Implementing a State-based Cardiovascular Disease and Diabetes Prevention Program

Running title: State-based Approach to Diabetes Prevention

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Additional information for this article can be found in an online appendix at http://care.diabetesjournals.org.

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Objective - To evaluate weight loss and cardiometabolic risk reduction achieved through an adapted DPP intervention among adults at high-risk for CVD and diabetes.

Research design and methods - Eight health care facilities implemented a group-based lifestyle intervention beginning in 2008. Participants attended 16 weekly core sessions followed by 6 monthly after core sessions.

Results - 1,003 participants were enrolled, 816 (81%) completed core and 578 (58%) completed after core. Of participants completing core and after core, 45% and 49% achieved the 7% weight loss goal, respectively. There were significant improvements in blood pressure, fasting glucose, and LDL cholesterol among participants completing the intervention.

Conclusions - Our findings indicate it is feasible for state coordinated CVD and diabetes prevention programs to achieve significant weight loss and improve cardiometabolic risk.

The Diabetes Prevention Program (DPP) and other studies demonstrated that lifestyle intervention can prevent the development of type 2 diabetes and reduce cardiometabolic risk among participants; prompting many countries to begin implementing efforts to translate these studies into practice (1-5). In 2008, the Montana Department of Public Health and Human Services (DPHHS) implemented an adapted DPP, and preliminary results demonstrated feasibility and effectiveness (6). This report describes weight loss and cardiometabolic risk improvement among participants completing the intervention.

RESEARCH DESIGN AND METHODS
A description of the early phase of this intervention has been published previously, and the initial cohort of participants is included in this report (6). Briefly, the DPHHS funded 8 health care facilities with recognized diabetes self-management education (DSME) programs beginning in 2008. Sites used trained health professionals as lifestyle coaches to provide the 16 session core followed by 6 monthly after core sessions (7). DPHHS staff provided technical assistance, data collection and analyses, and evaluation.

Overweight (BMI ≥ 25 kg/m\(^2\)) adults, with medical clearance from their referring provider and one or more of the following CVD and diabetes risk factors were eligible: a previous diagnosis of pre-diabetes; IGT or IFG; high blood pressure (≥130/85 mmHg or treatment) or dyslipidemia (triglycerides >150 mg/dl, LDL-cholesterol >130mg/dl or treatment, or HDL-cholesterol <40mg/dl men and <50mg/dl women); a history of gestational diabetes (GDM), or gave birth to a baby >9 pounds.

Height, weight, blood pressure, fasting blood glucose and lipid values were collected at enrollment, and completion of the core and after core. Participants were weighed at the beginning of each session and submitted self-monitoring records. Participants were considered core completers if they did not drop out or miss 3 or more consecutive sessions, and after core completers if they had completed follow-up laboratory measurements at ten months.

Institutional review board approval was not required by the DPHHS as previous research established the safety and efficacy of
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the lifestyle intervention and only de-identified data were utilized for analyses.

Participant data were analyzed using SAS 9.1 (Cary, North Carolina). Baseline characteristics were compared between all enrolled participants, core and after core completers; t tests were used to compare continuous variables and chi-squared tests were used to compare dichotomous variables. We calculated the proportion of completers that met the physical activity goal of >150 minutes per week in core, and 5% and 7% weight loss in core and after core. In core and after core, the last observed weight of completers was used to calculate mean weight loss for those not attending the final session. Paired t tests were used to assess mean weight loss, and the mean systolic and diastolic blood pressure, HDL, LDL, and fasting blood glucose from baseline to the end of core (4-month follow-up) and after core (10-month follow-up). Bonferroni correction was applied to the level of significance (α=0.003) to control for the number of paired t tests calculated.

RESULTS
Between February 2008 and January 2010, 1,003 participants were enrolled in the intervention, 816 (81%) completed core and 578 (58%) completed after core. Mean attendance was 14.9 (SD 1.6) sessions during core and 3.7 (SD 2.1) sessions during after core. The mean age of enrolled participants was 52.3 (SD 11.6) and 80% (n=805) were female. Core completers were significantly older compared to those who did not, and after core completers were significantly older, had a lower BMI at baseline and were more likely to have diagnosed dyslipidemia at baseline compared to those only completing core (Table available in online appendix at http://care.diabetesjournals.org).

At the conclusion of core 45% of completers achieved the 7% weight loss goal, 66% achieved 5% weight loss, and 66% met the physical activity goal. Among after core completers, 49% met the 7% weight loss goal, 64% achieved 5% weight loss, and 70% achieved the physical activity goal at the end of core.

Core and after core completers achieved significant improvements in weight, systolic and diastolic blood pressure, LDL cholesterol, and fasting blood glucose and a significant reduction in HDL at the end of core (Table 1). Significant improvements in HDL were seen for those completing after core. Participants with and without impaired glucose values at baseline achieved significant improvements in weight, blood pressure, LDL cholesterol, and blood glucose values at completion of core and after core (data not shown).

CONCLUSIONS
Core and after core completers achieved significant reductions in weight, and improvements in cardiometabolic risk. However, HDL decreased significantly at the end of core, but was followed by a significant increase for those completing after core. Other studies have found similar results, indicating reductions in HDL during initial weight loss, followed by increased HDL levels occurring during weight maintenance (8,9).

