

Article

Can Health Improvements from a Community-Based Exercise and Lifestyle Program for Older Adults with Type 2 Diabetes Be Maintained? A Follow up Study

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Abstract: Background: Older people consistently report a desire to remain at home. *Beat It* is a community-based exercise and lifestyle intervention that uses evidence-based strategies to assist older people with type 2 diabetes mellitus (T2DM) to improve physical and functional fitness, which are crucial to maintain independence. This follow up, real-world study assessed the efficacy of *Beat It* and whether older adults with T2DM were able to maintain improvements in physical activity, waist circumference and fitness one year post completion. Methods: We have previously reported methods and results of short-term outcomes of *Beat It*. This paper reports anthropometric measurements and physical fitness outcomes of *Beat it* at 12-months post program completion and compares them to validated standards of fitness required to retain physical independence. Results: Improvements that were observed post program were maintained at 12 months ($n = 43$). While the number of participants who met fitness standards increased post program, not all increases were maintained at 12 months. Conclusions: This study provides promising early evidence that an eight-week, twenty-hour community-based clinician-led exercise and lifestyle program can improve health outcomes in older adults with T2DM which were retained for at least a year after program completion.

Keywords: independent living; functional fitness; exercise; lifestyle; diabetes; exercise physiologist



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1. Introduction

In the field of health research, “translation” is the process through which breakthroughs in science are used to improve human health [1]. Research conducted in ‘real-world’ settings is essential to improving population health outcomes [2], particularly when we consider that it can take up to 17 years for research findings to be translated into practice [3]. Implementation focused healthcare research situated in real world settings is fundamental to rapid translation.

Type 2 diabetes (T2DM) is one of the fastest growing health challenges this century, with the number of adults with diabetes more than tripling in 20 years [4]. The aging population is contributing to the diabetes epidemic, with older adults representing a rapidly growing group of people with T2DM [5]. Regular physical activity is fundamental to T2DM management and essential in its prevention. However, two-thirds of older Australians do not meet physical activity guidelines [6]. The importance of maintaining functional fitness to support everyday activity and maintain independence is well established in the literature [7–10]. In people with T2DM, poor physical fitness is associated with mortality from all causes and the risk of falls [11–13]. In contrast, good physical fitness is well known to extend years of active independent living, reduce disability and improve the quality of life for older people [14]. Interventions aimed to motivate and increase physical activity

levels in older adults with T2DM are needed, and our earlier results about *Beat It* provided promising initial outcomes for people over 60 [15].

In the general adult population, supervised group exercise sessions are an accepted and effective strategy for increasing physical activity in community-settings [16,17]. In older adults with T2DM, small-scale community-based supervised group exercise programs have demonstrated effectiveness in improving physical fitness in the short term (immediately post-intervention) [15,18–22], with few follow-up studies demonstrating that these improvements can be maintained for up to one year [23,24]. It is not clear whether such programs delivered across urban and regional community settings can deliver and maintain improvements in physical fitness and other health indicators over the long term.

Beat It is an eight-week community-based clinician-led group exercise and education program that supports adults self-managing diabetes. It was first established by Diabetes NSW and ACT and is currently funded by the National Diabetes Services Scheme (NDSS). The eight-week health and physical fitness outcomes from this program have been published elsewhere [15]. This follow up study is aimed at assessing whether participants in this program were able to maintain improvements in physical activity levels, waist circumference and fitness (muscular strength and power, aerobic endurance, balance, and flexibility) one year post completion.

2. Materials and Methods

The eight-week *Beat It* program design, study recruitment and measures have been reported elsewhere [15]. In brief, *Beat It* consisted of group exercise sessions conducted twice each week under the supervision of an Accredited Exercise Physiologist (AEP). These sessions included a variety of moderate-intensity resistance, aerobic, flexibility and balance exercises. Each participant had a one-on-one initial consultation with the AEP, which included pre-exercise screening, baseline health and fitness measures and goal setting. Additionally, participants were provided with six group diabetes self-management education sessions over the eight-week period. To deliver the program, all AEPs completed a specialized facilitator training program, with this certification being refreshed every two years.

This study employed a pre-post evaluation design where participants completed in-person physical assessment sessions at baseline, eight weeks, and 12 months post program. Gender, date of birth, and residential postcode were collected. Socioeconomic status was estimated as previously described [15] using the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD), which ranks postcodes by relative socioeconomic advantage and disadvantage [25]. IRSAD was dichotomised into top and bottom 50% of deciles. In addition to sociodemographic variables, the study collected body mass index (BMI), waist circumference, lower body strength, aerobic capacity, flexibility, and balance. Participants with missing data for gender, age, postcode, waist circumference, and the physical assessment measures: 30 s sit-to-stand test, six-minute walk test (6MWT), and the chair sit-and-reach test, were excluded from analysis.

