

Institution: Cardiff University		
Unit of Assessment: Allied Health Professions, Dentistry, Nursing and Pharmacy (3)		
Title of case study: Improving the oral health of UK children in deprived communities through policy and practice change		
Period when the underpinning research was undertaken: 2008 – 2017		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Chestnutt, Ivor	Clinical Professor	01/07/1999 - present
Chadwick, Barbara	Clinical Professor	21/04/1986 - 31/07/2020
Hood, Kerenza	Professor	01/11/1997 - present
Morgan, Maria	Senior Lecturer	01/08/2012 - present
Murphy, Simon	Professor	01/10/2004 - present
Playle, Rebecca	Senior Statistician	11/10/2007 - 31/07/2020
Trubey, Rob	Research Associate	17/05/2014 - present
Period when the claimed impact occurred: 2015 – 2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact (indicative maximum 100 words) <p>Tooth decay in children is a major health concern, particularly for children in deprived communities. In 2009, Welsh Government implemented a national oral health improvement programme to address this issue; this programme, however, lacked evidence of public health benefits. Cardiff research provided evidence for Welsh Government to change its policy and practice, including a cost-saving shift in preventative treatment from fissure sealants to fluoride varnish and a major refocus of the national programme to target children under five. Based on Cardiff research, Welsh Government continues investing over £3M per year to support the revised national oral health programme. Cardiff research also provided the evidence base for a NICE Guideline which Public Health England uses to direct oral health initiatives in England.</p>		
2. Underpinning research (indicative maximum 500 words) <p>Dental caries (tooth decay) is a major health concern in children, particularly those from deprived backgrounds where levels of decay are three times higher than in more affluent areas. From the mid-1980s to the mid-2000s, there was no change in the prevalence of decay in 5-year-olds in Wales. In 2009, devised to address these concerns, Welsh Government launched 'Designed to Smile' (D2S), an oral health improvement programme targeted at children resident in deprived communities with a focus on in-school toothbrushing. There was, however, no objective measure of the effectiveness of the D2S programme to prove that the £3.1M invested annually was a good use of public resources, maximising public oral health outcomes.</p> <p>To provide this much-needed evidence base, Cardiff University's Dental Public Health Unit (DPHU) conducted the following research:</p> <p>2.1 Randomised Controlled Trial</p> <p>Commencing in 2011, Cardiff researchers conducted one of the largest clinical trials in dentistry, following over 1,000 six-year-olds for four years in deprived communities within South Wales [3.1]. This was funded by the National Institute for Health Research's Health Technology Assessment Programme [G3.1]. At this time, the D2S programme provided fissure sealants (a plastic covering that reduces the susceptibility of tooth biting surfaces to decay). An alternative to fissure sealants is to apply fluoride varnish; however, prior to Cardiff's clinical trial, a Cochrane review was unable to show conclusive evidence of which treatment was most effective at preventing tooth decay and which was more cost effective.</p> <p>Cardiff's randomised controlled trial (known as Cardiff's 'Seal or Varnish?' trial) was the first to demonstrate the cost effectiveness and equivalence of fluoride varnish in preventing tooth</p>		

decay compared with fissure sealant (17.5% of children who had fluoride varnish treatment had significant decay in their molars after three years, compared to 19.6% in the sealant-treated group). The costs of the two technologies showed a statistically significant difference; the mean cost to the NHS (including intervention costs) per child was £500 for fissure sealants, compared with £432 for fluoride varnish, a difference of £68.13 in favour of fluoride varnish [3.2].

2.2 Epidemiological surveys

Cardiff also led a series of epidemiological surveys (in 2008, 2012, 2016 and 2017) measuring the impact of D2S on dental health [3.3]. The results showed that the prevalence of dental caries in five-year-olds fell from 47.6% in 2008, at the start of the D2S programme, to 34.2% in 2017, 9 years after D2S implementation [3.4]. Cardiff also showed that 14.5% of 3-year-olds had at least one tooth affected by decay, and 46.4% of the decay prevalence at age 5 could be explained by decay prevalence at age 3, demonstrating that early prevention was likely to have the most impact in preventing future tooth decay [3.5].

