The process of providing preventive dental care: A grounded theory study of dentists’, dental teams’ and patients’ experiences.

Alexandra Sbaraini, BDS, MDSc

A thesis submitted in fulfilment of the requirements for the degree of DOCTOR OF PHILOSOPHY at the University of Sydney, Sydney, New South Wales, Australia.

2012
CANDIDATE’S DECLARATION

I, Alexandra Sbaraini, hereby declare that the work described in this thesis is my own. I am the principal researcher of all work contained in this thesis, including work conducted in association with my PhD supervisors. This thesis does not contain written or published materials prepared by others except where acknowledged within the text and has not been submitted to any other university or institution as a part or whole requirement for any higher degree.

I, Alexandra Sbaraini, understand that if I am awarded a higher degree for my thesis entitled “The process of providing preventive dental care: A grounded theory study of dentists’, dental teams’ and patients’ experiences” being lodged for examination, the thesis will be lodged in the University Library and be available immediately for use. I agree that the University Librarian (or in the case of a department, the Head of the Department) may supply a photocopy or microform of the thesis to an individual for research or study or to a library.

.......................................................... Date: 12/06/2012
Alexandra Sbaraini
DECLARATION re THESIS

CONTRIBUTION STATEMENT and CO-AUTHORS

The roles played by the co-authors of the papers in Chapter Two to Five were as follow:

Dr Stacy Carter was my primary supervisor and she provided intellectual input into the review of Chapters Two, Three, Four and Five.

Associate Professor Wendell Evans was an associate supervisor who provided intellectual input into the review of Chapters Two, Three, Four and Five.

Professor Anthony Blinkhorn was an associate supervisor who provided intellectual input into the review of Chapters Two, Four and Five.

The final editorial authority remained my own.

DECLARED BY:                                      DATE:

Alexandra Sbaraini                                      12/6/12

Dr Stacy M Carter                                      15/6/12

Associate Professor Wendell Evans                   12 June 2012

Professor Anthony Blinkhorn                           12. 6. 12

iii
ABSTRACT 1

Background: This study was built on a previous Australian randomized controlled trial. Intervention practices in the trial were provided with evidence-based preventive protocols to guide their treatment of dental caries. During that trial, the numbers of decayed, missing and filled teeth were monitored. Outcomes in the intervention practices varied widely; this qualitative study was designed to explain how dentists, their teams and patients adopted evidence-based preventive care in practice.

Methods: 40 participants (10 dentists, 2 hygienists, 9 dental assistants, 2 practice managers and 17 patients) were interviewed about their experience and work processes. Analysis involved transcript coding, detailed memo writing, and data interpretation.

Results: Dentists and their teams talked about a process of slowly adapting their practices towards preventive care. Dentists spoke spontaneously about two “assumptions” or “rules” underpinning continued restorative treatment.

They said that these assumptions were deeply held, and acted as a barrier to provide preventive care: 1) dentists believed that some patients were too “unreliable” to benefit from prevention; and 2) dentists believed that patients thought that only tangible restorative treatment offered “value for money”.

Dentists also described other factors that could hinder prevention: in particular, having an historical restorative background and being “focused on cutting cavities fast and well”. On the positive side, successful adaptation was possible (1) when the dentist-in-charge brought the whole dental team together – including other dentists – and got everyone interested and actively participating during preventive activities; (2) when the physical environment of the practice was re-organized around preventive activities, (3) when the dental team was able to devise new and efficient routines to accommodate preventive activities, and (4) when the fee schedule was amended to cover the delivery of preventive services, which hitherto was considered as “unproductive time”. Whether or not they were able to adapt, all dentists trusted the concrete clinical evidence that they had produced themselves, that is, seeing results in their patients mouths made them believe in a specific treatment approach.

