Supporting self-management in diabetes prevention and care: findings from an action-oriented research program

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Director, Centre for Outcomes Research and Evaluation, Research Institute of the McGill University Health Centre

MUHC Department of Medicine, Medical Grand Rounds, 22 January 2019
## The types and faces of diabetes

### Type 2 Diabetes
- 95% of diabetes in adults
- Weight higher and physical activity lower than optimal for insulin sensitivity
- Family history, ethnicity, socioeconomic factors

### Type 1 Diabetes
- 5% of diabetes
- More than 90% of childhood and youth onset diabetes
- Autoimmune destruction of islet cells – low insulin
- Narrow therapeutic window with high risk for hypos

### Gestational diabetes
- New onset diabetes in pregnancy
- Roughly 6% Canadian pregnancies, 12% worldwide
- Elevated risks for large for gestational age offspring, preeclampsia
- Similar risk factors as type 2 diabetes
- 20% or more develop type 2 diabetes in years following pregnancy
Self management

- **Physical activity**
  - To reduce insulin resistance & improve cardiometabolic profiles (T2D, GDM, T1D)
  - To prevent hyperglycemia (T2D, GDM)
  - To increase fitness (T2D, GDM, T1D)
  - To optimize (maintain) weight (T2D, GDM, T1D)
  - Structure and plan to prevent hypoglycemia (T1D, T2D, GDM)

- **Eating**
  - To optimize weight (T2D, GDM)
  - To reduce insulin resistance & improve cardiometabolic profiles (T2D, GDM)
  - To prevent hyperglycemia (T2D, GDM, T1D)
  - To avoid (potentially fatal) hypoglycemic episodes (T1D, T2D, GDM)

- **Stigma and anxiety** (T1D, T2D, GDM)
Self management support

- Transfer of information
- Active stimulation of symptom monitoring
  - Enhancing problem solving skills (= anticipation)
  - Self-treatment
  - Resource utilization
  - Stress/symptom management

- VPN in youth with Type 1 Diabetes
- Enhanced physical activity
  - Enhancing dietary intake
  - Enhancing smoking cessation
  - Enhancing medication adherence

- SMARTER in Type 2 Diabetes and Hypertension
- MoMM and MoMMii Studies after GDM

General approach for each component should be enhancing patients’ active role and responsibility in plan of care.
Prescribing step counts in type 2 diabetes and hypertension: Results of the Step Monitoring to improve ARTERial health (SMARTER)

Learning Objective 1. To learn how to deliver the SMARTER physician-delivered step count prescription strategy and gain knowledge of the importance of steps/day
<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>DAILY STEPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary</td>
<td></td>
</tr>
<tr>
<td>Low active</td>
<td></td>
</tr>
<tr>
<td>Somewhat active</td>
<td></td>
</tr>
<tr>
<td>Active</td>
<td></td>
</tr>
<tr>
<td>Highly active</td>
<td></td>
</tr>
</tbody>
</table>

Step categories
Tudor-Locke *et al*, *ISBPNA*, 2011
Step categories
Tudor-Locke *et al*, *ISBPNA*, 2011

<table>
<thead>
<tr>
<th>Classification</th>
<th>Daily Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary</td>
<td>&lt; 5,000</td>
</tr>
<tr>
<td>Low active</td>
<td>5,000 to 7,499</td>
</tr>
<tr>
<td>Somewhat active</td>
<td>7,500 - 9,999</td>
</tr>
<tr>
<td>Active</td>
<td>10,000 - 12,499</td>
</tr>
<tr>
<td>Highly active</td>
<td>&gt; 12,500</td>
</tr>
</tbody>
</table>
### Rules of Thumb

**Table 2. Minimum pedometer-based step rates for moderate-intensity walking using three different analytic approaches**

<table>
<thead>
<tr>
<th></th>
<th>Multiple regression analysis</th>
<th>Mixed-model analysis</th>
<th>ROC-curve analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n$</td>
<td>Minimum step rates (step-min$^{-1}$) for moderate-intensity (3 METs) walking</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>97</td>
<td>89</td>
<td>106</td>
</tr>
<tr>
<td>Men</td>
<td>39</td>
<td>92</td>
<td>101</td>
</tr>
<tr>
<td>Women</td>
<td>58</td>
<td>91</td>
<td>111</td>
</tr>
<tr>
<td>Normal weight</td>
<td>25</td>
<td>127</td>
<td>105</td>
</tr>
<tr>
<td>Overweight</td>
<td>34</td>
<td>94</td>
<td>106</td>
</tr>
<tr>
<td>Obese</td>
<td>37</td>
<td>103</td>
<td>105</td>
</tr>
</tbody>
</table>

**ROC, receiver operating characteristic**

- **100 steps** $\cong$ 1 minute walking
- **1,000 steps** $\cong$ 10 minutes walking
- **3,000 steps** $\cong$ 30 minutes walking

30 minutes moderate-intensity activity at least 5 days/week

Higher step counts associated with better cardiometabolic profiles and lower CVD events

Yates et al, Lancet, 2014

Reduction in CVD events for each 2,000 steps/day in prediabetes

- At baseline
  - HR 0.92, 95% CI 0.86–0.99
- During follow-up
  - HR 0.90, 95% CI 0.84–0.96
Steps and all-cause mortality in the Tasped Prospective Cohort Study

- Free-living adults in Tasmania, Australia (N= 2576)
- Average steps over 2 days with 1 weekday
- Australian National Death Index (mortality to June 2011; 219 deaths)

Table 3. The Association Between Daily Steps and All-cause Mortality.

