Improving the Oral Health of Indigenous Children in Canada

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Faculty/Presenter Disclosure

- Dr. Robert Schroth has no relevant financial relationships with the manufacturer(s) of commercial services discussed in this CME activity
- We do not intend to discuss an unapproved/investigative use of a commercial product/device in this presentation
Objectives

• Share new discoveries on dental caries in Indigenous children including, epidemiology and associations with risk factors, like the oral microbiome.

• Share research experiences and evidence on the prevention of dental caries in Indigenous children in Canada and the United States.

• Review principles for promoting oral health in Indigenous communities and share evidence from the evaluation of oral health promotion programs implemented to prevent dental caries and improve oral health (e.g. Health Canada’s Children’s Oral Health Initiative, Indian Health Service Early Childhood Caries Collaborative).
Early Childhood Caries

- Early childhood caries (ECC) is decay in primary teeth up to 72 months (6 years)
- First Nations, Métis and Inuit children frequently experience a more severe form of the disease, called Severe Early Childhood Caries (S-ECC)
- Common disease in children from low-income households, newcomer and refugee families, rural and remote regions of Canada, First Nations, Métis and Inuit populations
- Increase risk of decay through childhood and adolescence
- S-ECC can negatively affect health and well-being
- Magnitude of the problem varies by jurisdiction
- Range **8.4 per 1,000** in Ontario **110.6 per 1,000** in Nunavut
Dental surgery to treat S-ECC is a serious ongoing health care challenge

Schroth, Quinonez, Shwart, Wagar 2016 J Can Dent Assoc
Are Some Populations at Higher Risk?

- As high for children from rural (versus urban) neighbourhoods: 3.2 x
- As high for children from the least (versus the most) affluent neighbourhoods: 3.7 x
- As high for children from neighbourhoods with high (versus low) Aboriginal populations: 7.8 x

Source: Schroth, Quinonez, Shwart, Wagar 2016 J Can Dent Assoc
1. Determining the microbiome associated with severe caries in Canadian First Nations children

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Methods

**QUEST organization:** Quantifying, Understanding and Eliminating Severe Tooth Decay in AI/AN Children

**Inclusion Criteria:**
- Children <72 months of age
- Severe dental caries meeting the case definition for S-ECC
- Parent or caregiver self-identifying the child as Canadian First Nations or Métis

**Exclusion Criteria:**
- Children >72 months of age
- Children who have taken antibiotics within the last 3 months
- U of M Health Research Ethics Board approved & approved by Misericordia Health Centre
- Questionnaire on general health, oral health, demographics, and diet.
- Plaque samples collected following set protocol.

**DNA sequencing**
- Forsyth HOMINGS (Human Oral Microbe Identification using Next Generation Sequencing) service was used
- Preliminary data analysis were conducted at UCLA

**Data analysis** included descriptive and bivariate analyses (Chi Square and t tests). $P \leq 0.05$ was significant
## Results – Characteristics of Participants

20 caries-free children and 30 children with S-ECC were recruited and sampled.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>S-ECC</th>
<th>Caries-Free</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>19 (63.3%)</td>
<td>9 (45.0%)</td>
<td>0.20</td>
</tr>
<tr>
<td>Female</td>
<td>11 (36.7%)</td>
<td>11 (55.0%)</td>
<td></td>
</tr>
<tr>
<td>Child's Age (months)</td>
<td>42.8 ± 12.2</td>
<td>37.4 ± 10.3</td>
<td>0.11</td>
</tr>
<tr>
<td>Lives in FN Community</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>17 (56.7%)</td>
<td>0 (0%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>No</td>
<td>13 (43.3%)</td>
<td>20 (100%)</td>
<td></td>
</tr>
<tr>
<td>Indigenous Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Nations</td>
<td>30 (100%)</td>
<td>19 (95.0%)</td>
<td>0.22</td>
</tr>
<tr>
<td>Métis</td>
<td>0 (0%)</td>
<td>1 (5.0%)</td>
<td></td>
</tr>
<tr>
<td>Birth Weight (grams)</td>
<td>3421.3 ± 573.2</td>
<td>3529.9 ± 699.0</td>
<td>0.22</td>
</tr>
</tbody>
</table>
Bacterial Composition of Plaque in S-ECC vs. Caries-free

Relative abundance of species

Caries-free

S-ECC

Streptococcus sanguinis
Streptococcus mutans
Veillonella dispar
Microbial communities of the S-ECC and caries-free groups did not differ in terms of species richness or diversity.

