

## Abstract

Prediabetes and Type 2 diabetes mellitus (T2DM) is increasingly prevalent and both conditions have a variety of comorbidities. There are many programs aimed at the reduction or prevention of prediabetes and/or T2DM. However, only a few studies have evaluated the effect of intervention duration and evidence-based frameworks on specific populations at risk for prediabetes or T2DM. This review evaluated evidence-based lifestyle intervention programs to determine whether the duration of programming relates to the efficacy of evidence-based lifestyle change interventions. The aim was to assess relevant outcomes of these interventions in prediabetic or T2DM individuals aged 45 and older. The PRISMA framework was followed. Searches systematically screened and evaluated 2654 articles. Thirteen articles met the inclusion/exclusion criteria. Databases searched included: PubMed; SCOPUS; ProQuest; Biomed Central; SpringerLink; ScienceDirect; EBSCOHost; JSTOR; Taylor & Francis; Wiley Online; BioOne; CINAHL; SAGE Journal, and Google Scholar (2009 – 2022). Identifying the most effective timeframe for lifestyle intervention programming to reduce the risks associated with prediabetes/T2DM can help providers develop appropriate educational initiatives for patients at risk for pre-diabetes and/or T2DM. After screening, there were 13 studies which met the review criteria. All of the studies included in this comparative review used evidence-based interventions. Evidence-based lifestyle intervention programs that are  $\geq 12$ -months produced significant and consistent results in mediating outcomes related to prediabetes/T2DM than  $< 12$ -month programs in adults aged 45 years and older.

## Key Words

HbA1c, prediabetes, Type 2 diabetes mellitus, adults 45 and older, nutrition education, intervention duration

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3 **What is known about this topic and what this paper adds**  
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- 6 • Nutrition lifestyle education interventions  $\geq$  12-months consistently lead to weight loss,  
7 HbA1c reduction, and prediabetes prevention.
- 8 • Nutrition lifestyle interventions benefit from development, design, and implementation  
9 based on known program planning frameworks.
- 10 • Expanded research efforts including stratified age categories and consistent diabetic  
11 indicators is recommended.  
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## Introduction

Prediabetes is a serious but potentially reversible health condition defined by abnormal cellular responses leading to increased glucose in the bloodstream (CDC, 2020; Mayo Clinic, 2021). In patients with prediabetes HbA1c is not high enough ( $< 6.4\%$ ) to be classified as Type 2 Diabetes Mellitus (T2DM) ( $\geq 6.5\%$ ) but is elevated above normal levels ( $> 5.7\%$ ) (CDC, 2021b).

Remaining in a prediabetic state can increase risk of complications including blindness and amputations, the development of cardiovascular disease, renal disease, metabolic syndrome, stroke, and progression to T2DM (American Diabetes Association, 2021; CDC, 2020; Grundy Scott, 2012; Mayo Clinic, 2021). Risk factors for prediabetes and T2DM include, but are not limited to, being overweight (BMI 25 to  $< 30$ ) or obese (BMI 30 or higher), being aged 45 years or older, having a family history of T2DM, having a poor diet, and physical inactivity (CDC, 2019a, 2020; Mayo Clinic, 2021; National institute of diabetes and digestive and kidney diseases, 2018). Determinants affecting the development and progression of prediabetes, such as cost of healthy foods and perceived lack of time for health behavior activities like shopping for and preparing healthy foods/meals or incorporating physical activity into a daily routine, may lead to increased intake of convenience foods over nutritious alternatives in individuals consuming a westernized dietary pattern and/or in impoverished populations (Amer et al., 2020; CDC, 2021a; Escoto et al., 2012; French et al., 2019; Naja et al., 2015). Food choices based on convenience, cost, or availability can lead to diets that are low in nutrients but high in calories, sodium, saturated fats, and added sugars. Dietary and lifestyle patterns that increase such food choices may increase the risk of prediabetes and obesity (Drewnowski & Eichelsdoerfer, 2010; Escoto et al., 2012; French et al., 2019). To reduce the incidence and severity of prediabetes, studies have evaluated the use of lifestyle change programs in adult populations (Amer et al., 2020; Arens et al., 2018; Baker et al., 2011; Davies et al., 2016; Diabetes Prevention Program

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3 Research Group, 2002; Dunkley et al., 2014; Fianu et al., 2016; Gillison et al., 2015; Knowler et  
4 al., 2002; Mudaliar et al., 2016; Portero McLellan et al., 2014). Some of these programs have  
5 shown lifestyle interventions may lower the risk of prediabetes and associated comorbidities by  
6 encouraging healthy behaviors such as increased exercise, weight reduction, and weight  
7 maintenance (up to 7%) (Amer et al., 2020; Baker et al., 2011; Diabetes Prevention Program  
8 Research Group, 2002; Dunkley et al., 2014; Fianu et al., 2016; Gillison et al., 2015; Knowler et  
9 al., 2002; Mudaliar et al., 2016). However, only a few studies have evaluated the effect of  
10 nutrition education intervention duration and evidence-based frameworks on specific populations  
11 at-risk for or diagnosed with prediabetes or T2DM (Association of Diabetes Care & Education  
12 Specialists, 2020; CDC, 2019b; Diabetes Prevention Program Research Group, 2002).

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26 This comparative analysis, conducted following the PRISMA framework (Moher et al., 2009),  
27 reviewed the literature to determine the effect of time in relation to the efficacy of evidence-  
28 based lifestyle change interventions and to assess relevant outcomes of these interventions in  
29 prediabetic or T2DM individuals aged 45 and older. The aim of the review was to determine if  
30 program intervention durations  $\geq$  12-month, compared to  $<$  12-month programs, were as or more  
31 effective at normalizing indicators associated with reduction of prediabetes and/or T2DM  
32 including: 5-7% weight loss and/or maintaining post intervention weight loss, an HbA1c  $<$  5.7,  
33 and/or lowering incidence of prediabetes/T2DM in adults aged 45 years and older who have or  
34 are at risk for prediabetes or T2DM. Additionally, current literature on lifestyle change  
35 interventions methods and frameworks was evaluated to determine best practices for future  
36 design of prediabetes intervention programs.

