



TC White Dental Awards Report

Please use typescript or CAPITAL LETTERS when filling out this form

SECTION 1 PERSONAL DETAILS	
Title (please circle): Miss Other _____	PID:
Surname: Carson	
Forename(s): Susan Jane	

SECTION 2 PROJECT DETAILS	
Scholarship(s) Awarded: TC White Young Researcher Award 2014	Amount Awarded: £1525.00
Project Name: Exploring links between epidemiological and routinely collected data: investigating the relationship between dental caries and Body Mass Index amongst children in Tayside	Project Location: University of Dundee Dental School

Project Aims and Objectives:

The aim of this study was to investigate the relationship between dental caries and Body Mass Index (BMI) amongst children in Tayside.

Specific objectives were:

- To link epidemiological dental (National Dental Inspection Programme) and routinely collected health (Child Health Surveillance Programme) data for children from the Tayside area
- To investigate the relationship between dental caries and BMI amongst children in Tayside
- To examine potential confounders (age, sex, socioeconomic status) in the relationship between dental caries and BMI amongst children in Tayside.

Additional objective: To examine caries prevalence in relation to the Scottish Index of Multiple Deprivation (SIMD) and the Scottish Government 6-fold Urban Rural Classification (SGUR6).

Summary of Visit/Project (including pictures, methodology, results and conclusion if applicable):

Methodology

In this study, linked data from the National Dental Inspection programme (NDIP) and the Child Health Surveillance Programme (CHSP) were used to investigate the relationship between dental caries and body weight in children in Tayside.

Study Population: Children between the ages of 4 and 7 who had data recorded as part of a randomly sampled Primary 1 National Dental Inspection Programme (NDIP) detailed inspection in the NHS Tayside area between 2003 and 2008.

Data Linkage: NDIP and CHSP data for children were deterministically linked using the Community Health Index (CHI) number as a unique identifier.

Data Analysis: Data were analysed within a remote access safe-haven environment using SPSS Statistics 21. Differences in decayed, missing and filled primary teeth (dmft) were compared across categories of infant feeding habits, BMI, SIMD and SGUR6. Variables which converted BMI into sex and age appropriate categories for at risk of underweight, overweight and obesity were derived from the available BMI data and added by the researcher.

Results

Linked Dataset: After linkage, complete cases were available for 1138 children (96.9%). The mean age was 5.6 years (SE=0.01). Of the included children, 48% were female and 52% male. The mean dmft was 1.55 (SE=0.08).

Table 1 Descriptive results for BMI variables:

CHSP screening	Number in dataset	Minimum BMI	Maximum BMI	Mean	Standard Deviation
6 to 8 weeks	882	10.62	22.29	15.50	1.47
24 months	887	10.57	41.09	17.38	1.84
42months	923	9.70	53.69	16.18	2.07
Pre-school	824	5.64	54.94	16.27	2.33
School	691	12.53	136.43	16.57	5.05

Relationship between dmft and BMI: No statistically significant relationship was found between dmft and BMI.

Relationship between dmft and SIMD decile: Living in an area of high deprivation is significantly associated with increased dmft ($F(1, 1136) = 73.0, p < 0.01$).

Relationship between dmft and 6 fold Urban Rural Classification: A statistically significant difference in dmft between urban and rural groups was found ($F(5, 1132) = 14.8, p < 0.01$). The dmft was significantly increased for those living in Large Urban [UR1] and Other Urban [UR2] areas compared to Accessible Rural [UR5] areas ($p < 0.01$) but not significantly different when compared with other rural areas [UR4 and 6]. See Appendix A for further details.

Conclusions

This study has presented a method to link dental inspection and Child Health Surveillance Programme data within a safe-haven environment. There were found to be limitations in terms of the availability and quality of the data available for linkage and analysis. There appears to be no significant relationship between dental caries and BMI amongst children in Tayside. Analysis of the linked data shows that caries prevalence as measured by dmft is related not only to relative deprivation (SIMD) but also to elements of urban-rural classification (SGUR6). Methods such as this could potentially be used to inform local strategy to tackle inequalities which may otherwise remain hidden within large-area based indices, such as SIMD.

Learning Outcomes (*how aims and objectives were met*):

Medical Research Council (MRC) Research Data and Confidentiality eLearning Certificate was completed to allow access to HIC Safe Haven data [Appendix B].

Undertaking the Applied Statistics for Routine Datasets Master of Public Health Module allowed me to develop proficiency in the use and interpretation of relevant statistical terminology and concepts in record-linked routine health data. It also allowed me to skills which enabled me to perform and interpret relevant statistical procedures with missing data. [Appendix C].

