TBM

ORIGINAL RESEARCH

Telephone based coaching for adults at risk of diabetes: impact of Australia's Get Healthy Service

Leonie Cranney,[1,2] Blythe O'Hara,[1,2] Joanne Gale,[1,2] Chris Rissel,[1,3] Adrian Bauman,[1,2] Philayrath Phongsavan[1,2]

[1]Prevention Research Collaboration, Sydney School of Public Health, University of Sydney, Sydney, Australia

[2]Charles Perkins Centre, University of Sydney, Sydney, Australia

[3]NSW Office of Preventive Health, Liverpool, Australia

Correspondence to: L Cranney, leonie.cranney@sydney.edu.au

Cite this as: *TBM* 2019;XX:XX–XX
doi: 10.1093/tbm/ibz007

Abstract

The Get Healthy Information and Coaching Service (GHS), an effective 6-month telephone-based healthy lifestyle coaching service, includes a population-targeted diabetes prevention module (DPM) tailored for adults at risk for type 2 diabetes. This study determined DPM's reach and impact on anthropometric and lifestyle risk factors. Pre-post evaluation design examined self-reported anthropometric (body weight, waist circumference) and lifestyle risk factors (physical activity and dietary behaviors) of DPM participants. Descriptive and chi-square analyses were performed on sociodemographic variables. Behavioral changes were assessed using matched pairs analysis, independent samples analysis, and multivariate analysis. There were 4,222 DPM participants (76.0% female; 75.9% aged ≥ 50; 95.4% spoke English at home). The DPM included higher proportions of older adults (≥50) (75.9% vs. 46.5%; $p < .001$), retirees (28.7% vs. 18.5%; $p < .0001$), less educated (33.3% vs. 24.9%; $p < .0001$), more disadvantaged (41.7% vs. 34.8%; $p < .001$) and living in regional or rural areas (43.2% vs. 39.8%; $p < .001$) than the GHS program. DPM participants reported significant improvements at six months for all anthropometric (−3.3 kg weight; −1.2 BMI units; −4.3 cm waist circumference) and behavioral risk factors (+0.2 fruit serves/day; +0.7 vegetables serves/day; −0.2 sweetened drinks/day; −0.2 takeaway meals/week; +1.1 30-min walking sessions/week; +0.7 30-min moderate activity sessions/week; +0.2 20-min vigorous activity sessions/week). Nearly one-third (31.1%) of participants lost ≥5% body weight. The DPM reached priority population groups, those typically underrepresented in diabetes prevention programs and resulted in clinically relevant improvements in anthropometric and lifestyle risk factors in adults at increased risk for type 2 diabetes.

Keywords:

Telephone coaching, Diabetes, Lifestyle intervention, Obesity

Implications

Practice: A free telephone-based healthy lifestyle coaching service can reach priority population groups and is effective at reducing the risk profile of adults at risk of diabetes.

Policy: Policymakers who want to reduce the incidence of diabetes should consider telephone-based delivery of diabetes prevention lifestyle interventions to provide equitable access and reach priority populations.

Research: Future research should ascertain whether positive risk profile outcomes achieved by participants of telephone-based diabetes prevention lifestyle intervention can be maintained long-term in priority populations.

BACKGROUND

In 2014–2015 an estimated one million Australian adults had type 2 diabetes, representing 5% of the adult population [1]. This is likely to be an underestimation by around 20% [1]. The impact of diabetes on the individual and the community is substantial [2], diabetes is associated with a range of health complications and is one of the top ten causes of death in Australia [3].

Type 2 diabetes is largely preventable by maintaining a healthy lifestyle, and preventing associated risk factors in common with a number of other non-communicable diseases, including insufficient physical activity, unhealthy eating, and visceral adiposity [4]. In 2014–2015, 63.4% of Australian adults were overweight or obese (11.2 million people), nearly one in two (49.8%) adults met the recommended daily serves of fruit, while 7.0% met the guidelines for serves of vegetables; and only 44.5% of 18- to 64-year-olds participated in sufficient physical activity [5].