2.3 Evidence Report for The National Institute for Health and Care Excellence (NICE)

In 2013, the Cardiff team was commissioned by NICE to write a report to inform national dental guidance for vulnerable groups [3.6]. The Cardiff team undertook three pieces of work to create this report:

- identification and analysis of Oral Health Needs Assessments produced by Consultants in Dental Public Health (CDPHs) across the UK [3.6, pp.21-28];
- a primary qualitative research study involving a series of semi-structured interviews with CDPHs to seek their views on the Oral Health Needs Assessments process [3.6, pp.29-36];
- two structured reviews of the literature: one examining the evidence base on oral health needs assessment and vulnerable groups, the other a review of the literature around methods used to produce general health needs assessments [3.6, pp.37-47].

From these three components, a set of general principles and good practice points were identified and were used to devise a ten-step model for undertaking oral health needs assessment, which was outlined in Cardiff's report for NICE [3.6, p.57].

3. References to the research (indicative maximum of six references)

[3.1] **Chestnutt IG, Chadwick BL**, Hutchings S, **Playle R**, Pickles T, Liles C, Kirkby N, **Morgan MZ**, Hunter L, Hodell C, Withers B, **Murphy S**, Morgan-Trimmer S, Fitzsimmons D, Phillips C, Nuttall J and **Hood K**. (2012) Protocol for "Seal or Varnish?" (SoV) trial: a randomised controlled trial to measure the relative cost and effectiveness of pit and fissure sealants and fluoride varnish in preventing dental decay. BMC Oral Health 12:51 DOI: 10.1186/1472-6831-12-51

[3.2] **Chestnutt IG**, Hutchings S, **Playle R**, Morgan-Trimmer S, Fitzsimmons D, Awar N, Angel L, Derrick S, Frew C, Hoddell C, **Hood K**, Humphreys I, Kirby N, Lau TMM, Liles C, **Moran MZ**, **Murphy S**, Nuttall J, Onishenko K, Phillips C, Pickles T, Scoble C, Townson J, Withers B, **Chadwick BL** (2017) Seal or Varnish? A randomised controlled trial to determine the relative cost and effectiveness of pit and fissure sealant and fluoride varnish in preventing dental decay. Health Technology Assessment, (21):1-256. DOI: 10.3310/hta21210.

[3.3] **Trubey RJ, Chestnutt IG** (2013) Attitudes towards establishing a daily supervised school-based toothbrushing programme-determined by Q-sort methodology. Community Dental Health 30, 45-51 DOI: 10.1922/CDH_3044Trubey07

[3.4] Jones CM, Davies GM, Monaghan NP, **Morgan MZ**, Neville JS, Pitts NB (2017) The caries experience of 5-year-old children in Scotland in 2013-14, and in England and Wales in 2014-15. Community Dental Health 34, 157-162 DOI: 10.1922/CDH_4085Jones06

[3.5] Monaghan N. **Morgan MZ**, (2017) What proportion of caries into dentine at age 5 is present at age 3? Community Dental Health 34, 93-96 DOI: 10.1922/CDH_4042Morgan04

[3.6] Chestnutt IG, Morgan MZ, Monaghan NP, Thompson S, Collins L (2013) An overview of oral health needs assessments to support NICE public health guidance, 'Oral health: local authority strategies to improve oral health, particularly among vulnerable groups'. [nice.org.uk/guidance/ph55/evidence/report-1-an-overview-of-oral-health-needs-assessments-main-report-pdf-431755885](https://www.nice.org.uk/guidance/ph55/evidence/report-1-an-overview-of-oral-health-needs-assessments-main-report-pdf-431755885)

Selected grant:

[G3.1] Chestnutt IG, Murphy S, Hood K, Chadwick B, Morgan M, Playle R. Seal or Varnish? A randomised trial to determine the relative cost and effectiveness of pit and fissure sealants and fluoride varnish in preventing dental decay. National Institute for Health Research's Health Technology Assessment Programme. 02/4/2011-28/02/2018 £1,560,291

4. Details of the impact (indicative maximum 750 words)

Cardiff's research provided the evidence base to inform Welsh Government policy around their major national oral health programme, as well as the development of a new NICE clinical guideline.