Patients talked about their experience of dental care, particularly about the relationship between patients and dentists during the provision of preventive care and advice in general dental practices. Historical, biological, financial, psychosocial and habitual dimensions of patients’ experience of dental care and
self-care were revealed. Participants were amazed by their new experience of
dental care without “drilling and filling” teeth and characterised dentists as either
“old-school” or “new-school” based on the treatment options provided and the
clinical relationship offered.

Conclusion: Translating evidence into dental practice entailed a slow and complex
adaptation process, requiring more than the removal of barriers. The findings
suggest that dentists should be encouraged to look at preventive care as a central
part of their practices, to lead their teams toward preventive care and to
experience results that are self-reinforcing and offer benefits to all involved.
ACKNOWLEDGMENTS

The completion of this research and thesis would not have been possible without the generous support of many people. First, I would like to acknowledge my primary supervisor Dr Stacy M Carter. Stacy, thank you so much for your incredible support over the past three years. It has been great to work alongside someone so experienced and knowledgeable. It has been a privilege working with you and I hope we can work together in the future.

Next, I would like to thank my associate supervisors, Associate Professor Wendell Evans and Professor Anthony Blinkhorn. I have greatly appreciated your knowledge, assistance and advice.

My genuine thanks go to the ten dentists, two dental hygienists, nine dental assistants, two practice managers and 17 patients around New South Wales, Australia, who have agreed to participate in this research. This research would not have been possible without them.

I wish to thank my dear friend Paula Vendramini Dias Clark for her friendship, encouragement and for the enjoyable times we had working together over the years.

I would like to thank warmly everyone in the Centre for Values, Ethics & the Law
in Medicine for their friendly support. A special thanks to Emeritus Professor Miles Little; his excellent knowledge and experience have been of great value for me, but more importantly his friendship made of this an enjoyable experience.

I was also fortunate to receive funding to support this research. My thanks go to the National Health and Medical Research Council (Project Grant 632715); the Oral Health Foundation, the University of Sydney; the Dental Board New South Wales; and the Australian Dental Research Foundation.

At last and not least, and importantly, I owe my big thanks to my loving, supportive, cheering and patient husband Carlos for his continual patience and understanding, and to our loved baby girl, soon to be born, for inspiring and amazing me every day. To them I dedicate this thesis.
LIST OF PUBLICATIONS AND PRESENTATIONS

This is a thesis by publication and so much of the work presented in this thesis has been published and/or presented in:


**Oral presentations:**


**Invited speaker presentations:**

Sbaraini A. The process of adapting to non-surgical caries management in private practice. Paper presented at the International Association for Dental Research (IADR) Dental Forum hosted at the 2010 IADR Australia/New Zealand Division Golden Jubilee Meeting, on 29 September 2010.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>i</td>
</tr>
<tr>
<td>Declarations</td>
<td>ii</td>
</tr>
<tr>
<td>Abstract</td>
<td>iv</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>vii</td>
</tr>
<tr>
<td>List of publications and presentations</td>
<td>ix</td>
</tr>
<tr>
<td>List of Abbreviations</td>
<td>3</td>
</tr>
<tr>
<td>Preface</td>
<td>4</td>
</tr>
<tr>
<td><strong>Chapter One:</strong> Introduction</td>
<td>10</td>
</tr>
<tr>
<td>Overview of this chapter</td>
<td>11</td>
</tr>
<tr>
<td>Introduction to dental caries and its management</td>
<td>12</td>
</tr>
<tr>
<td>Effectiveness of preventive non-operative management of dental caries</td>
<td>14</td>
</tr>
<tr>
<td>Patterns of management of dental caries in practice</td>
<td>15</td>
</tr>
<tr>
<td>A possible solution: evidence-based care from medicine to dentistry</td>
<td>21</td>
</tr>
<tr>
<td>Evidence-based dentistry</td>
<td>26</td>
</tr>
<tr>
<td>What is hindering the transfer of evidence-based non-operative preventive dental care into dental practice?</td>
<td>31</td>
</tr>
<tr>
<td>Rationale for the study</td>
<td>39</td>
</tr>
<tr>
<td>Aims of the thesis</td>
<td>41</td>
</tr>
<tr>
<td>Research questions</td>
<td>42</td>
</tr>
<tr>
<td>The context of this study: general dental practices in Australia</td>
<td>44</td>
</tr>
<tr>
<td>References</td>
<td>48</td>
</tr>
<tr>
<td><strong>Chapter Two:</strong> How to do a grounded theory study: a worked example of a study of dental practices.</td>
<td>68</td>
</tr>
<tr>
<td><strong>Chapter Three:</strong> How do dentists understand evidence and adopt it in practice?</td>
<td>83</td>
</tr>
<tr>
<td><strong>Chapter Four:</strong> How do dentists and their teams incorporate evidence about preventive care? An empirical study.</td>
<td>95</td>
</tr>
<tr>
<td><strong>Chapter Five:</strong> Experiences of dental care: what do patients value?</td>
<td>142</td>
</tr>
</tbody>
</table>
Chapter Six: What factors influence the provision of preventive care by general dental practitioners