Weight loss is an important strategy for overweight or obese adults at risk of developing type 2 diabetes, and 5% body weight loss can produce positive health benefits [6, 7]. Programs targeting both diet and physical activity in those at risk for type 2 diabetes have demonstrated improvements in associated risk factors including weight loss, with more intensive programs achieving greater weight loss than less intensive programs [8–10]. These programs are typically delivered through face-to-face individual or group-based modalities [9], limiting their reach [11]. Studies have suggested telephone-based services that support adults at risk of developing type 2 diabetes are equally effective at reducing the risk of diabetes with comparable weight loss outcomes to face-to-face

Published online: XX XXXX 2019

programs [12–14]. They can overcome barriers to access including distance, transport, and time [11, 13, 14]; however, there is conflicting evidence on whether such services result in better retention than face-to-face programs [12, 14].

The Australian Get Healthy Information and Coaching Service (GHS) provides a free telephone-based coaching program for adults at risk of type 2 diabetes and other chronic diseases (www.gethealthynsw.com.au); it provides a real world example of translational research being scaled across the general population. The GHS has been successful in supporting participants in making sustained improvements in healthy eating, physical activity, and weight; and thereby decreasing their chronic disease risk profile [15, 16]. A specific module, the diabetes prevention module (hereafter referred to as DPM) targeting the prevention of type 2 diabetes was introduced in July 2013, based on the Sydney Diabetes Prevention Program (SDPP) [17], an effective face-to-face program for type 2 diabetes prevention that found comparable weight loss outcomes for participants receiving telephone-delivered individual sessions to those participating in face-to-face group sessions [12]. The SDPP lifestyle modification program comprised an initial individual session, three group sessions followed by three monthly contact with participants [17]. The SDPP was based on health coaching principles and focused on setting specific goals regarding physical activity and healthy eating delivered by lifestyle officers.

The purpose of this implementation research was to examine the reach and effectiveness of an efficacious face-to-face diabetes prevention lifestyle intervention (SDPP), brought to scale and adapted to an existing effective population telephone-based healthy lifestyle intervention service. This study describes the demographic characteristics, anthropometric and behavioral risk factors of DPM participants at baseline and 6 months, compared with GHS coaching participants. The study determined the magnitude of changes following exposure to DPM in anthropometric and behavioral risk factors, the proportion of participants who improved and their sociodemographic factors in comparison to GHS coaching participants.

METHOD

GHS coaching program

The GHS is available to all New South Wales adults via self-referral or referral from a health practitioner. Participants chose to receive detailed self-help materials or enroll in a personalized 6-month telephone coaching program, referred to as the GHS coaching program. The program comprised 10 individually tailored calls provided by qualified health coaches over a 6-month period on a tapered schedule, with a higher frequency of calls occurring in the first 12 weeks [18]. Coaches typically had a background in dietetics, exercise physiology and psychology, and received training and ongoing support in relation to health coaching and motivational interviewing. Where possible participants accessed the same health coach for the duration of their access to the program.

The DPM was introduced in July 2013 to provide greater support to GHS participants aged more than 40 years, and at risk of type 2 diabetes as determined by the valid and reliable Australian type 2 diabetes risk assessment tool (AUSDRISK) [19]. Participants with an AUSDRISK score of 12 or more were allocated to the DPM. Participants in this module received three extra coaching calls focused on individual risk for type 2 diabetes at the start of the 6-month program. Details regarding the GHS (including the structure, content, and length of calls) and its evaluation design and framework has been previously reported [15, 18].

Study design and participants

This study employed a pre- and post-test evaluation design, comprised of two cohorts: the GHS general coaching cohort and the DPM cohort and included those participants who gave consent for their data to be included in the study. Data from those enrolled in both cohorts between February 2009 and December 2015 were analyzed to assess the reach of the DPM. Data from those enrolled in both the GHS general coaching and the DPM between January 2014 and December 2015 were analyzed to assess program completion and impacts, including differences between cohorts; this census period was chosen to minimize the potential influence of the change in service provider that occurred in December 2013. Aboriginal GHS participants and GHS participants that received information only were excluded from the study. Participants that had missing data at baseline or 6 months were excluded from the analysis. The University of Sydney Human Research Ethics Committee granted ethics approval (ref. no. 02-2009/11570).

