The economic benefits of sugarfree gum

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The burden of poor oral health
Dental disease is a significant global economic burden

Globally:

- WHO estimates oral diseases are the fourth most expensive conditions to treat\(^1\)

In the UK:

- £3.4bn per year spent by the NHS on dental disease\(^2\)
- >1 million patient contacts with NHS dental services per week\(^2\) with many seeking treatment for dental disease
- Funding gap of £30bn\(^2\)

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Oral health in England
A generational issue

Oral health in England\(^1\)
Prevalence of tooth decay and exposure to risk factors for poor oral health is a multi-generational issue:

- It is estimated that one in every three adults in England has active or untreated tooth decay
- Tooth extractions are the main reason for children to be admitted to hospital and receive a general anaesthetic

\(^1\) NHS Choices (2015)
Oral health in England
Importance of children & teenagers

- WHO states that: “Oral health is integral to overall health and essential for wellbeing.”¹

- Poor oral health in children has wide-ranging impacts, including:²
  - Pain and infection
  - Missing school/college days and parents losing work days
  - Increased risk of caries in adult teeth

Cost is also a major factor:
- The NHS is pivotal in children’s oral care: 70% of children are cared for by an NHS dentist,³ leading to an estimated cost of £33.4 million per year⁴
- Whilst children’s oral health has improved over the past 20 years⁵ more can be done
  - Not just for clinical reasons – NHS spent £30 million on hospital-based tooth extractions for children aged 18 years and under in 2012–13⁶

² Faculty of Dental Surgery (2015) The state of children’s oral health in England
⁴ Claxton, L, Taylor, M, Kay, E. The Economic Impact of sugarfree Gum Use in the UK. Data on File. 2015
Oral health in England

Inequalities

• Significant inequalities exist across England which are often related or experienced in tandem – a problem for policy-makers and practitioners

• Health inequalities are potentially avoidable – specifically those that are related to wealth, education or social position

• A number of factors contribute to regional variation, including: socio-economic situation, water fluoridation availability and access to NHS care

1 Faculty of Dental Surgery (2015) The state of children’s oral health in England
2 Table taken from:
Oral health in England

Policy progress

Growing policy recognition

- Policy attention is being focused on the connection between oral health and overall wellbeing
- Oral health improvement is the responsibility of local authorities – with a focus on partnership action to address the wider determinants of health

Delivering Better Oral Health

- Recognises oral health’s contribution to general health and well-being of individuals
- Includes of ‘good practice’ – pragmatic recommendations
- Focuses on integration of oral health in wider programmes

Role of sugarfree gum in oral health
**Wealth of clinical evidence supports the oral health benefits of sugarfree gum**

The oral care benefits of sugarfree gum are supported by clinical studies spanning more than 40 years and demonstrated by a **median reduction in dental caries incidence of 52%**