## 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 **Methods** 55 56 57 58 59 60

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3 The protocol used to determine article quality for this review was based on the Academy of  
4 Nutrition and Dietetics Evidence Analysis library (EAL) and the review process was guided by  
5 the PRISMA framework (see Figure 1) (Academy of Nutrition and Dietetics., 2016; Moher et al.,  
6 2009). Searches were performed in the following databases - PubMed; SCOPUS; ProQuest;  
7 Biomed Central; SpringerLink; ScienceDirect; EBSCOHost; JSTOR; Taylor & Francis; Wiley  
8 Online; BioOne; CINAHL; SAGE Journal; and Google Scholar. Key terms and MeSH phrases  
9 (see Table 1) were used for the search. Initial screening of articles evaluated the title and  
10 abstract of the study and a secondary screening evaluated the studies for relevancy, to  
11 remove duplicates, and assess for eligibility. The review was limited to studies published  
12 between 2009 and 2022 (see Table 2). Additionally, the inclusion/exclusion criteria limited  
13 the search to studies published in English, evidence-based studies, and a minimum age of 45  
14 years or older among other criteria (see Table 2). Studies that did not include an evidence-based  
15 lifestyle intervention were excluded (see Table 2).

## 35 **Results**

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37 A total of 13 published studies met the inclusion criteria and were analyzed for this comparative  
38 review. Five  $\geq$  12-month intervention studies and eight  $<$  12-month intervention studies were  
39 included (see Table 3). Each study was evaluated and given a quality rating based on the  
40 Academy of Nutrition and Dietetics EAL quality criteria checklist (Academy of Nutrition and  
41 Dietetics., 2016). Bias was assessed for each study and is addressed in the limitations section of  
42 this review.

### 54 ***Intervention duration: $\geq$ 12-months***

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3 A prospective RCT ( $n = 434$ ) evaluating the efficacy of a modified Chinese type 2 diabetes  
4 prevention lifestyle intervention in rural Chinese adults found significant weight loss ( $p < 0.001$ ),  
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6 reduction in HbA1c ( $p = 0.002$ ), and reduction in the incidence of T2DM ( $p < 0.001$ ) at year one  
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8 as well as significant reduction in the incidence of T2DM ( $p = 0.041$ ) at 12 months follow-up in  
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10 the intervention group compared to the control group(Hu et al., 2017). Similarly, an 8-year RCT  
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12 ( $n = 4,585$ ) found that in American adults, an intensive lifestyle intervention (ILI) adapted from  
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14 the DPP had significant effects including initial weight loss, initial weight loss  $\geq 5\%$ , and initial  
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16 weight loss  $\geq 10\%$  at the endpoint of the intervention ( $p < 0.001$ ) in the intervention group  
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18 compared to the control (Look AHEAD Research Group., 2014). Likewise, a 4-year RCT ( $n =$   
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20 4,503) evaluating the effect of an ILI adapted from the DPP in American adults showed the  
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22 intervention group experienced statistically significant weight loss ( $p < 0.001$ ) and reduction in  
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24 the incidence of T2DM ( $p < 0.001$ ) at year 1 with statistically significant, but decreasing, level  
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26 of weight loss ( $p < 0.001$ ) and reduction in the incidence of T2DM ( $p < 0.001$ ) in year 4  
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28 compared with the control group(Gregg et al., 2012). Furthermore, a 4-year RCT ( $n = 4,815$ )  
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30 evaluating an ILI adapted from the DPP in American adults found a significant effect on initial  
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32 weight loss ( $p < 0.0001$ ), initial weight loss  $\geq 7\%$  ( $p < 0.0001$ ), and initial weight loss  $\geq 10\%$  ( $p$   
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34  $< 0.0001$ ) in the intervention group at year 4 compared to the control (Wadden et al., 2011).  
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37 Finally, a RCT ( $n = 4,959$ ) evaluating an ILI adapted from the DPP found American adults  
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39 experienced significant weight loss in year 1, initial weight loss  $\geq 7\%$ , and initial weight loss  $\geq$   
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41 10% ( $p < 0.001$ ) in the intervention group compared to the control (Wadden et al., 2009).  
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51 ***Intervention duration: < 12-months***  
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3 An observational study with a pre-post design evaluating a low-cost supervised walking program  
4 ( $n = 56$ ) found that in highly motivated Dutch adults who had T2DM ( $n = 30$ ) or were at risk for  
5 T2DM ( $n = 26$ ) there was a significant decrease in body weight ( $p < 0.01$ ) and, more specifically  
6 in participants with T2DM and a pre-study HbA1c  $> 53$  mmol/mol ( $n = 8$ ), there was a  
7 significant reduction in HbA1c ( $p = 0.03$ ) over the 28-week program (Hoogendoorn et al., 2019).  
8 Similarly, a longitudinal study ( $n = 66$ ) evaluating the efficacy of using diabetes conversation  
9 maps with a weight loss program in elderly Italians found significant weight loss in the  
10 intervention group ( $p < 0.0001$ ) compared with the control at week 4, and a significant reduction  
11 in HbA1c ( $p < 0.0001$ ) for the intervention group compared to the control at the 3-month follow-  
12 up (Defeudis et al., 2018; Kewming et al., 2016).  
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15 Additionally, a RCT ( $n = 60$ ) found that participants in a culturally adapted DPP intervention for  
16 Chinese immigrants (12 bi-weekly core sessions) in New York City demonstrated significant  
17 weight loss at 6 months ( $p = 0.0001$ ) and maintained weight loss at a 12 month follow-up ( $p =$   
18  $0.0003$ ) as well as a significant reduction in HbA1c at a 12 month follow-up ( $p < 0.05$ ) in the  
19 intervention group compared to the control (Yeh et al., 2016). Likewise, a retrospective analysis  
20 evaluating year 1 results of a 6-month lifestyle intervention called the Diet-Exercise-Activity-  
21 Lifestyle program in American adults ( $n = 92$ ) found significant average weight loss in  
22 participants at month 6 ( $p < 0.001$ ) and at month 12 ( $p = 0.008$ ) (Bersoux et al., 2010; Swanson  
23 et al., 2012).  
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26 Providing additional support for programs that are  $<12$  months in duration, a pilot randomized  
27 clinical trial ( $n = 62$ ) evaluating the efficacy of a 6-month self-monitoring and intensive  
28 education focused lifestyle intervention in Italian adults recorded significant reductions in weight  
29 loss ( $p = 0.02$ ) and reduction of HbA1c ( $p = 0.04$ ) at month 6 in the intervention group compared  
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3 to the control; furthermore, they found a significant portion (61.9%) of the intervention group  
4 reached the target HbA1c of < 7.0% at month 6 ( $p = 0.005$ ) compared to the control (Franciosi et  
5 al., 2011). A smaller ( $n = 26$ ) non-randomized comparison study evaluating the efficacy of an  
6 education and very low-calorie diet intervention in Australian adults found significant average  
7 weight loss ( $p = 0.004$ ) and reduction in HbA1c ( $p = 0.017$ ) at 12 weeks in the intervention  
8 group compared to the control (Farrer & Golley, 2014).  
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12 Despite the positive findings noted above, a pragmatic cluster randomized controlled trial ( $n =$   
13 1,570) evaluating the efficacy of a group education lifestyle intervention in South African adults  
14 did not find significant results in body weight loss ( $p = 0.392$ ) or in the reduction of HbA1c ( $p =$   
15 0.967) in either the intervention or the control group at a 12 month follow-up (Mash et al., 2015;  
16 Mash et al., 2014). Furthermore, an RCT evaluating the effects of a 3-month yoga program  
17 lifestyle intervention in American adults found slight but non-significant weight loss ( $p = 0.166$ )  
18 in the intervention group ( $n = 13$ ) compared to the control ( $n = 12$ ) at three months (Yang et al.,  
19 2011).  
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## 39 **Discussion**