Chapter Seven: Conclusions
   Answering the aims of this thesis
   Transferability of findings
   Implications for actions
   References

Appendices
   Appendix A: List of search terms
   Appendix B: Tooth structure and tooth decay leaflet
   Appendix C: Tables 1 to 9
   Appendix D: Participant Information Statement
   Appendix E: Participant Consent Form
   Appendix F: Ethics approval
## LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA</td>
<td>American/Australian Dental Association</td>
</tr>
<tr>
<td>DMFT</td>
<td>Decayed, Missing, and Filled Teeth</td>
</tr>
<tr>
<td>DPBRN</td>
<td>Dental Practice-Based Network</td>
</tr>
<tr>
<td>EBD</td>
<td>Evidence-based dentistry</td>
</tr>
<tr>
<td>EBM</td>
<td>Evidence-based medicine</td>
</tr>
<tr>
<td>EBP</td>
<td>Evidence-based practice</td>
</tr>
<tr>
<td>IADR</td>
<td>International Association for Dental Research</td>
</tr>
<tr>
<td>MPP</td>
<td>Monitor Practice Program</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomized Controlled Trial</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
</tbody>
</table>
PREFACE

This thesis describes a qualitative study focused on preventive dentistry, I explored how dentists and their teams working in general dental practices in New South Wales (NSW), Australia, and some of their patients, dealt with the introduction of a set of evidence-based preventive protocols to manage dental caries in adults. A previous Australian randomised controlled trial (RCT) called the Monitor Dental Practice Program (MPP) tested whether dentists could increase their use of preventive techniques. In the intervention arm, dentists were provided with a set of evidence-based preventive protocols to apply; control practices provided usual care. The intervention protocols guided dentists to systematically apply preventive techniques to prevent the incidence of dental caries and to arrest early stages of caries in their patients, therefore reducing the need for restorative care. The protocols focused on (1) primary prevention of new caries lesions (tooth brushing with high concentration fluoride toothpaste and dietary advice) and (2) intensive secondary prevention through professional treatment to arrest caries progress (application of fluoride varnish, supervised monitoring of dental plaque control and supervised monitoring of clinical outcomes). I was a research assistant on that RCT.

As the RCT unfolded, I observed that practices in the intervention arm were not implementing the preventive protocols uniformly. So I was intrigued by this and started to wonder why the implementation process was different in different
practices. This was the starting point for this study. This study aimed to understand how the protocols used in the RCT had been implemented, including the conditions that led to variation in the process, and the consequences of this variation.