<table>
<thead>
<tr>
<th></th>
<th>HRa (95% CI)</th>
<th>P value</th>
<th>AHRA (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average daily steps at baseline, (per 1000 increase)</td>
<td>0.94 (0.90–0.98)</td>
<td>0.002</td>
<td>0.94 (0.90–0.98)</td>
</tr>
<tr>
<td>Average daily steps at baseline, (per 1000 increase)c</td>
<td>0.92 (0.81–1.04)</td>
<td>0.20</td>
<td>0.92 (0.81–1.05)</td>
</tr>
<tr>
<td>Average daily steps at baseline, (per 1000 increase)d</td>
<td>0.94 (0.90–0.98)</td>
<td>0.005</td>
<td>0.94 (0.90–0.99)</td>
</tr>
<tr>
<td>Average daily steps at repeat review, (per 1 000 increase)</td>
<td>0.90 (0.84–0.97)</td>
<td>0.004</td>
<td>0.90 (0.83–0.97)</td>
</tr>
</tbody>
</table>

a Adjusted for age and sex
b Adjusted for age, sex, BMI at baseline, total energy intake from all sources (kJ) at baseline, current smoking status at baseline, alcohol consumption (g/day) at baseline, education at baseline and study cohort
c For deaths in the first two years
d For later deaths excluding any deaths in the first two years after baseline

doi:10.1371/journal.pone.0141274.t003
## Step counts are low in type 2 diabetes

<table>
<thead>
<tr>
<th>Study</th>
<th>Location</th>
<th>Population</th>
<th>Average daily step count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dasgupta <em>et al.</em>, 2010</td>
<td>Montréal, QC; Canada</td>
<td>201 adults with type 2 diabetes</td>
<td>5,308</td>
</tr>
<tr>
<td>DeGreef <em>et al.</em>, 2010</td>
<td>Ghent-Veurne, Belgium</td>
<td>133 adults with type 2 diabetes</td>
<td>5,365</td>
</tr>
<tr>
<td><strong>Tudor-Locke <em>et al.</em>, 2002</strong></td>
<td>London, ON; Canada</td>
<td>160 adults with type 2 diabetes</td>
<td>6,662</td>
</tr>
<tr>
<td><strong>Colley <em>et al.</em>, 2011</strong></td>
<td>Canada</td>
<td>2,832 Canadian adults</td>
<td>8,965</td>
</tr>
<tr>
<td><strong>Tudor-Locke <em>et al.</em>, 2009</strong></td>
<td>USA</td>
<td>3,744 US adults</td>
<td>9,676</td>
</tr>
</tbody>
</table>
Pedometer-based programs can increase steps in type 2 diabetes (but are limited in duration)
Qiu et al, BMC Medicine, 2014

<table>
<thead>
<tr>
<th>Source</th>
<th>Sample size</th>
<th>WMD (95% CI)</th>
<th>%, Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>With a PA goal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>De Greef et al. 2011-2</td>
<td>60 32</td>
<td>3.820 (2.702, 4.938)</td>
<td>15.61</td>
</tr>
<tr>
<td>De Greef et al. 2010</td>
<td>20 21</td>
<td>4.063 (1.314, 6.812)</td>
<td>8.40</td>
</tr>
<tr>
<td>De Greef et al. 2011-1</td>
<td>43 24</td>
<td>1.598 (-1.00, 3.296)</td>
<td>12.77</td>
</tr>
<tr>
<td>Tudor-Locke et al. 2004</td>
<td>24 23</td>
<td>3.501 (1.436, 5.566)</td>
<td>11.07</td>
</tr>
<tr>
<td>Subgroup estimates (P &lt; 0.001)</td>
<td>3,200 (2.053, 4.347)</td>
<td>47.86</td>
<td></td>
</tr>
<tr>
<td>Without a PA goal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kirk et al. 2009</td>
<td>82 33</td>
<td>115 (-721, 951)</td>
<td>16.87</td>
</tr>
<tr>
<td>Piette et al. 2011</td>
<td>145 146</td>
<td>1,185 (596, 1,774)</td>
<td>17.80</td>
</tr>
<tr>
<td>Plotniko et al. 2013</td>
<td>130 78</td>
<td>359 (-325, 1,043)</td>
<td>17.47</td>
</tr>
<tr>
<td>Subgroup estimates (P = 0.077)</td>
<td>598 (-65, 1,260)</td>
<td>52.14</td>
<td></td>
</tr>
<tr>
<td>Overall estimates (P = 0.001)</td>
<td>1,822 (751, 2,894)</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2
Forest plot of RCTs investigating step counter use in PA (steps/d) in T2D patients. The sample size represents the number of participants completing the trials. Summary estimates were analyzed with a random-effects model. CI, confidence interval; PA, physical activity; RCTs, randomized controlled trials; steps/d, steps per day; T2D, type 2 diabetes; WMD, weighted mean difference.
Physician step prescription and monitoring to improve ARTERial health (SMARTER): A randomized controlled trial in patients with type 2 diabetes and hypertension