Evaluation (*including description of the impact of the project/award on your clinical and/or NHS practice*):

The protocol for the project was presented as poster at the annual University of Dundee College of Medicine, Dentistry and Nursing (CMDN) Research Symposium [Appendix D]. This was awarded joint first prize in the postgraduate student category [Appendix E].

The research award has specifically allowed me to develop my clinical research skills by undertaking an Applied Statistics for Routine Datasets module. The course covered relevant aspects of clinical data management, linkage and analysis with a focus on those which are specific to NHS Scotland. This has informed the development of the statistical analysis plan for this project as well as enabling me to carry out relevant linkage. The award has also allowed me to produce a poster which was presented to a national audience at the BASCD Scientific Conference held at Queens College, University of Oxford. This was accompanied by a verbal presentation plus Q&A session. [Appendix F]

Finally, the research training which this award enabled me to undertake has had impact beyond the scope of this project and my wider PhD. As part of my speciality training in Dental Public Health I have been fortunate to become involved in a number of projects which have benefited from my increased knowledge of health informatics, the data linkage process and analysis of observational data. One such project was the Scottish Adult Oral Health Survey Pilot, the report for this can be found at:

<https://www.isdscotland.org/Health-Topics/Dental-Care/Publications/2017-02-21/2017-02-21-SAOHS-Report.pdf?99601382018>

Some final analysis is ongoing and, following on from the BASCD Conference, a paper is being prepared for submission to Community Dental Health. This project will be presented as part of my PhD thesis, the anticipated completion date for this is September 2018. The methodology and findings were presented at the Scottish Dental Practice Based Research Network 'Data' study day as part of a seminar on routine data, practice data and big datasets. To be able to gain knowledge, skills and experience in this area has been invaluable to me, but will also potentially benefit NHS dentistry in Scotland as I progress beyond postgraduate studentship and a training grade.

Acknowledgements:

This study forms part of a wider PhD by research investigation into the structure, process and outcome of a dental data linkage project through a mixed-method exploration of the relationship between childhood body weight and dental caries experience. I would like to acknowledge and thank the following people for their input at various stages:

Dr Jo Cecil, School of Medicine, University of St Andrews

Dr Stephanie Chambers, formerly of Dental Health Services Research Unit, University of Dundee

Prof Peter Donnan, Dundee Epidemiology & Biostatistics Unit, University of Dundee

Professor Ruth Freeman, Dental Health Services Research Unit, School of Dentistry, University of Dundee

Duncan Heather, Health Informatics, Population Health Science, University of Dundee

Prof Mark Hector, School of Dentistry, University of Dundee

Prof Gerry Humphris, School of Medicine, University of St Andrews

Dr Gavin Revie, School of Dentistry, University of Dundee



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JUST A TALE OF TWO CITIES?

- Using data linkage to look at inequalities in the dental caries experience of 5-year old children in Tayside
Susan J. Carson and Ruth Freeman

1. Background

Tayside, in the East of Scotland, has a population of around 410,000. Most residents live in urban areas, of which the cities of Dundee and Perth are the largest. Children in remote and rural areas have previously been found to have better dental health than those in urban areas.¹

Whilst urban-rural differences in dental caries of 5 year old children in Scotland have been reported at a national level, strategy to tackle such inequalities is often developed at local health board level.² Public funding to monitor disease levels and to target interventions is scarce. It is therefore necessary to look at ways in which routinely available data from multiple sources^{3,4} can be used to support the measurement of local population health inequalities in order to determine areas where community action and public health intervention are most required.



Fig. 1 Map of Tayside Study Area

2. Aims

- To present a method to link dental inspection data to routinely collected Scottish Child Health Surveillance Programme (CHSP) data
- To examine caries prevalence in relation to the Scottish Index of Multiple Deprivation (SIMD) and the Scottish Government 6-fold Urban Rural Classification (SGUR6).

3. Methods

Study Population

Children between the ages of 4 and 7 who had data recorded as part of a randomly sampled Primary 1 National Dental Inspection Programme (NDIP) detailed inspection in the NHS Tayside area between 2003 and 2008.

Data Linkage

Data for 1174 children were deterministically linked using the Community Health Index (CHI) number as a unique identifier.