Data collection procedures and measures

The measures used to evaluate the GHS have been reported elsewhere [18]. Briefly, all measures were collected using computer-assisted telephone interviews by GHS coaches during GHS program delivery at baseline and 6 months.

Sociodemographic variables

Sociodemographic data included gender, date of birth, residential postcode, education level, employment status, language spoken at home, and Indigenous status. Participants' postcodes were used to determine Socio-Economic Indexes for Areas (SEIFA) [20], as a measure of area socioeconomic status, and Accessibility-Remoteness Index of

Australia Plus (ARIA) as a measure of geographical location remoteness [21].

Outcome measures

Anthropometric measures include self-reported weight (kg), height (cm), and waist circumference (cm), with BMI scores calculated on height and weight and categorized into: underweight (BMI < 18.5); healthy weight (18.5 ≤ BMI ≤ 24.99); overweight (25 ≤ BMI ≤ 29.99); and obese (BMI ≥ 30.00) [22]. Waist circumference risk was calculated differently for males (no risk < 94 cm, 94 cm ≤ increased risk < 102 cm, greatly increased risk ≥ 102 cm); and females (no risk < 80 cm, 80 cm ≤ increased risk < 88 cm, greatly increased risk ≥ 88 cm) [23]. A measurement validation GHS substudy showed moderate-strong correlation between these self-report and objective anthropometric measurements [15]. Physical activity was assessed by three validated questions (3Q-PA), and categories for recommended physical activity were defined by those engaging in ≥5 sessions per week of walking, or ≥5 sessions per week of moderate activity, or combinations of walking and moderate-vigorous activity summing to 5 sessions per week [24]. Participants reported consumption of the number of daily serves of fruit and vegetables and answers were categorized into those meeting the recommended levels of consumption of ≥2 serves of fruit daily, and ≥5 serves of vegetables daily in accordance with Australian Dietary Guidelines [25]. Proportional changes in body weight from baseline to six months were calculated, classified into ≥5% versus ≤5% body weight loss. Information for sociodemographic measures were collected at baseline only, and information on outcome measures were collected at baseline and 6 months.

Data analysis

Descriptive and chi-square analyses were performed on sociodemographic variables stratified by program type, program time period (baseline and 6 months) and program completion. To compare changes in key health-related behaviors from baseline to 6 months, paired *t*-tests were performed to examine within-individual changes in BMI, weight, and waist circumferences from baseline to 6 months, as these followed normal distributions. Nonparametric Wilcoxon signed-rank sum tests were performed to account for the non-normally distributed data for physical activity and nutrition. To compare differences between DPM and GHS participants independent sample analyses were conducted: *t*-tests were used for anthropometric data and Wilcoxon–Mann–Whitney tests for physical activity and nutrition data. Logistic regression was conducted to determine which factors were most associated with DPM participants achieving ≥5% weight loss. General linear modeling was conducted to examine the effects of sociodemographic variables, baseline risk factors, and program type (GHS vs. DPM) on 6-month weight change; the modeling included adjusting for (a) baseline demographics and (b) baseline demographics, baseline risk factors, and the interaction between program and baseline BMI. These variables were chosen to allow for variations in sociodemographic and risk factor profile between DPM and GHS participants, the potential influence of baseline BMI and the impact of the program itself. Data were cleaned and analyzed using SAS software, Version 9.4. (SAS Institute, Inc., Cary, NC).

RESULTS

Sociodemographic, anthropometric, and risk factor profile

Between July 2013 and December 2015, 4,222 participants enrolled in the DPM, the majority were female, aged ≥50, and spoke English at home (Table 1). In comparison to participants of the general GHS program, DPM had significantly higher proportions of older adults (≥50), retirees, less educated, more disadvantaged, English speaking and living in regional or rural areas. DPM participants also had higher proportions of adults that were obese, had a greatly increased waist circumference and were insufficiently active at baseline.

Anthropometric and behavioral risk factor changes at 6 months

Between January 2014 and December 2015, 3,288 participants enrolled in the DPM. DPM participants reported significant improvements in all anthropometric (−3.3 kg weight; −1.2 BMI units; −4.3 cm waist circumference) and behavioral risk factors (+0.2 fruit serves/day; +0.7 vegetables serves/day; −0.2 sweetened drinks/day; −0.2 takeaway meals/week; +1.1 30-min walking sessions/week; +0.7 30-min moderate activity sessions/week; +0.2 20-min vigorous activity sessions/week) from baseline to 6 months (Table 2).