The number of days per week participants engaged in aerobic and resistance exercise was collected at each timepoint. Aerobic exercise was dichotomised into less than three and three or more times per week, and resistance exercise was dichotomised into less than two, and two or more times per week.

Participants were asked to rate their willingness to include planned exercise in the management of their diabetes, and their confidence to exercise using a 5-point LIKERT scale. At the 12-month timepoint, 5-point LIKERT scales were used to record whether participants consumed more vegetables; less unhealthy food; and included more incidental activity in their daily lives. These questions were constructed by Diabetes NSW and ACT specifically for the purpose of evaluating the initiative, and as such, are not validated tools (Supplementary Material). This study was approved by the Macquarie University Human Ethics Committee, protocol number 5201950887424.

Data analysis was performed using SPSS version 27 (SPSS Inc, Chicago, IL, USA). Mean and standard deviations (SD) were calculated for continuous variables. Frequencies and percentages were calculated for categorical variables, excluding participants with missing data for that variable.

3. Results

A total of 43 people were included in the study. They attended the program at eight different locations across urban and regional New South Wales (NSW), were aged 60 years and over, had a diagnosis of T2DM, and had participated in *Beat It*. Of this cohort, 31 (72.1%) were female, age ranged from 61 to 81 years with a mean age 69.0 ± 4.2 years, 52.6% were born overseas, and 94.3% spoke English at home. Over one-third (37.2%) of participants were from lower socio-economic regions, and 58.1% resided within a major city, with the remainder residing in inner regional towns.

Improvements in waist circumference, aerobic capacity, strength, flexibility, and balance were observed post-program in both male and female participants, which were maintained at 12 months (Table 1 and Figure 1). The number of participants who met the fitness standards considered appropriate for healthy independent living for older individuals increased post program, however not all increases were maintained at 12 months (Table 2). At 12 months, an increase in the proportion of participants who performed aerobic exercise three or more times per week (45.9% vs. 54.5%) and resistance exercise two or more times per week (32.4% vs. 58.8%) compared to baseline, was reported.

Table 1. Anthropometric and Fitness Assessment measurements.

	Male (<i>n</i> = 12)			Female (<i>n</i> = 31)		
	Baseline Mean (SD)	8 Weeks Mean (SD)	12 Month Mean (SD)	Baseline Mean (SD)	8 Weeks Mean (SD)	12 Month Mean (SD)
Weight (kg)	95.1 (23.1)	95.2 (23.1)	94.3 (21.6)	83.9 (18.3)	83.1 (17.5)	82.6 (17)
Waist circumference (cm)	111.1 (16.7)	107.5 (16.5)	107.4 (14.3)	107 (15.2)	103.2 (13.8)	105.4 (15.1)
Chair sit and reach (cm)	−10 (7.5)	−8.1 (7.7)	−9.1 (9.4)	−4.4 (9)	0.5 (8.1)	−3.2 (9.1)
Sit to Stand in 30 s	22.4 (9.8)	30.9 (14.6)	26.3 (10.5)	22.8 (7.5)	27.6 (7)	25.4 (7)
Six-minute Walk test (m)	430.3 (213.2)	507.6 (208.5)	458.2 (145.2)	408 (83.3)	461.3 (79.8)	447.3 (90.5)
Balance (seconds) *,#	14.4 (9.6)	15.5 (9.3)	19.3 (17.8)	15.7 (13.8)	17.9 (11.7)	21.1 (16.8)

* Males *n* = 11 cases; # Females *n* = 29 cases.