<table>
<thead>
<tr>
<th>Study</th>
<th>Country of study</th>
<th>N</th>
<th>Population</th>
<th>Intervention</th>
<th>Follow-up period</th>
<th>Baseline caries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Möller 1973</td>
<td>Denmark</td>
<td>340</td>
<td>School children</td>
<td>Sorbitol gum</td>
<td>2 years</td>
<td>NR</td>
</tr>
<tr>
<td>Scheinin 1975</td>
<td>Finland</td>
<td>100</td>
<td>Young adults</td>
<td>Xylitol gum</td>
<td>1 year</td>
<td>NR</td>
</tr>
<tr>
<td>Glass 1983</td>
<td>USA</td>
<td>540</td>
<td>Children aged 7-11</td>
<td>Sorbitol gum twice a day</td>
<td>2 years</td>
<td>NR</td>
</tr>
<tr>
<td>Isokangas 1989</td>
<td>Finland</td>
<td>324</td>
<td>Children aged 11-12</td>
<td>Xylitol gum</td>
<td>5 years</td>
<td>NR</td>
</tr>
<tr>
<td>Kandelman 1990</td>
<td>Canada</td>
<td>274</td>
<td>Children aged 8-9</td>
<td>15% and 65% Xylitol gum</td>
<td>2 years</td>
<td>NR</td>
</tr>
<tr>
<td>Mäkinen 1995</td>
<td>Belize</td>
<td>1,277</td>
<td>Children aged 10</td>
<td>Sorbitol, xylitol or combinations</td>
<td>40 months</td>
<td>NR</td>
</tr>
<tr>
<td>Mäkinen 1996</td>
<td>Belize</td>
<td>510</td>
<td>Children aged 6</td>
<td>Sorbitol, xylitol or combinations</td>
<td>24 months</td>
<td>NR</td>
</tr>
<tr>
<td>Beiswanger 1998</td>
<td>Puerto Rico</td>
<td>1,402</td>
<td>Children in grades 5-7</td>
<td>Sorbitol gum, daily after meals.</td>
<td>2 years</td>
<td>NR</td>
</tr>
<tr>
<td>Alanen 2000</td>
<td>Estonia</td>
<td>740</td>
<td>Children aged 10</td>
<td>Xylitol gum</td>
<td>3 years</td>
<td>Control group DMFS: 2.18 (SD 3.30)/ Xylitol group DMFS: 2.10 (SD 2.55) Measurement excludes surfaces with incipient caries</td>
</tr>
<tr>
<td>Szöke 2001</td>
<td>Hungary</td>
<td>547</td>
<td>School children aged 8-13</td>
<td>Sorbitol stick, daily after meals</td>
<td>2 years</td>
<td>Control group DMFS: 1.94 (2.85) Gum group DMFS: 1.69 (SD 2.64) Measurement excludes surfaces with incipient caries</td>
</tr>
<tr>
<td>Machiulskiene 2001</td>
<td>Lithuania</td>
<td>432</td>
<td>Children aged 9-14</td>
<td>Sorbitol, xylitol, HIS gum</td>
<td>3 years</td>
<td>Control group DMFS: 6.4 (SD 4.3) Xylitol gum group DMFS: 5.0 (SD 3.9) Measurement includes all stages of caries formation</td>
</tr>
<tr>
<td>Kovari 2003</td>
<td>Finland</td>
<td>921</td>
<td>Children in day care centres</td>
<td>Xylitol gum</td>
<td>6 years</td>
<td>NR</td>
</tr>
<tr>
<td>Peng 2004</td>
<td>China</td>
<td>1,143</td>
<td>Children aged 6-7</td>
<td>Sorbitol, xylitol, carbamide gum</td>
<td>2 years</td>
<td>Control group DMFS: 0.05 (SD 0.30) Gum group DMFS: 0.07 (SD 0.32) Measurement includes all stages of caries formation</td>
</tr>
<tr>
<td>Morgan 2008</td>
<td>Australia</td>
<td>2,720</td>
<td>Children aged 11-13</td>
<td>CPP-ACP gum</td>
<td>2 years</td>
<td>Control group DMFS: 2.80 (SD 3.85) Gum group DMFS: 2.76 (SD 3.79) Measurement includes all stages of caries formation</td>
</tr>
</tbody>
</table>

Independent recognition of the oral health benefits of sugarfree gum

European Commission has approved five oral health claims for sugarfree gum\(^1\) and the benefits are also recognised by the FDI World Dental Federation\(^2\)

**Three claims: general function (EC authorized Article 13 claim)**
1. Sugar-free chewing gum contributes to the neutralization of plaque acids.
2. Sugar-free chewing gum contributes to the maintenance of tooth mineralization.
3. Sugar-free chewing gum contributes to the reduction of oral dryness.

**Two claims: disease risk reduction (EC authorized Article 14 claim)**
1. Chewing sugar-free gum helps neutralize plaque acids. Plaque acids are a risk factor in the development of dental caries.
2. Chewing sugar-free gum helps reduce tooth demineralization. Tooth demineralization is a risk factor in the development of dental caries.

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\(^2\) FDI Worldwide
Economic benefits of sugarfree gum
Economic models are becoming increasingly important

- Increased constraints on healthcare budgets means economic considerations in decision-making about health interventions have increased
- Economic models help assess the value for money of an intervention
What are economic models?