The proportion of DPM participants that were obese or had a greatly increased waist circumference decreased from baseline to 6 months (Figure 1). There were increased proportions of DPM participants from baseline to 6 months for: meeting the recommended daily serves of vegetables (12.6%–24.1%); recommended daily serves of fruit (50.5%–69.6%) and undertaking sufficient physical activity levels (32.4%–53.8%).

Nearly one-third (n = 192; 31%) DPM participants lost 5% or more of their body weight at 6 months, with significantly higher proportions of older adults (≥50 years) (33.4% vs. 22.3%; $\chi^2 = 5.56$; $p < .05$) and those sufficiently active at baseline (36.82% vs. 28.09%; $\chi^2 = 5.0$; $p < .05$) than those that did not achieve this weight loss. After adjusting for sociodemographic variables and baseline risk factors participants whose highest level of education was Year 10 or

Table 1 | Baseline sociodemographic characteristics and risk factor profile of GHS diabetes prevention module and GHS general coaching participants (enrolled between February 2009 and December 2015)

	Diabetes prevention module[a] participants		General GHS coaching participants	
Characteristics	*N*	%	*N*	%
Sociodemographics				
Gender				
Female	3,209	76.0	16,780	74.8
Male	1,013	24.0	5,662	25.2
Age**				
18–49	1,019	24.1	11,998	53.5
≥50	3,202	75.9	10,439	46.5
Education**				
Certificate/diploma or higher	2,152	51.4	13,109	58.8
High school	2,036	48.6	9,179	41.2
≤Year 10***	1,393	33.3	5,548	24.9
Employment**				
Paid employment	1,946	46.4	12,493	56.0
Other	2,245	53.6	9,816	44.0
Retired***	1,204	28.7	4,125	18.5
SEIFA**				
Least disadvantaged (1st, 2nd and 3rd quintile)	2,452	58.3	14,586	65.2
Most disadvantaged (4th and 5th quintile)	1,755	41.7	7,774	34.8
Language**				
English	4,028	95.4	20,843	92.9
Other	194	4.6	1,600	7.1
Region**				
Major city	2,384	56.8	13,455	60.2
Other	1,816	43.2	8,897	39.8
Risk factors				
Overweight***	822	24.9	5,642	33.5
Obese***	2,291	69.4	8,525	50.6
Increased waist circumference[b,]***	184	5.7	2,180	17.2
Greatly increased waist circumference[b,]***	2,929	91.2	9,212	72.5
Less than 2 serves of daily fruit**	1,689	49.6	8,756	52.8
Less than 5 serves of daily vegetables	2,983	87.4	14,661	88.4
Insufficient physical activity[c,]*	2,296	67.6	10,546	65.1

[a]Introduced July 2013.
[b]Waist circumference risk was computed differently for males and females. For males: increased risk ≥94 and ‹102 cm, greatly increased risk ≥102 cm; for females: increased risk ≥80 cm and ‹88 cm, greatly increased risk ≥88 cm.
[c]Insufficient physical activity is defined as not engaging in ≥5 sessions per week of walking, or ≥5 sessions per week of moderate activity, or 3–4 sessions per week of walking and ≥1–2 sessions per week of moderate activity, or ≥1–2 sessions per week of walking and 3–4 sessions per week of moderate activity.
*$p < .01$, **$p < .001$, ***$p < .0001$ (χ^2 tests).

below [adjusted odds ratio (AOR): 1.73 (1.12, 2.67)] and those with sufficient physical activity at baseline [AOR: 1.77 (1.16, 2.69)] were significantly more likely to lose 5% or more of their body weight at 6 months.

There were no significant differences between the degree of improvements made by DPM and GHS cohorts in regard to anthropometric and most behavioral risk factors from baseline to 6 months, with the exception of GHS participants having significantly greater improvements in vegetable and takeaway consumption (Table 2).