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41 The DPP acted as guiding framework for many studies included in this comparative review, and  
42 it was used in a modified form or noted as an example for the framework by all 5 studies  
43 investigating  $\geq 12$ -month interventions, one of which showed a partial or complete remission  
44 of T2DM is possible with lifestyle change (see Table 3). Four  $\geq 12$ -month intervention  
45 studies used approaches adapted from the DPP focused on weight loss and physical activity  
46 and demonstrated that a 5-10% weight loss and maintenance is statistically predictable in the age  
47 range defined by the review criteria. Only one of the included studies with a  $\geq 12$ -month  
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3 intervention focused on and was found to have a significant impact on HbA1c values,  
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5 adding to the evidence that the interventions based on the DPP and delivered  $\geq 12$  months  
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7 may help reduce the risk of T2DM and/or prediabetes in adults aged 45 years and older (see  
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9 Table 3).

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12 Eight of the included studies had interventions  $< 12$ -months (see Table 3). These studies were  
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14 based on several different frameworks and were offered over a variety of durations  $< 12$ -months.  
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16 Additionally, these studies reported more issues than those interventions with durations over  
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18 12 months including six of the studies noted selection process issues and/or small sample  
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20 sizes. Six of the eight included  $< 12$ -month intervention studies found significant decreases  
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22 in body weight. Also, six of the eight  $< 12$ -month intervention studies evaluated HbA1c, and  
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24 five of those studies showed a significant reduction in HbA1c. While all eight  $< 12$ -month  
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26 evidence-based lifestyle intervention studies evaluated at least one of the inclusion criteria  
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28 outcomes, none of these studies evaluated as comprehensive parameters as the studies  
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30 conducted  $\geq 12$  months; further evaluation of studies  $< 12$  months may contribute to the  
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32 understanding of how intervention programs such as the ILI can reduce the development of  
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34 T2DM and/or prediabetes within shorter durations (see Table 3). It must be noted that restrictive  
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36 calorie diets are often not feasible for long durations and can lead to increased weight regain  
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38 after cessation (Clifton, 2017; Paisey et al., 2002; Turk et al., 2009).

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41 While the interventions included in this review reported significant outcomes associated with at  
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43 least one of the parameters being investigated, future research will be needed to address the gaps  
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45 in the literature that include using consistent indicators associated with reduction of pre-diabetes  
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47 and/or T2DM, including more specific age ranges, and consistent study frameworks so it is  
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49 easier to compare across studies. We recommend use of categorical age ranges (e.g. 45-54, 55-  
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3 64, 65+) to better understand efficacy associated with weight reduction over time, HbA1c  
4 reduction over time, and prediabetes prevention. Results further defined via age stratification  
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6 could lead to more tailored approaches when developing future nutrition education interventions.  
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10 A strength of this comparative review worth noting is that the 13 included studies had limited  
11 bias and all of these studies provided insight into the efficacy of possible reduction in the  
12 development of prediabetes and/or T2DM as related to the duration of lifestyle-based  
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14 interventions however, there were several limitations in this review.  
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### 20 21 **Study limitations**

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23 Search bias may have been introduced by the incomplete retrieval of information due to human  
24 error in the search (see Table 1). Furthermore, the inclusion/exclusion criteria notes that only  
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26 studies with a less than 20% dropout rate were included in the review (see Table 2). One of the  
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28 included <12-month studies had a higher dropout rate than the criteria (see Table 2) however,  
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30 the framework, potential for study success, and the insight provided into the difficulties of using  
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32 established methodology in an area with insufficient social and environmental support merited its  
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34 inclusion into the review (Mash et al., 2015; Mash et al., 2014).  
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### 42 **Conclusion**

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44 Despite the consistent results and structured frameworks in the  $\geq 12$ -month interventions, there is  
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46 minimal evidence supporting a clear benefit of  $\geq 12$ -month verses <12-month interventions in  
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48 the efficacy of normalizing indicators of prediabetes or T2DM including 5-7% weight loss  
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50 and/or maintaining post intervention weight loss, an HbA1c < 5.7, and/or lowering incidence of  
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52 prediabetes/T2DM. However, we found that evidence-based lifestyle intervention programs  $\geq$   
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3 12-months produced more consistent results related to prediabetes and/or T2DM than < 12-  
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5 month programs in adults aged 45 years and older. Additionally, there are benefits related to  
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7 participation in lifestyle-based interventions based on known frameworks, including a reduction  
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9 of risks related to prediabetes and T2DM, regardless of the duration of the intervention. Further  
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11 research is warranted to better define the relationship between lifestyle intervention duration and  
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13 intervention ability to modulate indicators associated with prediabetes and/or T2DM in more  
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15 categorically specific age groups.  
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### 21 **Author Contributions**

22  
23 C.C. conceived and designed analysis. C.C., E.D., and B.A-E. collected the data and performed  
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25 the analysis. J.B. and J.K. contributed data and analysis tools. C.C., E.D., and B.A-E. conceived  
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27 and designed analysis. J.B. and J.K. contributed. C.C. wrote the paper.  
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**Table 1. MeSH search terms used**