This thesis is arranged in six chapters, written so that each chapter is able to be read independently. They cover the following topics: an overview of the relevant literature on the management of dental caries in adult patients by dentists (Chapter One); a detailed description of grounded theory methodology and its application in practice during this study (Chapter Two); dentists’ definition of the most valued kind of knowledge and its adoption in practice (Chapter Three); dentists’ and their teams’ experiences while managing dental caries including a complex adaptation process, barriers and facilitators for preventive care and reasons for limited preventive activity (Chapter Four); patients’ experiences of dental care when visiting dental practices with and without a structured preventive approach in place and the nature of the relationship between dentists and patients (Chapter Five); and an explanation of how dental practices can be oriented toward either preventive or restorative care (Chapter Six). The University of Sydney allows published papers that arose from the candidature to be included in the thesis. The contents of chapters Two to Six are exact duplicates of the published (Chapter Two, Three, Five and Six), and submitted (Chapter Four) manuscripts for journal publication.
In Chapter One, I present an overview of the relevant literature on the
management of dental caries in adult patients by dentists. The literature was
searched systematically, although it is not a systematic review. A list of search
terms used is at Appendix A. In Chapter One, I argue that restorative management
of early dental caries still predominates while the best evidence available in
dentistry suggests that, in most cases, restorative intervention might not be
necessary. Evidence-based dentistry has been proposed by dental academics as an
effective way to solve this gap between evidence and practice. However it is well-
recognised that the availability of high-quality evidence will not necessarily
change the way dentists practice. This thesis is intended to contribute to a better
understanding of how evidence-based knowledge about the prevention and
management of dental caries is actually used in practice.

In Chapter Two, a detailed description of grounded theory methodology and its
application in practice during this study is given. In Chapter Two, I argue that by
employing grounded theory methodology rigorously, researchers can better design
and justify their methods, and produce high-quality findings that will be more
useful to patients, professionals and the research community.

In Chapter Three, I present findings about how dentists defined and adopted
evidence in practice. Dentists valued tangibility, and placed the most trust in
evidence that they had generated and tested themselves. Emphasis was placed on
the importance of talking about real patients’ cases with colleagues. Dentists also
valued having the opportunity to experiment with new products and techniques in order to see the evidence directly in patients’ mouths. I argue that translating evidence to dentists in a way that reflects these values and practices may therefore be as important as the evidence itself.

In Chapter Four, I present dentists’ and their dental teams’ experiences while adapting to evidence-based preventive care, reasons for variation in adaptation and non-adaptation. Adapting to prevention was a complex process. This process was influenced by practical, philosophical and historical aspects of dental care. Time was needed to allow dentists and their teams to go through this process of slowly adapting their practices to this new way of working. I argue that transferring evidence-based preventive protocols into these dental practices entailed a slow process of adapting research evidence to existing practice logistics.

In Chapter Five, I present findings about how patients experience dental care when visiting dental practices with and without a structured preventive approach in place; potential barriers that could hinder preventive activities as well as facilitators for prevention, and the nature of the relationship between dentists and patients. I argue that oral health self-care was not simply a matter of individual patients changing their behaviour. Despite the existing barriers for prevention, changes occurred in the context of a relationship with a dentist and the dental team – having a preventive structured approach in place helped individual patients
to feel that their dentist respected their views and concerns. The respect that dentists offered and patients valued was intrinsically bound up with the provision of structured preventive care.

In Chapter Six, I argue that the orientation of dental practices towards preventive or restorative management of dental caries resulted from an interaction between dentists’ leadership and the prioritisation of cultural, social and economic resources. Four hybrid hypothetical practices were created from elements of the eight practices observed during this study. These hybrid hypothetical practices express the differences observed across all eight practices. These differences reflect (1) how resources worked in practice and (2) the way that dentist’s leadership changed the use of resources, that is, the way resources were prioritised towards preventive care. Leadership was imperative for movement away from restorative and towards preventive care to be achieved. Such leadership is potentially a large and challenging task, requiring the leader to coordinate all members of a dental team and guide them towards making preventive care a central part of their practices.

