Children's **HE**althy **W**eight Guideline **I**mplementation in the Dental Setting: A multi-phase sequential mixed methods project

"The CHEWI Project"

A thesis submitted in fulfilment of the requirements for the Doctor of Philosophy (PhD) degree

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Dedicated to

Marion "May" Vitty

2 January 1947 – 7 June 2022

Thank you for helping raise me into who I am today. You taught me magic, manners, and most of all, love. You were always there for me. It is an honour to be one of “your children”.

You were there with me on my first day of school.

You are here in my heart on my last.

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Statement of Authentication

This thesis is submitted to Western Sydney University in fulfilment of the requirement of Doctor of Philosophy.

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

Signature: 

Amy Villarosa

Date: 26th November 2022

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Anthology of publications

Quality publications statement

I confirm the following:

- I am the first author on the five publications in this thesis
- All publications are indexed on Web of Science/Scopus
- All publications are published in Q1 and Q2 journals, and no lower than Q3
- All publications have been peer reviewed

Signature:  Date: 26th November 2022

Peer-reviewed papers

1. **Villarosa, A. R.**, George, D., Ramjan, L. M., Srinivas, R., & George, A. (2018). The role of dental practitioners in addressing overweight and obesity among children: A scoping review of current interventions and strategies. *Obesity Research & Clinical Practice*, *12*(5), 405-415. https://doi.org/https://doi.org/10.1016/j.orcp.2018.07.002 (Impact Factor: 5.214, Quartile: 2, Citations: 6)
2. **Villarosa, A. R.**, Ramjan, L. M., Maneze, D., & George, A. (2021). Conducting Population Health Research during the COVID-19 Pandemic: Impacts and Recommendations. *Sustainability*, *13*(6). https://doi.org/10.3390/su13063320 (Impact Factor: 3.889, Quartile: 1, Citations: 7)
3. **Villarosa, A. R.**, Maneze, D., Ramjan, L. M., Srinivas, R., Camilleri, M., & George, A. (2019). The effectiveness of guideline implementation strategies in the dental setting: a systematic review. *Implementation Science*, *14*(1), 106. https://doi.org/10.1186/s13012-019-0954-7 (Impact Factor: 7.327, Quartile: 1, Citations: 14)
4. **Villarosa, A. R.**, Maneze, D., Ramjan, L. M., Kong, A., & George, A. (2022). The codesign of implementation strategies for children's growth assessment guidelines in

the dental setting. Research Involvement and Engagement, 8(1), 19. https://doi.org/10.1186/s40900-022-00356-8 (Impact Factor: 3.907, Quartile: 1, Citations: 1)

5. **Villarosa, A. R.**, Maneze, D., Salamonson, Y., Ramjan, L. M., & George, A. (2022). Development and psychometric testing of the intention to engage in children's healthy weight (iCHeW) guideline scale for dental staff. Obesity Research & Clinical Practice, 16(4), 337-342. https://doi.org/10.1016/j.orcp.2022.06.006. (Impact Factor: 5.214, Quartile: 2)

Table 1 outlines the individual author contributions to the respective manuscripts. All authors consented for these publications to be included in this thesis. Refer to Appendix 1 for consent forms.

Table 1: Author contributions to peer-reviewed manuscripts (Papers 1-5)

Author	Conceptualisation, study design and methodology	Data collection	Data analysis	Interpretation and discussion	Manuscript draft	Manuscript revisions and final approval
Amy Villarosa	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5
Ajesh George	1, 2, 3, 4, 5	4, 5	1, 2, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5
Lucie Ramjan	4	4	3, 4	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5
Della Maneze	4	3, 4	3, 4	2, 3, 4, 5	2, 3, 4, 5	2, 3, 4, 5
Ravi Srinivas				1, 3	1, 3	1, 3
David George		1	1		1	1
Michelle Camilleri				3	3	3
Ariana Kong			4	4	4	4
Yenna Salamonson			5	5	5	5

List of conference presentations

International

1. Villarosa AR, Ramjan L, Maneze D, Camilleri M, Srinivas R, George A. (2019) *Expanding the role of dental practitioners to address childhood overweight and obesity*. 2nd Asia Pacific Conference on Integrated Care; 11th-13th November 2019; Melbourne Convention Centre, Australia.

National

2. Villarosa AR, Ramjan L, Maneze D, George, A. (2021) *How do we conduct population health research during COVID-19? Implications and recommendations*. Preventive Health Conference 2021, 10th-12th May 2021, Pan Pacific, Perth Australia.
3. Villarosa AR, Maneze D, Ramjan LM, Kong A, George A. (2022) *Innovative strategies for implementing children's growth assessments in the dental setting*. Preventive Health Conference 2022, 11th-13th May 2022, Brisbane Convention & Exhibition Centre, Brisbane, Australia.

Local

1. Villarosa AR, George A. (2018) *Children's healthy eating and weight guideline implementation in the dental setting: The CHEWI project*. Australian Dental and Oral Health Therapists' Association (NSW) Inc. Professional Development Day & AGM 2018, 3rd November 2018, Moby's Beachside Retreat, Boomerang Beach, Australia (invited speaker).
2. Villarosa AR, George D, Ramjan LM, Srinivas R, George A. (2018) *The role of dental practitioners in addressing overweight and obesity among children: A scoping review of current interventions and strategies*. Health Beyond Research & Innovation Showcase, 6-7th June, 2018, William Inglis Hotel, Warwick Farm, Australia.

3. Villarosa AR, Ramjan LM, Maneze D, Camilleri M, Srinivas R, George A. (2019) *Guideline implementation strategies in the dental setting: A systematic review*. The Inaugural Joanna Briggs Collaboration Regional Symposium in Evidence Based Healthcare, 28th June 2019, St George Hospital, Kogarah, Australia

List of grants

1. Development and implementation of the Children's Healthy Eating and Weight Intervention (CHEWI) program for dental therapists in South Western Sydney Local Health District (Category 2)

   SWSLHD - $17,733

   Investigators: **Villarosa, A**., George, A.

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   National Health and Medical Research Council - $88,502

   Western Sydney University - $24,000

   Investigators: **Villarosa, A**., George, A.

List of abbreviations

Abbreviations	
ADOHTA	Australian Dental and Oral Health Therapists' Association
AI	Appreciative Inquiry
BMI	Body Mass Index
CFIR	Consolidated Framework for Implementation Research
CHeW	Children's Healthy Weight
CHEWI	Children's Healthy Eating and Weight Guideline Implementation
CI	Constructive Inquiry
COM-B	Capability, Opportunity, Motivation and Behaviour
DA	Dental Assistant
DOHT	Dental or Oral Health Therapist
DT	Dental Therapist
EPOC	Effective Practice and Organisation of Care
GP	General Practitioner
HREC	Human Research Ethics Committee
I-CVI	Index of Content Validity for each Item
iCHeW	Intention to engage in Children's Healthy Weight
IF	Impact Factor
IM	Integrated Model of Behavioural Prediction
IRSD	Index of Relative Socioeconomic Disadvantage
MeSH	Medical Subject Heading
NHMRC	National Health and Medical Research Council
NPT	Normalisation Process Theory
NSW	New South Wales
OHT	Oral Health Therapist
PAF	Principal Axis Factoring

PAHRIS	Promoting Action on Research Implementation in Health Services
PICO	Population, Intervention, Control, Outcome
PROSPERO	International Prospective Register of Systematic Reviews
S-CVI/Ave	Scale-level Index of Content Validity, calculated using average I-CVIs
SSB	Sugar-Sweetened Beverage
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
US-CDC	United States Center for Disease Control and Prevention
WHO	World Health Organisation

Glossary of terms

Term	Definition
Above a healthy weight	See *overweight*.
Adolescence	A period of development widely considered to begin with the onset of puberty, often spanning from 10-19 years of age.
Appreciative inquiry	A strengths-based collaborative approach to organisational change. It utilised a methodology that follows a process of discovering the best of what is, dreaming of what could be, designing what should be, and delivering the change.
Attitude	An individual's overall perception regarding how favourable a behaviour is.
Awareness	Whether an individual knows of a behaviour, and if so, to what extent.
Behavioural determinant	Factors that directly affect a behaviour. These factors can be internal or external to an individual.
Behaviour	In this study, a behaviour generally refers to a specific action of interest, for example, an individual's choice or practice.
Below a healthy weight	See *underweight*.
Body Mass Index	Previously known as Quetelet's index, a measure of weight status defined as weight in kilograms divided by height in metres squared.
Central clinic	Where a district has multiple public dental clinics, a central clinic is a clinic that treats most patients, provides the most services, and where most staff are based.
Childhood	In Australia, a child is any person under the age of 18 years.
Codesign	A participatory approach that involves end-users in the design of interventions and solutions.
Constructive inquiry	An approach that incorporates the principles of appreciative inquiry in the development of strengths-based solutions, with an objective measurement of their effectiveness.
Dental assistant	A person who works as part of the dental team to provide support to staff such as dental officers, dental therapists, and oral health therapists. Also referred to as dental nurse.
Dental officer	More widely known as a dentist, these dental staff are registered healthcare professionals who specialise in care of the teeth and their supporting structures.

Dental staff	Any individual who works as part of the dental team. This could encompass dental assistants, dental therapists, oral health therapists and dental officers.
Dental therapist	A dental practitioner qualified to provide oral health assessment, diagnosis, treatment, management, and preventative services for children, and can treat adults with additional training. This practitioner works only within a structured professional relationship with a dentist.
Environmental constraints	Factors within someone's environment that may prevent them from engaging in a behaviour. This could include policies, and availability of equipment and resources such as information, time, and money.
Family tax benefit part A	A fortnightly benefit payment that aims to help with the cost of raising children. Eligible households must have a child, and meet an income test, whereby the maximum benefit is awarded for household incomes below $58,108, and the benefit is reduced by 20 cents for every dollar over $58,108, up to $103,368.
Growth assessment	An evaluation of a child's weight status, whereby their weight and height are measured, from which BMI is calculated and their BMI percentile is determined. This percentile is then compared to cut-offs to determine whether they have a healthy weight.
Guideline	In this study, this will generally refer to advice regarding the provision of healthcare and related practices.
Healthy lifestyle advice	Any advice that can promote a healthy lifestyle including achieving a healthy weight. This could include advice on diet, physical activity, water intake, sleep duration and screen time.
Healthy weight	For children over 2 years, a healthy weight corresponds to a BMI ranging between the 5th and the 85th percentile for children of the same age and sex.
Implementation	In this study, implementation refers to the adoption or execution of a guideline or policy in practice.
Implementation strategies	This study uses "implementation strategies" to refer to any method or technique that could enhance the adoption of guidelines in practice.
Integrated Model of Behavioural Prediction (IM)	A model developed by Fishbein, which is based on a reasoned action approach to understanding behaviour, which posits that although there may be infinite factors influencing behaviour, only a small number need to be considered to predict or change a behaviour. Specifically, this model predicts that people will act on their intentions when they have the necessary skills, and when environmental factors do not impede on this behaviour.

Intention	A determination to act in a certain way. According to the IM, intention is a function of attitude, perceived norm, and self-efficacy.
Obesity	For children aged over 2 years, obesity corresponds to a BMI at or above the 95th percentile.
Oral health therapist	A dental practitioner who has dual qualifications as a dental therapist and dental hygienist, meaning that in addition to dental therapist roles, they can provide periodontal/gum treatment.
Organisational culture	The collection of expectations, practices and values that guide and inform an organisation.
Overweight	Among children older than 2 years, overweight refers to having a BMI from the 85th up to the 95th percentile for children of the same age and sex.
Perceived norm	The social pressure an individual expects regarding a behaviour.
Periodontal	Relating to the structures surrounding and supporting the teeth.
Practices	The application of rules and knowledge that leads to action.
Psychometric evaluation	Evaluation of scales used to measure individuals' personality attributes and/or behaviours.
Satellite clinic	Where a district has multiple public dental clinics, and one of these is a central clinic, a satellite clinic refers to any of the other clinics which do not treat as high a proportion of patients, and where fewer staff are based.
Scale	A graduated measure or rank of order.
Screen time	The length of time (usually in hours) that an individual spends using electronic devices with screens, such as smart phones, computers, and television.
Self-efficacy	An individual's perceived capability to perform a behaviour.
Skill	The ability of an individual to perform a specific behaviour.
Sugar-sweetened beverage	Any beverage containing added sugar or other sweeteners.
Tooth decay	Damage to the surface of a tooth, resulting from bacterial action.
Well above a healthy weight	See *obesity*.

Thesis abstract

Background: There has been an increasing prevalence of childhood overweight and obesity worldwide and locally, with a quarter of Australian children now considered overweight or obese. This is of concern as obesity in childhood is associated with obesity in adulthood and increased risk of chronic diseases. In response to this, in 2015 the New South Wales (NSW) government released a Premier's Priority titled "Tackling Childhood Obesity", which called for all public health services to identify children above a healthy weight and refer them to appropriate services. This priority encompassed public dental services, due to the shared risk factors between childhood obesity and oral health including consumption of sugar-sweetened beverages, and the opportunities they have to recall and monitor child patients at regular intervals. In light of this, in 2018 the NSW Ministry of Health released guidelines titled 'Growth Assessment and Dietary Advice in Public Oral Health Services' for dental staff (DS) such as dental and/or oral health therapists and dental assistants across the state. However, to ensure these guidelines are incorporated into practice, it is anticipated that implementation strategies will be required to support dental practitioners.

Aims: This study aimed to develop and pilot implementation strategies to facilitate the translation of the 'Growth Assessment and Dietary Advice in Public Oral Health Services' guidelines into dental staff's practice. Specific objectives included:

1. Summarise the existing evidence on the most effective guideline implementation strategies for the dental setting
2. Codesign implementation strategies with dental staff and parents to facilitate implementation of children's healthy weight guidelines into the dental setting
3. Design and psychometrically evaluate an instrument that measures dental staff behavioural intention
4. Refine and pilot test the implementation strategies using the developed instrument and service data

Methods: This multi-phase sequential mixed methods project employed several designs and data collection approaches, all selected on their ability to address each of the study objectives. The CHEWI project was undertaken across five phases; in Phase 1 the foundational evidence was built using scoping and systematic literature reviews, and in Phase 2 implementation strategies were codesigned using the principles of appreciative inquiry. In Phase 3 the iCHEW scale was developed, in Phase 4 the implementation strategies were refined, and in Phase 5 the implementation strategies were piloted in a pre- and post-test pilot study using the iCHEW scale and service data to determine the impact of the strategies on adherence. Data collection and analysis were guided by the integrative model of behavioural prediction (IM).

Results: Paper 1 highlighted the potential role of dental staff in addressing overweight and obesity in childhood, and the acceptability of this role for parents. However, this paper also identified a lack of empirical research in this field. Paper 2 summarised the existing evidence regarding implementation strategies for dental staff and their effectiveness. It found that strategies such as audit and feedback, reminders, education, patient-mediated interventions, and multifaceted interventions were as effective in the dental setting as they were in other health settings. However, it also found that pay-for-performance was an effective strategy in the dental setting, despite this being less effective in other settings.

Paper 3 discussed the considerations for population health research during the COVID-19 restrictions and alternative methods that could be used during such restrictions. It highlighted these challenges in the context of this project and summarised the key alternative methods that were used for data collection in this project, such as online focus groups.

Paper 4 presented the qualitative codesign findings which resulted in the following six preliminary strategies: i) sending growth assessment information to patients before appointments; ii) providing refresher training to staff; iii) including dental assistants in

growth assessments; iv) updating staff regarding referral outcomes; v) culturally appropriate information resources for patients and families; and vi) longitudinal tracking of growth assessments in patient information systems. In Paper 5, a scale to measure the determinants of the behavioural intentions of dental staff regarding children's healthy weight guidelines, the iCHeW scale, was developed according to the domains of the IM. This scale was validated by a reference group and expert panel and was found to have good internal consistency and factorial validity, with minimal floor and ceiling effect.

The unpublished results in Chapter 8 presented the refinement of the implementation strategies codesigned in Paper 4, and the final resulting suite of implementation strategies. Furthermore, Chapter 9 presented the unpublished findings from a pilot of these strategies in two health districts in Sydney, which used the iCHeW scale (n=16), as well as a review of the routinely collected service data. From the pilot, there was a non-significant improvement in behavioural determinants of providing a growth assessment, with the difference in behavioural determinant scores between baseline and follow-up having a moderate, non-significant effect size (effect size=0.304, z=-1.216 p=0.224). The specific behavioural determinant of attitudes towards the provision of growth assessments had a statistically significant improvement from an average total score of 30.1 out of a possible total of 49 at baseline, to 35.2 out of a total of 49 at follow-up (effect size=0.557, z=-2.226, p=0.026). This difference was more pronounced among dental staff in District 2.

Furthermore, a significant improvement in adherence to children's healthy weight guidelines was seen in District 2 (20.94%, p<0.001), however a significant decrease was seen in District 1 (22.54%, p<0.001). When looking at factors associated with growth assessment provision, in District 1, children had 1.5 times higher odds of receiving a growth assessment if they were treated by a dental officer (OR = 1.54, p=0.050). Conversely, children in District 2 had significantly lower odds of receiving a growth assessment if they were treated by a dental officer (OR = 0.203, p<0.001) or if they were treated at a satellite clinic (OR = 0.572, p<0.001).

Conclusion: This project has provided valuable insight into the systematic development of implementation strategies for the dental setting by drawing upon the principles of codesign as well as involving a range of stakeholders. It was clear that dental staff can play a key role in addressing overweight and obesity in childhood, although this can be a challenging role expansion. A systematic approach where dental staff and parents could codesign their own strategies, and in ensuring involvement of other stakeholders in the refinement of these strategies produced strategies that were acceptable, feasible, and sustainable for all involved parties. Initial findings from this project showed promising improvements to behavioural determinants and self-reported behaviours following the introduction of the strategies for one district. Further research to confirm these findings using larger sample sizes, explore the impact of organisational culture on implementation and evaluate the impact of children's healthy weight guidelines in the dental setting on children's health outcomes is recommended.

Chapter 1

Introduction

"Individually we are one drop. Together we are an ocean."

— Ryunosuke Satoro

1.1 Locating the study

This project was initiated in response to the introduction of Children's Healthy Weight (CHeW) guidelines for children accessing all public health services in the state of New South Wales, Australia. With the public health concern of childhood overweight and obesity a challenge for any single profession to manage, policy makers concluded that an interdisciplinary approach would be most effective, whereby the responsibility could be shared among all public health services. Thus, in 2018, guidelines were released with the recommendation that all public health services routinely conduct growth assessments to determine whether children were below, above, or well above a healthy weight, and if so, refer them to appropriate services (NSW Ministry of Health, 2019). This included the public oral health services, where children received care from dental staff (DS) including dental assistants (DAs), dental therapists (DTs) and oral health therapists (OHTs). Guidelines specific to the NSW public dental services were developed by the NSW Ministry of Health, specifically the NSW Centre for Oral Health Strategy (NSW Ministry of Health, 2019), with no involvement from the CHEWI project team. The guidelines were developed through extensive consultation with key stakeholders. These stakeholders included NSW health groups such as the NSW Centre for Population Health, the Sydney Children's Hospital Network, the NSW State Oral Health Executive Committee, the NSW Oral Health Promotion Network, and the NSW Get Healthy service. Additionally, information technology groups from local health districts across the state, nutritionists and dietitians, local general practitioners, and consumers were consulted in the development of the guidelines.

These guidelines were rolled out across the state, which included two implementation strategies; the mandatory completion of a core training module regarding weight assessment, and an item number which could be claimed for each child upon the provision of children's healthy weight services (Australian Dental Association, 2022a; NSW Ministry of Health, 2019). This enabled clinics to receive remuneration from the NSW government for the provision of the children's healthy weight services. Although compliance to these guidelines was not strictly mandated, adherence was monitored, with a key performance indicator of 70% adherence used as the goal for all public dental services.

Senior management staff at oral health services in two local health districts in Greater Western Sydney were consulted by the study team at the commencement of the CHEWI project. Through this consultation, it was identified that these guidelines could be challenging and may be met with resistance by dental staff. As a result, it was agreed that implementation strategies would be required to successfully implement these new guidelines.

To identify the specific needs of the key stakeholders in these guidelines, including senior management, dental staff and patients at the participating oral health services, and ensure implementation strategies were appropriate, it was necessary to directly involve these individuals in the development of the implementation strategies. Yet, there was some concern about potential negativity from some dental staff, if they were to be involved in the study, and that this would not be constructive for the implementation of the guidelines. The methodology used by the candidate (see Chapters 3 and 4) therefore facilitated the involvement of key stakeholders, including senior management, dental staff and parents of patients, and enabled them to directly influence the strategies to be delivered to the participating sites, while ensuring a positive and constructive approach.

1.2 Terminology

The investigators of this project acknowledge that although weight status has important links with general health, it is influenced by a myriad of factors. As a result, people should not be assigned moral judgement or character flaws based on their weight status, and language used to represent weight status should be sensitive of this (Puhl & Heuer, 2010). To avoid the use of pejorative language associated with weight status, specific terminology will be used to represent weight status. Specifically, this thesis will avoid the use of the word "obese" as an adjective or noun to describe any individual or group, and instead will employ terms such as "people with obesity", "people who experience obesity", and "people who experience overweight". Furthermore, specific terminology has been employed at the participating study sites, with children below the 5th BMI percentile being referred to as "below a healthy weight", children above the 85th, but below the 95th BMI percentile referred to as "above a healthy weight" and children above the 95th BMI percentile referred to as "well above a healthy weight". Therefore, these terms may be used throughout this thesis, especially in relation to the research activities for this project.

In addition to this, specific terminology will be employed when referring to those working in the dental field. The dental field employs a range of staff with diverse roles in the dental team. With some considered dental practitioners, and others working as support members within the dental team, the term "dental staff" will be used as an inclusive term for all these individuals.

1.3 Thesis outline

As shown in Figure 1, this thesis is presented as the following compilation of chapters and publications:

Chapter 2 discusses the introduction and background of the thesis. It orients the CHEWI project by describing the major concepts and context that influence the significance of this study. Included in this chapter is the first publication from the CHEWI project (Paper

1), which is a scoping review of evidence surrounding the role of dental staff in addressing childhood overweight and obesity. This chapter ends with an outline of the rationale for this thesis, including gaps in the existing research that instigated this study, as well as the study aims and significance.

Chapter 3 outlines the conceptual framework that underpins the CHEWI project, and comprehensively discusses the methodological approach that was used for this study.

Chapter 4 discusses the specific methods adopted for the various phases of this project, with specific reflection on the COVID-19 pandemic and how this impacted the ultimate methods selected. Included in this chapter is CHEWI Paper 2, which discusses the various considerations and impacts of the COVID-19 pandemic on public health research methods.

Chapter 5 presents the findings from a systematic review to determine effective guideline implementation strategies for dental staff. These findings are presented in Paper 2.

Chapter 6 presents the qualitative findings for this study, which describes the codesign of implementation strategies for the children's healthy weight guidelines by dental staff and parents in the community. These findings are presented as Paper 4, which details the codesign process and the final implementation strategies proposed for these guidelines.

Chapter 7 describes the investigator-developed instrument used for to measure behavioural determinants of dental staff engaging in children's healthy weight guidelines, and the psychometric evaluation of this instrument. These results are presented in Paper 5.

Chapter 8 presents the refinement of the implementation strategies and the final implementation strategies for each district. These results are presented as unpublished findings.

Chapter 9 presents the quantitative results of the pilot of the CHEWI implementation strategies in two districts. These results are presented as unpublished findings.

Chapter 10 presents a comprehensive discussion of all major study findings, including an integration of the quantitative and qualitative findings. It also discusses the effectiveness of the conceptual framework in identifying the predictors of adherence to the CHEWI guidelines, and the strengths and limitations of the project.

Chapter 11 presents the conclusions, recommendations, and proposals for future research of children's healthy weight interventions in the dental setting.

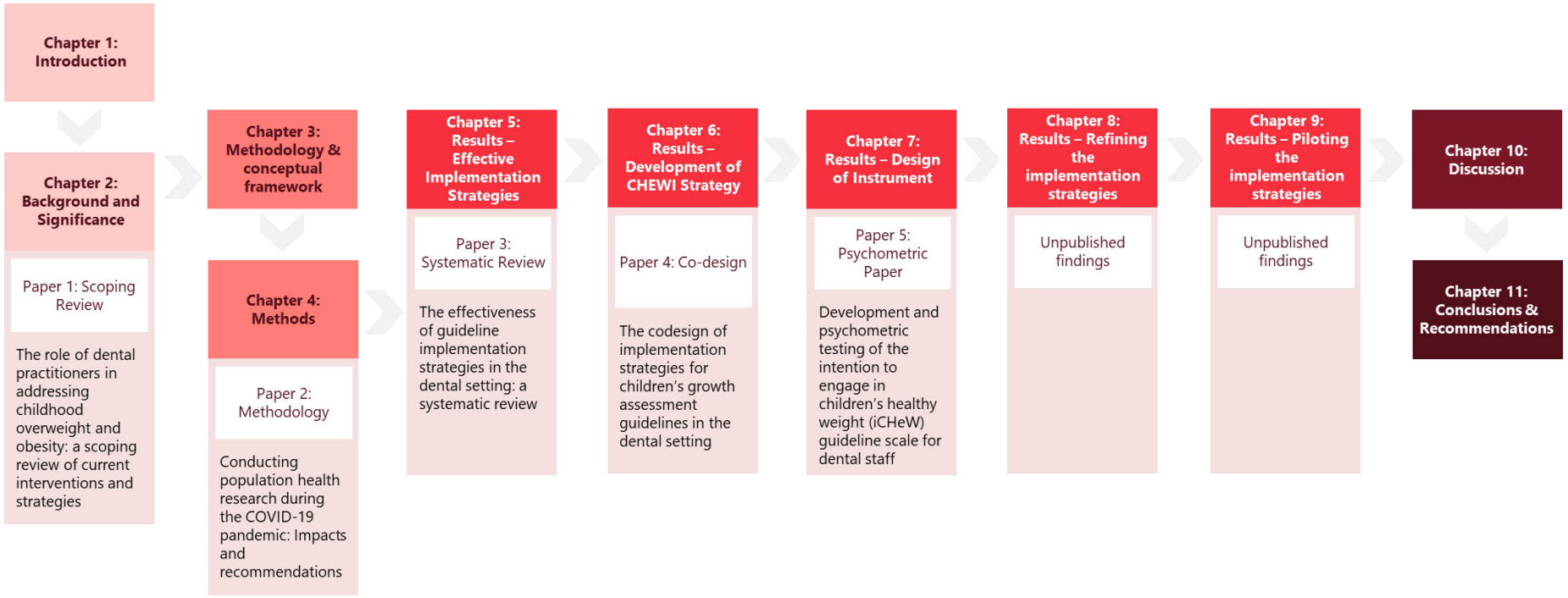

Figure 1: Thesis structure

Chapter 2

Background

2.1 Childhood overweight and obesity

Overweight and obesity among children is an increasing global public health concern, with its prevalence worldwide having almost doubled between 1980 and 2013, to over a fifth of children (Ng et al., 2014). In Australia, this prevalence is higher than the global average, with approximately one in every five children aged 2-4 years, and one in four children and adolescents aged 5-17 years currently experiencing overweight or obesity (Australian Institute of Health and Welfare, 2018). This is of concern, as there is mounting evidence to show that children who experience overweight and obesity in early childhood are more likely to continue to do so into adulthood, and that this effect starts from early childhood (Baur & Garnett, 2019; World Health Organisation, 2020). In addition, children above a healthy weight are at a higher risk of developing chronic diseases at a younger age, including cardiovascular disease, diabetes, hypertension, sleep apnoea, musculoskeletal conditions, and some cancers (World Health Organisation, 2020). Not only can overweight and obesity impact the physical health of children, but it can also affect a child's psychosocial development, being associated with low self-esteem, depression and poor quality of life, as well as being at a greater risk of bullying and social isolation (Rankin et al., 2016; World Health Organisation, 2012). Preventing excess weight among children has therefore been an ongoing focus of both national and global health strategies, due to its significant detrimental impacts on an individual's health, both in childhood and in adulthood (World Health Organisation, 2012).

2.2 The aetiology of childhood overweight and obesity

The aetiology of overweight and obesity in childhood is complex, involving an interplay of multifactorial antecedents (Lytle, 2009). Although some of these factors are non-modifiable, such as genetics, there are significant modifiable factors that can increase the

risk of excess weight in childhood (Dattilo, 2017). The fundamental cause of childhood overweight and obesity is an imbalance between energy intake and energy expenditure. Thus modifiable factors related to excess weight in childhood include practices resulting in an increased intake of energy dense, low micronutrient foods such as sugar-sweetened beverages (SSB), and practices related to physical inactivity such as lack of exercise and excessive screen time (Lytle, 2009; Mihrshahi & Baur, 2018; World Health Organisation, 2020). Childhood obesity is not only linked to knowledge, beliefs and resulting behaviours, but is also being increasingly related to social and economic development and policies related to agriculture, transport, urban planning, the environment, education, and food processing, distribution and marketing (World Health Organisation, 2020). Furthermore, the knowledge and beliefs of parents and/or caregivers have been shown to contribute to the risk of excess weight in childhood (Lytle, 2009; Mihrshahi & Baur, 2018).

These modifiable factors are often targeted in health promotion and disease prevention interventions to reduce overweight and obesity among children (World Health Organisation, 2012). Many such interventions have been successfully designed and implemented, including EPODE (Ensemble Prevenons l'Obesite Des Enfans/Together Let's Prevent Childhood Obesity) from France, the Pacific Obesity Prevention in Communities (OPIC) Project in Australia, Fiji, New Zealand and Tonga, and the Collaboration of Community-based Obesity Prevention Sites (CO-OPS Collaboration) in Australia (World Health Organisation, 2012). Despite the favourable outcomes of these interventions, the prevalence of childhood obesity remains high (Ng et al., 2014).

2.3 Measuring overweight and obesity in childhood

Although there are many ways of assessing weight status in childhood, the most common methods utilise Body Mass Index (BMI) as a measure. Body Mass Index is calculated by dividing weight in kilograms by height in metres squared (see Formula 1). The World Health Organisation (WHO) determines paediatric overweight and obesity BMI cut-offs by the number of standard deviations each child is from the WHO growth standard

median for age and sex (World Health Organisation, 2020). This is more conservative for children younger than five years old, whereby overweight is considered to be more than two standard deviations above the median, and obesity is considered to be more than three standard deviations above the median (World Health Organisation, 2020). Conversely, for children older than five years, overweight is defined as more than one standard deviation above the median, and obesity is considered more than two standard deviations above the median (World Health Organisation, 2020). Perhaps more commonly known are the United States Center for Disease Control and Prevention (US-CDC) cut-offs, where obesity is defined by BMI percentile when compared to a reference population of the same age and sex (Centers for Disease Control and Prevention, 2016). By this system, overweight is defined as any BMI greater than the 85th percentile, and obesity is any BMI greater than the 95th percentile for a child of the same age and sex.

$$Body\ Mass\ Index = \frac{Weight\ (kg)}{\left(Height\ (m)\right)^2}$$

Formula 1: Formula for calculation of Body Mass Index (BMI)

2.4 Current recommendations for childhood obesity in Australia

In 2013, the National Health and Medical Research Council (NHMRC) developed clinical practice guidelines informing the management of overweight and obesity in Australian children (National Health and Medical Research Council, 2013). These guidelines recommended monitoring the growth of children aged 2-18 years using either US-CDC or WHO Body Mass Index (BMI) percentile, and WHO charts for children younger than two years (National Health and Medical Research Council, 2013). These guidelines promote weight maintenance rather than weight loss as an acceptable approach for children with overweight or obesity. Furthermore, they recommended that healthy lifestyle changes be encouraged such as reducing consumption of energy-dense, low micronutrient foods, and increasing physical activity (National Health and Medical Research Council, 2013). In

addition, referral to hospital or paediatric services is recommended for children who have a BMI well above the 97th percentile on WHO charts, or children with serious comorbidities or suspected underlying medical causes (National Health and Medical Research Council, 2013). General practitioners (GPs) or practice nurses are recognised within these guidelines as the healthcare providers responsible for assessing weight status, initiating weight-related discussion, and providing assistance or referral for weight management (National Health and Medical Research Council, 2013).

However, research suggests that growth assessment and healthy weight promotion is often not prioritised in general practice (Thomas & Urrego, 2017). For example, in Australia, one study highlighted that over 92% of GPs were unaware of the 2003 NHMRC clinical practice guidelines (McMeniman et al., 2011), and another found that less than 5% of GPs routinely checked children's weight (O'Shea et al., 2014). With high overweight and obesity rates among Australian children, in 2015 the NSW government released a Premier's Priority titled "Tackling Childhood Obesity", which aimed to reduce overweight and obesity among children by 5% in 10 years (NSW Ministry of Health, 2016, 2018c). This priority called for supporting all health professionals, to identify children above a healthy weight and refer them to appropriate services (NSW Ministry of Health, 2018c). Specific strategic actions included plans to "implement the routine delivery of brief advice and referral for children who are above a healthy weight" (NSW Ministry of Health, 2016). Despite the introduction of these interventions, the rates of overweight and obesity among children in NSW only decreased by 0.1% from 21.5% to 21.4% in the three years that followed (NSW Ministry of Health, 2018c).

2.5 The role of dental professionals

Research emphasises the potential for other health practitioners to play an instrumental role in the identification of overweight and obesity in children, with a clear role highlighted for dental staff (Dooley et al., 2017; Perman, 2011; Sanghavi & Siddiqui, 2017). In fact, dental staff are in an ideal position to provide weight assessments and track children's

growth, as they often see children on a regular basis for periodic oral examinations and could therefore conduct serial measurements of weight and height (Perman, 2011). In addition, dental staff are well placed to provide basic healthy lifestyle advice for children and discuss modifiable risk factors for obesity, as many of these are shared risk factors for tooth decay, such as excess consumption of SSB and sugar intake (Dooley et al., 2017; Lamster & Eaves, 2011; Wright & Casamassimo, 2017). This is further supported by emerging evidence suggesting that obesity may be associated with periodontal disease and tooth decay (Hayden et al., 2013; Katz & Bimstein, 2011; Keller et al., 2015). In turn, periodontal disease may also be associated with an increased risk of developing insulin resistance and diabetes (Gurav, 2012).

2.5.1 Types of dental staff

Although the term dentist is used consistently in many countries to describe a registered dental practitioner, terms used to describe other types of dental qualifications can vary. For example, in the US, dental hygienists are preventative dental care experts, generally trained at an associate degree level, and dental assistants are usually trained at a certificate level. There are other staff, such as dental laboratory technicians and community dental health coordinators with more specialised roles (American Dental Association, 2022). In comparison, in the UK, dental assistants are referred to as dental nurses, and they have an additional type of dental staff, known as a dental therapist, who can perform routine dental work (The National Health Service, 2022).

Australian dental staff can hold a variety of the above qualifications from dental assistant, or dental nurse, through to dentist (Australian Government, 2012). Each of these qualifications require varying education levels, from the diploma required to practice as a dental assistant to the 5-year bachelor's degree required to practice as a dentist (Australian Government, 2012). Higher education levels allow for a wider scope of practice, permitting various health promotion and counselling initiatives (refer to glossary for details) (Australian Government, 2012). Although dentists have the highest qualification level and the broadest

scope of practice, and therefore seem to be the most suitable practitioners to play a role in activities such as healthy weight promotion, they also have high caseloads to balance and are often the most time constrained (Australian Institute of Health and Welfare, 2008). In 2020, there were 2.3 full time equivalent dental therapists per 100,000 population in Australia, of which approximately three quarters worked primarily in the public sector, and 6.9 oral health therapists per 100,000 population, of which over a quarter worked primarily in the public sector (Australian Government, 2021a, 2021b; Australian Institute of Health and Welfare, 2023). This was approximately 3.5 full time equivalent public dental and oral health therapists per 100,000, who primarily treat children, compared with 5.4 full time equivalent public dentists per 100,000 population, who treat both adults and children (Australian Institute of Health and Welfare, 2023). Thus public dentists are in higher demand, with longer waiting times as a likely result (Australian Institute of Health and Welfare, 2023). Furthermore, dental officers are more costly to employ, with full time NSW public dentist salaries starting at $96,063 per annum, compared to a $67,442 per annum starting salary for NSW public oral health therapists (New South Wales Government, 2022).

Therefore, the most suitable Australian dental practitioners to be involved in children's healthy weight promotion may be dental therapists, oral health therapists and dental assistants. Regarding dental and oral health therapists (DOHTs), dental therapists are required to complete a three-year degree which qualifies them to provide dental services to children (Australian Dental Association, 2018). Oral health therapists undertake a similar degree, and in addition to dental therapist qualifications, can practice as a dental hygienist and provide periodontal treatment to patients (refer to glossary for further details) (Australian Dental Association, 2018). With additional training, both dental and oral health therapists are able to treat adults, however, they often work primarily with children, making them ideal practitioners to identify and manage childhood obesity in the dental setting (Australian Dental Association, 2018). Compared with just over 15 percent of dentists, over 80 percent of DOHTs work in the public sector, where most Australian children can access

free dental care (Australian Government, 2012). In addition, the involvement of DOHTs in children's healthy weight guidelines is a cost-effective option when compared to dentists, due to their lower salaries (New South Wales Government, 2022; NSW Ministry of Health, 2018b). Furthermore, dental assistants, who play a major role in supporting DOHTs in practice, could also provide support with children's healthy weight practices (Australian Dental Association, 2022b).

2.6 Paper 1: The role of dental staff in addressing overweight and obesity among children

While there is a clear role for dental staff in addressing overweight and obesity among children, a recent review found no evidence of programs effectively implementing specific targets for childhood obesity prevention in the dental setting such as reducing SSB consumption (Dooley et al., 2017). In addition, no available research summarised the effectiveness and acceptability of children's healthy weight interventions in dental practice, or identified implementation strategies that could be adopted. As a result, the following scoping review was undertaken, which outlined the effectiveness of the existing published children's healthy weight interventions in the dental setting, the acceptability of such interventions, and proposed strategies for these interventions.

2.6.1 Citation: Paper 1

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Review

The role of dental practitioners in addressing overweight and obesity among children: A scoping review of current interventions and strategies

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ABSTRACT

Introduction: With the growing prevalence of childhood obesity worldwide, there is a need for interventions to identify and address overweight and obesity in childhood. Although guidelines recommend general practitioners routinely screen for overweight and obesity among children, research suggests this is often not done. To address this, dental practitioners may be able to play a role in identifying and addressing overweight and obesity among children.
Methods: This review aimed to explore the evidence and efficacy of existing obesity and overweight interventions targeting children in the dental setting. A systematic search of nine electronic databases was conducted to identify relevant published and grey literature. This was expanded to also include strategies for promoting oral health in the dental setting.
Results: A total of 11 records were included in this review, which focussed on the current role and effectiveness of dental practitioners in addressing obesity among children, and the available strategies and resources. Although there was a paucity of research on the training of dental practitioners in this area and their efficacy in identifying and addressing obesity among children, evidence suggests that parents found it acceptable for dental practitioners to promote healthy practices to children who experience overweight or obesity. This review also identified screening tools and strategies for identifying and addressing overweight and obesity among children in dental practice.
Conclusion: There is a clear role for dental practitioners in addressing overweight and obesity among children, however further research is required to identify the most effective interventions to implement in dental practice.

Contents

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Introduction

Overweight and obesity among children is an increasingly prevalent global public health concern, with the number of children experiencing overweight and obesity worldwide having increased by 47.1% between 1980 and 2013, to over a fifth of children [1]. Evidence suggests children with overweight and obesity are more likely to experience obesity in adulthood and are at a higher risk of chronic disease at a younger age, including cardiovascular disease, diabetes, hypertension, sleep apnoea, musculoskeletal conditions, and some cancers [2]. Further, overweight can have a detrimental impact on a child's psychological wellbeing and quality of life [3]. Although the antecedents to obesity and overweight in children are multifactorial and genetics can have an influence, there are significant modifiable factors that increase the risk of excess weight in childhood [4]. These include nutritional practices such as consumption of sugar-sweetened beverages (SSBs), knowledge and beliefs of both children and parents/caregivers, and physical inactivity [5].

Numerous health promotion and disease prevention interventions have been designed and successfully implemented for children with overweight and obesity [6]. Many of these interventions address modifiable risk factors such as diet and physical activity and include EPODE (Ensemble Prevenons l'Obesite Des Enfans/Together Let's Prevent Childhood Obesity) from France, the Pacific Obesity Prevention in Communities (OPIC) Project in Australia, Fiji, New Zealand and Tonga, and the Collaboration of Community-based Obesity Prevention Sites (CO-OPS Collaboration) in Australia [6]. Yet despite the success of these interventions, the prevalence of children with obesity continues to increase [1]. Consequently there has been growing pressure on General Practitioners (GPs) to play a greater role in the identification of overweight and obesity among children through the use of Body Mass Index (BMI) percentile charts, however studies highlight that this is not prioritised, with the majority of GPs not routinely assessing BMI or overweight status [7–10].

Despite the challenges, work by Sanghavi and Siddiqui emphasise the potential for other health practitioners to play an instrumental role in the identification of overweight and obesity in children, including dental practitioners [11]. Recent evidence suggests that obesity may be associated with periodontal disease [12–14] and tooth decay [15]. In turn, periodontal disease may also be associated with an increased risk of developing insulin resistance and diabetes [16,17]. This growing evidence highlights that dental practitioners should have a vested interest in the management of overweight and obesity among their patients.

Further, dental practitioners are in an ideal position to identify, counsel and/or refer for overweight and obesity in children, with children being a large patient group whom they see on a regular basis for periodic check-ups, and could potentially discuss modifiable risk factors for obesity and tooth decay, such as excess consumption of SSB and sugar intake [18–21]. Dental practitioners taking on a more active advocacy and counselling role, have the potential to meet a significant unmet need in this area, with a recent review of obesity interventions for children in primary care settings finding no evidence of programs effectively targeting and reducing sugar-sweetened beverage consumption [22]. While there is definite scope for the role of the dental practitioner in screening for overweight and obesity among children, to date no reviews have summarised the existing interventions in the dental setting.

Aim

This review aimed to explore the scope of evidence and potential efficacy of existing overweight and obesity interventions for children implemented in a dental setting. Specifically the review sought to address the following research areas:

1. Current evidence of the role and effectiveness of dental practitioners in addressing overweight and obesity among children.
2. Available resources and strategies for addressing overweight and obesity among children in the dental setting.

Terminology

Although there are several definitions of overweight and obesity in childhood, in this review we adopted the definitions as specified by the Centers for Disease Control and Prevention (CDC) [23]. These definitions utilise the Body Mass Index (BMI), which is calculated by dividing a person's weight in kilograms by the square of their height in metres. According to the CDC, among children older than 2 years, *overweight* refers to having a BMI from the 85th up to the 95th percentile for children of the same age and sex, and *obesity* is defined as having a BMI at or above the 95th percentile. The term *dental practitioner* was used to encompass all health practitioners working with dental qualifications, including general dentists, dental specialists, and those with diploma-level training such as dental hygienists, dental assistants or dental nurses. The term *recall* is used in this paper to refer to routinely scheduled dental visits at a dental clinic, which may also be referred to in the literature as *check-ups* or *periodic examinations*. This is in contrast to the term *follow-up*, which in this paper refers to visits scheduled with the specific purpose of monitoring progress following an intervention. *Screen time*

is used in this review to refer to the time spent using any electronic device, including television, mobile phones, tablets and computers.

Materials and methods

Study design

In order to examine the extent and nature of existing research surrounding obesity interventions for children in the dental setting, and identify gaps in the existing literature, a scoping review was conducted according to the methodological framework recommended by Arksey and O'Malley [24]. Although scoping reviews do not necessitate quality appraisal, and provide a narrative account rather than quantifying an intervention's effectiveness, they can map areas of research with rigour and transparency, in turn providing a systematic way of summarising, disseminating and identifying gaps in the research base so further recommendations can be made [24,25]. Further, scoping reviews allow for inclusion of a broader range of study designs, ensuring all possible literature is considered in subject areas with limited empirical research.

Search strategy

An extensive search of the following databases: Medline (Ovid), PubMed, ProQuest, Scopus, CINAHL, Cochrane, Embase, and PsycINFO was conducted in December 2017. In addition, a search of the grey literature was conducted using Google Scholar, and through review of government and non-government organisation websites. An individualised search strategy was developed for each database according to their indexing terms, including Boolean operators, truncations and Medical Subject Headings (MeSH). Search strategies used a combination of key words including: *childhood*; *paediatric*; *obesity*; *weight*; *dental professionals*; *oral health professionals*; *oral health*; *dental*; *intervention*. Upon identification of key articles; cited references and related articles recommended by each database were manually searched. Bibliographic mining was also undertaken; where reference lists of key articles were searched for further relevant literature.

Inclusion and exclusion criteria

All articles published up to December 2017 were included in this review. In order to map the entire research base in this area, no limitations were placed on study design, quality or location. Studies not published in the English language were included if an English translation was available.

Study selection and data extraction

For this review, the investigators sought studies that described obesity-related interventions for children in the dental setting, including weight screening, nutritional counselling, and education of dental practitioners regarding overweight and obesity among children. Throughout the selection and screening process, the investigators continually revisited and revised the aims of the study in response to the search results. Through this process, the scoping review evolved from exploring only implemented and evaluated obesity interventions for children in the dental setting to also include proposed interventions or strategies for promoting healthy weight among children in the dental setting. Studies found in searches were systematically screened first by title, then by abstract and full text for relevance. Screening was conducted simultaneously by two investigators, and consensus was achieved to produce the final included records. Data extracted from relevant studies included first author, year, location, aims, study design, study population, eligibility criteria, intervention, outcomes and conclusions. Relevant articles were then categorised into themes corresponding to the study aims (Table 1).

Results

The search returned 3986 records, with all databases searched returning results except the government and non-government organisation websites. A total of 2090 duplicates were removed, and a further 1849 articles were excluded through screening titles and abstracts. After screening the full texts of the remaining 47 articles, a total of 11 articles were identified as relevant (Fig. 1). These studies were based in the United Kingdom ($n = 2$), Canada ($n = 3$) and the United States ($n = 6$).

Current role and effectiveness

This review identified five studies [26–30] that provided insight into the current role dental practitioners have in addressing overweight and obesity among children in their practice. Two broad themes emerged from these findings: (i) existing interventions and their efficacy; and (ii) acceptability of dental practitioners' role in overweight and obesity among children.

Existing interventions and their efficacy

There was an evident lack of current evidence regarding the role of dental practitioners in overweight and obesity among children, with only three records found that detailed existing overweight and obesity interventions for children in the dental setting [27,29,30]. All three of these interventions involved anthropometric screening, healthy weight counselling, or a combination of both. Sekhavat [27] described an obesity intervention for children at a university paediatric dental clinic, where a dentist completed weight and height measurements as well as assessment of obesity status. The dentist then provided a 5–10 min counselling session to parents of patients that encouraged increasing the child's physical activity, decreasing SSB intake and decreasing screen time. Evaluation of this intervention showed no significant changes to weight, physical activity or dietary habits, however there was a significant decrease in screen time [27]. In contrast, the healthy weight intervention by Tavares and Chomitz [29] utilised a dental hygienist to undertake weight and height measurements for children, assessment of obesity status and provide healthy weight counselling in the form of an individualised health report card. Although there were no weight-related outcomes measured as part of the evaluation of this intervention, the majority (95.5%) of caregivers reported improvements in their food choices, and over three quarters (80.6%) reported a reduction in screen time. In addition, most caregivers thought their child were comfortable with the healthy weight intervention [29]. The intervention by Watt et al. [30] involved 3–4, 15-min motivational interviewing sessions led by the research staff that focussed on dietary habits and physical activity. Similarly to Sekhavat [27], this study did not have sufficient power to detect a significant improvement in weight, waist circumference, physical activity and diet, however participants were receptive and satisfied with the intervention [30].

Acceptability of dental practitioners' role in overweight and obesity among children

Two studies explored parents' perspectives of the role of dental practitioners in overweight and obesity among children [26,28]. The case study by Henderson provided insight into the acceptability of receiving dietary advice for their children from dental practitioners, highlighting that parents were generally accepting of the idea of delivering obesity interventions in the dental setting. However, they had questions regarding dentists' scope of practice and concern regarding the potential stigmatisation of children [26].

Table 1
Summary of findings.

Author/ref./country	Article type	Aims/research question	Study design	Study population & eligibility criteria	Intervention	Outcome/conclusion	Theme
Azarpazhooh et al. [31], Canada	Peer reviewed article	To validate a simplified overweight screening instrument for children aged 6–11 in a university dental clinic	Cross-sectional study	168 healthy children aged 6–11 attending an undergraduate paediatric dentistry clinic for routine care	• Screening tool consisted of male and female specific tables showing 85th percentile weights and heights for each age • Overweight/obesity status assessed using screening instrument and validated against the WHO BMI index	• 89% agreement was achieved between the two methods for detecting weight status	Resources and strategies
Henderson [26], United Kingdom	Peer reviewed article	To assess how acceptable dietary advice delivered in the dental setting targeted at obesity is to parents, dental practitioners and commissioners	Case study	Four parents who were mothers of children 4–5 years of age attending five dental practices chosen by postcode and socio-economic status	N/A	• Parents accepted the idea of delivering obesity interventions in the dental setting • Parents raised issues regarding dentists' scope of practice and concern regarding the potential of stigmatising children	Current role and effectiveness
Huang et al. [32], United States	Peer reviewed article	To design, implement and pilot test a Health and Obesity: Prevention and Education (HOPE) curriculum for medical and dental trainees/clinicians	Descriptive	24 residents (in paediatrics, paediatric dentistry or preventative medicine) who completed all HOPE modules	• Training program consisting of 7 modules regarding prevention, assessment and management of paediatric obesity, presented in lectures of one hour per module	• All participants agreed that the material was informative, met specific objectives and was clearly presented. • Participants commented on the need for relevant clinical examples	Resources and strategies
Nainar [33], Canada	Peer reviewed article	To describe an evidence-based, pragmatic nutrition workup that could be utilised in the dental office	Descriptive	N/A	N/A	Authors proposed a workup including: • Assessing weight status using growth charts • Five nutrition counselling items: do not skip breakfast; limit/avoid sugar-sweetened beverage consumption; be physically active at least 1 h/day; limit screen time to less than 2 h/day; and get adequate sleep	Resources and strategies

Pont et al. [34], United States	Peer reviewed article	To describe the importance of obesity prevention for children in the dental setting and recommend screening and health promotion approaches	Discussion paper	N/A	N/A	• Suggest use of Pediatric Risk Assessment Tool (PRAT) to double as primary screening tool for obesity risk in conjunction with BMI percentile • Recommend dentists use motivational interviewing to influence lifestyle change	Resources and strategies
Sekhavat [27], Canada	Thesis	To evaluate the effectiveness of short counselling for healthy weight among children at dental visits and assess the reliability of a simplified child overweight screening instrument	Randomised controlled trial	A convenience sample (168 at baseline and 155 at follow-up) of English-speaking children aged 6–11 years free of systemic disease, who attended an undergraduate paediatric dentistry clinic for their routine dental care.	• A baseline visit involving overweight screening, nutrition and physical activity assessment and counselling, and provision of educational resources • A recall visit involving reassessment of overweight as well as nutrition and physical activity	• No statistically significant changes to BMI, sugar sweetened beverage consumption or physical activity • Statistically significant decrease in screen time ($p = 0.01$)	Current role and effectiveness
Swinney [28], United States	Thesis	To explore caregivers' opinions regarding having the dental team provide healthy weight counselling to their children	Qualitative study	Caregivers whose children were aged 2–6 years and were established patients at a paediatric dental clinic at a university in North Carolina	N/A	• Most were receptive, suggesting dental practitioners need compassion and a rapport with their patients • Some queried the importance of weight to dentists, or preferred referral to paediatricians	Current role and effectiveness

Table 1 (*Continued*)

Author/ref./country	Article type	Aims/research question	Study design	Study population & eligibility criteria	Intervention	Outcome/conclusion	Theme
Tavares and Chomitz [29], United States	Peer reviewed article	To describe and pilot test a healthy weight intervention (HWI) in dental care	Protocol and pilot study	139 patients aged 6–13 years from two community dental clinics, who returned for 2–3 dental visits over the 18 months	The dental hygienist: • Assessed diet, physical activity and screen time • Measured weight and height, calculating BMI • Completed an individualised health report card with recommended health behaviour changes	• 95.5% of caregivers improved food choices, and 80.6% reduced screen time • Most thought their child was comfortable with the HWI • By the 6-month visits, hygienists could complete all care duties including the HWI within 40 min	Current role and effectiveness
Tseng et al. [35], United States	Peer reviewed article	To describe a protocol for monitoring children's BMI in the dental setting	Discussion paper	N/A	N/A	• BMI percentile and growth trajectory can be used to assess weight of children from 2 years • Calibrated digital scales should be used to measure weight, and a stadiometer to measure height • Recommended strategies to communicate weight status in a sensitive way and referral to paediatrician	Resources and strategies

Watt et al. [30], United Kingdom	Final report	To develop a childhood obesity intervention (The SWITCH programme) aimed at adolescents, and evaluate it using a process evaluation and exploratory RCT	N/A	39 patients aged 11–16 years, attending eligible dental clinics in London, with overweight or obesity (BMI percentile 85% or more), who drink at least 1 can of soft drink daily	• Prior to intervention, BMI, waist circumference and 24 h dietary recall measurements taken • Intervention of 3–4, 15-min motivational interviewing (MI) sessions lead by research staff	RCT • Intervention group had consistently lower intake of sugary drinks and unhealthy snacks, however not statistically significant • Control group had lower BMI ($p = 0.08$) and waist circumference ($p = 0.05$) scores at follow-up. Process evaluation • Participants were receptive, satisfied with the intervention and found it acceptable	Current role and effectiveness
Ziegler and Hughes [36], United States	Peer reviewed article	To discuss weight screening techniques and healthy weight advice that oral health care professionals (OHCPs) can use	Discussion paper	N/A	N/A	• Weight and height should be measured empathetically • Measure weight and height during the patient's first visit and at each 6-month recall • Child's BMI percentile should be explained, as well as healthy diet/oral health behaviours • Refer to other health care professionals	Resources and strategies

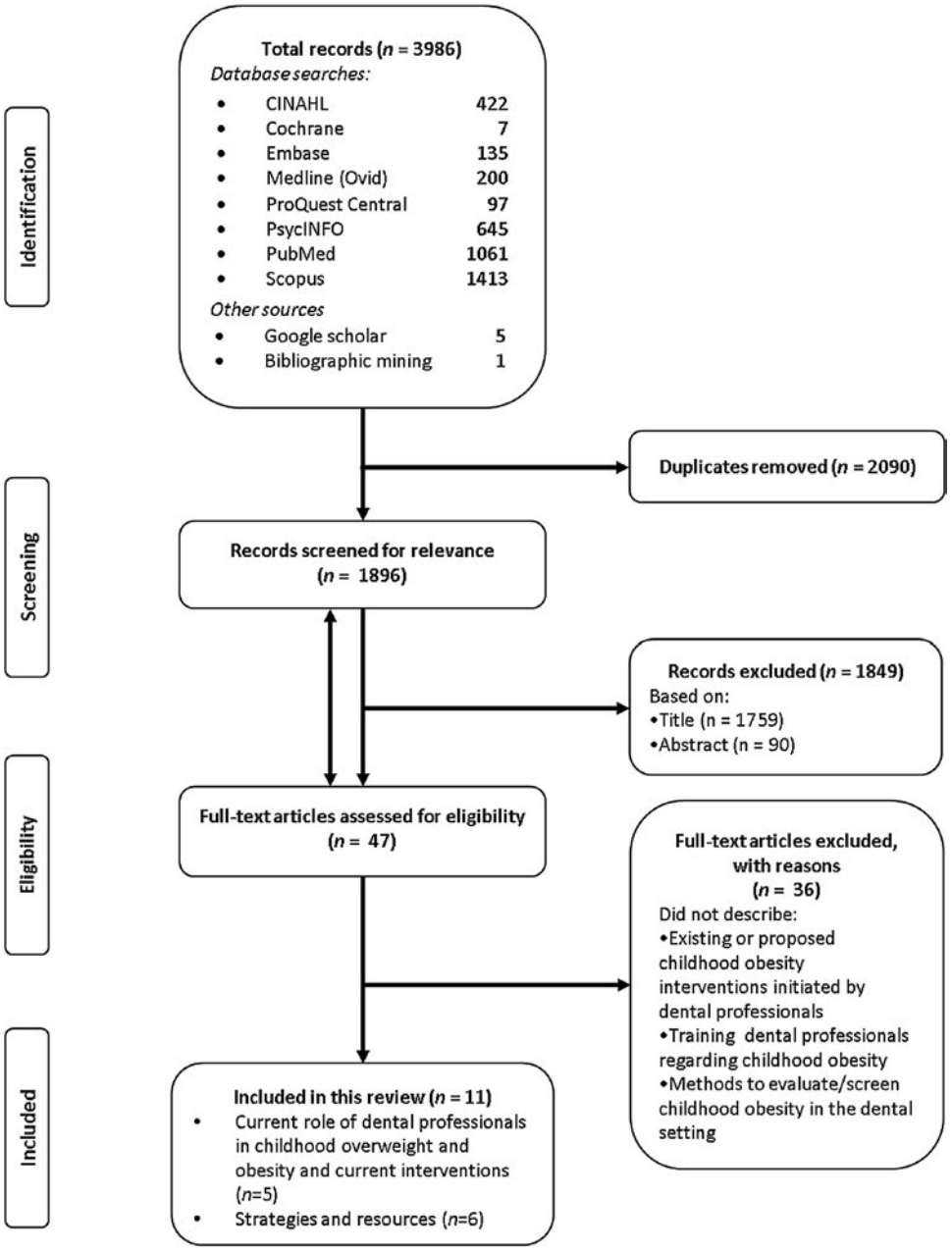

Fig. 1. PRISMA flow diagram illustrating the search and inclusion process.

Swinney also presented similar findings, with parents also suggesting that dental practitioners need compassion and an existing rapport with patients to be in a position to approach the topic of weight in a sensitive manner [28].

Resources and strategies

A further six studies [31–36] described resources that could be used to increase the capacity of dental practitioners to address overweight and obesity among children, as well as strategies to translate these resources into practice. These studies encompassed three themes: (i) anthropometric screening tools; (ii) training resources; and (iii) proposed strategies for involving dental practitioners in the management of overweight and obesity among children.

Anthropometric screening tools

Five studies discussed methods to assess children's weight and to screen for obesity in the dental setting [31,33–36]. Four studies recommended the traditional use of BMI percentiles and growth charts to evaluate a child's weight [33–36]. Growth charts provide a visual representation of a child's patterns of growth, whereby measures such as weight, height and BMI can be plotted on a chart to determine the percentiles these measurements lie in for a reference population of the same age and sex [37]. However one study by Azarpazhooh et al. sought to simplify this process specifically for use by dental practitioners [31]. They validated a simple instrument that allowed dental practitioners to use a child's weight and height to promptly ascertain a child's BMI percentile without having to plot their weight and height on a chart, nor calculate the BMI. This instrument was validated against standard guidelines, achieving 89% agreement with the WHO BMI index [31]. Further, in addition to BMI assessment, Pont et al. proposed the use of existing tools

used in dental practice to act as primary screening tools for obesity risk [34]. Specifically the authors suggested the use of the Pediatric Risk Assessment Tool (PRAT), which gathers data on sugar consumption in both food and drink, to assess obesity risk and inform nutritional counselling advice. The authors illustrate an algorithm for dental practitioners to use, which details recommended health promotion messages according to PRAT score, although this has not been evaluated [34].

Training resources

Overall, there was limited information on the training of practising dental practitioners regarding management of overweight and obesity among children, with only one study by Huang et al. [32] that presented a training curriculum for both trainee and practising dental practitioners. This curriculum contained modules regarding the assessment of obesity among paediatric patients and behavioural counselling for effective dietary and physical activity change. Participants received education on how to effectively communicate health messages to patients and their families, barriers to counselling, how to counsel effectively, how to teach and motivate parents to implement healthy family lifestyles, and motivational interviewing techniques. However, although all participants agreed that the material was informative, met specific objectives and was clearly presented, there was no evaluation undertaken to determine whether it resulted in an increase in knowledge and confidence among dental practitioners to address overweight and obesity among children in practice [32].

Proposed strategies for involving dental practitioners in the management of overweight and obesity among children

A range of strategies that could be used in the implementation of future healthy weight interventions were proposed by four articles [33–36]. Nainar [33] proposed a 5-min work-up where dental practitioners would assess a child's weight status using growth charts. Following this, they would cover 5 basic areas for counselling advice: do not skip breakfast, limit/avoid sweetened beverage consumption, be physically active at least 1 h/day, limit screen time to less than 2 h/day, and get adequate sleep. Pont et al. on the other hand recommended the use of BMI percentiles and the PRAT to screen for obesity risk, followed by motivational interviewing techniques to influence lifestyle change [34]. Along with assessing BMI percentile and providing healthy weight counselling, both Tseng et al. and Ziegler and Hughes emphasised the need to explain the child's weight status in a sensitive and empathetic way, and recommended referral to other health care practitioners for further advice and support [35,36].