<b>Search terms related to the population</b>	<b>Search terms related to the intervention</b>	<b>Search terms related to the intervention</b>	<b>Search terms related to outcomes or effects</b>
Adults aged 45 years and older who have or are at risk for prediabetes or type 2 diabetes (T2DM)	A ≥ 12-month evidence-based lifestyle intervention program	A < 12-month evidence-based lifestyle intervention program	5 – 7 percent weight loss and/or maintaining post intervention weight loss; an HbA1c < 5.7; and/or lowering incidence of prediabetes/T2DM
Adult Middle aged (MeSH) 45- 65 years old Aged (65-75 years old (MeSH) Prediabetes Prediabetic state (MeSH) Diabetes Mellitus, Type 2 (MeSH)	Primary prevention (MeSH) Early medical intervention (MeSH) Education (MeSH) Time factors (MeSH) Curriculum (MeSH) Health Education (MeSH)	Primary prevention (MeSH) Early medical intervention (MeSH) Education (MeSH) Time factors (MeSH) Curriculum (MeSH) Health Education (MeSH)	Weight loss (MeSH) Weight reduction programs (MeSH) Hemoglobin A, glyated (MeSH) HbA1c (MeSH) Body weight maintenance (MeSH)

**Table 2. Inclusion/Exclusion criteria**

<b>Criteria</b>	<b>Inclusion</b>	<b>Exclusion</b>
<b>Age</b>	Adults $\geq$ 45 years old	Adults <45 years old
<b>Setting</b>	Outpatient	In patient
<b>Health Status</b>	Healthy, with normal risk factors associated with obesity, T2DM, or prediabetes	Patients with other diagnosed comorbidities or poor prognosis. Excludes normal risk factors associated with obesity, T2DM, or prediabetes
<b>Problem/Condition</b>	Healthy adults that have been diagnosed with prediabetes or T2DM	Patient has other serious health issues
<b>Intervention</b>	Included an evidence-based lifestyle intervention	Did not include an evidence-based lifestyle intervention
<b>Intervention Model</b>	Based on at least one theory or behavioral change model or on established evidence-based programs such as the Diabetes Prevention Program (DPP)	Does not include theory or behavioral change model
<b>Intervention Delivery</b>	Delivered by trained educators	Not delivered by trained educator
<b>Number of Educational Sessions</b>	Two or more educational sessions	Less than 2 educational sessions
<b>Behavioral Change Curricula</b>	Goal setting, lifestyle change evaluations, and biometric change evaluations such as weight loss assessments	Does not include curricula
<b>Size of Study Groups</b>	The sample size must have at least 10 individuals	A sample size with less than 10 individuals
<b>Study Drop Out Rate:</b>	Less than 20%	Greater than 20%
<b>Language</b>	English	Other than English
<b>Duration of Intervention</b>	$\geq$ 12 month or <12 month	N/A
<b>Measurements used for analysis</b>	Outcomes related to at least one indicator of pre-diabetes	No outcomes related to pre-diabetes
<b>Study Design Preferences</b>	Primary research, Randomized Controlled Trial, Retrospective, Observational	Systematic Review, Meta-analysis
<b>Year Range</b>	2009-2022	< 2009
<b>Authorship</b>	Only the newest article by same author will be accepted unless the study population is different, or unless there is a relevant follow-up period	Studies by the same author will be excluded unless the study population is different, or unless there is a relevant follow-up period
<b>Other</b>	Full text articles only	Articles without full text will be excluded

**Table 3. Study overview table for included  $\geq 12$ -month and  $< 12$ -month evidence-based lifestyle intervention programs**

Author, Year, Study Design, Country, Funding Source	Quality Grade (+, -, 0)	Study Purpose	Study Population	Intervention and Setting	Outcome Measures	Results/ Conclusion
<b><math>\geq 12</math>-month evidence-based lifestyle intervention programs</b>						
<u>Author, year:</u> Hu Z, Qin L, Xu H. 2017.  <u>Study Design:</u> Prospective randomized controlled trial  <u>Country:</u> China  <u>Funding Source:</u> None reported	+	The purpose of this study was to determine if the intervention, a modified Chinese type 2 diabetes prevention lifestyle intervention, could prevent type 2 diabetes (T2DM), and reduce body weight, plasma glucose, and HbA1c over the control, standard health advice, in Chinese adults who live in rural China, aged 60 years and older, with prediabetes (diagnosed by oral glucose tolerance tests: impaired fasting glucose (IFG), impaired glucose tolerance (IGT), or IFG and IGT, 1999 WHO criteria).	This prospective randomized controlled trial focused on Chinese adults who live in rural China, aged 60 years and older, with prediabetes (diagnosed by oral glucose tolerance tests: impaired fasting glucose (IFG), impaired glucose tolerance (IGT), or IFG and IGT, 1999 WHO criteria). The participants were randomly assigned to either the intervention (n=214) or the control (n=220).	Intervention (4-part):  <u>Modified “Chinese type 2 diabetes prevention guide”</u> 1. Lifestyle education: <u>Program materials:</u> “Chinese type 2 diabetes prevention guide” - used to create program materials <u>Session duration:</u> 60-minutes covering topics including nutrition and exercise – every 3 months provided by intervention study team (IST) 2. Lifestyle intervention: instructions also given every 3-months on subjects including calculating calories 3. Self-monitoring blood glucose (SMBG): training occurred - reported: 1 <sup>st</sup> of every month covering topics - finger sticks <u>Provided by:</u> public health professionals 4. Helping Each Other Group (HEOG): <u>Number of participants /groups:</u> 5–7 given/ assigned at first intervention with weekly reminders and monthly reminders given by group assigned person  Control:  Standard health advice including dietary changes provided every six months by the IST	Incidence of T2DM  Body Weight  HbA1C	This prospective randomized controlled trial concluded that the use of the lifestyle intervention was statistically significant in body weight reduction ( $p < 0.001$ ), HbA1c reduction ( $p = 0.002$ ), and reduction in the incidence of type 2 diabetes (T2DM) ( $p < 0.001$ ) at year 1, as well as significant reduction in the incidence of T2DM ( $p = 0.041$ ) at 12 months follow-up, in the intervention versus the control, indicating the success of intervention in lowering the risk of developing type 2 diabetes (T2DM) in elderly Chinese adults.
<u>Author, year:</u> Look AHEAD Research Group. 2014.  <u>Study Design:</u> Randomized controlled trial  <u>Country:</u> USA	+	The purpose of this study was to determine if at year 8 the intervention, a long-term intensive lifestyle intervention (ILI) adapted from the DPP, could reduce initial body weight, initial body weight $\geq 5\%$ , and initial body weight $\geq$	This randomized controlled trial, part of the multicentered Look AHEAD (Action for Health in Diabetes) study, evaluated results at year 8. The focus was on American adults with type 2 diabetes (T2DM), BMI $\geq 25$ kg/m <sup>2</sup> , ages 45–76 years old. The participants were randomly assigned to either the intervention (n=2,310) or the control (n=2,275).	Intervention:  <u>Intensive lifestyle intervention (ILI) adapted from the DPP</u> Years 2-8: <u>Individual sessions:</u> lifestyle counseling once per month, in person, 20-30 minutes per session with a follow up phone call ~ 2 weeks later, and monthly group meetings with options to attend a refresher group (6-8 weeks) and/or a national campaign (8-10 weeks)	Body Weight	This randomized controlled trial concluded that the use of the lifestyle intervention was statistically significant for the intervention in initial weight loss, initial weight loss $\geq 5\%$ , and initial weight loss $\geq 10\%$ at year eight ( $p < 0.001$ ) compared to the control indicating the success of intervention in lowering the risk of developing type 2 diabetes (T2DM) in American adults.