Kaberi Dasgupta MD, MSc¹,⁶,⁸ | Ellen Rosenberg MD² | Lawrence Joseph PhD¹ | Alexandra B. Cooke MSc³ | Luc Trudeau MD⁴ | Simon L. Bacon PhD⁵ | Deborah Chan BSc¹ | Mark Sherman MD⁶ | Rémi Rabasa-Lhoret MD, PhD⁷ | Stella S. Daskalopoulou MD, PhD⁸

Clinical Trials.gov identifier: NCT01475201
Nominated Principal Investigator: K Dasgupta
Co Principal Investigators: S Daskalopoulou and E Rosenberg
INTERVENTION ARMS

Active Intervention Arm

• Provided pedometer & log book
• Study staff assessed baseline steps and gave to patient and physician
• Discussion at clinic visits (3 to 4 over 1 year)
• Written step prescription
• Overall goal of +3,000 steps/day over 1 year but individualized rate of increase

Control arm

• No pedometer or log book provided
• Study staff assessed baseline steps but did not give to patient or physician
• Advised to engage in physical activity such as walking 30 to 40 minutes daily at each clinic visit
Possible step count increments by clinic visits to aim for increase of 3,000 steps per day above baseline in approximately 1 year (for Physician’s reference).

<table>
<thead>
<tr>
<th>Steps per day at baseline (after baseline step count determined – 0 months)</th>
<th>Clinic Visit 1</th>
<th>Clinic Visit 2</th>
<th>Clinic Visit 3</th>
<th>Clinic Visit 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5000</td>
<td>+ 500</td>
<td>+ 750</td>
<td>+ 750</td>
<td>+ 1000</td>
</tr>
<tr>
<td>5000 – 7,499</td>
<td>+ 750</td>
<td>+ 1000</td>
<td>+ 1,250</td>
<td>+ 1,000</td>
</tr>
<tr>
<td>≥ 7,500</td>
<td>+ 1,000 / +2,000</td>
<td>+ 1,250</td>
<td>+ 1,000</td>
<td></td>
</tr>
</tbody>
</table>

Today’s Date: ____________________________

Patient name: ____________________________

**Baseline Step Count:** ____________  **Steps start date:** ____________

Which visit is this? ____________  **Recommended Step Count:** ____________

-----------------------------------------------------------------------------------------------------------------------------------

**SMARRx®**

Step count prescription

Today’s Date: ____________________________

Patient name: ____________________________

Please try to complete at least ____________ steps per day until your next clinic visit.
Please record your step counts in your log sheets at the end of each day.
Please bring your log sheets to the next clinic visit which will be in about three months.

Physician’s Name ____________________________  Physician’s Signature ____________________________
Outcomes: Differences in between arm changes

- Primary: arterial stiffness (carotid femoral pulse wave velocity)
- Co-primary: steps/day
- Secondary:
  - Blood pressure
  - A1C in type 2 diabetes participants
  - Insulin resistance (HOMA-IR) in participants not on insulin
  - Lipid profile
  - Anthropometric measures
Participant flow

- **692 assessed for eligibility**
  - 135 declined, 165 not eligible
- **392 invited for evaluation**
  - 20 with arrhythmia, 3 incomplete
- **369 completed evaluation**
  - 22 had steps at or above 10,000/day
- **347 randomized** (web based, permuted blocks)
  - 174 active arm, 173 control arm
- **275 completed final evaluations** (79%)
  - 135 active arm, 140 control arm
Some characteristics

- Average age: 60 years
- Over half women
- 75% married/common-law, 60% employed
- 70% type 2 diabetes, 90% hypertension
- Mean BMI: 32 kg/m$^2$
- Waist circumference 101 cm women and 107 cm men
- Mean steps: 5,000/day
- Mean BP: 124/76 mm Hg
- Mean A1C: 7.7%
- Elevated HOMA-IR
Outcomes

- Equivalent to increase of 20% steps over baseline
- Underpowered to detect cfPWV change but conclusive A1C and HOMA-IR
Relationship between steps/day and cfPWV in those who completed baseline assessment
Dasgupta et al, Journal of Hypertension, 2017