After controlling for sociodemographic variables and baseline risk factors improvements in weight change remained significant for all participants; with the fully adjusted model (baseline sociodemographics, risk factors, and the interaction between program and baseline BMI) results (mean change (95% CI)) demonstrating no significant differences between DPM and GHS cohorts for 6-month weight changes [DPM: −3.4 kg (−4.7, −2.1); GHS: −3.5 kg (−4.7, −2.3) (type III p = .2)].

Table 2 | Anthropometric and behavioral risk factor changes from baseline to 6 months for diabetes prevention module and general Get Healthy Information and Coaching Service (GHS) participants (January 2014–December 2015)

	Diabetes prevention module (DPM) participants				General GHS participants			
Risk factors	*N* (baseline to 6 month change)	Baseline	6 months	Mean change (baseline to 6 months)	*N* (baseline to 6 month change)	Baseline	6 months	Mean change (baseline to 6 months)
Weight (kg)[a]								
Mean	615	94.0	90.8	−3.3**	763	84.3	81.4	−2.9
(*SD*)		(22.3)	(22.1)	(5.7)		(20.6)	(19.8)	(5.9)
BMI (kg/m^2)[a]								
Mean	571	34.5	33.3	−1.2**	724	30.2	29.2	−1.0
(*SD*)		(7.3)	(7.2)	(2.1)		(6.6)	(6.3)	(2.0)
Waist circumference (cm)[a]								
Mean	534	109.0	104.7	−4.3**	580	97.6	93.7	−4.2
(*SD*)		(15.4)	(15.3)	(8.3)		(15.7)	(14.4)	(7.4)
Fruit (daily serves)[b]								
Mean	717	1.6	1.8	0.2**	859	1.5	1.8	0.3
(*SD*)		(1.2)	(0.9)	(1.1)		(1.2)	(0.9)	(1.1)
Vegetables (daily serves)[b]								
Mean	717	2.6	3.3	0.7**	859	2.5	3.4	0.9*
(*SD*)		(1.6)	(1.5)	(1.4)		(1.6)	(1.5)	(1.4)
Sweetened drinks (daily serves)[b]								
Mean	708	0.4	0.2	−0.2**	854	0.5	0.2	−0.2
(*SD*)		(1.1)	(0.7)	(1.0)		(1.3)	(0.7)	(0.9)
Takeaway meals (weekly serves)[b]								
Mean	710	0.7	0.4	−0.2**	849	1.2	0.8	−0.4*
(*SD*)		(1.2)	(0.9)	(1.1)		(1.7)	(1.1)	(1.2)
Walking (no. 30 min sessions per week)[b]								
Mean	718	2.4	3.5	1.1**	868	2.5	3.4	0.9
(*SD*)		(2.6)	(2.8)	(2.9)		(2.7)	(3.0)	(2.8)
Moderate physical activity (no. 30 min sessions per week)[b]								
Mean	715	1.0	1.7	0.7**	859	1.0	1.9	0.8
(*SD*)		(1.9)	(2.3)	(2.3)		(1.9)	(2.4)	(2.4)
Vigorous physical activity (no. of 20 min sessions per week)[b]								
Mean	714	0.3	0.5	0.2***	858	0.6	0.9	0.3
(*SD*)		(1.1)	(1.4)	(1.4)		(1.5)	(1.8)	(1.6)

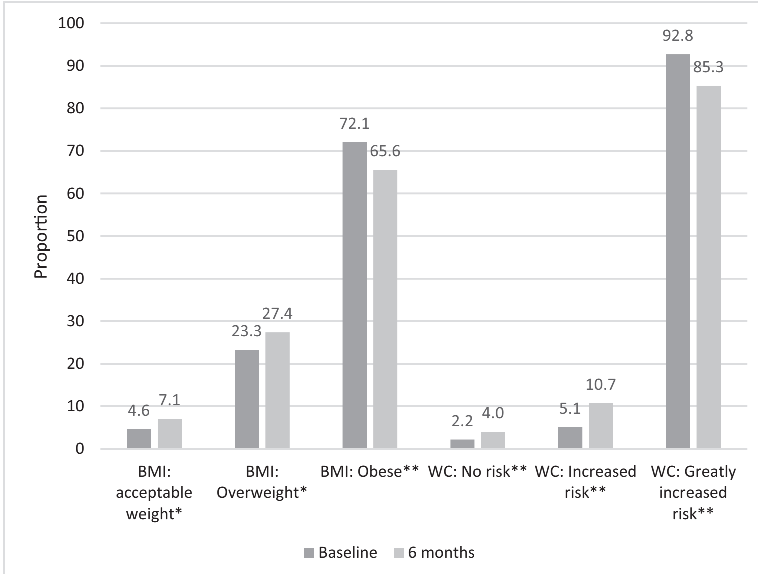
[a]*t*-Test undertaken for significant mean difference between matched paired samples (DPM) and between independent samples (DPM vs. GHS).
[b]Nonparametric test undertaken for significant median difference between related samples (DPM) and independent samples (DPM vs. GHS).
*$p < .01$ (independent samples analysis), **$p < .0001$ (matched pair analysis), ***$p < .001$(matched pair analysis).