Finally, Chapter Seven answers the specific aims of this thesis in relation to the study outcomes and their contribution to the literature. Implications for practice and directions for future research are discussed.

Each chapter contains its own reference list. Appendices which were published as
online supplementary material are included at the end of the relevant chapter.

Ethical approval for this study was gained from the Human Research Ethics Committee of the University of Sydney prior to commencement.
CHAPTER ONE - INTRODUCTION
1.1 Overview of this chapter

Over the last century, there have been many advances in research which have improved our understanding of dental caries as a multifactorial, lifestyle-associated disease process.\textsuperscript{1} There are sound scientific reasons to pursue preventive non-operative methods of controlling dental caries but the application of these methods in general dental practice remains a complex issue.\textsuperscript{1-7} Evidence from surveys of dentists in Australia and overseas suggests that restorative care has been the dominant approach used to manage the initial stages of dental caries which could have been controlled with preventive non-operative care.\textsuperscript{8-12} This restorative approach is problematic because it does not deal with the underlying causes of dental caries per se, and it creates a lasting need to repair and replace restorations. The need to replace restorations is due to a range of factors including inadequate tooth preparation, marginal failure, and secondary caries.\textsuperscript{12} Eventually cyclic restorative care may lead to loss of teeth and then replacement by dentures or implants creating a financial burden for patients.\textsuperscript{12}

Amongst health professions in general there has been recognition that research evidence is not necessarily translated into practice. For example, this is an issue which has worried academics in dentistry who have complained that primary care dental practitioners do not change their clinical practice in line with the latest research.\textsuperscript{13-18} There is an information-practice gap. This thesis aims to offer a contribution to the better understanding of how general dental practitioners use
scientific information to determine their approach to the control and prevention of 
caries in their adult patients, how prevention can become routine in clinical dental 
practice, and what occurs when practices move towards a greater emphasis on 
prevention. This introductory chapter reviews the literature on the management of 
dental caries so as to place the scientific rationale for preventive therapies in 
perspective. In preparing this chapter a detailed literature search was undertaken 
using the terms outlined in Appendix A.

1.2 Introduction to dental caries and its management

Dental caries is a common preventable disease – its aetiology, diagnosis and 
treatment have been topics of extensive research. A carious lesion is generally 
defined as a localized destruction that affects tooth enamel, dentine and 
cementum. It begins with microbiological changes within the biofilm (dental 
plaque) adjacent to the teeth. It progresses or reverses depending on changes in 
salivary flow and composition, exposure to fluoride, the frequency of 
consumption of non-milk extrinsic sugars and oral hygiene habits. Dental 
caries is essentially a process of demineralization or remineralization, and 
irreversible damage occurs if the demineralization takes precedence. Therefore 
the key factor in the control of dental caries is to ensure that the oral environment 
favours remineralization. This requires both the dental team and the individual

---

2 For the non-dental reader a diagram of the structure of a tooth and a leaflet about tooth decay are presented in Appendix B.
patient to work together to achieve the appropriate oral environment.3

The preventive non-operative approaches to enhance remineralization and control dental caries require both professional dental care and patient self-care. The professional input includes: oral hygiene instruction for effective dental plaque control via tooth brushing; use of fluoride in a variety of forms (toothpaste, mouthwash, rinse, professionally applied varnish); saliva stimulation or substitution and more recently calcium phosphate-based remineralisation systems.3, 6,7,12, 19, 20

Dietary advice could be added to this list, but it should be noted that in 2001 Van Loveren and Duggal argued that ‘‘most efforts to limit sugar consumption in the population are not very successful’’ and that ‘‘dietary variables alone have never explained more than six per cent of the variance in caries increment.’’21 The relative inability of the dental team to modify diet means that efforts should be concentrated on other caries risk factors which can be successfully changed, such as fluoride exposure, dental plaque control and regular monitoring of oral health. Such measures are supported by a strong evidence-base.22, 23

---

3 This thesis is written from the point of view of clinical dentistry, where patients are still referred to as patients, and so I have adopted this language because my main aim is to influence clinical dentistry.
However, professional care will only be successful if patients use home care fluoride products regularly and if the dental team maintain an interest in advising individuals about maintaining their routine recall visits.