<table>
<thead>
<tr>
<th>Model</th>
<th>cfPWV change, m/s (95% CI) per 1000 steps/day</th>
<th>Other variables in model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.20 (-0.28, -0.12)</td>
<td>Unadjusted</td>
</tr>
<tr>
<td>2</td>
<td>-0.14 (-0.21, -0.07)</td>
<td>+ Age, sex</td>
</tr>
<tr>
<td>3</td>
<td>-0.12 (-0.16, -0.04)</td>
<td>+ BMI</td>
</tr>
<tr>
<td>4</td>
<td>-0.13 (-0.2, -0.05)</td>
<td>+ Ethnicity, immigrant status, employment, education</td>
</tr>
<tr>
<td>5</td>
<td>-0.11 (-0.2, -0.02)</td>
<td>+ Type 2 diabetes, hypertension</td>
</tr>
<tr>
<td>6</td>
<td>-0.11 (-0.2, -0.02)</td>
<td>+ Medication classes¹</td>
</tr>
</tbody>
</table>

**TABLE 3. Change in carotid femoral pulse wave velocity per 1000 steps/day**

cfPWV, carotid-femoral pulse wave velocity; CI, confidence interval.

¹The medication classes are specific categories of antihyperglycemic (metformin, sulfonylureas, insulin), antihypertensive (angiotensin-converting enzyme inhibitor or angiotensin receptor blocker, β-blocker, calcium channel antagonist, diuretic, other), and lipid-lowering therapies (statins, other).
A simple physician-delivered step count prescription strategy incorporated into routine clinical practice can augment physical activity and confer some favourable cardiometabolic changes in sedentary overweight adults with type 2 diabetes and/or hypertension.
6. Step count monitoring with a pedometer or accelerometer can be considered in combination with physical activity counselling, support and goal-setting to support and reinforce increased physical activity [Grade B, Level 2 (140,141)].

Physical Activity and Diabetes

Chapter 1

Ronald J. Sigal MD MPH FRCPC, Marni J. Armstrong CEP PhD, Simon L. Bacon PhD, Normand G Boulé PhD, Kaberi Dasgupta MD MSc FRCPC, Glen P Kenny PhD, Michael C Riddell PhD
Shared partner diabetes risk in gestational diabetes and couple based T2D prevention strategies

Learning Objective 2. To appreciate the concept of shared diabetes risk in couples and how this may be leveraged for couple-based collaboration for prevention
Mothers with GDM can develop postpartum diabetes
Song and colleagues, *Obesity Reviews*, 2017
He (husband) can be supportive- but when I give this man brown rice, he looks at me funny... if he would hear it from elsewhere, maybe, it’ll be different

And my husband is still buying hotdogs. If you send him to the grocery store – it’s a disaster!

...my daughter. She prevents me from eating what I should not be eating

I think the kids too it’s important to learn from a young age, the proper eating habits.

Mothers want father collaboration for diabetes prevention
Dasgupta, Da Costa and colleagues, PLoS One, 2014
Partners influence partners
Jackson and colleagues, *JAMA Intern Med*, 2015
Effect size 1.26 (1.08, 1.45)  

Effect size 1.18 (0.97, 1.4)

Spousal diabetes as a diabetes risk factor: A systematic review and meta-analysis  
Aaron Leong, Elham Rahme, and Kaberi Dasgupta  
BMC Medicine, 2014
Setting
- Canadian province of Quebec

Exposures
- Either, neither, both GDM/GH categories

Outcomes
- Diabetes, hypertension, CVD & mortality

Sample
- GDM mother matched to non GDM mothers (1990-2007); follow-up to 2012

Adjusted Cox proportional hazard models
- Preterm delivery, infant size at delivery, previous pregnancy, hospitalization in 3 years prior, psychiatric disease, airway disease, deprivation index, ethnicity, co-habitation with partner
GDM leads to postpartum diabetes in fathers
Dasgupta and colleagues, *Diabetes Care, 2015*

- Unadjusted HR 1.33 (95% CI 1.24-1.43)
- Adjusted HR 1.18 (95% CI 1.09 to 1.27)
GDM with GH indicates even higher risk for postpartum diabetes in fathers

Table 3. Hazard Ratios for Diabetes, Hypertension, and a Composite Cardiovascular Disease and Mortality Outcome Among Mothers and Fathers, by Gestational Diabetes and Gestational Hypertension Status, Quebec, Canada, 1990–2007