4.1 Informing Welsh Government policies on national oral health

Cardiff's research informed Welsh Government decisions about their national oral health programme, including:

a. To continue funding the national oral health programme at over £3M per year

Cardiff's work demonstrating the effectiveness of Designed 2 Smile (D2S) has ensured continued Welsh Government investment in the programme. Welsh Government's Chief Dental Officer, Dr Collette Bridgman, states that *"The surveys of the oral health of 5-year-olds conducted by your Department in 2008, 2012, 2015 and 2016 have been instrumental...to demonstrate the impact of the programme and is essential to informing the ongoing commissioning of Designed to Smile"* **[5.1a]**. Welsh Government invests over £3M in the programme annually, with £3.7M allocated for the year 2018-2019 **[5.1b p.27]**.

b. To move from fissure sealants to fluoride varnish

The economic evaluation carried out as part of Cardiff's 'Seal or Varnish?' Trial (detailed in section 2.1) demonstrated that provision of fluoride varnish was more cost-effective than fissure sealants in a community setting **[3.2]**. As a result, the Welsh Government announced that fissure sealants would no longer be included in the D2S programme or be provided as stand-alone care by the community dental services in schools. An enquiry into Dentistry by Welsh Government's Health, Social Care and Sport Committee relied heavily on Cardiff's data to confirm the shift away from fissure sealants. In oral evidence to the enquiry, the Chief Dental Officer for Wales cited Cardiff's research stating *"There was a research paper published by Professor Ivor Chestnutt, from Cardiff University, which demonstrated that the fissure sealant as a preventative intervention was as effective as fluoride varnish"* **[5.2]**. She later went on to add, *"by removing some of what we saw was less effective—fissure sealant delivery at a later stage—we were able to use that resource more effectively and expand the number of children actually receiving the benefits of Designed to Smile"* **[5.2]**.

c. To target children under five through a refocused D2S Programme

By demonstrating that early prevention was likely to have the most impact on minimising tooth decay **[3.5]**, Cardiff's evidence led the Welsh Government to announce in March 2017 that the D2S programme would now be re-focused to target pre-school children **[5.2, 5.3]**. The aim of focusing on this younger cohort was to ensure that as many children as possible would be decay free by five years old. Financial savings from the move away from fissure sealants allowed the Welsh Government to expand primary decay prevention, daily brushing and fluoride varnish application in early years settings **[5.2]**, with guidance issued from the Welsh Government through a Welsh NHS circular **[5.4]**. This refocusing of the D2S programme, based on Cardiff's evidence, meant that a further 10,000 applications of fluoride varnish were incorporated into the national oral health programme.

In 2019, a written statement by the Cabinet Secretary (Minister for Health and Social Services) Vaughan Gething, marking the 10th anniversary of the launch of D2S, noted,

- *“From our surveys we can estimate that there are around 4,000 fewer 5-year-olds who have decay nowadays compared with before Designed to Smile was introduced”.*
- *“We also know that the number of children undergoing dental procedures under general anaesthesia has reduced by 35% in the last 6 years. That is over 3,200 fewer children having to have a general anaesthetic a year for removal of decayed teeth”* [5.5].

An analysis of Cardiff’s data additionally confirmed improvements from D2S across the social spectrum without any worsening in oral health inequalities [5.6]. Currently, close to 100,000 children, in areas of greatest economic need, are accessing the national oral health programme in Wales. The 12% reduction in caries prevalence in 5-year-olds between 2008 and 2017 is considered evidence of positive D2S programme impact [5.2], following two decades in which the prevalence of decay did not change in Wales [3.4].

4.2 Providing an evidence base for oral health NICE Guidelines

The Cardiff team was commissioned by NICE to provide the evidence base for NICE national guideline PH55 ‘Oral health: local authorities and partners’ [5.7a, p.74]. Cardiff’s research report [3.6] was used as evidence to support recommendations 12-20, out of a total of 21 recommendations [5.7b]. The guideline was published in October 2014 [5.7a, 5.8]. Included in these NICE recommendations were the following, all linked to Cardiff research:

- Recommendation 15: Consider supervised tooth brushing schemes for nurseries in areas where children are at high risk of poor oral health;
- Recommendation 18: Introduce specific schemes to improve and protect oral health in primary schools in areas where children are at high risk of poor oral health;
- Recommendation 19: Consider supervised tooth brushing schemes for primary schools in areas where children are at high risk of poor oral health;
- Recommendation 20: Consider fluoride varnish programmes for primary schools in areas where children are at high risk of poor oral health.