Discussion

The successful implementation of childhood obesity interventions remains a challenge. Children have unique developmental needs, compounded by the multifaceted aetiology of obesity among children, which further complicates obesity treatment decisions in childhood [38]. Perhaps even more so than adults, the lifestyle habits of children are heavily influenced by social and environmental factors including parents/family and sedentary activities [5]. As such, effective obesity interventions for children require consideration of the influence of family behaviours on children's food choices and physical activity levels, and therefore the family as a 'whole' should be involved in any behaviour change process [38]. Further, as children's independence levels and experienced risk factors change as they develop, studies recommend a case-by-case, patient-centred approach to suit their developmental stage [38,39]. Studies also underscore the need for sensitivity and an empathetic approach in the management of childhood obesity, as an intense focus on weight and dietary restriction among children can have deleterious effects on self-esteem, self-worth and could be a trigger for disordered eating behaviours [38,40].

The current role of dental practitioners in addressing childhood overweight and obesity

Despite the growing body of evidence suggesting that dental practitioners could play a role in addressing overweight and obesity among children [11,18,41], our review highlighted few instances where this was the case, with only three published interventions that were implemented and evaluated [27,29,30]. Overweight and obesity interventions that were implemented for children in the dental setting focussed around one or both of two strategies: (i) anthropometric screening, and (ii) healthy weight counselling [27,29,30]. However, among these interventions, it could not be determined which individual strategy was effective in addressing obesity among children in the dental setting, or whether both strategies were required, as the majority of studies used both in parallel.

Further, among the two studies that conducted statistical comparisons [27,30], little significant change in the children's weight and behavioural outcomes could be detected from these interventions, except for the study by Sekhavat, which showed a significant decrease in screen time among children [27]. The lack of significant results in the study by Watt et al. may be attributed to it being a pilot exploratory RCT and as such the small sample size may have affected statistical power [30]. While the third study by Tavares and Chomitz evaluated their intervention, they did not provide any statistical analyses, rather they reported caregivers' feedback and self-reported changes that were noted as a result of the intervention, highlighting efficacy in that the majority of caregivers self-reported positive behavioural changes as a result of the program [29]. It is noteworthy that none of the above interventions explored the use of referral pathways or interventions that spanned across settings to include other health practitioners in the care of their paediatric patients. This suggests the potential need for more extensive, interdisciplinary interventions to effectively address overweight and obesity in childhood across different health care settings.

The two studies in the review that explored the acceptability of obesity interventions for children in the dental setting highlighted that the majority of parents found them to be acceptable, however there was some confusion regarding the relevance of a child's weight within the dentist's scope of practice and concern about weight stigmatisation [26,28]. Parents' concern regarding stigmatisation of children's weight is not uncommon, with studies in other settings also reporting similar findings [42–44]. Regardless of parental concerns, many parents do not recognise overweight and obesity in their children, therefore the literature highlights the importance of weight screening as early identification results in greater success [45,46].

From this review we identified that no studies evaluated the competency of dental practitioners in conducting accurate weight screening or effective healthy weight counselling, which could be a plausible contributing factor in the effectiveness of obesity interventions for children in the dental setting. Another point to note is that the interventions in this review were implemented by various dental practitioners, including dentists and dental hygienists. Currently, there is insufficient evidence available to compare the effectiveness of different dental practitioners performing this role. Similarly no needs assessments have been conducted to determine which dental practitioner may be the most acceptable. One intervention in the review did employ a dental hygienist rather than a dentist to screen children for obesity and to deliver healthy weight advice [22], which may be an appropriate approach particularly in settings where dentists are time-poor. However, no interventions

explored dental practitioners within paediatric specialties, examples of which include paediatric dentists in Australia [47] and the United States [48], and dental therapists in Australia [49]. Further research is required in this area to determine the most appropriate dental practitioner to be conducting obesity interventions for children.

Resources and strategies

A scoping review by Mallonee et al. suggests that training dental practitioners in skills such as motivational interviewing and active listening could build their capacity to promote lifestyle changes [50]. Despite this, none of the evaluated interventions found in this review discussed elements of the training provided to dental staff to be able to implement the intervention, with two out of three interventions conducted by the researchers themselves [27,30], rather than by the dental staff at the respective clinics. Although an existing review has summarised strategies to train undergraduate dental students regarding overweight and obesity among children [51], our review highlighted that there is limited evidence available that explores similar training for practising dental practitioners. One article [32] described the development of a training program for both dental and medical practitioners and students regarding obesity among children, and although the program was piloted and obtained feedback from participants, the effectiveness of this program in improving knowledge and practice levels is unknown.

There were several resources identified that discussed methods for assessing the weight status of children in the dental setting [31,33–36]. These resources were all in agreement regarding the use of BMI percentiles and growth charts, as the 'gold standard' in screening and monitoring obesity among children in the dental setting. This is consistent with various national and international guidelines for childhood obesity screening in other settings [52–54]. There was also a focus on how to best implement the use of BMI percentiles and growth charts in dental practice, with suggestions made for simplified index tables to calculate BMI percentile [31] and the incorporation of obesity screening as a part of existing oral health screening tools [34]. While the former strategy was validated against the WHO BMI index, further research is required to pilot both strategies in the dental setting and assess their effectiveness, acceptability and feasibility in practice.

Finally, four articles proposed strategies that dental practitioners could use in the management of overweight and obesity among children in the dental setting [33–36]; however none of these strategies have been implemented or evaluated. All of these interventions emphasised the need for weight screening as well as healthy weight counselling, however the degree of counselling proposed ranged from a simple 5-min program to motivational interviewing sessions.

It is important to highlight that all but two of the included studies in this review were from either Canada or the United States, identifying the need for further research in this area globally. Conclusions drawn in this review may only have transferability to cultural and health care contexts similar to those of North American countries. Further research is required to ascertain whether such interventions may result in very different outcomes, in countries where cultural differences, or where the provision of dental care services varies.

Conclusion and recommendations

In summary, this review confirms that dental practitioners could potentially play a role in addressing overweight and obesity among children. However, there is a need for further well-designed studies that assess the effectiveness of obesity-related interventions for children in the dental setting, as well as the ability of dental practitioners to perform screening and counselling interventions. It is also important to identify which dental practitioners are receptive and most appropriate in delivering these interventions. In addition, there is a need for greater empirical research evaluating the effectiveness of training regarding obesity among children for practising dental practitioners, and whether it can produce sustainable change resulting in improvements to their knowledge and practice levels.

Conflict of interest

The authors declare that they have no conflict of interest.

References

[1] Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2014;384(9945):766–81.
[2] World Health Organisation. Why does childhood overweight and obesity matter?; 2018. Available from: http://www.who.int/dietphysicalactivity/childhood_consequences/en/.
[3] Rankin J, Matthews L, Cobley S, Han A, Sanders R, Wiltshire HD, et al. Psychological consequences of childhood obesity: psychiatric comorbidity and prevention. Adolesc Health Med Ther 2016;7:125–46.
[4] Dattilo AM. Modifiable risk factors and interventions for childhood obesity prevention within the first 1,000 days. In: Black RE, Makrides M, Ong KK, editors. Complementary feeding: building the foundations for a healthy life, vol. 87. Switzerland: Karger; 2017. p. 183–96.
[5] Lytle LA. Examining the etiology of childhood obesity: the IDEA study. Am J Community Psychol 2009;44(3–4):338–49.
[6] World Health Organisation. Population-based approaches to childhood obesity prevention. Geneva, Switzerland: World Health Organisation; 2012.
[7] McMeniman E, Moore R, Yelland M, McClure R. Childhood obesity: how do Australian general practitioners feel about managing this growing health problem? Aust J Prim Health 2011;17(1):60–5.
[8] O'Shea B, Ladewig EL, Kelly A, Reulbach U, O'Dowd T. Weighing children; parents agree, but GPs conflicted. Arch Dis Child 2014;99(6):543–5.
[9] Staiano A, Marker A, Liu M, Hayden E, Hsia D, Broyles S. Childhood obesity screening and treatment practices of pediatric healthcare providers. J La State Med Soc 2017;169:2–10.
[10] Thomas KMMD, Urrego FMD. Are pediatricians diagnosing obese children? Ochsner J 2017;17(1):80–2.
[11] Sanghavi A, Siddiqui NJ. Advancing oral health policy and advocacy to prevent childhood obesity and reduce children's consumption of sugar-sweetened beverages. J Public Health Dent 2017;77(Suppl. 1):S88–95.
[12] Keller A, Rohde JF, Raymond K, Heitmann BL. Association between periodontal disease and overweight and obesity: a systematic review. J Periodontol 2015;86(6):766–76.
[13] Martens L, De Smet S, Yusof MY, Rajasekharan S. Association between overweight/obesity and periodontal disease in children and adolescents: a systematic review and meta-analysis. Eur Arch Paediatr Dent 2017;18(2):69–82.
[14] Katz J, Bimstein E. Pediatric obesity and periodontal disease: a systematic review of the literature. Quintessence Int 2011;42(7):595–9.
[15] Hayden C, Bowler JO, Chambers S, Freeman R, Humphris G, Richards D, et al. Obesity and dental caries in children: a systematic review and meta-analysis. Community Dent Oral Epidemiol 2013;41(4):289–308.
[16] Gurav AN. Periodontitis and insulin resistance casual or causal relationship? Diabetes Metab J 2012;36(6):404–11.
[17] Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A, Makrilakis K, et al. Periodontitis and diabetes: a two-way relationship. Diabetologia 2012;55(1):21–31.
[18] Nainar SMH. Promotion of healthy weight in pediatric dental practice. Pediatr Dent 2012;34(5):372.
[19] Lamster IB, Eaves K. A model for dental practice in the 21st century. Am J Public Health 2011;101(10):1825–30.
[20] Perman JA. Teaming up against childhood obesity. Bariatr Nurs Surg Patient Care 2011;6(3):109–10.
[21] Wright R, Casamassimo PS. Assessing attitudes and actions of pediatric dentists toward childhood obesity and sugar-sweetened beverages. J Public Health Dent 2017;77(Suppl. 1):S79–87.
[22] Dooley D, Moultrie NM, Sites E, Crawford PB. Primary care interventions to reduce childhood obesity and sugar-sweetened beverage consumption: food for thought for oral health professionals. J Public Health Dent 2017;77(Suppl. 1):S104–27.
[23] Centers for Disease Control and Prevention. Defining childhood obesity; 2016. Available from: https://www.cdc.gov/obesity/childhood/defining.html.
[24] Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol 2005;8(1):19–32.

[25] Peters MD, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic scoping reviews. Int J Evid Based Healthc 2015;13(3):141–6.
[26] Henderson EJ. Acceptability of delivery of dietary advice in the dentistry setting to address obesity in pre-school children: a case study of the Common Risk Factor Approach. Public Health Nutr 2015;18(10):1801–6.
[27] Sekhavat A. Efficacy of nutrition and physical activity counseling for preadolescent children in a dental setting: a randomized clinical trial [M.Sc.]. Ann Arbor: University of Toronto (Canada); 2014.
[28] Swinney FV. Caregivers' perceptions about discussing their children's weight in the dental setting [M.S.]. Ann Arbor: The University of North Carolina at Chapel Hill; 2014.
[29] Tavares M, Chomitz V. A healthy weight intervention for children in a dental setting: a pilot study. J Am Dent Assoc 2009;140(3):313–6.
[30] Watt RG, Murphy M, Ntouva A, Porter J, Yusuf H. Preventing obesity in young people attending primary dental care settings: an exploratory randomised controlled trial. Submitted to National Institute for Health Research; 2013.
[31] Azarpazhooh A, Sekhavat A, Sigal MJ. Validity of a simplified screening instrument for assessing overweight children in a dental setting: a cross sectional study. BMC Pediatr 2017;17(1):56.
[32] Huang J, Pokala P, Hill L, Boutelle KN, Wood C, Becerra K, et al. The Health and Obesity: Prevention and Education (HOPE) curriculum project—curriculum development. Pediatrics 2009;124(5):1438–46.
[33] Nainar SM. Five-minute nutrition workup for children in dental practice. Gen Dent 2013;61(1):e2–3.
[34] Pont SJ, Huizinga MM, Fields WT, Beech BM. Targeting teeth: pediatric obesity and the dental office. Obes Manag 2008;4(3):104–410.
[35] Tseng R, Vann Jr WF, Perrin EM. Addressing childhood overweight and obesity in the dental office: rationale and practical guidelines. Pediatr Dent 2010;32(5):417–23.
[36] Ziegler J, Hughes CV. Weighing in on pediatric obesity: weight screening at the dental visit. J Am Dent Assoc 2016;147(2):146–50.
[37] Melbourne TRCsH. Growth charts; 2018. Available from: https://www.rch.org.au/childgrowth/Growth_Charts/.
[38] Baur LA, O'Connor J. Special considerations in childhood and adolescent obesity. Clin Dermatol 2004;22(4):338–44.
[39] Davis MM, Gance-Cleveland B, Hassink S, Johnson R, Paradis G, Resnicow K. Recommendations for prevention of childhood obesity. Pediatrics 2007;120(Suppl. 4):S229.
[40] Ikeda JP, Crawford PB, Woodward-Lopez G. BMI screening in schools: helpful or harmful. Health Educ Res 2006;21(6):761–9.
[41] Manchir M. Article spotlights dental role in childhood obesity prevention. Am Dent Assoc News 2017;48(16):8.
[42] Davidson K, Vidgen H. Why do parents enrol in a childhood obesity management program? A qualitative study with parents of overweight and obese children. BMC Public Health 2017;17(1):159.
[43] Nnyanzi LA, Summerbell CD, Ells L, Shucksmith J. Parental response to a letter reporting child overweight measured as part of a routine national programme in England: results from interviews with parents. BMC Public Health 2016;16(1):846.
[44] Kubik MY, Fulkerson JA, Story M, Rieland G. Parents of elementary school students weigh in on height, weight, and body mass index screening at school. J Sch Health 2006;76(10):496–501.
[45] Lundahl A, Kidwell KM, Nelson TD. Parental underestimates of child weight: a meta-analysis. Pediatrics 2014;76(10):496–501 https://doi.org/10.1542/peds.2013-2690.
[46] Whitlock EP, Williams SB, Gold R, Smith P, Shipman S. U.S. Preventive Services Task Force evidence syntheses, formerly systematic evidence reviews. In: Screening and interventions for childhood overweight. Rockville, MD: Agency for Healthcare Research and Quality (US); 2005.
[47] Australian Academy of Paediatric Dentistry. What is paediatric dentistry?; 2018. Available from: https://www.aapd.org.au/.
[48] American Academy of Pediatric Dentistry. What is a pediatric dentist; 2018. Available from: http://www.aapd.org/the_pediatric_dentist/.
[49] Australian Dental Association. Dental therapist; 2018. Available from: https://www.adansw.com.au/Careers/Dental-Therapist.
[50] Mallonee LF, Boyd LD, Stegeman C. A scoping review of skills and tools oral health professionals need to engage children and parents in dietary changes to prevent childhood obesity and consumption of sugar-sweetened beverages. J Public Health Dent 2017;77(Suppl. 1):S128–35.
[51] Divaris K, Bhaskar V, McGraw KA. Pediatric obesity-related curricular content and training in dental schools and dental hygiene programs: systematic review and recommendations. J Public Health Dent 2017;77(Suppl. 1):S96–103.
[52] Grossman DC, Bibbins-Domingo K, Curry SJ, Barry MJ, Davidson KW, Doubeni CA, et al. Screening for obesity in children and adolescents: US Preventive Services Task Force recommendation statement. JAMA 2017;317(23):2417–26.
[53] National Health and Medical Research Council. In: Department of Health, editor. Clinical practice guidelines for the management of overweight and obesity in adults, adolescents and children in Australia. Canberra: Commonwealth of Australia; 2013.
[54] Valerio G, Balsamo A, Baroni MG, Brufani C, Forziato C, Grugni G, et al. Childhood obesity classification systems and cardiometabolic risk factors: a comparison of the Italian, World Health Organization and International Obesity Task Force references. Ital J Pediatr 2017;43(1):19.

2.7 Dental care in the Australian context: Implications for children's healthy weight interventions

In the Australian context, all children aged under 18 years are eligible for free dental care at public dental clinics in New South Wales, South Australia, Tasmania and the Northern Territory (Productivity Commission, 2017). Among the other states and territories, public dental care is provided to children within certain age groups (Productivity Commission, 2017). Specifically, public dental care is available to children from age 4 up to approximately 16 in Queensland (Queensland Government, 2014), from 5 years of age up to 16 in Western Australia (Government of Western Australia, 2019), from 0 to 12 years of age in Victoria (Victoria State Government, 2018), and from 0 to 14 years of age in the Australian Capital Territory (ACT Government, 2019). Furthermore, in 2014, the Australian Government introduced the Child Dental Benefits Schedule in all states and territories, which provided individual oral healthcare benefits to eligible children, capped up to a total of $1000 over a two-year calendar period (Australian Government, 2018). Eligibility criteria for this schedule include being aged between 2-17 years and being from a family either receiving Family Tax Benefit Part A or a relevant Australian Government payment such as income support payments, allowances and disability pensions (Australian Government, 2018). With these multiple government schemes to increase children's access to dental services in Australia, children are becoming a large patient group whom dental staff see on a regular basis, particularly in the public dental setting (Australian Institute of Health and Welfare, 2023). Thus, dental staff can support primary care efforts in promoting healthy weight among children.

2.8 Clinical guidelines

In light of the role that dental staff can play in children's healthy weight promotion, the NSW Ministry of Health released guidelines for the conduct of growth assessment and provision of healthy lifestyle advice in public oral health services (NSW Ministry of Health, 2019). Defined as "systematically developed statements to assist practitioner and patient

decisions about appropriate healthcare for specific clinical circumstances", clinical guidelines aim to improve the quality of care provided to patients and subsequently improve patient outcomes (Grimshaw & Russell, 1993; Institute of Medicine (US) Committee to Advise the Public Health Service on Clinical Practice Guidelines, 1990; Woolf, 1993). Not only can clinical guidelines benefit the patient in terms of health outcomes, but they can also be a resource to inform patients regarding clinicians' decisions, and drive public policy by drawing attention to areas of need (Woolf et al., 1999). In addition, clinical guidelines can benefit healthcare professionals by improving the quality of clinical decisions, supporting quality improvement activities and highlighting gaps in the evidence, thus encouraging further research (Woolf et al., 1999). Therefore, the introduction of clinical guidelines regarding growth assessment and healthy lifestyle advice in public oral health services could be of great benefit.

2.9 Guideline implementation

Research highlights that the success of clinical guidelines is variable, often impacted by a lack of practitioner compliance (Conroy & Shannon, 1995; Grimshaw & Russell, 1993). Yet, the evidence suggests that practitioner refusal only accounts for a very small proportion of noncompliance (Ellrodt et al., 1995). Other factors such as inadequacies in the healthcare system; peer and patient resistance; guideline complexity; lack of awareness, self-efficacy or incongruence in outcome expectations; and inability to overcome inertia of previous practice have been identified to potentially impact a clinician's decision to comply with clinical guidelines (Cabana et al., 1999). Specifically regarding the implementation of children's healthy weight guidelines in the dental setting, studies in countries other than Australia have cited lack of training, fear of appearing judgemental, fear of patient rejection, and the complexity of providing healthy weight counselling in a sensitive way, as significant barriers to compliance (Greenberg et al., 2017; Tseng et al., 2010).

The results of the barriers to guideline compliance have been a growing emphasis on providing strategies to address these factors and to optimise the uptake of new clinical

guidelines into practice (Grol, 2001). These strategies are often referred to as guideline implementation strategies, and can often include the provision of education and training, equipment and resources, as well as various incentives (Effective Practice and Organisation of Care, 2015). It is therefore anticipated that a guideline implementation strategy would be required to implement children's healthy weight guidelines in the dental setting.

As part of the rollout of the children's healthy weight guidelines released by the NSW Ministry of Health, there were two implementation strategies provided; the mandatory completion of a core training module regarding weight assessment, and an item number which could be claimed for each child upon the provision of children's healthy weight services (Australian Dental Association, 2022a; NSW Ministry of Health, 2019). This enabled clinics to receive remuneration from the NSW government for the provision of the children's healthy weight services.

2.9.1 Gaps in the research

Despite the evidence to support the role of dental staff in hildren's healthy weight promotion and the existence of guidelines to inform such practice in NSW, no research has been done in Australia to evaluate the implementation of children's healthy weight guidelines into dental practice. Furthermore, there is limited evidence summarising the effectiveness of various implementation strategies for any guidelines in the dental setting, with no specific evidence available for children's healthy weight guidelines. This highlights the need for further high quality, systematic research to be conducted surrounding the implementation of children's healthy weight guidelines in the dental setting, including the design and evaluation of implementation strategies for these guidelines.

2.10Aims and significance

2.10.1 Project aims and objectives

This project aimed to use a systematic, evidence-based process to develop and evaluate implementation strategies to improve dental staff adherence to children's healthy weight guidelines. Specific objectives were to:

1. Review the literature regarding children's healthy weight interventions in the dental setting through a scoping review, to map the current evidence and assess the effectiveness of dental staff in promoting healthy weight to children (Chapter 2).
2. Conduct a systematic review to identify and evaluate the most effective guideline implementation strategies for the dental setting (Chapter 5).
3. Engage with dental staff and parents of children in focus groups to identify areas of potential to optimise implementation of children's healthy weight guidelines into the dental setting, and codesign implementation strategies to facilitate this (Chapter 6).
4. Design and systematically validate an instrument, which measures behavioural determinants of dental staff engaging in children's healthy weight practices (Chapter 7).
5. Refine the implementation strategies to meet the needs of each district (Chapter 8)
6. Conduct a quantitative pilot study to evaluate the effectiveness of the codesigned implementation strategies in influencing dental staff behavioural determinants and adherence to children's healthy weight guidelines (Chapter 9).

Table 2 outlines the objectives and research questions of the CHEWI project, and highlights how these were addressed through the findings in this thesis.

Table 2: Aligning objectives and research questions of the CHEWI project with published and unpublished findings

Objectives	Study Questions	Thesis Paper
1. Review the literature regarding children's healthy weight interventions in the dental setting through a scoping review, to map the current evidence and assess the effectiveness of dental practitioners in promoting healthy weight to children	• What is the role and effectiveness of dental practitioners in addressing overweight and obesity among children • What are the available resources and strategies for addressing overweight and obesity among children in the dental setting	**Thesis Paper 1:** The role of dental practitioners in addressing overweight and obesity among children: A scoping review of current interventions and strategies
2. Conduct a systematic review to identify and evaluate the most effective guideline implementation strategies for the dental setting	• What are effective guideline implementation strategies for improving dental practitioners' adherence to clinical guidelines?	**Thesis Paper 3:** The effectiveness of guideline implementation strategies in the dental setting: A systematic review
3. Engage with dental staff and parents of children in semi-structured focus groups to identify areas of potential to optimise implementation of children's healthy weight guidelines into the dental setting, and codesign implementation strategies to facilitate this	• What are the impacts of COVID-19 on the conduct of population health research, and what are effective alternative recruitment and data collective strategies that could be used in this time? • What strategies could facilitate the implementation of children's growth assessment and dietary advice guidelines in the dental setting?	**Thesis Paper 2:** Conducting population health research during the COVID-19 pandemic: Impacts and recommendations **Thesis Paper 4:** The codesign of implementation strategies for children's growth assessment guidelines in the dental setting
4. Design and systematically validate an instrument, which measures behavioural determinants of dental staff engaging in children's healthy weight practices	• How can the behavioural intentions of dental staff regarding growth assessment for children be effectively measured?	**Thesis Paper 5:** Development and psychometric testing of the intention to engage in Children's Healthy Weight (iCHeW) scale
5. Refine the implementation strategies to meet the needs of each district	• How should the codesigned implementations strategies be modified	**Thesis Chapter 8**

	to meet the needs of each participating district?	
6. Conduct a quantitative pre- and post-test study (using the validated instrument) to evaluate the effectiveness of the co-designed implementation strategies in influencing dental staff behavioural determinants and adherence to children's healthy weight guidelines	• What is the effectiveness of a suite of co-designed implementation strategies in influencing dental staff behavioural determinants and adherence to children's healthy weight guidelines? • What is the effectiveness of a suite of co-designed implementation strategies in changing dental staff's adherence to children's growth assessment guidelines?	**Thesis Chapter 9**

2.10.2 Significance

With the lack of evidence surrounding the implementation of children's healthy weight guidelines into practice, especially in Australia, this project has provided valuable evidence, particularly around the effectiveness of implementation strategies for children's healthy weight guidelines. As a result, this project has addressed a major unmet need in Australian paediatric care. This is in line with the *Australia: The healthiest country by 2020* statement by the National Preventative Taskforce, which calls for initiatives that "strengthen, upskill and support primary healthcare workers and the public health workforce to support people in making healthier choices" (Australian Government, 2009). In addition, it has championed the NSW Premier's Priority to reduce overweight and obesity rates of children by 5% over 10 years, specifically in strategic direction 2: routine advice and clinical service delivery, which calls for the implementation of "the routine delivery of brief advice and referral for children who are above a healthy weight, along with their families, commencing with pilot testing in a limited number of inpatient and outpatient services" (NSW Ministry of Health, 2016). Furthermore, it is in accordance with the strategic framework for dental health in NSW which also calls for integrated health promotion, including the provision of "support to other health promotion campaigns that include common messages around alcohol, smoking, water consumption and reduction of intake of sugary drinks and food" (Centre for Oral Health Strategy, 2013).

By using a systematic process, outcomes of this research can inform both state and national policy on the implementation of guidelines for the identification and management of overweight and obesity among children in the dental setting. Thus, this project has produced an evidence-based implementation strategy to help optimise the translation of childhood obesity guidelines in the dental setting into a feasible, acceptable approach for both clinicians and the community that can be implemented nationwide.

Chapter 3

Paradigm, methodology and conceptual framework

3.1 Overview

This chapter will provide an overview and rationale for the pragmatist paradigm utilised to visualise and define this study, and detail the multi-phase sequential methodology and constructive inquiry approach used to achieve the study aims (Figure 2). Lastly, this chapter will explore the conceptual framework underpinning the study's methodology, that is, the integrative model of behavioural prediction (IM).

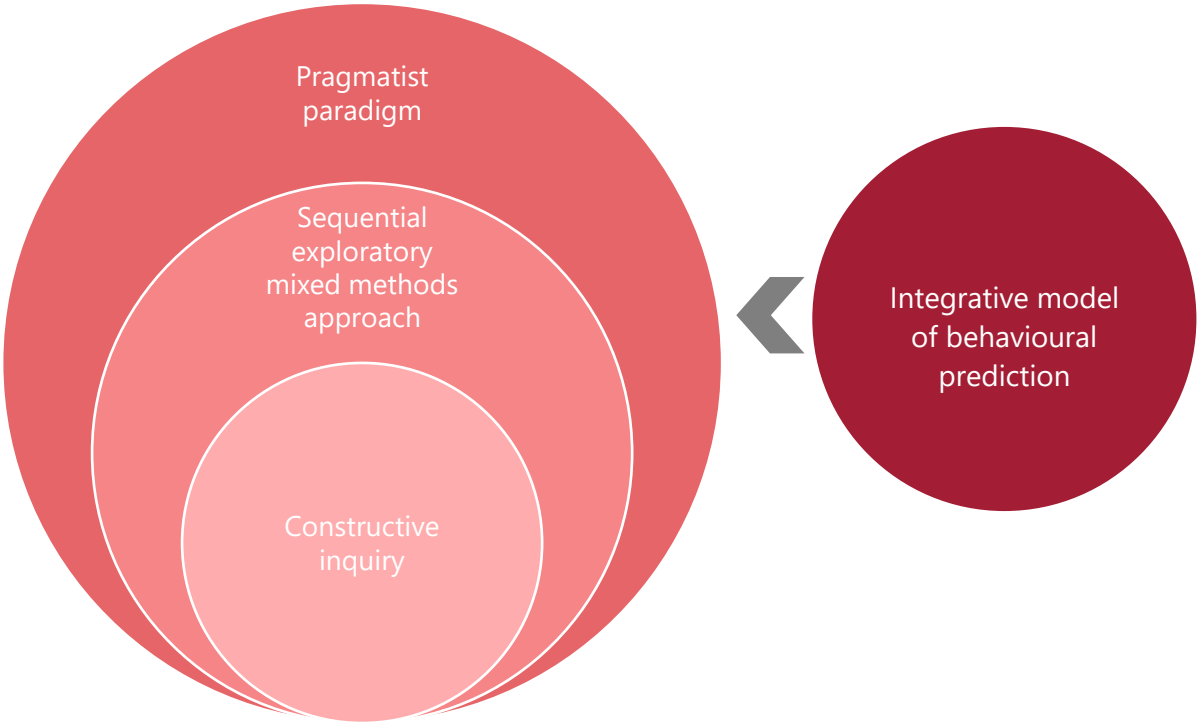

Figure 2: The paradigm, methodology and conceptual framework of the CHEWI project

3.2 Adopting a pragmatist paradigm

3.2.1 Defining pragmatism

A researcher's philosophical basis often stems from a specific paradigm, which is a view of understanding reality, often shared by a community of researchers (Sweet & Davis, 2020). Therefore, the paradigm adopted by a researcher will often guide and shape the

research they conduct. Positivism is a paradigm that stipulates that there is a single objective reality, and thus researchers adopting this paradigm typically utilise quantitative research methods. On the other hand, the paradigm of constructivism accepts the subjectivity of reality, and therefore that there may be multiple realities according to the experiences of every person. With the contrast of these paradigms, there has been a history of debate between researchers who adopt each of these paradigms (Johnson & Onwuegbuzie, 2004). Pragmatism sidesteps the need to define reality altogether, by accepting that there are both singular and multiple realities that can be researched (Yvonne Feilzer, 2009). It acknowledges that the world is comprised of many elements, of which some are objective, some subjective, and some a mixture of both (Yvonne Feilzer, 2009). As such, pragmatism accepts findings from both qualitative and quantitative research, highlighting that on an ontological and epistemological level they have many commonalities in their approaches to inquiry. It strives to combine insights from both approaches into solutions for the "real world" (Denscombe, 2008; Morgan, 2007).

3.2.2 Rationale for a pragmatist paradigm

With this study's goal of developing implementation strategies as a workable solution for the implementation of children's healthy weight guidelines into the dental setting, a paradigm was required that was focused on outcomes, rather than principles. Furthermore, the perspectives of both dental staff and parents were vital in ensuring the success of the implementation strategies developed in this study, as both parties would be impacted by, and involved in, these strategies. As a result, this study would need to explore a range of subjective realities, accounting for not only the potential for differences in demographic characteristics between dental staff and parent groups, but also a great breadth of diversity within each of these groups. However, at the same time, this study would need to utilise some objective measures to quantify the impact of developed strategies on various measures of success and performance. The pragmatist paradigm not only focuses on outcomes and workable solutions, but it also acknowledges and incorporates layers of both subjective and

objective realities (Johnson & Onwuegbuzie, 2004; Ormerod, 2006; Yvonne Feilzer, 2009). With the close alignment of principles of the pragmatist paradigm with the objectives and requirements of this study, pragmatism was an apt fit, and therefore the paradigm chosen to underpin the design of this study.

3.3 Methodological approach

3.3.1 A sequential mixed methods approach

Within the pragmatist paradigm adopted for this project, a multi-phase sequential mixed methods approach was utilised to frame the project's methods (Figure 2). Mixed methods research is a methodology that includes the gathering and synthesis of both qualitative and quantitative data. Specifically, a multi-phase sequential mixed methods design combines multiple sequential and/or concurrent mixed methods phases to achieve an overall study aim (Creswell & Plano Clark, 2018). This approach was deemed appropriate for this study as mixed methods research is often regarded as the methodological counterpart to pragmatism and thus was an apt fit for the paradigm chosen for this study (Johnson & Onwuegbuzie, 2004; Ormerod, 2006). Furthermore, mixed methods approaches are known to address the known biases in individual methodological approaches, with the synthesis of both qualitative and quantitative approaches enhancing the strengths of each approach while minimising their weaknesses (Creswell & Plano Clark, 2018). A multi-phase sequential approach specifically enables researchers to develop and evaluate programs, which was the aim of this study (Creswell & Plano Clark, 2018). Thus, this approach enabled the early literature review and qualitative phases of this study to inform the development of implementation strategies, and an instrument which was then used to quantitatively pilot the implementation strategies in the later phases (Figure 3).

Figure 3: Multi-phase sequential mixed methods design for CHEWI project

3.3.2 Using constructive inquiry

To achieve the CHEWI project's aims of developing and evaluating an implementation strategy for children's healthy weight guidelines in the dental setting, this project utilised a multi-phase, constructive inquiry study design involving five phases (Figure 3). With the understanding that children's healthy weight guidelines are a significant role expansion for dental staff, and may be met with hesitancy from both staff and clients, it was vital to incorporate a study design with a focus on a constructive, positive dialogue with consumers.

Constructive Inquiry (CI), as proposed by Howieson (2011), was chosen as the study design for this project because it draws upon the principles of Appreciative Inquiry (AI) in its approach.

AI is based on the theory that every organisation has strengths, and drawing upon these creates the starting point for positive change (Cooperrider et al., 2003). This methodology will therefore enable focus to be shifted away from the challenges that may be experienced in this role expansion, towards the existing strengths that can be used to guide the development of the implementation strategies (Cooperrider et al., 2003). AI starts with an affirmative topic, and guides participants through a cyclic process known as the 4 D's: i) Discovering: exploring the best in a system; ii) Dreaming: identifying new possibilities; iii) Designing: developing strategies; and iv) Destiny: delivering strategies through innovation and action (Cooperrider et al., 2003). This approach heavily encourages simultaneous involvement from all levels of an organisation, rather than a hierarchical approach, enabling people at the point of care in a health system to become change agents and innovate (Hung et al., 2018).

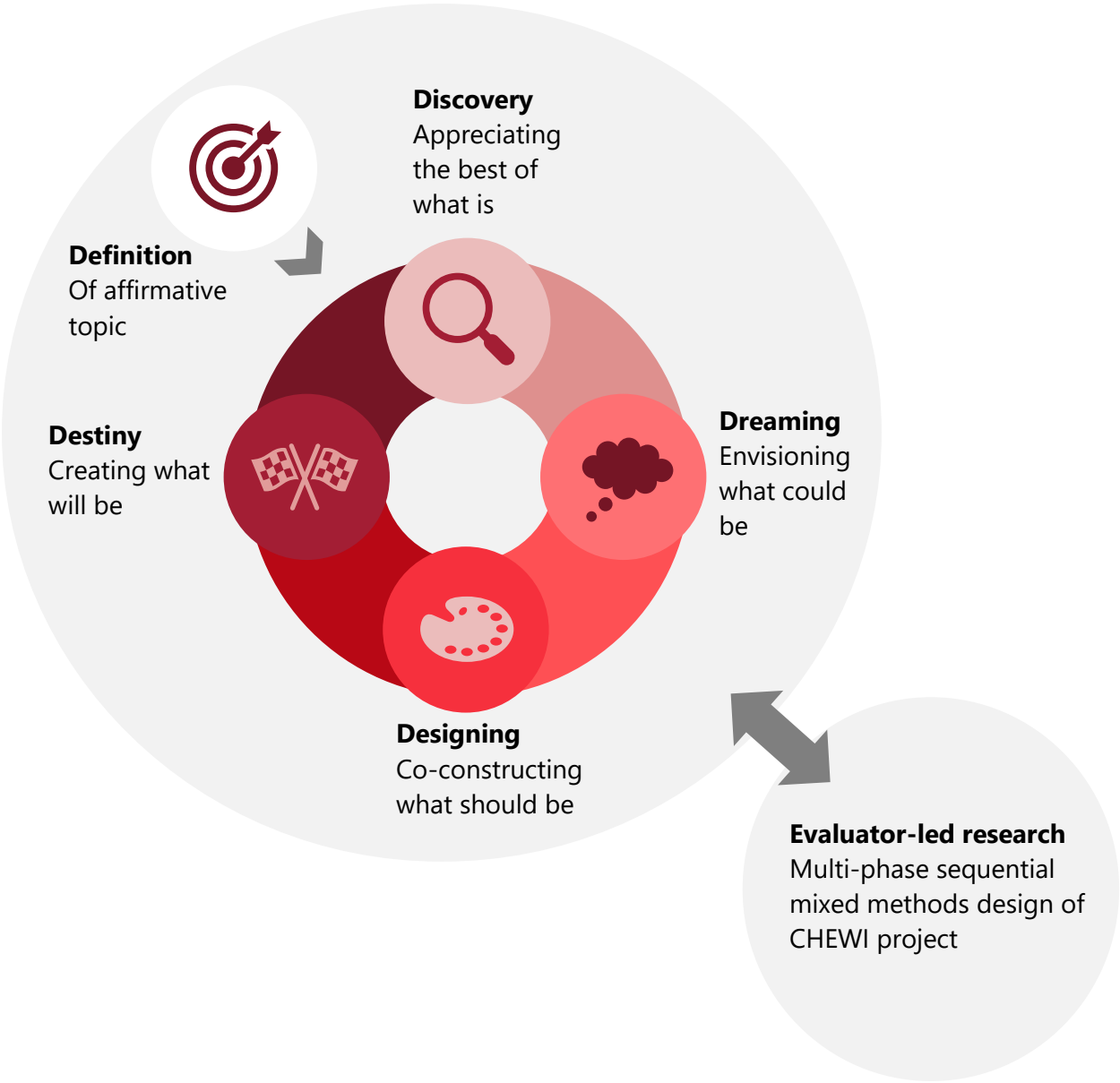

Figure 4: Constructive Inquiry as the union of Appreciative Inquiry and evaluator-led research

However, as AI has a heavy focus on participants themselves being agents of change, it does not permit for predetermined use of traditional research and evaluation methods. Rather, such methods are only utilised if the AI cycle requires it, and even then, are solely participant led (Howieson, 2011). This therefore does not permit for the conduct of evaluator-led assessments on the effectiveness of the AI process, which can be an important component of research projects in the health setting (Hennessy & Hughes, 2014; Hung et al., 2018; Knibbs et al., 2010; Trajkovski et al., 2013). CI, on the other hand, purposefully integrates qualitative and/or quantitative research methods into the AI cycle, and this

research can be predetermined and evaluator led (Figure 4) (Howieson, 2011). This is compatible with multi-phase sequential designs beginning with appreciative assessment of current practice and codesign of strategies to improve practice, followed by the objective measurement of the effectiveness of these strategies (Figure 4) (Howieson, 2011). This evaluator led approach would therefore enable systematic and evidence-based generation of strategies for this project and provide key information on the effectiveness of these strategies. Furthermore, such an approach would add value to the collaborative partnerships that were established for this project, as these partners valued tangible evidence and quantitative evaluations. Thus, constructive inquiry was well suited to the aims and context of this study.

3.4 Conceptual framework

In light of the CI approach used for this study, it was essential to utilise a theoretical framework that was compatible with this strength-based approach. There are a range of frameworks commonly used in implementation science, such as the Consolidated Framework for Implementation Research (CFIR) (Damschroder et al., 2009), the Promoting Action on Research Implementation in Health Services framework (PARIHS) (Kitson et al., 1998), and the Normalisation Process Theory (NPT) (May et al., 2009). However, although each of these are useful frameworks, none of them alone perfectly aligned with the goals of the CI approach, and thus were not an ideal fit to frame the methods of this project. However, one implementation science framework was utilised in the interpretation of results, which is discussed along with further description of the other frameworks in Chapter 4, Section 4.2.6.7. In consideration of the limitation of contemporary implementation science frameworks, it was deemed more appropriate for the framework used in this project to focus on the outcome of adherence to children's healthy weight guidelines, that is, behavioural change.

There are many behaviour change theories comprised of similar constructs, including Lewin's Three-step Model of Change, Diffusion of Innovation Theory, the Capability,

Opportunity, Motivation and Behaviour (COM-B) model, and the Integrative Model of Behavioural Prediction. Yet, similar to the implementation science frameworks, not all behaviour change theories are appropriate for the CI approach used in this study. Lewin's Three-step Model of Change postulates that a successful change includes three aspects: i) unfreezing the present level (if necessary); ii) moving to the new level; and iii) freezing group life on the new level (Burnes, 2020). However, this model is designed to help investigators identify forces both preventing and necessary for change (Burnes, 2020), which does not align with CI, which aims to enable the participants themselves to be the agents of change (Howieson, 2011).

The Diffusion of Innovation Theory maps the process by which people adopt new ideas, practices or philosophies according to five stages: i) knowledge or awareness stage; ii) persuasion or interest stage; iii) decision or interest stage, iv) implementation or trial stage; and v) confirmation or adoption stage (Kaminski, 2011). Additionally, it classifies the adopters of these innovations into five categories: i) innovators; ii) early adopters; iii) early majority; iv) late majority; and v) laggards (Kaminski, 2011). Furthermore, it proposes five characteristics that influence the effectiveness of an innovation: i) observability; ii) relative advantage; iii) compatibility; iv) trialability; and v) complexity (Kaminski, 2011). Although this theory would be more useful in guiding the development and evaluation of the guidelines themselves, it presented less utility in the context of this study, where the guidelines could not be changed. Furthermore, as the initial implementation was already completed, the diffusion process would be less observable.

The Capability, Opportunity, Motivation and Behaviour (COM-B) model proposes that people need the capability, opportunity and motivation to perform a behaviour (Barker et al., 2016). Aiming to guide understanding of behaviour in the context of intervention design, this model is better suited to situations where the investigator is designing interventions on a theoretical basis (Barker et al., 2016). Conversely, in CI approaches, participants are drawing upon their own experiences to design the interventions (Howieson, 2011).

Thus in the context of the CHEWI project, it was concluded that the most appropriate conceptual framework to guide this study would be one based on the Integrative Model of Behavioural Prediction (IM) proposed by Fishbein (2008). This framework simply provides a detailed analysis of the determinants of a behaviour change, without any further requirements regarding the nature of the behaviour or measures used to change the behaviour, and thus is readily compatible with the CI approach (Fishbein, 2008; Howieson, 2011). Fishbein argues that although there are various determinants of a behaviour, only a small number need to be considered to accurately predict a behaviour. This theory, which began as the Theory of Reasoned Action (TRA) and later developed into the Theory of Planned Behaviour (TPB), was most recently transformed into the IM (Cho, 2012; Fishbein, 2008). All three of these models are based upon the central principle that a person's intention to perform a behaviour is the largest predictor of their behaviour, and this intention is influenced by their beliefs (Ajzen, 1985; Cho, 2012; Fishbein & Ajzen, 1975). The limitations of TRA and TPB were that: i) they were based on the assumption that a person had already acquired the knowledge and skills to perform the behaviour successfully; and ii) they did not account for factors other than beliefs that may influence intention, such as environmental factors, personality traits, mood or past experience (Ajzen, 1985; Fishbein & Ajzen, 1975).

A conceptual framework based on the IM addressed all of these limitations, postulating that people will act on their intentions if they have the necessary skills to do so. This assumes that there are no environmental constraints that may impede the behaviour despite intentions to do so, such as policies, and availability of equipment and resources such as information, time, and money (Cho, 2012; Fishbein, 2008). The concept map in Figure 5 shows the relationship between dental staff's intention to adhere to children's healthy weight guidelines and actual adherence to children's healthy weight guidelines, and how it is mediated by awareness of and skill to perform children's healthy weight guidelines, and any environmental constraints. This intention is displayed as a function of three behavioural

determinants: i) attitude, or how favourable the behaviour is; ii) perceived norm, or the social pressure surrounding this behaviour; and iii) self-efficacy, or how capable a person feels in effectively performing the behaviour. These determinants are respectively a result of: i) outcome beliefs: beliefs regarding whether the behaviour would have desirable outcomes; ii) normative beliefs: beliefs regarding social networks and whether they would support and engage in the behaviour; and iii) efficacy beliefs: perceived capability to perform the behaviour.

This model further hypothesizes that background variables, such as demographics, personality traits and culture have an indirect influence on behaviour by acting as sources of beliefs. Thus, according to this model, Phases 2 and 4 of this study involved the design and refinement of an intervention that focused on enhancing the attitudes, perceived norms, self-efficacy, knowledge, and environment of dental staff to further children's healthy weight guideline adherence. In Phase 3 of this study, an instrument was developed that would assess changes in the behavioural determinants of dental staff before and after the delivery of the intervention. The impact of the intervention on each of these behavioural determinants was then assessed in Phase 5 (Figure 5).

3.5 Summary

This chapter provided an overview of the paradigm, methodology, study design and conceptual framework used in the conduct of the CHEWI project. These were respectively a pragmatist paradigm, mixed methods methodology, a multi-phase sequential constructive inquiry design and the Integrative Model for Behavioural Prediction. Throughout the chapter, the choice of each approach was justified and contextualised within the three-phase design of the project. The following chapter will describe, in detail, the methods used for each phase of the project, as well as adaptations that were made in response to COVID-19 restrictions.

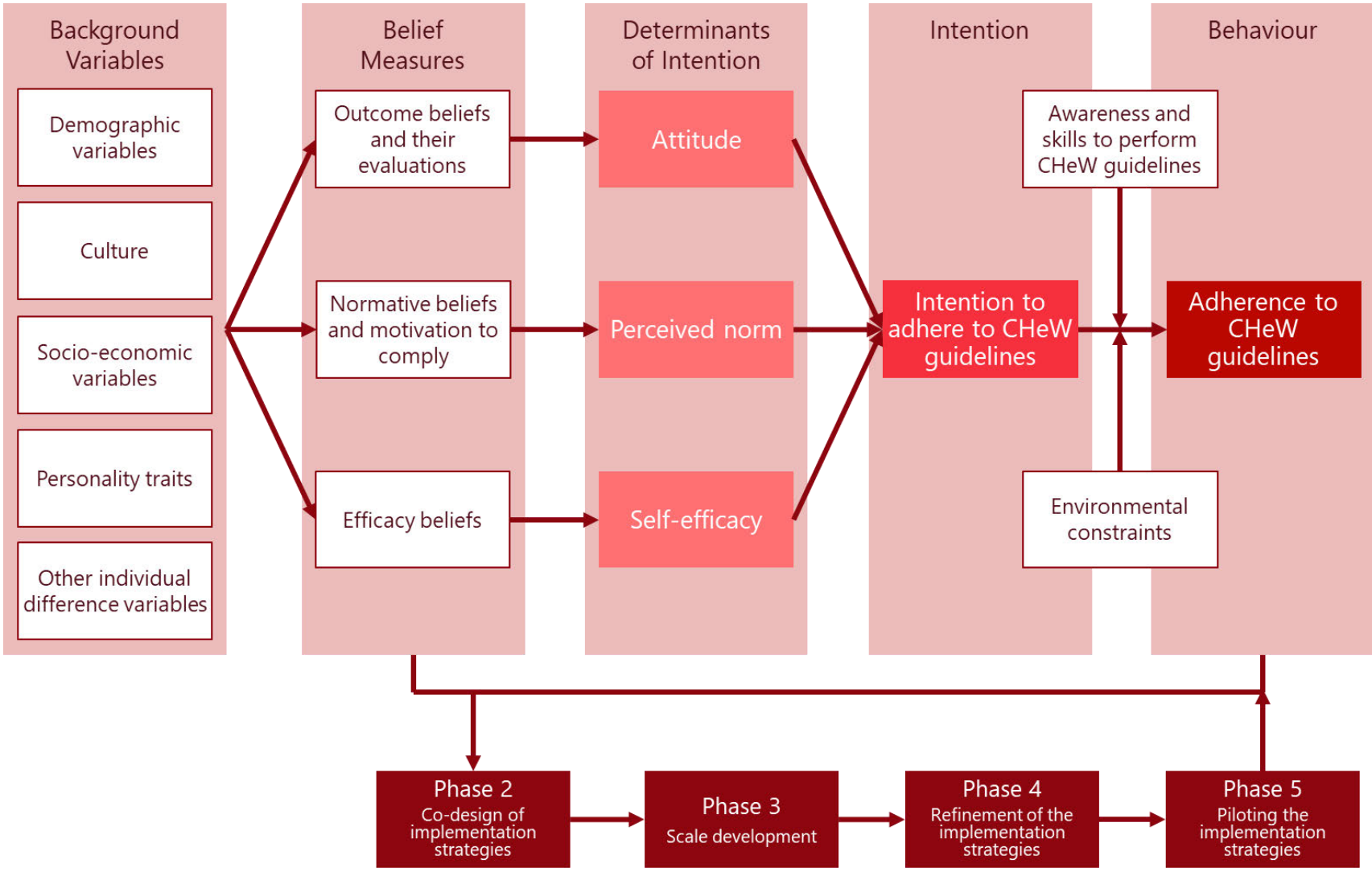

Figure 5: Conceptual framework for the study using the Integrative Model of Behavioural Prediction

Chapter 4

Methods

4.1 Overview

This chapter will detail the methods used for the CHEWI project over four phases, and how the data from these phases were integrated. In addition, this chapter will discuss the ethical considerations for this project and highlight the impacts that the COVID-19 pandemic had on the conduct of this project.

4.2 Methods for the CHEWI project: A five-phase approach

The CHEWI project aimed to develop and evaluate implementation strategies for children's healthy weight guidelines in the dental setting. As previously stated, to achieve these aims, the CHEWI project utilised a multi-phase sequential mixed methods design using a constructive inquiry approach over four phases. This five-phase approach entailed: i) building the foundational evidence using a systematic review; ii) codesign of the implementation strategies using an appreciative inquiry qualitative phase; iii) development of a scale to measure dental staff's intention to engage in children's healthy weight guidelines using a mixed methods approach; iv) refining the implementation strategies according to identified needs at each site; and v) piloting the implementation strategies and exploring their impact on guideline adherence using a quantitative approach (Figure 8).

4.2.1 Setting

Phases 2 and 4 of the CHEWI project occurred within two local health districts across Greater Western Sydney, NSW; renamed District 1 and District 2 for anonymity. This area was chosen as the current children's healthy weight guidelines were developed for public dental services within NSW, and Greater Western Sydney represents some of the most culturally and socioeconomically diverse individuals in NSW (Australian Bureau of Statistics, 2018). In addition, this area experiences some of the highest rates of overweight and obesity

in childhood, coupled with a rapidly growing population and increasing number of children (South Western Sydney Local Health District, 2017). Phase 2 of the CHEWI project was a national study, sampling participants from a range of Australian cities and states.

At the time of this study, District 1 was larger than District 2, with a population of around 1 million people. District 1 was more culturally and linguistically diverse, with under half (46%) of people speaking English at home (Australian Bureau of Statistics, 2016). Regions within this district experienced anywhere from the 1st to the 10th decile of the Index of Relative Socio-economic Disadvantage (IRSD) (Australian Bureau of Statistics, 2016, 2018). This was indicative of a diverse community comprised of individuals from the 10% most disadvantaged to the 10% least disadvantaged individuals in the country. In contrast, District 2 was smaller, with a population of almost 350,000 people, and most people (82%) within this district spoke English at home. Although regions within this district experienced anywhere from the 2nd to the 9th decile of the Index of Relative Socio-economic Disadvantage, most were above the 7th decile, indicating this population experienced less socioeconomic disadvantage than District 1 (Australian Bureau of Statistics, 2016, 2018).

Regarding provision of public dental services across these districts, District 1 contained nine public dental clinics at the commencement of the CHEWI project, which was reduced to six clinics by the end of the project. District 2 operated out of three public dental clinics at the commencement of the project, which increased to four by the end of the project. Of these clinics at District 2, one was considered the central clinic, which treated the largest number of patients in the district and at which most staff were based. The remaining clinics were satellite clinics, of which some were rurally located, and fewer staff were based at these clinics.

Prior to the commencement of the CHEWI project, there was a significant restructure at District 1, which resulted in many dental and oral health therapists receiving redundancy packages and ending their employment at the district. This was not well received by staff,

with it impacting both staff attitudes and workload with less staff available, and this likely had an impact on organisational culture at this district.

4.2.2 Phase 1: Building the foundational evidence

Although the CHEWI project was focussed on obtaining local, workable solutions for implementing children's healthy weight guidelines, it was still necessary to consider the existing international literature on effective implementation strategies for the dental setting. This would provide an evidence base that could be referred to throughout the development of the specific implementation strategies for this project. Thus, for the first phase of the CHEWI project, a systematic literature review was conducted to gather global evidence regarding effective guideline implementation strategies for dental practice. Following are the methods used for this phase, with findings and further detail on methods for this phase presented in Chapter 5, Paper 3.

4.2.2.1 Aim

The systematic review aimed to identify the most effective guideline implementation strategies for changing practice in the dental setting. These findings were used to inform the development of implementation strategies for children's healthy weight guidelines.

4.2.2.2 Study design

This study followed a systematic review design and was undertaken according to the framework developed by Khan et al. (2003). Specifically, this involved a five-step process: i) framing the question; ii) identifying relevant work; iii) assessing the quality of studies; iv) summarising the evidence; and v) interpreting the findings.

4.2.2.3 Data sources and search strategy

Extensive searches were undertaken across databases including Scopus, CINAHL, PubMed/MEDLINE, ProQuest, Embase, Cochrane, PsycINFO and Web of Science. Search strategies were constructed using a range of Boolean operators, truncations, and Medical

Subject Headings (MeSH) to combine search terms such as: guideline, recommendation, consensus, implementation, dissemination, translation, strategy, approach, intervention, and dentist. In addition, bibliographic mining and manual searches of any recommended articles within each database were undertaken, including forward and backward citation searches.

4.2.2.4 Eligibility criteria

Eligible studies for this review included experimental and quasi-experimental studies. Specific eligibility criteria were developed according to the Population, Intervention, Control, Outcome (PICO) framework. These criteria ensured participants had a qualification in a dental profession, interventions were strategies to facilitate the implementation of clinical guidelines into practice, controls involved guideline dissemination only, and outcomes were focused on guideline adherence. Due to the paucity of information in this area, no restrictions were placed on time of publication.

4.2.2.4.1 Study selection and data extraction

A systematic screening process was used to screen identified studies for eligibility first by title, then by abstract, and finally by full text. Study eligibility was determined independently by two reviewers, with a third reviewer invited to achieve consensus when discrepancies arose.

4.2.2.4.2 Risk of bias assessment

The risk of bias and quality of each study was assessed using the Joanna Briggs Institute critical appraisal tools for both randomised controlled trials and quasi-experimental designs (The Joanna Briggs Institute, 2017a, 2017b). This was independently performed by two reviewers, and where any discrepancies in assessment arose, a third reviewer was involved to achieve consensus. Using the appraisal tools, a score was computed for each article as a percentage of the number of met criteria over the total number of

applicable criteria. Cut-off values were established prior to scoring, with studies scoring less than 30% excluded from analysis, 30-59% considered poor quality, 60-79% considered moderate quality and greater than 80% considered high quality (Goldsmith et al., 2007).

4.2.2.4.3 Data extraction and synthesis

Data from included studies were extracted using a data extraction tool (Appendix 2), which were validated through consensus with the research team, and included fields such as author, year, location, aims, study design, population and eligibility criteria, intervention/implementation strategies used and outcomes.

Due to the small number of articles meeting the eligibility criteria for the study, a qualitative, narrative synthesis of study findings was undertaken. Types of implementation strategy used in each study were classified according to the Effective Practice and Organisation of Care (EPOC) taxonomy of health systems interventions (Effective Practice and Organisation of Care, 2015). This taxonomy was systematically developed by the Cochrane EPOC Review Group to allow the classification of health systems' interventions into categories based on conceptual or practical similarities (Effective Practice and Organisation of Care, 2016). Unlike similar taxonomies, this taxonomy was developed with attention to a variety of health settings, thus it was deemed an appropriate tool for the classification of the interventions used in this international review (Effective Practice and Organisation of Care, 2016). Further detail on the justification for this taxonomy can be found in Chapter 5, Paper 2. In the case where interventions consisted of components from multiple EPOC categories, these were classified as multifaceted interventions.

4.2.2.4.4 Registration

The protocol for this systematic review was registered with the International Prospective Register of Systematic Reviews (PROSPERO), registration ID CRD42018093023.

4.2.3 Phase 2: Codesign of implementation strategies

4.2.3.1 Aims

The aim of this phase of the CHEWI project was to collaborate with dental staff as service deliverers, and parents of children as consumers, to codesign potential implementation strategies for children's healthy weight guidelines in the dental setting. These strategies were further refined and developed using current evidence and expert opinion.

4.2.3.2 Design

This study followed a qualitative design using the principles of AI, which aimed to create positive organisational change (Cooperrider et al., 2003). In order to do this, focus groups were employed, as they encourage discussion and interaction between participants, thus enabling participants to engage in the discovery, dreaming and designing stages of appreciative inquiry, and codesign implementation strategies for the CHEWI project (Nyumba et al., 2018).

4.2.3.3 Population and recruitment

Purposive sampling, as well as snowballing, was used to recruit dental staff and parents for the focus groups between July and August of 2020. Purposive sampling is a non-probability sampling technique that is used to generate a sample with specific characteristics, thus enabling the research questions to be answered (Teddlie & Yu, 2007). It is particularly beneficial for qualitative research, where it is vital for participants to have specific characteristics or experiences (Campbell et al., 2020). In this study, dental staff, including dental therapists, oral health therapists and dental assistants working at the targeted local health districts, as well as parents of children eligible for treatment at public dental clinics in NSW were purposively selected. Snowball sampling was used to supplement recruitment of parents, where other participants or informants were invited to nominate

individuals eligible to participate and refer them to contact the study investigators (Noy, 2008).

Flyers advertising the study were circulated to staff and eligible parents at the participating oral health services. In addition, flyers for parents were distributed to other parents living within these participating local health districts. Interested participants were provided with information sheets and invited to participate in online focus groups on Zoom, scheduled at a convenient time. Although it was initially intended for these focus groups to be conducted face to face, COVID-19 restrictions made it necessary to use non-face-to-face methods, with videoconferencing shown to be one of the more effective qualitative data collection methods in these circumstances (Villarosa et al., 2021). Please refer to Section 4.5, Paper 2 for more information regarding this. Investigators endeavoured to maintain at least a 1:3 parent to dental staff ratio in the study sample, and initially conducted separate focus groups with dental staff and parents, to ensure parents were not intimidated during focus groups, fostering optimal interaction between participants. In addition, investigators aimed to maximise variability of parents invited to participate, to ensure adequate representation of the socioeconomic, cultural, and linguistic diversity of the areas.

4.2.3.4 Data collection

A series of recorded focus groups were facilitated by 2-4 researchers, lasting approximately two hours each. The structure of these focus groups is summarised in Figure 6. Prior to the focus groups, the primary researcher, who had received formal training in appreciative inquiry, provided in-depth training to all other researchers who facilitated the focus groups. Further information on this training can be found in Chapter 6, Paper 4.