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<p><u>Funding Source:</u> Primary funding: The National Institutes of Health, see article for all funding</p>		<p>10% over the control, diabetes support and education (DSE), in American adults with type 2 diabetes (T2DM), BMI <math>\geq</math> 25 kg/m<sup>2</sup>, ages 45–76 years old.</p>		<p><u>Key focuses:</u> year 1 weight reduction/maintenance increased/maintained physical activity</p> <p>Control:</p> <p><u>Diabetes support and education (DSE) program</u> <u>Group sessions:</u> three 1-hour group meetings per year, for the first four years, 1 meeting per year after that <u>Key focuses:</u> standard care (diet, exercise)</p>		
<p><u>Author, year:</u> Gregg EW, Chen H, Wagenknecht LE, et al. 2012.</p> <p><u>Study Design:</u> Randomized controlled trial</p> <p><u>Country:</u> USA</p> <p><u>Funding Source:</u> Primary funding: The National Institutes of Health, see article for all funding</p>	<p>+</p>	<p>The purpose of this study was to determine if at years 1-4 the intervention, a long-term intensive lifestyle intervention (ILI) adapted from the DPP, could achieve partial or complete remission of type 2 diabetes (T2DM) to pre- diabetic or nondiabetic levels (fasting plasma glucose &lt; 126 mg/dL, HbA1c &lt; 6.5%, no diabetes medication) and reduce body weight over the control, the diabetes support and education (DSE), in American adults with T2DM, not on diabetes medication, with a fasting glucose of <math>\geq</math> 126 mg/dL, an HbA1c <math>\geq</math> 6.5%, BMI <math>\geq</math> 25 kg/m<sup>2</sup>, between 45–76 years old.</p>	<p>This randomized controlled trial, part of the multicentered Look AHEAD (Action for Health in Diabetes) study, evaluated results for years 1-4. The focus was on American adults with type 2 diabetes (T2DM), not on diabetes medication, a fasting glucose of <math>\geq</math> 126 mg/dL, an HbA1c <math>\geq</math> 6.5%, BMI <math>\geq</math> 25 kg/m<sup>2</sup>, between 45–76 years old. The participants were randomly assigned to either the intervention (n=2,241) or the control (n=2,262).</p>	<p>Intervention:</p> <p><u>Intensive lifestyle intervention (ILI) adapted from the DPP</u> Year 1: <u>Months 1-6:</u> group sessions (n=10-20) led by lifestyle councilors, 60-75 minutes per session, group sessions occurred during weeks 1-3 of each month with one individual session (20-30 minutes) during week 4 of that same month <u>Months 7-12:</u> monthly individual sessions continued; group sessions decreased to 2 sessions per month <u>Key focuses:</u> weight reduction and increased physical activity Years 2-8: <u>Individual sessions:</u> lifestyle counseling once per month, in person, 20-30 minutes per session with a follow up phone call ~ 2 weeks later, and monthly group meetings with options to attend a refresher group (6-8 weeks) and/or a national campaign (8-10 weeks) <u>Key focuses:</u> year 1 weight reduction/maintenance increased/maintained physical activity</p> <p>Control:</p> <p><u>Diabetes support and education (DSE) program</u> <u>Group sessions:</u> three 1-hour group meetings per year, for the first four years, 1 meeting per year after that <u>Key focuses:</u> standard care (diet, exercise)</p>	<p>Incidence of T2DM</p> <p>Body Weight/ Maintenance</p>	<p>This study concluded that the use of the lifestyle intervention was statistically significant at year 1 in reducing the incidence of type 2 diabetes (T2DM) and weight loss (<math>p &lt; 0.001</math>) with a statistically significant but decreasing incidence of T2DM and weight loss in year 4 (<math>p &lt; 0.001</math>) for the intervention compared to the control indicating the success of the intervention in lowering the risk of developing T2DM in American adults.</p>
<p><u>Author, year:</u> Wadden TA, Neiberg RH,</p>	<p>+</p>	<p>The purpose of this study was to determine if at year 4 the intervention, a</p>	<p>This randomized controlled trial, part of the multicentered Look AHEAD (Action for Health in Diabetes) study, evaluated results</p>	<p>Intervention:</p> <p><u>Intensive lifestyle intervention (ILI) adapted from the DPP</u></p>	<p>Body Weight</p>	<p>This study concluded that the use of the lifestyle intervention was statistically significant at year 4 in initial weight loss (<math>p &lt; 0.0001</math>), initial weight loss <math>\geq</math> 7% (<math>p</math></p>