Fig. 2 Data linked within the Health Informatics Centre Safe-Haven

Data Analysis

- Analysis was carried out within a remote-access 'safe haven' environment using SPSS Statistics 21
- Differences in decayed, missing and filled primary teeth (dmft) were compared across categories of SIMD and SGUR6 classification
- Linear Regression was used to examine the relationship between dmft and local SIMD decile
- One-way ANOVA was used to examine the relationship between dmft and SGUR6 category
- One-way ANCOVA was conducted to determine a difference between SIMD quintile on dmft controlling for SGUR6.

5. Conclusions

This study has presented a method to link dental inspection and Child Health Surveillance Programme data within a safe haven environment. Analysis of the linked data shows that caries prevalence as measured by dmft is related not only to relative deprivation (SIMD) but also to elements of urban-rural classification (SGUR6). It could potentially be used to inform local strategy to tackle inequalities which may otherwise remain hidden within large-area based indices, such as SIMD. Dental caries experience of 5-year old children in Tayside is not just a 'Tale of Two Cities' but rather a complex map of potential inequality.

6. References

- Levin KA, Davies CA, Douglas GVA, Pitts NB. Urban-rural differences in dental caries of 5-year old children in Scotland. *Social Science & Medicine*. 2010;71(11):2020-7.
- NHS Tayside. Oral Health Equity Strategy 2015-2020. Directorate of Public Health: NHS Tayside. 2016.
- Wood R, Stirling A, Nolan C, Chalmers J, Blair M. Trends in the coverage of 'universal' child health reviews: observational study using routinely available data. *BMJ open*. 2012;2(2):e000759.
- Bohensky MA, Jolley D, Sundararajan V, Evans S, Pilcher DV, Scott I, et al. Data linkage: a powerful research tool with potential problems. *BMC health services research*. 2010;10(1):346.

4. Results

Linked Dataset

After linkage, complete cases were available for 1138 children (96.9%). The mean age was 5.6 years (SE=0.01). Of the included children, 48% were female and 52% male. The mean dmft was 1.55 (SE=0.08).

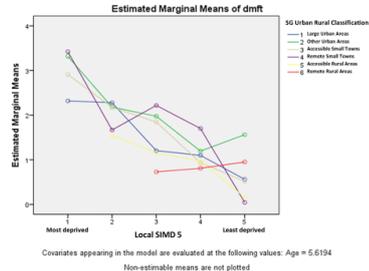
Relationship between dmft and SIMD decile

Living in an area of high deprivation is significantly associated with increased dmft ($F(1, 1136) = 73.0, p < 0.01$).

Relationship between dmft and 6 fold Urban Rural Classification

- A statistically significant difference in dmft between urban and rural groups was found ($F(5, 1132) = 14.8, p < 0.01$)
- dmft was significantly increased for those living in Large Urban [UR1] and Other Urban [UR2] areas compared to Accessible Rural [UR5] areas ($p < 0.01$) but not significantly different when compared with other rural areas [UR4 and 6].

Fig 3. Estimated Marginal Means of dmft by SIMD Quintile controlling for Urban Rural Classification



The Estimated Marginal Mean dmft in Remote Small Towns [UR4] was increased in SIMD 3 when compared to SIMD 2. The Estimated Marginal Mean dmft increased between SIMD 4 and 5 in Remote Rural Areas [UR6]. In Tayside, targeted oral health interventions are currently limited to areas of local SIMD 1 and 2 within in this age group.

7. Acknowledgements and Approvals

Ethical Approval: Health Informatics Centre Managed Datasets Database (REC reference: 14/ES/0015, IRAS project ID: 143637). This project is funded by the TC White Young Researcher Grant, TC White Bequest Fund of the Royal College of Physicians and Surgeons of Glasgow (Grant Ref: 804991). With acknowledgement to: Prof Mark Hector (PhD Supervisor) and Dr Gavin Revie, School of Dentistry, University of Dundee. Dr Stephanie Chambers, University of Glasgow. Dr Joanne Cecil and Prof Gerry Humphris, University of St Andrews. Derek Richards, NHS Tayside. Duncan Heather, Health Informatics Centre, University of Dundee.

Appendix D. CMDN University of Dundee Research Symposium Poster 2015



UNIVERSITY OF DUNDEE
School of Dentistry

Exploring links using epidemiological and routinely collected data:
the relationship between childhood body weight and dental caries experience

Susan Carson PhD Student
Supervision by Professor Ruth Freeman and Professor Mark Hector



DENTAL HEALTH SERVICES RESEARCH UNIT

1. Introduction

3. Aims and Objectives

The amount of sugar we consume in our diet and the resulting health effects has received extensive coverage in the media in recent months. Excess consumption of added sugars is a recognised contributor to the development of a number of non-communicable diet-related diseases including obesity, type two diabetes and dental caries. In simple terms dental caries and body weight are linked via the common risk factor of diet.¹ A number of systematic reviews have reported associations between body weight and dental caries,²⁻⁴ although the data are mixed and provide conflicting evidence.⁵ There remains limited evidence available on the relationship between low and high body weight and dental caries.³ It is therefore important to examine the relationship which exists amongst children living in Tayside in order to obtain robust evidence which will inform policy and to potentiate comparative study between areas across Scotland and beyond.