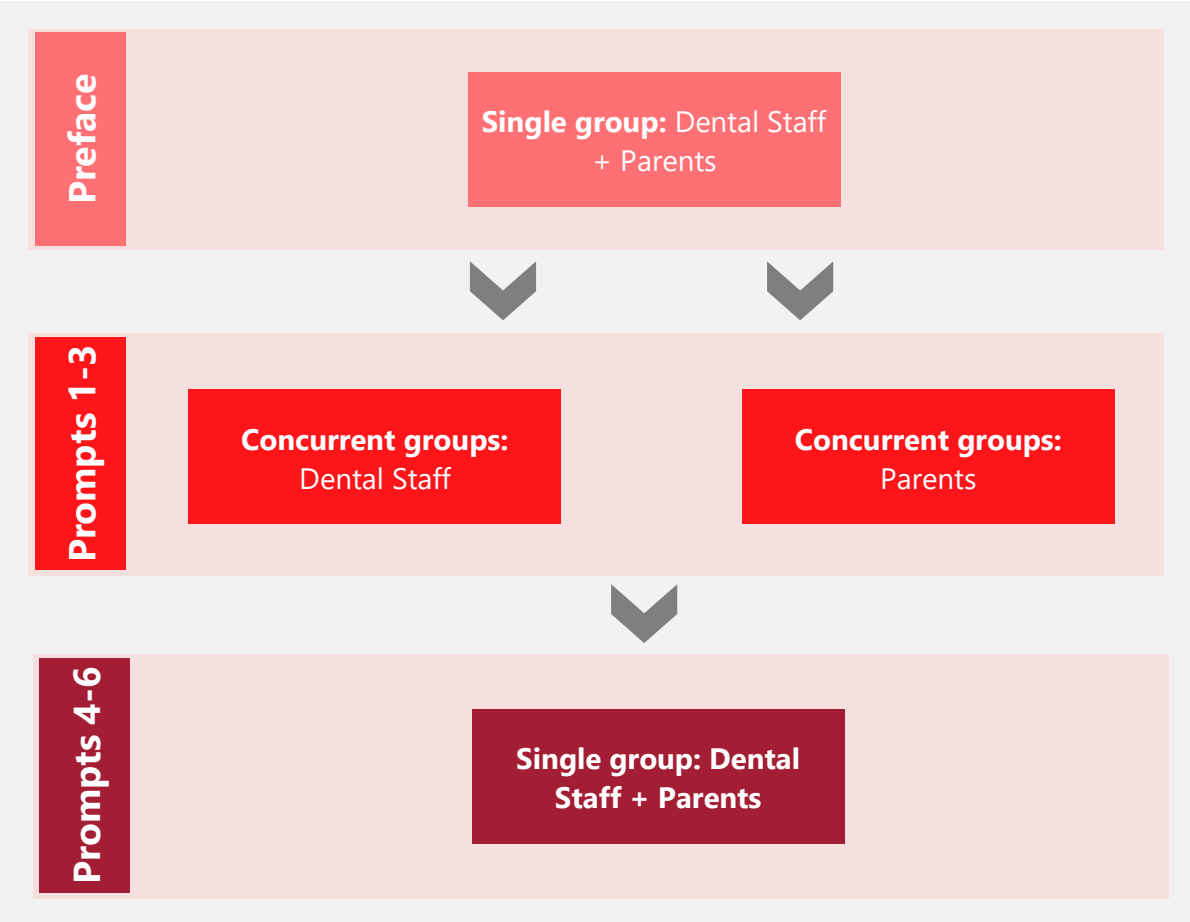

Figure 6: Focus group structure

All focus groups were prefaced by a brief to both parents and dental staff, covering the study aims, requirements of participation, informed consent and collection of demographic data including age, sex, employment status, profession, years of experience for dental staff, and number and age of children for parents. After this, the focus groups were split into separate, concurrent focus groups of parents and dental staff respectively, with the specific goal of enabling parents to discuss their initial ideas freely, without any sense of intimidation. Discussion in these concurrent focus groups was guided by the following prompts:

1. Consider and discuss a "highpoint moment" where you recall providing or receiving a health promotion message in a sustainable way or one that created a positive impact.
2. Reflect on the causes of success in this moment.

3. Using the causes of success identified previously, name three causes of success that you believe we should keep and focus on when we engage in children's healthy weight promotion at public dental clinics.

These prompts were used flexibly with examples to guide conversation, and were modified to suit the comprehension level of the participants involved. For example, with prompt two, "*reflect on the causes of success in this moment*", facilitators may have instead asked "*what factors do you think would have made that a positive experience?*", with further prompts such as "*what things about you, others or the surrounding environment helped make this a positive experience?*". Facilitators served as scribes to record the most important causes of success that were identified from these three prompts, following which the concurrent focus groups were combined into one larger focus group. This group was quickly briefed regarding the aims of the large focus group, and then discussion commenced whereby representatives from each focus group presented the recorded causes of success they identified, and why they were identified. Causes of success from both concurrent groups were mind-mapped together to identify any areas of difference or similarity. Subsequently, the following prompts were used to initiate codesign of the implementation strategy:

4. In each of your focus groups, you identified the three most important causes of success for you. Can you think of any reasons why there are similarities/differences between your causes of success?
5. Keeping in mind the needs of both parties, can you identify the four most important causes of success in health promotion messages?
6. How do you think we can use these causes of success to ensure children's healthy weight promotion is successfully implemented into dental services?
    - What resources/procedures do we already have in place that we can use in line with these causes of success?
    - What else can be created/developed?

Meaning derived from large group discussion was verified by the facilitator through taking field notes, reflection, paraphrasing and active listening.

4.2.3.5 Data analysis

Digital recordings of all focus groups were professionally transcribed and reviewed by the PhD candidate for accuracy. These transcriptions were further cross-checked with field notes, and pseudonyms were assigned to all participants to ensure anonymity. Final transcripts were imported into the NVivo qualitative software, where content analysis was undertaken. Content analysis was chosen for this study as it enabled the IM theoretical framework to be taken into account during analysis. To this end, the content analysis approach utilised was a hybrid approach, which used a combination of conventional analysis derived from the data, and directed content analysis guided by the IM theoretical framework (Hsieh & Shannon, 2005). Analysis was undertaken by independent investigators, who each developed unique coding frames that were merged into the final coding frame in a consensus meeting involving all investigators. This coding frame included both concept-driven, or deductive categories drawn from the IM, as well as data-driven, or inductive categories, drawn from the participant's identified causes of success. Figure 7 depicts the content analysis coding frame, including the relationship between concept-driven and data-driven elements.

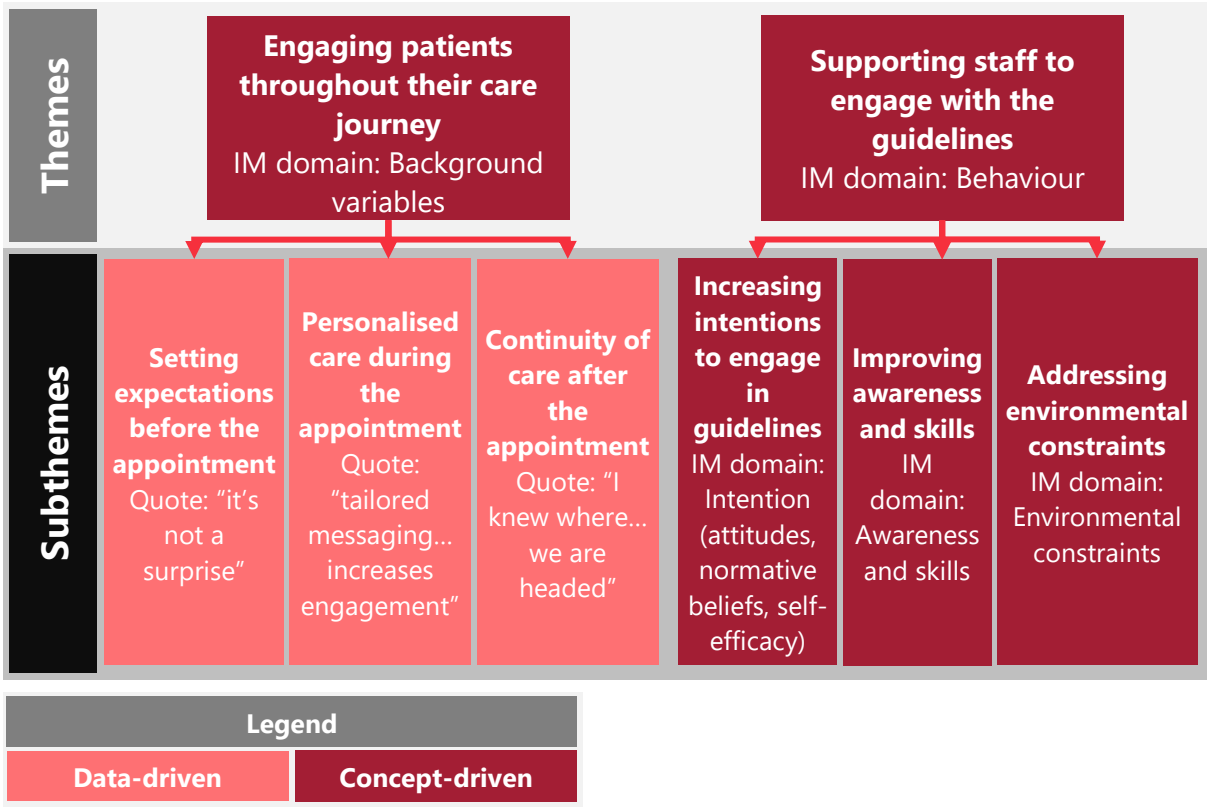

Figure 7: Coding frame for Phase 2 findings

4.2.3.6 Rigour

Several measures were implemented to ensure trustworthiness of the findings and to address the tenets of credibility, transferability, dependability and confirmability (Shenton, 2004). By basing the coding frame on participant-generated themes, involving multiple independent researchers in analysis and triangulation of data collected from parents and dental staff across multiple sites, credibility of research findings was enhanced. Additionally, triangulation, along with the recording of focus groups, use of field notes, and careful documentation of the steps followed in the conduct of this study, ensured confirmability and dependability of the results. Furthermore, thick description was used to sufficiently detail the context in which data were collected, as well as involvement of different health districts, and types of dental staff and parents with a range of demographic characteristics, which enhanced transferability of results.

In addition, extensive measures were utilised to ensure reflexivity among investigators, including the use of a questionnaire which enabled researchers to reflect on their

backgrounds, beliefs, and prior relationships. In turn, this provided awareness regarding if, and how, these factors may have impacted data collection. Full results of this reflexivity exercise can be found in Chapter 6, Paper 4.

4.2.4 Phase 3: Scale development

4.2.4.1 Aims

The aim of Phase 3 of this project was to develop the iCHeW scale to assess the behavioural determinants influencing dental staff's intention to engage in children's growth assessments, provision of healthy lifestyle advice and referrals. This instrument was used as the baseline and follow-up questionnaire in the evaluation of the CHEWI strategies.

4.2.4.2 Study design

This phase followed a sequential design across three stages: i) face validity; ii) content validity testing; and iii) psychometric evaluation of the iCHEW scale.

4.2.4.3 Setting

This study was conducted in Australia between 2020-2021, while the NSW Ministry of Health was implementing routine growth assessments for children in public dental services. All phases of this study were conducted across a range of cities, states, and territories in Australia.

4.2.4.4 Item generation

Draft items for the scale were generated by the researchers based on the existing literature. Specifically, items were identified through a comprehensive review of the literature relating to behavioural determinants of health practitioners' practice changes relevant to promoting healthy weight in childhood. A total of 36 initial items were developed to measure intention to engage in children's healthy weight guidelines using each of the dimensions of IM: i) attitudes; ii) behavioural constraints; iii) perceived norms; iv) self-

efficacy; and v) behavioural intention (Cho, 2012). All items used a 7-point Likert response format to optimise reliability and variability in responses, and provide a neutral midpoint (Croasmun & Ostrom, 2011).

4.2.4.5 Phase i: Face validity testing

Face validity refers to an item's ability to measure what it is supposed to measure, based upon the link between the item and the objectives of the study (Kumar, 2005). Dental clinicians and higher-degree research students were recruited to comprise a reference group of individuals either considered part of the target audience for the scale, or with research skills to provide feedback on a psychometric scale. Following the provision of background information regarding the aim of the study and IM, the reference group was asked to comment on the face validity, comprehensibility and completeness of items. Based on this feedback, items were refined, removed and/or added.

4.2.4.6 Phase ii: Content validity testing

A panel of experts in interdisciplinary oral healthcare, including academics, clinicians, and policy makers, reviewed the resulting items for content validity. This refers to the ability of an instrument to cover the full range of the issue or attitude being measured (Kumar, 2005). Each expert was independently asked to rank each item according to the relevance of the items to each dimension of IM using the index of content validity for each item (I-CVI) (Lynn, 1986). The resulting average I-CVI scores were used to determine whether an item will be retained or deleted, with items with I-CVI scores lower than 0.78 removed. The average of I-CVI scores across the entire scale (S-CVI/Ave) was used to provide a summary of the content validity of the overall scale.

4.2.4.7 Phase iii: Structural validity and reliability testing

A national cross-sectional sample of dental staff, including dental assistants, dental therapists, and oral health therapists, were recruited through word of mouth, social media

and the Australian Dental and Oral Health Therapists' Association (ADOHTA) and were asked to complete the instrument online. These data were psychometrically tested in IBM SPSS statistics version 27 (IBM Corp, 2020), whereby floor and ceiling effects were examined using a threshold of 30%, principal axis factoring (PAF) was conducted to determine structural validity, and Cronbach's alpha calculated to determine internal consistency. Factor loading scores of 0.3 or greater were considered significant, and a Cronbach's alpha of 0.7 or greater was deemed acceptable for this study (Santos & Reynaldo, 1999). With studies recommending a sample size of at least five subjects per item, the target sample size for this 25-item scale was determined to be at least 125 participants (Hair et al., 1995).

4.2.5 Phase 4: Refining the implementation strategies

4.2.5.1 Aims

The fourth phase of the CHEWI project aimed to refine the codesigned strategies from Phase 2 into a suite of practicable implementation strategies for each participating district.

4.2.5.2 Setting

Along with Phase 5, this study was set in the two participating local health districts within Greater Western Sydney, NSW, as identified in Phase 2, which were already undertaking practice according to the new children's healthy weight guidelines. However, both districts were impacted by a period of COVID-19 related restrictions, whereby only emergency care was being provided. Children requiring general dental care, who usually are not put on waitlists for public dental treatment, were commonly being put on waitlists during these COVID-19 lockdowns. As a result, staff had limited ability to adhere to children's healthy weight guidelines, which were only intended for non-emergency appointments, and thus it was determined that the guidelines would need to be reimplemented. Accordingly, the suite of strategies developed for each district were delivered as part of a reimplementation of the guidelines.

4.2.5.3 Refining and delivering the implementation strategies

Although preliminary strategies had been codesigned in Phase 2, it was recognised that these would need further refinement in order to be tailored to, and practicable within, each of the participating settings. First, these preliminary codesigned strategies were compared with the existing literature from the systematic review in Phase 1, to ensure the strategies were aligned with best available evidence. It was also recognised that refining the preliminary codesigned implementation strategies to be tailored to each site required strong partnerships with the community (consumers), dental care professionals (providers), and other key stakeholders (management and referral pathways). Thus implementation working groups were formed for each site.

4.2.5.3.1 Implementation working groups to refine implementation strategies

To involve all key stakeholders in the refinement of these implementation strategies, codesigned strategies were presented to implementation working groups which were comprised of these stakeholders at each site. These groups served to determine the most acceptable and feasible strategies and identify available resources and other requirements for these strategies. Furthermore, these groups proposed refinements that would enable these strategies to be best used in each site, accounting for considerations that may impact the feasibility and sustainability of the strategies. These considerations included the administrative processes in place at each site, for example, protocols for mail-outs and reminder letters, as well as other factors such as area demographics such as cultural and linguistic diversity, available staff incentives and workplace culture. Strategies were refined in an iterative process, where strategies were presented at regular working group meetings, stakeholders recommended any required modifications, and these modifications were presented and further refined at subsequent meetings.

Stakeholders involved in the implementation working groups varied between districts. At District 1, this included the director of oral health services, a nurse educator who delivered growth assessment training to dental staff and worked at one of the referral pathways, a dietitian who worked at one of the referral pathways, and the study investigators. Furthermore, the district's oral health consumer committee, comprised of dental staff and community members who were parents, was involved in the refinement of some strategies. Although the composition of this committee varied from meeting to meeting, a minimum of two community members was required to achieve quorum, and it generally had at least two dental staff attendees. This committee also performed their own consultation with six parents in the community for one strategy, to gather feedback on its presentation, readability and content. No further changes were identified from this process. At District 2, the implementation working group included the director of oral health services, a dental staff member, and the study investigators. Furthermore, relevant referral pathways were consulted in the refinement of some strategies.

4.2.5.3.2 Delivery of the implementation strategies

Resulting refined strategies were progressively delivered as they were finalised over a period of about 12 months due to COVID-19 related delays (see Section 4.5 for more detail on the impact of COVID-19). Staff members that were key in any processes required for delivering these strategies were identified and informed of these strategies and how they were to be used. Furthermore, these strategies were promoted at each of the participating clinics to ensure staff awareness and to optimise their uptake.

4.2.6 Phase 5: Piloting the implementation strategies

4.2.6.1 Aims

The final phase of the CHEWI project aimed to pilot the final implementation strategies and explore their preliminary effects on behavioural intention and adherence to the children's healthy weight guidelines.

4.2.6.2 Design

This study was undertaken as a pre- and post-test pilot study, which measured predictors of behavioural intention, self-reported practice, and actual practice before and after the delivery of the strategies to determine any degree of change.

4.2.6.3 Population and recruitment

Although strategies were made available to any staff working at the participating clinics, only dental assistants, dental therapists, and oral health therapists were eligible to complete the pre and post questionnaires. Invitations for these questionnaires were distributed via email, as well as face-to-face through field visits to each clinic. Data on adherence to the children's healthy weight guidelines were only available for dental and oral health therapists.

4.2.6.4 Data collection

All study data were collected using a pre-test, post-test design, whereby all measures were gathered at two time points; once prior to the initiation of the developed CHEWI strategies, and again at least one month following the delivery of these strategies. All participants were asked to complete the baseline questionnaire developed in Phase 3, along with demographic and self-reported practice items. Once the CHEWI strategies had been delivered, participants were asked to complete the same questionnaire as the post-questionnaire. In addition, data describing dental therapists' and oral health therapists' actual practices over this time were retrieved from the clinics' information management systems, via deidentified reports. Specifically, this included a unique item number that dental staff use to claim funds when weight assessment and advice are provided, as well as notes for cases where weight assessment, advice and referrals were offered, but were declined by the parent or child.

4.2.6.5 Measures

4.2.6.5.1 Questionnaire Measures

4.2.6.5.1.1 Intention to engage in Children's Healthy Weight (iCHeW) guideline Scale

Dental staff's behavioural intention, and related behavioural determinants, regarding adherence to children's healthy weight guidelines, were measured using the intention to engage in Children's Healthy Weight guideline (iCHeW) Scale. The iCHeW scale was developed as part of Phase 3 of this project, and consists of 27 items across five domains: i) attitudes, ii) behavioural constraints, iii) perceived norms, iv) self-efficacy, and v) behavioural intention. These items were specifically designed to align with the conceptual framework for this study, the IM, thus all scale domains directly correlated with domains of the IM. All items were on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

This scale, initially developed to measure behavioural intention regarding provision of weight and height assessments specifically, was also adapted to measure dental staff intentions regarding the practices of providing healthy lifestyle advice and referrals to weight management services. Thus, this scale was used in three instances, once for each of these practices.

4.2.6.5.1.2 Feedback on the implementation strategies

In addition to the quantitative measures above, in the post-questionnaire only, participants were asked to provide any feedback on the implementation strategies using open-ended items, which asked regarding the best aspects of the strategies, as well as suggestions for improvement.

4.2.6.5.1.3 Dental staff's self-reported behaviours

The self-reported practice of dental staff regarding children's healthy weight guidelines was measured using three items for each practice: i) the frequency of providing children's healthy weight services in their usual practice, ii) the frequency of offering children's healthy weight services during the past month, and iii) the frequency of patients receiving children's healthy weight services during the past month. All items were answered on an 11-point response format ranging from 0 (Never) to 10 (All of the time). Ratings for these items were added together to produce an overall self-reported behaviour score.

4.2.6.5.2 Dental staff's adherence to children's healthy weight guidelines

Dental staff's rate of adherence to children's healthy weight guidelines was determined by health service data. In the oral health service data, each service provided to a patient was allocated a unique code, including the children's healthy weight services. Thus, the rate of adherence was determined by dividing the total number of children allocated the children's healthy weight services code by the total number of children seen in non-emergency courses of care. This was computed by provider, by site and by district.

4.2.6.6 Data analysis

All data were entered and analysed in IBM SPSS statistics version 27 (IBM Corp, 2020). Descriptive statistics such as means, medians and frequencies were used to represent behavioural intention and adherence of dental staff to children's healthy weight guidelines before and after the implementation strategy. Using *a priori* power analysis, it was estimated that a total of 28 participants would be required to determine a medium effect size (0.5) using Wilcoxon signed-rank tests, with 95% confidence and 80% power (Faul et al., 2009). Statistical tests such as Pearson's chi-squared tests for group comparisons of categorical data and Wilcoxon signed-rank tests for group comparisons of continuous data were used to determine the statistical significance of this change. To investigate factors associated with a

child receiving a growth assessment, logistic regression models were constructed, including variables relating to time point (pre vs post) provider characteristics (position, number of children treated over study period) and characteristics of the providers' primary site for one district (central vs satellite clinic).

4.2.6.7 Interpretation of results

Although implementation science frameworks were not appropriate to inform the methods of the CHEWI project, these frameworks could be valuable in the interpretation of results. There are a range of implementation science frameworks, with the more commonly used ones being the Consolidated Framework for Implementation Research (CFIR) (Damschroder et al., 2009), the Promoting Action on Research Implementation in Health Services framework (PARIHS) (Kitson et al., 1998), and the Normalisation Process Theory (NPT) (May et al., 2009). The PARIHS views implementation success as a function of three predictors: evidence, context and facilitation (Kitson et al., 1998). It is by transforming these predictors from weak to strong conditions that implementation success can be increased. On the other hand, the NPT focuses on implementation strengths and deficits from the viewpoint that the end goal of implementation is normalisation. Finally, the CFIR utilises five domains to describe the factors that can influence implementation effectiveness (Damschroder et al., 2009). These include: i) characteristics of the intervention being implemented; ii) the outer setting (economical, political and social contexts); iii) the inner setting (structural, political and cultural contexts); iv) the individuals involved; and v) the implementation process (Damschroder et al., 2009). This provides a more detailed and nuanced insight into implementation than the other two frameworks, which are more simplified. As a result, the CFIR was chosen as a framework to further analyse the impact of the intervention. This interpretation enabled further exploration of the impact of the implementation strategies considering the characteristics and contexts of each district.

4.3 Data integration

It is known that the integration of qualitative and quantitative data is essential for mixed methods research and improves the significance and utility of resultant findings. There are a range of approaches that can be used to integrate qualitative and quantitative findings, which can be implemented at the study design, methods and interpretation, and reporting levels of research. To therefore optimise the significance and utility of the results of the CHEWI project, data integration approaches were utilised at all levels.

4.3.1 Integration at the study design level

The data integration approach used at the study design level was the multi-phase sequential mixed methods design, described in detail in Chapter 3. This specifically involved a systematic review in Phase 1 that was used to build the evidence which the later phases would draw upon. Following this, qualitative focus groups were conducted in Phase 2, with dental staff and parents in the participating communities, data from which were used to identify and develop implementation strategies. These implementation strategies were further refined in Phase 4. These implementation strategies were subsequently evaluated in Phase 5 via quantitative surveys and electronic health service data. A smaller auxiliary sequential study was embedded into Phase 3 of this study design, where qualitative feedback was used to ensure face validity of questionnaire items to be used in the Phase 5 survey, following which items were quantitatively rated by experts to ensure content validity. Afterwards, items were again quantitatively evaluated for structural validity.

4.3.2 Integration at the methods level

Approaches used to integrate data at the methods level included both connecting, building, and embedding approaches. Connecting approaches involve the use of the same sampling frame to link quantitative and qualitative data together. Such an approach was used to connect the qualitative Phase 2, and the quantitative Phase 5 of the CHEWI project,

whereby both phases sampled dental assistants, dental therapists and oral health therapists practicing at the two participating local health districts.

Integration was also achieved through building approaches, which were utilised across all three phases of the CHEWI project. Such approaches are related to sequential methods and utilise data collected using one methodological approach to inform data collected in the subsequent approach. Specifically, in the CHEWI project, Phase 1 identified a range of strategies that could improve guideline adherence, Phase 2 identified specific strategies for children's healthy weight guidelines in greater western Sydney, and Phase 4 refined these strategies. Phase 5 evaluated the effectiveness of these strategies in improving guideline adherence. Furthermore, Phase 3 was used to develop the questionnaire which informed the data collection in Phase 5. However, as building approaches were utilised across multiple phases, the CHEWI project also utilised embedding approaches. These approaches involve linking qualitative and quantitative data collection at multiple time points across the phases of the CHEWI project.

4.3.3 Integration at the interpretation and reporting level

Data integration at the interpretation and reporting level was achieved by using approaches to integrate both through narrative and joint displays. Integrating through narrative is characterised by describing qualitative and quantitative findings in either a single or series of reports. The specific approaches used to integrate data through narrative were the staged approach and the contiguous approach. In the staged approach, each step of a multi-phase mixed methods project is analysed and published separately. This is demonstrated through each phase of the CHEWI project having a distinct chapter and/or publication in this thesis. The contiguous approach, on the other hand, presents qualitative and quantitative findings in a single report, using distinct sections for each methodological approach. This is evident in Chapter 7, presenting Phase 3 of the CHEWI project, which is a sequential mixed methods study on its own. As a result, both qualitative and quantitative

results are presented in Chapter 7 and its associated publication, however these are given distinct sections.

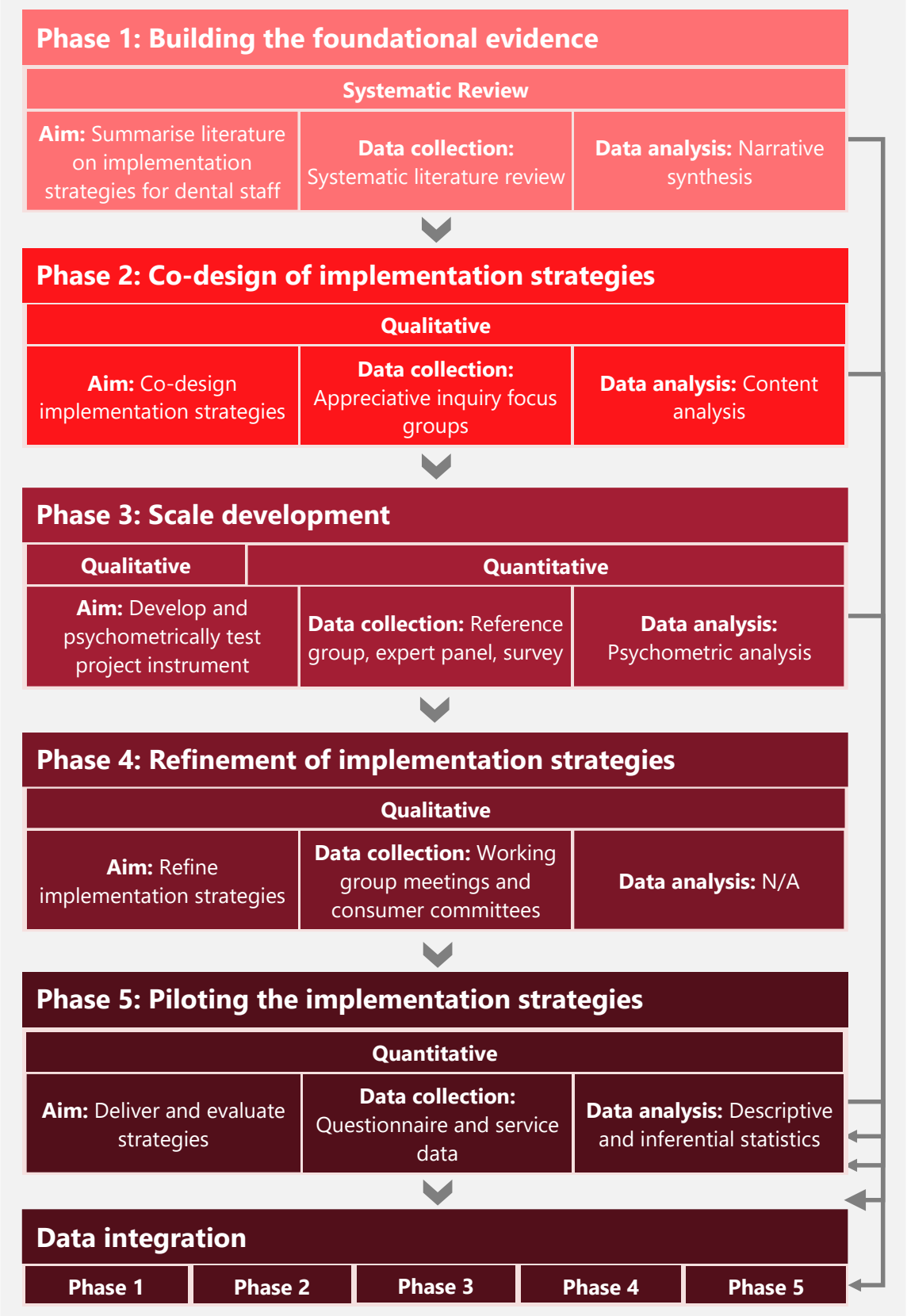

Figure 8: 5-phase approach of the CHEWI project

4.4 Ethical considerations

Ethical approval for the CHEWI project was obtained from the South Western Sydney Local Health District Human Research Ethics Committee (2019/ETH12668), and the Nepean Blue Mountains Local Health District Human Research Ethics Committee (2019/STE16374, 2019/STE16377). Reciprocal approval was also received from the Western Sydney University Human Research Ethics Committee (RH13667). The approval letters from these committees have been included in Appendix 3. As the COVID-19 pandemic began prior to data collection, amendments were made to these ethics applications to ensure the project was conducted in a safe manner, and any additional burden of participation was addressed. The principles of autonomy, beneficence and justice are considered fundamental to the ethical conduct of research. These principles are therefore reflected in the conduct of the CHEWI project as detailed in the following sections.

4.4.1 Autonomy

Autonomy is a principle that embodies a person's ability to choose for themselves and determine their own life course and can be ensured through informed consent (Aita & Richer, 2005). In research, this specifically refers to the voluntary nature of participation, and in ensuring that individuals are provided sufficient information to make rational choices about participation (Aita & Richer, 2005). In the CHEWI project, all participants were over the age of 18 years, which is the commencement of legal adulthood in Australia, and thus were deemed able to make informed decisions. Furthermore, ample information was provided to interested individuals through a variety of media, including flyers and verbal descriptions of the study, which catered to a range of literacy levels. Moreover, focus groups were scheduled in collaboration with interested individuals to ensure they were held at a convenient time and better enabled participation.

4.4.2 Beneficence

The principle of beneficence promotes obtaining findings that benefit participants or society, while ensuring the welfare of participants is maintained by minimising any risks (Aita & Richer, 2005). In order to address this principle, all consent forms used in the CHEWI project detailed both the risks and benefits of participating. Furthermore, the project was designed to minimise the burden of participation while maintaining the quality of findings, by providing compensation for participation in the form of a supermarket gift card. Alternative modes of data collection such as online focus groups and surveys were also offered to maximise participation opportunities. Potential participants were also informed that while some aspects of the research may not benefit them directly, their participation would likely benefit children and staff in general, by improving children's healthy weight screening rates and increasing the ease of these practices.

4.4.3 Justice

Justice requires the selection of research participants to be fair and equitable, particularly regarding demographic characteristics such as race, cultural background, and gender (Aita & Richer, 2005). The CHEWI project aimed to recruit a sample that was representative of the practice environments and local communities at each of the participating districts, and thus involved staff from a range of clinics and ensured dental assistants, dental therapists and oral health therapists all participated. Furthermore, investigators endeavoured to recruit parents from a variety of cultural and socioeconomic backgrounds.

4.4.4 Confidentiality

In addition to the above three principles, an important principle discussed by the National Health and Medical Research Council is confidentiality, which refers to the use of private information only for the purpose for which it was given to the researchers (National Health and Medical Research Council, 2007). Information can be considered private both

due to the content as well as the context of its communication. Parents in the CHEWI project may share health information when recalling their experiences with health promotion, which is considered private data due to its content. On the other hand, dental staff in the CHEWI project may discuss certain challenges they experienced in their practice, which may not inherently be private but could include information that they would not want their line managers to be privy to. As a result, all participants were informed that their data would be treated confidentially, only for the intended purpose, and identifiable data would not be shared or disseminated in any way. In addition, all data were deidentified prior to analysis, including focus group data, where pseudonyms were assigned to all participants. Furthermore, a data management plan was used to ensure all data was managed in a secure manner.

4.5 Impact of COVID-19

Shortly before the intended commencement of data collection for the CHEWI project, there was a global outbreak of the SARS-CoV-2 virus, otherwise referred to as the COVID-19 pandemic. This impacted the methods of the CHEWI project in several ways and required some approaches to be modified. Most of these impacts and modifications were documented and discussed in Paper 2.

4.5.1 Citation: Paper 2

Villarosa AR, Ramjan LM, Maneze D, George A. Conducting Population Health Research during the COVID-19 Pandemic: Impacts and Recommendations. Sustainability. 2021;13(6).

4.5.2 Aims: Paper 2

The aims of this paper were to discuss the impact of COVID-19 on the conduct of population health research and explore alternatives to face-to-face methods for recruitment

and data collection. Additionally, this paper reflected upon the impacts of COVID-19 on the CHEWI project and resulting modifications that were made to the methods of this project.

4.5.3 Conclusion: Paper 2

This paper found that restrictions related to COVID-19 can present a myriad of challenges that impact how population health research can be conducted. Nonetheless, alternatives to face-to-face methods have been shown to produce data of similar quality to face-to-face methods, if not higher quality, as long as these alternatives are carefully considered in light of the study aims. For the CHEWI project, the major impacts were seen on the timeline of the project, whereby the development and evaluation of the CHEWI strategies was delayed until practice resumed as normal. Furthermore, once practice had resumed as normal, there were still restrictions in place that prevented the conduct of face-to-face data collection, and as a result the focus groups in Phase 2, and the face-to-face reference group in Phase 3, were changed from face to face to online.

sustainability

MDPI

Review

Conducting Population Health Research during the COVID-19 Pandemic: Impacts and Recommendations

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Abstract: The COVID-19 pandemic has resulted in many changes, including restrictions on indoor gatherings and visitation to residential aged care facilities, hospitals and certain communities. Coupled with potential restrictions imposed by health services and academic institutions, these changes may significantly impact the conduct of population health research. However, the continuance of population health research is beneficial for the provision of health services and sometimes imperative. This paper discusses the impact of COVID-19 restrictions on the conduct of population health research. This discussion unveils important ethical considerations, as well as potential impacts on recruitment methods, face-to-face data collection, data quality and validity. In addition, this paper explores potential recruitment and data collection methods that could replace face-to-face methods. The discussion is accompanied by reflections on the challenges experienced by the authors in their own research at an oral health service during the COVID-19 pandemic and alternative methods that were utilised in place of face-to-face methods. This paper concludes that, although COVID-19 presents challenges to the conduct of population health research, there is a range of alternative methods to face-to-face recruitment and data collection. These alternative methods should be considered in light of project aims to ensure data quality is not compromised.

Keywords: population health research; public health research; COVID-19; research methods

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1. Introduction

Since the announcement of COVID-19 as a pandemic in early March, countries around the world have been instating measures to prevent its spread. Among developed countries, these measures have centered around restricting the movement and gathering of people [1,2]. In Australia, specific measures have included closures of state borders, staying at home where possible, restriction on the size of outdoor and indoor assemblies, minimum space requirements for each person in enclosed areas, and the requirement to keep a 1.5-metre distance from others [3–5]. Furthermore, measures have been taken to protect groups considered at higher risk of contracting COVID-19, such as older people, those with chronic diseases, hospitalised individuals and Aboriginal and Torres Strait Islander peoples. These measures have included restrictions of visitors to residential aged care facilities and hospitals [6,7] and restriction of movement into remote Aboriginal and Torres Strait Islander communities [8].

It is, therefore, understandable that such constraints have, and will continue to have, a significant impact on many aspects of human undertakings and social interactions, including conducting health research over this period of change. In Australia, national guidelines have been released regarding the safe conduct of clinical trials during COVID-19, which

inform contingency planning and alternative models to mitigate risks, particularly if the trial involves participants who are symptomatic for COVID-19 [9]. However, there remains a lack of such guidance for other types of research studies, including those which utilise population health research methods. Population health research, also known as public health research, has been defined as research that investigates and analyses factors that affect the health of populations or population groups or that tests and evaluates interventions to improve population health [10]. This research can employ quantitative, qualitative and mixed methods methodologies. Population health research is essential to inform health policies and programs, to ensure minimisation of gaps and inequities in healthcare provision and reduce strain on health services through preventative measures, an important consideration during COVID-19 [10]. Thus, it is essential that, where ethical and feasible, measures are taken to ensure population health research continues, particularly during this period when a number of health issues related to the pandemic and its control measures are emerging.

Over recent decades, as technology advanced and new techniques emerged, the use of alternatives to face-to-face research, such as e-research methods and secondary data sources in population health research, have been heavily critiqued. These methods have been shown to provide both benefits, such as reduced time and costs for large samples, and challenges, such as low response rates [11,12]. However, given the global situation, there is increasing pressure to reduce the need for population health researchers to conduct face-to-face research with participants [13,14]. To ensure ethical conduct of research and adherence with guidelines from governing institutions, researchers may no longer have the option to recruit participants, deliver interventions or gather data in person, and may actually be required to outline contingency plans if this becomes the case [15,16]. Thus, it is essential for researchers to consider alternative methods to undertake population health research that do not rely on face-to-face contact. The aims of this article are, therefore, to:

(i) Explore the potential impact of COVID-19 on the conduct of population health research, and
(ii) Discuss potential alternative recruitment and data collection strategies

This discussion will be supported by existing literature and supplemented with reflections from an ongoing population health research project, the conduct of which has been impacted by the COVID-19 pandemic.

2. Review of the Literature

2.1. Impact of COVID-19 on the Conduct of Population Health Research

Due to ethical considerations, policy changes and new guidelines that have arisen from the COVID-19 pandemic, the conduct of population health research has been impacted in various ways [13–16]. This section will discuss the effects of these changes in light of the current literature and reflect upon the authors' own experience of COVID-19 during their research.

2.1.1. Research and Ethics

During times of public health emergency, it is imperative for health services to prioritise responses that address issues relating to the emergency [17]. However, concurrent research that explores the general health of the population during such times, or produces evidence that supports the response, should be given equal importance. Redirecting personnel and mobilizing equipment, facilities or other resources for outbreak response in pandemics, such as COVID-19, must be balanced with the ongoing need to facilitate research, both regarding the pandemic as well as research that is unrelated to the pandemic but could benefit the health of the general population [18]. In line with this, when assessing the ethical nature of their projects, researchers need to take measures to consider the value of their projects in view of the global context of COVID-19.

As a result, healthcare bodies and ethics committees are adopting different approaches when assessing new research projects, with some organisations choosing to postpone all

face-to-face non-trial research activities and defer approval for commencement of new studies which are not related to COVID-19 [19]. Researchers will need to act in accordance with the policies and recommendations of their governing bodies during this time, and thus they may not be able to commence or continue their population health research projects.

2.1.2. Recruitment of Participants

Moreover, it has been identified that COVID-19 may be impacting vulnerable populations in a much more severe way than other population groups, and thus individuals from vulnerable population groups may experience more risk from participation in population health research [20]. However, the exclusion of such participants on the basis of being from a vulnerable population group is unethical, as any exclusion criteria must be based upon robust and current evidence [17]. Thus, the risks and benefits of involving individuals from vulnerable population groups in population health research must be carefully considered during this time, and it is vital to ensure that the benefits of participation outweigh the risks [21].

Although there is a range of recruitment methods that can be ethically employed in health research, there are several methods that could be affected by restrictions related to the COVID-19 pandemic. In the circumstance where the researcher is recruiting patients in a clinical setting that they are not a member of, changes in visitation policies may restrict the entry of the researcher to meet potential participants face-to-face [7,22]. Therefore, any recruitment methods dependent on face-to-face contact to inform potential participants and obtain consent may need to be reconsidered.

Furthermore, if the recruitment method involves clinical team members identifying eligible participants and explaining the study or being study participants themselves, there are additional factors to be considered [22]. Even prior to the pandemic, clinicians' workload and time availability already posed significant challenges to research participation [23]. This is now even more of a challenge, considering that the changes in context, practice and policy resulting from the COVID-19 pandemic have increased the workloads of clinical staff around the world. Along with the stress and burnout staff are currently experiencing, their capacity to participate in the research project may be further limited [24]. Thus, it is likely that researchers may be unable to rely upon recruitment methods or participant samples that heavily involve the input of clinicians.

In both clinical and public settings, convenience recruitment methods, such as placement of research advertisement materials in areas where people congregate, for example, clinic waiting rooms, universities or community centers, may also be affected by COVID-19 restrictions. This is due to the fact that physical distancing and closures of public spaces and community facilities could greatly reduce the number of people frequenting such areas [25]. In addition, many health services are providing temporary telehealth services for patients, circumventing the need to attend clinics in person at all [9]. In addition, many universities have taken measures to operate partially or completely online [13]. As a result, many convenience recruitment methods may not be feasible for the foreseeable future.

2.1.3. Data Collection

The safety of research participants and research staff is paramount, and due to the communicable nature of COVID-19, many institutions are mandating the suspension of face-to-face data collection methods altogether [14]. Unfortunately, many population health research methods traditionally rely on face to face contact. An example of one of these methods used in both qualitative and quantitative research is observation, which is often conducted face-to-face in the natural environment [26]. However, not only may a researcher have limited ability to access this natural environment, but furthermore, in light of physical distance measures, it may not be permissible or ethical for a researcher to observe a participant in close proximity. Data collection that requires researchers and participants to be in close contact, such as with biophysical measures, will also pose difficulties for similar

reasons [27]. Such limitations to data collection methods may impact the types of outcomes researchers can explore.

Similar to guidance stipulated for clinical trials, in cases where face-to-face data collection may proceed, it may be within the researchers' duty of care to monitor participants for COVID symptoms and/or provide COVID testing [9]. This may be particularly crucial in instances where participants and research teams will be working with healthcare services or where group data collection methods, such as focus groups, will be used. This may require modification of study methods and allocation of additional resources to monitor symptoms and conduct COVID tests, and thus may have budget and staffing implications.

In addition, COVID-19 has had a significant socioeconomic impact resulting in job losses, financial instability, and family stressors [28] which may disproportionately increase respondent burden, particularly among vulnerable populations. Respondent burden is defined as how difficult, time-consuming or emotionally stressful an individual perceives participation in a research project to be, and may result in non-responses, or lower data quality [29]. This must also be considered in choosing data collection methods.

2.1.4. Data Quality

There are some data collection methods that, although easily conducted remotely, may obtain better data quality when conducted face-to-face with a researcher. For example, questionnaire data are often more complete and of higher quality when participants are assisted or supervised by a researcher [30].

There must also be considerations regarding how the current global context may impact data validity. Workforces around the world may be required to change their workplace practices [31]. These changes have been particularly extreme for those working in healthcare settings, including additional guidelines regarding hygiene and cleaning, use of personal protective equipment, procedures used during face-to-face consultations, postponement of non-emergency care and transition of some services to telehealth [32]. Given these changes to how healthcare is being delivered and received, it is important to consider comparability of data before and after such changes occurred and that such changes may impact the internal validity of longitudinal studies [33]. Furthermore, given that some practice changes, such as postponement of non-emergency consultations, are intended as temporary measures, researchers may need to consider the generalizability and/or relevance of any data collected while these measures are in place. This phenomenon, referred to as the interaction of history and treatment, is a major threat to the external validity of study findings [34].

Overall, there is the potential for COVID-19 to significantly impact the conduct of population health research projects. In some recent scoping reviews on population oral health strategies involving the broader workforce, only five out of 75 primary research studies followed qualitative or mixed methods, which all involved direct contact with participants [35–38]. A total of 33 out of the 34 quantitative intervention studies required direct contact with participants for delivery of the intervention and/or data collection [35–38]. A further 23 of the remaining 36 quantitative observational studies also required face-to-face contact for data collection, meaning a total of 81% of primary research studies in these scoping reviews would have been impacted by COVID-19 restrictions [35–38]. For many quantitative studies, face-to-face data collection methods may be the only appropriate way to collect data, particularly where participants are considered 'hard-to-reach', that is, from socially disadvantaged or underprivileged groups [39]. This could include those who are homeless and transient, those who have a chronic mental illness, those with low literacy levels, and indigenous peoples [39]. Furthermore, investigators may choose these methods to minimise nonresponse, or for sensitive topics [30]. This highlights that depending on the research area, there is the potential for the majority of studies to be impacted.

2.2. *Alternative Recruitment and Data Collection Strategies*

Despite the impacts identified above, particularly on recruitment of participants and data collection, there are many alternatives to face-to-face data collection that could be of merit during COVID-19. This section will discuss the benefits and limitations of these alternatives and draw upon reflection from the authors' research to describe how such alternatives could be implemented.

2.2.1. Recruitment Strategies

Although face-to-face and certain convenience recruitment methods may not be feasible during a pandemic, there is a range of other recruitment methods that may be used. These include distribution of advertisement material via emails, letters, phone calls and the use of social media platforms. Evidence suggests that second to face-to-face recruitment, telephone recruitment may result in the highest response rates from participants and thus should be considered as an alternative during COVID-19 [40]. Limitations are that such methods can be costly and time-consuming, with one study reporting that telephone recruitment resulted in 1680 h spent on the phone and a total cost of $79 USD per participant [40]. Mailing advertising materials was shown to have a similar response rate [40] while incurring lower costs, with one study citing costs of printing and postage to be around $52 USD per participant [41].

With the advancement of online technology, research has highlighted the merit of online recruitment methods in health research. Although emailing of advertising materials may result in lower response rates than telephone or postal mail methods, it enables the identification and contact of a higher number of eligible participants [42]. Furthermore, with the growing popularity of various online and social media platforms, which are now being accessed by millions of people, their value as a recruitment tool is increasingly recognised [42]. Research indicates recruitment via social media remains valid in the COVID-19 context and has been able to reach a large number of participants [43]. One of the most commonly used platforms for research recruitment is Facebook, with its advantages of being the largest social media platform and having the ability for targeted advertisements to be shown to people with specific demographic characteristics, thereby, increasing chances of identifying eligible individuals [42]. This may also be considerably more cost-effective than other methods, with costs per participant reported to be from $0.60 to $20 USD [42]. Similarly, Instagram, which is owned by Facebook, can create similar targeted advertisements, which can also be linked to Facebook. However, Instagram users are generally a younger demographic, thus desired participant demographics should be taken into consideration when using these social media platforms for recruitment [44]. Twitter is also a commonly used platform, where users can pay for posts to be promoted, that is, displayed in feeds of users who do not follow the posting account, however, it is not able to target advertisements based on specific demographic characteristics [44]. Studies have also reported advertisements on search engines, such as Google, to be an effective recruitment strategy, and may have similar costs when compared to advertisements on social media platforms [45]. Despite the known merits of online recruitment methods, it has also been identified that samples from social media strategies can be biased, reducing diversity in age, socioeconomic status, location and ethnic background, and often result in lower retention rates [40–42,45]. Thus, in designing an online recruitment strategy, researchers should consider the potential limitations of these methods and have strategies in place to ensure a representative sample [43].

2.2.2. Data Collection Strategies

As discussed previously, face-to-face quantitative data collection methods, such as observations, biophysical measures and face-to-face questionnaires, may no longer be feasible or ethical during this period. However, there are several alternative data collection options. An example of this is the retrospective review of medical records, particularly electronic medical records, preventing unnecessary visits to healthcare facilities, with the

added advantage of increased accessibility to a larger volume of patient data [46]. Medical records can be an effective and valid source of data for outcomes, such as length of stay, discharge destination and diagnosis, and thus should be considered as alternative data sources during the COVID-19 pandemic [46,47]. However, there are some variations seen between medical records and other forms of data collection, and this should be considered, for example, when interpreting results [48,49]. Another potential alternative to observations or physical measures is self-report. Studies have shown this to be valid for measures, such as weight, height and physical activity, and therefore, could serve as valid proxy measures for physical measurements [50,51]. However, some inaccuracies are seen in self-report of less socially accepted behaviors, such as cigarette smoking status [52]. This phenomenon of self-report bias is well recognised in the literature, however, when these limitations are acknowledged and accounted for, self-report data can still provide significant contributions to the existing body of evidence [53]. Compared to using medical records and self-report data in place of observations and physical measures, adapting face-to-face questionnaires for mail, telephone or online modes seems much more straightforward. Despite the idea that face-to-face questionnaires provide higher data quality, evidence continues to emerge that telephone, mail and online questionnaires yield sufficiently similar data quality and thus may be viable alternatives during COVID-19 [54,55].

The use of alternative methods when face-to-face options are not possible is probably more controversial when it comes to qualitative methodologies. For example, the use of telephone interviews for qualitative research has been widely criticised, with suspected losses of contextual and nonverbal data due to the absence of visual cues, as well as a lack of rapport and probing, making interpretation more challenging [56]. However, there is a lack of evidence to support these claims, which currently suggests that quality of data from telephone interviews is similar to that from face-to-face interviews, thus telephone interviews could be a simple alternative to use during COVID-19 [56,57]. Additionally, as various online platforms become more accessible with advancements in technology, the popularity of conducting interviews via online means is increasing [58]. Email has been used as a platform for qualitative interviews for years, although it presents some challenges regarding trustworthiness of data, specifically credibility, and also requires asynchronous interview techniques to be considered [58,59]. However, it has also been recognised as a viable and convenient method that may be particularly useful during COVID-19 [58,59]. Moreover, synchronous online qualitative interviews have become more feasible in recent years due to widespread access to electronic devices and internet connections, improvements in internet speeds and improvements in instant messaging and video conferencing software, such as Skype [60–62]. These platforms overcome the challenges presented with asynchronous interviews, and although instant messaging does not allow for visual cues, video conferencing does [61,62]. These methods are particularly valuable during times of limited flexibility or access to research participants, such as COVID-19, and have the potential to produce data comparable to face-to-face interviews, as long as any technical difficulties are considered and addressed [60–62]. Online methods may also be viable alternatives for the conduct of focus groups during COVID-19. For example, online discussion boards have been effectively used as an alternative to face-to-face focus groups, despite having similar limitations to other asynchronous online qualitative methods [63]. Likewise, the use of video conferencing software, such as Skype, may have similar effectiveness for focus groups as when used with interviews [60,63,64].

3. Reflection

3.1. Impact of COVID-19 on the Conduct of the Authors' Project

The authors' own research project aims to develop and evaluate a guideline implementation strategy to facilitate the translation of children's healthy weight guidelines for public oral health staff into practice. All primary research associated with this project is centred around two phases: (i) Developing the guideline implementation strategy using co-design focus groups and input from an expert panel, and (ii) evaluation of the guideline

implementation strategy using a pretest-posttest design and a validated questionnaire. Although ethical approval had already been obtained for the conduct of the project, this was done prior to the announcement of the pandemic, and the authors anticipated modification of study methods, and therefore, ethics amendments may be required. Data collection was scheduled to commence just as the pandemic was announced.

As the first phase was based around face-to-face focus groups with both public dental practitioners and parents of children in the community, the authors immediately had concerns regarding the safety and logistics of such gatherings in an enclosed space. Moreover, the implementation of children's healthy weight guidelines for public oral health staff was dependent on routine care being provided at the public oral health services. However, as a response to the COVID-19 pandemic, the participating public oral health services were only providing emergency care at the scheduled time of data collection, and many staff were being redeployed to COVID-19 testing clinics. As a result, the internal and external validity of any data collected during this time of altered practice would be greatly compromised if data collection were to proceed. Finally, as the authors intended to use convenience methods to recruit parents by distributing flyers in oral health service waiting rooms, it was anticipated that these recruitment methods would need modification. Therefore, it was determined that the development and evaluation of the guideline implementation strategy should be postponed until routine dental practice resumed. Once this time came, it was anticipated that the recruitment and data collection strategies would need to be modified to ensure the most effective methods were chosen, and risks to participants were minimised.

3.2. Alternative Recruitment and Data Collection Strategies

As stated in the previous section, primarily due to internal validity concerns, the development and evaluation of the guideline implementation strategy for the authors' research project were postponed until the dental services could resume practice as normal. Even with the inability to undertake the development and evaluation component as planned, there were still research activities that could be undertaken during this time. This included the development and evaluation of the questionnaire that would be used to assess the guideline implementation strategy. The authors initially planned to take a five-step validation process for the questionnaire: (i) Item generation using a review of the literature, (ii) face validation using a face-to-face reference group, (iii) construct validation using an online questionnaire with an expert panel, (iv) pilot testing and (v) factorial validation using a large online sample. Once the COVID-19 restrictions were instated, the authors scrutinised this process and realised that very few face-to-face steps were included in the process, and the face-to-face steps that were included could be easily modified to instead utilise alternative data collection strategies with minimal impact on data quality.

The main step requiring modification was step 2: Face validation using a face-to-face reference group. The first consideration was the recruitment method, which although it was already intended to be purposive recruitment via email, the original participation incentive was provision of refreshments during the time of the reference group. As this reference group would no longer be assembling face-to-face, the authors decided to reallocate the funds for the light refreshments to supermarket gift vouchers, and this change was approved by the governing ethics committee. This more direct method to reimburse time and effort of participation was also deemed necessary due to the potential of increased respondent burden that participants may be feeling during this time.

In addition, the data collection method also required modification. The reference group became a virtual, online reference group conducted via email. With the difficulties that the enforced lockdown presented for participants, including the need for child minding, homeschooling and redeployment of health staff, it was agreed that this method would increase flexibility, allowing a two-week period where participants could provide feedback at their convenience. As per the initial design, this reference group did not require synchronous discussion, rather, each participant was to provide written feedback on their

own hard copy of the questionnaire. Thus, the asynchronous format of providing the same briefing and feedback via email was seen to have minimal impact on the quality of data obtained. Using these methods, the authors were able to successfully obtain complete feedback on the questionnaire from all four members of the reference group.

Shortly after the questionnaire validation was completed, practice at the dental health services resumed as normal, therefore, the development and evaluation of the guideline implementation strategy could proceed. However, the authors were increasingly aware that the risks of COVID-19 with face to face data collection may not change in the near future. As a result, it was concluded that alternative data collection strategies would be implemented for the remainder of the project to eliminate the need for face to face contact. For the focus groups, it was decided that internet videoconferencing would be the best way to go, as visual brainstorming was an essential component of the focus group. Despite concerns about accessibility of videoconferencing software for study participants, throughout recruitment, it was found that participants preferred participating via videoconferencing, with platforms, such as Zoom, becoming more familiar to them over lockdown periods. A total of four videoconference focus groups were conducted for the project, and the authors were able to still utilise conventional focus group techniques to collect rich data from all participants. While the evaluation phase of this study is yet to commence, it was concluded that administering the evaluation questionnaires via an online survey platform would be an appropriate alternative to hard copy questionnaires. To ensure response rates are as high as possible in this phase, study champions will be nominated at each study site to help promote and coordinate this step. It is hypothesised that the authors' careful consideration of the possible alternatives to data collection and recruitment contributed to the success of these substitute methods, which have traditionally been considered less desirable.

4. Conclusions

COVID-19 presents a range of challenges that can impact the conduct and quality of population health research. Regardless, there is a range of alternative strategies that can be employed to facilitate the safe and effective conduct of population health research during uncertain times. While all research methods have their own strengths and limitations, researchers should carefully consider the methods most appropriate for their study's specific needs without compromising the quality of their data.

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References

1. California Department of Public Health. COVID-19. Available online: https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Immunization/ncov2019.aspx (accessed on 19 May 2020).
2. Cabinet Office. Coronavirus Outbreak FAQs: What You Can and Can't Do. Available online: https://www.gov.uk/government/publications/coronavirus-outbreak-faqs-what-you-can-and-cant-do/coronavirus-outbreak-faqs-what-you-can-and-cant-do (accessed on 19 May 2020).
3. NSW Government. What You Can and Can't Do under the Rules. Available online: https://www.nsw.gov.au/covid-19/what-you-can-and-cant-do-under-rules (accessed on 19 May 2020).
4. Victoria State Government. Stay at Home Restrictions. Available online: https://www.dhhs.vic.gov.au/stay-home-restrictions-coronavirus (accessed on 19 May 2020).