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	Wing RR, et al. 2011.  <u>Study Design:</u> Randomized controlled trial  <u>Country:</u> USA  <u>Funding Source:</u> Primary funding: The National Institutes of Health, see article for all funding	long-term intensive lifestyle intervention (ILI) adapted from the DPP, could reduce initial weight, initial weight $\geq 7\%$ , and initial weight $\geq 10\%$ when compared to the control, diabetes support and education (DSE), in American adults with type 2 diabetes (T2DM), BMI $\geq 25$ kg/m <sup>2</sup> , ages 45–76 years old.	through year 4. The focus was on American adults with type 2 diabetes (T2DM), BMI $\geq 25$ kg/m <sup>2</sup> , ages 45–76 years old. The participants were randomized into either the intervention (n=2,419) or the control (n=2,396).	Years 2-8: <u>Individual sessions:</u> lifestyle counseling once per month, in person, 20-30 minutes per session with a follow up phone call ~ 2 weeks later, and monthly group meetings with options to attend a refresher group (6-8 weeks) and/or a national campaign (8-10 weeks) <u>Key focuses:</u> year 1 weight reduction/maintenance increased/maintained physical activity  Control:  <u>Diabetes support and education (DSE) program</u> <u>Group sessions:</u> three 1-hour group meetings per year, for the first four years, 1 meeting per year after that <u>Key focuses:</u> standard care (diet, exercise)	< 0.0001), and initial weight loss $\geq 10\%$ ( $p < 0.0001$ ) compared to the control indicating the success of the intervention in lowering the risk of developing type 2 diabetes (T2DM) in American adults.	
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36	<u>Author, year:</u> Wadden TA, West DS, Neiberg RH, et al. 2009.  <u>Study Design:</u> Randomized controlled trial  <u>Country:</u> USA  <u>Funding Source:</u> Primary funding: The National Institutes of Health, see article for all funding	+ The purpose of this study was to determine if at year 1 the intervention, a long-term intensive lifestyle intervention (ILI) adapted from the DPP, could achieve average initial body weight loss $\geq 7\%$ compared to the control, diabetes support and education (DSE), in American adults with type 2 diabetes (T2DM), BMI $\geq 25$ kg/m <sup>2</sup> , blood pressure $\leq 160/100$ mm Hg, HbA1c $\leq 11\%$ , triglyceride levels $< 600$ mg/dl, ages 45–74 years old.	This randomized controlled trial, part of the multicentered Look AHEAD (Action for Health in Diabetes) study, evaluated year 1 results. The focus was on American adults with type 2 diabetes (T2DM), BMI $\geq 25$ kg/m <sup>2</sup> , blood pressure $\leq 160/100$ mm Hg, HbA1c $\leq 11\%$ , triglyceride levels $< 600$ mg/dl, ages 45–74 years old. The participants were randomized in either the intervention (n=2,496) or the control (n=2,463).	Intervention:  <u>Intensive lifestyle intervention (ILI) adapted from the DPP</u> Year 1: <u>Months 1-6:</u> group sessions (n=10-20) led by lifestyle counselors, 60-75 minutes per session, group sessions occurred during weeks 1-3 of each month with one individual session (20-30 minutes) during week 4 of that same month <u>Months 7-12:</u> monthly individual sessions continued; group sessions decreased to 2 sessions per month <u>Key focuses:</u> weight reduction and increased physical activity  Control:  <u>Diabetes support and education (DSE) program</u> <u>Group sessions:</u> three 1-hour group meetings per year, for the first four years, 1 meeting per year after that <u>Key focuses:</u> standard care (diet, exercise)	Body Weight  This randomized controlled trial concluded that the use of the lifestyle intervention was statistically significant at year 1 on initial weight loss, initial weight loss $\geq 7\%$ , and initial weight loss $\geq 10\%$ ( $p < 0.001$ ) in the intervention versus the control, indicating the success of the intervention in lowering the risk of developing type 2 diabetes (T2DM) American adults.	
37	<b>&lt; 12-month evidence-based lifestyle intervention programs</b>					
38 39 40 41 42 43 44 45 46 47	<u>Author, year:</u> Hoogendoorn SW, Rutten G,	+ The purpose of this study was to determine if the intervention, a low-	This observational study (pre-post design) focused on highly motivated Dutch adults, that either had or were at risk for type 2	Intervention:  <u>Supervised walking program: Nijkerk challenge (NC)</u>	Body Weight  HbA1c	This study concluded that the use of the lifestyle intervention was statistically significant at week 28 in the reduction of body weight ( $p < 0.01$ ) and in

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Hart HE, de Wolf C, Vos RC. 2019.	cost supervised walking program, could reduce body weight, HbA1c, and improve health status, in highly motivated Dutch adults that either had or were at risk for type 2 diabetes (T2DM), average age of 60.6 (±10 years).	diabetes (T2DM), average age of 60.6 (±10 years). The 56 participants were divided into groups based on whether they had T2DM (n=30) or were at risk for T2DM (n=26).	<p><u>Total duration:</u> 28 weeks</p> <p><u>Structure:</u> supervised groups of participants walked once per week</p> <p><u>Supervisors:</u> healthcare professionals including RD's and general practitioners</p> <p><u>Level of intensity:</u> dependent upon participant (had to be able to walk a minimum of 6 km)</p> <p><u>Additional support:</u> encouraged to exercise outside of the walking program, educational sessions and cooking classes were offered</p>	participants (n=8) with type 2 diabetes (T2DM) and a pre-study HbA1c > 53 mmol/mol had a significant reduction in HbA1c ( $p = 0.03$ ) indicating the success of the intervention in lowering the risk of T2DM in elderly Dutch adults.		
<u>Study Design:</u> Observational study (pre-post design)						
<u>Country:</u> Netherlands						
<u>Funding Source:</u> None reported						
<u>Author, year:</u> Mash RJ, Rhode H, Zwarenstein M. et al. 2014.	Ø	The purpose of this study was to determine if the intervention, a group education lifestyle intervention, could improve diabetes self-care, achieve 5% weight loss, and reduce HbA1c by 1% over the control, usual education, in South African adults with type 2 diabetes (T2DM), average age 56.1 ( ± 11.6) years old.	This pragmatic cluster randomized controlled trial focused on South African adults with type 2 diabetes (T2DM) average age 56.1 ( ± 11.6) years old. The participants were randomly assigned to either the intervention (n=710) or the control (n=860).	<p>Intervention:</p> <p><u>Group education lifestyle intervention</u></p> <p><u>Session duration:</u> 60-minutes per session</p> <p><u>Number of sessions:</u> 4 sessions intended to be held monthly, guided by trained staff using motivational interviewing principles</p> <p><u>Follow-up:</u> 12 months</p> <p>topics included lifestyle modification including portion control and stress management and understanding medications, diabetes, and complication mitigation</p> <p>Control:</p> <p>Usual education included educational talks and individual counseling</p>	Body Weight  HbA1c	This study concluded that the use of the group education lifestyle intervention in adverse conditions including low attendance and lack of resources including appropriate facilities and funding might be reasons why the study did not achieve statistically significant results in any of the primary study outcomes or secondary outcomes at 12 months (weight loss ( $p = 0.392$ ) and HbA1c ( $p = 0.967$ )) excluding significant results in mean systolic ( $p = 0.044$ ) and diastolic blood pressure ( $p = 0.002$ ) indicating a lack of success of the intervention in lowering the risk of developing type 2 diabetes (T2DM) in South African adults.
<u>Study Design:</u> Pragmatic cluster randomized controlled trial						
<u>Country:</u> South Africa						
<u>Funding Source:</u> BRIDGES Grant, Chronic Diseases Initiative for Africa, and Stellenbosch University, see article for all funding						
<u>Author, year:</u> Defeudis G, Khazrai Y, Di Rosa C, et al. 2018.	+	The purpose of this study was to evaluate the effectiveness of the intervention, diabetes conversation maps (CM) with a weight loss program, in achieving weight loss and the reduction of HbA1c over the control, standard care with a weight loss program, in elderly Italians average age 67.8 (±7.93) years,	This longitudinal observational study focused on elderly Italians average age 67.8 (±7.93) years, with type 2 diabetes (T2DM), BMI > 25 kg/m <sup>2</sup> . The participants included 33 men and 33 women who were recruited by doctors and dieticians and could choose either the intervention (n=32) or the control (n=34).	<p>Intervention:</p> <p><u>Conversation Maps (CM) with a weight loss program</u></p> <p><u>Pre-session:</u> 15 minutes with a dietician at the beginning of each meeting evaluating the participants food diaries</p> <p><u>CM session:</u> 75 minutes once per week for 4 weeks, all educators for these sessions were certified in CM</p> <p><u>CM educational method:</u> 4 maps covering lifestyle changes, diabetes disease education, diet and exercise, and insulin use</p> <p>Control:</p>	Body Weight  HbA1c	This study concluded that the use of the lifestyle intervention was statistically significant in weight loss in the intervention ( $p < 0.0001$ ) over the control ( $p = 0.0078$ ) at week 4 and a reduction in HbA1c in the intervention ( $p < 0.0001$ ) over the control ( $p = ns$ ) at the 3-month follow-up, indicating the success of the intervention in lowering the risk of developing type 2 diabetes (T2DM) in elderly Italian adults.
<u>Study Design:</u> Longitudinal Observational Study						
<u>Country:</u> Italy						
<u>Funding Source:</u>						