Figure 1. Rarefaction curves of diversity indices. A) chao1 (species richness) and B) Faith’s phylogenetic diversity index. S-ECC plaque samples are in red, caries-free in blue.

- Microbial communities of the S-ECC and caries-free groups did not differ in terms of species richness or diversity.
<table>
<thead>
<tr>
<th>Species-level OTU</th>
<th>Median Relative Abundance, % (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Caries-Free (n=20)</td>
</tr>
<tr>
<td>Streptococcus HOT 058</td>
<td>23.7 (12.3 – 42.0)</td>
</tr>
<tr>
<td>Leptotrichia shahii</td>
<td>3.4 (0 – 16.7)</td>
</tr>
<tr>
<td>Lautropia mirabilis</td>
<td>3.2 (0.2 – 11.6)</td>
</tr>
<tr>
<td>Haemophilus parainfluenzae</td>
<td>2.0 (0.01 – 7.2)</td>
</tr>
<tr>
<td>Veillonella dispar</td>
<td>2.2 (0.15 – 9.4)</td>
</tr>
<tr>
<td>Rothia aeria*</td>
<td>2.4 (0.37 – 7.6)</td>
</tr>
<tr>
<td>Corynebacterium matruchotii*</td>
<td>2.0 (0.66 – 5.4)</td>
</tr>
<tr>
<td>Actinomyces naeslundii*</td>
<td>1.8 (0.68 – 6.2)</td>
</tr>
<tr>
<td>Rothiadentocariosa</td>
<td>1.7 (0.12 – 24.5)</td>
</tr>
<tr>
<td>Abiotrophia defectiva</td>
<td>1.1 (0.07 – 6.3)</td>
</tr>
<tr>
<td>Gemella haemolysans</td>
<td>0.87 (0.09 – 3.8)</td>
</tr>
<tr>
<td>Granulicatella adiacens</td>
<td>0.82 (0.14 – 2.3)</td>
</tr>
<tr>
<td>Porphyromonas HOT 279</td>
<td>0.63 (0.03 – 3.5)</td>
</tr>
<tr>
<td>Granulicatella elegans*</td>
<td>0.32 (0.03 – 1.2)</td>
</tr>
<tr>
<td>Leptotrichia HOT 225</td>
<td>1.0 (0.03 – 4.5)</td>
</tr>
<tr>
<td>Fusobacterium nucleatum ss. vincentii_</td>
<td>0.54 (0.04 – 3.8)</td>
</tr>
<tr>
<td>Corynebacterium durum</td>
<td>0.80 (0.14 – 9.4)</td>
</tr>
<tr>
<td>Streptococcus mutans</td>
<td>0.15 (0.006 – 10.4)</td>
</tr>
<tr>
<td>Prevotella melaninogenica*</td>
<td>0.10 (0.002 – 3.6)</td>
</tr>
<tr>
<td>Alloprevotella HOT 473*</td>
<td>0.04 (0 – 1.7)</td>
</tr>
<tr>
<td>Gemella morbillorum</td>
<td>0.58 (0.11 – 3.3)</td>
</tr>
<tr>
<td>Haemophilus HOT 036*</td>
<td>0.07 (0.003 – 0.3)</td>
</tr>
<tr>
<td>Streptococcus sanguinis*</td>
<td>0.56 (0.19 – 0.8)</td>
</tr>
<tr>
<td>Neisseria mucosa</td>
<td>0.44 (0.09 – 1.2)</td>
</tr>
<tr>
<td>Aggregatibacter HOT 458</td>
<td>0.25 (0.003 – 2.3)</td>
</tr>
</tbody>
</table>
Relative Abundance of the Top 25 Genera-level Operational Taxonomic Units (OTUs) Detected in Plaque of Caries-Free (CF) and children with S-ECC