5. Government of Western Australia. COVID-19 Coronavirus: Community Advice. Available online: https://www.wa.gov.au/organisation/department-of-the-premier-and-cabinet/covid-19-coronavirus-community-advice (accessed on 19 May 2020).
6. Australian Government. Coronavirus (COVID-19) Advice for People in Aged Care Facilities. Available online: https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov-health-alert/advice-for-people-at-risk-of-coronavirus-covid-19/coronavirus-covid-19-advice-for-people-in-aged-care-facilities (accessed on 21 May 2020).
7. Government of Western Australia. COVID-19 Public Hospital Visitor Guidelines. Available online: https://healthywa.wa.gov.au/~{}/media/Files/Corporate/general%20documents/Infectious%20diseases/PDF/Coronavirus/COVID-19-Public-Hospital-Visitor-Guidelines.pdf (accessed on 21 May 2020).
8. Australian Government. Coronavirus (COVID-19) Advice for Aboriginal and Torres Strait Islander People and Remote Communities. Available online: https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov-health-alert/advice-for-people-at-risk-of-coronavirus-covid-19/coronavirus-covid-19-advice-for-aboriginal-and-torres-strait-islander-peoples-and-remote-communities (accessed on 21 May 2020).
9. Australian Government. COVID-19 Temporary MBS Telehealth Services. Available online: http://www.mbsonline.gov.au/internet/mbsonline/publishing.nsf/Content/Factsheet-TempBB (accessed on 1 June 2020).
10. Centre for Epidemiology and Evidence. *Population Health Research Strategy 2018–2022*; NSW Ministry of Health: Sydney, NSW, Australia, 2019.
11. Benfield, J.; Szlemko, W. Internet-Based Data Collection: Promises and Realities. *J. Res. Pract.* **2006**, *2*, D1.
12. Knottnerus, J.A.; Tugwell, P. Requirements for utilizing health care—Based data sources for research. *J. Clin. Epidemiol.* **2011**, *64*, 1051–1053. [CrossRef] [PubMed]
13. Western Sydney University. Information on Coronavirus (COVID-19). Available online: https://www.westernsydney.edu.au/coronavirus-information.html (accessed on 1 June 2020).
14. American Psychological Association. Conducting Research during the COVID-19 Pandemic: Advice from Psychological Researchers on Protecting Participants, Animals and Research Plans. Available online: https://www.apa.org/news/apa/2020/03/conducting-research-covid-19 (accessed on 21 May 2020).
15. Charles Sturt University. Funding and Grants: COVID-19. Available online: https://research.csu.edu.au/funding-and-grants (accessed on 24 May 2020).
16. Australian Research Council. ARC Post Award Guidance Including Major Investments: Responding to the Impact of COVID-19. Available online: https://www.arc.gov.au/arc-post-award-guidance-including-major-investments-responding-impact-covid-19 (accessed on 24 May 2020).
17. WHO Working Group on Ethics & COVID-19. *Ethical Standards for Research during Public Health Emergencies: Distilling Existing Guidance to Support COVID-19 R&D*; World Health Organisation: Geneva, Switzerland, 2020.
18. Lurie, N.; Manolio, T.; Patterson, A.P.; Collins, F.; Frieden, T. Research as a Part of Public Health Emergency Response. *N. Engl. J. Med.* **2013**, *368*, 1251–1255. [CrossRef]
19. Austin Health. Contingency Plan for COVID19 Interruption to Non-Drug/Non-Device Studies. Available online: https://www.austin.org.au/Assets/Files/OfR_Austin%20Health%20COVID%20guidelines%20non-drug%20non-device%20studies_20200324.pdf (accessed on 1 June 2020).
20. United Nations. UN Working to Ensure Vulnerable Groups Not Left behind in COVID-19 Response. Available online: https://www.un.org/en/un-coronavirus-communications-team/un-working-ensure-vulnerable-groups-not-left-behind-covid-19 (accessed on 1 June 2020).
21. National Academies of Sciences, Engineering, and Medicine; Committee on Clinical Trials during the 2014–2015 Ebola Outbreak; Board on Global Health; Board on Health Scienves Policy; Health and Medicine Division. Conducting clinical research during an epidemic. In *Integrating Clinical Research into Epidemic Response: The Ebola Experience*; Keusch, G., McAdam, K.P., Busta, E.R., Mancher, M., Cuff, P.A., Eds.; National Academies Press: Washington, DC, USA, 2017.
22. Sydney Local Health Discrict. Recruitment and Privacy. Available online: https://www.slhd.nsw.gov.au/rpa/research/recruitment.html (accessed on 24 May 2020).
23. Asch, S.; Connor, S.E.; Hamilton, E.G.; Fox, S.A. Problems in recruiting community-based physicians for health services research. *J. Gen. Intern. Med.* **2000**, *15*, 591–599. [CrossRef]
24. Liu, Q.; Luo, D.; Haase, J.E.; Guo, Q.; Wang, X.Q.; Liu, S.; Xia, L.; Liu, Z.; Yang, J.; Yang, B.X. The experiences of health-care providers during the COVID-19 crisis in China: A qualitative study. *Lancet Glob. Health* **2020**, *8*, e790–e798. [CrossRef]
25. ACT Government. ACT Government Public Spaces Closed. Available online: https://www.covid19.act.gov.au/news-articles/act-government-public-spaces-closed (accessed on 1 June 2020).
26. Whitehead, D.; Whitehead, L. Sampling data and data collection in qualitative research. In *Nursing and Midwifery Research*, 5th ed.; Schneider, Z., Whitehead, D., LoBiondo-Wood, G., Haber, J., Eds.; Elsevier Australia: Chatswood, NSW, Australia, 2016; pp. 111–126.
27. Da Costa, C.; Schneider, Z. Quantitative data collection and study validity. In *Nursing and Midwifery Research*, 5th ed.; Schneider, Z., Whitehead, D., LoBiondo-Wood, G., Haber, J., Eds.; Elsevier Australia: Chatswood, NSW, Australia, 2016; pp. 181–196.
28. Nicola, M.; Alsafi, Z.; Sohrabi, C.; Kerwan, A.; Al-Jabir, A.; Iosifidis, C.; Agha, M.; Agha, R. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *Int. J. Surg.* **2020**, *78*, 185–193. [CrossRef]

29. Graf, I. Respondent Burden. In *Encyclopedia of Survey Research Methods*; Lavrakas, P.J., Ed.; SAGE Publications, Inc.: Thousand Oaks, CA, USA, 2008; pp. 739–740. [CrossRef]
30. Lavrakas, P.J. (Ed.) Face-to-face interviewing. In *Encyclopedia of Survey Research Methods*; SAGE Publications, Inc.: Thousand Oaks, CA, USA, 2008. [CrossRef]
31. Australian Government. Coronavirus Disease (COVID-19): Information for Employers. Available online: https://www.health.gov.au/sites/default/files/documents/2020/04/coronavirus-covid-19-information-for-employers_2.pdf (accessed on 9 June 2020).
32. Australian Government. Coronavirus (COVID-19) Advice for the Health and Aged Care Sector. Available online: https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov-health-alert/coronavirus-covid-19-advice-for-the-health-and-aged-care-sector (accessed on 9 June 2020).
33. Shields, L.; Smyth, W. Common quantitative methods. In *Nursing and Midwifery Research*, 5th ed.; Schneider, Z., Whitehead, D., LoBiondo-Wood, G., Haber, J., Eds.; Elsevier Australia: Chatswood, NSW, Australia, 2016; pp. 143–164.
34. Ferguson, L. External Validity, Generalizability, and Knowledge Utilization. *J. Nurs. Scholarsh.* **2004**, *36*, 16–22. [CrossRef] [PubMed]
35. Kwok, C.; McIntyre, A.; Janzen, S.; Mays, R.; Teasell, R. Oral care post stroke: A scoping review. *J. Oral Rehabil.* **2015**, *42*, 65–74. [CrossRef] [PubMed]
36. Poudel, P.; Griffiths, R.; Wong, V.W.; Arora, A.; Flack, J.R.; Khoo, C.L.; George, A. Oral health knowledge, attitudes and care practices of people with diabetes: A systematic review. *BMC Public Health* **2018**, *18*, 577. [CrossRef]
37. Villarosa, A.C.; Villarosa, A.R.; Salamonson, Y.; Ramjan, L.M.; Sousa, M.S.; Srinivas, R.; Jones, N.; George, A. The role of indigenous health workers in promoting oral health during pregnancy: A scoping review. *BMC Public Health* **2018**, *18*, 381. [CrossRef] [PubMed]
38. Villarosa, A.R.; George, D.; Ramjan, L.M.; Srinivas, R.; George, A. The role of dental practitioners in addressing overweight and obesity among children: A scoping review of current interventions and strategies. *Obes. Res. Clin. Pract.* **2018**, *12*, 405–415. [CrossRef] [PubMed]
39. Bonevski, B.; Randell, M.; Paul, C.; Chapman, K.; Twyman, L.; Bryant, J.; Brozek, I.; Hughes, C. Reaching the hard-to-reach: A systematic review of strategies for improving health and medical research with socially disadvantaged groups. *BMC Med Res. Methodol.* **2014**, *14*, 42. [CrossRef] [PubMed]
40. Heerman, W.J.; Jackson, N.; Roumie, C.L.; Harris, P.A.; Rosenbloom, S.T.; Pulley, J.; Wilkins, C.H.; Williams, N.A.; Crenshaw, D.; Leak, C.; et al. Recruitment methods for survey research: Findings from the Mid-South Clinical Data Research Network. *Contemp. Clin. Trials* **2017**, *62*, 50–55. [CrossRef] [PubMed]
41. Peel, R.; Ren, S.; Hure, A.; Evans, T.J.; D'Este, C.A.; Abhayaratna, W.P.; Tonkin, A.M.; Hopper, I.; Thrift, A.G.; Levi, C.R.; et al. Evaluating recruitment strategies for AUSPICE, a large Australian community-based randomised controlled trial. *Med. J. Aust.* **2019**, *210*, 409–415. [CrossRef]
42. Amon, K.L.; Campbell, A.J.; Hawke, C.; Steinbeck, K. Facebook as a Recruitment Tool for Adolescent Health Research: A Systematic Review. *Acad. Pediatrics* **2014**, *14*, 439–447.e4. [CrossRef]
43. Ali, S.H.; Foreman, J.; Capasso, A.; Jones, A.M.; Tozan, Y.; DiClemente, R.J. Social media as a recruitment platform for a nationwide online survey of COVID-19 knowledge, beliefs, and practices in the United States: Methodology and feasibility analysis. *BMC Med. Res. Methodol.* **2020**, *20*, 116. [CrossRef]
44. Arigo, D.; Pagoto, S.; Carter-Harris, L.; Lillie, S.E.; Nebeker, C. Using social media for health research: Methodological and ethical considerations for recruitment and intervention delivery. *Digit. Health* **2018**, *4*, 2055207618771757. [CrossRef]
45. Lane, T.S.; Armin, J.; Gordon, J.S. Online Recruitment Methods for Web-Based and Mobile Health Studies: A Review of the Literature. *J. Med. Internet Res.* **2015**, *17*, e183. [CrossRef] [PubMed]
46. Sarkies, M.N.; Bowles, K.A.; Skinner, E.H.; Mitchell, D.; Haas, R.; Ho, M.; Salter, K.; May, K.; Markham, D.; O'Brien, L.; et al. Data Collection Methods in Health Services Research. *Appl. Clin. Inform.* **2015**, *6*, 96–109. [CrossRef]
47. Tirschwell, D.L.; Longstreth, W.T., Jr. Validating administrative data in stroke research. *Stroke* **2002**, *33*, 2465–2470. [CrossRef]
48. Greiver, M.; Barnsley, J.; Glazier, R.H.; Harvey, B.J.; Moineddin, R. Measuring data reliability for preventive services in electronic medical records. *BMC Health Serv. Res.* **2012**, *12*, 116. [CrossRef]
49. Kennedy, A.D.M.; Leigh-Brown, A.P.; Torgerson, D.J.; Campbell, J.; Grant, A. Resource use data by patient report or hospital records: Do they agree? *BMC Health Serv. Res.* **2002**, *2*, 2. [CrossRef]
50. Davies, A.; Wellard-Cole, L.; Rangan, A.; Allman-Farinelli, M. Validity of self-reported weight and height for BMI classification: A cross-sectional study among young adults. *Nutrition* **2020**, *71*, 110622. [CrossRef] [PubMed]
51. Gosney, J.L.; Scott, J.A.; Snook, E.M.; Motl, R.W. Physical Activity and Multiple Sclerosis: Validity of Self-Report and Objective Measures. *Fam. Community Health* **2007**, *30*, 144–150. [CrossRef]
52. Wong, S.L.; Shields, M.; Leatherdale, S.; Malaison, E.; Hammond, D. Assessment of validity of self-reported smoking status. *Health Rep.* **2012**, *23*, D1.
53. Althubaiti, A. Information bias in health research: Definition, pitfalls, and adjustment methods. *J. Multidiscip. Healthc.* **2016**, *9*, 211–217. [CrossRef] [PubMed]
54. De Leeuw, E. (Ed.) *Data Quality in Mail, Telephone and Face to Face Surveys*; T. T. Publikaties: Amsterdam, The Netherlands, 1993; Volume 38, pp. 80–81.

55. Teo, T. Online and paper-based survey data: Are they equivalent? *Br. J. Educ. Technol.* **2013**, *44*, E196–E198. [CrossRef]
56. Novick, G. Is there a bias against telephone interviews in qualitative research? *Res. Nurs. Health* **2008**, *31*, 391–398. [CrossRef]
57. Vogl, S. Telephone Versus Face-to-Face Interviews: Mode Effect on Semistructured Interviews with Children. *Sociol. Methodol.* **2013**, *43*, 133–177. [CrossRef]
58. James, N.; Busher, H. Credibility, authenticity and voice: Dilemmas in online interviewing. *Qual. Res.* **2006**, *6*, 403–420. [CrossRef]
59. Meho, L.I. E-mail interviewing in qualitative research: A methodological discussion. *J. Am. Soc. Inf. Sci. Technol.* **2006**, *57*, 1284–1295. [CrossRef]
60. Janghorban, R.; Roudsari, R.L.; Taghipour, A. Skype interviewing: The new generation of online synchronous interview in qualitative research. *Int. J. Qual. Stud. Health Well-Being* **2014**, *9*, 24152. [CrossRef] [PubMed]
61. Mirick, R.; Wladkowski, S. Skype in Qualitative Interviews: Participant and Researcher Perspectives. *Qual. Rep.* **2019**, *24*, 3061–3072.
62. Pearce, G.; Thøgersen-Ntoumani, C.; Duda, J.L. The development of synchronous text-based instant messaging as an online interviewing tool. *Int. J. Soc. Res. Methodol.* **2014**, *17*, 677–692. [CrossRef]
63. Lally, R.; Eisenhauer, C.; Buckland, S.; Kupzyk, K. Feasibility of Synchronous Online Focus Groups of Rural Breast Cancer Survivors on Web-Based Distress Self-Management. *Oncol. Nurs. Forum* **2018**, *45*, E111–E124. [CrossRef] [PubMed]
64. Rosenthal, M. Qualitative research methods: Why, when, and how to conduct interviews and focus groups in pharmacy research. *Curr. Pharm. Teach. Learn.* **2016**, *8*, 509–516. [CrossRef]

4.6 Summary

This chapter described the methods that were used to conduct the CHEWI project across the five sequential exploratory phases, and how the phases were integrated at the design, methods, interpretation, and reporting levels. Furthermore, it highlighted the ethical considerations for this project, centred around the principles of autonomy, beneficence, justice, and confidentiality. Finally, this chapter detailed the impacts of COVID-19 on the conduct of the CHEWI project, and the methods that were modified in response to these impacts.

Chapter 5

Results, Phase 1: Building the foundational evidence on guideline implementation strategies for the dental setting

5.1 Introduction

This chapter presents the findings from Phase 1 of this project. Specifically, systematic review findings are presented, which summarise effective guideline implementation strategies for the dental setting. These findings are presented as a peer-reviewed journal article, published in Implementation Science, and serve as foundational evidence which informed the subsequent phases of this project. This chapter is presented as a brief overview of the aims of Phase 1 and an introduction to the resulting publication, Paper 3, followed by the publication itself, and finally a brief conclusion to summarise these findings.

5.2 Phase 1 overview

The aim of this phase was to examine the evidence surrounding the effectiveness of various guideline implementation strategies in the dental setting. This phase, presented as Paper 3, identifies a paucity of literature surrounding effective guideline implementation strategies specifically for the dental setting. In response to this, a systematic review is presented to explore the effectiveness of guideline implementation strategies in the dental setting. This paper then discusses the effectiveness of these strategies, compares these findings with other health settings and concludes by proposing the most effective strategies for the dental setting.

5.3 Citation: Paper 3

Villarosa AR, Maneze D, Ramjan LM, Srinivas R, Camilleri M, George A. The effectiveness of guideline implementation strategies in the dental setting: a systematic review. Implement Sci. 2019;14(1):106.

5.4 Conclusion

Paper 3 highlighted implementation strategies that have been effective in other settings, such as audit and feedback, reminders, education, patient-mediated interventions, and multifaceted interventions that may also be effective in the dental setting. In addition, this study identified pay for performance as a potentially effective strategy in the dental setting, despite its limited effectiveness in other settings.

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Implementation Science

SYSTEMATIC REVIEW Open Access

The effectiveness of guideline implementation strategies in the dental setting: a systematic review

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Abstract

Background: Guideline implementation has been an ongoing challenge in the dental practice setting. Despite this, there are no reviews summarising the existing evidence regarding effective guideline implementation strategies in this setting. In order to address this, this systematic review examines the effectiveness of guideline implementation strategies in the dental practice setting.

Methods: A systematic search was undertaken according to the PRISMA statement across nine electronic databases, targeting randomised controlled trials and quasi-experimental studies which evaluated the effectiveness of guideline implementation strategies in improving guideline adherence in the dental setting. All records were independently examined for relevance and appraised for study quality by two authors, with consensus achieved by a third author. Data were extracted from included studies using a standardised data extraction pro forma.

Results: A total of 15 records were eligible for inclusion in this review, which focused on the effects of audit and feedback, reminders, education, patient-mediated interventions, pay for performance and multifaceted interventions. Although there were some conflicting evidence, studies within each category of implementation strategy indicated a positive effect on guideline adherence.

Conclusions: This study has identified education, reminders and multifaceted interventions as effective implementation strategies for the dental practice setting. Although this is similar to research findings from other health sectors, there is some evidence to suggest patient-mediated interventions may be less effective and pay for performance may be more effective in the dental setting. These findings can inform policy makers, professional associations, colleges and organisations in the future adoption of clinical guidelines in the dental practice setting.

Trial registration: This systematic review was registered with the International Prospective Register of Systematic Reviews (PROSPERO), registration ID CRD42018093023.

Keywords: Dentistry, Implementation, Clinical guidelines

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Contributions to the literature

- Research summarising the effectiveness of guideline implementation strategies remains inconclusive and lacks focus on the dental setting, which has some of the lowest rates of guideline adherence.
- Similar to findings in other settings, audit and feedback, reminders, education, patient-mediated interventions and multifaceted interventions may be effective in the dental setting, and this study identified pay for performance as an additional effective strategy.
- These findings contribute to a recognised gap in the literature, by highlighting which implementation strategies may be the most effective for dental practitioners, which can serve to inform the future adoption of clinical guidelines in this sector.

Background

With a growing emphasis on evidence-based practice in the clinical setting, health services are developing increasing numbers of clinical guidelines to direct more efficient clinical practice. Defined as "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances", clinical guidelines delineate appropriate and inappropriate care [1]. The overall goal of developing clinical guidelines is to improve the quality of care provided to patients by increasing clinical efficiency reducing inappropriate practices, thereby improving patient outcomes [2, 3]. They can also be a resource to inform patients regarding their clinicians' decisions, and drive public policy by drawing attention to areas of need [4]. In addition, clinical guidelines can afford benefits to health care professionals as they can improve the quality of clinical decisions, support quality improvement activities and highlight gaps in the evidence, thus encouraging further research [4].

Despite the growing number of guidelines, the success of their use to change or introduce evidence-based health practices, otherwise known as implementation, is variable [5]. It has been acknowledged that the mere existence of clinical guidelines will not necessarily result in their implementation [6]. Research identifying determinants of guideline implementation across various settings has been extensively undertaken across the globe and has highlighted a myriad of factors that can impact the successful use of clinical guidelines [7–12]. These include individual health professional factors such as knowledge, awareness, self-efficacy, expectancy of positive outcomes, attitudes and intention [2, 7–14], as well as patient factors, such as applicability of guidelines to patients, patient preferences and behaviour [7, 8, 11]. Other factors such as organisational and environmental factors, as well as guideline complexity, can also potentially impact a clinician's decision or ability to adhere to clinical guidelines [7–12, 14]. Therefore, guideline implementation strategies seek to address these potential barriers to compliance, and facilitate the application of new guidelines into practice [15].

Although research has focussed on evaluating which implementation strategies are the most effective in changing practice [16, 17], the evidence from these reviews were inconclusive, and often included studies that were most common in acute care or general practice settings [16, 17]. It has been acknowledged that these findings may not be applicable to other settings, such as the dental setting, which research suggests could be one of the clinical areas with lowest guideline compliance [18]. The dental setting has unique contextual factors that may impact the uptake of new guidelines, and these need to be considered when developing guideline implementation strategies [17, 19–21]. For example, the size of dental practices is highly variable, with some practitioners operating alone, and other practices involving more than 10 practitioners. This may have an influence on the success of guideline implementation, with evidence suggesting larger practices are more likely to comply with clinical guidelines [19]. With the push for dental practitioners to expand their scope of practice to include addressing health issues such as tobacco cessation [22], diabetes [23] and childhood obesity [24], it is essential to identify effective guideline implementation strategies specifically in the dental setting. With no studies synthesising the available findings in this area, the aim of this systematic review was to explore the effectiveness of various guideline implementation strategies in improving dental practitioners' adherence to any clinical guidelines. This review specifically focussed on identifying changes in dental practitioners' adherence, that is behaviour change, to any clinical guidelines they may have to follow, both dental and non-dental.

Methods

Research design

A systematic review was conducted according to the framework developed by Khan et al. [25] and reported according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement (Additional file 1) [26]. This approach was chosen as it appropriately addressed the study aims to systematically synthesise the existing evidence regarding the effectiveness of each type of implementation strategy. Several study authors are experienced in systematic review methodologies, having published multiple systematic reviews across various fields [27–30].

Searches

Databases including Scopus, CINAHL, MEDLINE, ProQuest, Embase, Cochrane, PsycINFO and Web of Science, as well as Google Scholar, were extensively searched from October 2018 to April 2019 (Additional file 2). With the assistance of a librarian, a combination of Boolean operators, truncations and Medical Subject Headings (MeSH) were used to develop individualised search strategies according to the indexing terms of each database. These search strategies incorporated key words such as *guideline, recommendation, consensus, implementation, dissemination, translation, strategy, approach, intervention,* and *dentist*. Upon identification of relevant articles, the reference lists and any cited references were manually searched for further relevant literature. This search strategy was deemed to meet the PRESS Checklist for Elements for the Peer Review of Electronic Search Strategies [31] (Additional file 3).

Study inclusion and exclusion criteria

All articles that were relevant to the study aims and published in the searched databases from inception up to 7 April 2019 were eligible for inclusion in this review. Inclusion and exclusion criteria have been presented in Table 1 according to the Population, Intervention, Control, Outcome (PICO) framework. Included studies followed experimental or quasi-experimental designs, including randomised controlled trials, pretest-posttest studies, interrupted time series studies and non-equivalent groups studies. Observational studies such as cross-sectional surveys, case-control studies and cohort studies were excluded from this review.

Terminology

There are numerous health professionals that provide dental care to individuals. Among the most well-known are dentists, who can practice in general dentistry, or go on to specialise in various areas, including endodontics, periodontics, orthodontics and special needs dentistry [32–34]. However other dental practitioners work as part of the dental team to provide direct care to individuals, including dental assistants, dental therapists and dental hygienists [33, 35, 36]. In this review, the term *dental practice* was used to encompass all of the above professions, and *dental practitioner* encompassed the care providers working in these professions. Previous systematic reviews have commonly categorised implementation strategies into *single interventions*, which utilise a sole strategy, such as audit and feedback, education or reminders, and *multifaceted interventions*, which utilise multiple strategies concurrently [16, 17]. These terms were also used to classify implementation strategies in this review.

Table 1 Inclusion and exclusion criteria according to the PICO framework

Population	
Inclusion criteria	• Participants with a qualification in any dental profession. This could include dentists, specialists in endodontics, periodontics, orthodontics and special needs dentistry, dental assistants, dental therapists and dental hygienists • Participants that practiced in a clinical dental care setting
Exclusion criteria	• Participants that follow oral- or dental-related guidelines but are not a dental practitioner, for example an ear, nose and throat surgeon or a nurse providing oral care
Intervention	
Inclusion criteria	• Any strategy that was utilised to facilitate the implementation of clinical guidelines into practice. These could include single interventions, which utilise a sole strategy, such as audit and feedback, education or reminders, and multifaceted interventions, which utilise multiple strategies concurrently
Exclusion criteria	• Involved guideline dissemination as part of the intervention, meaning the comparison group or participants at baseline would not be aware of the guidelines to be able to implement them into practice
Control	
Inclusion criteria	• Exposure to disseminated guidelines only. Thus, participants in control groups should be aware of the existence of the guidelines, but no further intervention should be provided to facilitate their uptake
Exclusion criteria	• No exposure to disseminated guidelines
Outcome	
Inclusion criteria	• Focussed on guideline adherence as a primary outcome. This could be measured by count or percentage of instances of guideline-adherent behaviour over a set time period. This could be performed prospectively using observation or retrospectively using audit or other similar methods
Exclusion criteria	• Focussed on other outcome measures such as patient outcomes instead of guideline adherence

Study quality assessment

The risk of bias and quality of each study was assessed using the Joanna Briggs Institute critical appraisal tools for both randomised controlled trials and quasi-experimental designs [37, 38] (Tables 2 and 3). This was initially performed by the first author and then independently reviewed by a second author (LR or DM). In the instance of any discrepancies in assessment, a third author (LR or DM) was involved to achieve consensus. This third author was not able to identify who provided each assessment. The appraisal tools were used to develop a score for each article, as a percentage of the number of met criteria out of the total number of applicable criteria. Through consensus among the authors, cut-off values were established prior to scoring, whereby

Table 2 Summaries of included studies

First author, year, country	Aims	Study design	Study population	EPOC categories [intervention(s)]	Comparator group	Outcome
Afuakwah, C., 2015, Scotland	Improve documentation of caries risk assessments (CRA)	Pretest-posttest quasi-experimental study	Four dentists working at a general dental practice in a Scottish Index of Multiple Deprivation One area	Multifaceted intervention: • Reminders [CRA pro forma, aide memoire] • Education (NFS) [staff training]	N/A	Adherence improved from 52.5% pre-intervention to 100% post-intervention
Amemori, M., 2013, Finland	Develop and evaluate two interventions intended to increase the implementation of tobacco use prevention and cessation counselling	Cluster randomised controlled trial	75 dentists and dental hygienists employed at 34 clinics within two municipal health care regions in Finland	• Education (meetings) [lectures, interactive sessions, multimedia demonstrations and role play session (n = 21)] • Multifaceted intervention (n = 27): o Education (meetings) [as above] o Pay for performance [fee for service]	No intervention (n = 25)	• No effect on prevention counselling for any group • Cessation counselling 6 months post-intervention was higher for intervention groups (effect size = 0.52, p = 0.007), despite a relapse after 2 months
Bahrami, M., 2004, Scotland	Evaluate the effectiveness of different implementation strategies for clinical guidelines relating to the management of impacted and unerupted third molar teeth	Pragmatic, 2 × 2 factorial cluster randomised controlled trial	51 general dental practices in Scotland who had been given the opportunity to attend a postgraduate course regarding the guidelines	• Reminders [computer-aided learning with decision support (n = 13)] • Audit and feedback [audit and feedback (n = 13)] • Multifaceted intervention (n = 13): o Reminders [as above] • Audit and feedback [as above]	No intervention (n = 12)	No significant difference in guideline adherence was seen between intervention and control groups
Chopra, R., 2014, UK	To audit dentists' antimicrobial prescription and evaluate the effectiveness of education on their adherence to antimicrobial prescribing guidelines	Pretest-posttest quasi-experimental study	Two audit cycles each including 60 patients in the dental department of a hospital in London	Education (meetings) [extensive training and education of staff and students]	N/A	A 50% increase in appropriate prescriptions was seen post intervention, as was a 38% increase in practitioners recording a diagnosis
Elouafkaoui, P., 2016, Scotland	Compare the impact of individualised audit and feedback interventions on dentists' antibiotic prescribing rates	Cluster randomised controlled trial	2566 dentists from 795 general dental practices	• Audit and feedback [audit and feedback (n = 1999)]	Current practice (n = 567)	• A 5.7% greater decrease in antibiotic prescription (p = 0.01) was seen among the intervention groups • Defined daily dose rate reduced by 6.6% more in the intervention group (p = 0.03)
Friction, J., 2011, USA	Compare the impact of two reminder approaches on access of guidelines for patients with medically complex conditions	Randomised clinical trial	109 dentists from 15 dental clinics	• Reminders [computer alerts to providers (n = 32)] • Patient-mediated interventions [notifications to patients (n = 38)]	Usual care (n = 39)	Both interventions increased guideline website use by 19% for the first 6 months (p < 0.05); however, this was not sustained to 12 months
Gnich, W., 2018, Scotland	Explore the effect of a financial incentive on frequency of fluoride varnish application(FVA)	Non-equivalent groups quasi-experimental study	709 dentists who had submitted payment claims for dental services to the NHS	Pay for performance [novel fee-for-service	Continuous fee-for-service (n = 350)	FVA rates increased among both groups; however, a greater increase was seen among the intervention

Table 2 Summaries of included studies *(Continued)*

First author, year, country	Aims	Study design	Study population	EPOC categories [intervention(s)]	Comparator group	Outcome
	and underlying mechanisms		primary care dental contract	(n = 343)]		group (β = 0.82, 95% CI = 0.72–0.92)
Isaacson Tilliss, T., 2006, USA	To determine the effect of a multifaceted implementation strategy on oral cancer screening examinations and discussions of tobacco use	Cluster randomised controlled trial	31 dental care providers at 6 dental practices in Colorado	Multifaceted intervention (n = 18): • Local consensus process [local consensus process] • Reminders [multi-modal reminders for practitioners] • Patient-mediated interventions [multi-modal reminders for patients] • Education (meetings) [interactive educational workshop]	Usual care (n = 12)	No significant change was seen in patient reports of dental provider practice following the intervention, except a 22.1% (p = 0.015) increase in reporting "the dentist/hygienist told me that I was being screened for oral cancer"
Montini T., 2013, USA	To test the feasibility of using web-based computer-mediated clinical decision support system to improve dentists' adher ence to the Treating To bacco Use and Depend ence Clinical Practice Guidelines	Pretest-posttest quasi-experimental study	One general dental clinic located at the New York College of Dentistry	Reminders [computer decision support system]	N/A	• Screening patients for tobacco use increased by 33.1% ($p < 0.001$) • Rates of advising, referring and prescribing nicotine replacement therapy for tobacco users increased by 58.9% ($p < 0.001$), 15.2% ($p < 0.001$) and 14.3% (p = 0.035) respectively
Rindal, D. B., 2013, USA	To determine the effect of a computer-assisted to bacco intervention tool on frequency of dentists' ad herence to tobacco guidelines	Cluster randomised controlled trial	548 patients from 15 HealthPartners Dental Group clinics in metropolitan Minnesota	Reminders [practitioners provided with computer decision support system]	Usual care	Rates of assessing interest in quitting (17%, p = 0.0006), discussing strategies (21%, p = 0.003) and referral (20%, p = 0.007) were significantly higher in the intervention group
Rosseel, J. P., 2012, The Netherlands	To examine the effect of patient-mediated feedback on adherence of dental practitioners to tobacco cessation guidelines	Pretest-posttest quasi-experimental study	23 primary care dental practices in the Netherlands, their professional personnel and patients	Patient-mediated interventions [patient-mediated feedback]	N/A	More patients reported receiving assessment of smoking status (25.3% increase, $p < 0.01$), information on smoking (21.3% increase, $p < 0.01$) and advice and support (26.5%, $p < 0.01$) 12 months post-intervention despite a 6.1% drop in reported provision of advice after

Table 2 Summaries of included studies *(Continued)*

First author, year, country	Aims	Study design	Study population	EPOC categories [intervention(s)]	Comparator group	Outcome
						6 months
Shelley, D., 2011, USA	To evaluate the effect of a multicomponent intervention to implement tobacco use treatment guidelines in public health dental clinics	Pretest-posttest quasi-experimental study	14 comprehensive care general dentistry clinics at the New York College of Dentistry	Multifaceted intervention: • Reminders [chart system] • Education (meetings) [faculty and student training] • Environment [nicotine replacement therapy] • Referral systems [referral protocol] • Audit and feedback [referral feedback]	N/A	• No significant difference in rates of screening for tobacco use • Rates of advising, assessing and referring or prescribing nicotine replacement therapy for tobacco users increased by 20.6% ($p < 0.001$), 12.1% ($p = 0.01$) and 9.1% ($p = 0.01$) respectively
Simons, D., 2013, UK	To determine the effects of an audit on the process and outcomes of clinical endodontic care	Pretest-posttest quasi-experimental study	20 clinicians within the Community Dental Service of the National Health Service	Audit and feedback [audit and feedback]	N/A	In general, there was increased adherence to various endodontic guidelines (0.7–42.9% increase), although this was not seen in all guidelines
Walsh, M. M., 2006, USA	To compare the effects of workshop training and mailed self-study training with and without reim bursement on tobacco-use-related attitudes and be haviours as reported by dentists and patients	Cluster randomised controlled trial with a 2 × 2 factorial design	265 dentists who participated in Delta Dental plans serving state employees in California, Pennsylvania and West Virginia	• Education (materials) [self-study ($n = 100$)] • Education (meetings) [workshop ($n = 99$)]	No intervention ($n = 66$)	Although patient and self-reported adherence to tobacco guidelines was higher among both intervention groups, more dentists in the workshop group reported adherence than in the self-study group. Due to a low claim rate, reimbursement had no further effect on this
Zahabiyoun, S., 2015, UK	To determine whether clinical audit can improve use of antibiotics in the dental service	Pretest-posttest quasi-experimental study	Two dental clinics in the northeast of England	Audit and feedback [clinical audit]	N/A	• Compliance with metronidazole prescription guidelines increased by 15.3% ($p = 0.012$) • Compliance with amoxicillin prescription guidelines increased by 35.2% ($p = 0.041$)

studies with a score of less than 30% were excluded from analysis, 30–59% were considered poor quality, 60–79% were considered moderate quality and greater than 80% were considered high quality [54].

Screening

A systematic screening process was conducted whereby initial search results were screened for eligibility first by title, then by abstract, and finally by full text. Titles and abstracts of identified records were screened independently by two authors (AV and DM), and a third author (AG) was invited to achieve consensus when discrepancies arose. For records that were not excluded by title or abstract, full texts were obtained and independently screened by the same investigators (AV and DM), and consensus was achieved by a third investigator (AG) where required.

Data extraction strategy

Data from included studies was extracted by the first author using a data extraction tool (Additional file 4), which was validated through consensus with the research team, and included fields such as author, year, location, aims, study design, population and eligibility criteria, intervention/implementation strategies used and outcomes, measured by change in proportion of guideline-adherent practice where possible.

Data synthesis and presentation

Due to high heterogeneity of included interventions, as well as the small number of articles meeting the eligibility criteria within each type of intervention, it was decided that a narrative synthesis of study findings would be undertaken. Studies were categorised by type of implementation strategy according to the Effective Practice and Organisation of Care (EPOC) taxonomy of health systems interventions [55]. This taxonomy was systematically and iteratively developed by the Cochrane EPOC Review Group to allow the classification of health systems interventions into categories based on conceptual or practical similarities [56]. Throughout the development process of this taxonomy, it was applied to various reviews of health systems interventions of high relevance to developing countries, making this a tool that could be relevant to a variety of settings [56]. In contrast, many other taxonomies, such as the ERIC taxonomy, only included panellists from specific geographic locations in their development, which could limit their applicability to studies conducted elsewhere [57]. Thus, the EPOC taxonomy was deemed an appropriate tool for the classification of the interventions used in this review. A process was adopted whereby initial classification was conducted by the first author (AV) who examined the interventions described within each study allocated these interventions to the EPOC category with the best matching definition. This categorisation was peer checked by other authors (LR, DM and AG). In the case where interventions consisted of components from multiple EPOC categories, these were classified as multifaceted interventions. All data was presented as a qualitative review.

Registration

This systematic review was registered with the International Prospective Register of Systematic Reviews (PROSPERO), registration ID CRD42018093023.

Results

Search results

All database searches returned results, yielding a total of 3493 records. Following the removal of 1652 duplicates, titles and abstracts of records were screened, resulting in the exclusion of a further 1772 articles. Of the 96 full-text articles assessed, reasons for exclusion included the incorrect intervention (n = 19), incorrect study design (n = 14), not in the dental setting (n = 4), incorrect outcome (n = 2), the control group was not exposed to the guidelines (n = 10), no English full text available (n = 1) and no formal guidelines were in place (n = 3). A total of 15 studies were included in this review [39–53]. See Fig. 1 for further detail regarding the search and screening process.

Study characteristics

Of the included studies, seven studies were from the UK [39–42, 48, 50, 52], six studies were from the USA [43–46, 51, 53], one study was from Finland [47] and one study was from the Netherlands [49]. Included studies were published between 2004 and 2018. A total of seven included studies were randomised controlled trials (RCTs) [39, 42, 44–47, 53], of which six were cluster randomised [39, 42, 44, 46, 47, 53] and one was individually randomised [45]. The remaining eight studies followed quasi-experimental designs, with seven being pretest-posttest quasi-experimental studies [40, 41, 43, 48, 49, 51, 52] and one being a non-equivalent groups design [50]. Out of all 15 studies, six involved implementation of interdisciplinary guidelines related to tobacco cessation into the dental setting [43, 44, 46, 47, 49, 51], and the rest explored the implementation of general dental guidelines [39–42, 45, 48, 50, 52, 53]. Implementation strategies employed in each study were classified into the following categories: audit and feedback (n = 4) [39–42], reminders (n = 4) [42–45], education (n = 3) [46–48], patient-mediated interventions (n = 2) [45, 49], pay for performance (n = 1) [50] and multifaceted interventions (n = 5) [42, 47, 51–53]. Three studies [42, 45, 47] were classified into multiple categories, as they included both multifaceted and single intervention arms. Details of the included studies can be seen in Table 2, and a summary of the effectiveness of implementation strategies in each category can be seen in Table 3.

Table 3 Effectiveness of each implementation strategy

Type of implementation strategy	Type of outcome	Reported effects
Audit and feedback	Antibiotic guideline adherence	Significant improvement: [39, 40]
	Endodontic guideline adherence	Some improvement†: [41]
	Third molar guideline adherence	No improvement: [42]
Reminders	Tobacco cessation guideline adherence	Significant improvement: [43, 44]
	Medically complex conditions guideline adherence	Significant improvement, not sustained: [45]
	Third molar guideline adherence	No improvement: [42]
Education	Tobacco cessation guideline adherence	Significant improvement: [46] Some improvement: [47]
	Antibiotic guideline adherence	Improvement†: [48]
Patient-mediated interventions	Tobacco cessation guideline adherence	Significant improvement: [49]
	Medically complex conditions guideline adherence	Significant improvement, not sustained: [45]
Pay for performance	Fluoride varnish guideline adherence	Significant improvement: [50]
Multifaceted interventions	Tobacco cessation guideline adherence	Some improvement: [47, 51]
	Caries risk assessment guideline adherence	Improvement†: [52]
	Oral cancer screening guideline adherence	No improvement: [53]
	Third molar guideline adherence	No improvement: [42]

†No significance testing conducted

Quality assessment

The quality assessments of included studies are shown in Tables 4 and 5. All 15 studies received an acceptable quality assessment (score of 30% or higher) for inclusion in the review. Of the seven included RCTs, two were assessed to be of high quality [45, 46], four were of moderate quality [39, 42, 44, 47] and one was of poor quality [53] (Table 4). On average, RCTs had a score of 72.1%. The most common areas of methodological weakness in included RCTs were lack of blinding of both participants and those administering the intervention. This was expected due to the nature of the interventions making blinding difficult and unfeasible at times. Despite this, one RCT was able to implement a study design that permitted blinding [46]. Three of the eight included quasi-experimental studies was of high quality [49–51], with four being of moderate quality [40, 41, 43, 52], and one being of poor quality [48] (Table 5). Quasi-experimental studies had an average score of 74.08%. Weaknesses among these studies included limited use of control groups and lack of reliability of measures.

Single interventions

The 12 studies classified into single intervention categories involved interventions classified as audit and feedback (n = 4) [39–42], reminders (n = 4) [42–45], education (n = 3) [46–48], patient-mediated interventions (n = 2) [45, 49] and pay for performance (n = 1) [50].

Audit and feedback

Four studies explored the effectiveness of audit and feedback interventions on the implementation of guidelines in dental practice [39–42]. This category included two cluster RCTs [39, 42] and three pretest-posttest quasi-experimental studies [40, 41, 49]. The study by Zahaboyoun et al. found audit and feedback to significantly increase compliance with both metronidazole and amoxicillin prescription guidelines [40]. Similarly, the study by Elouafkaoui et al. found a significant decrease in antibiotic prescription following an audit and feedback intervention [39]. Simons and Williams reported mixed results, where audit and feedback increased adherence to some, but not all, endodontic guidelines; however, the statistical significance of these changes was not evaluated [41]. Conversely, the cluster RCT by Bahrami et al. [42] showed no significant improvement in guideline adherence to unerupted third molar guidelines following an audit and feedback intervention.

Reminders

An additional four studies investigated the effect of reminder strategies on guideline implementation [42–45]. Of these studies, three were RCTs [42, 44, 45] and one was a quasi-experimental study [43]. The quasi-experimental study by Montini et al. found that a computer decision support system significantly improved not only tobacco screening rates, but also rates of advising, referring and prescribing nicotine replacement therapy for tobacco users [43]. Similarly, the computer decision support system used by Rindal et al. also significantly improved clinicians' adherence to tobacco cessation guidelines [44]. However, while increasing guideline adherence for the first 6 months, the study by Friction et al. found that computer alerts to providers did not

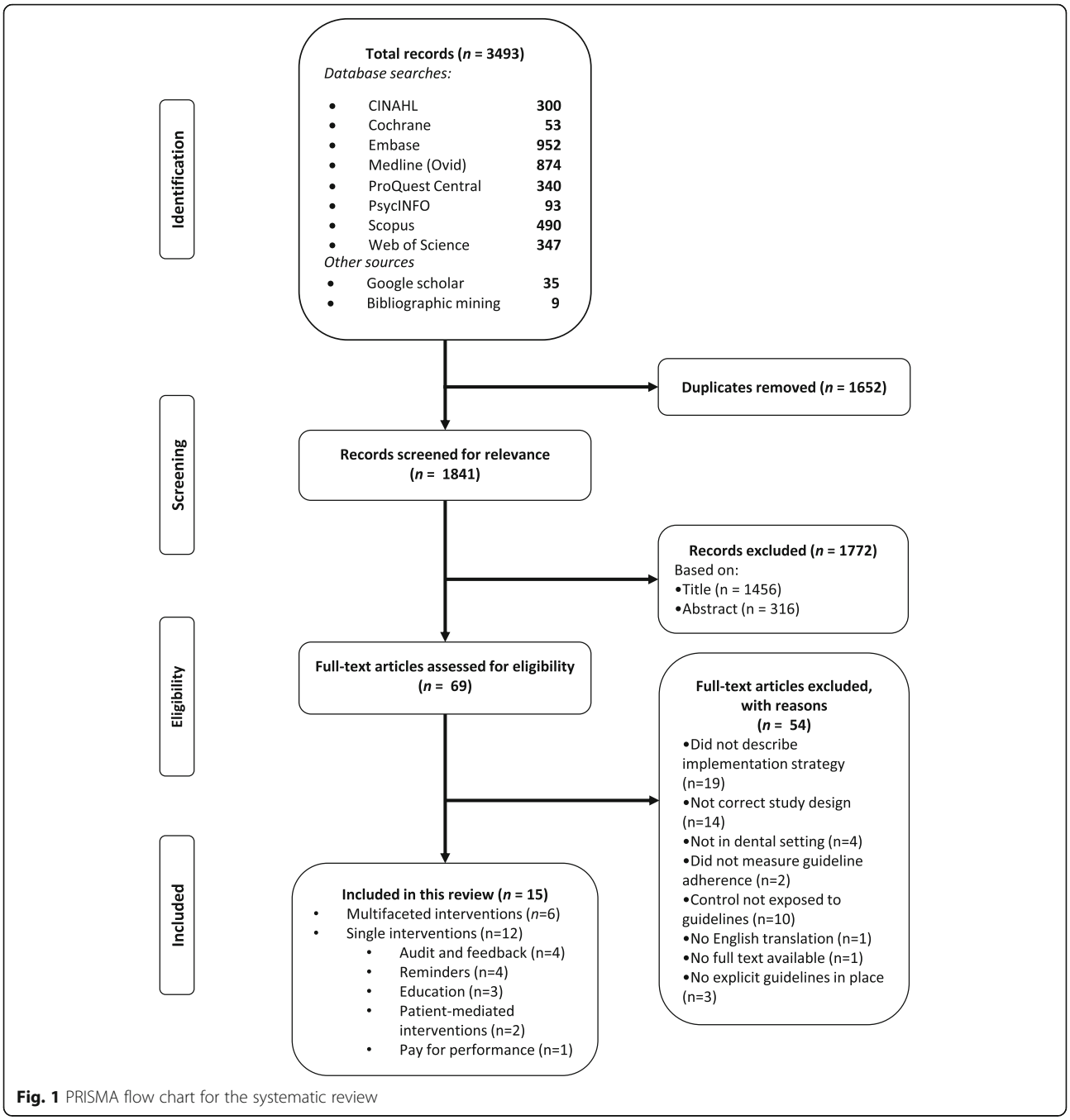

Fig. 1 PRISMA flow chart for the systematic review

cause sustained change in adherence to guidelines for patients with medically complex conditions [45]. In addition, the computer-aided learning and decision support strategy used by Bahrami et al. showed no significant effect on guideline adherence [42].

Education

Three studies evaluated the effectiveness of education strategies on improving guideline adherence [46–48], two of which were RCTs [46, 47]. The cluster RCT by Walsh et al. found that although both self-study and workshop-based education strategies improved self-reported adherence to tobacco cessation guidelines, there was higher reported adherence in the workshop intervention [46]. In addition, the pretest-posttest quasi-experimental study by Chopra et al. found that extensive training and education caused an increase in adherence to antimicrobial prescribing guidelines, despite having

Table 4 Quality assessment of included randomised controlled trials

Criteria	Study identification						
	[47]	[42]	[39]	[45]	[53]	[44]	[46]
1. Was true randomisation used for assignment of participants to treatment groups?	Y	Y	Y	Y	?	Y	Y
2. Was allocation to treatment groups concealed?	Y	Y	Y	Y	N	?	Y
3. Were treatment groups similar at the baseline?	N	Y	N	Y	Y	Y	Y
4. Were participants blind to treatment assignment?	N	N	N	N	N	?	Y
5. Were those delivering treatment blind to treatment assignment?	N	N	N	N	N	N	Y
6. Were outcomes assessors blind to treatment assignment?	Y	Y	Y	Y	N	N	Y
7. Were treatment groups treated identically other than the intervention of interest?	Y	Y	Y	Y	Y	Y	Y
8. Was follow-up complete and if not, were differences between groups in terms of their follow up adequately described and analysed?	Y	Y	Y	Y	Y	Y	Y
9. Were participants analysed in the groups to which they were randomised?	Y	Y	Y	Y	Y	Y	Y
10. Were outcomes measured in the same way for treatment groups?	Y	Y	Y	Y	Y	Y	Y
11. Were outcomes measured in a reliable way?	Y	Y	Y	Y	Y	Y	Y
12. Was appropriate statistical analysis used?	Y	Y	Y	Y	N	Y	Y
13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomisation, parallel groups) accounted for in the conduct and analysis of the trial?	Y	Y	Y	Y	N	Y	Y
Total score	76.9%	76.9%	69.2%	92.3%	46.2%	69.2%	100.0%

Y yes, *N* no, ? unclear, *N/A* not applicable

no statistical evaluation of this effect [48]. However, Amemori et al. found mixed results, concluding that an education package consisting of lectures, interactive sessions, multimedia demonstrations and a role play session resulted in a significant increase in provision of tobacco cessation counselling, but not tobacco prevention counselling [47].

Patient-mediated interventions

Two studies explored the use of patient-mediated interventions as guideline implementation strategies. Rosseel et al. found that patient-mediated feedback increased the proportion of patients reporting having received guideline-adherent information, advice and support regarding tobacco cessation; however, this declined after 6

Table 5 Quality assessment of included quasi-experimental studies

Criteria	Study identification							
	[52]	[48]	[50]	[43]	[49]	[51]	[41]	[40]
1. Is it clear in the study what is the "cause" and what is the "effect" (i.e. there is no confusion about which variable comes first)?	Y	Y	Y	Y	Y	Y	Y	Y
2. Were the participants included in any comparisons similar?	Y	?	Y	?	Y	Y	Y	Y
3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Y	Y	Y	Y	Y	Y	?	Y
4. Was there a control group?	N	N	Y	N	N	N	N	N
5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?	Y	Y	Y	Y	Y	Y	Y	Y
6. Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analysed?	Y	N/A	Y	N/A	Y	N/A	N/A	N/A
7. Were the outcomes of participants included in any comparisons measured in the same way?	Y	Y	Y	Y	Y	Y	Y	Y
8. Were outcomes measured in a reliable way?	?	?	N	N	Y	N/A	Y	N
9. Was appropriate statistical analysis used?	N	?	Y	Y	Y	Y	Y	Y
Total score	66.7%	50.0%	88.9%	62.5%	88.9%	85.7%	75.0%	75.0%

Y yes, *N* no, ? unclear, *N/A* not applicable

months [49]. In addition, the study by Friction et al. found that notifying patients to ask for a review of care during their visit caused an increase in adherence to guidelines for patients with medically complex conditions in the first 6 months; however, this was not sustained [45].

Pay for performance

Finally, one non-equivalent groups quasi-experimental study by Gnich et al. evaluated the effectiveness of fee-for-service as a single intervention to improve guideline implementation [50]. The investigators found that guideline-adherent fluoride varnish application rates increased rapidly among practitioners that had received fee-for-service during the intervention, when compared to practitioners who had already been receiving fee-for-service prior to the intervention.

Multifaceted interventions

A total of five studies tested the effectiveness of a multifaceted intervention and were therefore included in this category [42, 47, 51–53]. This category included three RCT studies [42, 47, 53], with the remaining two studies following pretest-posttest quasi-experimental study designs [51, 52]. The multifaceted interventions utilised in these studies varied and comprised of a combination of two or more implementation strategies including education, audit and feedback, fee-for-service or decision support (see Table 2). All five studies in this category involved education in combination with other strategies as part of the multifaceted intervention. Four studies combined education with reminders [42, 51–53], two utilised audit and feedback [42, 51], and one employed a pay for performance strategy [47].

Although results seen within each study varied, three studies [47, 51, 53] showed a significant increase in some component of guideline implementation following the multifaceted intervention. These studies [47, 51, 53], which explored the implementation of multicomponent tobacco cessation guidelines, highlighted mixed results, with multifaceted interventions causing a significant improvement in adherence to some guideline components, but no change was seen in other components. Similar to their single intervention, Amemori et al. [47] highlighted that their education plus fee-for-service intervention caused a significant increase in tobacco cessation counselling; however, no change was seen in tobacco prevention counselling. Similarly, the multicomponent intervention utilised by Shelley et al. [51], which involved a chart system, training, protocols and referral feedback, resulted in a significant increase in providing advice, assessments and assistance to tobacco users; however, rates of tobacco use screening remained the same. Finally, the local consensus process, multi-modal reminders for patients and practitioners and interactive educational workshop utilised by Isaacson et al. caused no significant change in patient-reported adherence to oral cancer screening guidelines aside from patient agreement with the statement "the dentist/hygienist told me that I was being screened for oral cancer" [53].

The multifaceted interventions in the remaining two studies [42, 52] did not exhibit significant changes in adherence for various reasons. One study by Afuakwah and Welbury [52] indicated that a pro forma, aide memoire and staff training had a positive effect on adherence to guidelines regarding documentation of caries risk assessments. However, this study did not compute any inferential statistics; therefore, the significance of this change could not be ascertained. The study by Bahrami et al. did compute inferential statistics to determine the effect of a multifaceted intervention involving computer-aided learning with decision support plus audit and feedback on adherence; however, no significant improvement was detected.

As seen in Fig. 2, overall, a slightly higher proportion of studies involving multifaceted interventions reported improvements in guideline adherence when compared to single interventions. Among single interventions, studies classified into the "reminders" and "education" categories reported larger improvements in guideline adherence. In addition, all studies involving interdisciplinary guidelines reported some effect of the implementation strategies, on guideline adherence, whereas over 20% of studies involving dental guidelines reported no effect.

Discussion

With existing research highlighting dental practice to have some of the lowest guideline compliance in the health sector, it is evident that the implementation of clinical guidelines in this setting remains a challenge [18–21]. As no published reviews summarise the evidence regarding implementation strategies in the dental setting, this review aimed to evaluate the current research in this area and identify effective guideline implementation strategies. This review identified a total of 15 studies that investigated the effectiveness of implementation strategies in the dental setting, with 13 studies investigating single implementation strategies and 5 studies involving multifaceted implementation strategies. There were studies classified across the categories of audit and feedback [39–41], reminders [43, 44], education [46–48], patient-mediated interventions [49], pay for performance [50] and multifaceted interventions [47, 51–53] that reported a significant increase in adherence to some or all guideline components.

Within the single interventions, the effectiveness of audit and feedback interventions was variable, with the three successful studies showing slightly smaller effect

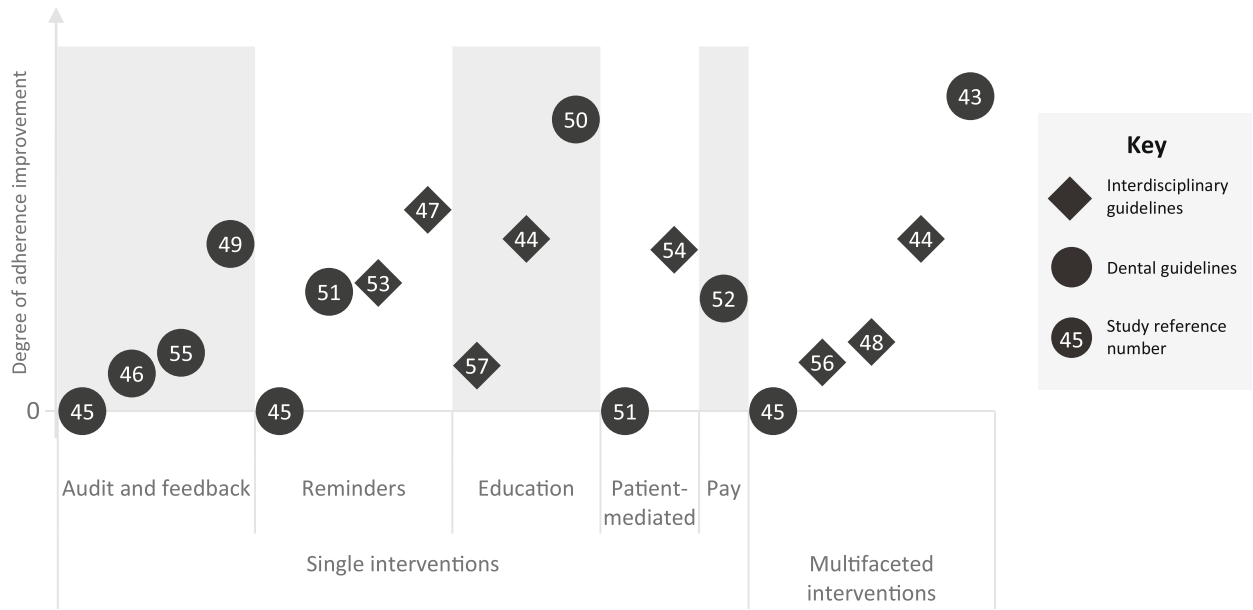

Fig. 2 A diagrammatic representation of the effect of each study intervention on improvement in adherence, grouped by intervention category and guideline type

sizes than studies in other categories [39–41]. Systematic reviews of implementation strategies in other health care settings have also reported audit and feedback interventions to have variable outcomes on guideline adherence [17, 58]. Ivers et al. [58] reported that audit and feedback interventions may be more effective when baseline performance is low; when the source of feedback is a supervisor or colleague; when they are provided more than once; when they are delivered in both verbal and written formats; and when they include both explicit targets and action plans. Hypotheses developed by Colquhoun et al have reinforced these findings, also suggesting that involvement of recipients in the design of the audit and feedback process could improve the effectiveness of these interventions [59].

Three of four studies within this review using reminders reported guideline adherence to improve following intervention [43–45], with higher improvements indicating reminders may be a more effective strategy in the dental setting than audit and feedback. Other reviews have also highlighted reminders as a promising strategy to improve guideline adherence [17, 60–63], and one review has even highlighted the potential for this strategy to positively impact on patient outcomes [64]. It is suggested that computerised decision support systems may be more effective in improving compliance; however, they may also lengthen consultation times and may be more stressful for clinicians to use [17]. Further, studies evaluating reminder systems developed specifically by the organisations where implementation will occur have shown larger effects on improving practice than the adoption of existing reminder systems [62].

Similar to other health care settings [17, 60, 61], this review found education to be an effective implementation strategy, with three of four included studies in this category reporting improvement in guideline adherence [46–48]. However, the intervention consisting of passive education strategies, that is, in the "educational materials" EPOC category, resulted in lower effects when compared with other interventions [46]. This is consistent with other literature, which highlight passive education strategies to be largely unsuccessful in improving guideline adherence [17].

Only one out of the two studies in the patient-reported feedback demonstrated a significant improvement in guideline adherence, indicating some potential variability in the effectiveness of this implementation strategy; however, more research is required to confirm this [49]. Reviews in other health care settings have shown these types of interventions to be more effective [17, 65].

Although the sole study investigating a pay-for-service intervention in this review reported a moderate significant effect on guideline adherence [50], interestingly, this type of implementation strategy was less often explored in other settings with inconclusive results found regarding its effectiveness [17, 60, 61]. The effectiveness of this strategy was hypothesised to be due to its ability to normalise or validate the responsibility of dental care practitioners in performing the service.

Of the five studies exploring multifaceted interventions in this review, four highlighted positive effects on guideline adherence [47, 51–53]. Previous studies in other settings have shown huge success of multifaceted interventions, showing them to be much more effective than single implementation strategies alone, making them one of the most frequently researched and recommended approaches for guideline implementation [17, 61]. Despite this, there is little evidence regarding the best components to include in these strategies, as there does not seem to be a relationship between number or type of components used and effectiveness of the strategy [17].

Despite this evidence of positive effects across all types of implementation strategies, some studies only found partial effects on implementation, and further there were some studies that did not show evidence of effect on guideline adherence. Many of the studies that showed only partial effects had some characteristics in common, the first of which was complexity of guidelines. All five studies that only found partial improvements in guideline adherence involved complex guidelines with multiple criteria for compliance, often combined with interdisciplinary practice [41, 46, 47, 51, 53]. This is supported by previous research in other settings, with previous reviews highlighting guideline complexity as the single most frequently cited guideline characteristic affecting guideline implementation [66].

Further, the two studies that highlighted no effect of their implementation strategies on guideline adherence had some methodological limitations that may have impacted on the effects of the implementation strategies. Firstly, Bahrami et al. acknowledged a high baseline compliance in their study, which may have produced a ceiling effect, meaning that no greater improvement was possible following the intervention [42]. In addition, this is the oldest study included in this review, conducted in 2004, yet it heavily involved the use of computer decision support systems as part of the implementation strategies, despite the fact that computer systems were not commonly used in patient care at that time. This is reinforced by the fact that the authors specifically developed the computer software package for the purpose of this study, contained on a stand-alone laptop [42]. As a result, clinicians would be required to specifically use this laptop when decision support was required, rather than the decision support being embedded into computer patient records as was commonly done in more recent studies [43, 44], potentially reducing compliance to this decision support intervention. The second study that did not find overall significant improvements was Friction et al., which used the frequency of accessing an online computer decision support tool as an indicator of guideline adherence [45]. The limitation of this proxy, acknowledged by the authors, was that there was the potential that the more the decision support tool was used, the more clinicians may begin to learn the guidelines, and as a result may not have needed to refer to the decision support repeatedly [45]. This is reinforced by the trend in the data that increases in guideline adherence were seen at 6 months, but regressed to baseline at 12 months [45].

In summary, this study has highlighted that implementation strategies such as audit and feedback, reminders, education, patient-mediated interventions, pay for performance and multifaceted interventions have all had some success in the dental setting, with reminders, education, pay for performance and multifaceted interventions showing the most promise. Further research is required to provide more high-quality evidence regarding the effectiveness of each strategy type and gain an understanding of aspects of each type of strategy that may increase the success of guideline implementation. Despite some promising findings in this review, it has several limitations that should be considered in the interpretation of results. Firstly, the quality of evidence identified by this review varied, with most of the 15 included studies being of poor or moderate quality, and only five studies being deemed high quality. In addition, two included studies did not conduct statistical tests for the positive changes they identified following their implementation strategies, one of which only involved four clinicians, further impacting the interpretability of the study findings [48, 52]. Further, due to the heterogeneity of this data, resulting from the variability of implementation strategies used in each study, meta-analysis was not possible in this review, and as a result, the effects of each strategy could not be quantitatively compared. A large number of included studies were published in the UK and USA, which could limit generalisability of findings. In addition, although rigorous search strategies were used, there is a chance that not all relevant studies were identified, and due to a paucity of research in this field, relatively few studies were ultimately included. Finally, this study excluded studies for which full texts or English translations could not be obtained, which may have potentially introduced some bias into the results of the review. Nonetheless, this study is the first systematic review of implementation strategies in the dental setting and has provided significant insight into which strategies may be most effective for the implementation of guidelines in this sector.

Conclusions

This study has confirmed findings in other settings that implementation strategies such as audit and feedback, reminders, education, patient-mediated interventions and multifaceted interventions may be effective in improving guideline adherence in the dental setting. It has

highlighted that interventions such as education, reminders and multifaceted interventions may be the most effective in this setting, and it has identified pay for performance as a potentially effective strategy that has previously been inconclusive in other settings. Although some included studies showed equivocal findings or no effects on guideline adherence, key strategies were identified that could be utilised in the implementation of any future dental guidelines, as well as considerations that should be taken into account in the use of these strategies. This information is particularly relevant in light of the increased need and focus on role expansion of dental professionals into other areas like childhood obesity. This review highlights the need for further, high-quality research to be conducted in this setting, to gain a better understanding of the conditions under which each strategy works best. Increasing the number of studies using rigorous methods within each strategy category will allow heterogeneity of findings to be reduced, therefore enabling meta-analyses to be conducted.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s13012-019-0954-7.

Additional file 1. PRISMA checklist.
Additional file 2. Search strategy.
Additional file 3. PRESS checklist.
Additional file 4. Data extraction tool.

Abbreviations

CRA: Caries risk assessment; EPOC: Effective Practice and Organisation of Care; FVA: Fluoride varnish application; MeSH: Medical Subject Headings; PRISMA: Preferred reporting items for systematic reviews and meta-analyses; PROSPERO: International Prospective Register of Systematic Reviews; RCT: Randomised controlled trial

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Not applicable

Authors' contributions

ARV designed and conducted the search strategy, performed initial screening and quality assessment of studies and was a major contributor in writing the manuscript. DM also screened studies for eligibility and performed quality assessment, similarly contributing to writing the manuscript. LR performed quality assessment and contributed to writing the manuscript. MC and RS contributed to writing the manuscript. AG provided consensus for eligibility screening and contributed to writing the manuscript. All authors read and approved the final manuscript.

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Not applicable

Competing interests

The authors declare that they have no competing interests.

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References

1. Institute of Medicine (US) Committee to Advise the Public Health Service on Clinical Practice Guidelines. Clinical practice guidelines: directions for a new program. Washington (DC): National Academies Press (US); 1990.
2. Grimshaw JM, Russell IT. Effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations. Lancet. 1993;342(8883):1317–22.
3. Woolf SH. Practice guidelines: a new reality in medicine: iii. impact on patient care. Archives of Internal Medicine. 1993;153(23):2646–55.
4. Woolf SH, Grol R, Hutchinson A, Eccles M, Grimshaw J. Potential benefits, limitations, and harms of clinical guidelines. British Medical Journal (Clinical Research Ed). 1999;318(7182):527–30.
5. Proctor EK, Landsverk J, Aarons G, Chambers D, Glisson C, Mittman B. Implementation research in mental health services: an emerging science with conceptual, methodological, and training challenges. Administration and Policy in Mental Health and Mental Health Services Research. 2009; 36(1):24–34.
6. US Department of Health and Human Services. The road ahead: research partnerships to transform services. A report by the National Advisory Mental Health Council's Workgroup on Services and Clinical Epidemiology Research. Bethseda, MD: National Institutes of Health, National Institute of Mental Health; 2006.
7. Bernhardsson S, Johansson K, Nilsen P, Öberg B, Larsson MEH. Determinants of guideline use in primary care physical therapy: a cross-sectional survey of attitudes, knowledge, and behavior. Physical Therapy. 2014;94(3):343–54.
8. Flottorp SA, Oxman AD, Krause J, Musila NR, Wensing M, Godycki-Cwirko M, et al. A checklist for identifying determinants of practice: a systematic review and synthesis of frameworks and taxonomies of factors that prevent or enable improvements in healthcare professional practice. Implementation Science. 2013;8(1):35.
9. Hsiao J-L, Chen R-F. Critical factors influencing physicians' intention to use computerized clinical practice guidelines: an integrative model of activity theory and the technology acceptance model. BMC Medical Informatics and Decision Making. 2016;16(1):3.
10. Jones JA, Reeve CA. Factors influencing the use of clinical guidelines by general practitioners working in a setting of complex multimorbidity: a case study by interviews. BMC Fam Pract. 2018;19(1):157.
11. Sauro KM, Wiebe S, Holroyd-Leduc J, DeCoster C, Quan H, Bell M, et al. Knowledge translation of clinical practice guidelines among neurologists: a mixed-methods study. PLoS One. 2018;13(10):e0205280–e.
12. Ouimet M, Landry R, Amara N, Belkhodja O. What factors induce health care decision-makers to use clinical guidelines? Evidence from provincial health ministries, regional health authorities and hospitals in Canada. Social Science & Medicine. 2006;62(4):964–76.
13. Conroy M, Shannon W. Clinical guidelines: their implementation in general practice. British journal of general practice. 1995;45(396):371–5.
14. Cabana MD, Rand CS, Powe NR, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. JAMA. 1999; 282(15):1458–65.
15. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. Lancet. 2003;362(9391):1225–30.
16. Grimshaw J, Thomas R, MacLennan G, Fraser C, Ramsay C, Vale L, et al. Effectiveness and efficiency of guideline dissemination and implementation strategies. 2004.