DPM completers' characteristics

Just under half (n = 1,584; 48.2%) of DPM participants withdrew from the program and less than one quarter of DPM participants (n = 958; 29.1%) completed the program (i.e., completed all 13 sessions). DPM had a significantly higher proportion of completers and lower proportion of those that withdrew than the GHS program (56.1%; and 20.5%, respectively χ^2 = 88.02; $p < .0001$). DPM completers had significantly higher proportions of the following groups compared with those who withdrew from the service: males (23.9% vs. 19.8%; χ^2 = 5.91; $p < .05$); aged ≥ 50 (81.0% vs. 70.7%; χ^2 = 33.48; $p < .0001$); not in paid employment (61.6% vs. 46.5%; χ^2 = 54.39; $p < .0001$); retired (37.3% vs. 24.3%; χ^2 = 48.19; $p < .0001$); living in the most disadvantaged suburbs (4th and 5th SEIFA quintiles) (43.8% vs. 39.7%; χ^2 = 4.15; $p < .05$); living in a rural or regional area (50.0% vs. 43.3%; χ^2 = 10.46; $p < .01$).

DISCUSSION

This study found significant improvements in body weight, waist circumference, nutrition practices, and physical activity in adults at increased risk for type 2 diabetes that participated in a diabetes prevention program delivered by telephone. The average weight loss achieved by DPM participants was 3.3 kg and nearly one-third of DPM participants lost 5% or more of their body weight. This level of improvement in body weight has been associated with significant health benefits and reduced risk of diabetes [6–8, 26, 27]. These weight reduction outcomes are



Denotes significant difference between proportions at baseline and 6 months at *p<0.05;

**p<0.01

Fig. 1 | Proportion of diabetes prevention module (DPM) participants in classifications for body mass index (BMI) and waist circumference (WC) risk at baseline and 6 months. Significant difference between proportions at baseline and 6 months at $*p < .05$; $**p < .01$.

comparable with other diabetes prevention lifestyle interventions [8, 28], including those delivered by telephone [11, 13], and those delivered primarily face-to-face and of longer duration [12, 17, 27, 29, 30]. Our findings add to the evidence that telephone delivery of diabetes prevention lifestyle interventions may be as effective as face-to-face delivery [12–14].

DPM participants' improvements in weight, BMI, and waist circumference were slightly better than GHS participants, however not significantly. The DPM had a significantly larger proportion of participants at baseline who were obese and had a greatly increased waist circumference, as expected due to the screening procedures. Significantly better outcomes might be expected for DPM participants compared with general GHS participants, given their higher baseline risk factors and the more intense intervention received. Other studies have attributed higher mean baseline BMI to greater weight reduction outcomes in diabetes prevention lifestyle programs [8, 28]; however our study controlled for baseline BMI and there were no differences in the outcomes of GHS and DPM participants. The profile of participants also differed, with DPM participants more likely to be older, retired, less educated, more disadvantaged, and living in regional or rural areas than the GHS participants; a finding which suggests that the DPM program is meeting the needs of those communities who traditionally may be less likely to access health services.