Our lifestyle intervention has a number of strengths, which supported translating this research into practice. We included overweight adults with risk factor(s) for CVD or diabetes, rather than only adults with pre-diabetes; an approach supported by recommendations from the American Diabetes and Heart Associations acknowledging the importance of addressing an individual’s global risk for CVD and diabetes (10). We also relied on physician referrals rather than time consuming screening events. Finally, offering the DPP in groups allowed for greater participant enrollment than a one-on-one intervention.
There are several limitations to our study. First, there was a dropout rate of 19% and 42% at the end of core and after core, respectively. Second, we used a pre and post evaluation with no comparison group. Third, we relied on self-reported physical activity and diet measures. Fourth, we were unable to obtain laboratory measures for all participants. Lastly, our analyses only included participants completing the intervention, which differed from the DPP where an intention to treat analysis was used.

Coordinated, state and national approaches to implement diabetes prevention programs are needed. A recent assessment of Montana DSME programs indicates these programs have the capacity to provide diabetes prevention services; the primary barrier being lack of reimbursement (11). Other promising models in the U.S. include regional training and implementation centers in Pittsburgh and Indianapolis (12,13). Due to the large number of persons at high-risk for diabetes in the U.S. many prevention sites will be needed, including DSME programs, and other settings.

Author contribution: Each author was responsible for the following: K.V researched data, contributed to discussion, wrote manuscript and reviewed/edited manuscript. T.O.H researched data, contributed to discussion, wrote manuscript and reviewed/edited manuscript. T.S.H. researched data, contributed to discussion and reviewed/edited manuscript. M.B. researched data and reviewed/edited manuscript. S.H. researched data and reviewed/edited manuscript. All authors are affiliated with the Montana Department of Public Health and Human Services.

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REFERENCES


Table 1. Weight loss and cardiometabolic risk factor outcomes among all participants completing the core and after core lifestyle intervention at four and ten months, Montana, 2008-2010.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Completed core</th>
<th>p*</th>
<th>Completed after core</th>
<th>p†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td></td>
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<tr>
<td>Completed core, N=816</td>
<td>99.2 +/- 20.7</td>
<td>92.4 +/- 20.0</td>
<td>&lt;.001</td>
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<tr>
<td>Completed after core, N=578</td>
<td>97.4 +/- 20.4</td>
<td>90.3 +/- 19.5</td>
<td>&lt;.001</td>
<td>89.7 +/- 19.3</td>
<td>&lt;.001</td>
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<tr>
<td>Systolic blood pressure (mmHg)</td>
<td></td>
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<tr>
<td>Completed core, N=684</td>
<td>133.6 +/- 15.7</td>
<td>126.5 +/- 14.9</td>
<td>&lt;.001</td>
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<tr>
<td>Completed after core, N=453</td>
<td>132.7 +/- 15.4</td>
<td>125.9 +/- 14.3</td>
<td>&lt;.001</td>
<td>127.1 +/- 14.6</td>
<td>&lt;.001</td>
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<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td></td>
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<tr>
<td>Completed core, N=683</td>
<td>82.0 +/- 11.0</td>
<td>78.6 +/- 9.6</td>
<td>&lt;.001</td>
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<tr>
<td>Completed after core, N=452</td>
<td>81.2 +/- 10.9</td>
<td>77.7 +/- 9.1</td>
<td>&lt;.001</td>
<td>77.7 +/- 9.2</td>
<td>&lt;.001</td>
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<tr>
<td>HDL (mg/dL)</td>
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<tr>
<td>Completed core, N=692</td>
<td>48.8 +/- 12.0</td>
<td>46.3 +/- 10.8</td>
<td>&lt;.001</td>
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<tr>
<td>Completed after core, N=488</td>
<td>49.1 +/- 11.6</td>
<td>46.1 +/- 10.7</td>
<td>&lt;.001</td>
<td>51.0 +/- 11.8</td>
<td>&lt;.001</td>
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<tr>
<td>LDL (mg/dL)</td>
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<tr>
<td>Completed core, N=663</td>
<td>125.2 +/- 34.6</td>
<td>114.9 +/- 32.6</td>
<td>&lt;.001</td>
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<tr>
<td>Completed after core, N=473</td>
<td>123.2 +/- 33.2</td>
<td>112.0 +/- 32.0</td>
<td>&lt;.001</td>
<td>118.7 +/- 31.2</td>
<td>&lt;.001</td>
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<tr>
<td>Fasting blood glucose (mg/dL)</td>
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<tr>
<td>Completed core, N=613</td>
<td>101.5 +/- 14.7</td>
<td>97.4 +/- 12.7</td>
<td>&lt;.001</td>
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<tr>
<td>Completed after core, N=418</td>
<td>101.6 +/- 14.9</td>
<td>96.9 +/- 11.7</td>
<td>&lt;.001</td>
<td>96.9 +/- 15.2</td>
<td>&lt;.001</td>
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</table>

Data are means +/- SD. *Results of the paired samples t test, comparisons of 4-month and baseline values. †Results of the paired samples t test, comparisons of 10-month and baseline values.