1.3 Effectiveness of preventive non-operative management of dental caries

The effectiveness of preventive non-operative approaches to manage dental caries have been demonstrated for more than 35 years. These approaches include a combination of intensive topical fluoride applications, oral hygiene instruction, and monitoring the success of tooth brushing by recording the levels of dental plaque on the teeth. Since the 1980s, non-operative approaches and regular monitoring have been recommended as ways of arresting enamel and dentine carious lesions. This evidence suggests that general dental practitioners should therefore only restore teeth with cavitated lesions which are unlikely to be reversed by the currently available preventive therapies.

One possible barrier to the widespread implementation of this evidence is the values and routines of practicing dentists. If preventive therapies are to be used extensively, it will be particularly important that dental practitioners prioritise these over restorative intervention. That is, dental practitioners will need to accept that whilst restorative care eradicates carious or diseased tissue in a specific tooth and replaces it with a filling material, it does not restore or maintain general oral
health. Non-operative approaches, in contrast, do help patients to maintain and protect their own oral health.\textsuperscript{6, 12, 27-34} Despite the extent and consistency of the research findings on the value of preventive care, there has been limited acceptance of the non-operative approach in dental practice where restorative care remains the dominant philosophy.\textsuperscript{1, 3, 6, 12, 35-37}

1.4 Patterns of management of dental caries in practice

The restorative approach to dealing with all forms of caries is the most common activity for general dental practitioners worldwide; despite the plethora of evidence that a non-operative preventive approach should be the first clinical option when dealing with early carious lesions.\textsuperscript{2-7, 12, 26, 27, 35-40} The scale of the information gap between science and practice can be demonstrated by the findings from surveys in Australia, Canada, France, Scotland, Brazil, Croatia, Iran, the United States of America (USA) and Scandinavian countries.\textsuperscript{8-11, 41-57} The key results from these surveys are shown on Tables 1 to 8 (Appendix C). The tables highlight the global evidence that dentists provide restorative rather than preventive care to manage early caries lesions; they also demonstrate the need for research, such as that reported in this thesis that examines how the existing strong evidence-base can make a difference to practice.

The common themes for all countries (Tables 1 to 7), except for the Scandinavian countries, are that overall dentists tend to restore a carious lesion before it
penetrates dentine and that dentists disagree about when a lesion should be restored. There is also variability in relation to dentists’ provision of preventive services.

Overall, dentists tend to restore too early

The moment of restorative intervention in the treatment of caries has been the subject of studies in a number of countries (Table 1 to 7). The results from these surveys have shown that the majority of dentists would provide restorative treatment before a carious lesion penetrates dentine, even though there is ample scientific evidence to suggest that this practice is unnecessary and potentially causes future harms.

Scandinavia is an interesting exception

Scandinavian dentists seem to be the only exception reported in the literature; in those countries dentists’ restorative threshold has changed over time (Table 8). This shift was first observed by Tveit et al. in Norway when comparing data from the 1983 and 1995 surveys. In 1983, 66 per cent of dentists reported that they would restore lesions confined to enamel compared to 18 per cent in 1995, when most dentists reported that they would wait until a carious lesion had reached dentine in a radiograph before placing a restoration. A continuing trend towards postponing operative treatment until the lesion had reached dentine was confirmed in 2011 when Vidnes-Kopperud et al. reported that only 7 per cent of Scandinavian dentists would restore approximal lesions confined to enamel.
According to Vidnes-Kopperud et al. a major change on dentists’ views of dental caries progression occurred between 1983 and 1995. In 1983, dentists in Norway believed that caries lesions progressed quickly from enamel to dentine and thus the treatment they provided was more invasive than was necessary.\textsuperscript{10} Vidnes-Kopperud et al. suggested that the shift in dentists’ practices that occurred from the early 1980s onwards could be explained by a review published in 1983 showing that, contrary to what was believed, caries progression from enamel to dentine was slow.\textsuperscript{57} Although the authors attributed this change in part to the generation of new evidence that caries progression from enamel to dentine was slow, they did not explain why this evidence may have had effects in Scandinavia but not elsewhere.