<table>
<thead>
<tr>
<th>GDM/GH Status in Mother(^a)</th>
<th>Mothers Unadjusted</th>
<th>Mothers Adjusted(^c)</th>
<th>Fathers Unadjusted</th>
<th>Fathers Adjusted(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HR  95% CI</td>
<td>HR  95% CI</td>
<td>HR  95% CI</td>
<td>HR  95% CI</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Either</td>
<td>15.5 13.7, 17.3</td>
<td>14.7 12.9, 16.6</td>
<td>1.3  1.2, 1.4</td>
<td>1.2  1.1, 1.3</td>
</tr>
<tr>
<td>Both</td>
<td>41.8 29.5, 59.1</td>
<td>36.9 26.0, 52.3</td>
<td>1.7  1.4, 2.2</td>
<td>1.8  1.4, 2.3</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Either</td>
<td>2.0  1.8, 2.1</td>
<td>1.9  1.8, 2.0</td>
<td>1.1  1.1, 1.7</td>
<td>1.1  1.0, 1.2</td>
</tr>
<tr>
<td>Both</td>
<td>6.0  5.1, 7.0</td>
<td>5.7  4.9, 6.7</td>
<td>1.2  1.0, 1.4</td>
<td>1.2  1.0, 1.4</td>
</tr>
<tr>
<td>Cardiovascular disease/mortality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Either</td>
<td>1.5  1.3, 2.7</td>
<td>1.4  1.2, 1.7</td>
<td>1.2  1.1, 1.3</td>
<td>1.2  1.1, 1.3</td>
</tr>
<tr>
<td>Both</td>
<td>2.3  1.6, 3.2</td>
<td>2.4  1.6, 3.5</td>
<td>1.1  0.8, 1.4</td>
<td>1.1  0.8, 1.4</td>
</tr>
</tbody>
</table>

Health Centre, 5252 boul de Maisonneuve, Office 3E.09, Montréal, QC, H4A 3S5, Canada (e-mail: kaberidasgupta@mcgill.ca).

Initially submitted February 2, 2017; accepted for publication April 5, 2017.
We have been trying to have mothers and fathers collaborate for diabetes prevention
Group-based activities with on-site childcare and online support improve glucose tolerance in women within 5 years of gestational diabetes pregnancy

Anne-Sophie Brazeau¹, Aaron Leong¹, Sara J Meltzer, Rani Cruz, Deborah DaCosta, Mary Hendrickson-Nelson, Lawrence Joseph, Kaberi Dasgupta¹ and MoMM study group

Health behaviour changes in partners of women with recent gestational diabetes: a phase IIa trial

Anne-Sophie Brazeau¹, Sara J Meltzer², Romina Pace², Natasha Garfield², Ariane Godbout³, Leslie Meissner⁴, Elham Rahme², Deborah Da Costa³ and Kaberi Dasgupta¹
**Intervention**

**1-h Physical activities with exercise physiologists**
- Discussion on active lifestyle
- 5 different activities
- Outside and inside sessions
- Children participation at 2 sessions

**1.5-h Nutrition with dietitians**
- Discussion on eating behavior:
  - Mindful eating, healthy plates, portion sizes
  - Meal preparation

**0.5-h Meal Sharing**
- Emphasize on mindful eating and healthy plates

**Between IN-PERSON SESSIONS**

**Motivational tools**
- Pedometer
- Phone text messages

**Online resource – study website**
- with information on diabetes prevention, active living, healthy eating, recipe ideas, examples of exercises and stress management tips