17. Prior M, Guerin M, Grimmer-Somers K. The effectiveness of clinical guideline implementation strategies – a synthesis of systematic review findings. Journal of Evaluation in Clinical Practice. 2008;14(5):888–97.
18. Grilli R, Lomas J. Evaluating the message: the relationship between compliance rate and the subject of a practice guideline. Medical care. 1994; 32(3):202–13.
19. Cleveland JL, Foster M, Barker L, Gordon Brown G, Lenfestey N, Lux L, et al. Advancing infection control in dental care settings: factors associated with dentists' implementation of guidelines from the Centers for Disease Control and Prevention. Journal of the American Dental Association. 2012;143(10):1127–38.
20. Spallek H, Song M, Polk DE, Bekhuis T, Frantsve-Hawley J, Aravamudhan K. Barriers to implementing evidence-based clinical guidelines: a survey of early adopters. Journal of Evidence-Based Dental Practice. 2010;10(4): 195–206.
21. Polk DE, Weyant RJ, Shah NH, Fellows JL, Pihlstrom DJ, Frantsve-Hawley J. Barriers to sealant guideline implementation within a multi-site managed care dental practice. BMC Oral Health. 2018;18(1).
22. Gordon JS, Lichtenstein E, Severson HH, Andrews JA. Tobacco cessation in dental settings: research findings and future directions. Drug and Alcohol Review. 2006;25(1):27–37.
23. Lalla E, Kunzel C, Burkett S, Cheng B, Lamster IB. Identification of unrecognized diabetes and pre-diabetes in a dental setting. Journal of Dental Research. 2011;90(7):855–60.
24. Tseng R, Vann WF, Perrin EM. Addressing childhood overweight and obesity in the dental office: rationale and practical guidelines. Pediatric Dentistry. 2010;32(5):417–23.
25. Khan KS, Kunz R, Kleijnen J, Antes G. Five steps to conducting a systematic review. J R Soc Med. 2003;96(3):118–21.
26. Moher D, Liberati A, Tetzlaff J, Altman DG, The PG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLOS Medicine. 2009;6(7):e1000097.
27. Kong AC, Ramjan L, Sousa MS, Gwynne K, Goulding J, Jones N, et al. The oral health of Indigenous pregnant women: a mixed-methods systematic review. Women and Birth. 2019.
28. Ramjan L, Cotton A, Algoso M, Peters K. Barriers to breast and cervical cancer screening for women with physical disability: a review. Women Health. 2016;56(2):141–56.
29. George A, Johnson M, Blinkhorn A, Ellis S, Bhole S, Ajwani S. Promoting oral health during pregnancy: current evidence and implications for Australian midwives. J Clin Nurs. 2010;19(23–24):3324–33.
30. Villarosa AR, George D, Ramjan LM, Srinivas R, George A. The role of dental practitioners in addressing overweight and obesity among children: a scoping review of current interventions and strategies. Obes Res Clin Pract. 2018;12(5):405–15.
31. McGowan J, Sampson M, Lefebvre C. An evidence based checklist for the peer review of electronic search strategies (PRESS EBC). Evidence Based Library and Information Practice. 2010;5:1.
32. American Dental Association. General dentistry 2019 [Available from: https://www.ada.org/en/education-careers/careers-in-dentistry/general-dentistry.
33. British Dental Association. BDA advice: careers in dentistry 2011 [Available from: https://bda.org/dcps/working-in-dentistry/Documents/e12_careers_in_dentistry_-_sept_11.pdf#search=dental%2520careers.
34. Australian Dental Association. Dental specialists 2019 [Available from: https://www.ada.org.au/Careers/Specialists.
35. American Dental Association. Dental team careers 2019 [Available from: https://www.ada.org/en/education-careers/careers-in-dentistry/dental-team-careers.
36. Australian Dental Association. Dental team 2019 [Available from: https://www.ada.org.au/Careers/Dental-Team.
37. The Joanna Briggs Institute. The Joanna Briggs Institute critical appraisal tools for use in JBI systematic reviews: checklist for randomized controlled trials 2017 [Available from: http://joannabriggs.org/assets/docs/critical-appraisal-tools/JBI_RCTs_Appraisal_tool2017.pdf.
38. The Joanna Briggs Institute. The Joanna Briggs Institute critical appraisal tools for use in JBI systematic reviews: checklist for quasi-experimental studies (non-randomized experimental studies) 2017 [Available from: http://joannabriggs.org/assets/docs/critical-appraisal-tools/JBI_Quasi-Experimental_Appraisal_Tool2017.pdf.
39. Elouafkaoui P, Young L, Newlands R, Duncan EM, Elders A, Clarkson JE, et al. An audit and feedback intervention for reducing antibiotic prescribing in general dental practice: the RAPiD cluster randomised controlled trial. Plos Medicine. 2016;13(8):e1002115–e.
40. Zahabiyoun S, Sahabi M, Kharazi MJ. Improving knowledge of general dental practitioners on antibiotic prescribing by raising awareness of the faculty of general dental practice (UK) guidelines. Journal of Dentistry (Tehran, Iran). 2015;12(3):171–6.
41. Simons D, Williams D. Can audit improve patient care and treatment outcomes in endodontics? British Dental Journal. 2013;214(9).
42. Bahrami M, Deery C, Clarkson JE, Pitts NB, Johnston M, Ricketts I, et al. Effectiveness of strategies to disseminate and implement clinical guidelines for the management of impacted and unerupted third molars in primary dental care, a cluster randomised controlled trial. British Dental Journal. 2004;197(11):691–6.
43. Montini T, Schenkel AB, Shelley DR. Feasibility of a computerized clinical decision support system for treating tobacco use in dental clinics. Journal of Dental Education. 2013;77(4):458–62.
44. Rindal DB, Rush WA, Schleyer TKL, Kirshner M, Boyle RG, Thoele MJ, et al. Computer-assisted guidance for dental office tobacco-cessation counseling: a randomized controlled trial. American Journal of Preventive Medicine. 2013;44(3):260–4.
45. Fricton J, Rindal DB, Rush W, Flottemesch T, Vazquez G, Thoele MJ, et al. The effect of electronic health records on the use of clinical care guidelines for patients with medically complex conditions. Journal of the American Dental Association. 2011;142(10):1133–42.
46. Walsh MM, Belek M, Prakash P, Grimes B, Heckman B, Kaufman N, et al. The effect of training on the use of tobacco-use cessation guidelines in dental settings. Journal of the American Dental Association. 2012;143(6):602–13.
47. Amemori M, Virtanen J, Korhonen T, Kinnunen TH, Murtomaa H. Impact of educational intervention on implementation of tobacco counselling among oral health professionals: a cluster-randomized community trial. Community Dentistry and Oral Epidemiology. 2013;41(2):120–9.
48. Chopra R, Merali R, Paolinelis G, Kwok J. An audit of antimicrobial prescribing in an acute dental care department. Primary dental journal. 2014;3(4):24–9.
49. Rosseel JP, Jacobs JE, Hilberink SR, Segaar D, Akkermans R, Maassen IM, et al. Patient-reported feedback promotes delivery of smoking cessation advice by dental professionals. International Journal of Health Promotion and Education. 2012;50(3):101–10.
50. Gnich W, Sherriff A, Bonetti D, Conway DI, Macpherson LMD. The effect of introducing a financial incentive to promote application of fluoride varnish in dental practice in Scotland: a natural experiment. Implementation science: IS. 2018;13(1).
51. Shelley D, Anno J, Tseng TY, Calip G, Wedeles J, Lloyd M, et al. Implementing tobacco use treatment guidelines in public health dental clinics in New York City. Journal of Dental Education. 2011;75(4):527–33.
52. Afuakwah C, Welbury R. Why do you need to use a caries risk assessment protocol to provide an effective caries preventive regime? Primary Dental Journal. 2015;4(4):56–59, 61–6.
53. Isaacson TT. Improving implementation of oral cancer screening recommendations [Ph.D.]. Ann Arbor: University of Colorado at Denver; 2006.
54. Goldsmith MR, Bankhead CR, Austoker J. Synthesising quantitative and qualitative research in evidence-based patient information. Journal of epidemiology and community health. 2007;61(3):262–70.
55. Effective Practice and Organisation of Care. EPOC taxonomy 2015 [Available from: https://epoc.cochrane.org/epoc-taxonomy.
56. Effective Practice and Organisation of Care. The EPOC taxonomy of health systems interventions Oslo: Norwegian Knowledge Centre for Health Services; 2016 [Available from: https://epoc.cochrane.org/resources/epoc-resources-review-authors.
57. Powell BJ, Waltz TJ, Chinman MJ, Damschroder LJ, Smith JL, Matthieu MM, et al. A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project. Implementation Science. 2015;10(1):21.
58. Ivers N, Jamtvedt G, Flottorp S, Young JM, Odgaard-Jensen J, French SD, et al. Audit and feedback: effects on professional practice and healthcare outcomes. Cochrane Database Syst Rev. 2012;6.
59. Colquhoun HL, Carroll K, Eva KW, Grimshaw JM, Ivers N, Michie S, et al. Advancing the literature on designing audit and feedback interventions: identifying theory-informed hypotheses. Implementation Science. 2017; 12(1):117.
60. Ebben RHA, Siqeca F, Madsen UR, Vloet LCM, van Achterberg T. Effectiveness of implementation strategies for the improvement of

guideline and protocol adherence in emergency care: a systematic review. BMJ Open. 2018;8(11):e017572.
61. Watkins K, Wood H, Schneider CR, Clifford R. Effectiveness of implementation strategies for clinical guidelines to community pharmacy: a systematic review. Implementation science : IS. 2015;10(1):151.
62. Ammenwerth E, Schnell-Inderst P, Machan C, Siebert U. The effect of electronic prescribing on medication errors and adverse drug events: a systematic review. J Am Med Inform Assoc. 2008;15(5):585–600.
63. Cheung A, Weir M, Mayhew A, Kozloff N, Brown K, Grimshaw J. Overview of systematic reviews of the effectiveness of reminders in improving healthcare professional behavior. Systematic Reviews. 2012;1(1):36.
64. Durieux P, Trinquart L, Colombet I, Nies J, Walton R, Rajeswaran A, et al. Computerized advice on drug dosage to improve prescribing practice. Cochrane Database Syst Rev. 2008;3:Cd002894.
65. Fonhus MS, Dalsbo TK, Johansen M, Fretheim A, Skirbekk H, Flottorp SA. Patient-mediated interventions to improve professional practice. Cochrane Database Syst Rev. 2018;9:Cd012472.
66. Francke AL, Smit MC, de Veer AJ, Mistiaen P. Factors influencing the implementation of clinical guidelines for health care professionals: a systematic meta-review. BMC Medical Informatics and Decision Making. 2008;8(1):38.

Publisher's Note

Chapter 6

Results, Phase 2: Codesign of the implementation strategies

6.1 Introduction

The findings from Phase 2 of the CHEWI project are presented in this chapter. These findings represent the qualitative codesign of guideline implementation strategies for children's healthy weight guidelines in the dental setting. This chapter presents these findings as Paper 4, which was published in Research Involvement and Engagement. An overview of the aims of Phase 2 and Paper 4 are provided, following which the paper is presented. The chapter concludes with a brief summary of the key findings.

6.2 Phase 2 overview

Phase 2 aimed to enable dental staff and parents in the community to codesign implementation strategies for the children's healthy weight guidelines in the dental setting, with no such guidelines having been codesigned in past literature. The results from this phase are presented in Paper 4, which is a qualitative, codesign study using the principles of appreciative inquiry to design constructive, actionable implementation strategies.

6.3 Citation: Paper 4

Villarosa AR, Maneze D, Ramjan LM, Kong A, George A. The codesign of implementation strategies for children's growth assessment guidelines in the dental setting. Res Involv Engagem. 2022;8(1):19.

6.4 Conclusion

As a result of the study presented in Paper 4, a series of guideline implementation strategies were designed by both staff and parents for children's healthy weight guidelines in the dental setting. These strategies were encompassed in the themes of engaging patients

throughout their care journey and supporting staff to engage with the guidelines. Specific strategies included: i) sending growth assessment information to patients before appointments; ii) providing refresher training to staff; iii) including dental assistants in growth assessments; iv) updating staff regarding referral outcomes; v) providing culturally appropriate information resources for patients and families; and vi) including longitudinal tracking of growth assessments in patient information systems.

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Research Involvement and Engagement

RESEARCH ARTICLE

Open Access

The codesign of implementation strategies for children's growth assessment guidelines in the dental setting

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Abstract

Background: Considering the interdisciplinary role dental staff can play in addressing overweight and obesity in childhood, this study aimed to codesign guideline implementation strategies for children's growth assessment and dietary advice guidelines in the dental setting.

Methods: This qualitative study utilised principles of codesign and appreciative inquiry through a series of four, two-hour focus groups with dental staff and parents. Focus groups were analysed using content analysis.

Results: Discussion fell into two main themes, engaging patients throughout their care journey and supporting staff to engage with the guidelines. Six strategies were developed within these themes: (1) providing growth assessment information to patients and families before appointments, (2) providing refresher training to staff, (3) involving dental assistants in the growth assessment, (4) keeping dental staff updated regarding referral outcomes, (5) culturally appropriate information resources for patients and families, and (6) enabling longitudinal growth tracking in patient information systems.

Conclusions: This study successfully designed six implementation strategies for children's growth assessment guidelines in the dental setting. Further research is required to determine their impact on guideline adherence.

Keywords: Codesign, Implementation, Childhood, Overweight, Obesity, Dental

Plain English summary

Being above a healthy weight in childhood is a major public health issue. In parts of Australia, dental staff need to screen for and promote healthy weight among children. As this is not a normal part of dental care, it could be hard for this change to come about. So, this study aimed to create strategies to help dental staff to screen for and promote healthy weight among children. As we wanted those impacted by the strategies to have a say, we worked with public dental staff and parents. When health staff and the community come together to design ways to improve health care, this is known as codesign. In groups, these people codesigned a series of strategies. Strategies for parents included: (1) informing parents about what to expect in their child's appointment; and (2) creating resources for parents from other cultures. Strategies for dental staff included (1) ensuring staff were trained; (2) involving the whole dental team

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to save time; (3) ensuring dental staff heard back from services they sent children to for healthy weight support; and (4) creating a way to record children's growth over time. Bringing in both parents and dental staff gave them a voice to codesign strategies to help dental staff screen and promote healthy weight among children. This produced a suite of strategies that were appropriate for all involved.

Introduction

Overweight and obesity among children is a serious public health concern around the world. Between 1980 and 2013, the global prevalence of overweight and obesity among children and adolescents increased by almost 50%, with more than a fifth of children in developed countries classified as experiencing overweight or obesity [1]. This is of concern, as children who experience overweight or obesity are more likely to continue to experience overweight or obesity in adulthood, develop noncommunicable diseases [2], and experience low self-esteem, depression, poor quality of life, bullying and social isolation [3, 4]. Managing overweight and obesity in childhood has therefore been an ongoing focus of both national and global health strategies [4]. Although many health promotion and disease prevention interventions have been developed to reduce overweight and obesity among children [4], the prevalence of childhood obesity remains high [1].

In response to this, the Australian National Health and Medical Research Council (NHMRC) developed clinical practice guidelines recommending that growth of children be monitored using US-CDC or WHO Body Mass Index (BMI) percentile for children aged 2–18 years, and the WHO charts for children aged younger than two years [5]. These guidelines recognise general practitioners (GPs) or practice nurses as the health care providers responsible for these practices [5]. However, research suggests that weight assessment and promotion is often not prioritised in general practice, with over 92% of GPs unaware of the NHMRC clinical practice guidelines [6], and less than 5% of GPs routinely checking children's weight [7]. There is potential for other health practitioners to address overweight and obesity in children, including dental practitioners [8]. In fact, dental practitioners are well placed for this, as they often see children on a regular basis for periodic oral examinations and could conduct serial growth assessments [8]. Furthermore it is known that being below or above a healthy weight can share risk factors with tooth decay, such as nutrient poor diets, or excess consumption of sugar and sugar-sweetened beverages, and thus identification of these behaviours is already of relevance to dental practice [9–11].

In light of the interdisciplinary role that dental practitioners can play in children's healthy weight promotion, Australia's most populated state, New South Wales (NSW), released guidelines for the conduct of children's growth assessments in public oral health services [12]. However, research highlights that the success of clinical guideline implementation is variable [13]. When implementing children's growth assessment guidelines in the dental setting, studies have cited lack of training, fear of appearing judgemental, fear of patient rejection, and the complexity of providing healthy weight counselling in a sensitive way, as significant barriers to compliance [10]. Thus there is a growing need to provide strategies to address these factors and optimise the uptake of new clinical guidelines into practice [14]. It is anticipated that guideline implementation strategies will be required to implement children's growth assessment guidelines in the dental setting, which can include the provision of education and training, equipment and resources, as well as various incentives [15].

Yet to date, no published research explores the development of implementation strategies for this purpose, nor used co-design as the approach. Co-design is a participatory approach that brings together patient and staff experiences with inputs from other stakeholders to improve health service delivery [16]. It acknowledges a clear link between staff and patient experiences in the delivery of healthcare, and solutions designed in this way are more likely to be feasible and sustainable, as they are acceptable to all stakeholders involved [16].

Methods

Aims

The aim of this study was to design strategies that would facilitate the implementation of children's growth assessment and dietary advice guidelines in the dental setting.

Study design

This study followed a qualitative, appreciative inquiry approach. Appreciative inquiry allows a shift from the traditional research approach of identifying problems in a system, to an approach of identifying what can be done to improve the system [17]. This can promote organisational change, moving away from a potential culture of blame towards self-determined change, which is particularly useful when implementing guidelines such as children's growth assessment guidelines in the dental

setting [17]. This approach allows different members within an organisation to engage in their own research to improve service delivery, and aligns with the principles of codesign, which aims to engage staff and end users in the development of solutions for healthcare delivery [16, 17]. These approaches were thus incorporated to enable the development, feasible, sustainable strategies that would be acceptable by all individuals involved in the guidelines, both staff and end users. All results in this study were presented according to the COREQ reporting guidelines [18]. This study was a single phase of a multi-phase, sequential mixed methods project aiming to develop and evaluate the effectiveness of guideline implementation strategies for children's growth assessment guidelines in the dental setting.

Theoretical framework

The integrative model of behavioural prediction (IM) underpinned this study (Additional file 1), which assumes that intentions are the immediate antecedents of behaviour, with environmental factors, skills and awareness as moderators to this relationship [19]. Intentions, in turn, are considered a function of attitudes, perceived normative pressure and self-efficacy [19]. All study findings were framed around the IM.

Context

This study was undertaken across two Local Health Districts in Greater Western Sydney, NSW, Australia between July to August of 2020. One district (D1) was larger, with a population around 1 million people served by nine public dental clinics. In this district, under half (46%) of people spoke English at home, and regions within this district experienced anywhere from the 1st to the 10th decile of the Index of Relative Socio-economic Disadvantage (IRSD) [20, 21]. This indicated this was a diverse community, with individuals from the 10% most to the 10% least disadvantaged individuals in the country. The other district (D2) was smaller, with a population of almost 350,000 people served by three public dental clinics. Most people (82%) within this district spoke English at home, and regions within this district experienced anywhere from the 2nd to the 9th decile of the Index of Relative Socio-economic Disadvantage, however most were above the 7th decile, indicating this population experienced less disadvantage than D1 [20, 21].

Participants and sampling

In line with the principles of co-design, recruitment strategies endeavoured to sample both the staff that would be engaging in the new guidelines, as well as parents who would be end-users of these guidelines and could provide consumer insight. Purposive sampling was used to ensure a spread of dental therapists (DTs), oral health therapists (OHTs) and dental assistants (DAs) employed at the 12 participating public dental clinics were recruited. DTs and OHTs are the main practitioners that treat children in NSW public dental services, and thus would be the main staff involved in the new guidelines. DAs are partnered with DTs and OHTs to aid them throughout the appointment, and therefore could also play a role. Focus group times were organised during free time slots in clinic appointment books. Eligibility criteria for dental staff can be seen in Table 1. Invitation flyers, information sheets and consent forms were circulated to eligible staff via email.

Parents (P) of children living within either of the participating districts were also recruited using purposive sampling. This sampling technique was used in an attempt to obtain diversity in parents regarding cultural and linguistic diversity, socioeconomic status, level of education and gender. Refer to Table 1 for eligibility criteria for parents. Word of mouth recruitment and snowballing was used, where dental staff and researchers invited eligible parents to contact the principal investigator, who in turn provided further information, consent forms and scheduled them into a focus group time slot. Invited participants included attendees at the public dental services, parents known to the research team, and parents accessing a multicultural health service.

Data collection

A total of four focus groups were conducted, two at each participating district. These focus groups were conducted virtually over Zoom and lasted approximately two hours, with only researchers and participants present. Focus groups 1, 3 and 4 were facilitated by AV and AG, and focus group 2 also had LR and DM present. All

Table 1 Eligibility criteria for participants

Dental staff criteria	Parent criteria
Is a practising dental therapist, oral health therapist or dental assistant	Has at least one child aged 2–18 years
Works in public dental services within either of the participating districts	Lives within either of the participating districts

facilitators were experienced qualitative researchers, with the lead investigator being formally trained in appreciative inquiry. The lead investigator provided all other facilitators with training regarding appreciative inquiry and the intended format of the focus groups. At the commencement of each focus group, while dental staff and parents were together, a facilitator gave an introduction explaining the guidelines and codesign process in simple terms, and emphasising the desire for all participants to have a voice based on their firsthand experiences. After initial introduction, dental staff and parents were moved into separate breakout rooms to ensure participants were comfortable and able to express themselves freely, particularly as dental staff may have a position of power in respect to the parents. In these separate rooms they recalled and share positive experiences with either providing or receiving health promotion and identify themes that they perceived led to the success of those experiences. Each room was asked to choose the three most important themes that could be useful in the implementation of the children's growth assessment guidelines. These themes were written down by facilitators, with the list verified by all participants.

Following this, the breakout rooms were combined into a single room, where participants identified the top four themes overall. This involved either combining common themes between groups or eliminating less relevant themes. At this stage, facilitators used the written list of themes to ensure themes were objectively and accurately presented, ensured all participant voices were sufficiently heard, and avoided leading questions to ensure the process was led by participants. Due to the appreciative inquiry approach, only positive factors were inherently being discussed, and as a result there were very few points of disagreement, and minimal issues in bringing together the staff and parents. Where any disagreement arose, facilitators enabled all participants to express and justify their opinions, and in all cases, the act of doing this enabled others to gain perspective and for consensus to be achieved. Participants were then prompted to use the final themes to co-design actionable implementation strategies that could be used with the growth assessment guidelines. Toward the end of each workshop, strategies proposed by participants were written by facilitators onto a screen shared document. Facilitators ensured participants verified these strategies at this time, and where required, modifications were made. One focus group (focus group 4) had only dental staff participate, and as a result they engaged in a single continuous focus group where all the above steps were still undertaken, aside from sharing and combining themes with the other group. All focus groups were recorded, and investigators also took field notes, some of which were verified by participants.

Data analysis

All recorded focus groups were professionally transcribed verbatim and reviewed by a study investigator (AV) for accuracy. All participants were assigned pseudonyms for confidentiality (see Additional file 2 for all pseudonyms with basic participant characteristics), after which, content analysis was undertaken. All study investigators familiarised themselves with some of the focus group transcripts, with AV and AK reading all focus group transcripts. Transcripts were initially analysed to develop preliminary coding frames, with two preliminary coding frames independently developed, one by AV, and the other by DM and AK. A consensus meeting with the entire study team was held to review both coding frames, negotiate divergent viewpoints and decide upon the best structure for the final coding frame. Following this the final coding frame was piloted and refined by AV, and a final consensus was achieved with the study team. The final coding frame included a hybrid of both concept-driven categories (deductive) derived from the theoretical framework adopted for the study, and data-driven categories (inductive) generated by participants' themes. All relevant study data were categorised into this final coding frame.

Research team and reflexivity

All members of the research team completed a reflexivity questionnaire following data collection to allow researchers to reflect on how their backgrounds, beliefs and prior relationships may have impacted data collection. See Additional file 3 for the full reflexivity questionnaire. All investigators had experience in facilitating and analysing focus groups, with one researcher (LR) having an extensive background in qualitative research. Furthermore, all researchers had a health-related professional background, which allowed unique insight into the research area and in-depth probing of participants. Most investigators shared the beliefs that overweight in childhood, as well as expanding the scope of clinical practice were challenging and sensitive topics to address, however acknowledged that a strength-based approach could be an effective way to conduct the study. Only one researcher (DM) had close relationships with some of the participants, with one participant being a niece, and the other being a friend, however upon reflection it was not believed to impact on the data collected. To address any bias caused by this relationship, it was ensured that

this investigator did not facilitate the focus group alone and played more of a scribe role than facilitator. Other researchers noted that some participants were current or prior colleagues (AG and AV), however considering the topics being discussed it was anticipated this would not significantly impact data collection. Further details on each researcher can be seen in Additional file 4.

Rigour and trustworthiness

Throughout the conduct of this study, various strategies were used to ensure the rigour and trustworthiness of study findings, and specifically to address credibility, transferability, confirmability and dependability [22]. The credibility of research findings was ensured by prompting participants to generate initial themes on which the coding frame was based, through the use of multiple independent researchers when undertaking analysis and through data triangulation derived from different perspectives. These included perspectives from dental healthcare workers as providers of health promotion and parents as consumers of health promotion messages [22]. This data triangulation, along with recording of focus groups and field notes from researchers, also helped ensure confirmability of results [22]. Dependability was also ensured through the recording of focus groups, discussions and careful documentation of the steps undertaken in the research processes [22]. Finally, transferability was maximised through the use of thick description to sufficiently detail the context in which data was collected, as well as involvement of different local health districts, different types of dental staff, and parents from a range of cultural backgrounds and educational levels [22].

Table 2 Demographic characteristics of participants

Characteristic	*n* (%)
Dental staff (*n* = *20*)	
Current position	
Dental Assistant	5 (25.0)
Dental Therapist	8 (40.0)
Oral Health Therapist	7 (35.0)
Sex	
Male	1 (5.0)
Female	19 (95.0)
Age (mean ± SD)	42.75 ± 12.14
Highest level of education	
Diploma/Certificate	10 (50.0)
Bachelor	7 (35.0)
Graduate Certificate/Diploma	3 (15.0)
Received training regarding growth assessment for children	
Yes	18 (90.0)
No	2 (10.0)
Parents (*n* = *9*)	
Sex	
Male	0 (0.0)
Female	9 (100.0)
Age (mean ± SD)	38.33 ± 9.24
Number of Children (median, range)	2, 2–5
Age of Youngest/Only Child (mean ± SD)	6.44 ± 4.32
Age of Oldest Child (mean ± SD)[†]	12.78 ± 8.48
Highest level of education	
Diploma/Certificate	3 (33.3)
Bachelor	3 (33.3)
Masters	3 (33.3)
Children have received a growth assessment in the dental setting	
Yes	4 (44.4)
No	5 (55.6)

Results

Demographics

A total of 20 dental staff participated in the four focus groups and eight parents participated across three focus groups. Of the dental staff, five were dental assistants and 15 were dental therapists and most reported receiving training regarding growth assessment. All eight parents who participated in the study were females with age ranging from 29 to 54 years (mean 40.25 years). Full demographic characteristics of participants are outlined in Table 2.

Content analysis

Content analysis resulted in the development of a coding frame which was constructed to align with the IM framework and consisted of two major themes: (1) engaging patients throughout their care journey; and (2) supporting staff to engage with the guidelines. This frame also had six subthemes, three under each major theme. All themes and subthemes were discussed by all four focus groups. The perspectives of the patients as seen in the first theme of this coding frame were vital background factors that could shape stereotypes and stigmas related to the guidelines. As per the IM, these factors influence intentions and environmental constraints when engaging in the guidelines. Please refer to Additional file 5 for additional quotes for each theme and subtheme.

Theme 1: Engaging patients throughout their care journey

Across all four focus groups, parents and dental staff alike highlighted the importance of keeping patients and their families engaged throughout their entire care journey, from before the appointment through to after the appointment. This was considered key if implementation of the children's growth assessment guidelines was to be successful.

Setting expectations before the appointment—"it's not a surprise"

Parents and dental staff from all four focus groups discussed the importance of patients and their families being aware of these guidelines prior to attending their appointment. This would ensure patients and their families already knew what to expect coming to their appointment and would not feel as though they were being judged when they were invited to participate in a growth assessment.

> *"…if someone's coming for an appointment, telling them beforehand that this is going to happen, so they don't feel like they've walked in the front door and you looked at their child and went, wow, that child looks overweight I'm going to do a height and weight on them." (Sarah – P, D1)*

Within two focus groups, there were some comments from dental staff and parents that prior information about the guidelines be particularly beneficial to prepare teenagers and children with special needs who may be more sensitive or apprehensive about receiving a growth assessment.

When it came to specific strategies, participants from all focus groups suggested incorporating this information into the existing appointment booking processes. In NSW, initial appointments for public dental consultations are generally booked through a central call centre, following which a reminder letter will be sent to patients. Thus, parents and dental staff discussed the potential for some brief information regarding the growth assessment to be provided either through the call centre or with reminder letters.

> *"…they could tell us when we book an appointment or even you know how you get a letter sent out in the mail with the appointment time and stuff on it, could they add it into that" (Joanne – P, D2)*

Personalised care during the appointment—"tailored messaging… increases engagement"

Parents and dental staff from all focus groups highlighted the need for personalised care during the appointment, and how this was vital when conveying growth assessment information to patients and their families. When receiving health information, parents and dental staff from all three focus groups agreed that information tailored to the specific experiences of each patient, that could be understood by both the child and parent, resulted in the best outcomes. One parent summarised that they preferred "*not being talked to by a health professional with one narrow message. The tailored messaging to the child, plus the parents I think increases engagement.*" (Mai – P, D1).

However, one area in which personalised care was limited was regarding cultural sensitivity. Parents from culturally and linguistically diverse (CALD) backgrounds in one focus group emphasised the need to be culturally sensitive when engaging with these guidelines to avoid feelings of being judged or criticised. One parent reflected on her own experience:

> *"I felt all the time that criticism, even in the way they were speaking to me, they spoke like … [by] raising their voice [I was going to] understand better and it was not the case. I could understand, but I couldn't speak. That was my problem." (Isabella – P, D1)*

Dental staff from three focus groups agreed that acknowledging various cultural backgrounds was an important part of personalised care and proposed that more educational resources developed for people from culturally and linguistically diverse backgrounds would be helpful. One dental staff member stated, "*it's very, very important if you're going to have resources [there] has to be a translation*" (Lucy – OHT, D1). However, it was acknowledged that some districts were more multicultural than others, and thus the need for multicultural resources varied.

Continuity of care after the appointment—"I knew where… we are headed"

Parents from all three focus groups discussed that they wanted continuity of care when being referred to weight management services, so they could have a seamless transition while still being followed up at subsequent dental appointments.

> *"…some sort of clear follow through plan so that we could always go back to someone and get reassured, rather than it being this one event experience for the parent and child, and then they're move on to be referred to all these other programs, and it's never*

discussed again." (Mai - P, D1)

Dental staff from all focus groups also appreciated the benefits of being able to follow through with patients. However, in two focus groups, dental staff also highlighted that following up patients after referral to other services was sometimes difficult as these services did not always send updates or discharge summaries back to the referral clinic.

> *"I would never really know if they've even done the Go4Fun [children's healthy weight program] or anything like that unless I ask them the following time if they have or have not or whatever." (Rosalie - OHT, D2)*

Dental staff suggested the routine provision of such updates could be a strategy to ensure that they remain informed about their patients' progress and allowed for follow up.

Theme 2: Supporting staff to engage with the guidelines

Focus group participants also acknowledged the support dental staff required to engage with the children's growth assessment guidelines. This support was needed to increase intentions to adhere to guidelines, improve awareness and skills, and address environmental constraints.

Increasing intentions to engage in guidelines—"this is a new practice that's come into play"

Most dental staff across all focus groups demonstrated positive attitudes and believed the children's growth assessment guidelines were beneficial. Specifically, they emphasised these guidelines could help provide assessments to children that do not regularly access other health services. Furthermore, dental staff from three out of the four focus groups, and parents from all three focus groups expressed that although a sensitive topic, especially with teenagers, most parents would accept the growth assessment guidelines and understood that this had a connection to oral health. Therefore, staff displayed a good amount of confidence with adhering to the guidelines once they explained to the patient that this was part of standard care across all medical services.

> *"…you just say to them that this is a new practice that's come into play with all of health. You'll be asked at doctors – you know, various different medical appointments and it's just part of the normal procedure. Are you happy to go ahead with it? I don't think I've ever had someone say no to me by saying it that way." (Fatima – OHT, D2)*

However, one staff member was concerned about the appropriateness of growth assessment for children and thought it would not be accepted by parents. As a result, this staff member did not display high self-efficacy in engaging with the guidelines. "*I understand why the government wants to do this, but I do feel very cornered in giving people information that they most probably don't want to know.*" (Leslie – DT, D2).

Regarding specific strategies to feel more confident in adhering to the guidelines, staff proposed that there should be more informational pamphlets available to provide parents a rationale for the growth assessments.

Improving awareness and skills—"you've got to give [them] the knowledge and the training"

Dental staff from all four focus groups and parents from two out of three focus groups thought it was vital for staff to be adequately trained regarding the growth assessment guidelines. Staff from three focus groups discussed that training would help ensure consistent messaging throughout the dental service. Furthermore, one staff member highlighted that although some staff had received training, they still lacked sufficient skill when performing the growth assessments.

To address this, staff from three focus groups proposed future training programs, which should have more in depth information about the referral pathways that were in place. Staff from two focus groups discussed the potential for direct collaboration with other allied health staff to improve their skills in the care of their patients:

> *"A dietitian point of view is different from a dental therapist, oral health therapist point of view... I think it's a collaboration is what we need, and we need to be trained differently." (Marie – DT, D1)*

Addressing environmental constraints—"we haven't got enough time"

Dental staff from all focus groups explained that environmental factors, things beyond their control in their work environment and context, could impact engagement of both them and their patients in the growth assessment guidelines. Time limitations were discussed in all focus groups, as dental therapists have limited time to complete consultations. Staff proposed that training dental assistants to conduct the growth assessment could be a potential strategy to save time by enabling dental therapists to simultaneously conduct other activities. One dental therapist explained, "*the only*

criticism I've got of it is that we haven't got enough time and if we can train the assistants to be able to take the measurements, that's a really big help." (Jane – DT, D1).

Staff from three focus groups and parents from one focus group also discussed the location of the scales and timing of the growth assessment as a factor that could influence the outcomes of growth assessments. With some scales in central locations and others in private rooms, and some appointments being a less appropriate time for growth assessments, such as emergency or acute consultations, staff wanted the freedom to decide when and where these assessments were conducted. They highlighted this could help encourage the cooperation of patients and families.

> *"Whether to do it at the first appointment or whether it is … more appropriate to make sure that we look after the pain rather than concentrate on height and weight at the beginning…" (Bianca – DA, D1)*

Dental staff from two focus groups raised issues with how productivity was measured in their clinics. Performing dental treatments such as fillings could credit staff with higher productivity for the same amount of time required when compared to health promotion activities. They therefore explained that a system which better recognised the time required for health promotion would further incentivise implementation of the growth assessment guidelines.

> *"…if … you've done three fillings in one side that's more productive than what the dental health education is or the diet discussion in their eyes and in their view." (Leslie – DT, D2)*

Finally, staff from one focus group thought the patient information systems they used should include a longitudinal growth chart. Staff clarified that the existing system catalogued a new chart for each new growth assessment, rather than plotting them longitudinally. They emphasised that a longitudinal growth chart would enable them to better monitor children over time.

> *"…show them the changes because some kids belong at the 80th percentile, some kids belong at the 20th percentile... I would like to be able to compare over visits much more easily than we can." (Peter – DT, D2)*

The designed strategies

From the above themes, six implementation strategies were designed by participants. For dental staff, these included: (1) the use of refresher training to ensure staff were trained on a regular basis; (2) the involvement of dental assistants in the growth assessment to save time for dental therapists to engage in other tasks; and (3) developing a way to record and present children's growth measurements across time so that staff could track a child's progression. For parents, implementation strategies involved: (1) the inclusion of growth assessment information in the booking reminder letters they received prior to attending appointments, (2) developing information resources for parents from CALD backgrounds; and (3) requesting referral pathways to send discharge summaries back to the referring dental clinics. See Fig. 1 for all strategies.

Discussion

This qualitative study aimed to use the principles of appreciative inquiry to codesign implementation strategies for children's growth assessment and dietary advice guidelines in the dental setting. Strategies proposed

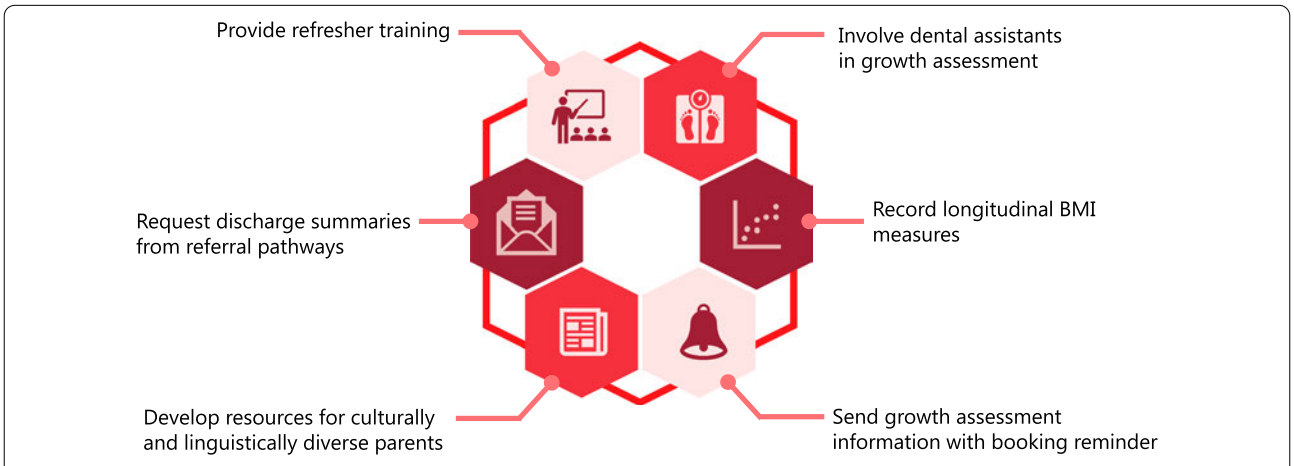

Fig. 1 Strategies codesigned by participants

in this study were based around two main themes: (1) engaging patients throughout their care journey, and (2) supporting staff to engage with the guidelines. Within the theme of engaging patients, participants proposed strategies to provide information regarding the guidelines prior to the appointment, provide tailored and culturally appropriate information during the appointment, and to ensure continuous care and sufficient follow-up after the appointment.

This theme of engaging patients is consistent with the existing literature, which highlights the importance of accounting for the needs of patients in implementation [23]. Specifically, studies in other healthcare settings have highlighted the importance of setting patient expectations through provision of information, being correlated with patient satisfaction [24]. In addition, personalised care, specifically regarding the information patients receive and cultural sensitivity, is also known to be vital in guideline implementation [25, 26]. Furthermore, research has found provider continuity to be associated with improved patient outcomes and satisfaction [27].

The second theme of supporting clinicians included strategies to provide educational resources and training, involve dental assistants to save time, and improve location of scales, timing of growth assessments, productivity appraisal and documentation of longitudinal growth assessments. Other studies also found that when it came to children's healthy weight and sugar consumption, dental staff were in need of educational materials, especially for nutrition-related advice, and further training [10]. Provision of education is also an effective implementation strategy for dental staff [28]. Research also highlights the need for innovative solutions to time constraints, which are a known challenge for childhood obesity interventions in the dental setting, and the importance of good productivity systems for staff, with pay for performance an effective implementation strategy for dental staff [28, 29]. Furthermore, current practice guidelines emphasise the importance of the location of scales and timing of growth assessment for privacy purposes, and the use of longitudinal growth charts for children's growth assessments [5, 30].

Although some dental research has based implementation strategies on qualitative data and feedback from users [31], to our knowledge there are no existing studies that use the principles of codesign for implementation strategies in the dental setting. Furthermore, to date, no published research explores the development of implementation strategies for children's growth assessment and dietary advice in the dental setting. Thus, this study provides rich insight into a unique approach for developing implementation strategies. Although there is a lack of empirical evidence regarding codesign approaches, it is known that codesign can be beneficial for practitioners and research outcomes, not only producing materials with increased relevance and acceptability for end users, but also resulting in a sense of support and enthusiasm for the intervention [32]. In light of the mounting evidence surrounding the links between oral health and general health, and thus the ever-expanding interdisciplinary role of dental staff [8, 33], research on the use of codesign in this context is much needed to inform such public health initiatives.

Despite this study being the first of its kind in this area, there are some limitations that should be acknowledged in the interpretation of the data. Firstly, the majority of participants in this study were female, and no male parents participated. However, 87.9% to 98% of the dental therapist, oral health therapist and dental assistant workforces in Australia are female, thus the study sample can be seen as representative of these figures [34–36]. In addition, Australian data indicates that not only are female parents more likely to be unemployed, but employed female parents more often utilise work arrangements that enable them to care for their children during the day [37]. This would significantly impact the demographic characteristics of parents available during business hours for this study. Nonetheless, the lack of male parent perspectives in this study could impact representation of single parent, and other households with only male parents, and therefore results should be interpreted with caution. Furthermore, the education level of parents was higher than average for Australia, with all parents holding an educational qualification beyond high school, compared to around 70% of Australians of the same average age [38]. Although it is anticipated these strategies would remain highly applicable to parents with other educational levels, this difference should still be considered when applying proposed strategies to other populations. This study was also limited to two urban districts in greater western Sydney, and although these districts have variability in cultural diversity and socioeconomic status, proposed strategies were based on the needs of individuals within these districts, and thus may be only applicable for districts with similar needs. Furthermore, due to the word of mouth and snowballing recruitment techniques, the exact number of individuals approached for the study was not documented, thus response rates could not be determined. Finally, while focus groups were conducted virtually for this study due to COVID-19 restrictions, research has highlighted the value of online platforms for qualitative research, with video conferencing methods having the potential to produce data of similar quality to face-to-face methods [39]. All participants were able

to use and access Zoom, and most were already familiar with the platform. Detailed instructions were provided to all participants, and telephone numbers were also collected as a contingency plan in the case of technical difficulties, however there were minimal technical issues experienced during the focus groups. Thus it is anticipated that there is negligible impact on data collected using this method.

Despite these limitations, this study has provided unique insights from key players and produced novel data regarding the codesign of implementation strategies in the dental setting. These findings could have a significant impact on how the public health concern of overweight and obesity in childhood is addressed in the dental setting. Further research could involve process evaluations to explore the experience of participants during similar codesign approaches. Future phases of this research project will involve quantitative evaluations to determine the effectiveness of co-designed strategies in improving guideline adherence.

Conclusions

This study used a collaborative, co-design approach to create potential implementation strategies for children's growth assessment guidelines in the dental setting. These strategies were focused around engaging patients and supporting staff so that both parties could adhere to the guidelines. This collaborative approach has provided a voice for key players in the design of effective, sustainable, and feasible implementation strategies for guidelines to assess children's growth in the dental setting. This will ultimately assist in addressing the public health concern of overweight and obesity in childhood.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40900-022-00356-8.

Additional file 1. The Integrative Model of Behavioural Prediction asapplied to the study.

Additional file 2. Focus group case classification table.

Additional file 3. Focus group reflexivity questionnaire.

Additional file 4. Characteristics of the research team.

Additional file 5. Table of additional quotes.

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Author contributions

ARV designed this study, conducted recruitment, data collection and analysis, and was a major contributor in writing the manuscript. DM, LR and AG all assisted with recruitment, data collection, data analysis and manuscript writing. AK assisted with data analysis and manuscript writing. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study received ethical approval from the Human Research Ethics Committees of both participating sites (2019/ETH12668). Participants were provided verbal and written information about the study before attending the focus group, and were given the opportunity to seek any clarification before giving written consent. Participants were informed of the voluntary nature of participation and that their decision to participate or not would not affect their care or relationship with the participating organisations. They were also notified that they could withdraw from the project at any stage.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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References

1. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2014;384(9945):766–81.
2. World Health Organisation. Noncommunicable diseases: childhood overweight and obesity 2020. Available from: https://www.who.int/news-room/q-a-detail/noncommunicable-diseases-childhood-overweight-and-obesity.
3. Rankin J, Matthews L, Cobley S, Han A, Sanders R, Wiltshire HD, et al. Psychological consequences of childhood obesity: psychiatric comorbidity and prevention. Adolesc Health Med Ther. 2016;7:125–46.
4. World Health Organisation. Population-based approaches to childhood obesity prevention, Geneva, Switzerland; 2012.
5. National Health and Medical Research Council. Clinical practice guidelines for the management of overweight and obesity in adults, adolescents and children in Australia. Melbourne; 2013.
6. McMeniman E, Moore R, Yelland M, McClure R. Childhood obesity: how do Australian general practitioners feel about managing this growing health problem? Aust J Prim Health. 2011;17(1):60–5.
7. O'Shea B, Ladewig EL, Kelly A, Reulbach U, O'Dowd T. Weighing children; parents agree, but GPs conflicted. Arch Dis Child. 2014;99(6):543–5.
8. Perman JA. Teaming up against childhood obesity. Bariatr Nurs Surg Patient Care. 2011;6(3):109–10.
9. Dooley D, Moultrie NM, Sites E, Crawford PB. Primary care interventions to reduce childhood obesity and sugar-sweetened beverage consumption:

food for thought for oral health professionals. J Public Health Dent. 2017;77(Suppl 1):S104–27.
10. Wright R, Casamassimo PS. Assessing attitudes and actions of pediatric dentists toward childhood obesity and sugar-sweetened beverages. J Public Health Dent. 2017;77(Suppl 1):S79–87.
11. Sheetal A, Hiremath VK, Patil AG, Sajjansetty S, Kumar SR. Malnutrition and its oral outcome—a review. J Clin Diagn Res. 2013;7(1):178–80.
12. New South Wales Government. Growth assessment and dietary advice in public oral health services 2019. Available from: https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/GL2019_001.pdf.
13. Conroy M, Shannon W. Clinical guidelines: their implementation in general practice. Br J Gen Pract. 1995;45(396):371–5.
14. Grol R. Successes and failures in the implementation of evidence-based guidelines for clinical practice. Med Care. 2001;39(82):46–54.
15. Effective Practice and Organisation of Care. EPOC taxonomy 2015. Available from: https://epoc.cochrane.org/epoc-taxonomy.
16. Dawda P, Knight A. Evidence based co-design: a toolkit for Australia. Canberra, Australia: Australian Healthcare and Hospitals Association, Consumers Health Forum of Australia; 2017.
17. Hennessy JL, Hughes F. Appreciative inquiry: a research tool for mental health services. J Psychosoc Nurs Ment Health Serv. 2014;52(6):34–40; quiz 58–9.
18. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007;19(6):349–57.
19. Fishbein M. A reasoned action approach to health promotion. Med Decis Making. 2008;28(6):834–44.
20. Australian Bureau of Statistics. Census 2016, language spoken at home by sex (LGA). Canberra: ABS; 2016.
21. Australian Bureau of Statistics. Census of population and housing: socio-economic indexes for areas (SEIFA), Australia, 2016. Canberra: ABS; 2018.
22. Shenton AK. Strategies for ensuring trustworthiness in qualitative research projects. Educ Inf. 2004;22(2):63–75.
23. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement Sci. 2009;4:50.
24. Hageman MGJS, Briët JP, Bossen JK, Blok RD, Ring DC, Vranceanu A-M. Do previsit expectations correlate with satisfaction of new patients presenting for evaluation with an orthopaedic surgical practice? Clin Orthop Relat Res. 2015;473(2):716–21.
25. Clouser JM, Sirrine M, McMullen CA, Cowley AM, Smyth SS, Gupta V, et al. "Passing out is a serious thing": patient expectations for syncope evaluation and management. Patient Prefer Adherence. 2021;15:1213–23.
26. Barksdale DJ. Provider factors affecting adherence: cultural competency and sensitivity. Ethn Dis. 2009;19(4 Suppl 5):S5-3-7.
27. Van Walraven C, Oake N, Jennings A, Forster AJ. The association between continuity of care and outcomes: a systematic and critical review. J Eval Clin Pract. 2010;16(5):947–56.
28. Villarosa AR, Maneze D, Ramjan LM, Srinivas R, Camilleri M, George A. The effectiveness of guideline implementation strategies in the dental setting: a systematic review. Implement Sci. 2019;14(1):106.
29. Cole DDM, Boyd LD, Vineyard J, Giblin-Scanlon LJ. Childhood obesity: dental hygienists' beliefs attitudes and barriers to patient education. J Dent Hyg. 2018;92(2):38.
30. New South Wales Government. Growth assessment in children and weight status assessment in adults. In: Centre for Population Health, editor. Sydney: Centre for Population Health; 2017.
31. Tilliss TI. Improving implementation of oral cancer screening recommendations [Ph.D.]. Ann Arbor: University of Colorado at Denver; 2006.
32. Slattery P, Saeri AK, Bragge P. Research co-design in health: a rapid overview of reviews. Health Res Policy Syst. 2020;18(1):17.
33. Villarosa AR, George D, Ramjan L, Srinivas R, George A. The role of dental practitioners in addressing childhood overweight and obesity: a scoping review of current interventions and strategies. Ob Res Clin Pract. 2018;12(5):405–15.
34. Australian Government. Dental therapists: 2017 factsheet. Canberra: Department of Health; 2019.
35. Australian Government. Oral health therapists: 2017 factsheet. Canberra: Department of Health; 2019.
36. Australian Government. Dental assistants Canberra: Commonwealth of Australia; 2021. Available from: https://joboutlook.gov.au/occupations/dental-assistants?occupationCode=4232.
37. Australian Government. Work and family Canberra: Australian Institute of Family Studies; 2021. Available from: https://aifs.gov.au/facts-and-figures/work-and-family.
38. Australian Bureau of Statistics. Educational qualifications in Australia. Canberra; 2017. Report No.: 2017.0.
39. Villarosa AR, Ramjan LM, Maneze D, George A. Conducting population health research during the COVID-19 pandemic: impacts and recommendations. Sustainability. 2021;13(6):3320.

Publisher's Note

Chapter 7

Results, Phase 3: Scale development

7.1 Introduction

This chapter presents the findings from Phase 3 of the CHEWI project, namely the development and psychometric evaluation of the iCHeW scale, which was used to pilot test the implementation strategies developed in Phase 5. These results are presented in Paper 5, which is a peer-reviewed journal article, published in Obesity Research and Clinical Practice. This chapter first introduces the aims of Phase 3 and Paper 5, then presents the paper, and finally concludes by summarising the key findings from this phase.

7.2 Phase 3 overview

The aim of Phase 3 was to develop and psychometrically evaluate a scale, named the iCHeW scale, that measured behavioural predictors of dental staff engaging with children's healthy weight guidelines, based on the Integrated Model of Behavioural Prediction (IM). As no such scale has been published in this area, a sequential mixed methods study was conducted and presented in Paper 5, which systematically developed and evaluated the iCHeW scale. This paper details the process taken to develop the scale and presents the results of psychometric analysis to evaluate the factorial validity and internal consistency of the scale.

7.3 Citation: Paper 5

Villarosa AR, Maneze D, Salamonson Y, Ramjan LM, George A. Development and psychometric testing of the iCHeW guideline scale for dental staff. Obes Res Clin Pract. 2022.

7.4 Conclusion

The study presented in Paper 5 resulted in the development of a valid and reliable scale that can be used to measure dental staff behavioural predictors of engaging in children's healthy weight guidelines. This scale has good internal consistency and factorial validity, with minimal floor and ceiling effect. It is anticipated that this scale will be appropriate for use to measure the degree of change in behavioural predictors of engaging in children's healthy weight guidelines and can potentially be adapted across a range of settings.

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Development and psychometric testing of the intention to engage in children's healthy weight (iCHeW) guideline scale for dental staff

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ABSTRACT

Statement of problem: In the evaluation of interdisciplinary interventions for childhood overweight and obesity, behavioural determinants can provide valuable insight into the reasons behind lack of adherence, or ineffectiveness of the intervention. Therefore, it is vital to assess the behavioural determinants of staff when evaluating the implementation of such interdisciplinary interventions. This study aimed to develop and psychometrically evaluate the intention to engage in Children's Healthy Weight guideline (iCHeW) scale, which assesses the behavioural determinants influencing dental staff's intention to conduct children's growth assessments.

Methods: Initial items were generated based on review of the literature and the dimensions of the integrative model of behavioural prediction (IM). To test this scale, a cross-sectional survey design was undertaken consisting of three phases: (i) face validity; (ii) content validity; and (iii) psychometric evaluation of the iCHeW scale with a national sample of 125 dental staff.

Results: The 35 items generated for the iCHeW scale were revised following feedback from a reference group. These 35 items were then appraised by an expert panel, yielding 27 items for psychometric testing. Using exploratory factor analysis, a five-factor solution was extracted, which corresponded to the IM domains, with the deletion of two items. Overall, Cronbach's alpha of the iCHeW scale was 0.95, with the following values for each subscale: (i) attitudes, 0.93; (ii) behavioural constraints, 0.83; (iii) perceived norms, 0.93; (iv) self-efficacy, 0.94; and (v) behavioural intention, 0.95.

Conclusions: The iCHeW scale is valid and reliable for assessing dental staff's intention to provide routine growth assessments to children and demonstrates potential for use with non-dental staff.

1. Introduction

Noncommunicable diseases are acknowledged as complex, global health priorities due to rising morbidity and mortality [1]. This has led to an increased recognition in the health workforce, that no single profession can meet all the healthcare needs of a patient [2]. To address this challenge, greater emphasis has been placed on interdisciplinary healthcare, with many models of care shifting from operating in silos to interdisciplinary approaches [3,4]. Defined as the provision of care by various disciplines with interdependent, collaborative roles [5], interdisciplinary care can be beneficial to patient outcomes, cost-effective and promote an increase in staff satisfaction [6,7]. Within interdisciplinary models of care, the roles of health staff are more often expanded beyond their traditional scope of practice [8,9]. However, these role expansions can have challenges [8], and thus it is vital to monitor and evaluate the implementation of interdisciplinary role expansion initiatives. An example of this initiative in Australia is in addressing childhood overweight and obesity [10]. Overweight and obesity in childhood

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is a complex and challenging health concern, that requires a collaborative approach and interdisciplinary action, whereby all public health services contribute to screening and management [10]. This includes dental staff in public oral health services, who have been called upon to expand their role beyond the traditional provision of dental care [11].

To evaluate the implementation of interdisciplinary models of care and role expansions, factors that contribute to a lack of model adherence, or to ineffectiveness of the intervention need to be determined [12]. Therefore, there is increasing emphasis on exploring theoretical frameworks that have utility in identifying determinants influencing behaviours [13]. Such research could enable better generalisation of findings to routine healthcare settings by providing information on factors influencing intervention effectiveness, and enables theory-based generation of strategies for quality improvement [13–15].

One such framework is suggested by Fishbein, who argues that only a small number of factors need to be considered to predict a behaviour [16]. He proposes the integrative model of behavioural prediction (IM) using a reasoned actioned approach, which postulates that one of the key predictors of a behaviour is intention [16]. In turn, behavioural intention is influenced by a person's attitudes, perceived norms and self-efficacy towards this behaviour [16]. However this model acknowledges that intention alone does not always dictate behaviour; other factors such as skills, abilities or unanticipated environmental constraints, could also influence behaviour [16].

Nevertheless, the use of the IM to predict behaviours must be tailored to the specific behaviour to be investigated. Although previous studies on overweight and obesity-related practices had developed and psychometrically evaluated questionnaires that utilise reasoned action approaches other than the IM, these did not focus on children nor on growth assessments [17]. To our knowledge, there are no psychometrically evaluated scales that assess behavioural determinants of engaging in routine children's growth assessments using a reasoned action approach, for dental staff or any other healthcare professional. Thus, this study aimed to develop and test the psychometric properties of an instrument which assesses the behavioural determinants influencing dental staff's intention to conduct routine growth assessments for children.

2. Materials and methods

2.1. Study design

This study used a 3-phase design to develop and test the psychometric properties of the intention to engage in Children's Healthy Weight guideline (iCHeW) scale. In Phase 1, a reference group was used to test face validity. Following this, an expert panel was used in Phase 2 to test content validity. Based on expert feedback on the scale items, a national study was conducted in Phase 3 to determine the structural validity and reliability of the scale (see Table 1 for more details). Where applicable, the conduct and reporting of this study was guided by the 'Consensus-based Standards for selection of health status Measurement Instruments (COSMIN)' [18].

2.2. Study context

This study was conducted in Australia between 2020 and 2021, when the New South Wales (NSW) Ministry of Health implemented routine growth assessments for children in public dental services [11]. These guidelines applied to a range of staff working at these services, including dental assistants, dental therapists and oral health therapists, which were the staff comprising the public dental teams that worked most closely with children. In Australia, dental assistants support and assist dental practitioners in providing care, and dental therapists provide oral health care primarily to school aged children, in a structured professional relationship with a dentist [19]. Oral health therapists hold the qualifications of dental therapists, as well as dental hygienists, meaning in addition to the role of the dental therapist, they can provide preventive, educational and therapeutic care to adults in a structured professional relationship with a dentist [19]. This study was undertaken as the public dental service guidelines were being implemented. As part of this, additional renumeration for providing growth assessments was being rolled out in public dental services [11]. In view of this incentive, public dental staff may have higher behavioural intention. Therefore, this study also aimed to develop a tool that could examine differences in intention of dental staff working in public versus private settings.

2.3. Ethical considerations

Ethical approval for this study was received from the South Western Sydney Local Health District Human Research Ethics Committee (2019/ETH12668). Participants were provided written information about the study and given the opportunity to seek any clarification before giving written consent. The voluntary nature of participation and confidentiality of data was emphasised to all participants. All study data was deidentified and stored with password protection.

2.4. Item generation for the iCHeW scale

The iCHeW scale aims to assess the behavioural determinants influencing dental staff's intention to conduct routine growth assessments for children according to the dimensions of the IM. Specifically, a comprehensive review of the literature relating to practice intentions was conducted, focusing on questionnaires that assess health practitioners' intention to engage in a practice change, to generate the initial 36 items for the iCHeW scale. Literature included to inform items encompassed peer-reviewed journal articles [20–25], and theses [26,27]. Items represented each of the five dimensions of the IM to be assessed by the scale: (i) attitudes; (ii) behavioural constraints; (iii) perceived norms; (iv) self-efficacy; and (v) behavioural intention. As a 7-point Likert response format has been reported to provide optimal reliability, sufficient variability in responses and a neutral midpoint [28], items were scored on a seven-point value ranging from 1 (strongly disagree) to 7 (strongly agree).

2.5. Sampling and participants

For all three phases of this study, purposive sampling was conducted to recruit participants. Participants were either invited via email or

Table 1
Phases of the development of the iCHeW scale.

Phase	Participants	Items	Psychometric test	Analysis
1. Reference group	Dental staff and oral health higher degree research students ($n = 4$)	36	Face validity	N/A
2. Expert panel	Experts in interdisciplinary oral health ($n = 5$)	36	Content validity	Index of content validity for each item (I-CVI), average scale-level index of content validity (S-CVI/Ave)
3. National survey	Dental therapists, oral health therapists and dental assistants practicing in Australia ($n = xx$)	27	Structural validity and internal consistency	Principal axis factoring (PAF), Cronbach's alpha

social media advertisement, where information about the study, the iCHeW scale and its conceptual underpinning, as well as the requirements of their participation, were detailed. In addition, the Australian Dental and Oral Health Therapists Association (ADOHTA) advertised Phase 3 of this study on their interest group pages and social media. In Phase 1, individuals who were considered part of the target audience of the scale, as well as those with the research skills to provide feedback on the qualities of a psychometric scale, were eligible to participate. This included dental staff and oral health higher degree research students. In Phase 2, experts in interdisciplinary oral health care, such as academics, clinicians, and policy makers, were invited to participate. Interdisciplinary interventions in the oral health setting require expertise and relevant experiences of professionals from different disciplines to provide specialised insight into the issue of behavioural determinants. In Phase 3, dental therapists, oral health therapists or dental assistants practising in Australia were eligible to participate.