None reported		with type 2 diabetes (T2DM), BMI > 25 kg/m <sup>2</sup> .		Standard care with a weight loss program met initially, at 4 weeks, and at 3 months		
<u>Author, year:</u> Yeh M, Heo M, Suchday S, et al. 2016.	+	The purpose of this study was to determine if the intervention, a culturally adapted diabetes prevention program (DPP), could achieve percent weight loss, reduced BMI, and reduced HbA1c over the control, diabetes prevention materials, in prediabetic Chinese immigrants in New York city with an BMI ≥ 23 kg/m <sup>2</sup> , HbA1c 5.7–6.4%, averaged ages, control (60.9 ± 12.2 years) and intervention (56.8 ± 9.5 years).	This randomized controlled trial focused on 60 prediabetic Chinese immigrants in New York city with an BMI ≥ 23 kg/m <sup>2</sup> , HbA1c 5.7–6.4%, averaged ages, control (60.9 ± 12.2 years) and intervention (56.8 ± 9.5 years). The participants were randomly assigned to either the intervention (n=30) or the control (n=30).	<u>Intervention:</u>  <u>Culturally adapted diabetes prevention program (DPP) for Chinese immigrants</u> <u>Sessions:</u> 1.5 to 2 hours, included materials in languages specific to the culture, exercises (tai chi), culture specific cooking tools, covering topics such as healthy eating and stress reduction <u>Number of sessions:</u> 12 bi-weekly core sessions with 6 monthly post-core sessions <u>Program implementation:</u> provided by trained lifestyle coaches  <u>Control:</u>  Diabetes prevention materials – mailed quarterly	Body Weight/ Maintenance  HbA1c	This study concluded that the use of the lifestyle intervention was statistically significant in percent weight loss at 6 months ( <i>p</i> = 0.0001) and mostly maintained percent weight loss at 12 months follow-up ( <i>p</i> = 0.0003) as well as had a significant reduction in HbA1c at 12 months follow-up ( <i>p</i> < 0.05) in the intervention over the control, indicating the success of the intervention in lowering the risk of developing type 2 diabetes (T2DM) in elderly Chinese immigrant adults.
<u>Study Design:</u> Randomized controlled trial						
<u>Country:</u> USA						
<u>Funding Source:</u> NIDDK (1 R34 DK090695 and 5P60DK20541) and the National Center for Advancing Translational Sciences Clinical Translation Science Award, see article for all funding						
<u>Author, year:</u> Bersoux S, Asbury KL, Cook CB, et al. 2010.	+	The purpose of this study was to evaluate year 1 results of the six-month lifestyle intervention, the Diet-Exercise-Activity-Lifestyle (DEAL) program, in the reduction of body weight 7% and glucose in American adults who were referred to the study and had either impaired fasting glucose (IFG), impaired glucose tolerance (IGT), or IFG and IGT, but not type 2 diabetes (T2DM), average age 62 ( ± 12) years.	This retrospective analysis focused on American adults who did not have type 2 diabetes (T2DM), average age 62 ( ± 12) years. There were 114 referrals from clinics to the Diet-Exercise-Activity-Lifestyle (DEAL) program and 92 of those referrals had either impaired fasting glucose (IFG), impaired glucose tolerance (IGT), or IFG and IGT and were enrolled in the program (n=92).	<u>Intervention:</u>  <u>Diet Exercise-Activity-Lifestyle (DEAL) program</u> <u>Primary emphasis:</u> lifestyle change under 6 months <u>Number of Sessions:</u> initial visit, then four 2-hour group classes with follow-ups at 6 and 12 months and a visit at 9 months if needed (the intervention occurred within 6 months) <u>Sessions:</u> provided by a nurse practitioner or a physician and physical therapists: covered nutrition and exercise <u>Metformin:</u> used post primary 6-month intervention if glucose levels/tolerance have not normalized or remained in pre-diabetic range  <u>Key focuses:</u> lifestyle changes	Body Weight/ Maintenance	This study concluded that the use of the lifestyle intervention, was statistically significant at 6 months in average weight loss ( <i>p</i> < 0.001) and the continuing study found significant weight loss at 12 months ( <i>p</i> = 0.008) in the intervention indicating the success of the intervention in lowering the risk of developing type 2 diabetes (T2DM) in elderly American adults.
<u>Study Design:</u> Retrospective Analysis						
<u>Country:</u> USA						
<u>Funding Source:</u> None reported						