**4-5 IN-PERSON SESSIONS**
- With on-site childcare free of charge
<table>
<thead>
<tr>
<th>Measure</th>
<th>Baseline all (n = 36), mean (SD)</th>
<th>Baseline completed (n = 27), mean (SD)</th>
<th>Final completed (n = 27), mean (SD)</th>
<th>Change from baseline, mean [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight, kg</td>
<td>77.1 (19.0)</td>
<td>76.4 (17.1)</td>
<td>76.2 (17.2)</td>
<td>−0.3% [−1.3, 0.7]</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>29.3 (7.0)</td>
<td>29.1 (6.7)</td>
<td>29.0 (6.8)</td>
<td>−0.3% [−1.3, 0.7]</td>
</tr>
<tr>
<td>Waist circumference, cm</td>
<td>92.7 (14.6)</td>
<td>91.8 (13.7)</td>
<td>90.8 (13.6)</td>
<td>−0.9% [−2.6, 0.7]</td>
</tr>
<tr>
<td>Fat mass, %*</td>
<td>40.7 (7.1)</td>
<td>41.7 (6.7)</td>
<td>41.5 (7.0)</td>
<td>−0.5% [−2.0, 1.1]</td>
</tr>
<tr>
<td>Systolic blood pressure, mm Hg</td>
<td>119.6 (11.2)</td>
<td>120.0 (11.2)</td>
<td>115.8 (11.4)</td>
<td>−3.3% [−5.8, −0.8]</td>
</tr>
<tr>
<td>Diastolic blood pressure, mm Hg</td>
<td>70.4 (6.7)</td>
<td>71.3 (6.9)</td>
<td>68.2 (8.4)</td>
<td>−4.3% [−7.3, −1.3]</td>
</tr>
<tr>
<td>Fasting plasma glucose, mmol/L</td>
<td>5.7 (0.8)</td>
<td>5.8 (0.8)</td>
<td>5.5 (0.9)</td>
<td>−4.9% [−9.5, −0.3]</td>
</tr>
<tr>
<td>1-h plasma glucose, mmol/L</td>
<td>9.5 (2.9)</td>
<td>9.8 (3.1)</td>
<td>9.1 (3.6)</td>
<td>−5.0% [−19.1, 9.1]</td>
</tr>
<tr>
<td>2-h plasma glucose, mmol/L†</td>
<td>7.2 (2.9)</td>
<td>7.6 (3.3)</td>
<td>6.8 (2.8)</td>
<td>−8.0% [−15.6, −0.5]</td>
</tr>
<tr>
<td>Fasting insulin, μU/mL</td>
<td>7.9 (4.5)</td>
<td>8.5 (4.9)</td>
<td>8.1 (5.0)</td>
<td>−5.3% [−13.3, 2.7]</td>
</tr>
<tr>
<td>1-h insulin, μU/mL*</td>
<td>88.7 (80.0)</td>
<td>101.7 (888)</td>
<td>82.5 (46.3)</td>
<td>−2.2% [−24.9, 20.6]</td>
</tr>
<tr>
<td>2-h insulin, μU/mL†</td>
<td>63.5 (65.0)</td>
<td>75.7 (72.7)</td>
<td>55.0 (50.2)</td>
<td>−15.9% [−35.6, 3.8]</td>
</tr>
<tr>
<td>ISI (β120), mg x L/mmol x μU x min†</td>
<td>56.6 (26.3)</td>
<td>59.3 (31.9)</td>
<td>72.3 (41.4)</td>
<td>23.7% [9.1, 38.4]</td>
</tr>
<tr>
<td>Matsuda Index†</td>
<td>5.6 (3.9)</td>
<td>5.0 (4.0)</td>
<td>6.5 (6.4)</td>
<td>37.9% [3.5, 72.4]</td>
</tr>
<tr>
<td>HOMA-IR</td>
<td>2.0 (1.3)</td>
<td>2.2 (1.4)</td>
<td>2.0 (1.3)</td>
<td>−9.4% [−18.6, −0.1]</td>
</tr>
<tr>
<td>Total Cholesterol, mmol/L</td>
<td>5.0 (0.7)</td>
<td>4.9 (0.6)</td>
<td>4.8 (0.7)</td>
<td>−1.9% [−4.9, 1.1]</td>
</tr>
<tr>
<td>HDL-cholesterol, mmol/L</td>
<td>1.3 (0.3)</td>
<td>1.3 (0.3)</td>
<td>1.3 (0.4)</td>
<td>0.0% [−4.0, 4.0]</td>
</tr>
<tr>
<td>LDL-cholesterol, mmol/L</td>
<td>3.0 (0.6)</td>
<td>2.9 (0.6)</td>
<td>2.9 (0.5)</td>
<td>2.1% [−2.4, 6.7]</td>
</tr>
<tr>
<td>Triglycerides, mmol/L</td>
<td>1.4 (0.8)</td>
<td>1.5 (0.9)</td>
<td>1.3 (0.7)</td>
<td>−9.7% [−20.2, 0.9]</td>
</tr>
<tr>
<td>Adiponectin, μg/mL</td>
<td>6.8 (4.4)</td>
<td>6.6 (4.0)</td>
<td>6.7 (4.0)</td>
<td>2.2% [−3.7, 8.1]</td>
</tr>
<tr>
<td>Leptin, ng/mL</td>
<td>25.2 (16.7)</td>
<td>23.6 (13.8)</td>
<td>26.2 (17.5)</td>
<td>11.4% [−1.8, 24.6]</td>
</tr>
</tbody>
</table>