Aim: To investigate the relationship between dental caries and body weight amongst children in Tayside.

Objectives:

- To link epidemiological dental and routinely collected health data for children from the Tayside area
- To investigate whether a relationship exists between dental caries and Body Mass Index (BMI) amongst children in Tayside
- To examine moderators and mediators in the relationship between dental caries and BMI amongst children in Tayside
- To complete a process evaluation on the development of a protocol for accessing, linking and analysing routine health and dental epidemiological data in health boards across Scotland.

2. Background

4. Method and Analysis

1. Epidemiological Data

Data on oral health in children are collected annually by the National Dental Inspection Programme (NDIP). This study makes use of the Detailed Inspection epidemiological data which is collected as a representative sample of either Primary 1 or Primary 7 age groups in alternate years. Dental disease has been shown to be strongly associated with deprivation and there is a marked social gradient with fewer pupils from the more deprived Scottish Index of Multiple Deprivation quintiles (SIMD 5) having teeth free from obvious caries.⁶

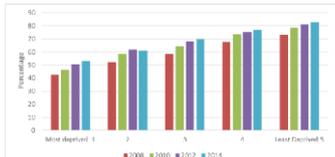


Fig. 1 Comparison between 2008 and 2014 of the proportion of P1 children in Scotland with 'no obvious decay experience' by SIMD quintile

2. Routinely Collected Data

NHS Scotland has a universal system of child health information systems interlinked by the Community Health Index (CHI) including the Pre-School Child Health Surveillance Programme in Scotland (CHSP P-S) and the School Health Surveillance Programme in Scotland (CHSP-S). Child body weight and height are routinely collected during the examination.

Method:

Simulated Community Health Index (CHI) allows linkage between data using an accurate patient identifier. Data from the National Dental Inspection Programme (NDIP) and the Child Health Surveillance Programme (CHSP) have been provided by the Health Informatics Centre.



Fig. 2 Data linked within HIC Safe-Haven

Data for >2000 Primary 1 children from across Tayside have been linked. These contain tooth condition by surface, demographic information, height, weight, BMI and socioeconomic position at a number of time points.

Analysis:

The anthropometric indices: weight-for-height to assess wasting, height-for-age to assess stunting, weight-for-age to assess underweight and BMI will be used to assess overweight, normal, wasting and stunting using the 2000 CDC Growth Charts for Children. Dental data by whole tooth and by surface will be coded according to established NDIP criteria (based on the recognised British Association for the Study of Community Dentistry coding system). Content factor analysis will be conducted to determine the effects of moderators and mediators on the relationship between dental caries and body weight within the Tayside representative sample.

5. Predicted Research Outcomes

- The development of a protocol for accessing, linking and analysing routine health and dental epidemiological data in health boards across Scotland
- Production of robust evidence on the relationship between dental caries and body weight amongst children in Tayside
- Providing information to assist in the planning of future interventions that take a common risk factor approach to promote oral and general health.

6. References

7. Acknowledgements

1. Sheiham A, Watt RG. The Common Risk Factor Approach: a rational basis for promoting oral health. *Community Dent Oral Epidemiol* 2000; 28: 399-406.
2. Hayden CI, Bowler JO, Chambers S, Freeman R, Humphris G, Richards D, Cecil JE. Obesity and dental caries in children: a systematic review and meta-analysis. *Community Dent Oral Epidemiol* 2013; 41: 289-308.
3. Hooley M, Skouteris H, Bogatin C, Satur J, Kilpatrick N. Body mass index and dental caries in children and adolescents: a systematic review of literature published 2004 to 2011. *Syst Rev* 2012; 1: 57.
4. Silva AE, Mendes AM, Demarco FF, Vargas-Ferreira F, Peres MA. Obesity and dental caries: systematic review. *Rev Saude Publica* 2013; 47: 799-812.
5. Carson SJ, Freeman R. Fact or fiction: does a relationship exist between free sugars, dental caries and body weight? *Dental Update* 2014; 41: 862-866.
6. Macpherson LMD, Ball G, Carson SJ, Chalmers SB, Conway DJ, Jones CM, McMahon AD, Thomson CT and White V (2014). National Dental Inspection Programme 2014: Report of the 2014 Detailed National Dental Inspection Programme of Primary 1 children and the Basic Inspection of Primary 1 and Primary 7 children Edinburgh: ISD Scotland on behalf of the Scottish Dental Epidemiological Coordinating Committee.

