The Relationship between Oral Health and General Health - An Analysis of TILDA

Briefing Paper prepared for the

Oral Health Policy Independent Panel (OHPIP)

Trutz Haase
Jonathan Pratschke

June 2014
1 Introduction

“The compartmentalization involved in viewing the mouth separately from the rest of the body must cease because oral health affects general health by causing considerable pain and suffering and by changing what people eat, their speech and their quality of life and well-being. Oral health also has an effect on other chronic diseases. Because of the failure to tackle social and material determinants and incorporate oral health into general health promotion, millions suffer intractable toothache and poor quality of life and end up with few teeth.

Health policies should be reoriented to incorporate oral health using socio-dental approaches to assessing needs and the common risk factor approach for health promotion. Oral diseases are the most common of the chronic diseases and are important public health problems because of their prevalence, their impact on individuals and society, and the expense of their treatment. The determinants of oral diseases are known — they are the risk factors common to a number of chronic diseases: diet and dirt (hygiene), smoking, alcohol, risky behaviours causing injuries, and stress — and effective public health methods are available to prevent oral diseases. (Aubrey Sheiham- WHO1)

2 Background and Review

At least for the past decade, there has been a paradigm shift in the understanding of oral health which is signified by a move from a largely separate health consideration into one which is closely associated with a person’s overall health. The mouth, and oral health, is thereby seen as both an important indicator for overall health, as well as a factor influencing it. Most importantly, there is an increasing body of evidence that supports a common risk factor approach: Behaviours and interventions that improve oral health also improve overall health and vice versa and this constitutes the principal approach underlying the development of a future Oral Health Policy for Ireland.

However, there appears to be little evidence yet from the Irish research literature that tries to operationalise the Common Risk Factor Approach (CRFA) in its research design and analysis (ref2). The purpose of this short briefing paper is to undertake a short secondary data analysis which explicitly addresses the CFRA using Irish dental, general health and socio-economic data. To this end, the paper builds on a recent analysis undertaken by Pratschke et al. (2013)2 which models the relationship between socio-economic background, behaviour, general health and well-being amongst the older population, using the first wave of the Irish Longitudinal Study on Ageing (TILDA).

3 Methodological Considerations

The operationalisation of a CRFA implies a number of prerequisites, notably

- a comprehensive measure of oral health;
- a comprehensive and well-structured measure of overall health;
- a comprehensive and well-structured measure of personal well-being, and
- a set of demographic, socio-economic and notably behavioural variables that can be modelled as respective risk and protective factors.

---

1 Aubrey Sheiham accessed at http://www.who.int/bulletin/volumes/83/9/editorial30905html/en/
From the outset, we can say that none of the major existing Irish datasets currently provides the necessary data to satisfy all of these prerequisites. We will briefly assess some of the key considerations.

### 3.1 A comprehensive measure of oral health

The first and possibly most substantive shortcoming in any of the major Irish data sets (taken here to comprise GUI, TILDA and SLAN but also the draft questionnaire of the Healthy Ireland Survey currently being prepared) is a comprehensive and well-defined measure of oral health. By this, we mean a measure that goes beyond the physical presence of teeth alone but, at its minimum, also includes structural dimensions such as functional limitation, physical pain, physical disability and possibly psychological and social disability. A widely used Oral Health Impact Profile (OHIP) was developed by Slade and Spencer\(^3\) in 1994 and reviewed in 2008 with regard to its validity using structural equation modelling techniques by Baker et al.\(^4\)

In sharp contrast to the use of the OHIP, either in its original or revised version, the assessment of oral health in the first wave of TILDA is limited to the simple question (ph507): “Which best describe the teeth you have?”, with a 5-point response scale (1) all own natural teeth – non missing (2) own teeth, no dentures – but some missing (3) dentures as well as some of own teeth (4) full dentures, and (5) no teeth or dentures. As a consequence, the present briefing paper is limited to a comparison of this single dimension of oral health with health in general.