*Data available for 26 who completed baseline and final assessments.
†Data available for 25 who completed baseline and final assessments.
<table>
<thead>
<tr>
<th>Measure</th>
<th>All participants</th>
<th>Partners</th>
<th>Mothers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before; mean (sd) [95% CI]</td>
<td>Mean change</td>
<td>Mean change</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>75.6 (14.9) -0.1 [-0.5, 0.3]</td>
<td>81.7 (14.7) -0.27 [-0.87, 0.34]</td>
<td>70.1 (12.8) -0.04 [-0.59, 0.52]</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>26.8 (4.3) -0.05 [-0.19, 0.09]</td>
<td>27.1 (4.0) -0.09 [-0.29, 0.11]</td>
<td>26.5 (4.6) -0.01 [-0.22, 0.20]</td>
</tr>
<tr>
<td>Systolic Blood pressure, mmHg</td>
<td>119.2 (13.3) -2.7 [-4.4, -1.0]</td>
<td>123.7 (13.3) -1.9 [-4.3, 0.5]</td>
<td>115.1 (12.1) -3.4 [-5.8, -1.1]</td>
</tr>
<tr>
<td>Diastolic Blood pressure, mmHg</td>
<td>72.6 (9.7) -1.8 [-3.3, -0.4]</td>
<td>75.6 (10.0) -2.5 [-4.7, 0.4]</td>
<td>69.9 (8.6) -1.2 [-3.1, 0.7]</td>
</tr>
<tr>
<td>Fasting plasma glucose, mmol/L</td>
<td>5.2 (0.5) 0.08 [0.01, 0.14]</td>
<td>5.2 (0.5) 0.09 [0.01, 0.19]</td>
<td>5.2 (0.6) 0.07 [-0.01, 0.14]</td>
</tr>
<tr>
<td>2-h plasma glucose, mmol/L</td>
<td>5.5 (1.6) 0.15 [-0.19, 0.48]</td>
<td>5.1 (1.5) 0.20 [-0.28, 0.69]</td>
<td>5.8 (1.6) 0.16 [-0.33, 0.66]</td>
</tr>
<tr>
<td>Fasting insulin, μU/mL</td>
<td>4.9 (3.1) 0.9 [0.3, 1.6]</td>
<td>5.0 (3.7) 0.9 [-0.2, 1.9]</td>
<td>5.0 (2.6) 0.9 [0.1, 1.1]</td>
</tr>
<tr>
<td>2-h insulin, μU/mL</td>
<td>30.2 (31.3) 6.8 [-0.7, 14.2]</td>
<td>31.5 (38.8) 7.0 [-6.7, 20.7]</td>
<td>28.5 (21.6) 19.4 [-7.3, 46.1]</td>
</tr>
<tr>
<td>HOMA-IR</td>
<td>1.2 (0.9) 0.21 [0.04, 0.38]</td>
<td>1.1 (1.2) 0.21 [-0.08, 0.49]</td>
<td>1.2 (0.6) 0.23 [0.04, 0.42]</td>
</tr>
<tr>
<td>ISI₂₉₂₀mg·L⁻²·mmol⁻¹×μU×min</td>
<td>94.0 (38.5) -6.2 [-12.9, 0.5]</td>
<td>104.4 (39.9) -6.5 [-17.3, 4.2]</td>
<td>83.5 (34.9) -5.9 [-14.3, 2.5]</td>
</tr>
<tr>
<td>Chol-tot, mmol/L</td>
<td>4.6 (0.7) -0.13 [-0.24, -0.02]</td>
<td>4.6 (0.7) -0.12 [-0.30, 0.06]</td>
<td>4.7 (0.7) -0.13 [-0.27, 0.01]</td>
</tr>
<tr>
<td>HDL-chol, mmol/L</td>
<td>1.3 (0.3) -0.02 [-0.06, 0.02]</td>
<td>1.2 (0.3) -0.01 [-0.07, 0.04]</td>
<td>1.4 (0.3) -0.02 [-0.08, 0.04]</td>
</tr>
<tr>
<td>Triglycerides, mmol/L</td>
<td>1.2 (0.7) -0.04 [-0.14, 0.06]</td>
<td>1.2 (0.7) -0.07 [-0.22, 0.09]</td>
<td>1.1 (0.7) -0.01 [-0.15, 0.13]</td>
</tr>
<tr>
<td>LDL-chol (calc), mmol/L</td>
<td>2.8 (0.6) -0.06 [-0.15, 0.03]</td>
<td>2.8 (0.7) -0.00 [-0.13, 0.13]</td>
<td>2.7 (0.6) -0.12 [-0.24, 0.00]</td>
</tr>
</tbody>
</table>
Letters to mother who had GDM <5 years (through their endocrinologist) and ≥1 phone calls
n=1090
→ n=188 (17%) wrong contact info

Publicity on targeted websites (diabetes association, daycare in the neighborhood, playground)
N=17 websites

Correct contact information n=902
→ n=387 (43%) did not call back
→ n=201 (22%) not interested

Assessed for eligibility n=314
→ n=208 (66%) not eligible

Eligible couples n=106
→ n=27 (27%) No longer interested
→ n=22 (21%) Father refused

57 couples

59 couples completed baseline assessments

Good engagement among recruited but recruitment is a challenge
Systematic review for participation rates in diabetes prevention after GDM pregnancy studies

5 databases- 2859 records

33 relevant studies, 16 info participation

Recruitment in pregnancy at clinic
  ■ 40% or more participation

Months or years postpartum
  ■ Under 15%
Stigma in youth with T1D, glycemic control, and creation of a virtual peer network

Learning Objective 3. To appreciate the link between stigma and poor glycemic control among youth and young adults with type 1 diabetes and how this may be addressed through a peer network.
Stigma and Its Association With Glycemic Control and Hypoglycemia in Adolescents and Young Adults With Type 1 Diabetes: Cross-Sectional Study