Ethical approval to conduct this research was obtained from the East of Scotland Research Ethics Service as part of the Health Informatics Centre Managed Datasets Database (REC reference: 14/ES/0015, IRAS project ID: 143637).

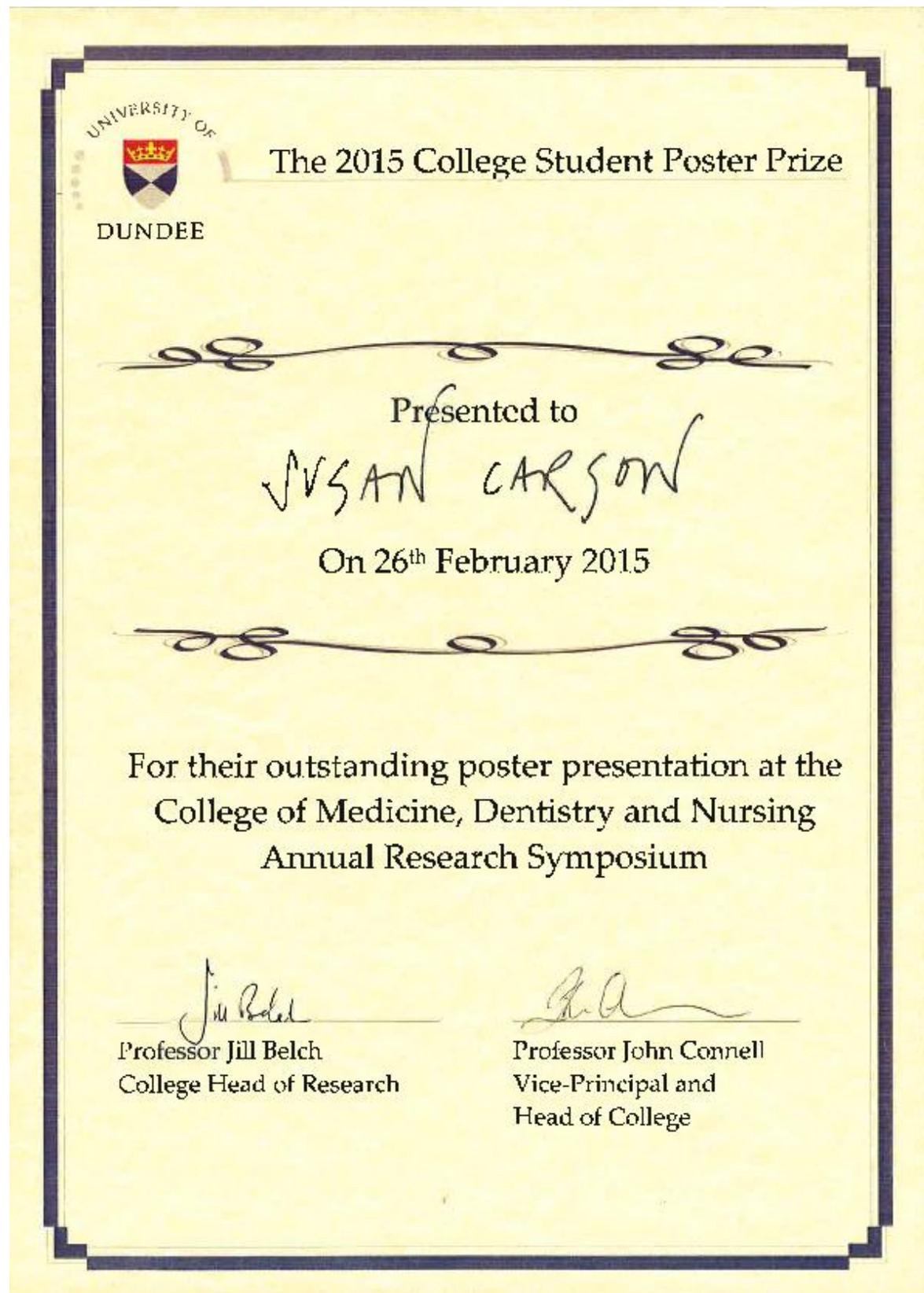
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Appendix F. Oral presentation at Queens College, University of Oxford