2.6. Data collection

For Phase 1, data were collected through a reference group conducted virtually via email. Participants were asked to provide feedback on the face validity of the scale, specifically regarding readability, clarity, relevance, and completeness of the questionnaire items. Suggestions to refine, reorder and remove items were provided via comments or tracked changes. In Phase 2, a panel of interested experts were prompted to access an online questionnaire where they could rate the relevance of each item on a 4-point scale from 0 (not relevant) to 3 (highly relevant) [29]. Space for written feedback and suggestions of further items was also provided. In Phase 3, participants were provided a link to an online REDCap questionnaire containing the iCHeW scale.

2.7. Data analysis

Data collected in Phase 2 was used to calculate the index of content validity for each item (I-CVI) by dividing the number of experts who gave an item a rating of "highly relevant" by the total number of experts. Items with insufficient content validity scores (I-CVI<0.78) were removed from the scale. A scale-level index of content validity (S-CVI) was computed for the scale, specifically the Average CVI (S-CVI/Ave), which is the sum of all I-CVIs divided by the total number of items.

Data collected in Phase 3 were imported into IBM SPSS statistics version 27 for all analysis [30]. Descriptive statistics were conducted to analyse demographic characteristics of participants, including their positions, length of experience, and geographical location. Floor and ceiling effects of each item were examined using the frequency of lowest and highest scores, with a value of < 30 % considered as the acceptable threshold [31]. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of ≥ 0.6 was set as the threshold for adequate correlation for exploratory factor analysis (EFA). Principal axis factoring (PAF) was conducted with Varimax rotation to extract the number of factors in the scale, with ≥ 0.3 as significant factor loading. The number of factors to be extracted was also guided through inspection of the scree plot and eigenvalues of each factor. With a criterion for adequate sample size being five subjects per item, PAF was deemed appropriate for the sample size of this study (n = 125, 25 items) [32]. Reliability, or internal consistency of the scale was measured by Cronbach's alpha, with a reliability coefficient ≥ 0.7 deemed an acceptable level of reliability. Corrected item-total correlation and alpha if item deleted values were also inspected. To assess the convergent and discriminant validity of the iCHeW scale, a Pearson's correlation matrix was constructed to examine correlations between overall iCHeW scale and subscale scores and work-related variables: years of experience, hours worked in public and private practice.

3. Results

3.1. Face and content validity testing

The I-CVI scores of the 36 initial items ranged from 0.4 to 1.0. The 10 items that scored an I-CVI below 0.78 were removed, and in line with the written feedback a further item was removed due to its similarities with another item, while two items deemed necessary to complete the scale were added. This resulted in 27 items, which had an S-CVI/Ave of 0.936.

3.2. Factorial validity and reliability testing

3.2.1. Sample characteristics

A total of 134 individuals accessed the survey, of which 130 consented to participate. Of these, five consenting participants were excluded as less than 50 % of the surveys were completed, leaving a total of 125 responses for analysis. The age of respondents ranged from 22 to 45 years (mean[SD], 43.63 [13.27] years), the majority of whom were females (93.5 %, $n = 116$). Over a third of respondents were oral health therapists (39.8 %, $n = 49$) or dental assistants (36.6 %, $n = 45$), with the remaining participants being dental therapists (23.6 %, $n = 29$). Although participants were sampled from all Australian states and territories, more than half of respondents reported their main job to be in New South Wales (NSW) in the past week (63.7%, $n = 79$). On average respondents worked 7.37 h/week in the private sector (SD = 12.59), and 23.75 h in the public sector (SD=16.87). Participants had an average of 18.29 years of experience working in the dental field (SD = 13.38, range 1–49 years).

3.2.2. Exploratory factor analysis

In the first iteration of exploratory factor analysis (EFA) with the 27-items, one low-loading item was removed (factor loading <0.3) and an additional item was removed due to low communality (<0.2). Using the final 25-item iCHeW scale, the KMO measure of sampling adequacy was 0.87, indicating suitability for factor analysis. The communality values ranged from 0.4 to 0.99, with five underlying factors that had eigenvalues over one (1.28–11.81), and the scree plot confirmed a 5-factor structure that explained 72.28 % of cumulative variance. These five factors corresponded to the IM dimensions used to construct the scale: (i) attitudes (6 items); (ii) behavioural constraints (6 items); (iii) perceived norms (5 items); (iv) self-efficacy (4 items); and (v) behavioural intention (4 items). Factor loadings ranged from 0.36 to 0.88 (Table 2).

3.2.3. Floor and ceiling effects

The mean score of the iCHeW scale in this sample was 110.42 (SD: 31.59) with a well-shaped aggregated score normal distribution, confirmed by the Kolmogorov-Smirnov test for normality (Test statistic: 0.56, $p = 0.200$). Using the 30 % as cut-off for floor and ceiling effects, among the 25 items, only a single item, "I am confident in my ability to do this", achieved a score above the threshold on its highest response category (32 %, $n = 21$).

3.2.4. Reliability testing

Overall, the 25-item iCHeW scale had good internal consistency, with a Cronbach's α of 0.95. Internal consistency remained good within each subsection, as indicated by the five IM dimensions: (i) attitudes ($\alpha = 0.93$); (ii) behavioural constraints ($\alpha = 0.83$); (iii) perceived norms ($\alpha = 0.93$); (iv) self-efficacy ($\alpha = 0.94$); and (v) behavioural intention ($\alpha = 0.95$).

3.2.5. Convergent and discriminant validity

The 25-item iCHeW scale demonstrated good convergent validity, indicated by a significant positive correlation between iCHeW score and number of hours worked in the public sector in the past week ($r = 0.29$, $p = 0.002$). Conversely, the scale and subscales also demonstrated good

Table 2
Factor loadings: A 5-factor extraction of 25-item the iCHeW Scale.

No.	Item	F1: (A)	F2: (C)	F3: (N)	F4: (SE)	F5: (I)
Factor 1: Attitudes (6 items, 20.0% variance, Cronbach's alpha: 0.93)						
A1.	Would be beneficial for my paediatric patients	**0.79**				
A2.	Should be a responsibility of allied dental personnel	**0.82**				
A3.	Is an important component of quality holistic clinical care	**0.77**				
A4.	Should be part of my standard practice	**0.88**				
A5.	Is something I am comfortable with	**0.71**				
A6.	Would motivate change among my paediatric patients and their families	**0.65**				
Factor 2: Behavioural Constraints (6 items, 14.6% variance, Cronbach's alpha: 0.83)						
C1R.	There are no professional benefits for me		**0.40**			
C2R.	There are no financial incentives for me or the clinic I work at		**0.45**			
C3R.	There is insufficient policy to inform my practice		**0.84**			
C4R.	My practice doesn't have educational resources to inform patients regarding these assessments		**0.83**			
C5R.	I have not received sufficient training to perform these assessments		**0.59**			
C6R.	These assessments are not valued in my practice		**0.53**			
Factor 3: Perceived Norm (5 items, 14.5% variance, Cronbach's alpha: 0.93)						
N1.	My patients would approve			**0.75**		
N2.	The caregivers of my patients would approve			**0.76**		
N3.	My line manager would approve			**0.69**		
N4.	My professional colleagues would approve			**0.68**		
N5.	I think my professional colleagues would also conduct regular weight and height assessments for children			**0.73**		
Factor 4: Self-Efficacy (4 items, 13.6% variance, Cronbach's alpha: 0.94)						
SE1.	I am confident in my ability to do this				**0.81**	
SE2.	I am confident in my knowledge				**0.81**	
SE3.	I feel that I have the skills that are needed to do this				**0.82**	
SE4.	I should have no difficulty with this				**0.74**	
Factor 5: Behavioural Intention (4 items, 9.8% variance, Cronbach's alpha: 0.95)						
I1.	I am interested in conducting regular weight and height assessments for children					**0.36**
I2.	I am considering conducting regular weight and height assessments for children					**0.69**
I3.	I intend on conducting regular weight and height assessments for children					**0.75**
I4.	I am planning to conduct regular weight and height assessments for children					**0.78**

discriminant validity, indicated by significant negative correlations between iCHeW score, number of hours worked in the private sector in the past week ($r = -0.26$, $p = 0.004$) and years' experience in the dental field ($r = -0.22$, $p = 0.013$). The correlation coefficient matrix is shown in Table 3.

4. Discussion

This study aimed to develop and test the psychometric properties of a scale that assessed the behavioural determinants of dental staff's intention to conduct children's growth assessments. The developed 25-item iCHeW scale demonstrated reliability and validity, factoring clearly into a 5-factor structure that reflected the dimensions of the IM. In addition, this scale had minimal floor and ceiling effect, with normally distributed aggregated scores. Furthermore, the iCHeW scale showed convergent and discriminant validity, being able to identify factors associated with higher or lower scores, such as years' experience in the dental field, with more years of experience negatively associated with iCHeW scores. This trend has been suggested in previous health research, which found that more experienced practitioners are less likely to adhere to guidelines [33]. Additionaly, in contrast to public dental staff, those working in the private sector had lower iCHeW scores. This highlights that the iCHeW scale is able to discriminate differences in subgroup behavioural intention, as the consequence of the rollout of the guidelines in public settings [11]. This convergent and discriminant validity is significant for clinical practice, as it suggests this scale is able to identify groups of staff less receptive to change, and therefore who will need additional strategies in the implementation of children's growth assessment guidelines. Such strategies could include the use of training to raise awareness, improvements to patient information systems to increase adherence to growth assessment data recording, provision of patient information resources, and increased collaboration with referral pathways for additional support [34].

There is a need for interventions that improve rates of routine anthropometric assessment for childhood overweight and obesity, and increasing recognition of the roles other health care providers, such as dental staff, can play [35,36]. The iCHeW scale serves as a reliable and valid tool that uses IM to provide in-depth evaluation of these interventions. To our knowledge, this is the first psychometrically evaluated scale to be developed for this purpose, using a reasoned action approach, and could assist in initiatives to expand the role of dental staff to address childhood obesity in other geographic locations and in the private sector. Furthermore, although the IM is behaviour-specific, and requires clear definition and description of the behaviour of interest, its focus on the fundamental similarities in behavioural determinants inherently maximises applicability to a wide variety of individuals [16]. This is confirmed by the results of this study, which saw high validity and reliability with a national sample of various dental staff. As a result, the iCHeW scale has the potential to be adapted to a range of other health care providers who engage in children's growth assessments, including primary health care, inpatient, outpatient, and community settings.

There are some limitations that should be considered in interpretation of these results. First, as purposive sampling was utilised in this study, there is the potential for selection bias in the study sample. Some respondents were identified through dental therapy interest groups within ADOHTA, which could have biased responses towards those who already have an interest in providing additional care to children. However, as none of these interest groups were specific to childhood overweight or obesity, the likelihood of bias regarding this specific scale was negligible. Furthermore, some bias may be reflected in the high proportion of participants from a single state in Australia. Nevertheless, all Australian states and territories were represented in the study, and there was a reasonable distribution of other demographic characteristics among participants. The second limitation is that a single item in the iCHeW scale demonstrated a small ceiling effect, however as this item exceeded the ceiling effect threshold by only a small margin, it is anticipated that this would have minimal impact on the aggregate scale scores. Despite these limitations, the iCHeW scale shows great potential in the evaluation of the implementation of childhood obesity

Table 3
Correlations: iCHeW scale, subscales, and work-related variables.

	iCHeW scale	iCHeW (Attitudes)	iCHeW (Constraints)	iCHeW (Norm)	iCHeW (Self-efficacy)	iCHeW (Intention)	Years of experience	Hours in private	Hours in public
iCHeW scale	1.00								
iCHeW (Attitudes)	0.75***	1.00							
iCHeW Constraints)	0.75***	0.33***	1.00						
iCHeW (Norm)	0.83***	0.55***	0.50***	1.00					
iCHeW (Self-efficacy)	0.78***	0.43***	0.54***	0.57***	1.00				
iCHeW (Intention)	0.86***	0.56***	0.59***	0.67***	0.63***	1.00			
Years of experience	**-0.22***	**-0.02**	**-0.30****	**-0.20***	**-0.21***	**-0.20***	**1.00**		
Hours in private	**-0.26****	**-0.18**	**-0.14**	**-0.27****	**-0.12**	**-0.35*****	**-0.19**	**1.00**	
Hours in public	**0.29****	**0.03**	**0.31****	**0.33*****	**0.17**	**0.34*****	**0.01**	**-0.65*****	**1.00**

*$p < 0.05$**$p < 0.01$***$p < 0.001$

interventions.

5. Conclusions

This study described the systematic development and psychometric testing of the iCHeW scale. This is a reliable and valid scale for assessing the behavioural determinants influencing dental staff's intention to conduct routine growth assessments for children. The iCHeW scale can be used for a variety of dental staff, is well suited for evaluating change, and is able to discriminate between various demographic factors that could impact change. As a result, the iCHeW scale is a valuable tool for the evaluation of the implementation of childhood obesity interventions and can identify when further strategies are required. Future research should confirm the validity and reliability of this scale when used with non-dental health staff.

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Declarations of interest

None.

CRediT authorship contribution statement

ARV, AG and YS were involved in the conceptualisation and methodology of the study. ARV and AG conducted the investigation for this project (recruitment and data collection). ARV and YS completed data curation and formal data analysis. All authors made substantial contribution to the writing of the manuscript, including the original draft, as well as review and editing. All authors read and approved the final manuscript.

References

[1] Weisz G, Vignola-Gagné E. The World Health Organization and the globalization of chronic noncommunicable disease. Popul Dev Rev 2015;41(3):507–32.
[2] Cameron A. Impermeable boundaries? Developments in professional and interprofessional practice. J Intensive Care 2011;25(1):53–8.
[3] Doehner W, Mazighi M, Hofmann BM, Lautsch D, Hindricks G, Bohula EA, et al. Cardiovascular care of patients with stroke and high risk of stroke: the need for interdisciplinary action: a consensus report from the European society of cardiology cardiovascular round table. Eur J Prev Cardiol 2020;27(7):682–92.
[4] Salari S, Klapman S, Fry B, Hamel S. Interprofessional education: in silo, ineffective. Med Sci Educ 2017;27(4):831–3.
[5] Zeiss AM, Steffen AM. Interdisciplinary health care teams in geriatrics: an international model. In: Bellack AS, Hersen M, editors. Comprehensive Clinical Psychology. Oxford: Pergamon; 1998. p. 551–70.
[6] Derrick H. Interdisciplinary healthcare teams. SPNHA Rev 2018;14(1):8.
[7] Danilov A, Danilov A, Barulin A, Kurushina O, Latysheva N. Interdisciplinary approach to chronic pain management. Post Med 2020;132(sup3):5–9.
[8] Giannitrapani KF, Glassman PA, Vang D, McKelvey JC, Thomas Day R, Dobscha SK, et al. Expanding the role of clinical pharmacists on interdisciplinary primary care teams for chronic pain and opioid management. BMC Fam Pr 2018;19(1):107.
[9] Ma JE, Haverfield M, Lorenz KA, Bekelman DB, Brown-Johnson C, Lo N, et al. Exploring expanded interdisciplinary roles in goals of care conversations in a national goals of care initiative: a qualitative approach. Palliat Med 2021;35(8):1542–52.
[10] New South Wales Government. Premier's priority: reduce overweight and obesity rates of children by 5 % over 10 years. In: Centre for Population Health, editor. 2016.
[11] New South Wales Government. Growth assessment and dietary advice in public oral health services 2019 [Available from: ⟨https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/GL2019_001.pdf⟩.
[12] Dobson D, Cook TJ. Avoiding type III error in program evaluation: results from a field experiment. Eval Program Plan 1980;3(4):269–76.
[13] Eccles MP, Armstrong D, Baker R, Cleary K, Davies H, Davies S, et al. An implementation research agenda. Implement Sci 2009;4:18.
[14] Eccles M, Grimshaw J, Walker A, Johnston M, Pitts N. Changing the behavior of healthcare professionals: the use of theory in promoting the uptake of research findings. J Clin Epidemiol 2005;58(2):107–12.
[15] Grol RPTM, Bosch MC, Hulscher MEJL, Eccles MP, Wensing M. Planning and studying improvement in patient care: the use of theoretical perspectives. Milbank Q 2007;85(1):93–138.
[16] Fishbein M. A reasoned action approach to health promotion. Med Decis Mak 2008;28(6):834–44.
[17] Hoppe CRG. Predicting Health Professionals' Management of Obesity [Ph.D.]. Ann Arbor: University of London, King's College (United Kingdom),; 1999.
[18] Mokkink LB, Terwee CB, Patrick DL, Alonso J, Stratford PW, Knol DL, et al. The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: an international Delphi study. Qual Life Res 2010;19(4):539–49.
[19] Australian Government. Dental Workforce 2012 [Available from: ⟨http://www.health.gov.au/internet/publications/publishing.nsf/Content/report_nacdh~report_nacdh_ch2~report_nacdh_wf⟩.
[20] Burgess AM, Chang J, Nakamura BJ, Izmirian S, Okamura KH. Evidence-based practice implementation within a theory of planned behavior framework. J Behav Health Serv Res 2017;44(4):647–65.
[21] Ellery J, McDermott RJ, Ellery PJ. Computers as a formal continuing education tool: moving beyond intention. Am J Health Behav 2007;31(3):312–22.
[22] Foy R, Bamford C, Francis JJ, Johnston M, Lecouturier J, Eccles M, et al. Which factors explain variation in intention to disclose a diagnosis of dementia? A theory-based survey of mental health professionals. Implement Sci 2007;2(1):31.
[23] Légaré F, Graham ID, O'Connor AC, Aubin M, Baillargeon L, Leduc Y, et al. Prediction of health professionals' intention to screen for decisional conflict in clinical practice. Health Expect 2007;10(4):364–79.
[24] Sutherland JLPRNA, Spencer GAPRN. U.S. nurse practitioner beliefs about routine HIV screening: predicting behaviors. J Assoc Nurses AIDS Care 2019;30(3):270–8.
[25] Wilbourn M, Salamonson Y, Ramjan L, Chang S. Development and psychometric testing of the attitudes, subjective norms, perceived behavioural control, and intention to pursue a career in mental health nursing scale. Int J Ment Health Nurs 2018;27(1):72–81.
[26] Bercher D. Attitudes of paramedics to home hazard inspections: applying the theory of planned behavior [Ph.D.]. Ann Arbor: University of Arkansas,; 2008.
[27] Harbour VJ. Using the Theory of Planned Behavior to Gain Understanding of Primary-care Providers' Behavior in Counseling Patients to Engage in Physical Activity [Ph.D.]. Ann Arbor: The University of Utah,; 2009.

[28] Croasmun JT, Ostrom L. Using Likert-type scales in the social sciences. J Adult Educ 2011;40(1):19–22.
[29] Polit DF, Beck CT, Owen SV. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. Res Nurs Health 2007;30(4):459–67.
[30] Corp IBM. IBM SPSS Statistics for Windows. Version 27. Armonk, NY: IBM Corp,; 2020.
[31] Dam VH, Thystrup CK, Jensen PS, Bland AR, Mortensen EL, Elliott R, et al. Psychometric properties and validation of the EMOTICOM test battery in a healthy Danish population. Front Psychol 2019;10(2660).
[32] Hair JF, Anderson RE, Tatham RL, Black WC. Multivariate Data Analysis with Readings. fourth ed. Englewood Cliffs: Prentice-Hall, Inc,; 1995. p. 757.
[33] Choudhry NK, Fletcher RH, Soumerai SB. Systematic review: the relationship between clinical experience and quality of health care. Ann Intern Med 2005;142 (4):260–73.
[34] Villarosa AR, Maneze D, Ramjan LM, Kong A, George A. The codesign of implementation strategies for children's growth assessment guidelines in the dental setting. Res Involv Engagem 2022;8(1):19.
[35] Sanghavi A, Siddiqui NJ. Advancing oral health policy and advocacy to prevent childhood obesity and reduce children's consumption of sugar-sweetened beverages. J Public Health Dent 2017;77(Suppl 1):S88–95.
[36] Thomas KMMD, Urrego FMD. Are pediatricians diagnosing obese children? Ochsner J 2017;17(1):80–2.

Chapter 8

Results, Phase 4: Refining and piloting the CHEWI strategies

8.1 Phase 4 Introduction

Chapter 8 presents the findings from Phase 4 of the CHEWI project, which aimed to refine the implementation strategies. This chapter first revisits the aims of Phase 4 and the preliminary implementation strategies, then presents the findings from the refinement of the strategies, and details the evolution and refinement of the implementation strategies. Results for this chapter are presented as unpublished findings. The chapter concludes with a summary of the final implementation strategies.

8.2 Phase 4 overview

Phase 4 aimed to refine the implementation strategies codesigned in Phase 2. It was anticipated that the preliminary codesigned strategies from Phase 2 would need further refinement to ensure optimal feasibility and sustainability within the participating services. This chapter details the process used to refine the implementation strategies for each district. Further information on the methods used for this phase can be found in Chapter 4, Section 4.2.5.3.

8.3 Phase 4 Results

8.3.1 Refinement of the implementation strategies

8.3.1.1 Preliminary implementation strategies from Phase 2

From the appreciative inquiry codesign study conducted in Phase 2, several preliminary strategies were proposed by participants. The main strategies proposed are outlined below.

8.3.1.1.1 Strategies to engage patients

8.3.1.1.1.1 Sending growth assessment information to clients in appointment reminder letters

Dental staff and parents in focus groups requested for patients and their parents to be aware of the children's healthy weight guidelines prior to the appointments. To ensure this, participants proposed including this information in appointment reminder letters that were routinely mailed out to parents prior to appointments, which provided information on their appointment time, and relevant protocols and procedures. Dental staff and parents also discussed the potential for this information to alternately be sent through an SMS alert.

8.3.1.1.1.2 Providing culturally appropriate information to clients and families through translated resources

Parents discussed that to ensure acceptance of the children's healthy weight guidelines there was a need for information that would be suitable for families from culturally and linguistically diverse backgrounds. Dental staff echoed this, highlighting that having certain educational resources only in the English language presented a challenge. Participants therefore proposed some of these educational resources be translated to other languages.

8.3.1.1.1.3 Updating staff regarding referral outcomes with discharge summaries

Staff highlighted some challenges regarding knowing what has happened with a client since the last appointment, if they had been provided a referral to healthy weight services. At the time of the study, staff were largely relying on asking the client or parent for any updates on their progress with the referral pathways. At the same time, parents wanted dental staff to be informed of their children's care journey through healthy weight referral pathways, as this continuity of care would help them to feel reassured. As a result, participants suggested that all referral services send regular progress updates and discharge summaries back to the

referring staff, so that they could be informed of the child's status prior to their next appointment with the dental services.

8.3.1.1.2 Strategies to support staff

8.3.1.1.2.1 Including dental assistants in growth assessments

When the children's healthy weight guidelines were initially rolled out in NSW, dental and oral health therapists were the main dental staff targeted. However, some staff agreed that involving dental assistants in some of the growth assessment procedures would be beneficial for time management. Dental assistants requested to be involved in both the growth assessments and provision of healthy lifestyle advice. While there was consensus among most dental and oral health therapists to include dental assistants in the weight and height measurements, dental and oral health therapists from the smaller clinics preferred to continue doing these procedures themselves. Parents were open to this potential strategy and did not have any preference on which dental staff performed the practices.

8.3.1.1.2.2 Providing refresher training to staff

As providing children's healthy weight practices was a significant role expansion for dental staff, parents deemed it important to ensure dental staff were adequately trained. Although training should have been provided to all dental and oral health therapists by this stage, some did not recall receiving training in this area. Furthermore, this training was not yet required for dental assistants, and as a result, it was proposed that all involved staff, including dental assistants receive refresher training to ensure all were adequately informed of the required practices and referral pathways. When it came to mode of delivery, some staff preferred face-to-face training.

8.3.1.1.2.3 Longitudinal tracking of growth assessments in patient information systems

Finally, staff at some sites highlighted that the growth charts currently provided in their electronic record systems could only plot one BMI percentile measurement per chart. Consequently, a new chart needed to be created for each appointment. Staff proposed the development of a new growth chart that could be used to plot a child's BMI percentile over time. This would enable dental staff to view all measurements in the one chart and better gauge a child's growth trends.

8.3.1.2 Final strategies

These preliminary strategies were refined to meet the needs of each participating site, that is District 1 and District 2, to ensure they were acceptable and feasible, and identify available resources and other requirements to implement these strategies. This was achieved in an iterative continuation of the codesign process whereby strategies were brought to working groups specifically formed for each participating site. For more information on the methods used to refine the implementation strategies, please refer to Chapter 4, Section 4.2.5.3. This resulted in two suites of strategies tailored to meet the needs of each site. The refinement process and final resulting strategies for each site are detailed below.

8.3.1.2.1 District 1

It was determined that all the preliminary codesigned strategies were a priority for District 1, and therefore working group meetings focused on refining all of these strategies. These strategies were further built upon, with some additional strategies developed during the refinement process, as seen in Table 3.

Table 3: Initial and final strategies for District 1

Initial strategy	Final strategy
Sending growth assessment information to clients in appointment reminder letters	Parent information flyer
Providing culturally appropriate information resources	Translated waiting room poster
Updating staff regarding referral outcomes with discharge summaries	Discharge summaries from referral pathways
Including dental assistants in growth assessments	Including dental assistants in growth assessments
Longitudinal growth chart	Growth chart history
Refresher training for staff	Refresher training for staff
–	Additional strategy: Case study
–	Additional strategy: Quality board

8.3.1.2.1.1 From information in appointment reminder letters to parent information flyer

Through an iterative process which included working group meetings and consumer consultation, the initial strategy of modifying the appointment reminder letters evolved into an information flyer to be included in the same letter envelopes as seen in Figure 9. Specifically, the initial idea of incorporating children's healthy weight information into appointment reminder letters was brought to the working group for District 1. Initially the working group was interested in exploring modification of the appointment letters. However, at a subsequent meeting, it was decided that the appointment letters already contained a significant amount of information, and therefore there would be challenges in ensuring clients or parents would see this information among what was already in the letter. As a result, it was agreed that perhaps receiving this information verbally from reception staff

who made bookings and reminder calls could be a more effective way of conveying this information to parents and clients. Due to changes in healthcare provision resulting from COVID-19 restrictions, this new script was not adequately trialled until the end of 2021. At this time, it was determined that the script was not feasible to be included in phone calls, due to the large amount of additional information that needed to be discussed regarding COVID-19 screening requirements.

Thus, it was determined that a flyer leaflet that would be included in appointment reminder letter envelopes, but separate to the letter itself, could be a better way of conveying this information to parents. The first version of this flyer was developed in early 2022 and was presented to the working group as well as a dental staff member at District 1 for feedback. At this working group, it was decided that the wording should be modified slightly, and that to better represent the care provision at District 1, the graphic should be changed from a male in a lab coat to a female in scrubs. This refined flyer was then presented to a consumer consultative committee for the District 1 oral health services, where service provision matters were tabled and discussed by community members. The consumer committee recommended the flyer be modified to provide parents with a rationale for the growth assessments, and to highlight that these practices are targeted for general appointments, rather than emergency appointments.

Furthermore, the committee requested a link to further information be included on the flyer and suggested that formal consumer feedback be obtained on the flyer once these changes were incorporated, so that the brochure could be endorsed by the district consumers, shown through a “gold tick” of approval. This feedback was obtained, and as no further changes were required, the flyer received the gold tick. This final version of the flyer was implemented at the District 1 oral health services on the 28th of April 2022. For all iterations of this strategy, please see Appendix 4.

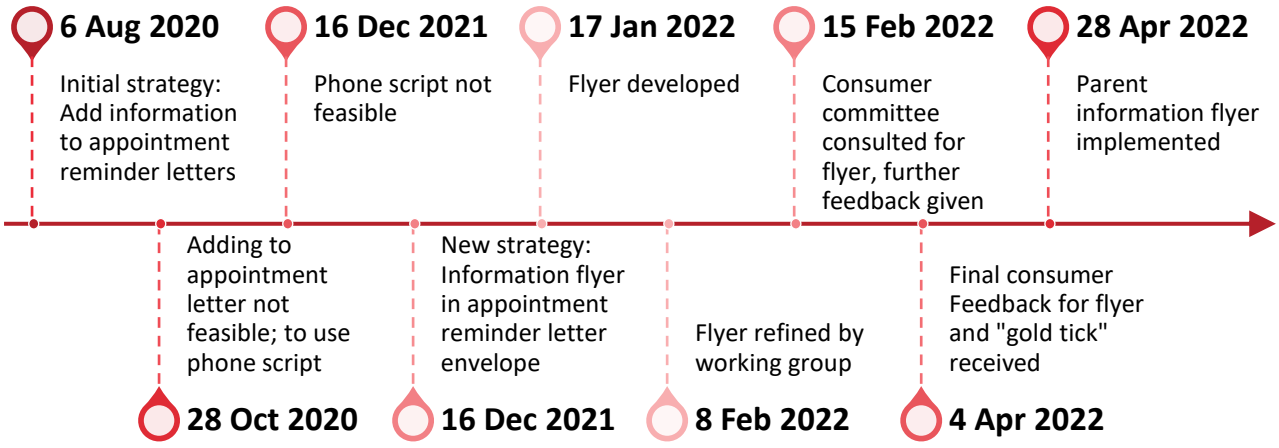


Figure 9: Timeline for development of parent information flyer for District 1

8.3.1.2.1.2 Translated waiting room posters

Following the suggested preliminary strategy of translating patient resources into languages commonly spoken in the local communities, the working group acceded to the translation of the waiting room poster into Arabic and Vietnamese languages. This poster, which was commonly displayed in oral health clinic waiting rooms, notified clients that dental staff would offer to measure the weight and height of children being treated. Arabic and Vietnamese languages were agreed upon by the working group as the more common languages requiring translation or interpretation at their services. After some time deciding how best to fund these translations, the oral health services decided to fund the translation themselves, and a professional translation service was used to produce Arabic and Vietnamese copies of these posters. The posters were then printed and delivered to District 1 oral health clinics on the 1st of June 2022, where dental staff could choose to display the translated versions alongside the English version. See Figure 10 for the full timeline for this translation, and Appendix 5 for the English, Arabic and Vietnamese versions of the waiting room poster.

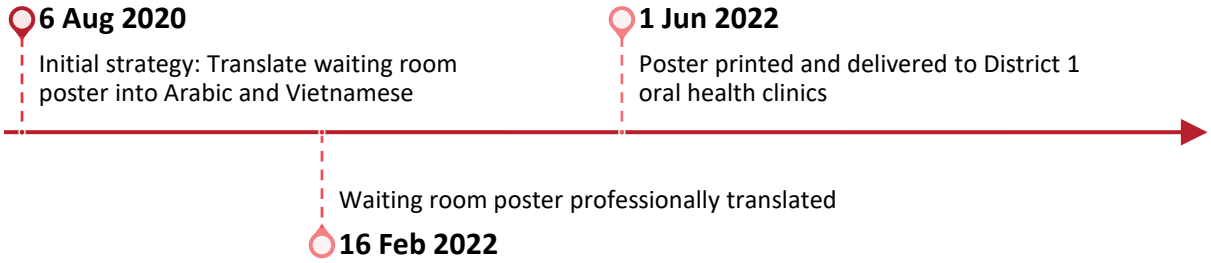


Figure 10: Timeline for translation of waiting room poster for District 1

8.3.1.2.1.3 Discharge summaries from referral pathways, case study and quality board

As seen in Figure 11, the preliminary strategy of ensuring referral services provided discharge summaries was discussed and approved by the working group. Specifically, the Growing Healthy Kids service was a referral service unique to District 1 that did not yet have a process in place to provide progress updates to the oral health clinics. Thus, it was agreed that a feedback form should be developed for this service to populate and send back to the referring dental staff.

By late 2021, the feedback form for Growing Healthy Kids was developed and implemented. After this, District 1 oral health clinic staff were contacted to confirm discharge summaries and progress updates were being received by the clinic, and to troubleshoot any challenges or issues with documentation.

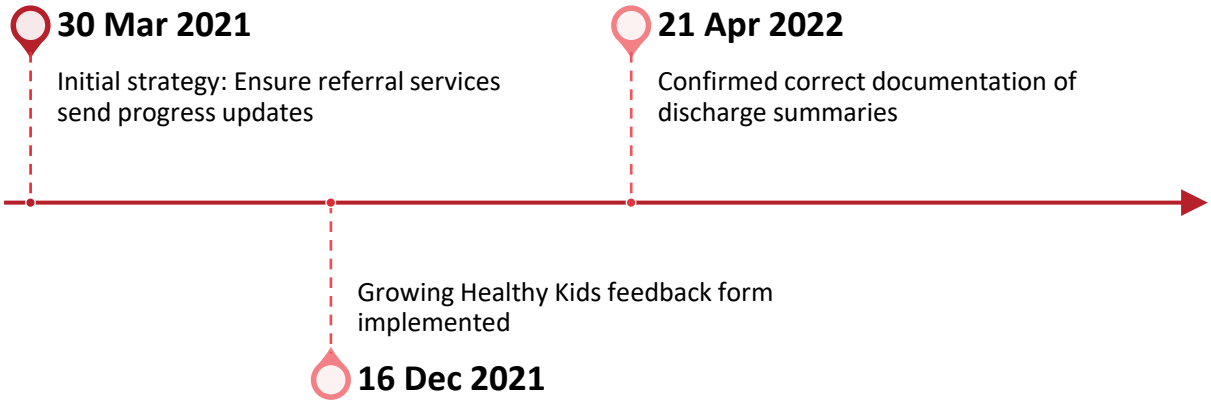


Figure 11: Timeline for ensuring referral pathways send progress updates to District 1 dental services

8.3.1.2.1.4 Including dental assistants in growth assessments

As seen in Figure 12, the preliminary strategy of including DAs in growth assessments was confirmed by the working committee. Specifically, the working committee concluded DAs should complete the growth assessments, either before or during the children's dental appointments. At a subsequent meeting, it was agreed that the DAs would require training to perform these growth assessments, and it was resolved this would be best achieved by including DAs in a refresher training with the other dental staff. This refresher training is further detailed in Section 8.3.1.2.1.6. Following the completion of this training, DAs were authorised to perform growth assessments as required.

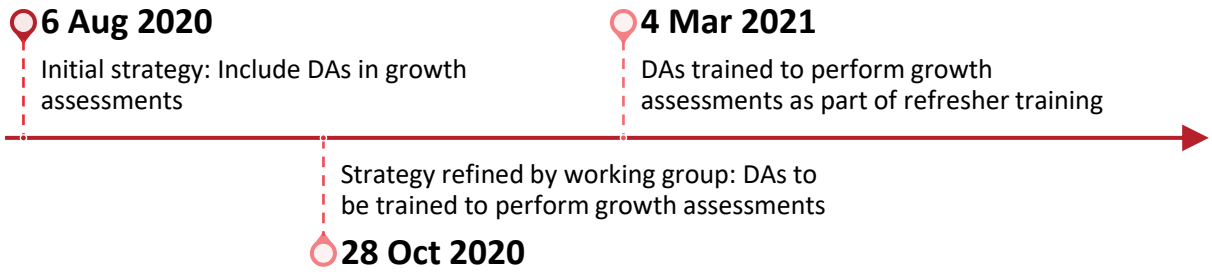


Figure 12: Timeline for development of strategy to include DAs in growth assessments at District 1

8.3.1.2.1.5 From longitudinal growth chart to growth chart history

Figure 13 depicts the timeline for the development of the growth chart history infographic. Although the working group agreed to the initial strategy of developing a longitudinal growth chart on the 6th of August 2020, upon meeting with one of the managers at the oral health services on the 16th of December 2020, it was concluded that a longitudinal growth chart would not be feasible. This was because the existing growth chart was a mandatory part of the growth assessment practices, and thus a longitudinal chart would have to be an additional document which would increase the data entry requirements for dental staff. Therefore, their limited time in an appointment meant this would not be feasible. Instead, the manager suggested informing staff about how to access the chart history for the existing growth charts, which would enable dental staff to easily view past measurements, even though they could not be viewed all at once. The working group agreed this was a suitable solution, and an infographic explaining how to access the growth chart history was developed in late 2020, and disseminated to staff through the refresher training, with recordings of this training disseminated in mid-2022. Further information on this training is available in Section 8.3.1.2.1.6. The full growth chart infographic can be seen in Appendix 6.

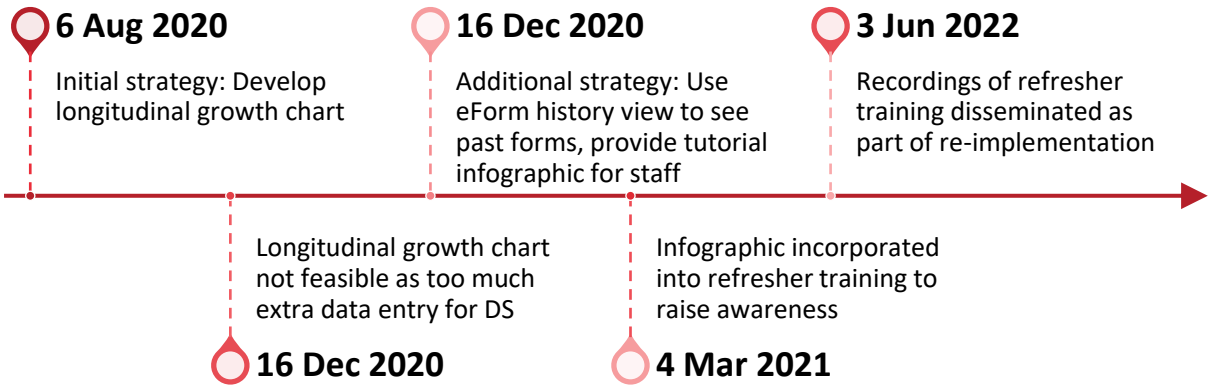


Figure 13: Timeline for development of growth chart history infographic for District 1

8.3.1.2.1.6 Refresher training for staff, including DAs

As shown in Figure 14, the working committee also agreed that refresher training was required. It was decided that this training would be provided both to dental staff who had already received training and needed a reminder, and dental staff who had not yet received the training, including DAs. The training was developed by the nurse educator in the working group, and included guidance on performing growth assessments, offering basic advice, and providing referrals to further services as required. It also contained a short segment on accessing the growth chart eForm history, so that dental staff could view previous growth assessments. The training was delivered by the same nurse educator to all dental clinics via Zoom, with the training repeated on multiple occasions so that different clinics were able to join sessions at dates and times that best suited them. To further ensure this training was accessible to as many dental staff as possible, the training was recorded and the recording disseminated to all staff via email. A full recording of the training can be accessed in Appendix 7.

Figure 14: Timeline for development of refresher training for dental staff at District 1

8.3.1.2.1.7 Case study for dental staff

In addition to the preliminary strategies identified in Phase 2, the working party also decided some other strategies may be beneficial to provide further feedback to dental staff. The first of these was the use of a case study that would be promoted among all dental staff. This case study illustrated a child who had their BMI assessed by District 1 dental staff and were referred to weight management services, and the positive health outcomes this child experienced. It was believed that having this knowledge would further encourage and reinforce best practices and adherence to the guidelines. The case study was developed and implemented in early 2022 (Figure 15). The full case study can be seen in Appendix 8.

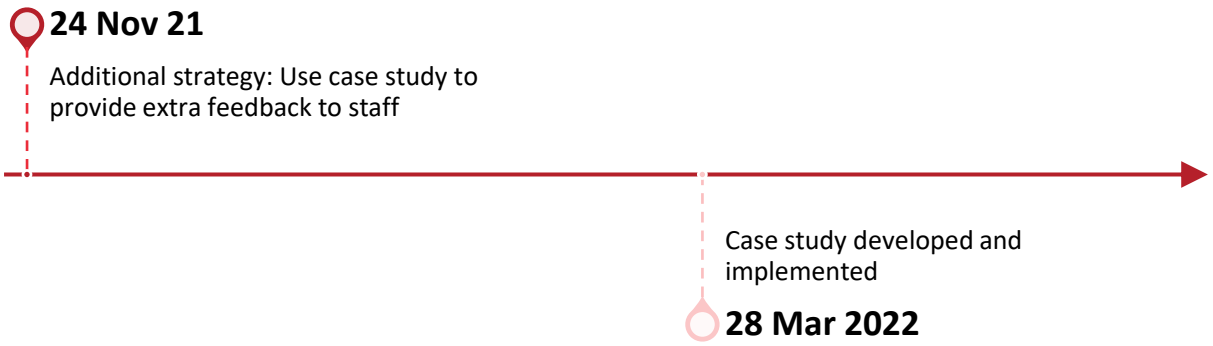


Figure 15:Timeline for development of case study for dental staff at District 1

8.3.1.2.1.8 Quality board to display staff adherence

The second additional strategy proposed by the working group was a quality board, to display rates of dental staff adherence to specific practices, and how well they were meeting targets for the district. By specifically including growth assessment adherence to these boards and informing dental staff of their progress with the growth assessments, it was believed this would provide dental staff with further feedback and reinforcement regarding their practices. In early 2022, the quality board was developed and implemented. See Figure 16 for the full timeline. The final quality board can be seen in Appendix 9.

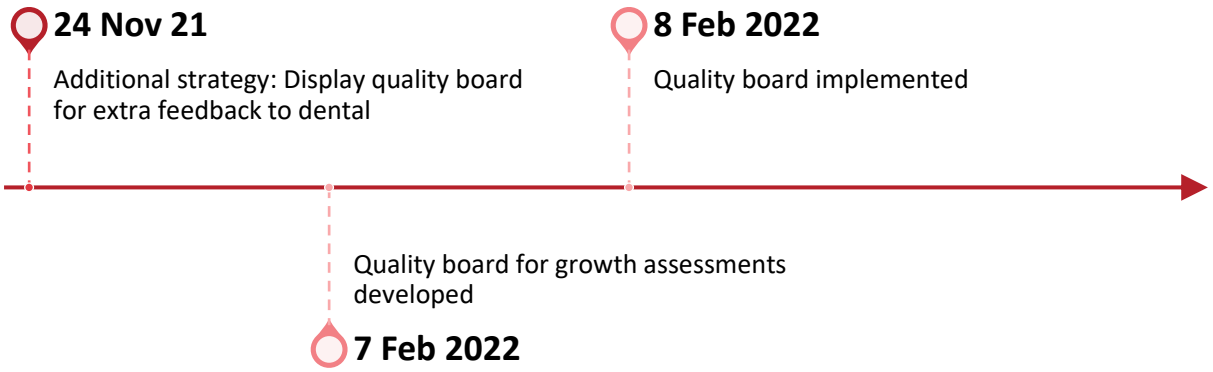


Figure 16: Timeline for development of quality board for dental staff at District 1

8.3.1.2.2 District 2

At District 2, it was determined that not all the codesigned strategies were necessary due to differing needs at this site. Specifically, the translated resources were not required due to a lower level of cultural and linguistic diversity in this area, and specific refresher training was not required as this district already utilised an online learning platform for their training, which could be accessed at any time. Additionally, staff at this site indicated a preference for dental and oral health therapists to continue performing the growth assessments personally, rather than having dental assistants perform them. However, this district did proceed with refining the other strategies, and developed one additional strategy as detailed below (Table 4).

Table 4: Initial and final strategies for District 2

Initial strategy	**Final strategy**
Sending growth assessment information to clients in appointment reminder letters	Parent information flyer
Updating staff regarding referral outcomes with discharge summaries	Discharge summaries from referral pathways
Longitudinal growth chart	Longitudinal growth chart
–	Additional strategy: Stamp for patient handouts

8.3.1.2.2.1 Information flyer in appointment letters

Like District 1, an iterative process resulted in the modification of the initial strategy of adding information to the appointment reminder letters into the development an information flyer to be included in the same letter envelopes as seen in Figure 17. Specifically, the initial idea of incorporating District 2 assessment information into

appointment reminder letters was tabled at the District 2 working group meeting. Like District 1, initially the working group was interested in exploring modification of the appointment letters, however, by late 2021, the same conclusion was reached regarding the appointment letters containing too much information to add anything else.

It was then suggested that a flyer leaflet, that would be included in appointment reminder letter envelopes, but separate to the letter itself, could be a better way of conveying this information to parents. The first version of this flyer was developed on the 10th of January 2022 and was presented to the working group for feedback on the 13th of January 2022, where minor wording changes were made. This final version of the flyer was implemented at the District 2 services on the 28th of February 2022. For all iterations of this strategy, please see Appendix 10.

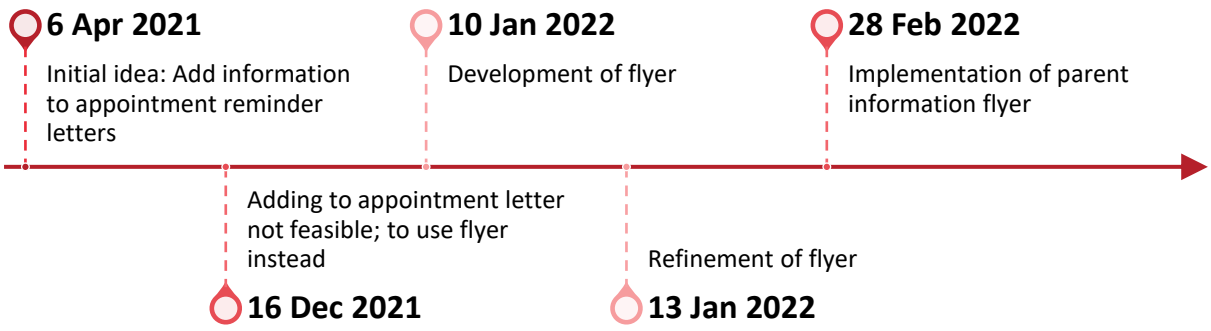


Figure 17: Development of parent information flyer for District 2

8.3.1.2.2.2 Discharge summaries from referral pathways

As seen in Figure 18, at District 2 the working group supported the preliminary strategy of ensuring referral services provided discharge summaries. Specifically, the working group was interested in ensuring one specific referral pathway (Go4Fun) provided progress updates, as they had not had much communication from this service. Go4Fun is a free lifestyle program aimed at children between 7-13 years who are above a healthy weight (NSW Ministry of Health, 2018a). Go4Fun was contacted and information regarding their

protocols for sending progress updates was reviewed and deemed appropriate. The main reason for the lack of communication was identified to be due to longer waitlists as a result of COVID-19 related disruptions. Following this, the District 2 oral health clinic staff were contacted to confirm progress updates were being received and to ensure these updates were being correctly documented without difficulty.

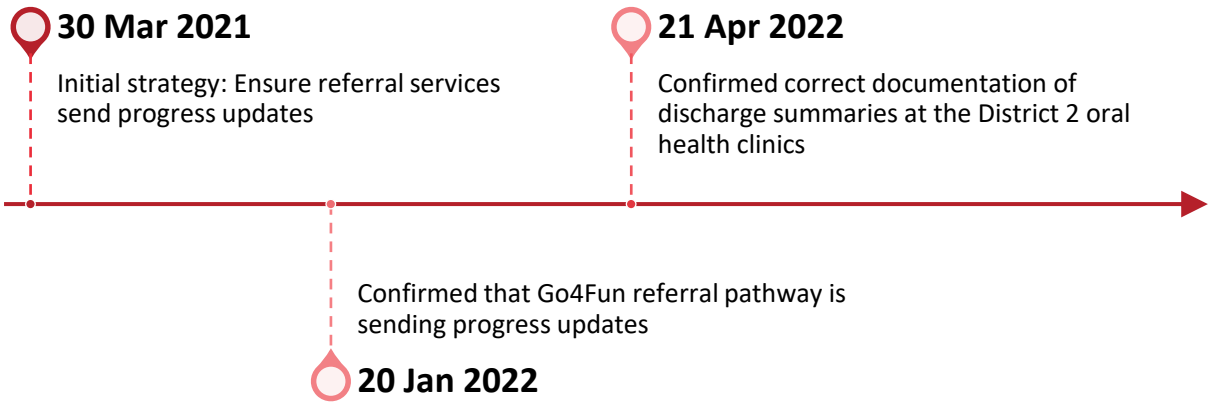


Figure 18: Process for ensuring referral services were sending progress updates to District 2

8.3.1.2.2.3 Longitudinal growth chart

Figure 19 depicts the timeline for the development of the longitudinal growth chart at District 2. In contrast to District 1, the District 2 working group agreed to the initial strategy of developing a longitudinal growth chart, and believed the extra time required for data entry to be feasible for their staff. The longitudinal growth chart was developed and presented to the working group and dental staff for feedback in early 2022. As part of the feedback received from staff, there was a suggestion to include a field on the growth chart that would automatically update with the last modified date, to ensure dental staff knew when the last measurement was plotted. This final version of the chart was implemented on the 3rd of March 2022. All iterations of this chart can be found in Appendix 11.

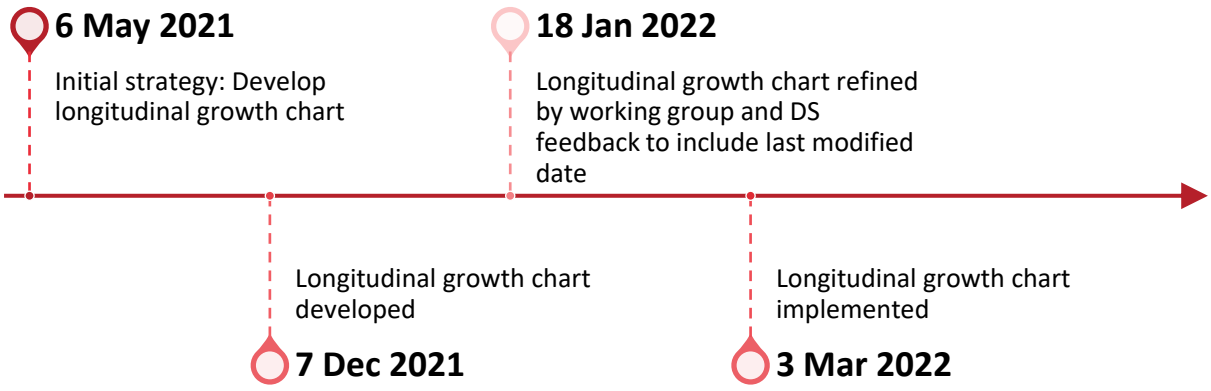


Figure 19: Development of longitudinal growth chart for District 2

8.3.1.2.2.4 Stamp for patient handouts

One final strategy that was not conceived during the codesign phase of this study was proposed by the District 2 working group, because of feedback received from dental staff. This was the development of a stamp to provide fields to label information on patient handouts, as seen in Figure 20. This need arose in early 2021 because the printable growth chart used at the oral health services did not contain fields to write in children's weight, height, and BMI percentile; it only had a chart area to plot BMI percentile on a line graph. As parents wanted to have the weight, height, and BMI percentile numbers, dental staff had to quickly handwrite a child's weight, height, and BMI percentile on growth chart print-outs. As a result, these measures were not adequately labelled and parents sometimes became confused about what the numbers meant. To address this, on the 1st of April 2021, the working group proposed a stamp, that would contain blank fields for weight, height, and BMI percentile, that could be used to pre-stamp these forms. This would mean dental staff would only need to populate the form with the correct numbers, without having to label them for parents. After dental staff determined the best placement for a stamp on this chart, stamp dimensions and formatting requirements were identified on the 17th of December

2021, and the stamps were manufactured on the 10th of February 2022. These stamps were implemented on the 28th of February 2022. An image of the stamp can be seen in Appendix 12.

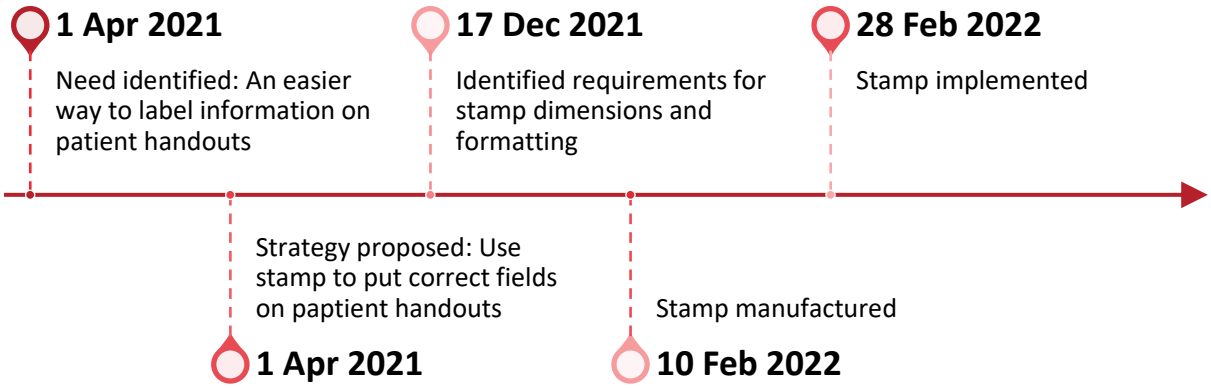


Figure 20: Development of stamp for patient handouts at District 2

8.4 The final implementation strategies

An overview of the final implementation strategies can be seen in Figure 21.

Figure 21: Final implementation strategies used at each district

8.5 Delivery of the implementation strategies

All strategies were delivered as they were finalised, and thus delivery was staggered over a period from the 3rd of March 2021 to the 3rd of June 2022. To maximise staff awareness of the interventions, informational videos were developed for District 1 and District 2 (click to play videos). These videos showcased the final strategies and outlined how the strategies were developed, the purpose of the strategies, how they could be used and where they could be found. See Appendix 13 for full hyperlinks to the videos.

8.6 Phase 4 Conclusions

Two unique suites of implementation strategies were developed for each district. These strategies, based on preliminary codesigned strategies were refined and evolved according to the needs identified at each district.

Chapter 9

Results, Phase 5: Piloting the implementation strategies

9.1 Phase 5 Introduction

Chapter 9 presents the findings from Phase 5, which aimed to conduct a pilot study to determine the preliminary impact of the developed implementation strategies on guideline adherence. Here, the aims and methods used in Phase 5 are briefly revisited, following which the quantitative results of the pilot study are presented. Results for this chapter are presented as unpublished findings. The chapter concludes with a summary of the effectiveness of the implementation strategies.

9.2 Phase 5 Overview

Phase 5 aimed to determine the impact of the developed implementation strategies. As discussed in Chapter 4, behavioural predictors, self-reported behaviour, and behaviour as recorded in digital health service data were measured and compared before and after the implementation strategies were delivered. This included the iCHeW scale, which measured behavioural predictors on a 7-point Likert scale, across the domains of attitudes, behavioural constraints, perceived norms, self-efficacy, and behavioural intention. Further information on the measures used for this phase can be seen in Chapter 4, Section 4.2.6.5 and Chapter 7. Findings from these comparisons are outlined below.

9.3 Phase 5 Results

9.3.1 Questionnaire findings

A total of 16 dental staff completed both the baseline and follow-up questionnaires. The average age of participants was 44.25 years (SD=14.67) and 87.5% (n=14) were female. A total of two participants (12.5%) were dental therapists, five (31.3%) were oral health therapists and a further nine (56.3%) were dental assistants. The average number of hours worked in the public sector was 34.31 hours per week (SD = 8.32, range 8-40 hours), with an

average of 2.29 hours per week (SD=8.27, range 0-30 hours) worked in the private sector. On average, participants had 18.19 years of experience working as dental staff (SD = 12.555, range 5-41 years).

9.3.1.1 iCHeW Scale

Overall, there was over a 7-point increase in iCHeW scores before and after the implementation strategies (131.50 to 138.56). When exploring individual iCHeW domains, this increase was most evident in the attitudes domain of the iCHeW scale, with an increase of over 5 points (30.12 to 35.19). When analysing the two participating districts separately, it was seen that increases in iCHeW scores were more pronounced in District 2, with more than a 10-point increase in total iCHeW scores (129.17 to 139.91) and more than a 7-point increase in attitudes domain scores (27.18 to 34.27). Conversely, District 1 had a marginal increase in attitudes domain scores (36.60 to 37.20), and there was a decrease in overall iCHeW scores (136.40 to 135.60). See Table 5 and Figures 22-25 for full comparisons of iCHeW scores before and after the delivery of the implementation strategies.

Table 5: Change in iCHeW scores before and after delivery of the implementation strategies

Domain	Pre score (mean ± SD)	Post score (mean ± SD)
	District 1 (n=5)	
Awareness	5.60	5.40
Attitudes	36.60	37.20
Constraints	30.60	30.80
Perceived Norm	25.60	26.40
Personal Agency	22.40	21.20
Intention	21.20	20.00
Total	136.40	135.60
	District 2 (n=11)	
Awareness	4.91	5.55

Attitudes	27.18	34.27
Constraints	33.45	33.82
Perceived Norm	27.27	27.36
Personal Agency	21.55	23.00
Intention	19.82	21.45
Total	129.27	139.91
All (n=16)		
Awareness	5.12	5.50
Attitudes	30.12	35.19
Constraints	32.56	32.88
Perceived Norm	26.75	27.06
Personal Agency	21.81	22.44
Intention	20.25	21.00
Total	131.50	138.56

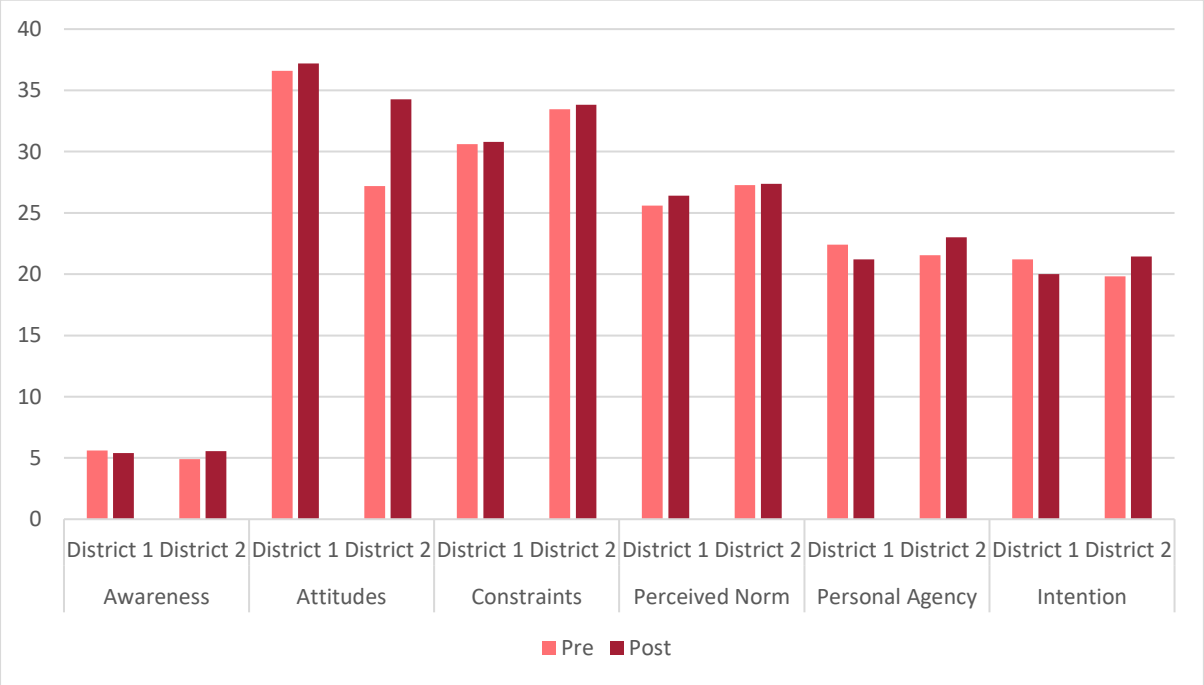


Figure 22: Changes in iCHEW scores by domain before and after delivery of the implementation strategies by district

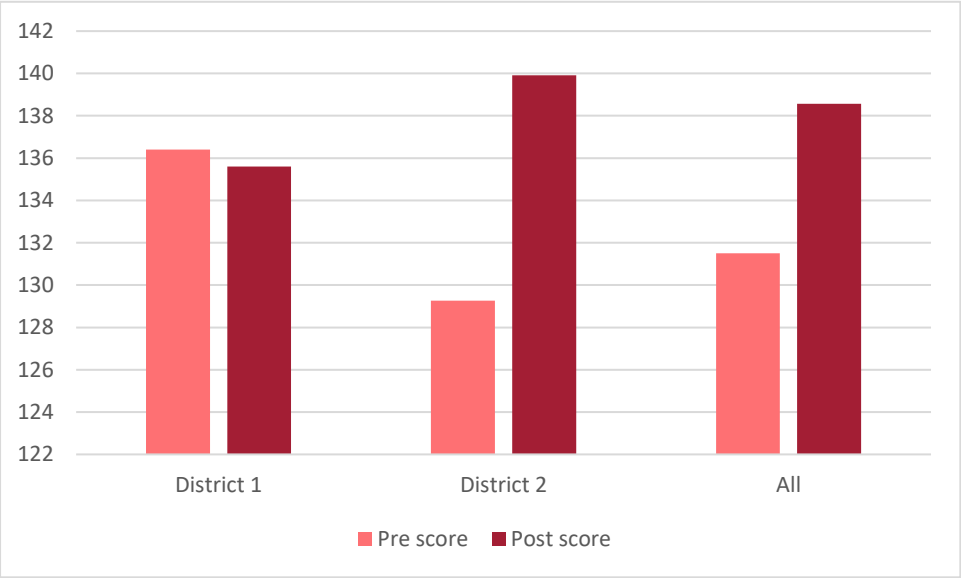


Figure 23: Changes in total iCHEW scores before and after delivery of the implementation strategies by district

9.3.1.2 Self-reported behaviours

As seen in Table 6 and Figure 25, small differences were seen between overall self-reported behaviour scores before and after the delivery of the implementation strategies. District 1 had a 1.6-point decrease in behaviour scores (19.2 to 17.6) and District 2 had a 2.8-point increase in behaviour scores (22.82 to 25.64).