- Models represent the detailed ‘real world’ in a more understandable structure

- This is the first time a cost-effectiveness study has been done on sugarfree gum as an intervention

- The aim of this model is to calculate the reduction in expenditure on dental treatment that would occur if the use of sugarfree gum increased
Methodology
Methodology overview

- Rapid review of literature regarding sugarfree gum

- Model constructed using baseline data from 12 year old population in the UK
  - Majority of evidence reviewing oral health impact of sugarfree gum are based on child and teenage populations
  - Tooth decay is most likely to develop before the age of 15
  - Teenagers are most likely consumers of sugarfree gum

- Comparison of current health spend with various hypothetical situations in which there are higher levels of sugarfree gum use

- Outcomes were assessed over a one-year time horizon.

- NHS – costs to the consumer for the purchase of SFG or to the body bearing the costs of a promotional campaign to increase SFG usage were not included. Patient charges for dental treatment were also excluded.

- Primary analysis assumed full compliance and uptake of the SFG regimen within each scenario

- Sensitivity analyses performed to analyse the effect of each variable

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Modelled three hypothetical scenarios

1. An increase of one additional sugarfree gum chewing occasion per day across the model population

2. Two sugarfree gum chewing occasions per day across the model population

3. Three sugarfree gum chewing occasions per day across the model population
Methodology - estimates for frequency of chewing

- Sugarfree gum usage estimated using consumer survey of a nationally representative sample of people aged 10 - 59 year\(^1\)

<table>
<thead>
<tr>
<th>Group</th>
<th>Group definition</th>
<th>Annual number of chewing occasions</th>
<th>Proportion of SFG users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1: No use</td>
<td>No use of SFG</td>
<td>0</td>
<td>6%</td>
</tr>
<tr>
<td>Group 2: Infrequent use</td>
<td>Less than one chewing occasion per week</td>
<td>26</td>
<td>22%</td>
</tr>
<tr>
<td>Group 3: Light use</td>
<td>Between 1 and 4 chewing occasions per week</td>
<td>130</td>
<td>36%</td>
</tr>
<tr>
<td>Group 4: Moderate use</td>
<td>Between 5 and 10 chewing occasions per week</td>
<td>390</td>
<td>22%</td>
</tr>
<tr>
<td>Group 5: Frequent use</td>
<td>More than 10 chewing occasions per week</td>
<td>780</td>
<td>14%</td>
</tr>
</tbody>
</table>

Chewing frequency behaviours in the UK in children aged 10 to 14 (2014)

- Observed situation among teenagers applied to a hypothetical population of teenagers with greater use of sugarfree gum.

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Methodology - baseline risk of disease in selected population

- Baseline risk of disease obtained from the Dental Public Health Epidemiology Programme\(^1\)
  - Used to determine population of 12 year olds in 2009 and determine proportion of children with tooth decay who received treatment and the treatment they received

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children examined</td>
<td>89,442</td>
</tr>
<tr>
<td>Average of DMFT</td>
<td>0.7</td>
</tr>
<tr>
<td>Number with caries experience (DMFT&gt;0)</td>
<td>30,181</td>
</tr>
<tr>
<td>Proportion with caries experience (% DMFT&gt;0)</td>
<td>33.74%</td>
</tr>
<tr>
<td>With caries experience, number with extraction experience (MT&gt;0)</td>
<td>3,165</td>
</tr>
<tr>
<td>With caries experience, proportion with extraction experience (%MT&gt;0)</td>
<td>10.49%</td>
</tr>
<tr>
<td>With caries experience, number with fillings present (FT&gt;0)</td>
<td>18,158</td>
</tr>
<tr>
<td>With caries experience, proportion with fillings present (%FT&gt;0)</td>
<td>20.30%</td>
</tr>
</tbody>
</table>

Baseline risk of decay in 12 year olds

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Methodology - the dose response relationship

**Linear**
Increased caries protection with each chewing occasion

**Exponential**
Frequent chewing occasions required before benefits realised
Methodology - treatment cost assumptions

• Of those with caries experience
  – the proportion with restorations was used to estimate the average spend on restorations per case of caries
  – the proportion with extraction experience was used to estimate average spend on extractions per case of caries

• Cost of tooth restoration and tooth extraction estimated to be £75 in primary care setting
  – 20% estimated to be under local anaesthetic
  – 80% under general anaesthetic