<table>
<thead>
<tr>
<th>Genera-level OTU</th>
<th>Caries-Free (n=20)</th>
<th>S-ECC (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strepococcus</td>
<td>28.3 (16.8 – 49.6)</td>
<td>31.3 (12.8 – 50.0)</td>
</tr>
<tr>
<td>Leptotrichia*</td>
<td>10.5 (4.2 – 23.7)</td>
<td>5.7 (0.61 – 30.4)</td>
</tr>
<tr>
<td>Neisseria</td>
<td>7.5 (0.70 – 27.9)</td>
<td>9.0 (0.22 – 26.4)</td>
</tr>
<tr>
<td>Rothia*</td>
<td>4.8 (0.72 – 29.9)</td>
<td>1.7 (0.04 – 10.3)</td>
</tr>
<tr>
<td>Fusobacterium</td>
<td>4.8 (0.65 – 12.3)</td>
<td>3.7 (1.1 – 9.5)</td>
</tr>
<tr>
<td>Haemophilus</td>
<td>2.1 (0.01 – 7.5)</td>
<td>4.6 (0.13 – 12.8)</td>
</tr>
<tr>
<td>Veillonella</td>
<td>2.4 (0.18 – 10.1)</td>
<td>4.1 (0.39 – 19.8)</td>
</tr>
<tr>
<td>Corynebacterium*</td>
<td>3.3 (1.4 – 14.8)</td>
<td>1.6 (0.01 – 8.1)</td>
</tr>
<tr>
<td>Actinomyces*</td>
<td>3.2 (1.4 – 9.4)</td>
<td>1.8 (0.25 – 7.4)</td>
</tr>
<tr>
<td>Lautropia</td>
<td>3.2 (0.19 – 11.6)</td>
<td>2.2 (0.05 – 10.2)</td>
</tr>
<tr>
<td>Prevotella</td>
<td>0.93 (0.17 – 9.1)</td>
<td>2.5 (0.20 – 26.5)</td>
</tr>
<tr>
<td>Granulicatella</td>
<td>1.3 (0.22 – 2.6)</td>
<td>2.3 (0.06 – 5.7)</td>
</tr>
<tr>
<td>Gemella</td>
<td>1.6 (0.20 – 4.9)</td>
<td>2.0 (0.29 – 7.0)</td>
</tr>
<tr>
<td>Porphyromonas</td>
<td>1.3 (0.08 – 5.1)</td>
<td>1.8 (0.023 – 9.2)</td>
</tr>
<tr>
<td>Capnocytophaga</td>
<td>1.5 (0.48 – 5.1)</td>
<td>0.94 (0.19 – 2.7)</td>
</tr>
<tr>
<td>Abiotrophia</td>
<td>1.1 (0.07 – 6.3)</td>
<td>1.3 (0.003 – 5.7)</td>
</tr>
<tr>
<td>Kingella</td>
<td>1.2 (0.61 – 2.5)</td>
<td>0.80 (0.065 – 2.1)</td>
</tr>
<tr>
<td>Alloprevotella*</td>
<td>0.13 (0.003 – 1.7)</td>
<td>1.0 (0.006 – 9.5)</td>
</tr>
<tr>
<td>Aggregatibacter</td>
<td>0.88 (0.01 – 3.3)</td>
<td>0.99 (0.14 – 4.1)</td>
</tr>
<tr>
<td>Campylobacter</td>
<td>0.59 (0.14 – 2.5)</td>
<td>0.46 (0.08 – 3.9)</td>
</tr>
<tr>
<td>Selenomonas</td>
<td>0.29 (0.02 – 3.7)</td>
<td>0.54 (0.02 – 4.2)</td>
</tr>
<tr>
<td>Cardiobacterium*</td>
<td>0.45 (0.04 – 2.2)</td>
<td>0.17 (0.002 – 0.7)</td>
</tr>
<tr>
<td>Lachnoanaerobaculum</td>
<td>0.43 (0.16 – 2.6)</td>
<td>0.32 (0.03 – 1.6)</td>
</tr>
<tr>
<td>TM7 [G-1]*</td>
<td>0.33 (0.004 – 1.4)</td>
<td>0.11 (0.005 – 1.8)</td>
</tr>
<tr>
<td>Bergeyella</td>
<td>0.33 (0.03 – 0.8)</td>
<td>0.27 (0.05 – 1.2)</td>
</tr>
</tbody>
</table>
**Figure 3.** Relative abundance of *Streptococcus mutans* in all subjects. Percent relative abundance of *S. mutans* is plotted individually for each subject.
2. Evaluating Health Canada’s Children’s Oral Health Initiative (COHI)