Anne-Sophie Brazeau¹, PhD, RD; Meranda Nakha², MD, FRCPC; Michael Wright³, BSc; Mélanie Henderson⁴, PhD, MD, FRCPC; Constadina Panagiotopoulou⁵, MD, FRCPC; Daniele Pacaud⁶, MD, FRCPC; Patricia Kearns⁷, BFA; Elham Rahme⁸, PhD; Deborah Da Costa⁸, PhD; Kaberi Dasgupta⁸, MSc, MD, FRCPC
AIMS

▸ Prevalence of stigma in youth 14 to 25 years of age with T1D
▸ Associations with high A1C
▸ Associations with severe hypos

Dr Anne-Sophie Brazeau, former Postdoc and now Assistant Professor of Human Nutrition, McGill University

Ms Deborah Chan, Research assistant and Kinesiologist, Dasgupta Diabetes Prevention and Management Research Group
Key questions: stigma

- I try not to deal with diabetes in front of my friends
- I have a hard time telling people I have diabetes
- I feel embarrassed taking care of my diabetes in front of other people

**Barriers to Diabetes Adherence in Adolescence questionnaire** (selected items)

- Option to share a personal experience of stigma
Hypoglycemia

▸ 1 severe episode in past year
▸ Defined as requiring assistance

High A1C

▸ A1C at or above 9%
▸ Mailed in capillary blood glucose samples and/or self-reported
Patient partner: Michael Wright

- Helped design questionnaire
- Assisted with recruitment
- Helped with data management and interpretation
- Co-author on paper
- Role in knowledge translation
- Summer student research grant from Diabetes Quebec
Recruitment

- Social media-based
- Tweets by Diabetes Canada and other smaller diabetes organizations
- $10 Amazon.ca gift certificates
- 380 respondents
What was the prevalence of stigma in our cohort?

<table>
<thead>
<tr>
<th></th>
<th>ALL</th>
<th>TEENS N=178</th>
<th>YOUNG ADULTS N=202</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys/Men</td>
<td>31%</td>
<td>42%</td>
<td>22%</td>
</tr>
<tr>
<td>Years with diabetes (SD)</td>
<td>9.6 (5.4)</td>
<td>8.1 (4.5)</td>
<td>10.9 (5.8)</td>
</tr>
<tr>
<td>A1C (SD)</td>
<td>7.8 (1.7)</td>
<td>7.9 (1.4)</td>
<td>7.8 (1.9)</td>
</tr>
<tr>
<td>Severe hypos in past year</td>
<td>28%</td>
<td>27%</td>
<td>29%</td>
</tr>
<tr>
<td>1 or more of key BDA items</td>
<td>65.5%</td>
<td>61.2%</td>
<td>69.3%</td>
</tr>
</tbody>
</table>
Stigma and poor glycemic control are linked

- TWICE as likely to have either high A1C or severe hypos in past year
  - OR 2.25 (95% CI 1.33 to 3.80)

- THREE times as likely to have high A1C
  - OR 3.05 (95% CI 1.36 to 6.86)

- TWICE as likely to have severe hypo in past year
  - OR 1.86 (95% CI 1.05 to 3.31)
Virtual Patient Network for peer Support and action in youth and young adults with Diabetes-type 1 (VPN)
Goals

- Community of support
- Identify the issues that matter to patients
- Build a platform for action and empowerment

Some VPN leaders: Michael Wright, Jordan McCarron, Alexandra Kellington, Sarah Baker, Melinda Provost, Zoeie Major-Orfao, and Mariam Elkeraby at Diabetes Canada 2017 meeting in Edmonton
The peer leaders received training from:

Patricia Kearns - She spent many years teaching individuals on how to be effective peer leaders. She taught the VPN peer leaders:

- Importance of peer leaders
- Role of a peer leader in the VPN project
- Benefits and challenges of being a peer leader

Dr. Jon Salsberg from the University of Limerick, Ireland spoke to the peer leaders about:

- Importance of involving peer participation versus having a researcher decide which topics to discuss
- Creating action and change through peer participation
<table>
<thead>
<tr>
<th>Language spoken</th>
<th>English only</th>
<th>French only</th>
<th>English and French</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=136</td>
<td>101 (74%)</td>
<td>24 (18%)</td>
<td>11 (8%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=136</td>
<td>25 (18%)</td>
<td>111 (82%)</td>
</tr>
</tbody>
</table>

Map Legend
- = < 5 members
- = 5-10 members
- = 10-15 members
- = 15-20 members
- > 20 members
Concluding remarks

• Disease management and support is more than medication prescription

• There are levers to support health behaviour change
  – Physicians and other clinical team members
  – Community based programs
  – Families and partners
  – Peers
  – Health technologies

• Developing and testing strategies has the potential to improve health outcomes and well being
Acknowledgements

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Karoline Kragelund Nielsen  Tony Chetty
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Nancy Wu  Aaron Leong

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Cindy Ibberson  Yousef Habel
Sabrina Pillay