• In-patient treatment for extractions estimated to be £1,165¹

• All estimated parameters were subjected to sensitivity analysis

Key findings
Scenario 1: An increase of one additional sugarfree gum chewing occasion per day across the model population

<table>
<thead>
<tr>
<th></th>
<th>Base case</th>
<th>Hypothetical scenario (linear model)</th>
<th>Hypothetical scenario (exponential model)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extraction costs</strong></td>
<td>£22,948,628</td>
<td>£21,018,002</td>
<td>£22,234,639</td>
</tr>
<tr>
<td><strong>Restoration costs</strong></td>
<td>£10,427,070</td>
<td>£9,549,860</td>
<td>£10,102,659</td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td>£33,375,698</td>
<td>£30,567,863</td>
<td>£32,337,298</td>
</tr>
<tr>
<td><strong>Total savings for this population</strong></td>
<td></td>
<td>£2,807,836</td>
<td>£1,038,400</td>
</tr>
<tr>
<td><strong>Average savings per person</strong></td>
<td></td>
<td>£4.10</td>
<td>£1.52</td>
</tr>
</tbody>
</table>
Scenario 2: 
Two sugarfree gum chewing occasions per day across the model population

<table>
<thead>
<tr>
<th></th>
<th>Base case</th>
<th>Hypothetical scenario (linear model)</th>
<th>Hypothetical scenario (exponential model)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraction costs</td>
<td>£22,948,628</td>
<td>£20,702,245</td>
<td>£22,148,906</td>
</tr>
<tr>
<td>Restoration costs</td>
<td>£10,427,070</td>
<td>£9,406,391</td>
<td>£10,063,704</td>
</tr>
<tr>
<td>Total costs</td>
<td>£33,375,698</td>
<td>£30,108,637</td>
<td>£32,212,610</td>
</tr>
<tr>
<td>Total savings for this population</td>
<td><strong>£3,267,062</strong></td>
<td><strong>£1,163,089</strong></td>
<td></td>
</tr>
<tr>
<td>Average savings per person</td>
<td><strong>£4.77</strong></td>
<td><strong>£1.70</strong></td>
<td></td>
</tr>
</tbody>
</table>
Scenario 3: Three sugarfree gum chewing occasions per day across the model population

<table>
<thead>
<tr>
<th></th>
<th>Base case</th>
<th>Hypothetical scenario (linear model)</th>
<th>Hypothetical scenario (exponential model)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extraction costs</strong></td>
<td>£22,948,628</td>
<td>£17,502,923</td>
<td>£17,313,302</td>
</tr>
<tr>
<td><strong>Restoration costs</strong></td>
<td>£10,427,070</td>
<td>£7,952,729</td>
<td>£7,866,571</td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td>£33,375,698</td>
<td>£25,455,652</td>
<td>£25,179,873</td>
</tr>
<tr>
<td><strong>Total savings for this population</strong></td>
<td><strong>£7,920,046</strong></td>
<td><strong>£8,195,826</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Average savings per person</strong></td>
<td><strong>£11.57</strong></td>
<td><strong>£11.97</strong></td>
<td></td>
</tr>
</tbody>
</table>
## Estimated cost savings for 12-year-olds by increased sugarfree gum chewing

Cost savings predicted by different levels of sugarfree gum chewing occasions

<table>
<thead>
<tr>
<th>Number of sugarfree gum chewing occasions per day</th>
<th>Cost saving (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One additional sugarfree gum chewing occasion per day</td>
<td>£1.1 - £2.8 million</td>
</tr>
<tr>
<td>Two sugarfree gum chewing occasions per day</td>
<td>£1.2 - £3.3 million</td>
</tr>
<tr>
<td>Three sugarfree gum chewing occasions per day</td>
<td>£7.9 - £8.2 million</td>
</tr>
</tbody>
</table>

Further long-term cost savings will also be generated by the prevention of successive restorations.
Summary

• An oral health policy that includes the chewing of sugarfree gum could lead to:
  – Improved oral health and wellbeing
  – Significant cost savings on dental care
  – A reduction in capacity pressure on the UK dental health care system

• There are lifetime benefits, not just those gained in the year of exposure

• Consider the savings if these results were applied to the whole population, not just 12 year olds
End