Other factors that may also contribute to the fact that Scandinavian dentists place a higher importance on prevention to manage early dental caries lesions include:

- the nature of their dental care system (a combined public health dental service system offering free dental care for children, people with disabilities and the elderly and a fee-for-service system for adults);
- a dental curriculum which has integrated preventive and restorative dentistry into the single subject of cariology;
- a caries treatment approach that has been in place for decades and includes identification of the main causal, predisposing factors and caries risk status of each patient and dentists’ familiarity with and embracement of a health system within which preventive dental care is part of general
health-promoting strategies.\textsuperscript{56-58}

Therefore, Scandinavia provides evidence that it is possible for dentists to move from a culture of restoration to one of prevention. However, the change was quite complex in that education, the payment system and government intervention were part of the process. Although the Scandinavian experience gives cause for optimism, in other countries, dentists’ responses are quite varied regarding when to intervene surgically in the caries process.

There is considerable disagreement between dentists on whether a particular tooth surface should be filled or not

Research findings on whether an enamel carious lesion should be restored shows considerable variation. That is, the proportions of dentists who say would restore an enamel lesion ranges from more than 80 per cent to as low as 5 per cent across different countries (Tables 1 to 8). The lowest figure however reflects the practice in Scandinavian countries where preventive non-operative treatment is encouraged for early carious lesions: the majority of dentists worldwide opt to provide restorative treatment to enamel lesions.\textsuperscript{8-11, 41-55}

Besides showing that dentists would provide restorative treatment before a carious lesion penetrates dentine, surveys have also shown the worldwide variation in dentists’ diagnosis and treatment plans. For example, French dentists not only varied regarding their restorative treatment threshold but they also made their
treatment decisions using different detection tools. They used visual inspection associated with probing the enamel in the majority of treatments while radiographs were taken for only 21 per cent of treatments. Scottish dentists’ restorative thresholds have also been shown to be diverse. For example, for each surface planned for filling by one dentist, on only 40 per cent of occasions would a second dentist agreed with the opinion of the first dentist. Likewise, Canadian dentists disagreed with one another and even with themselves in relation to their stated restorative thresholds. As in the studies performed in developed countries, large variations were also observed among Brazilian dentists’ restorative treatment decisions. When comparing the two Brazilian surveys in Table 5, a more conservative attitude is observed among dentists from the smaller cities, that is, 31.5 per cent of dentists in larger Brazilian cities would restore lesions in the outer half of enamel, while 16.7 per cent of dentists in smaller Brazilian cities would do the same.

Bader and Shugars reviewed studies that showed variation in the detection of dental caries lesions when dentists were asked to clinically diagnose dental caries lesions in patients’ mouths, in extracted teeth, in radiographs or in a combination of those. According to them, discrepancies in diagnosis of dental caries occur because dentists use a range of diagnostic methods that perform differently, and dentists interpret these methods differently. For example, dentists use different criteria for what represents a caries lesion when using the same diagnostic method. Bader and Shugars’ view was that dentists interpret the criteria in
different ways and dentists results may vary due to visual acuity and examination conditions, dentists’ experience and beliefs. These factors contribute to the different interpretation and varying treatment decisions for similar caries lesions.

There is also variability in relation to dentists’ provision of preventive services. Variability in relation to dentists’ provision of preventive services was also revealed in the literature over the years. The provision of preventive services was shown to be influenced by certain characteristics of dentists, dental practices and patients. These will be discussed further in section 1.7.