The Cardiff evidenced NICE guideline (PH55) also informed Public Health England’s approach to child oral health. The guideline (PH55) is cited as part of Public Health England’s ‘All Our Health’, a resource for health and care professionals. Last updated in August 2019, Public Health England’s ‘All Our Health’ resource cites the Cardiff evidenced NICE guideline PH55 as a tool to support local authorities to commission, review and evaluate oral health improvement programmes for children and young people in England [5.9].

Both Cardiff’s report informing the NICE guideline [3.6] and the NICE guideline itself were cited as references in a non-Cardiff paper by Walker et al (2018) [5.10], outlining how Wakefield council responded to the growing concern that the oral health of children in Wakefield was worse than the national average. This paper states: “In line with the NICE guidance (2014), the approach to completing the OHNA [Oral Health Needs Assessment] used a 10 step model (Chestnutt et al., 2013) [...] The council has now taken action to strategically co-ordinate work across stakeholders to improve oral health in local children” [5.10]. This 10 step model was created by the Cardiff team and outlined in Cardiff’s report [3.6].

Overall, Cardiff’s extensive research in the field of child oral health informed the Welsh Government’s approach to tackling, and reducing, tooth decay in Welsh children, as well as forming the backbone of NICE clinical guidelines supporting improved public oral health initiatives across Wales and England.

5. Sources to corroborate the impact (indicative maximum of 10 references)

[5.1] a. Testimonial: Collette Bridgman, Chief Dental Officer for Wales, Welsh Government b. Designed to Smile Monitoring Report for the school year 2018-2019

- [5.2]** National Assembly for Wales, Committee for Health, Sport and Social Sciences (2019) A Fresh Start: Inquiry into dentistry in Wales. Para 126, 137 <https://www.assembly.wales/laid%20documents/cr-ld12528/cr-ld12528-e.pdf>
- [5.3]** Welsh Government (2017) News article 'Healthier teeth for Wales' children thanks to successful oral health programme'. Article presenting results of our evaluation and describing reforms to programme based on our evidence. www.wales.nhs.uk/news/44444
- [5.4]** Welsh Government (2017) Welsh Health Circular 'Re-focussing of the Designed to Smile child oral health improvement programme'. Notice from WG to Local health board chief executives about re-focussing of D2S programme (p.4, section 1.1). <https://gov.wales/designed-smile-child-oral-health-improvement-programme-whc201723>
- [5.5]** Welsh Government: Written Statement by Minister for Health and Social services: Designed to Smile - 10 years of improving children's oral health in Wales. 19 September 2019 <https://gov.wales/written-statement-designed-smile-10-years-improving-childrens-oral-health-wales>
- [5.6]** Monaghan N (2019) Exponential tooth decay curve. Community Dental Health 36, 203-206. DOI: 10.1922/CDH_4476Monaghan04 <https://www.cdhjournal.org/issues/36-3-september-2019/983-exponential-tooth-decay-curve>
- [5.7]** a. NICE Guidelines PH55 (2014): <https://www.nice.org.uk/guidance/ph55> - P.74 PDF downloaded and saved b. A list of the recommendations from the guidelines PH55
- [5.8]** NICE (2015) <https://www.nice.org.uk/sharedlearning/designed-to-smile-working-to-improve-oral-healthcare-for-children>
- [5.9]** Public Health England Guidance (August 2019): Child oral health: applying All Our Health <https://www.gov.uk/government/publications/child-oral-health-applying-all-our-health/child-oral-health-applying-all-our-health>
- [5.10]** Walker IF, Eapen-Simon S and Gibson S. (2018) Dental Public Health in Action: Putting oral health on the local public health agenda. Community Dental Health (2018) 35, 132–135 DOI:10.1922/CDH_4068Walker04