### 3.2 A comprehensive measure of overall health

Questions of self-rated health are common in CSO and other household surveys in Ireland, but there have been few, if any attempts being made to develop comprehensive measurement scales of overall health which are built on an explicit dimensionality of its multiple facets. One of the exceptions is the study by Pratschke et al.\((\text{ibid})\) which applies a confirmatory factor approach to the specification of a measure of overall health as part of a wider structural equation model to investigate the impact of socio-economic background and behavioural characteristics to health and well-being of older persons.

In this model, overall health is conceptualised as a second order latent variable with five indicators: Cholesterol (Low Density Lipoprotein), Movement (“Timed-up and go” test), Neuropsychological Health, Mean Visual Acuity for both eyes and Mean Sensory Functioning, which is based on self-rated vision, hearing, smell and taste. Neuropsychological Health is itself defined as a first-order latent variable with four indicators: the 30-point Mini Mental State Examination, the 30-point Montreal Cognitive Assessment (MoCA) of cognitive functioning, the respondent’s mean score on three 6-point memory tests and a test of executive function based on naming animals. A small number of additional error covariances were specified, to improve overall model fit.

The measurement model for Overall Health is shown in Figure 1 below. The figure contains the estimates generated by the SEM model for men and women, expressing the net influence of each explanatory variable as a standardised regression coefficient. The standardised factor loadings vary between 0.20 (Cholesterol - men) and -0.68 (Movement – women). It is worth emphasising the enormous value of these objective, precise and independent measures of health, when compared to the subjective health assessments which are commonly used in studies of well-being.

---


3.3 The separate consideration of health and well-being

It is also beyond the aim of this paper to investigate the relationship between overall health and well-being. We would merely like to draw attention to the separate treatment of the two concepts in our overall model. In our view, health and well-being constitute two related, but nevertheless distinct concepts and we believe that there is a need for this relationship to be explicitly modelled. In our model, the latent concept of overall health is built on observations which can largely be deemed “objective”, at least in the sense that they are based on a medical practitioner’s observations. The latent concept of well-being, by contrast, comprises both an element of objective health, as well as an element of the lived experienced of this health status. It is thus a more subjective assessment and could be viewed as an interpretation of a person’s health status relative to his/her expectation. Most importantly, it also includes the effect of the personal and social environment. A supportive environment may not alter a person’s health, but can nevertheless improve one’s well-being. In our view there is therefore no contradiction when we observe that, as a person grows older, his/her overall health tends to decline, but that this is not necessarily accompanied by a corresponding deterioration in well-being. A full discussion of the conceptualisation of health and well-being and their respective measurement through composite indicators shall be considered in a separate paper.

3.4 Assigning causality

The final question which will need to be given considerable thought in the development of a model for a CRFA to oral and general health and well-being is the causality assigned to the different components of the model. No statistical analysis can, if taken on its own, assign the direction of causality. Within longitudinal analysis, the direction of causality may be established on the basis of temporality. In cross-sectional analysis, however, it has largely to be determined by way of logical argument and be based on theoretical considerations.

We are merely pointing here to the importance of this consideration as it will feature in a significant way when specifying complex models of CRFA to oral and general health and well-being. As alluded to in the introduction, the current perspective in oral health sciences is that oral health is both an...
indicator of general health, as well as influencing it. It is thus likely that there will be several possible ways in which one can model these relationships and that, without longitudinal data, the direction of causality will remain at least in part indeterminable.

4 Key Findings

Having briefly introduced the TILDA dataset and the specification of a latent concept of overall health in a structural equation model advanced by Pratschke et al., we can now present some insights that the TILDA data allows us to gain with respect to the relationship between oral health and general health in the Irish population aged fifty and over.