Table 6: Changes in self-reported behaviour scores before and after the delivery of the implementation strategies

	Pre score (mean ± SD)	**Post score (mean ± SD)**
District 1 (*n*=5)	19.20	17.60
District 2 (*n*=11)	22.82	25.64
All (*n*=16)	21.69	23.12

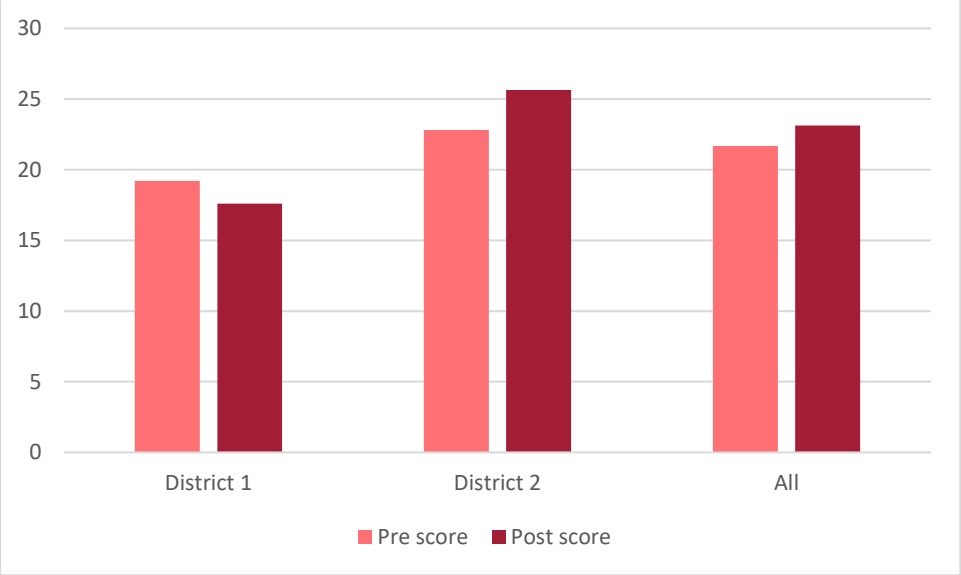


Figure 24: Changes in self-reported behaviour scores before and after delivery of the implementation strategies by district

9.3.2 Service data findings

9.3.2.1 Dental staff's guideline adherence

Frequency of growth assessment provision was calculated for the month of January 2022, and again for the month of July 2022, following the delivery of the implementation strategies. The number of paediatric clients seen, sites and dental staff varied both between clinics and time points, as seen in Table 7.

Table 7: Number of paediatric clients, sites and dental staff at each district across study time points

	District 1		District 2	
	January 2022	**July 2022**	**January 2022**	**July 2022**
Number of sites	6	6	4	3
Number of dental staff	29	26	26	25
Number of paediatric clients seen	486	786	268	1189
Number of paediatric clients seen by dental officers	28 (5.76%)	30 (3.82%)	48 (17.91%)	42 (3.53%)

Like the other measures, and when analysed overall, there was no difference seen in frequency of growth assessment before and after the delivery of the implementation strategies. However, when analysed by district, it was seen that District 1 had a statistically significant decrease in growth assessment provision, with 22.54% fewer children having received a growth assessment (χ^2=63.69, p<0.001). Conversely, at District 2, 20.54% more children received a growth assessment following the delivery of the implementation strategies (χ^2=45.05, p<0.001). Refer to Table 8 for all comparisons.

Table 8: Changes in growth assessment frequency before and after delivery of implementation strategies

Time point	Growth assessment received		χ^2	*p*-value
	No n(%)	Yes n(%)		
District 1				
Pre	126 (25.93)	360 (74.07)	63.69	<0.001
Post	381 (48.47)	405 (51.53)		
District 2				
Pre	122 (45.52)	146 (54.48)	45.05	<0.001
Post	297 (24.98)	892 (75.02)		
All				
Pre	248 (32.89)	506 (67.11)	0.5032	0.478
Post	678 (34.33)	1297 (65.67)		

9.3.2.2 Factors associated with receiving a growth assessment

As district was an effect modifier for rate of guideline adherence, further analysis to investigate correlates of a patient receiving a growth assessment was stratified by district. Specifically, separate logistic regression models were constructed for District 1 and District 2,

with both models having good fit, despite pseudo r-squared values indicating a limited amount of variance explained (Table 9).

In District 1, after controlling for the position of the treating provider, the threshold number of children treated by the provider, and the location of the clinic they were treated in, patients treated following the delivery of the implementation strategies had less than half of the odds of receiving a growth assessment (OR=0.383, $p<0.001$). The other factor significantly associated with a child receiving a growth assessment at this district was the position of the dental staff treating the children, with those treated by dentists having over 1.5 times the odds of receiving a growth assessment (OR=1.540, $p=0.050$).

In District 2, children had almost twice the odds of receiving a growth assessment following the delivery of the implementation strategies, controlling for the position of the treating provider, the threshold number of children treated by the provider, and the location of the clinic they were treated in (OR=1.848, $p<0.001$). Furthermore, children had less than a quarter of the odds of being provided a growth assessment at this district if they were treated by a dental officer (OR=0.203, $p<0.001$) and just over half the odds if they were treated at a satellite clinic, rather than the central, main clinic in this district (OR=0.572, $p<0.001$).

Table 9: Logistic regression models of factors associated with growth assessment provision for each district

District 1							
						95% Confidence Interval	
Variable	**Coef-ficient**	**Standard Error**	**Odds Ratio**	**z**	**p**	**Lower**	**Upper**
Treated post-intervention (ref=before)	-0.960	0.048	0.383	-7.60	<0.001	0.299	0.49

Treated by a dental officer (ref=treated by a dental/oral health therapist)	0.432	0.339	1.54	1.96	0.050	1.000	1.716
Treated by dental staff who treated more than 10 children over both time points	-0.099	0.295	0.906	-0.30	0.764	0.479	1.716
McFadden's R squared: 0.043; Hosmer Lemeshow Chi Squared: 0.01 (2df); p=0.996							

District 2							
						95% Confidence Interval	
Variable	**Coefficient**	**Standard Error**	**Odds Ratio**	**z**	**p**	**Lower**	**Upper**
Treated post-intervention (ref=before)	0.614	0.277	1.848	4.10	<0.001	1.377	2.479
Treated by a dental officer (ref=treated by a dental/oral health therapist)	-1.595	0.057	0.203	-5.71	<0.001	0.118	0.351
Treated by dental staff who treated more than 10 children over both time points	0.534	0.736	1.705	1.24	0.217	0.731	3.976
Treated by staff based at a satellite clinic	-0.559	0.711	0.572	-4.49	<0.001	1.599	2.862
McFadden's R squared: 0.070; Hosmer Lemeshow Chi Squared: 0.99 (2df); p=0.610							

9.4 Phase 5 Conclusions

Following delivery of these strategies, pilot findings have revealed high effectiveness of the strategies at one site, with a large improvement in attitudes and adherence. However, this was not reflected at the other site, which saw a significant decrease in adherence. Factors

associated with adherence varied between sites, but included the dental staff's position, number of children they treated and where the staff were based.

Chapter 10

Discussion

10.1 Introduction

The overall goal of this project was to develop and pilot effective implementation strategies for children's healthy weight guidelines in the dental setting, using a multi-phase sequential mixed methods approach. As stated in Chapter 2, the CHEWI project aimed to achieve this through the following objectives:

1. Review the literature regarding children's healthy weight interventions in the dental setting through a scoping review, to map the current evidence and assess the effectiveness of dental staff in promoting healthy weight to children (Chapter 2).
2. Conduct a systematic review to identify and evaluate the most effective guideline implementation strategies for the dental setting (Chapter 5).
3. Engage with dental staff and parents of children in focus groups to identify areas of potential to optimise implementation of children's healthy weight guidelines into the dental setting, and codesign implementation strategies to facilitate this (Chapter 6).
4. Design and systematically validate an instrument, which measures behavioural determinants of dental staff engaging in children's healthy weight practices, to evaluate the implementation strategies (Chapter 7).
5. Refine the implementation strategies according to the needs of each site (Chapter 8).
6. Conduct a quantitative pilot study to evaluate the effectiveness of the codesigned implementation strategies in influencing dental staff behavioural determinants and adherence to children's healthy weight guidelines (Chapter 9).

This chapter will summarise and sequentially integrate the findings from each phase according to the objectives of the CHEWI project. Published findings will be discussed

considering any new literature that has been generated since the publications, and unpublished findings will be compared to the existing literature. Additionally, the implications of the findings for research and practice will be discussed. The first section of this chapter will discuss Objective 1, namely the current research evidence on the role of dental staff in children's healthy weight guidelines, and potential implementation strategies required. Following this, Objectives 2, 3 and 5 will be integrated to discuss the codesigned and refined implementation strategies in view of the best available evidence. The third section of this discussion will integrate Objectives 4 and 6 to discuss the pilot study to measure the effectiveness of the implementation strategies, and how indicators of success were measured. Following a reflection upon the conceptual framework used for the project, the strengths and limitations of findings, including the impact of COVID-19, will be discussed.

10.2 Expanding the practice of dental staff: Their role in children's healthy weight and strategies to implement new practices

The scoping review (Paper 1) conducted for the background of this thesis gathered evidence on children's healthy weight interventions and related strategies for the dental setting. Although there was limited empirical evidence regarding the effectiveness of such interventions in the dental setting, findings nonetheless highlighted a clear role for dental staff in children's healthy weight, identifying that these interventions promoted positive behaviour change, and were acceptable to parents. For a full discussion of these findings in consideration of the existing literature, please refer to the discussion section of Paper 1.

Since the publication of this paper, emerging evidence has continued to reinforce the conclusions made in Paper 1. Specifically, an updated search of the published literature revealed an additional four publications relevant to the scoping review (Paper 1), that is, exploring existing or recommended interventions for addressing childhood obesity in the

dental setting (Chomitz et al., 2019; Guo et al., 2018; Large et al., 2022; Warrilow et al., 2022). Of the reported obesity-related interventions, only one study presented health-related outcomes (Chomitz et al., 2019). This outcome was positive behaviour change, which was seen among most participants following dietary guidance (Chomitz et al., 2019).

Three studies reported on acceptability of interventions such as BMI screening, dietary advice, and healthy lifestyle counselling (Chomitz et al., 2019; Guo et al., 2018; Large et al., 2022), showing high parent and staff acceptance. Despite this, one study did present the caveat that parent acceptance depended on the healthy lifestyle counselling approach used by dental staff (Guo et al., 2018). Furthermore, one of these studies explored dental staff acceptance, and highlighted that although many staff acknowledged the positive impact of growth assessments for children, and found this easy to do, almost a third of staff still reported some difficulties with these practices (Large et al., 2022). These difficulties surrounded raising the issue of weight with families, particularly in light of the sensitive nature of these discussions (Large et al., 2022). This was reinforced by another study that reported the level of implementation of children's growth assessment guidelines, and found that there was a low level of staff adherence, wherein few children were provided a formal diagnosis, verbal or written advice, or referrals, although BMI was calculated for 80% of children outside of the healthy weight range (Warrilow et al., 2022).

These findings not only emphasise the role of dental staff in children's growth assessments, but also reinforce the potential need for specific support for staff when engaging in these practices, such as implementation strategies. Yet, to date, no other studies have explored the development or evaluation of implementation strategies for this context. The CHEWI project therefore provides novel evidence that can be used to enable dental staff to fill this role.

10.3 Improving adherence to children's healthy weight guidelines in the dental setting: using and codesigning implementation strategies

When implementing new practice guidelines into the dental setting, the systematic review (Paper 3) highlighted that a range of strategies, including audit and feedback, reminders, education, patient-mediated interventions, pay for performance and multifaceted interventions could be effective. Refer to the discussion section of Paper 3 for a comparison of these findings with findings from other healthcare settings.

A review of the subsequent literature has identified a total of three additional studies that have been published since this paper, which meet the review's selection criteria of experimental and quasi-experimental studies on the effectiveness of implementation strategies in the dental setting. One of these concludes that education is an effective implementation strategy for dental staff, and further reveals that online interactive education strategies, such as those utilising Zoom, remain highly effective (Goff et al., 2022). The other two studies explore financial incentives as implementation strategies (Gnich et al., 2018; Leinonen & Vehkalahti, 2021), with one study concluding that while financial incentives can have a moderate effect on guideline adherence, they may be best used in conjunction with multiple implementation strategies (Gnich et al., 2018). Interestingly, the other study found that salaried dental staff in their cohort had higher rates of root canal guideline adherence than fee-for-service staff, however, it is to be noted that fee-for-service staff were remunerated regardless of their adherence level (Leinonen & Vehkalahti, 2021).

As seen in Table 10, the initial strategies developed in the codesign study (Paper 4) were consistent with those identified to be effective in the systematic review (Paper 3). Specifically, several of the codesigned strategies corresponded to the effective types of implementation strategies identified in Paper 3. These were staff training (education), providing growth assessment information to patients and families prior to appointments,

and resources for patients from culturally and linguistically diverse backgrounds (patient-mediated interventions), and ensuring discharge summaries were returned to referring dental clinics (a modification of audit and feedback) (Villarosa et al., 2022; Villarosa et al., 2019). Furthermore, additional strategies were codesigned in Paper 4 according to specific needs at each site, including involvement of dental assistants in growth assessments and developing longitudinal growth charts. These were intended to be packaged into suites (multifaceted intervention). Refer to Paper 4 for a full discussion of these strategies considering the published literature (Villarosa et al., 2022).

This codesign process extended into the refinement of the strategies (Chapter 8), which resulted in the evolution of the growth assessment information for patients and families into a mail-out flyer, and the longitudinal growth chart into a growth chart history for one district. Furthermore, this process resulted in the addition of two more audit and feedback strategies for one district: a case study and a quality board displaying the rate of adherence to the children's healthy weight guidelines.

As per the initial codesigned strategies, these final strategies remained consistent with the effective implementation strategies identified in Paper 3. Each of these strategies were also aligned with the IM conceptual framework used to underpin this study (Table 10) (Fishbein, 2008). All strategies aimed to improve adherence to children's healthy weight guidelines, either directly by addressing awareness and environmental constraints, or indirectly through increasing intention to perform children's healthy weight practices. For an in-depth description of the IM, please refer to Chapter 3, Section 3.4.

Table 10: Initial and final strategies, with alignment to implementation strategies in the literature and IM domains

Initial strategy	Final strategy	Type of implementation strategy	IM domain
District 1			
Sending growth assessment information to clients in appointment reminder letters	Parent information flyer	Patient-mediated strategy	Environmental constraints, normative beliefs
Providing culturally appropriate information resources	Translated waiting room poster	Patient-mediated strategy	Environmental constraints, normative beliefs
Updating staff regarding referral outcomes with discharge summaries	Discharge summaries from referral pathways	Audit and feedback	Outcome beliefs, efficacy beliefs
Including dental assistants in growth assessments	Including dental assistants in growth assessments	N/A – identified need	Environmental constraints
Longitudinal growth chart	Growth chart history	N/A – identified need	Environmental constraints
Refresher training for staff	Refresher training for staff	Education	Awareness and skills
-	Additional strategy: Case study	Audit and feedback	Outcome beliefs, efficacy beliefs
-	Additional strategy: Quality board	Audit and feedback	Outcome beliefs, efficacy beliefs
District 2			

Sending growth assessment information to clients in appointment reminder letters	Parent information flyer	Patient-mediated strategy	Environmental constraints, normative beliefs
Updating staff regarding referral outcomes with discharge summaries	Discharge summaries from referral pathways	Audit and feedback	Outcome beliefs, efficacy beliefs
Longitudinal growth chart	Longitudinal growth chart	N/A – identified need	Environmental constraints
-	Additional strategy: Stamp for patient handouts	Patient-mediated strategy	Environmental constraints

Specifically, provision of parent information flyers and the translated poster aimed to better inform parents and clients, and in turn reduce the environmental constraint of parents or clients declining growth assessments. Increasing rates of parent and client acceptance influenced the IM background variable of culture by fostering satisfaction and support among parents and clients. In turn, this aimed to improve dental staff normative beliefs, that is, increase dental staff beliefs that parents would approve these assessments and encourage them to offer these services more often. By ensuring referral services provided discharge summaries, and developing case studies and quality boards, dental staff could receive direct feedback regarding how their practices were impacting patient outcomes. It was hoped that this feedback would improve outcome and efficacy beliefs of dental staff, by demonstrating that not only could these practices benefit patients, but that dental staff could effectively provide these services. Consequently, this could improve dental staff attitudes and self-efficacy and increase their intentions of providing these services in the future.

The inclusion of DAs in growth assessments, creating a stamp, and developing a longitudinal growth chart or growth chart history aimed to reduce the environmental

constraints of time limits, difficulties in information transfer, and limitations of the current growth charts respectively. Provision of refresher training addressed the need to improve awareness and skills of dental staff regarding provision of children's healthy weight services. It was hoped that reducing environmental constraints and improving awareness and skills would result in a direct increase in children's healthy weight guideline adherence.

Although the systematic review (Paper 3) alone identified an array of implementation strategies that could have been delivered to improve guideline adherence, there were no implementation strategies identified specifically for children's healthy weight guidelines. With such a paucity in the existing literature, the principles of co-design played an invaluable role in ensuring the feasibility and sustainability of the developed implementation strategies in the specific context of this study. Evidence highlights that the approaches used to develop implementation strategies highly impact their effectiveness (Hamilton & Mittman, 2017; Powell et al., 2019). Specifically, studies recognise that implementation problems vary between contexts, and single-component approaches based on the assumption that the strategies that were effective in earlier studies would also be effective later do not consider these dynamics in implementation problems (Oxman et al., 1995). It is evident that there are no "silver bullet" strategies, and it is therefore vital to develop strategies based upon a deep understanding of the context of the implementation, including the causes of low adherence, the determinants of implementation, and the mechanisms and processes required to address them (Hamilton & Mittman, 2017; Oxman et al., 1995).

Specifically, evidence identifies that the most effective strategies are developed using systematic approaches involving identification of barriers, linking barriers to strategy component selection, use of theory and user engagement (Powell et al., 2019). The CHEWI project adopted such an approach, by drawing upon theory both through effective implementation strategies identified in the literature (Paper 1) and the IM, to identify a range of strategies that could be beneficial to adherence to children's healthy weight

guidelines. Then, the co-design process (Paper 4) ensured the best strategy component selection, by engaging end-users (parents and dental staff) in the identification of implementation strategies that best addressed their barriers to implementation. To ensure feasibility and sustainability in practice, these strategies were further shaped by specific practice requirements at each site through consultation with groups of key stakeholders (Chapter 8). These included management staff, to ensure strategies complied with district policies and procedures; dental staff, to ensure implemented strategies were practicable and acceptable; and consumers, to ensure patient-mediated strategies were acceptable and appropriate for the population demographics of each district. For example, staff and consumers discussed the higher proportion of individuals from CALD backgrounds in District 1, resulting in the need for translated patient materials, however no such needs were identified in District 2 and thus such materials were not utilised for this district. This best practice approach resulted in the development of tailored suites of implementation strategies for each district, which were anticipated to be effective in improving adherence to children's healthy weight guidelines.

10.4 Measures of success and piloting the implementation strategies

Objectives 4 and 5 of the CHEWI project reflected a need for studies that evaluate implementation strategies using reliable, valid instruments. As shown by the systematic review (Paper 3) and the literature that has emerged since its publication, there is a distinct paucity in studies that evaluate implementation strategies in the dental setting (Villarosa et al., 2019). Additionally, the research literature has identified a lack of studies that evaluate implementation strategies that have been tailored to various health settings (Colquhoun et al., 2017; Powell et al., 2017). Furthermore, there is a scarcity of research that uses psychometrically evaluated instruments in the evaluation of these strategies (Lewis et al., 2015).

The significance of outcome measures needs to be recognised in evaluations of the effectiveness of the implementation strategies. It is essential to have reliable, valid, and pragmatic instruments that can measure these outcomes if the success of implementation strategies is to be effectively monitored and evaluated (Weiner et al., 2017). Despite this, few existing measures of the outcomes of implementation strategies have had their psychometric and pragmatic qualities evaluated (Lewis et al., 2015). The psychometric paper (Paper 4) has contributed to the research in this area through the development of a valid instrument that uses the IM to measure determinants of the intention of dental staff to engage in children's healthy weight guidelines. By using a theoretical framework, not only does this instrument allow for a reliable evaluation of the effectiveness of the implementation strategies, but it also enables researchers to gain insight into why the strategies are, or are not, effective. Specifically, the use of the IM enables investigators to investigate relationships between adherence and the underlying behavioural determinants of guideline adherence, including attitudes, perceived norm, and self-efficacy, as well as awareness, skills, and environmental constraints. With the use of systematic psychometric evaluation alongside theory to inform the development and delivery of implementation strategies, the psychometric paper (Paper 4) has made a significant contribution to the literature that can enhance the design of effective implementation strategies.

When the effect of the implementation strategies on behavioural determinants and adherence to children's healthy weight guidelines at each district was explored in the pilot, variable results were seen. Overall, there was a significant increase in scores within the attitudes subdomain of iCHeW, and when stratifying this analysis by district, there was a significant increase in the attitudes subdomain for District 2, and a non-significant small increase for District 1. Furthermore, self-reported behaviour and rate of adherence had no significant change pre- and post-intervention when analysed overall. However, when stratified by district, there was a non-significant decrease in self-reported adherence for District 1, and a non-significant increase in self-reported adherence for District 2, with a

significant decrease in adherence for District 1 and a significant increase in adherence for District 2.

The significant difference in effect of the implementation strategies between districts may be attributable to several factors. Specifically, according to the CFIR proposed by Damschroder et al. (2009), major differences in the effect of the implementation strategies between districts were attributed to the implementation process, the inner setting, the outer setting, and the characteristics of individuals.

10.4.1 The impact of the implementation process on adherence

As defined by Damschroder et al. (2009), the implementation process is the change process that aims to achieve uptake of the intervention at individual and organisational levels . This can include a series of interrelated sub-processes, including planning the intervention, engaging individuals in the use of the intervention, executing the implementation strategies, reflecting upon and evaluating the intervention (Damschroder et al., 2009). Many factors of the implementation process were similar between districts, both in relation to the co-designed implementation strategies as well as any strategies that were in place prior to the commencement of this project, namely, the ability for clinics to claim payment for children's healthy weight services. Without this payment, most public dental services may not have adopted these guidelines.

However, one of the most significant differences between the implementation processes used by the two districts was in the engagement processes, namely that a champion was used for this project in District 2, whereas District 1 did not have a champion. It is well known that champions can play a pivotal role in the success of implementation in healthcare (Miech et al., 2018). Specifically, champions can play a role in project spread, and therefore penetration of implementation, especially when they have a strong and extensive social network among their colleagues (Luz et al., 2021). This can be pivotal in overcoming any organisational indifference or resistance regarding the intervention (Damschroder et al.,

2009). With the champion at District 2 being in a key coordination role among dental and oral health therapists, they were extensively linked with the staff at this district. This may explain the significant improvement in adherence at District 2. The reasons behind how and why champions were or were not used at each district were influenced by some inner setting factors.

10.4.2 The impact of the inner setting on adherence

Corresponding with environmental constraints and some background variables of the IM, Damschroder et al. (2009) describe the inner setting as the features of structural, political, and cultural contexts through which the implementation process will need to proceed (Damschroder et al., 2009; Fishbein, 2008). The inner setting encompasses structural characteristics such as the organisational structure, age, maturity and size of the organisation, as well as the networks, culture and implementation climate within the organisation (Damschroder et al., 2009). In this study, organisational structure, culture, and implementation climate may have had the largest impacts on use of champions and implementation success.

District 2 had a site structure where there was one central clinic where most staff were located, and a few smaller satellite clinics (refer to Chapter 4, Section 4.2.1 for more details). With the champion based at the central clinic, their social networks were strongest here, however, were less connected to the staff members who were at the satellite clinics. As a result, one of the implementation strategies, namely the mail out flyer, was not delivered to the satellite sites. The champion acknowledged this when providing feedback on the strategies (Appendix 14).

The weaker networks between the champion and the satellite clinics may therefore partly explain the lower odds of children receiving growth assessments at these sites. It is noteworthy that most of the satellite clinics were in rural areas, in comparison to the central clinic which was in a more metropolitan location. As rural sites can have additional

challenges and needs when implementing healthy weight interventions, this may also partially explain the lower implementation among satellite clinics (Barnidge et al., 2013).

Interestingly, the reason that there was no champion at District 1 is because a willing champion could not be identified at this district, and this may reflect the organisational culture, and resulting implementation climate at this district. These factors could have further impacted the effectiveness of the implementation strategies at this district.

A situation that unfolded at this district immediately prior to the commencement of this project may have been detrimental to organisational culture and decreased willingness of staff to engage in new practices. Specifically, there was a major restructure in staff, resulting in the termination of over half of the dental and oral health therapists at this district. See Chapter 4, Section 4.2.1 for more details. When examining factors affecting implementation of healthy weight interventions, organisational culture is a factor that is often overlooked when compared to tangible factors such as structures and staff behaviours (Barnidge et al., 2013). Yet, research has found organisational culture to be a strong predictor of guideline adherence (Williams et al., 2019).

Organisational culture can flow on to affect implementation climate, that is, the organisations' capacity for change, receptivity to an intervention and the support or expectations for adherence to the intervention. Districts 1 and 2 had similar impetus for adoption of the children's healthy weight guidelines, as well as organisational incentives, resources, and information. However the staff cuts and impacts on the organisational culture and staff workload in District 1 may have resulted in lower compatibility between the values of staff and the children's healthy weight guidelines, decreased prioritisation of the guidelines and a changed learning climate where staff may not feel as safe to try new methods (Damschroder et al., 2009; Klein & Sorra, 1996; Nembhard & Edmondson, 2011). This is reinforced by the significant increase in attitude scores for those who completed the questionnaire in District 2, compared to an albeit nonsignificant decrease for District 1.

Thus, the organisational culture and resulting implementation climate could have been key factors to impact the effectiveness of the implementation strategies at District 1.

There was also a major structural change that occurred at District 1, whereby one clinic was closed, and a clinic was opened within a new health facility, resulting in the relocation of staff, equipment and services from the closed clinic to the new clinic (refer to Chapter 4, section 4.2.1 for further details). This resulted in several challenges, the most pressing of which was the weight scales that were transferred from the old clinic to the new clinic needed to be re-calibrated. Rather than continue providing growth assessments using the uncalibrated scales, some dental staff chose not to provide growth assessments at all. This would have reduced the use of the implementation strategies at this site.

10.4.3 The impact of the outer setting on adherence

In addition to the inner setting, Damschroder et al. (2009) define the outer setting as the economic, political and social context within which an organisation resides, a factor of which is external policies and incentives (Damschroder et al., 2009). There was a difference in the policies at each district which impacted the process by which information was mailed to patients and their families. In District 1, most mail-outs were sent by a central appointment service, rather than directly from the district. The exception to this were letters that informed patients and their families that they had come off a waitlist and were eligible to schedule an appointment. However, all other letters, including new patient letters and recall letters that indicated it was time for a patient to have their regular examination, were not sent directly by the district, and therefore could not have the developed information flyer included in them. Thus, at District 1, the flyer was only sent to children and families when they were coming off a waitlist.

During COVID-19 lockdowns, children were frequently put on waitlists, however this was an uncommon practice outside of these lockdown periods. This reduced the utility of this strategy to specific time periods during the study period. In contrast, District 2 mailed all

patient letters directly from the district, and therefore enabled the information flyers to be included in letters to new patients, recall patients and waitlist patients. This difference in how the strategy could be used could therefore partially explain the increase in adherence that was seen in District 2 but not District 1.

10.4.4 The impact of the characteristics of individuals on adherence

Finally, Damschroder et al. (2009) acknowledge that there is a complex interplay between individuals and the organisations they work within, and thus the characteristics of individuals can have an impact on implementation (Damschroder et al., 2009). Specific attributes that may be part of this include knowledge and beliefs, self-efficacy, individual stage of change, and individual identification with the organisation, which correspond to outcome, normative and efficacy beliefs in the IM (Damschroder et al., 2009; Fishbein, 2008).

In the CHEWI study, it was found that being treated by a dental officer, rather than a dental therapist or oral health therapist, affected a child's odds of receiving a growth assessment. The nature of this association varied by district. In District 2, children had significantly lower odds of receiving a growth assessment if treated by a dental officer. This was anticipated, as it was generally uncommon for dental officers to treat children, and both the children's healthy weight guidelines and implementation strategies were largely targeted at dental and oral health therapists, who were the main providers that treated children. As a result, there was the expectation that dental officers would have less knowledge and self-efficacy regarding the guidelines and therefore have a lower level of adherence.

In contrast, children treated by dental officers in District 1 had higher odds of receiving a growth assessment. This may be due to the impact of the organisational culture at this district, as the restructure resulting in a significant reduction in dental and oral health therapist staff might have affected their identification with the organisation, specifically their

commitment to the organisation (Abraham, 2000). This could then influence the willingness of staff to engage in an intervention (Damschroder et al., 2009). As dental officers were less impacted by this restructure, they might have a higher commitment to the organisation and more willingness to engage in the intervention.

Despite the variability between districts, the results of the CHEWI project have shown that a systematic multi-phase approach incorporating constructive inquiry can produce effective implementation strategies for children's healthy weight guidelines in the dental setting. Involving champions, while addressing limitations in the inner and outer settings and considering individual characteristics might make these strategies more effective in a variety of settings.

10.5 Reflecting on the IM conceptual framework

Using the IM for the CHEWI project had several benefits. Firstly, it aligned with the best practices for the development of the implementation strategies; that is, using systematic approaches involving identification of barriers, linking barriers to strategy component selection, use of theory and user engagement (Powell et al., 2019). By viewing the primary outcome as behavioural change it enabled a focus on, and engagement with, the individuals involved in this behavioural change; that is, dental staff and parents of children in the community. Thus, implementation strategies could be tailored according to user needs at each district.

As it is not dependent on any particular methodological approach, the IM complemented each of the approaches used in each phase and could be adopted throughout the entire CHEWI project (Fishbein & Ajzen, 1975). This enabled each phase of the CHEWI project to be linked on a theoretical basis and fostered integration of evidence, as demonstrated throughout the discussion.

Furthermore, this framework enabled outcomes to be considered in detail, and determined that adherence to guidelines was a behaviour that had a complex interplay of determinants. By utilising this framework, an instrument was developed that could measure each of these behavioural determinants to a high level of validity and reliability, and behavioural determinants could be examined in depth. Arguably, the use of a framework specifically developed for implementation science restricted the measures used in the instrument, in that it focussed on the behaviour of guideline adherence, and did not measure other domains of guideline implementation that may be relevant to other, implementation-specific frameworks.

Nonetheless, it aligned with the best practices for the development of implementation strategies (Powell et al., 2019), and any limitations in the interpretation of findings through an implementation science lens were easily overcome by incorporating the Consolidated Framework for Implementation Research (CFIR) in the interpretation of findings, which aligned well with the IM (Damschroder et al., 2009). Thus it can be concluded that the IM was a good fit for the CHEWI project.

10.6 Strengths and Limitations

The key strength of the CHEWI project was that it utilised a systematic, theory-driven approach to develop implementation strategies, that were guided by evidence, and identified needs by users and key stakeholders. Being the first study to develop implementation strategies for children's healthy weight guidelines in the dental setting, the constant engagement with staff, parents and key stakeholders in each district ensured high feasibility and acceptability of these strategies. Embedding these strategies into the services provided at each district optimised the sustainability of these interventions. Additionally, this systematic approach maximised the validity of findings and provides a model that could be transferred to other dental settings. Due to the impact of this approach on the feasibility, acceptability, sustainability, and transferability of these interventions this systematic approach might have

contributed to the high effectiveness of these interventions at District 2. Furthermore, this project ensured that the questionnaire used in the evaluation of the strategies was psychometrically evaluated to further reinforce the validity and reliability of the findings. Through adopting innovative strategies such as promotional videos for the implementation strategies, the awareness of staff regarding each of the strategies was strengthened.

However, there are some limitations that should be considered when interpreting the findings of the CHEWI project. In Thesis Paper 1, findings were not considered according to age of children during synthesis of results, which may be of significance if the effectiveness of interventions vary with child age. However, considering the aims of Paper 1, and the paucity of research at the time of the review, this was not a priority in synthesis. The systematic review in Phase 1 was largely limited by the paucity of research in the field, resulting in lower quality and heterogenous findings. The major limitation of the codesign study in Phase 2 was the limited diversity of participants, especially parents, when it came to gender and educational level. Finally, the main limitation of Phase 3 was the purposive sampling method which may have resulted in some bias for the included study sample. Furthermore, recruitment of more parents in this phase may have provided additional insight in the co-design process. For full limitations of Phases 1-3, please refer to Papers 3-5 in Chapters 5, 6 and 7.

There are several limitations to consider when interpreting the results presented in Phase 5. First, despite being a rapid, convenient method that allows associations to be explored between dependent and independent variables, the pre-test post-test design used in Phase 5 has some limitations. Second, as participants were not selected using random sampling, the transferability of findings to other settings may be limited (Stratton, 2019). Third, the act of pre-testing participants allowed them to be better prepared for the post-test and might have increased their likelihood of a higher score (Stratton, 2019). However, as participants were only aware of the questionnaire time points, and not when the service data

was collected, it is anticipated that this was of less concern for this project. Finally, causality should be interpreted with caution for this study design, as this design assumed that any change between time points was a product of the study intervention (Stratton, 2019; Torgerson & Torgerson, 2008). As a result, any other factors that might result in temporal changes in adherence need to be considered. Although some measures were implemented, such as careful selection of data collection time points to ensure optimal comparability (see Section 10.6.1 for more details), not all temporal factors could be accounted for and thus results should be interpreted with caution.

In addition, due to difficulties in recruitment for the questionnaire, coupled with staff turnover rates over the study period, there was a low number of responses that could be paired over the pre- and post-test questionnaires. As a result, inferential analysis for these outcomes was not appropriate, and only absolute score differences could be presented. Thus these differences, and their implications for the wider dental workforce, should be interpreted with caution. Nonetheless, as this data was intended as a pilot, rather than a full evaluation, these findings still fulfilled the study objectives.

Regarding the electronic records data, as this was a comparison of children treated over two separate months, analysis could not be paired. Rather, independent analyses needed to be conducted. With each child having different characteristics that could influence whether a growth assessment was completed, this type of analysis would be unable to account for this, particularly as individual patient data such as demographic characteristics, BMI status and referral outcomes were not collected as part of this routine data. This limited the factors that could be explored when analysing predictors of a child receiving a growth assessment, and thus may explain the low pseudo r-squared values for both regression models. Despite this, it is anticipated that the large sample sizes provide high statistical power in analysis, and as many characteristics as possible were controlled for in analysis.

Finally, the electronic records did not differentiate between children who did not receive a growth assessment because it was declined by the child or parent, and children who did not receive a growth assessment because it was not offered by the dental staff. As a result, the findings of the CHEWI project were unable to account for this. Nonetheless, as some strategies were targeted specifically at increasing child and parent compliance, and others targeted at improving staff adherence, findings were still representative of the overall effect of the implementation strategies.

10.6.1 Additional impacts of COVID-19

After the publication of Paper 2, there were additional COVID-19 incidents and related restrictions that further impacted the progression of the CHEWI project. Specifically, further lockdowns occurred following the collection of baseline questionnaire data and the delivery of three strategies at District 1. These were the training program, which also included the infographic for accessing the growth chart histories, and trained dental assistants to be involved in the growth assessments. Furthermore, due to the restrictions on services that could be provided during lockdowns, children were only being treated for dental emergencies and acute conditions, and as a result, growth assessments were rarely indicated or provided over this time period. Thus, upon return of services to usual practice in January of 2022, several limitations needed to be accounted for.

The refinement and delivery of the remaining implementation strategies were delayed until January 2022, and as a result, collection of follow-up questionnaire data was also delayed. Additionally, it was expected that adherence would be significantly reduced by the time services resumed as usual in January 2022, due to the long time period where few growth assessments could be provided. Therefore, the guidelines were seen as being completely re-implemented as of this time. The developed strategies were therefore used to enhance this re-implementation. As a result, the use of service data from the time period prior to these lockdowns, when baseline questionnaire data were collected, might impact

validity. Therefore, it was concluded that service data from January 2022 would be more appropriate, although this would not match the time when the baseline questionnaire was administered. Due to time constraints of the student's PhD candidature, baseline questionnaire data could not be re-collected to match this time point.

Despite this, the CHEWI study still presents valuable data on the development of effective implementation strategies, specifically for role expansions such as use of children's healthy weight guidelines in the dental setting. It is believed that the benefits of the systematic, theory-driven approach, outweigh the other methodological limitations.

10.7 Chapter 10 Conclusions

This chapter summarised, integrated, and discussed each of the CHEWI project's objectives in light of the existing and emerging research literature. The conceptual framework used to inform the study is reflected upon, with strengths and limitations of the framework considered. It also identified key strengths and limitations of the CHEWI project, and explored the impact of COVID-19 on the later phases of the project. The next chapter will conclude the thesis and discuss the implications and recommendations for future practice, policy, and research.

Chapter 11

Conclusion

11.1 Conclusion

Childhood obesity remains a global public health concern, with the National Obesity Strategy aiming to reduce overweight and obesity in children and adolescents by at least 5% by 2030 (Australian Government, 2022). Specifically, this strategy encourages capacity building in the health workforce to integrate obesity prevention efforts into their practice (Australian Government, 2022). The NSW Premier's Priority echoes these goals, and calls for the implementation of "*the routine delivery of brief advice and referral for children who are above a healthy weight, along with their families*" (NSW Ministry of Health, 2016). Dental staff could play a significant role in achieving these goals, as they see children routinely and already promote the shared risk factors for oral health and childhood obesity (Dooley et al., 2017; Lamster & Eaves, 2011; Perman, 2011; Villarosa et al., 2018; Wright & Casamassimo, 2017).

Yet, there has been a lack of evidence surrounding the implementation of children's healthy weight guidelines into dental practice, especially in Australia (Villarosa et al., 2018). The CHEWI project, being the first of its kind in this area, has used the IM and a multi-phase mixed methods design to provide valuable evidence surrounding the development and evaluation of implementation strategies for children's healthy weight guidelines in the Australian dental setting. It has systematically summarised implementation strategies that could be effective in the dental setting, including audit and feedback, reminders, education, patient-mediated interventions, pay for performance and multifaceted interventions. It has also resulted in engagement with dental staff, parents in the community, and key stakeholders to develop and refine two suites of implementation strategies to meet the needs of two participating districts.

This project has highlighted that parent information flyers, translating waiting room posters, ensuring referral pathways provide discharge summaries, refresher training, and a variety of staff resources can be highly effective strategies for the implementation of children's healthy weight guidelines into the dental setting. The appointment of champions for implementation may be a key factor in ensuring the effectiveness of these implementation strategies, and it is further hypothesised that promoting positive organisational culture at each district is paramount.

Despite the minor limitations of the CHEWI project, it has nonetheless led the way for similar efforts in Australia, and globally, as it has provided the first empirical data on implementation strategies for children's healthy weight guidelines in the dental setting. Along with identifying potentially effective implementation strategies, the results of the CHEWI project have demonstrated acceptability, feasibility, sustainability, and transferability. It has additionally developed a psychometrically evaluated instrument which can be used to evaluate future efforts. The findings of the CHEWI project therefore could be vital in informing continuing efforts to utilise dental staff in the prevention of overweight and obesity around the world.

11.2 Recommendations

From the findings of the CHEWI project, several recommendations have emerged for clinical practice, policy, and future research, to improve both the effectiveness of the implementation strategies and childhood obesity prevention in Australia.

11.2.1 Recommendations for clinical practice

11.2.1.1 Recruit champions to promote implementation strategies

With the success of the implementation strategies at District 2, which utilised a champion, this project emphasises the potential difference a champion can make on the

effectiveness of implementation strategies (Luz et al., 2021; Miech et al., 2018). As previously discussed, it is vital for champions to have extensive social networks (Luz et al., 2021), thus for districts comprised of larger numbers of clinics or that span a large geographical area, it might be unfeasible for one champion to have sufficient reach across all clinics. Therefore, it is recommended that these districts recruit several champions, who would collaborate and coordinate with one another, to promote use of the implementation strategies and guideline adherence.

11.2.1.2 Continue to identify and implement measures to improve organisational culture at District 1

In addition, potential issues with organisational culture at District 1 were identified from the findings of this project. With the impact that organisational culture can have on not only these implementation efforts, but also any quality improvement initiatives in an organisation, it is vital for these issues to be explored and to develop supportive measures (Abraham, 2000; Klein & Sorra, 1996; Nembhard & Edmondson, 2011; Williams et al., 2019). As part of this process, dental staff should be consulted and involved, to ensure relevant aspects of culture are identified and addressed (Mannion & Davies, 2018).

11.2.1.3 Improve processes and systems used at District 1

Another limitation identified at District 1 was limited control of staff over information that was being sent to parents and patients prior to appointments, due to letters being mailed from a central service. As a result, it is recommended that a system that enables District 1 to directly mail their own patient letters be implemented.

11.2.1.4 Use codesign principles to develop tailored implementation strategies across New South Wales

As the children's healthy weight guidelines have been rolled out in public dental services across the whole of New South Wales (NSW Ministry of Health, 2019), Districts 1 and 2 are not the only districts that may require implementation strategies. Each district in

NSW may be experiencing its own implementation challenges, therefore an approach like the CHEWI project could be greatly beneficial for these districts. The transferability of the CHEWI project means that it could act as a framework for other districts across the state to follow. Specifically, the strategies developed for the CHEWI project may be readily applicable for some, if not most, districts, and these could be further built upon to develop specific strategies as required by each district. It is recommended that any strategies developed be done so alongside dental staff, community members and other key stakeholders in each district in a codesign approach which ensures that voices of different stakeholders are heard and considered.

11.2.1.5 Expand guideline implementation to private dental services

Although public dental staff can play a role in addressing childhood obesity, national data highlights that almost 60% of children had their most recent dental visit at a private practice (Australian Institute of Health and Welfare, 2023). This highlights the need for private dental practitioners to engage in these practices, along with public dental staff. Due to the way in which the CHEWI project flexibly tailored strategies according to specific site needs, a similar implementation process could be easily adopted in the private sector. However, for this to occur, it is anticipated that a similar claim process to the one used in the public sector (see Section 2.9 for further details) would be required in the private sector to enable payment for these services. Similar processes are already in place for other preventive health services, such as tobacco counselling in Australia (Australian Dental Association, 2022a).

11.2.2 Recommendations for Policy

11.2.2.1 National policies should promote the role of dental staff in childhood obesity

Although NSW acknowledges that dental staff can play a role in addressing childhood obesity, there are currently no nationally endorsed guidelines stating the same. If health promotion efforts are to effectively address childhood obesity on a national level, policy should be expanded to promote such efforts on a national scale. This would promote the adoption of projects similar to the CHEWI project around the country. This is in line with the National Obesity strategy, which aims to "*build on jurisdictional level obesity prevention and treatment policies and actions already in place*."

11.2.3 Recommendations for Future Research and Interventions

11.2.3.1 Larger studies are required to confirm CHEWI findings and further explore behavioural determinants

The low sample size for the questionnaire data was a major limitation of this project. Therefore, further research should focus on evaluating the impact of implementation strategies on behavioural determinants of children's growth assessment guidelines in the dental setting using larger samples. Sufficient statistical power could highlight key determinants of dental staff's behavioural intention, which in turn could shed light on any insufficiencies in organisational culture and other factors. Due to the small number of practicing dental and oral health therapists within NSW (Australian Government, 2021a, 2021b), such research will likely require more districts, or perhaps a national sample. Further studies that involve other regions and districts would also provide more insight into the transferability of the CHEWI project.

11.2.3.2 Further exploration of other implementation strategies and approaches could help inform implementation of children's healthy weight guidelines into the dental setting

The specific study context required the use of a strength-based approach to codesign the implementation strategies, limiting the ability to use more conventional implementation frameworks such as the CFIR, PARIHS or NPT. As a result, it is unknown how these frameworks could value-add to the implementation of children's healthy weight guidelines into the dental setting. Furthermore, the codesign approach used in this study resulted in a finite suite of implementation strategies, and other potentially effective strategies seen in the literature, such as reminders and decision aids (Villarosa et al., 2019), were not explored in-depth in the CHEWI project, and thus their effectiveness for this context is also unknown. Future research that explores the use of implementation frameworks and additional strategies not used in the CHEWI project could contribute valuable evidence regarding the effectiveness of these approaches for the implementation of children's healthy weight guidelines into the dental setting.

11.2.3.3 Further research is required to identify the impact of children's healthy weight guidelines in the dental setting on children's health outcomes

Although initial evidence highlights the fact that the involvement of dental staff in children's healthy weight guidelines can be beneficial for children, there is still limited evidence to quantify the impact of such interventions on children's health outcomes (Villarosa et al., 2018). Therefore, further research is required to explore the impact of these interventions on health outcomes, such as weight status, dietary and lifestyle habits as well as other risk factors or biomarkers for chronic disease. Having such empirical data could help identify the cost-effectiveness of these approaches as well as the overall benefit for the community. This information could be used to improve the attitudes of dental staff regarding

such interventions, and act as an impetus for more governments to adopt such approaches globally.

Reference List

Abraham, R. (2000). Organizational cynicism: bases and consequences. *Genetic, Social, and General Psychology Monographs*, *126*(3), 269-292.

ACT Government. (2019). *Child and youth dental*. Retrieved 1 March from https://www.health.act.gov.au/services/dental

Aita, M., & Richer, M.-C. (2005). Essentials of research ethics for healthcare professionals. *Nursing & Health Sciences*, *7*(2), 119-125. https://doi.org/https://doi.org/10.1111/j.1442-2018.2005.00216.x

Ajzen, I. (1985). From intentions to actions: a theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: from cognition to behavior* (pp. 11-39). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-69746-3_2

American Dental Association. (2022). *Dental team careers*. ADA. Retrieved 16 November from https://www.ada.org/resources/careers/dental-team-careers

Australian Bureau of Statistics. (2016). *Census 2016, language spoken at home by sex (LGA)* (2016 Census of Population and Housing, Issue.

Australian Bureau of Statistics. (2018). *Census of population and housing: socio-economic indexes for areas (SEIFA), Australia, 2016*.

Australian Dental Association. (2018). *Dental therapist*. Retrieved 8 May from https://www.adansw.com.au/Careers/Dental-Therapist

Australian Dental Association. (2022a). *The Australian schedule of dental services and glossary* (13 ed.).

Australian Dental Association. (2022b). *Dental assistant*. ADA. Retrieved 16 November from https://www.ada.org.au/Careers/Dental-Team/Assistant

Australian Government. (2009). *Australia: the healthiest country by 2020*. Canberra: Commonwealth of Australia

Australian Government. (2012). *Dental Workforce*. Retrieved 5 February from http://www.health.gov.au/internet/publications/publishing.nsf/Content/report_nacdh~report_nacdh_ch2~report_nacdh_wf

Australian Government. (2018). *The child dental benefits schedule*. Retrieved 1 March from http://www.health.gov.au/internet/main/publishing.nsf/Content/childdental

Australian Government. (2021a). *Dental therapists: 2019 factsheet* (Factsheet, allied health 2019, Issue. Commonwealth of Australia. https://hwd.health.gov.au/resources/publications/factsheet-alld-dental-therapists-2019.pdf

Australian Government. (2021b). *Oral health therapists: 2019 factsheet* (Factsheet, allied health 20179, Issue. Commonwealth of Australia. https://hwd.health.gov.au/resources/publications/factsheet-alld-oral-health-therapists-2019.pdf

Australian Government. (2022). *The National Obesity Strategy 2022-2032* (Health Ministers Meeting, Issue. https://health.gov.au/committees-and-groups/health-ministers-meeting-hmm

Australian Institute of Health and Welfare. (2008). *Dentist labour force in Australia, 2005*. AIHW Dental Statistics and Research Unit.

Australian Institute of Health and Welfare. (2018). *Children's headline indicators*. Retrieved 1 March from https://www.aihw.gov.au/reports/children-youth/childrens-headline-indicators/contents/overview

Australian Institute of Health and Welfare. (2023). *Oral health and dental care in Australia*. Retrieved 9 July from https://www.aihw.gov.au/reports/dental-oral-health/oral-health-and-dental-care-in-australia/contents/dental-care

Barker, F., Atkins, L., & de Lusignan, S. (2016). Applying the COM-B behaviour model and behaviour change wheel to develop an intervention to improve hearing-aid use in adult auditory rehabilitation. *International Journal of Audiology*, *55*(sup3), S90-S98. https://doi.org/10.3109/14992027.2015.1120894

Barnidge, E. K., Radvanyi, C., Duggan, K., Motton, F., Wiggs, I., Baker, E. A., & Brownson, R. C. (2013). Understanding and addressing barriers to implementation of environmental and policy interventions to support physical activity and healthy eating in rural communities. *Journal of Rural Health*, *29*(1), 97-105. https://doi.org/10.1111/j.1748-0361.2012.00431.x

Baur, L. A., & Garnett, S. P. (2019). Early childhood — a critical period for obesity prevention. *Nature Reviews: Endocrinology*, *15*(1), 5-6. https://doi.org/10.1038/s41574-018-0131-0

Burnes, B. (2020). The Origins of Lewin's Three-Step Model of Change. *The Journal of Applied Behavioral Science*, *56*(1), 32-59. https://doi.org/10.1177/0021886319892685

Cabana, M. D., Rand, C. S., Powe, N. R., & et al. (1999). Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA*, *282*(15), 1458-1465. https://doi.org/10.1001/jama.282.15.1458

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., . . . Walker, K. (2020). Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, *25*(8), 652-661. https://doi.org/10.1177/1744987120927206

Centers for Disease Control and Prevention. (2016). *Defining childhood obesity*. Retrieved 11th May from https://www.cdc.gov/obesity/childhood/defining.html

Centre for Oral Health Strategy. (2013). *Oral health 2020: a strategic framework for dental health in NSW*. North Sydney: NSW Government,

Cho, H. (2012). The integrative model of behavioural prediction as a tool for designing health messages. In *Health communication message design* (pp. 21-40). Sage Pubications.

Chomitz, V. R., Park, H. J., Koch-Weser, S., Chui, K. K. H., Sun, L., Malone, M. E., . . . Must, A. (2019). Modifying dietary risk behaviors to prevent obesity and dental caries in very young children: results of the Baby Steps to Health pediatric dental pilot.

Journal of Public Health Dentistry, *79*(3), 207-214. https://doi.org/10.1111/jphd.12311

Colquhoun, H. L., Squires, J. E., Kolehmainen, N., Fraser, C., & Grimshaw, J. M. (2017). Methods for designing interventions to change healthcare professionals' behaviour: a systematic review. *Implementation Science*, *12*(1), 30. https://doi.org/10.1186/s13012-017-0560-5

Conroy, M., & Shannon, W. (1995). Clinical guidelines: their implementation in general practice. *British Journal of General Practice*, *45*(396), 371-375.

Cooperrider, D. L., Whitney, D. K., & Stavros, J. M. (2003). *Appreciative inquiry handbook* (Vol. 1). Berrett-Koehler Publishers.

Creswell, J. W., & Plano Clark, V. L. (2018). Choosing a mixed methods design. In *Designing and conducting mixed methods research* (Third edition. ed.). SAGE.

Croasmun, J. T., & Ostrom, L. (2011). Using Likert-type scales in the social sciences. *Journal of Adult Education*, *40*(1), 19-22.

Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A., & Lowery, J. C. (2009). Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implementation Science*, *4*(1), 50. https://doi.org/10.1186/1748-5908-4-50

Dattilo, A. M. (2017). Modifiable risk factors and interventions for childhood obesity prevention within the first 1,000 days. In R. E. Black, M. Makrides, & K. K. Ong (Eds.), *Complementary Feeding: Building the Foundations for a Healthy Life* (Vol. 87, pp. 183-196). Karger.

Denscombe, M. (2008). Communities of Practice: A Research Paradigm for the Mixed Methods Approach. *Journal of Mixed Methods Research*, *2*(3), 270-283. https://doi.org/10.1177/1558689808316807

Dooley, D., Moultrie, N. M., Sites, E., & Crawford, P. B. (2017). Primary care interventions to reduce childhood obesity and sugar-sweetened beverage consumption: Food for thought for oral health professionals. *Journal of Public Health Dentistry*, *77 Suppl 1*, S104-S127. https://doi.org/10.1111/jphd.12229

Effective Practice and Organisation of Care. (2015). *EPOC taxonomy*. Retrieved 28 March from https://epoc.cochrane.org/epoc-taxonomy

Effective Practice and Organisation of Care. (2016). *The EPOC taxonomy of health systems interventions*. Norwegian Knowledge Centre for Health Services. Retrieved 3 April from https://epoc.cochrane.org/resources/epoc-resources-review-authors

Ellrodt, A., Conner, L., Riedinger, M., & Weingarten, S. (1995). Measuring and improving physician compliance with clinical practice guidelines: A controlled interventional trial. *Annals of Internal Medicine*, *122*(4), 277-282. https://doi.org/10.7326/0003-4819-122-4-199502150-00007

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior research methods*, *41*(4), 1149-1160.

Fishbein, M. (2008). A reasoned action approach to health promotion. *Medical Decision Making*, *28*(6), 834-844. https://doi.org/10.1177/0272989X08326092

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: an introduction to theory and research*. Addison-Wesley Publishing Company.

Gnich, W., Sherriff, A., Bonetti, D., Conway, D. I., & Macpherson, L. M. D. (2018). The effect of introducing a financial incentive to promote application of fluoride varnish in dental practice in Scotland: A natural experiment [Article]. *Implementation Science*, *13*(1), Article 95. https://doi.org/10.1186/s13012-018-0775-0

Goff, D. A., Mangino, J. E., Trolli, E., Scheetz, R., & Goff, D. (2022). Private Practice Dentists Improve Antibiotic Use After Dental Antibiotic Stewardship Education From Infectious Diseases Experts. *Open Forum Infectious Diseases*, *9(8) (no pagination)*, Article ofac361. https://doi.org/10.1093/ofid/ofac361

Goldsmith, M. R., Bankhead, C. R., & Austoker, J. (2007). Synthesising quantitative and qualitative research in evidence-based patient information. *Journal of Epidemiology and Community Health*, *61*(3), 262. https://doi.org/10.1136/jech.2006.046110

Government of Western Australia. (2019). *School dental service*. Retrieved 1 March from https://www.dental.wa.gov.au/dental-services/school-dental-service

Greenberg, B. L., Glick, M., & Tavares, M. (2017). Addressing obesity in the dental setting: What can be learned from oral health care professionals' efforts to screen for medical conditions. *Journal of Public Health Dentistry*, *77 Suppl 1*, S67-s78. https://doi.org/10.1111/jphd.12223

Grimshaw, J. M., & Russell, I. T. (1993). Effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations. *Lancet*, *342*(8883), 1317-1322. https://doi.org/https://doi.org/10.1016/0140-6736(93)92244-N

Grol, R. (2001). Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Medical Care*, *39*(8 Suppl 2), Ii46-54.

Guo, J. D., Vann Jr, W. F., Lee, J. Y., Roberts, M. W., & Vann, W. F., Jr. (2018). Identification of Preferred Healthy Weight Counseling Approaches for Children in the Dental Setting. *Journal of Clinical Pediatric Dentistry*, *42*(6), 414-421. https://doi.org/10.17796/1053-4625-42.6.2

Gurav, A. N. (2012). Periodontitis and Insulin Resistance: Casual or Causal Relationship? *Diabetes & Metabolism Journal*, *36*(6), 404-411. https://doi.org/10.4093/dmj.2012.36.6.404

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1995). *Multivariate data analysis with readings* (4th ed.). Prentice-Hall, Inc.

Hamilton, A. B., & Mittman, B. S. (2017). 385Implementation Science in Health Care. In *Dissemination and Implementation Research in Health: Translating Science to Practice* (pp. 0). Oxford University Press. https://doi.org/10.1093/oso/9780190683214.003.0023

Hayden, C., Bowler, J. O., Chambers, S., Freeman, R., Humphris, G., Richards, D., & Cecil, J. E. (2013). Obesity and dental caries in children: a systematic review and meta-

analysis. *Community Dent Oral Epidemiol*, *41*(4), 289-308. https://doi.org/10.1111/cdoe.12014

Hennessy, J. L., & Hughes, F. (2014). Appreciative inquiry: a research tool for mental health services. *Journal of Psychosocial Nursing and Mental Health Services*, *52*(6), 34-40; quiz 58-39. https://doi.org/10.3928/02793695-20140127-02

Howieson, J. (2011). A Constructive Inquiry Approach: Blending Appreciative Inquiry with Traditional Research and Evaluation Methods. *Evaluation Journal of Australasia*, *11*(2), 14-23. https://doi.org/10.1177/1035719X1101100203

Hsieh, H.-F., & Shannon, S. E. (2005). Three Approaches to Qualitative Content Analysis. *Qualitative Health Research*, *15*(9), 1277-1288. https://doi.org/10.1177/1049732305276687

Hung, L., Phinney, A., Chaudhury, H., Rodney, P., Tabamo, J., & Bohl, D. (2018). Appreciative Inquiry: Bridging Research and Practice in a Hospital Setting. *International Journal of Qualitative Methods*, *17*(1), 1609406918769444. https://doi.org/10.1177/1609406918769444

IBM Corp. (2020). *IBM SPSS Statistics for Windows*. In (Version 27.0) IBM Corp.

Institute of Medicine (US) Committee to Advise the Public Health Service on Clinical Practice Guidelines. (1990). *Clinical Practice Guidelines: Directions for a New Program* (M. J. Field & K. N. Lohr, Eds.). National Academies Press (US). https://doi.org/10.17226/1626

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, *33*(7), 14-26. https://doi.org/10.3102/0013189X033007014

Kaminski, J. (2011). Diffusion of innovation theory. *Canadian Journal of Nursing Informatics*, *6*(2), 1-6.

Katz, J., & Bimstein, E. (2011). Pediatric obesity and periodontal disease: a systematic review of the literature. *Quintessence International*, *42*(7), 595-599.

Keller, A., Rohde, J. F., Raymond, K., & Heitmann, B. L. (2015). Association between periodontal disease and overweight and obesity: a systematic review. *Journal of Periodontology*, *86*(6), 766-776. https://doi.org/10.1902/jop.2015.140589

Khan, K. S., Kunz, R., Kleijnen, J., & Antes, G. (2003). Five steps to conducting a systematic review. *Journal of the Royal Society of Medicine*, *96*(3), 118-121. https://doi.org/10.1177/014107680309600304

Kitson, A., Harvey, G., & McCormack, B. (1998). Enabling the implementation of evidence based practice: a conceptual framework. *Quality in Health Care*, *7*(3), 149-158. https://doi.org/10.1136/qshc.7.3.149

Klein, K. J., & Sorra, J. S. (1996). The Challenge of Innovation Implementation. *The Academy of Management Review*, *21*(4), 1055-1080. https://doi.org/10.2307/259164

Knibbs, K., Underwood, J., MacDonald, M., Schoenfeld, B., Lavoie-Tremblay, M., Crea-Arsenio, M., . . . Ehrlich, A. (2010). Appreciative inquiry: a strength-based research

approach to building Canadian public health nursing capacity. *Journal of Research in Nursing*, *17*(5), 484-494. https://doi.org/10.1177/1744987110387472

Kumar, R. (2005). *Research methodology: A step-by-step guide for beginners* (2nd ed.). Pearson Longman.