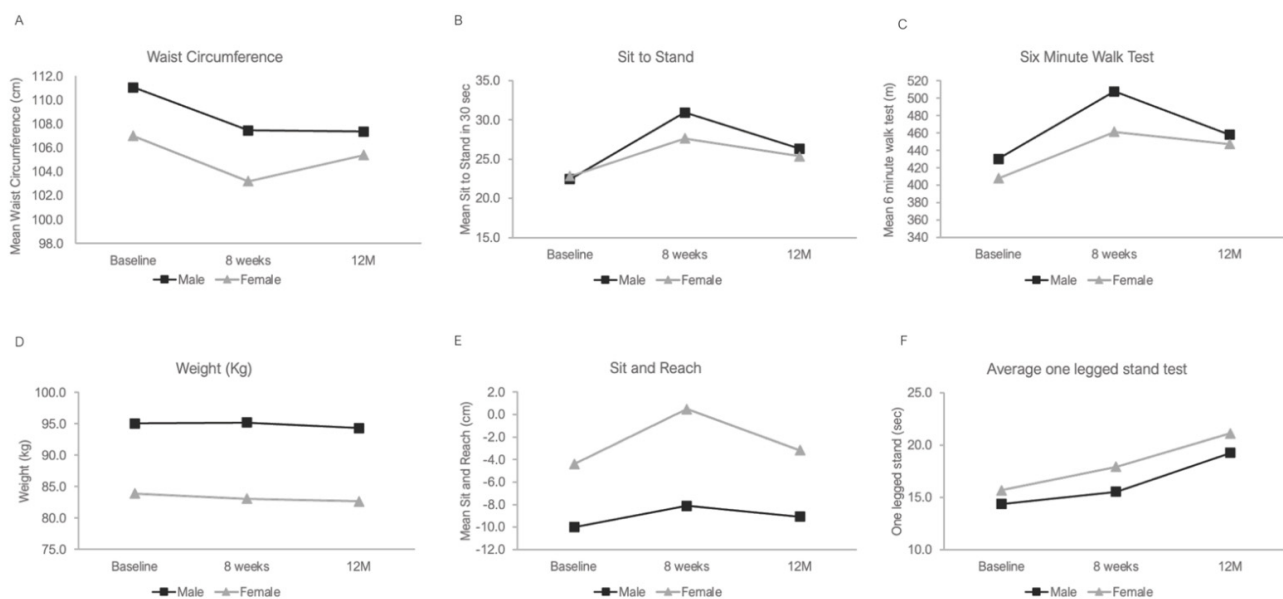
Table 2. Proportion of participants who meet or were above standard [26] for their age for waist circumference, BMI, and physical activity measures.

	Males <i>n</i> (%)			Female <i>n</i> (%)		
	Baseline	8 Weeks	12 Months	Baseline	8 Weeks	12 Months
Waist circumference (cm) #	3 (25%)	3 (25%)	2 (16.7%)	0	0	0
BMI (kg/m ²) *	3 (25%)	3 (25%)	2 (16.7%)	4 (13.3%)	5 (16.1%)	4 (13.3%)
Chair sit and reach (cm)	4 (33.3%)	6 (50.0%)	6 (50%)	16 (51.6%)	20 (64.5%)	16 (51.6%)
Sit to Stand in 30 s	10 (83.3%)	11 (91.7%)	10 (83.3%)	25 (80.6%)	30 (96.8%)	30 (96.8%)
Six-minute Walk test (m)	2 (16.7%)	4 (33.3%)	5 (41.7%)	3 (9.7%)	9 (29.0%)	6 (19.4%)

below Royal Australian College of General Practitioners recommendations for waist circumference [27];

* Normal BMI according to World Health Organization recommendations [28].

Improvements in the proportion of participants willing to include planned exercise as a part of their diabetes management (64.9% vs. 79.0%), and their confidence to exercise (66.7% vs. 85.7%) were also observed at 12 months compared to baseline. These participants also agreed or strongly agreed that they currently ate more vegetables (85.7%), consumed less unhealthy foods and drinks (82.9%), and did more incidental activity (82.9%) than what they did prior to participating in *Beat It*.



Males n=12; Females n=31

Figure 1. Anthropometric and Fitness Measures at Baseline, Post-intervention (eight weeks) and Follow up (12 months). From top left: (A) Waist Circumference, (B) Sit to Stand, (C) Six Minute Walk Test, (D) Body Weight, (E) Sit and Reach and (F) One Legged Stand Test.

4. Discussion

This study found that the health benefits of an eight-week, twenty-hour community-based clinician-led exercise and lifestyle program were retained for at least a year after program completion. This is an important finding because previous research shows that benefits of short-term interventions are difficult to maintain long term [29], and there are few studies conducted in real world settings [30]. This study population included a subset of participants in *Beat It* who completed pre and post measures. Whilst participants had the greatest benefit in the first eight weeks, most improvements were maintained including waist circumference, aerobic capacity, strength, flexibility, and balance.

