage physical health (Correll et al., 2013; Newall et al., 2012). The KBIM program appeared to be effective in both people with favourable changes to the metabolic potential of their medication regime and those who did not. In line with the broader literature and positive cardiometabolic algorithms, best practice for physical health management should include mindful antipsychotic medication prescribing, lifestyle intervention and metformin prescription when people gain clinically significant weight or develop blood glucose abnormalities (Curtis et al., 2012; Firth et al., 2019).

As anticipated, the program element with the greatest mean contacts was the exercise physiologist/gym sessions. This is a potential reason for the association found between this program element and weight. The onsite gym (one at each mental health service) was open 5 days per week, freely available to clients of the early psychosis programme and supervised by an exercise physiologist (with or without student exercise physiologists on clinical practicum) who provided individualized program and support during sessions. This contrasted with other elements such as dietician consults, cooking group and sports group, which were offered on a weekly basis.

Of the 182 program adopters between 2015 and 2019, >50% engaged in ≥10 sessions (considered high engagement) suggesting the program is acceptable. The peer worker role appears critical in increasing program adoption, engagement and retention, complimenting the skills of other team members in metabolic health education, and nutrition and physical activity intervention.

The inclusion of people greater than 3 months exposure to antipsychotic medication, who may have already experienced substantial weight gain, may have exaggerated the magnitude of effect. Further, the lack of a control group matched to demographic and clinical details means that the broader literature was relied upon to determine the magnitude of effect (Alvarez-Jimenez et al., 2008; Alvarez-Jiménez et al., 2008). We attempted to identify a matched control group by chart audit, however the pragmatic nature meant that participants commenced the program at varying times over the 5-year evaluation period and with varying prior exposures to treatment complicating the process of creating a matched control group of people who did not engage in KBIM. Further, there was a lack of follow-up data points on outcomes of interest. It is possible that people who engage with the KBIM program have greater engagement with the mental health service overall. As reports were generated based on KBIM contact, we were also not able to determine the true reach of the program across Early Psychosis Programmes. Finally, we were not able to determine the specific impact of individual program elements. However, it is possible that the KBIM intervention as a whole, by enhancing the profile of physical health care in the mental health service, may be more critical than any individual element of the program, given that participants gravitate towards the program elements that resonate with them.

This study adds further evidence that the Healthy Active Lives (HeAL) international declaration (www.iphys.org) target–less than 25% of people experiencing a first-episode of psychosis gaining clinically significant weight in the first 2 years of treatment–may be achievable in routine clinical practice (Shiers & Curtis, 2014). Early psychosis services could use this model as an platform, together with guidance from the 2019 Lancet Commission (Firth et al., 2019), to implement cardioprotective programs in usual care.

5 | CONCLUSION

The 12-week KBIM lifestyle program, offered as routine mental health care, appears effective in preventing increases in waist circumference and limiting weight gain in youth with first-episode psychosis in the early stages of antipsychotic medication treatment.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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