Lamster, I. B., & Eaves, K. (2011). A model for dental practice in the 21st century. *American Journal of Public Health*, *101*(10), 1825-1830. https://doi.org/10.2105/AJPH.2011.300234

Large, J. F., O'Keefe, E., Valentine, C., & Roebuck, E. M. (2022). Weight screening in paediatric dentistry: What do families and staff think? *International Journal of Paediatric Dentistry*, *32*, 64-66. https://doi.org/10.1111/ipd.12909

Leinonen, S., & Vehkalahti, M. M. (2021). Compliance with key practices of root canal treatment varies by the reward system applied in public dental services. *Journal of Endodontics*, *31*. https://doi.org/10.1016/j.joen.2021.07.018

Lewis, C. C., Fischer, S., Weiner, B. J., Stanick, C., Kim, M., & Martinez, R. G. (2015). Outcomes for implementation science: an enhanced systematic review of instruments using evidence-based rating criteria. *Implementation Science*, *10*(1), 155. https://doi.org/10.1186/s13012-015-0342-x

Luz, S., Drach-Zahavy, A., & Shadmi, E. (2021). A personal network approach to the study of nurse champions of innovation and their innovation projects' spread. *Journal of Advanced Nursing*, *77*(2), 775-786. https://doi.org/https://doi.org/10.1111/jan.14620

Lynn, R. M. (1986). Determination and quantification of content validity. *Nursing Research*, *35*(6), 382-386.

Lytle, L. A. (2009). Examining the Etiology of Childhood Obesity: The IDEA Study. *American Journal of Community Psychology*, *44*(3-4), 338-349. https://doi.org/10.1007/s10464-009-9269-1

Mannion, R., & Davies, H. (2018). Understanding organisational culture for healthcare quality improvement. *British Medical Journal*, *363*, k4907. https://doi.org/10.1136/bmj.k4907

May, C. R., Mair, F., Finch, T., MacFarlane, A., Dowrick, C., Treweek, S., . . . Montori, V. M. (2009). Development of a theory of implementation and integration: Normalization Process Theory. *Implementation Science*, *4*(1), 29. https://doi.org/10.1186/1748-5908-4-29

McMeniman, E., Moore, R., Yelland, M., & McClure, R. (2011). Childhood obesity: how do Australian general practitioners feel about managing this growing health problem? [Article]. *Australian Journal of Primary Health*, *17*(1), 60-65. https://doi.org/10.1071/PY10041

Miech, E. J., Rattray, N. A., Flanagan, M. E., Damschroder, L., Schmid, A. A., & Damush, T. M. (2018). Inside help: An integrative review of champions in healthcare-related implementation. *SAGE Open Medicine*, *6*, 2050312118773261. https://doi.org/10.1177/2050312118773261

Mihrshahi, S., & Baur, L. A. (2018). What exposures in early life are risk factors for childhood obesity? *Journal of Paediatrics and Child Health*, *54*(12), 1294-1298. https://doi.org/10.1111/jpc.14195

Morgan, D. L. (2007). Paradigms Lost and Pragmatism Regained: Methodological Implications of Combining Qualitative and Quantitative Methods. *Journal of Mixed Methods Research*, *1*(1), 48-76. https://doi.org/10.1177/2345678906292462

National Health and Medical Research Council. (2007). *Australian Code for the Responsible Conduct of Research: Revision of the Joint NHMRC/AVCC Statement and Guidelines on Research Practice*. National Health and Medical Research Council.

National Health and Medical Research Council. (2013). *Clinical practice guidelines for the management of overweight and obesity in adults, adolescents and children in Australia*. N. H. a. M. R. Council.

Nembhard, I. M., & Edmondson, A. C. (2011). Making It Safe: The Effects of Leader Inclusiveness and Professional Status on Psychological Safety and Improvement Efforts in Health Care Teams. In C. Kanes (Ed.), *Elaborating Professionalism: Studies in Practice and Theory* (pp. 77-105). Springer Netherlands. https://doi.org/10.1007/978-90-481-2605-7_5

New South Wales Government. (2022). *Health professional and medical salaries (state) award 2022*. Industrial relations commission of New South Wales. https://www.health.nsw.gov.au/careers/conditions/Awards/he-profmed-salaries.pdf

Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., . . . Pedroza, A. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*, *384*(9945), 766-781. https://doi.org/10.1016/S0140-6736(14)60460-8

Noy, C. (2008). Sampling knowledge: The hermeneutics of snowball sampling in qualitative research. *International Journal of social research methodology*, *11*(4), 327-344. https://doi.org/10.1080/13645570701401305

NSW Ministry of Health. (2016). *Premier's priority: reduce overweight and obesity rates of children by 5% over 10 years*. Retrieved from http://www.health.nsw.gov.au/heal/Publications/Premiers-priority-childhood-obesity-delivery-plan.pdf

NSW Ministry of Health. (2018a). *About Go4Fun*. Retrieved 9 October from https://go4fun.com.au/about/

NSW Ministry of Health. (2018b). *Health professional and medical salaries (state) award 2018*. Retrieved 11th May from https://www.health.nsw.gov.au/careers/conditions/Awards/he-profmed-salaries.pdf

NSW Ministry of Health. (2018c). *Tackling childhood obesity*. Retrieved 5 February from https://www.nsw.gov.au/improving-nsw/premiers-priorities/tackling-childhood-obesity/

NSW Ministry of Health. (2019). *Growth assessment and dietary advice in public oral health services* Retrieved 15 March from https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/GL2019_001.pdf

Nyumba, T. O., Wilson, K., Derrick, C. J., & Mukherjee, N. (2018). The use of focus group discussion methodology: insights from two decades of application in conservation. *Methods in Ecology and Evolution*, *9*(1), 20-32. https://doi.org/10.1111/2041-210x.12860

O'Shea, B., Ladewig, E. L., Kelly, A., Reulbach, U., & O'Dowd, T. (2014). Weighing children; parents agree, but GPs conflicted. *Archives of Disease in Childhood*, *99*(6), 543-545. https://doi.org/http://dx.doi.org/10.1136/archdischild-2013-304090

Ormerod, R. (2006). The History and Ideas of Pragmatism. *The Journal of the Operational Research Society*, *57*(8), 892-909.

Oxman, A. D., Thomson, M. A., Davis, D. A., & Haynes, R. B. (1995). No magic bullets: a systematic review of 102 trials of interventions to improve professional practice. *Canadian Medical Association Journal*, *153*(10), 1423-1431.

Perman, J. A. (2011). Teaming up against childhood obesity. *Bariatric Nursing and Surgical Patient Care*, *6*(3), 109-110. https://doi.org/http://dx.doi.org/10.1089/bar.2011.9961

Powell, B. J., Beidas, R. S., Lewis, C. C., Aarons, G. A., McMillen, J. C., Proctor, E. K., & Mandell, D. S. (2017). Methods to Improve the Selection and Tailoring of Implementation Strategies. *The Journal of Behavioral Health Services & Research*, *44*(2), 177-194. https://doi.org/10.1007/s11414-015-9475-6

Powell, B. J., Fernandez, M. E., Williams, N. J., Aarons, G. A., Beidas, R. S., Lewis, C. C., . . . Weiner, B. J. (2019). Enhancing the Impact of Implementation Strategies in Healthcare: A Research Agenda [Perspective]. *Frontiers in Public Health*, *7*. https://doi.org/10.3389/fpubh.2019.00003

Productivity Commission. (2017). *Introducing competition and informed user choice into human services: reforms to human services*. (Report No. 85). Canberra: Commonwealth of Australia

Puhl, R. M., & Heuer, C. A. (2010). Obesity stigma: important considerations for public health. *American Journal of Public Health*, *100*(6), 1019-1028. https://doi.org/10.2105/ajph.2009.159491

Queensland Government. (2014). *Child and adolescent oral health services*. Retrieved 1 March from https://www.health.qld.gov.au/oralhealth/services/school

Rankin, J., Matthews, L., Cobley, S., Han, A., Sanders, R., Wiltshire, H. D., & Baker, J. S. (2016). Psychological consequences of childhood obesity: psychiatric comorbidity and prevention. *Adolescent Health, Medicine and Therapeutics*, *7*, 125-146. https://doi.org/10.2147/ahmt.s101631

Sanghavi, A., & Siddiqui, N. J. (2017). Advancing oral health policy and advocacy to prevent childhood obesity and reduce children's consumption of sugar-sweetened beverages. *Journal of Public Health Dentistry*, *77 Suppl 1*, S88-S95. https://doi.org/10.1111/jphd.12235

Santos, J., & Reynaldo, A. (1999). Cronbach's alpha: A tool for assessing the reliability of scales. *Journal of Extension*, *37*(2), 1-5.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, *22*(2), 63-75. https://doi.org/10.3233/EFI-2004-22201

South Western Sydney Local Health District. (2017). *Growing healthy kids in South West Sydney: SWSLHD childhood overweight and obesity prevention and management action plan 2017-2025*. Retrieved 2 July from https://www.swslhd.health.nsw.gov.au/pdfs/SWSLHD_Plan_Brochure.pdf

Stratton, S. J. (2019). Quasi-Experimental Design (Pre-Test and Post-Test Studies) in Prehospital and Disaster Research. *Prehospital and Disaster Medicine*, *34*(6), 573-574. https://doi.org/10.1017/S1049023X19005053

Sweet, L., & Davis, D. (2020). An Overview of Research Theory, Process and Design. *Nursing and Midwifery Research: Methods and Appraisal for Evidence Based Practice*, 13.

Teddlie, C., & Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of Mixed Methods Research*, *1*(1), 77-100. https://doi.org/10.1177/1558689806292430

The Joanna Briggs Institute. (2017a). *The Joanna Briggs Institute critical appraisal tools for use in JBI systematic reviews: checklist for quasi-experimental studies (non-randomized experimental studies)*. Retrieved 13 February from http://joannabriggs.org/assets/docs/critical-appraisal-tools/JBI_Quasi-Experimental_Appraisal_Tool2017.pdf

The Joanna Briggs Institute. (2017b). *The Joanna Briggs Institute critical appraisal tools for use in JBI systematic reviews: checklist for randomized controlled trials*. Retrieved 13 February from http://joannabriggs.org/assets/docs/critical-appraisal-tools/JBI_RCTs_Appraisal_tool2017.pdf

The National Health Service. (2022). *Roles in the dental team*. NHS. Retrieved 16 November from https://www.healthcareers.nhs.uk/explore-roles/dental-team/roles-dental-team

Thomas, K. M. M. D., & Urrego, F. M. D. (2017). Are Pediatricians Diagnosing Obese Children? *The Ochsner Journal*, *17*(1), 80-82.

Torgerson, D. J., & Torgerson, C. J. (2008). The Limitations of Before and After Designs. In D. J. Torgerson & C. J. Torgerson (Eds.), *Designing Randomised Trials in Health, Education and the Social Sciences: An Introduction* (pp. 9-16). Palgrave Macmillan UK. https://doi.org/10.1057/9780230583993_2

Trajkovski, S., Schmied, V., Vickers, M., & Jackson, D. (2013). Using appreciative inquiry to transform health care. *Contemp Nurse*, *45*(1), 95-100. https://doi.org/10.5172/conu.2013.45.1.95

Tseng, R., Vann, W. F., Jr., & Perrin, E. M. (2010). Addressing childhood overweight and obesity in the dental office: rationale and practical guidelines. *Pediatric Dentistry*, *32*(5), 417-423.

Victoria State Government. (2018). *Access to Victoria's public dental care services*. Retrieved 1 March from https://www2.health.vic.gov.au/primary-and-community-health/dental-health/access-public-dental-services

Villarosa, A. R., George, D., Ramjan, L., Srinivas, R., & George, A. (2018). The role of dental practitioners in addressing childhood overweight and obesity: a scoping review of current interventions and strategies. *Obesity Research and Clinical Practice*, *12*(5), 405-415. https://doi.org/https://doi.org/10.1016/j.orcp.2018.07.002

Villarosa, A. R., Maneze, D., Ramjan, L. M., Kong, A., & George, A. (2022). The codesign of implementation strategies for children's growth assessment guidelines in the dental setting. *Research Involvement and Engagement*, *8*(1), 19. https://doi.org/10.1186/s40900-022-00356-8

Villarosa, A. R., Maneze, D., Ramjan, L. M., Srinivas, R., Camilleri, M., & George, A. (2019). The effectiveness of guideline implementation strategies in the dental setting: a systematic review. *Implementation Science*, *14*(1), 106. https://doi.org/10.1186/s13012-019-0954-7

Villarosa, A. R., Ramjan, L. M., Maneze, D., & George, A. (2021). Conducting population health research during the COVID-19 pandemic: impacts and recommendations. *Sustainability*, *13*(6), 3320. https://doi.org/10.3390/su13063320

Warrilow, L., Smart, L., & McDonald, S. (2022). 716 Getting our teeth stuck into obesity – The dentists role in weight management. *Archives of Disease in Childhood*, *107*(Suppl 2), A450-A451. http://dx.doi.org/10.1136/archdischild-2022-rcpch.731

Weiner, B. J., Lewis, C. C., Stanick, C., Powell, B. J., Dorsey, C. N., Clary, A. S., . . . Halko, H. (2017). Psychometric assessment of three newly developed implementation outcome measures. *Implementation Science*, *12*(1), 108. https://doi.org/10.1186/s13012-017-0635-3

Williams, N. J., Frank, H. E., Frederick, L., Beidas, R. S., Mandell, D. S., Aarons, G. A., . . . Locke, J. (2019). Organizational culture and climate profiles: relationships with fidelity to three evidence-based practices for autism in elementary schools. *Implementation Science*, *14*(1), 15. https://doi.org/10.1186/s13012-019-0863-9

Woolf, S. H. (1993). Practice guidelines: A new reality in medicine: iii. impact on patient care. *Archives of Internal Medicine*, *153*(23), 2646-2655. https://doi.org/10.1001/archinte.1993.00410230060008

Woolf, S. H., Grol, R., Hutchinson, A., Eccles, M., & Grimshaw, J. (1999). Potential benefits, limitations, and harms of clinical guidelines. *British Medical Journal*, *318*(7182), 527-530. https://doi.org/10.1136/bmj.318.7182.527

World Health Organisation. (2012). *Population-based approaches to childhood obesity prevention*. W. D. P. Services.

World Health Organisation. (2020). *Noncommunicable diseases: childhood overweight and obesity*. Retrieved 16 October from https://www.who.int/news-room/questions-and-answers/item/noncommunicable-diseases-childhood-overweight-and-obesity

Wright, R., & Casamassimo, P. S. (2017). Assessing attitudes and actions of pediatric dentists toward childhood obesity and sugar-sweetened beverages. *Journal of Public Health Dentistry*, *77 Suppl 1*, S79-S87. https://doi.org/10.1111/jphd.12240

Yvonne Feilzer, M. (2009). Doing Mixed Methods Research Pragmatically: Implications for the Rediscovery of Pragmatism as a Research Paradigm. *Journal of Mixed Methods Research*, *4*(1), 6-16. https://doi.org/10.1177/1558689809349691

List of Appendices

Consent for Thesis Paper 1

Villarosa, A. R., George, D., Ramjan, L. M., Srinivas, R., & George, A. (2018). The role of dental practitioners in addressing overweight and obesity among children: A scoping review of current interventions and strategies. Obesity Research & Clinical Practice, 12(5), 405-415. https://doi.org/https://doi.org/10.1016/j.orcp.2018.07.002

By signing below, you consent to the inclusion of this paper in the thesis of Amy R Villarosa and confirm your contributions.

Author	**Contributions**	**Signature**	**Date**
Amy R Villarosa	Study conception/design, literature searches, data extraction/synthesis, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
David George	Literature searches, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval		11 Dec 2021
Lucie Ramjan	Data extraction/synthesis, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
Ravi Srinivas	Critical revision of the manuscript for important intellectual content, manuscript approval		8 Nov 2022
Ajesh George	Study conception/design, data extraction/synthesis, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022

Consent for Thesis Paper 2

Villarosa, A. R., Ramjan, L. M., Maneze, D., & George, A. (2021). Conducting Population Health Research during the COVID-19 Pandemic: Impacts and Recommendations. Sustainability, 13(6).

By signing below, you consent to the inclusion of this paper in the thesis of Amy R Villarosa and confirm your contributions.

Author	Contributions	Signature	Date
Amy R Villarosa	Study conception/design, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
Della Maneze	Critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
Lucie Ramjan	Critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
Ajesh George	Study conception/design, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022

Consent for Thesis Paper 3

Villarosa, A. R., Maneze, D., Ramjan, L. M., Srinivas, R., Camilleri, M., & George, A. (2019). The effectiveness of guideline implementation strategies in the dental setting: a systematic review. Implementation Science, 14(1), 106. https://doi.org/10.1186/s13012-019-0954-7

By signing below, you consent to the inclusion of this paper in the thesis of Amy R Villarosa and confirm your contributions.

Author	Contributions	Signature	Date
Amy R Villarosa	Study conception/design, literature searches, data extraction/synthesis, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
Della Maneze	Data extraction/synthesis, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
Lucie Ramjan	Data extraction/synthesis, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
Ravi Srinivas	Critical revision of the manuscript for important intellectual content, manuscript approval		8 Nov 2022
Michelle Camilleri	Critical revision of the manuscript for important intellectual content, manuscript approval		31 Oct 2022
Ajesh George	Study conception/design, data extraction/synthesis, critical revision of manuscript for important intellectual content, manuscript approval		27 Nov 2022

Consent for Thesis Paper 4

Villarosa, A. R., Maneze, D., Ramjan, L. M., Kong, A., & George, A. (2022). The codesign of implementation strategies for children's growth assessment guidelines in the dental setting. Research Involvement and Engagement, 8(1), 19. https://doi.org/10.1186/s40900-022-00356-8

By signing below, you consent to the inclusion of this paper in the thesis of Amy R Villarosa and confirm your contributions.

Author	Contributions	Signature	Date
Amy R Villarosa	Study conception/design, data collection, data analysis, interpretation and discussion, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
Della Maneze	Study conception/design, data collection, data analysis, interpretation and discussion, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
Lucie Ramjan	Study conception/design, data collection, data analysis, interpretation and discussion, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022
Ariana Kong	Data analysis, interpretation and discussion, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022

Ajesh George	Study conception/design, data collection, data analysis, interpretation and discussion, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022

Consent for Thesis Paper 5

Villarosa, A. R., Maneze, D., Salamonson, Y., Ramjan, L. M., & George, A. (2022). Development and psychometric testing of the intention to engage in children's healthy weight (iCHeW) guideline scale for dental staff. Obesity Research & Clinical Practice, 16(4), 337-342. https://doi.org/https://doi.org/10.1016/j.orcp.2022.06.006

By signing below, you consent to the inclusion of this paper in the thesis of Amy R Villarosa and confirm your contributions.

Author	**Contributions**	**Signature**	**Date**
Amy R Villarosa	Study conception/design, data collection, data analysis, interpretation and discussion, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval	[redacted]	27 Nov 2022
Della Maneze	Study conception/design, data collection, data analysis, interpretation and discussion, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval	[redacted]	27 Nov 2022
Lucie Ramjan	Study conception/design, data collection, data analysis, interpretation and discussion, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval	[redacted]	27 Nov 2022
Yenna Salamonson	Data analysis, interpretation and discussion, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval	[redacted]	26 Nov 2022

Ajesh George	Study conception/design, data collection, data analysis, interpretation and discussion, manuscript preparation, critical revision of the manuscript for important intellectual content, manuscript approval		27 Nov 2022

Appendix 2: Data extraction tool for systematic review (Paper 3)

First Author/ Year/ Country	Aims	Study Design	Study Population	Intervention(s)	Comparison	Outcome	Critical Appraisal

From: Andrea Lee (South Western Sydney LHD) on behalf of SWSLHD-Ethics
To: Amy Villarosa
Cc: SWSLHD-Ethics
Subject: UPDATED: 2019/ETH12668: Application HREA - Approved
Date: Wednesday, 8 January 2020 10:46:35 AM

Date of Decision Notification: 08 Nov 2019 (Updated 08.01.2019)

Dear Amy Villarosa,

Thank you for submitting the following Human Research Ethics Application (HREA) for HREC review;

2019/ETH12668: Children's Healthy Eating and Weight guideline Implementation in the dental setting: The CHEWI project

This project was considered by the South Western Sydney Local Health District Human Research Ethics Committee at its meeting held on 8/11/2019 and was determined to meet the requirements of the National Statement on Ethical Conduct in Human Research (2007).

This project has been Approved to be conducted at the following sites:

- Nepean Hospital
- Lithgow Integrated Health Service
- Blue Mountains District ANZAC Memorial Hospital
- Nepean Blue Mountains Local Health District (Community Health)
- South Western Sydney Local Health District (Site)

The following documentation was reviewed and is included in this approval:

- Project Registration
- Human Research Ethics Application, Version 3.0, 21.10.2019
- Protocol, Version 2.0, 01.10.2019
- MASTER DOHT Flyer - Focus Group, Version 1.2, 22.08.2019
- MASTER Flyer – Parent Focus Group, Version 1.2, 22.08.2019
- MASTER DOHT Pre/Post Survey Flyer, Version 1.2, 22.08.2019
- MASTER DOHT Pre Survey Online Flyer, Version 1.0, 04.08.2019
- MASTER Participant Information Sheet - Focus Group, Version 1.3, 22.08.2019
- MASTER Participant Information Sheet – Parent Focus Group, Version 1.2, 22.08.2019
- MASTER Participant Information Sheet – Reference Group, Version 1.2, 22.08.2019
- MASTER Participant Information Sheet – Expert Panel, Version 1.2, 22.08.2019
- MASTER Participant Information Sheet – Pre Survey Face to Face, Version 1.2, 22.08.2019
- MASTER Participant Information Sheet – Pre Survey Online, Version 1.2, 22.08.2019
- MASTER Participant Information Sheet – Post Survey, Version 1.2, 22.08.2019
- MASTER Consent Form - Focus Group, Version 1.1, 09.08.2019
- MASTER Questionnaire Consent Form, Version 1.1, 09.08.2019
- MASTER Consent Form – Pre Survey, Version 1.1, 09.08.2019
- MASTER Consent Form – Post Survey, Version 1.1, 09.08.2019

- MASTER Focus Group Prompts, Version 1.2, 23.08.2019
- MASTER Pre Survey, Version 2.0, 01.10.2019
- MASTER Post Survey, Version 2.0, 01.10.2019
- MASTER Participant Demographic Form, Version 1.1, 23.08.2019
- MASTER Participant Demographic Form – Parent, Version 1.1, 23.08.2019
- MASTER Mailing List Form. Version 1.0, 09.08.2019

**Project condition: Please note that an amendment is required to be submitted to SWSLHD HREC prior to starting the phase 3 of the study. **

Application Documents - (Please note : Due to security reasons, this link will only be active for 14 days.)

The Human Research Ethics Application reviewed by the HREC was:
Version: 3
Date: 21 Oct 2019

It is noted that the South Western Sydney Local Health District Human Research Ethics Committee is constituted in accordance with the National Statement on Human Conduct in Research, 2007 (NHMRC). The approval is for a period of 5 years from the date of this e-mail (08 Nov 2019) , on condition of the submission of Annual Reports.

We wish you all the best with the project and remind you that any changes to the application and safety reports will need to be submitted and reviewed by the approving HREC prior to implementation.

This email constitutes ethical and scientific approval only.

This project cannot proceed at any site until separate research governance authorisation has been obtained from the Institution under whose auspices the research will be conducted at that site.

This HREC is constituted and operates in accordance with the National Statement on Ethical Conduct in Human Research (2007). The processes used by this HREC to review multi-centre research proposals have been certified by the National Health and Medical Research Council.

Please contact us if you would like to discuss any aspects of this process further, as per the contact details below. We look forward to managing this application with you throughout the project lifecycle.

Please note the following conditions of approval:

1. The Principal Investigator will immediately report anything which might warrant review of ethical approval of the project in the specified format, including: any serious or unexpected adverse events; and unforeseen events that might affect continued ethical acceptability of the project.

1. The Principal Investigator will report proposed changes to the research protocol, conduct of the research, or length of HREC approval to the HREC in the specified format, for review. For multi-centre studies, the Chief Investigator should submit

to the Lead HREC and then send the amendment approval letter to the investigators at each sites so that they can notify their Research Governance Officer.

1. The Principal Investigator will inform the HREC, giving reasons, if the project is discontinued before the expected date of completion.

1. The Principal Investigator will provide an annual report to the HREC and at completion of the study in the specified format.

1. The Principal Investigator must reassure participants about confidentiality of the data.

1. Proposed changes to the personnel involved in the study are submitted to the HREC accompanied by a CV where applicable.

1. The Principal Investigator is responsible for ensuring the research project is conducted in line with relevant NSW Health, South Western Sydney Local Health District and Hospital policies available from: https://www.swslhd.health.nsw.gov.au/ethics/policies.html

Should you have any queries about your project please contact Jessica Grundy on the telephone number 8738 8304. The HREC Terms of Reference, Standard Operating Procedures, membership and standard forms are available from the SWSLHD website: https://www.swslhd.health.nsw.gov.au/ethics/

Please quote the Local HREC reference 2019/ETH12668 in all correspondence. The HREC wishes you every success in your research.

Yours faithfully
Jessica Grundy
on behalf of
Professor Jeremy Wilson
Chairperson, SWSLHD Human Research Ethics Committee

This HREC is constituted and operates in accordance with the National Health and Medical Research Council's (NHMRC) National Statement on Ethical Conduct in Human Research (2007). The processes used by this HREC to review multi-centre research proposals have been certified by the National Health and Medical Research Council.

Kind regards,
Andrea Lee
Research Ethics and Governance Coordinator | Research Directorate
South Western Sydney Local Health District (SWSLHD)
Locked Bag 7103 Liverpool BC NSW 1871
Tel 02 8738 8305 | Fax 02 8738 8310 |

E-mail: SWSLHD-Ethics@health.nsw.gov.au
https://www.swslhd.health.nsw.gov.au/ethics/
Use REGIS for all Research Applications
The Research and Ethics Office is using REGIS for all Research Applications (HREA and SSA).

From:	no_reply@regis.health.nsw.gov.au
To:	Amy Villarosa
Cc:	Amy Villarosa; tanya.mahony@health.nsw.gov.au; kathleen.fitzgerald1@health.nsw.gov.au; SWSLHD-ethics@health.nsw.gov.au
Subject:	2019/ETH12668: General Amendment (33760) - Approved
Date:	Thursday, 22 October 2020 3:24:07 PM

Date of Decision Notification: 22 Oct 2020

Dear Amy Villarosa,

Thank you for submitting an Amendment for the following study;
2019/ETH12668: Children's Healthy Eating and Weight guideline Implementation in the dental setting: The CHEWI project

The Amendment has been reviewed by the South Western Sydney Local Health District Human Research Ethics Committee at its meeting who have determined the Amendment has been approved.

Amendment type: General Amendment with form ID 33760

The following documentation is included in this approval:

- Notification of an amendment to a research study, N/A, dated 17.10.2020
- Protocol - tracked and clean, Version 3.1, dated 17.10.2020
- MASTER Pre Survey - tracked and clean, Version 3., dated 11.10.2020, Site Version 2.0, dated 17.10.2020
- MASTER Post Survey - tracked and clean, Version 3.0, dated 11.10.2020, Site Version 2, dated 17.10.2020

"The following site documents listed above have been reviewed and authorised by the SWSLHD Research Directorate – Research Ethics and Governance Manager"

It is noted that the South Western Sydney Local Health District Human Research Ethics Committee is constituted in accordance with the National Statement on Human Conduct in Research, 2007 (NHMRC).

This email constitutes ethical and scientific approval only.

For NSW authorised sites (listed in REGIS): A Site General Amendment form will need to be submitted to each affected site. You are not required to upload this form or the ethics approved documents into the site form but you will need to identify this approved amendment form ID (33760).

Please contact us if you would like to discuss any aspects of this process further, as per the contact details below.

Conditions of approval:
1. The Principal Investigator will immediately report anything which might warrant review of ethical approval of the project in the specified format, including:
- any serious or unexpected adverse events; and
- unforeseen events that might affect continued ethical acceptability of the

project.
2. The Principal Investigator will report proposed changes to the research protocol, conduct of the research, or length of HREC approval to the HREC in the specified format, for review. For multi-centre studies, the Chief Investigator should submit to the Lead HREC and then send the amendment approval letter to the investigators at each sites so that they can notify their Research Governance Officer.
3. The Principal Investigator will inform the HREC, giving reasons, if the project is discontinued before the expected date of completion.
4. The Principal Investigator will provide an annual report to the HREC and at completion of the study in the specified format.
5. The Principal Investigator must reassure participants about confidentiality of the data.
6. Proposed changes to the personnel involved in the study are submitted to the HREC accompanied by a CV where applicable.

COVID 19:
Condition of approval: Please ensure that the restrictions and social distancing for COVID-19 are followed until the restrictions have been lifted

Yours Sincerely,
Tegan Roberts
On behalf of Andrea Lee
A/Research Ethics and Governance Manager
Research and Ethics Office
South Western Sydney Local Health District

Kind regards,
Tegan Roberts
A/Research Ethics and Governance Coordinator | Research Directorate
South Western Sydney Local Health District (SWSLHD)
Locked Bag 7103 Liverpool BC NSW 1871
Tel 02 8738 8305 | Fax 02 8738 8310 |
E-mail: SWSLHD-Ethics@health.nsw.gov.au
https://www.swslhd.health.nsw.gov.au/ethics/
Use REGIS for all Research Applications

From: no_reply@regis.health.nsw.gov.au
To: tanya.mahony@health.nsw.gov.au
Cc: Amy Villarosa
Subject: 2019/STE16374: SSA - Authorised
Date: Monday, 17 February 2020 3:19:20 PM
Attachments: Attachment19_CHEWI_DemographicForm_DOHT_Nepean_V1.1.docx.docx
Attachment20_CHEWI_DemographicForm_Parent_Nepean_V1.1.docx.docx
Attachment21_CHEWI_MailingListForm_Nepean_V1.docx.docx

Date of Decision Notification: 17 Feb 2020

Dear Tanya

Thank you for submitting the following Site Specific Assessment (SSA) for site governance review;

2019/STE16374: Children's Healthy Eating and Weight guideline Implementation in the dental setting: The CHEWI project

The Application has been reviewed and the Chief Executive/Delegate who has determined the application can now be authorised with a condition (see below).

It is noted that the application has been authorised for the following site:

- Nepean Hospital - Oral Health Centre

The following documentation is included in this authorisation:

- Protocol, Version 2.0, 01.10.2019
- Nepean Hospital DOHT Flyer - Focus Group, Version 1.0, 22.11.2019, based on the Master Version 1.2, 22.08.2019
- Nepean Hospital Flyer – Parent Focus Group, Version 1.0, 22.11.2019, based on the Master Version 1.2, 22.08.2019
- Nepean Hospital DOHT Pre/Post Survey Flyer, Version 1.0, 22.11.2019, based on the Master Version 1.2, 22.08.2019
- Nepean Hospital DOHT Pre Survey Online Flyer, Version 1.0, 6.1.2020 based on the Master Version 1.0, 04.08.2019
- Nepean Hospital Participant Information Sheet - Focus Group, Version 1.0. 25.11.2019, based on the Master Version 1.3, 22.08.2019
- Nepean Hospital Participant Information Sheet – Parent Focus Group, Version 1.0, 25.11.2019, based on the Master Version 1.2, 22.08.2019
- Nepean Hospital Participant Information Sheet – Reference Group, Version 1.0, 26.11.2019, based on the Master Version 1.2, 22.08.2019
- Nepean Hospital Participant Information Sheet – Expert Panel, Version 1.0, 26.11.2019, based on the Master Version 1.2, 22.08.2019
- Nepean Hospital Participant Information Sheet – Pre Survey Face to Face, Version 1.0, dated 26.11.2019, based on the Master Version 1.2, 22.08.2019
- Nepean Hospital Participant Information Sheet – Pre Survey Online, Version 1.0, dated 26.11.2019 based on the Master Version 1.2, 22.08.2019
- Nepean Hospital Participant Information Sheet – Post Survey, Version 1.0, dated 26.11.2010, based on the Master Version 1.2, 22.08.2019
- Nepean Hospital Consent Form - Focus Group, Version 1.0, 26.11.2019, based on the Master Version 1.1, 09.08.2019
- Nepean Hospital Questionnaire Consent Form, Version 1.0, 26.11.2019, based on

the Master Version 1.1, 09.08.2019
- Nepean Hospital Consent Form – Pre Survey, Version 1.0, 26.11.2019, based on the Master Version 1.1, 09.08.2019
- Nepean Hospital Consent Form – Post Survey, Version 1.0, dated 26.11.2019, based on the Master Version 1.1, 09.08.2019
- Nepean Hospital Focus Group Prompts, Version 1.0, dated 26.11.2019, based on the Master Version 1.2, 23.08.2019
- Nepean Hospital Pre Survey, Version 1.0, dated 26.11.2019 based on the Master Version 2.0, 01.10.2019
- Nepean Hospital Post Survey, Version 1.0, 26.11.2019, based on the Master Version 2.0, 01.10.2019
- Nepean Hospital Participant Demographic Form, Version 1.0, 26.11.2019 based on the Master Version 1.1, 23.08.2019 (Amended document attached, please save and use during the study)
- Nepean Hospital Participant Demographic Form – Parent, Version 1.0, dated 26.11.2019, based on the Master Version 1.1, 23.08.2019 (Amended document attached, please save and use during the study)
- Nepean Hospital Mailing List Form, Version 1.0, 26.11.2019 based on the Master Version 1.0, 09.08.2019 (Amended document attached, please save and use during the study)

The following documents were lodged to support your application and are acknowledged:

- Ethics email of approval, dated 8 November 2019 (updated 8 January 2020)
- Email of response to the NBMLHD Research Governance Office, dated 21.1.2020
- Data Management Plan

Application Documents

The Site Specific Assessment reviewed/authorised is:
Version: 2
Date: 21 Jan 2020

Condition of Approval
If any member of the study team is NOT employed by the Nepean Blue Mountains Local Health District, please contact the Research Governance Office (ph. 4734 1998) to enquire about the requirements for an external researcher prior to coming on site to undertake the research.

It is noted that the South Western Sydney Local Health District HREC approved the Human Research Ethics Application (HREA) associated with the SSA on 8 November 2019. Site authorisation with cease on the date of HREA expiry 8 November 2024.

We wish you all the best with the study and remind you that any changes to the application and safety reports may need to be submitted and reviewed by the approving HREC and outcomes provided to the Site Research Governance Officer prior to implementation.

Please contact us if you would like to discuss any aspects of this process further, as per

the contact details below.

Regards

Jody Middlemiss
Research Governance Officer
Nepean Blue Mountains Local Health District

Research Office: Level 5, South Block, Nepean Hospital
Tel 02 4734 1998 | Fax 02 4734 1967 | NBMLHD-RGO@health.nsw.gov.au

WESTERN SYDNEY
UNIVERSITY

REDI Reference: RH13667

HUMAN RESEARCH ETHICS COMMITTEE

15 January 2020

Associate Professor Ajesh George
School of Nursing and Midwifery

Dear Ajesh,

I wish to formally advise you that the Human Research Ethics Committee has noted the external HREC approval of your research titled: "Children's Healthy Eating and Weight guideline Implementation in the dental setting: The CHEWI project" under the Western Sydney University number RH13667.

Lead HREC Details
Name of HREC: HREC : South Western Sydney Local Health District Research and Ethics Office
Ref: 2019/ETH12668

Date of Western Sydney University HREC recognition: 15 January 2020

Conditions of Approval

1. Please advise Western Sydney University HREC of amendments approved by the Administering HREC.
2. Please advise Western Sydney University HREC of any serious or unexpected adverse events reported to the Administering HREC
3. As the Administering HREC has approved the protocol until 20 November 2024 the Western Sydney University record will close after that date unless we are advised that the Administering HREC has approved an extension.

Please quote the registration number and title as indicated above in the subject line on all future correspondence related to this project. All correspondence should be sent to humanethics@westernsydney.edu.au as this email address is closely monitored.

Regards

Human Ethics Officer on behalf of Western Sydney University HREC
humanethics@westernsydney.edu.au

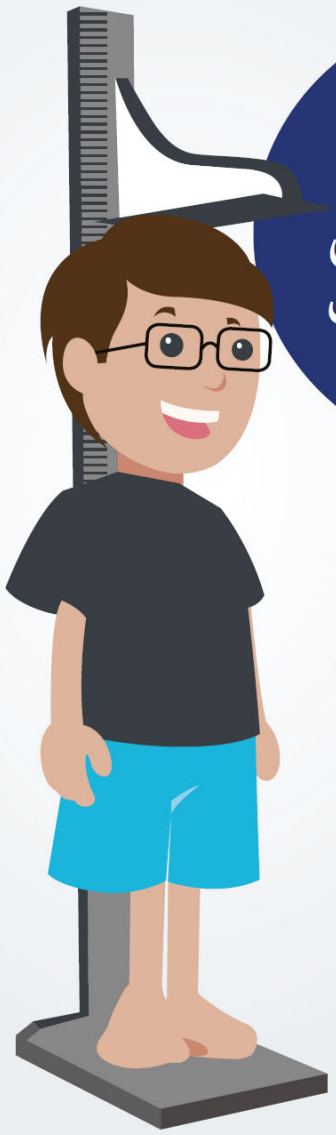
Appendix 4: All iterations of the District 1 parent information flyer


As part of your child's dental check-up, we measure height and weight
Regularly checking your child's height and weight helps health care providers act early if your child's growth is outside a healthy range
We will offer to measure all children's height and weight in non-emergency appointments. We can refer children to services for further support if needed
Scan the QR code below for more information:
NSW
Health
South Western Sydney Local Health District


As part of your child's dental check-up, we measure height and weight
Regularly checking your child's height and weight helps health care providers act early if your child's growth is outside a healthy range
We will offer to measure all children's height and weight in non-emergency appointments. We can refer children to services for further support if needed
Scan the QR code below for more information:
NSW
Health
South Western Sydney Local Health District
Date of publication: 05 April 2022

Appendix 5: Translated waiting room posters for District 1

نقيس طول جميع الأطفال وأوزانهم من ضمن تقييم صحة كل طفل



سوف يساعدك موظفو طبّ الأسنان على قياس طول طفلك ووزنه

لنصائح وإرشادات عن العادات الصحية تفقّد
makehealthynormal.nsw.gov.au

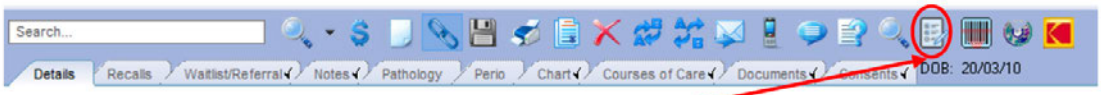
لموارد موجّهة للمختصّين الصحيين تفقّد
pro.healthykids.nsw.gov.au

NSW GOVERNMENT | healthykids for professionals

Appendix 6: Infographic for accessing growth chart history

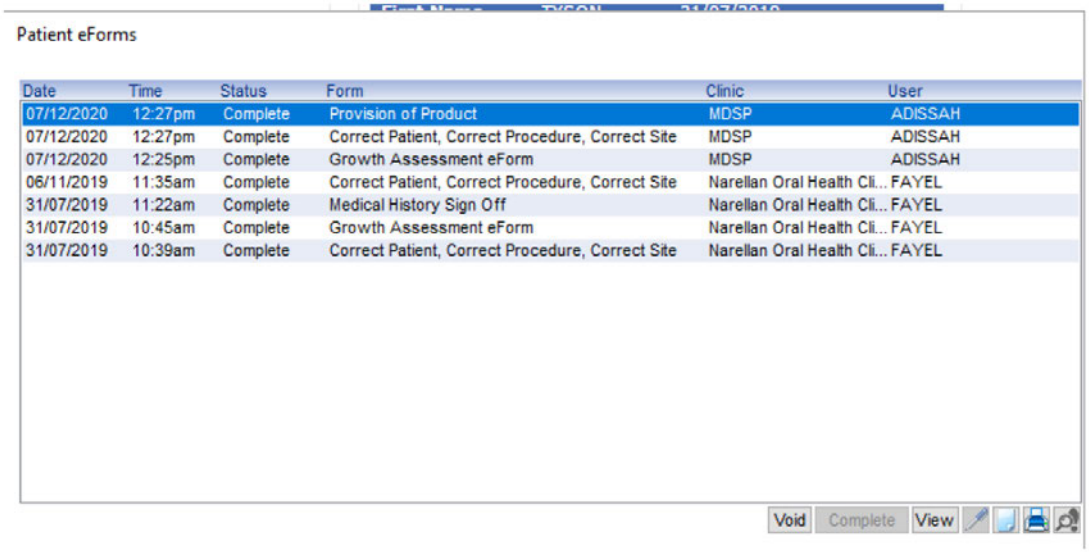
Accessing eforms in Titanium

Previously completed eforms can be accessed by



Selecting the eform icon on the toolbar

This opens the below dialogue box allowing you to select any previously completed eforms to view or print



Appendix 7: Recording of refresher training

https://youtu.be/6D42L8MCwxQ

Appendix 8: Case study for District 1

Growing Healthy Kids GHKBITES

Lessons from the weight management service **EDITION March 2022**

A Change in Tactics!

Background

A 14 year old female of Iraqi refugee background had routine growth assessment done by the local Oral Health Therapist and Refugee Health Nurse. The issue of weight was raised; she was referred to the weight management clinic. At referral her BMI was 35.2 kg/m2 (130% of the 95th percentile) consistent with severe obesity. No co-morbidities were noted at referral; blood investigations had not been done.

First Appointment

Weight gain of 15.9kg in the 8 months since referral, with BMI increasing to 40.5 kg/m2 (140-150% of the 95th percentile).

Fasting biochemistry:

- Dyslipidaemia with total cholesterol 5.9mM (normal <4.0mM); LDL 4.0mM (normal <2.5mM); TG 1.9mM (normal < 1.5mM)
- Insulin resistance: fasting insulin of 34.3mU/L (normal <10mU/L)

Intervention

What did we do?

The client received individual dietitian and exercise physiologist intervention with a focus on improving BMI, normalising insulin and lipid levels.

Dietetics: Education and counselling were provided, including a 30% energy deficit diet plan tailored to family and cultural needs.

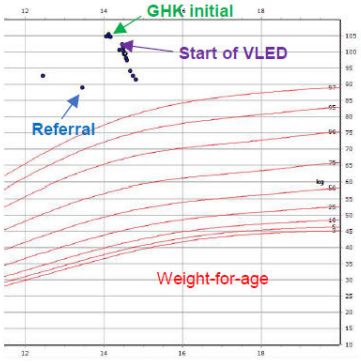
Challenges: At 8-week point of diet intervention, there was minimal weight loss and a hypocaloric diet was reported that did not reflect her weight trends.

Solution: Lack of progress was discussed. Client was happy to try an intensive diet intervention, i.e. Very Low Energy Diet (VLED) using meal replacement shakes and increasing frequency of reviews to weekly.

Exercise: Vigorous aerobic exercise was prescribed at a weekly volume of 5-6 hours through walking and jogging. Strategies have involved regular follow up, exercise progression and use of exercise tracking Apps.

Strengths: The client was highly motivated to implement lifestyle changes for weight management and attended appointments consistently with her family.

Outcome



In 3 months, fasting insulin reduced to 20.8 mU/L, despite minimal weight loss. By 9 months, the patient has lost a total of 13.4kg (13%) since the start of intervention, now 91.5kg. BMI has reduced by 5.1 kg/m2 to 35.4 kg/m2 (120% of the 95th percentile).

Changes to biochemistry:

- Improved dyslipidaemia: total cholesterol 5.9 → 3.8mM; LDL 4.0 → 3.3mM; TG 1.9 → 0.8mM
- Improved fasting insulin: reduction from 34.3 →13.2mU/L

Where To From Here?

The client is now weaning off VLED to a diet plan based on nutrient value for age in line with the Australian Guide to Healthy Eating. The client has since registered for the gym and is doing one hour of combined aerobic and resistance training daily and is keen to continue this with friends. The client is motivated to work towards her goal of 85kg; which would bring her out of the severe obesity cut-off.

Lessons Learnt

Routine screening

Health care professionals are in a prime position to assess, sensitively discuss, and refer their clients to appropriate programs.

Intensive interventions work

Intensive interventions such as a VLED is a structured, set calorie meal plan that may work better to improve compliance for clients who have lack of insight into their intake.

Exercise improves insulin

In 3 months, insulin reduced despite minimal weight loss, consistent with research showing that exercise is effective for improving insulin. In exercise, increased muscle contraction increases insulin sensitivity, resulting in improvement in insulin resistance.

Regular reviews are key

Regular reviews are required to identify and address barriers. Effectiveness of dietary intervention should be reviewed with consideration of other intervention strategies when goals are not met. Weekly physical assessments and reviews improved compliance and dietary insight.

A change in tactics works!

www.growinghealthykids.com.au
www.pro.healthykids.nsw.gov.au or contact Growing Healthy Kids directly on **4633 0251**

e: **SWSLHD-GHKWeightManagementService @ health.nsw.gov.au**

Growing Healthy Kids in South West Sydney | NSW Government Health South Western Sydney Local Health District

Appendix 9: Quality board for District 1

South Western Sydney Local Health District

Oral Health Services

Child height and weight

1 January to 31 March 2022

Performance Report

Growth assessment help health professionals to see if your child is growing as expected. Oral Health Clinics perform routine height and weight measurement to address the issue of childhood obesity.

Our clinicians discuss the outcome of the assessment with the parents and if needed, referral is made to 'Go 4 fun' and 'Get Healthy' and Growing Healthy Kids Service' programs for further management.

Oral Health Service conducts growth assessment audit 4 times a year to ensure staff are providing routine height and weight measurement for the children.

The services result of 70% compliance demonstrates good outcome of the growth assessment by the clinical staff.

We encourage you to ask our dental staff about the growth assessments when you visit our clinics with your children.

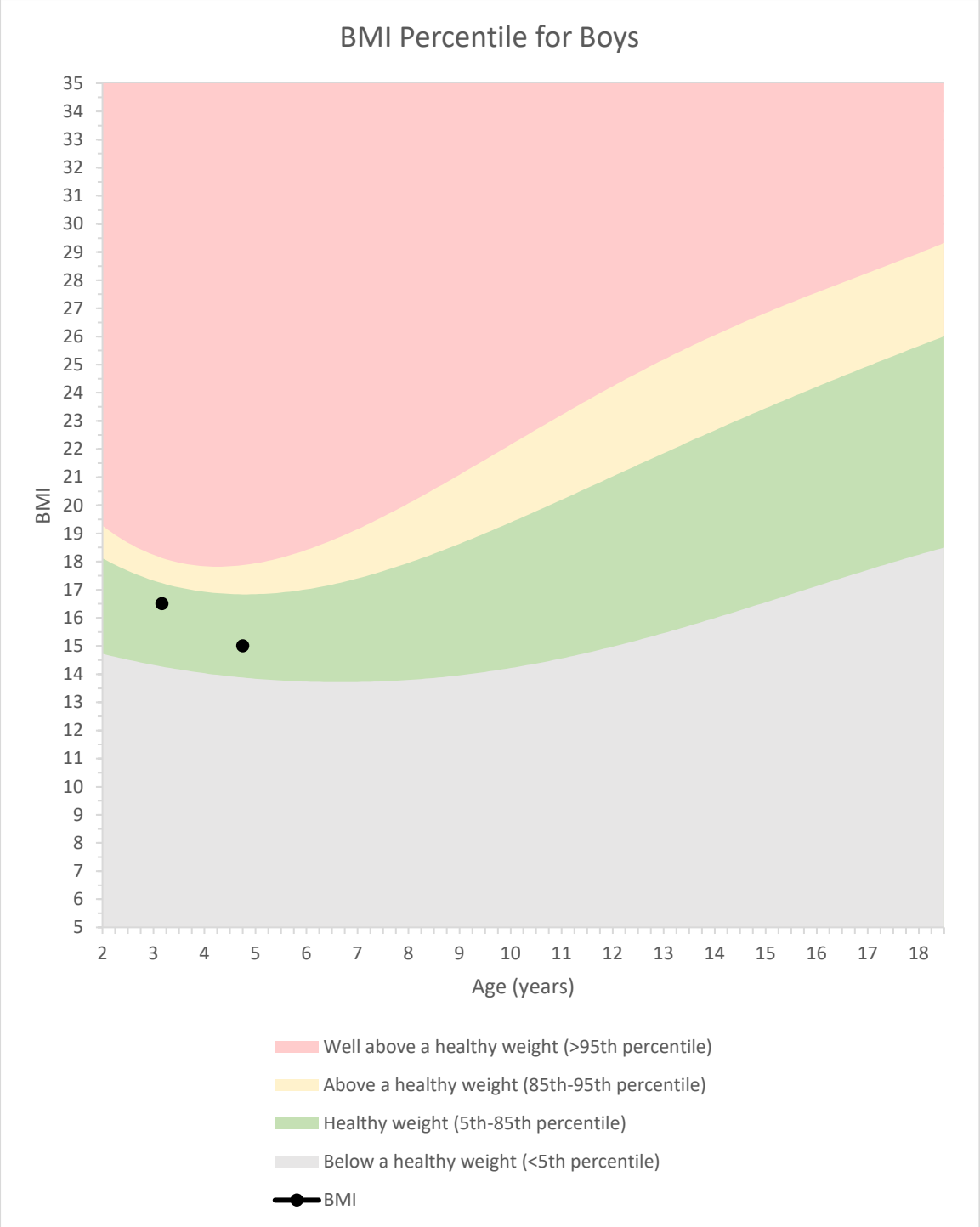
For more information visit: https://healthyliving.nsw.gov.au/

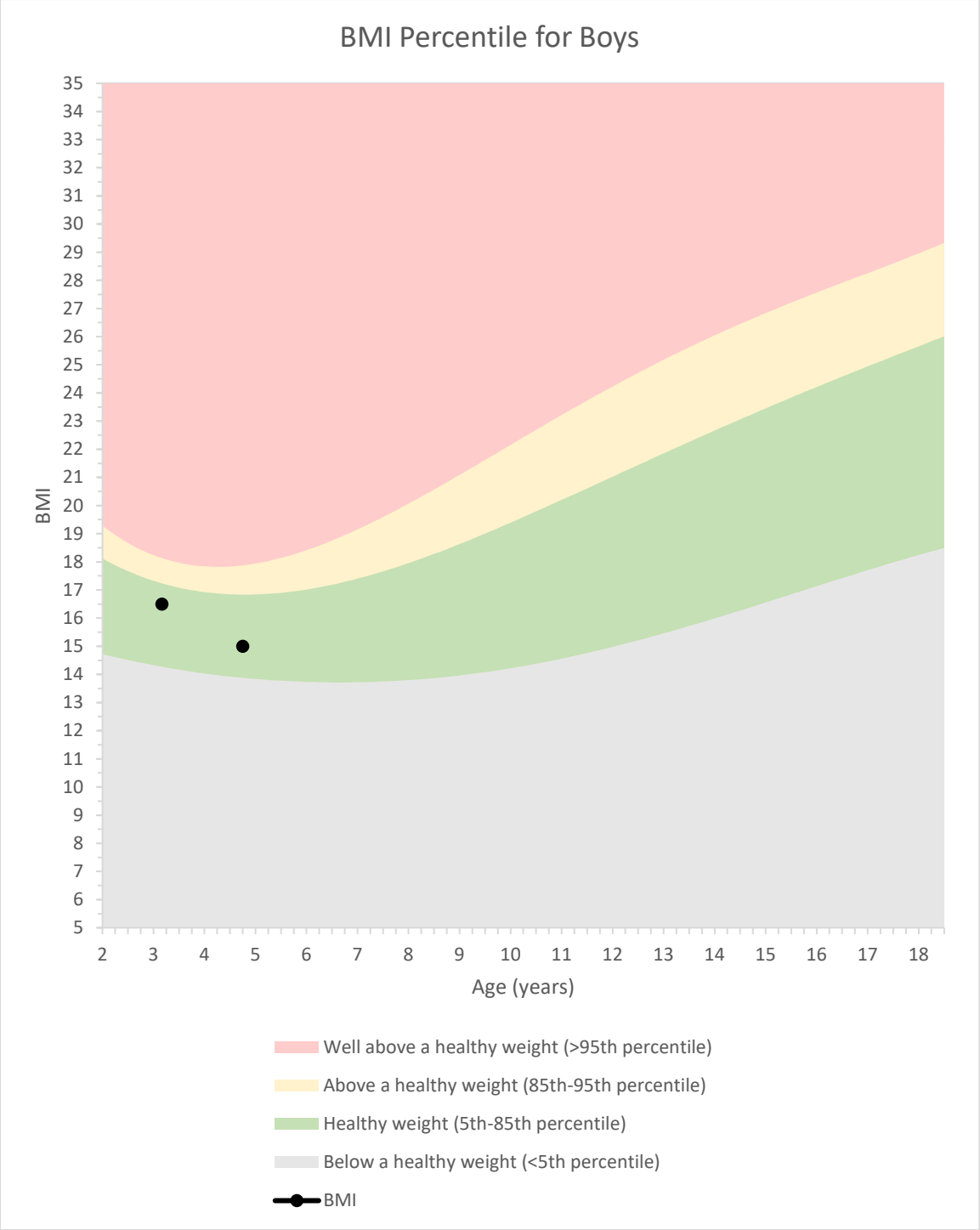
transforming your experience

NSW Health South Western Sydney Local Health District

Appendix 10: All iterations of the District 2 parent information flyer

Appendix 11: Longitudinal growth chart iterations





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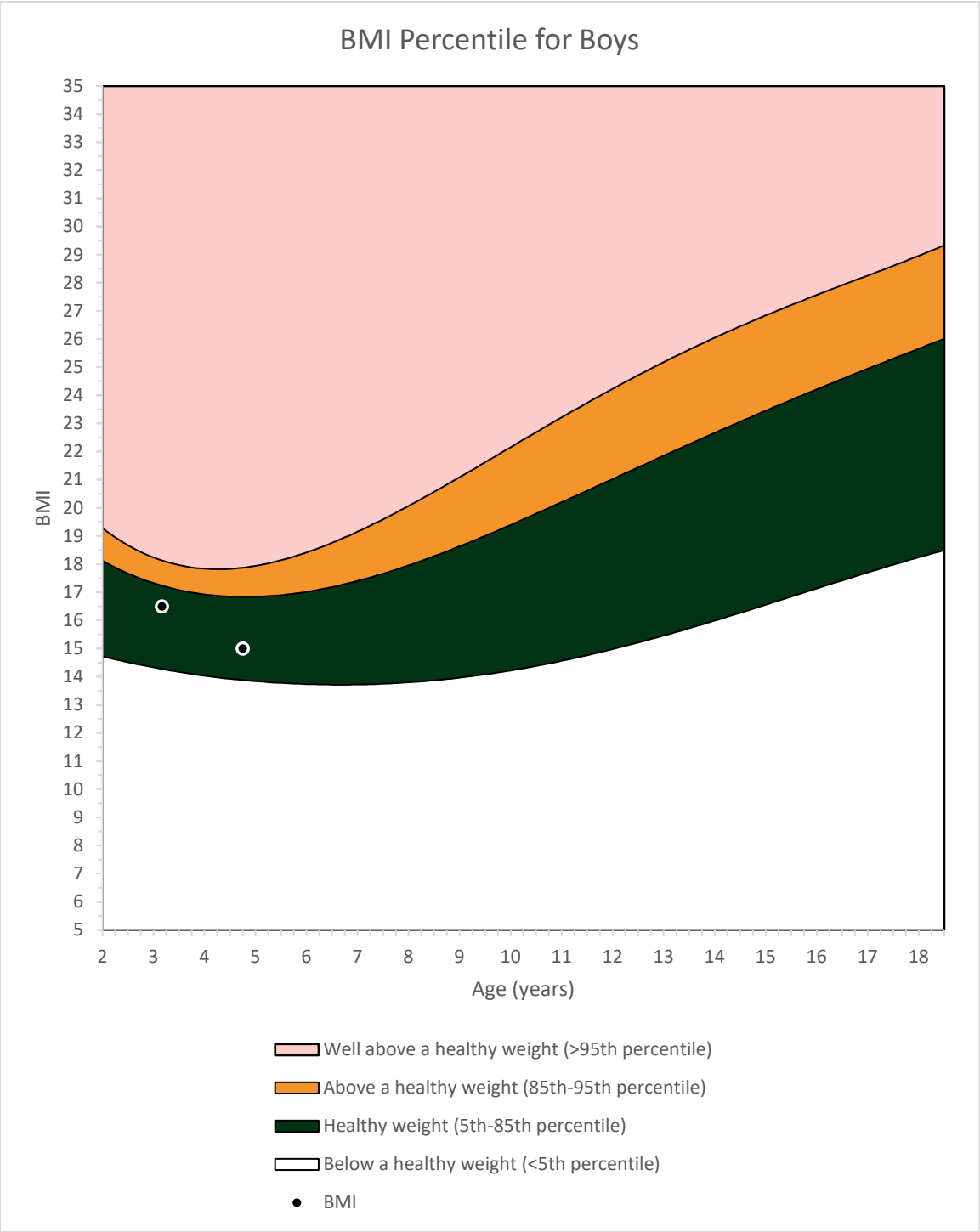

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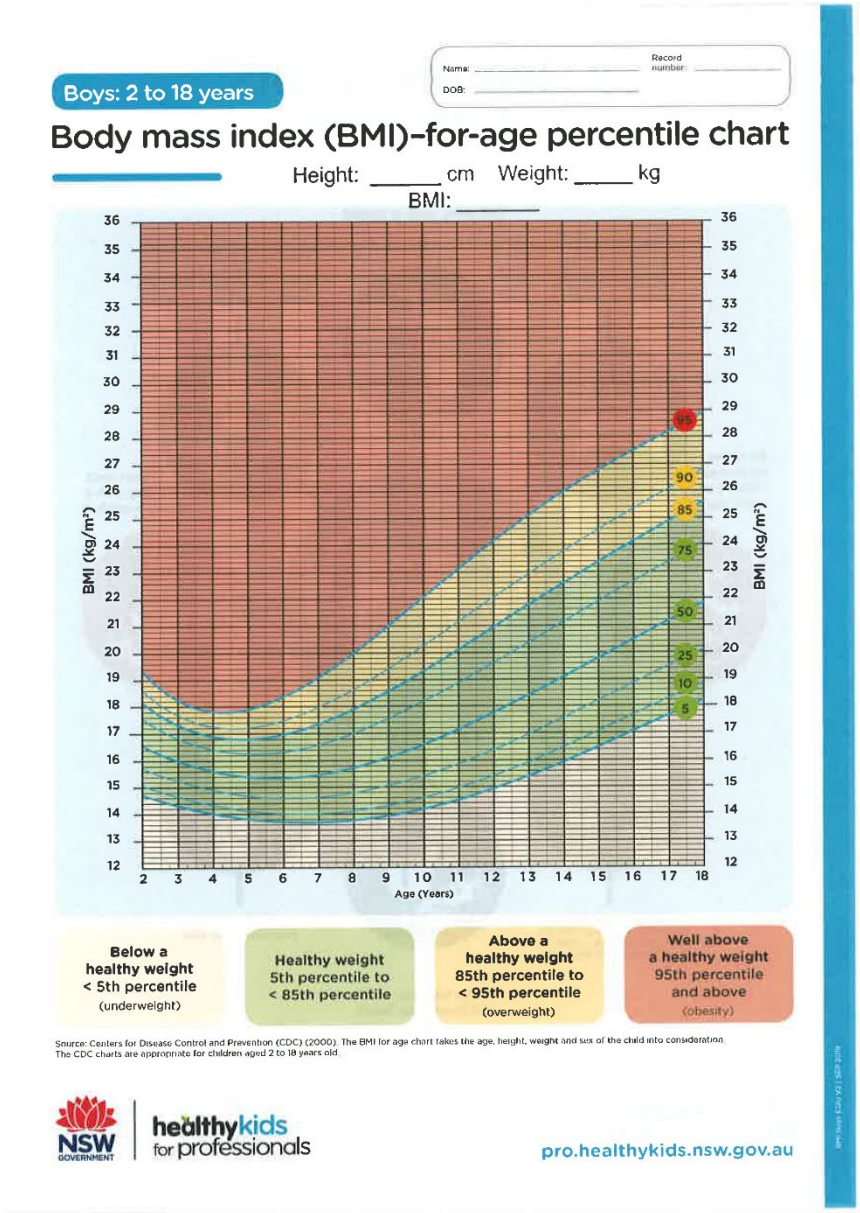
Appendix 12: Stamp for patient handouts



Appendix 13: Promotional videos used for implementation strategies

District 1

https://youtu.be/Swk87BtqMsQ

District 2

https://youtu.be/AMNZowHwJJ4

Appendix 14: Quote from District 2 champion

Transcribed quote from recorded meeting with District 2 champion on the 20th of October 2022:

"*But I will be honest, we have only done it at [central clinic]. We didn't do it at any of the satellite clinics and I just didn't think about … using it for the other clinics.*"