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<p><u>Author, year:</u> Yang K, Bernardo LM, Sereika SM, Conroy MB, Balk J, Burke LE. 2011.</p>	<p>+</p>	<p>The purpose of this study was to determine if the intervention, a 3-month yoga program, could reduce cardiometabolic risk factors including body weight over the control, general health education, in American adults ages 45 - 65 years old, with a family history of type 2 diabetes (T2DM), and have at least one cardiometabolic risk factor, don't or haven't exercised (max: 30 minutes, 2 times/week), are at high risk for T2DM.</p>	<p>This randomized controlled trial focused on American adults ages 45 - 65 years old, with a family history of type 2 diabetes (T2DM), and have at least one cardiometabolic risk factor, don't or haven't exercised (max: 30 minutes, 2 times/week), are at high risk for T2DM. The participants were randomized into either the intervention (n=13) or control (n=12).</p>	<p>Intervention: <u>3-month yoga program, lifestyle intervention</u> <u>Vinyasa style yoga</u>: taught by certified instructor - PhD certified nurse <u>Yoga session</u>: 1-hour long group sessions with a warm-up (5-7 minutes) and relaxation period (10 minutes) home practice was encouraged with audio instructions from instructor between group sessions along with maintaining any previous exercise habits <u>Time frame</u>: 2 times per week, 2-3 days between sessions</p> <p>Control: General health education packets mailed every 2 weeks for study duration covering topics like eating out along with maintaining any previous exercise habits</p>	<p>Body Weight</p>	<p>This study concluded that the use of the lifestyle intervention showed a slight but non-significant weight loss (<math>p = 0.166</math>) in mean weight change from baseline at three months in the intervention versus the control, indicating the potential success of the intervention in lowering the risk of developing type 2 diabetes (T2DM) in American adults.</p>	
<p><u>Study Design:</u> Randomized controlled trial</p>							
<p><u>Country:</u> USA</p>							
<p><u>Funding Source:</u> Central Research Development Funds (CRDF) of University of Pittsburgh and the Montefiore Clinical Translational Research Center, see article for all funding.</p>							
<p><u>Author, year:</u> Farrer O, Golley R. 2014.</p>	<p>+</p>	<p>The purpose of this study was to determine the effectiveness of the intervention, education and very low-calorie diet (VLCD), in reducing body weight 5-10%, HbA1c, and cholesterol over the control, same education and meal plan, in Australian adults ages 54 ± 7.5 and control (57 ± 10.9) with type 2 diabetes (T2DM), BMI &gt; 27 kg/m<sup>2</sup>, raised cholesterol or blood pressure.</p>	<p>This small (n=26) non-randomized comparison study focused on Australian adults ages 54 ± 7.5 and control (57 ± 10.9) with type 2 diabetes (T2DM), BMI &gt; 27 kg/m<sup>2</sup>, raised cholesterol or blood pressure. The participants, guided by the program dietician using participants weight loss history, chose either the intervention (n=9) if participants had a history of failed weight loss attempts or the control (n=17) if participants had no history of weight loss attempts.</p>	<p>Intervention: <u>Education and Optifast VLCD program</u> Education: <u>Number of sessions</u>: 4 sessions total, once per month for 12 weeks, covering meal planning, eating out, and shopping <u>Provided by</u>: a dietician telephone support and weigh in (initiated by participant) Optifast VLCD program: <u>3 Levels</u>: intensive (3 optifast/day + food for energy, no meals), transition (2 optifast/day + food for energy, some meals), maintenance (1 optifast/day + food for energy, more meals), at week 12 regular meals resumed</p> <p>Control: Same education program with a meal plan, telephone support and weigh in (initiated by participant)</p>	<p>Body Weight</p>	<p>HbA1c</p>	<p>This study concluded that the use of the lifestyle intervention was statistically significant at 12 weeks in average weight loss (<math>p = 0.004</math>) and significant in HbA1c reduction (<math>p = 0.017</math>) in the intervention over the control, indicating the success of the intervention in lowering the risk of developing type 2 diabetes (T2DM) in Australian adults.</p>
<p><u>Study Design:</u> Non-randomized comparison</p>							
<p><u>Country:</u> Australia</p>							
<p><u>Funding Source:</u> None reported</p>							

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3	<u>Author, year:</u>	+	The purpose of this	This pilot randomized clinical trial	Intervention:	Body Weight
4	Franciosi M,		study was to	focused on Italian adults with type		
5	Lucisano G,		determine if the 6-	2 diabetes (T2DM), HbA1c 7% -	<u>6-month self-monitoring and intensive</u>	
6	Pellegrini F, et		month intervention, a	9%, on oral hypoglycemic therapy,	<u>education focused lifestyle intervention</u>	HbA1c
7	al. 2011.		self-monitoring and	and self-monitoring < 1 time per	<u>Number of sessions:</u> one in – person session	
8	<u>Study Design:</u>		intensive education	week over the last 12 months, ages	every 3 months and one phone call per month	
9	Pilot randomized		focused lifestyle	45 – 75 years old. The participants	<u>Standardized educational program:</u> topics	
10	clinical trial		intervention could	were randomized by using a 3:1,	included estimating portion sizes, monitoring	
11	<u>Country:</u>		achieve weight loss	intervention (n=46) to control	glucose, and diabetes related critical thinking	
12	Italy		and reduction in	(n=16), randomization ratio.	<u>Provided by:</u> trained diabetes nurses	
13	<u>Funding Source:</u>		HbA1c < 7%		Control:	
14	None reported		compared to the		<u>Standard counseling:</u> follow-up visits every 3	
15			control, standard		months, focusing on lifestyle and diet	
16			counseling, in Italian			
17			adults with type 2			
18			diabetes (T2DM),			
19			HbA1c 7% - 9%, on			
20			oral hypoglycemic			
21			therapy, and self-			
22			monitoring < 1 time			
23			per week over the last			
24			12 months, ages 45 –			
25			75 years old.			
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This study concluded that the use of the lifestyle intervention, was statistically significant at 6 months in weight loss ( $p = 0.02$ ) and reduction of HbA1c ( $p = 0.04$ ) in the intervention over the control and found that 61.9% of the intervention reached the target HbA1c of < 7.0% at 6 months ( $p = 0.005$ ) over the control indicating the success of the intervention in lowering the risk of developing type 2 diabetes (T2DM) in Italian adults.

Figure 1. PRISMA Flow Diagram