Typically, this population group experiences physical decline as they age, with greater health and personal care needs compounded by physical inactivity and the subsequent atrophy of muscle mass and the increase in fat mass leading to loss of mobility and functional independence [31]. Balance, strength, and gait training can improve function and independence of people with T2DM [12]; however, developing and sustaining behavioural change with diet and physical activity is difficult to achieve [32]. Strategies that have proven effective tend to be customized to the needs and priorities of individuals [32]. This study shows that it is possible with a relatively short, clinician-led program to sustain benefits which will likely enable greater independence for longer. The authors attribute this to the tailored and individualized program for each participant reflecting their complex needs, while also offering a social group setting. The expertise of the AEPs, who were able to motivate, encourage and provide feedback on performance, combined with the small group size, appears to have enabled a cost-effective approach to improving health outcomes for a highly vulnerable population.

Given the rapidly increasing rates of T2DM in high income countries and the subsequent stress on aging and health care resources, programs like *Beat It* can contribute to improving quality of life, sustaining independence, and reducing healthcare needs. The program has now been scaled to 170 communities in NSW alone, 34% of which are rural, with over 120 AEPs having delivered the program.

While current evidence and guidelines support a multidisciplinary approach to T2DM care [33], research reveals that AEPs as a workforce are underutilized in Australia's health

system [34]. This underutilization is attributable in part to the Australian health-care system and the fact that general practitioners (GPs) are the gateway for patients to access subsidized care from allied health providers. One study examining the trends and characteristics of GP referrals to AEPs from a sample of over 680,000 patient encounters with over 7000 GPs found that there were only 619 referrals to AEPs [35]. The low referral rates to AEPs are ascribable to clinician perceptions about non-medical treatments, concerns about responsibility of care, a view of perceived patient disinterest in lifestyle interventions and a perceived lack of change in chronic condition post-referral [36]. Diabetes NSW and ACT who deliver the *Beat It* program have been able to circumvent this issue, as individuals with T2DM proactively seek medical clearance from their GP to participate. This promotes patient engagement with their GP, as well as builds awareness of the key role that AEPs can play in improving health outcomes through the supervision of an exercise intervention. Further education of GPs and other primary health care referrers about the role of AEPs in the prevention and management of chronic disease is needed. This needs to be supported by broader interprofessional collaboration in the management of T2DM given the chronic nature of the condition and the quality of life effects of proactive, multidisciplinary management [33].

The primary limitation of this study was the small sample size, with 43 *Beat It* participants completing all evaluation measures. This reflects the real-world nature of the study and that people consented to research as an adjunct to a program to improve management of T2DM. Information regarding co-morbidities, insulin dependence and length of time since a participants' diabetes diagnosis was not available. Embedding data collection for *Beat It* within existing reporting systems will likely increase the quality and size of data in the future. Despite the small sample, the results are reliable because they apply across gender and a range of sociodemographic criteria.

From a health economical perspective, there is evidence of lower health care utilization and costs in T2DM individuals who meet minimum physical activity guidelines [17,37]. Diabetes NSW & ACT engaged in an independent economic analysis of the program, which found that *Beat It* generated substantial value for participants with every \$1 spent generating a social value return on investment of between 3.5 and 6.5 dollars. According to this analysis, on a per participant basis, the program creates approximately \$800 of value for individuals and \$1800 for the healthcare system [38]. The economic analysis used a social return on investment [39] method which assigned value to benefits such as reduced GP visits, reduced hospital presentations and admissions, reduced cardio-metabolic risk, and consequent reductions in long term complications from T2DM. These data were compared with the total cost of delivering the program. Further research on the health economics of *Beat It* is warranted to assess the costs and benefits over time. With the COVID-19 pandemic, *Beat It* was adapted to an online format. Further research will be needed to assess whether the benefits of *Beat It* are transferrable online and to determine the impact on SROI. Further research about the specific aspects of *Beat It* that have the greatest effect would also be valuable.

5. Conclusions

This study offers important findings for practitioners and policy makers seeking to maximise and sustain behaviour change in older people with T2DM, maximizing the quality of life and maintaining independence. T2DM is endemic in high income countries [4] and *Beat It* offers an affordable and scalable solution with sustained benefits to individuals and the wider community. Further evaluation of *Beat It* when adapted for Indigenous and other culturally and linguistically diverse communities, in addition to it being delivered online, will provide greater insights into the efficacy of this promising program.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/diabetology3020025/s1>, Pre- and post-program survey.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Macquarie University Human Ethics Committee (protocol number 5201950887424 27/02/2019).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author, Morwenna Kirwan.

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Conflicts of Interest: The authors declare that they have no conflict of interest.

Abbreviations

New South Wales (NSW), Australian Capital Territory (ACT).

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