The DPM has provided equitable access to a diabetes prevention lifestyle intervention, reaching priority population groups, with significantly higher proportions of unemployed, those living in disadvantaged, regional or rural areas enrolled in and completing the DPM compared with the GHS program. These findings are encouraging given the increasing diabetes-related hospitalizations and deaths associated with increasing socioeconomic disadvantage and remoteness [31–33] and the fact these groups are typically underrepresented in diabetes prevention programs [29, 34]. However, the proportion of participants completing the program, while similar to the GHS program [15], is low compared with some face-to-face diabetes prevention lifestyle interventions [12, 30]. The evidence is uncertain on whether face-to-face or telephone-based diabetes prevention lifestyle programs results in greater retention [12, 14], one study found better retention in a group-delivered program [12], yet another reported telephone-delivery resulted in better engagement and retention due to flexibility of call scheduling and increased accessibility [14]. Strategies and incentives to encourage completion of the 6-month DPM coaching program should be explored, given the significant improvements achieved by completing participants and their potential health benefits.

Males were underrepresented in the DPM, similar to the GHS coaching program [15] and to other diabetes prevention programs [12, 29, 34, 35]. Encouragingly, DPM completers had significantly higher proportions of males than those that withdrew from the service. Engagement and retention strategies targeting males are particularly important for the DPM and diabetes prevention programs more broadly [29, 34, 35], given the increased diabetes prevalence and associated hospitalizations and deaths for males [31–33].

The majority of DPM participants were English-speaking, similar to other diabetes prevention programs in Australia [12, 34] and the GHS program. Given the increased risk of diabetes in certain ethnic groups, strategies to increase the engagement of these groups are needed. Previous formative research revealed limited awareness and uptake of the GHS by the Australian Chinese community and identified engagement strategies that may broadly apply to non-English speaking communities that are being tested.

The DPM had significantly higher proportions of older adults and retirees compared with the GHS coaching program. This finding was expected, as the AUSDRISK screening procedure [19] used to allocate GHS participants to the DPM includes age as a risk factor due to the increased diabetes prevalence in older adults [32] and is consistent with other Australian diabetes prevention programs [12, 34]. It is notable and encouraging that DPM completers had higher proportions of these groups compared to noncompleters and a significantly greater proportion of older adults achieved weight loss of 5% or more, given the increased hospitalizations with age [33]. Our findings support the evidence indicating older adults may be more receptive to behavioral weight loss interventions than younger adults [6, 36].

A limitation of this study includes the reliance on self-reported data, with the potential for social desirability bias inflating positive outcomes. Previous GHS measurement validation research demonstrated acceptable reliability of self-reported weight, height, waist circumference, physical activity, and nutrition indicators [15], however results should be interpreted with consideration of these limitations. Long-term follow-up is needed to determine whether DPM participants' improved anthropometric and behavioral outcomes are maintained. Demonstration of 6-month post-program maintenance of these outcomes has been demonstrated for the GHS [16], and determining the maintenance of such outcomes in this high-risk population will be important.

A further limitation of this study is the missing data evident at baseline and 6-months and while the improvements made by participants in this study are in line with those previously reported [15, 16], the results of this study again should be interpreted in consideration of this limitation. Finally, evaluation of the GHS does not include a comparison group, this was not feasible or appropriate for a population wide service, and the evaluation represents a compromise between scientific rigor and the real world complex service that is GHS.

CONCLUSION

This study demonstrated significant positive anthropometric and behavioral risk factor changes in participants of a telephone-delivered diabetes lifestyle prevention program that were at increased risk of type 2 diabetes. Weight reduction outcomes achieved have been associated with significant health benefits and reduced diabetes risk. They are also comparable with other diabetes prevention lifestyle interventions, including face-to-face and more intensive programs, indicating telephone delivery may be a suitable alternative, with strategies to improve retention. The DPM reached and retained older adults and priority population groups, including those unemployed or living in disadvantaged, regional, or rural areas. However, males and those that spoke a language other than English were underrepresented and additional engagement and retention strategies for these at-risk groups are needed. Further research to ascertain whether the positive outcomes demonstrated are maintained long-term in these priority populations is required.

Compliance with Ethical Standards

Funding This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgments We thank the participants of the GHS modules. We also thank Healthways and Medibank Health Solutions, the NSW Ministry of Health and the Office for Preventive Health for facilitating data access.

Conflict of Interest Dr Chris Rissel is Director of the Office of Preventive Health, which is responsible for the GHS. All other authors declare that they have no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study. This article does not contain any studies with animals performed by any of the authors.

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