- COHI started in the Fall 2004 in some Canadian First Nation and Inuit communities
- Shift focus from treating disease to prevention and less invasive treatment
- Target groups:
  - Pregnant women and caregivers
  - Children 0-4 years (preschool)
  - Children 5-7 years (school age)

**GOAL of COHI:** over time COHI will result in significant improvement of the oral health in First Nations and Inuit children
The Children’s Oral Health Initiative: An intervention to address the challenges of dental caries in early childhood in Canada’s First Nation and Inuit communities

Kavita R. Mathu-Muju, DMD, MPH; James McLeod, RDT; Mary Lou Walker, RDH; Martin Chartier, DMD; Rosamund L. Harrison, DMD, MSc

ABSTRACT

OBJECTIVE: The objective of the Children’s Oral Health Initiative (COHI) is to increase access to preventive oral health services provided to First Nations and Inuit (FN/I) children living on federal reserves and in remote communities.

PARTICIPANTS: COHI targets preschool children; 5-7-year-olds; pregnant women; and parents/caregivers in FN/I communities.

SETTING: The program was piloted in 2004 by Health Canada and is potentially available to all FN/I communities. However, the community must consent to the program’s implementation and agree to support a community member to be trained as a COHI aide.

INTERVENTION: Dental therapists and hygienists screen eligible children, apply fluoride varnish and sealants to children’s teeth, and stabilize active dental caries with glass ionomer. An innovation was the development of a community oral health worker, the COHI Aide. The COHI Aide is a community member who serves as an advocate for preventive oral health in the community and provides instruction to children, parent/caregivers and expectant mothers in preventing dental caries.

RESULTS: COHI was piloted in 41 communities in 2004. By 2014, the program had expanded to 370 FN/I communities, which represents 55% of all eligible FN/I communities. In 2012, 23,085 children had received COHI preventive oral health services.

CONCLUSION: The results demonstrate COHI’s success as a preventive oral health care delivery model in remote communities. Implementation and delivery of preventive oral health services has been enhanced by the sustained presence of a community-based COHI Aide.

KEY WORDS: Indigenous health services; pediatric dentistry; oral health; dental caries; community health worker