Table 1: Description of teeth by age group

<table>
<thead>
<tr>
<th>Description of teeth</th>
<th>50-59 years %</th>
<th>60-69 years %</th>
<th>70-79 years %</th>
<th>80 years and over %</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>All own natural teeth - none missing</td>
<td>16.1</td>
<td>7.0</td>
<td>3.5</td>
<td>2.8</td>
<td>10.0</td>
</tr>
<tr>
<td>Own teeth, no dentures - some missing</td>
<td>50.8</td>
<td>35.2</td>
<td>21.7</td>
<td>18.8</td>
<td>38.5</td>
</tr>
<tr>
<td>Dentures as well as some of own teeth</td>
<td>28.2</td>
<td>43.4</td>
<td>44.8</td>
<td>32.6</td>
<td>36.7</td>
</tr>
<tr>
<td>Full dentures</td>
<td>4.6</td>
<td>13.7</td>
<td>29.0</td>
<td>42.0</td>
<td>14.1</td>
</tr>
<tr>
<td>No teeth or dentures</td>
<td>0.3</td>
<td>0.6</td>
<td>1.0</td>
<td>3.9</td>
<td>0.7</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 1 provides an overview of the raw data which describes the presence of teeth in Ireland’s population aged fifty and over by decile age ranges. This is the only information on oral health available from the first wave of TILDA.

Table 2: Correlations between selective key variables

<table>
<thead>
<tr>
<th>Description of teeth</th>
<th>Age</th>
<th>Gender</th>
<th>Social Class</th>
<th>Active Lifestyle</th>
<th>Cogn. Function</th>
<th>Overall Health</th>
<th>Well-being</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of teeth</td>
<td>-</td>
<td>.41</td>
<td>.05</td>
<td>-.25</td>
<td>-.20</td>
<td>-.32</td>
<td>-.32</td>
</tr>
<tr>
<td>Age</td>
<td>.41</td>
<td>-</td>
<td>-.03</td>
<td>-.13</td>
<td>-.28</td>
<td>-.40</td>
<td>-.55</td>
</tr>
<tr>
<td>Gender</td>
<td>.05</td>
<td>-.03</td>
<td>-</td>
<td>-.06</td>
<td>.04</td>
<td>.07</td>
<td>.06</td>
</tr>
<tr>
<td>Social Class</td>
<td>-.25</td>
<td>-.13</td>
<td>-.06</td>
<td>-</td>
<td>.34</td>
<td>.41</td>
<td>.27</td>
</tr>
<tr>
<td>Active Lifestyle</td>
<td>-.20</td>
<td>-.28</td>
<td>.04</td>
<td>.34</td>
<td>-</td>
<td>.39</td>
<td>.40</td>
</tr>
<tr>
<td>Cognitive Functioning</td>
<td>-.32</td>
<td>-.40</td>
<td>.07</td>
<td>.41</td>
<td>.39</td>
<td>-</td>
<td>.47</td>
</tr>
<tr>
<td>Overall Health</td>
<td>-.32</td>
<td>-.55</td>
<td>.06</td>
<td>.27</td>
<td>.40</td>
<td>.47</td>
<td>-</td>
</tr>
<tr>
<td>Personal Well-being</td>
<td>-.06</td>
<td>ns</td>
<td>-.04</td>
<td>.17</td>
<td>.29</td>
<td>.17</td>
<td>.24</td>
</tr>
</tbody>
</table>

All correlations significant at 5% level

Table 2 shows the correlations between the description of teeth, age and gender and the key latent concepts in the overall structural equation model of health, well-being and its determinants. Whilst all of the correlations are in line with expectations, the only relationship worth noting as possibly unexpected to some readers is that between age and well-being, which is statistically not significant. As already noted, age is clearly correlated with a deterioration of health, but not so with personal well-being.

Figure 2 overleaf shows the clear relationship between oral health (as measured here by a single indicator of the presence of own teeth) and the latent concept of overall health as specified by Pratschke et al. As already noted, this of itself does not imply any causal relationship but points to the likelihood of common determinants and thus potential support for a CFRA.
Finally, we present a brief multiple regression analysis to gauge the major determinants of dental health from the TILDA data.