Table 1. Number of COHI communities per fiscal year

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</tr>
</thead>
<tbody>
<tr>
<td>Atlantic (n = 34)</td>
<td>10</td>
<td>6</td>
<td>19</td>
<td>23</td>
<td>25</td>
<td>28</td>
<td>28</td>
<td>29</td>
<td>33</td>
<td>32</td>
<td>32 (94%)</td>
</tr>
<tr>
<td>Quebec (n = 40)</td>
<td>4</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>19 (48%)</td>
</tr>
<tr>
<td>Ontario (n = 139)</td>
<td>11</td>
<td>25</td>
<td>28</td>
<td>10</td>
<td>34</td>
<td>53</td>
<td>60</td>
<td>60</td>
<td>62</td>
<td>70</td>
<td>69 (50%)</td>
</tr>
<tr>
<td>Manitoba (n = 63)</td>
<td>3</td>
<td>28</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27 (43%)</td>
</tr>
<tr>
<td>Saskatchewan (n = 70)</td>
<td>6</td>
<td>24</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28 (43%)</td>
</tr>
<tr>
<td>Alberta (n = 48)*</td>
<td>4</td>
<td>4</td>
<td>11</td>
<td>19</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28 (43%)</td>
</tr>
<tr>
<td>British Columbia (n = 198)</td>
<td>3</td>
<td>30</td>
<td>27</td>
<td>27</td>
<td>49</td>
<td>56</td>
<td>61</td>
<td>62</td>
<td>62</td>
<td>79 (40%)</td>
<td>6 (3%)</td>
</tr>
<tr>
<td>Northern Region (n = 44)</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6 (3%)</td>
</tr>
<tr>
<td>TOTAL FN/I communities (n = 636)</td>
<td>41 (6%)</td>
<td>129 (20%)</td>
<td>154 (24%)</td>
<td>179 (28%)</td>
<td>236 (37%)</td>
<td>261 (41%)</td>
<td>266 (42%)</td>
<td>259 (42%)</td>
<td>300 (47%)</td>
<td>320 (50%)</td>
<td>242 (38%)</td>
</tr>
</tbody>
</table>

Note: The data were provided by the Oral Health Promotion Office, Office of Primary Health Care in Ottawa ON.

* A discrepancy noted was that Aboriginal Affairs and Northern Development Canada (AANDN) lists Alberta as having 48 First Nations communities, but national data show that up to 55 communities had implemented COHI. For the purpose of this document, the working number of communities is defined as 636 across Canada and 48 in the province of Alberta, and the data are managed accordingly.

1 The First Nations Health Authority assumed responsibility for the delivery of health services in British Columbia.

2 The federal government reports both 617 and 636 as being the total number of First Nations communities in Canada. However, data available at AANDN, updated as of 2015, indicate that 636 represents the current number of communities. These 636 communities have census and National Household Survey data based on the total population enumerated within the communities affiliated to this First Nation.

3 As of 2014, the number of communities from British Columbia are excluded, as health care delivery was transferred to the BC First Nations Health Authority; the working number of communities for the 2014–2015 year is 438.
**Research Objectives**

**COHI Evaluation Research**
Evaluate the relevance and impact of the program for children and families in First Nations and Inuit communities in different regions of Canada.

**Project 1**
Rates of Dental Surgery in Manitoba under general anesthesia

Whether communities with COHI have lower rates than those without and whether rates have changed since 2004.

**Project 2**
Data from COHI database of delivered prevention services

Impact COHI having on First Nations and Inuit children in Atlantic Canada, Saskatchewan and Ontario.

**Project 3**
Community & COHI worker perspectives

Discover attitudes, beliefs and values of COHI in communities and the impact on children’s oral health.
Project 1
S-ECC Surgery Rate in Manitoba

Dental surgery rate under General Anesthesia to measure
• Decay severity
• Treatment need

Using provincial health data
• Compare before & after start of COHI
• Time trend analysis
• Control other factors
  – Maternal age
  – Sex
  – Size for gestational age
  – Income assistance
  – Area Socioeconomic Status
  – Urbancity
  – Maternal education

27 of 63 First Nations in Manitoba have COHI
Project 2

COHI Database

Impact on First Nations and Inuit children in Saskatchewan, Ontario and Atlantic Canada

Information on

- Preventive services and dental procedures (fluoride varnish applications, alternative restorative techniques/interim stabilization techniques)

- Prevention and dental procedures to registered First Nations and Inuit people from communities with COHI

- Trends since COHI launch

Figure 1. National Children’s Oral Health Initiative Preventive Dental Service Totals 2006–2014 (data provided by the Oral Health Promotion Office, Office of Primary Health Care in Ottawa, ON)
Project 3
Community Perspective

Views and perspectives of therapists, hygienists, COHI aides, parents and caregivers about the COHI program in their community

➢ Interviews with staff

➢ Focus groups with caregivers and community to identify benefits and barriers in the community
3. Healthy Smile Happy Child

http://www.wrha.mb.ca/healthinfo/preventill/oral_child.php

GOAL: reduce the incidence and severity of ECC in Manitoba, Canada

– community development principles
– relationships with existing programs
– build capacity to ensure sustainability
Improved knowledge, attitude, and behaviors toward early childhood oral health.

Modest, yet statistically significant reduction in caries scores and the prevalence of S-ECC.
Research Objectives – Scaling up HSHC for First Nations and Metis children

Continue to promote ECOH and prevent ECC with First Nations and Metis community partners

• Work with partners in the spirit of Reconciliation to:
  – Use traditional teachings in oral health promotion
  – Identify outdated policy and practice in Indigenous children’s oral health & recommend new
  – Adapt and assess the effectiveness and scalability of HSHC

• Assess
  – Caregivers change in attitudes, knowledge and behaviours towards ECOH and ECC
  – Changes in young children’s oral health status
  – Oral health-related quality of life
Scaled-up Healthy Smile Happy Child

Current HSHC Messages

- Primary teeth are important
- ECC is preventable
- Cause and consequence of ECC
- Screening for risk
- Importance of nutrition
- Prenatal Oral Hygiene
- Infant and child Oral Hygiene

HSHC Scale-up Research

- New teachings
- Feedback and new knowledge
- Cultural foundation

Possible Enhancements

- Promote traditional ways to feed (breastfeeding, traditional foods, healthy diet)
- Promote prenatal and infant dental visits
- Improve access to early dental visits and oral screenings
- Cultural teachings on oral health and wellness by grandparents and elders
- Partnership with local maternal-child programs
- Improving access to toothbrushes and paste for infants, toddlers and preschool children
Silver Diamine Fluoride – Renewed Interest

4. Recently introduced in the U.S. as a non-invasive, interim intervention to arrest caries, especially in underserved populations lacking access to restorative dental services.

- SDF is an inexpensive, non-invasive medicament that is applied topically.

- SDF has been used internationally for decades to arrest dental caries in primary and permanent teeth.

- A recently published meta-analysis reported that two-thirds of all dentinal caries lesions studied (those that had progressed into the dentin) were found to be arrested after treatment with SDF

Silver Diamine Fluoride (SDF)

- Topical fluoride applied to teeth by health professional
- Research shows that it can stop decay in 81% of active lesions
- 38% SDF is approved by FDA in USA and by Health Canada in Canada
- Safe to use in children
- Useful in high-risk populations
- Need for preliminary data to measure feasibility, effectiveness, acceptability, and establish protocol for dental health professionals to stop caries in young children
Objectives of SDF Study

• Determine feasibility of SDF to arrest caries in young children

• Determine parent and caregiver acceptability of the process

Mix of quantitative and qualitative method to study topical application of SDF to caries and primary teeth
Study Population

**Goal:** 40 children and parent or caregiver

**Inclusion criteria**
- children < 72 months with cavities and need treatment
- At least 1 primary tooth with caries that is eligible for SDF
  - Soft lesions into the dentin
  - Teeth meet PUFA criteria
  - Cooperative for examination and SDF treatment

**Exclusion criteria**
- Allergy or sensitivity to silver or other metals
- Hereditary defect of enamel
- Medical problems that limit participation
- Immediate need of treatment
Methods

• 2 applications of SDF (4 months apart)
• Questionnaire- demographic info, arrest rate, any arrested teeth, morbidity, rate of children needing surgery under GA
• Clinical visit
  – Decayed, missing, filled teeth due to decay (dmft)
  – Decayed, missing, filled score (dmfs)
  – Caries activity by hardness and colour of caries
  – Colour of lesion
• Focus group and informant interviews with parents, caregivers to gather information on acceptability of SDF

• Data analysis using descriptive statistics, bivariate measures for clinical and survey data, McNemar’s test to compare arrest rate and dichotomous data in questionnaires. Paired t-test to compare normally distributed data. A p-value of ≤0.05 will be significant
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