Table 3: Determinants of Description of Teeth

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>.395</td>
<td>.120</td>
<td>3.30</td>
<td>.001</td>
</tr>
<tr>
<td>Age</td>
<td>.032</td>
<td>.002</td>
<td>17.67</td>
<td>.000</td>
</tr>
<tr>
<td>Gender</td>
<td>.115</td>
<td>.026</td>
<td>.315</td>
<td>4.46</td>
</tr>
<tr>
<td>Social class</td>
<td>-.119</td>
<td>.014</td>
<td>-.136</td>
<td>8.39</td>
</tr>
<tr>
<td>Cognitive Functioning</td>
<td>-.102</td>
<td>.016</td>
<td>-.117</td>
<td>6.47</td>
</tr>
<tr>
<td>Overall Health</td>
<td>-.050</td>
<td>.016</td>
<td>-.056</td>
<td>3.03</td>
</tr>
</tbody>
</table>

The overall $r$ is equal to .47 and the adjusted $R^2$ equals .22. Whilst the overall strength of the relationship is both substantively and statistically significant, it is clear that the relationship between oral health (as measured by the description of teeth only) and general health as indicated in Table 2 ($r=.32$ after adjusting sign) is largely driven by the underlying co-determinants; i.e. age, gender and social class. Nevertheless, both Cognitive Functioning and Overall Health do have an additional and statistically significant effect on oral health.

5 Discussion

The purpose of this briefing paper is to examine the first wave of TILDA data to ascertain whether future waves of TILDA constitute a useful data source to investigate the relationship between oral health and general health and well-being within a framework of a Common Risk Factor Approach (CRFA).

We find that the first wave of TILDA avails of an extremely minimal measure of oral health only, namely a 5-point measure which describes the extent to which a person has maintained his/her own teeth. Furthermore, one needs to be aware of the limiting range effect particularly with respect to this narrow measure of oral health, as the dataset comprises of the population aged fifty and over. In this respect, the SLAN dataset may be of potentially greater importance as it covers the whole adult population.
On the positive side, the TILDA dataset offers the construction of a complex and well-structured measure of overall health. As exemplified by Pratschke et al., it is possible to specify the relationship between demographic, socio-economic and behavioural characteristics and the overall health and well-being of a person by way of a complex structural equation model which conceptualises key concepts as latent variables. Particularly if accompanied by a more comprehensive measure of oral health, as presented by the Oral Health Impact Profile (OHIP), it should be possible to develop a comprehensive SEM model that concurs with the CFRA between oral and general health outcomes.

Towards this end, we believe three considerations to be of particular importance.

5.1 Awareness of the CRFA in the design of GUI, TILDA, SLAN and HI

There is a huge gap between the paradigm shift in oral health sciences over the past 10-15 years and the conceptualisation of oral health in the major Irish social science datasets to date, including GUI, TILDA and SLAN, but also the new Healthy Ireland survey which is currently being developed. Whilst acknowledging that there is limited scope for including multiple questions on oral health within the wide spectrum of questions which these surveys need to encompass, the CRFA to oral and general health emphasises the close inter-relationship between oral and general health and thus underpins the importance of including a more comprehensive Oral Health Impact Profile (OHIP) into these surveys.

5.2 A comprehensive measure of oral health

Before a more comprehensive measure can be included, agreement needs to be achieved about the conceptual design of a single multidimensional measure of oral health. Building on Baker et al. we believe that it is necessary to discuss the dimensions to be included in any prospective OHIP, notably the inclusion of well-being dimension(s) within it. If dimensions of psychological and social well-being are to be included, it is important that the questions related to these are phrased explicitly with relation to oral health, such as to not confound these with general measures of well-being. More likely, dimensions of well-being should possibly be left out of any prospective OHIP and be included in a separate but comprehensive measure of personal well-being.

5.3 The use of SEM in modelling Common Risk Factors for oral and general health

Pratschke et al. demonstrate that it is possible to construct a comprehensive measure of overall health from the TILDA dataset and the use of such latent concept to model the influence of demographic, socio-economic and behavioural characteristics on health and well-being.

The importance of such approach, build on the application of latent variable modelling as part of a wider structural equation model, is that it provides an ideal means by which to model a Common Risk Factor Approach (CRFA). An SEM approach will allow testing the commonality of a diverse set of risk and protective factors to both oral and general health, including demographic, socio-economic and behavioural aspects. As a method, SEM provides the ideal environment to develop a perspective on future oral health policy which is imbedded in a wider health perspective as envisaged in Healthy Ireland.