From the literature reviewed so far it is clear that there is variation in dentists’ management of dental caries from providing no treatment, offering preventive non-operative care or only restorative treatment. This variation results in the provision of unnecessary restorative treatment and/or failure to provide adequate preventive care when needed. The next section presents a possible solution for the problem of variability in dentists’ practices.
1.5  A possible solution: evidence-based care from medicine to dentistry

The problem of variability in diagnosis and practice is not limited to dentistry. It became a central focus in medicine during the 1960s and 1970s. In 1967, David Sackett and his colleagues founded the world's first Department of Clinical Epidemiology and Biostatistics at McMaster University, Hamilton, Canada, to investigate variability in medical care. This group of biostatisticians and epidemiologists pioneered the application of epidemiological principles to the practice of medicine. They started to design and implement randomized controlled trials (RCTs) to test “the nature, prevention and management of health care problems;” the intention was that trial results would then be used to influence health-care decisions. At the same time, Archibald Leman Cochrane, a British medical researcher, offered a harsh critique of medical practices in his 1972 monograph entitled *Effectiveness and Efficiency. Random Reflections on Health Services.* According to Cochrane, the ability of doing “more good than harm” or the “effectiveness” of old and new medical interventions should be demonstrated by RCTs. Health care systems, he argued, should use available resources to “maximize the delivery” of tested “effective interventions”. Cochrane’s statements provided an influential justification for Sackett and his colleagues, who then expanded on their initial concept of applying epidemiology to the practice of medicine.
As a result of these changes in medical culture, there was a massive increase in the production of evidence from RCTs. This created a large body of evidence that needed to be managed. The National Peri-natal Epidemiology Unit was established in Oxford, United Kingdom, in 1978 to assemble a register for RCTs in peri-natal medicine. In 1988 the Oxford Database of Peri-natal Trials was launched aiming to provide synthesized evidence from the results of many trials in a single database. This initiative later developed into the Cochrane Collaboration (1993) and its Cochrane Library which contains systematic reviews on many interventions that are kept updated as new evidence becomes available.

In the early 1990s, the work from the previous two decades in Canada, the United Kingdom, and in the USA were brought together in a coordinated movement. The core idea was that “epidemiological principles and biostatistics” should be used to identify the “best evidence,” which should then be incorporated into “the fundamentals of medical training and patient care.” The textbook Clinical Epidemiology, published in 1985, disseminated this idea worldwide through the training of health professionals. This movement later became known as “Evidence-Based Medicine” (EBM).

The phrase “evidence-based” appeared in the literature in front of the word “medicine” for the first time in 1991. However, it was an audacious publication
in 1992 by Sackett et al. that “patented” the term “evidence-based medicine.”

Back then, Sackett et al. defined EBM as “a new approach to teaching the practice of medicine” and “a new paradigm of medical practice.” A new hierarchy of knowledge was also established: RCTs and meta-analyses were placed at the top of the ladder and clinical experience at the bottom, as RCTs were considered the least prone to bias, and clinical experience the most prone to bias. Specialist journals, such as the *ACP Journal Club* by the American College of Physicians, established 1991, were founded to further disseminate EBM ideas, providing clinicians with newly evaluated evidence and aiming to assist them putting evidence into practice. The *Evidence Based Medicine Journal* was publicized in an editorial in 1995 in the *British Medical Journal* which gave this description of EBM:

“... evidence based medicine is rooted in five linked ideas: firstly, clinical decisions should be based on the best available scientific evidence; secondly, the clinical problem - rather than habits or protocols - should determine the type of evidence to be sought; thirdly, identifying the best evidence means using epidemiological and biostatistical ways of thinking; fourthly, conclusions derived from identifying and critically appraising evidence are useful only if put into action in managing patients or making health care decisions; and, finally, performance should be constantly evaluated.”

---

[80] Back then, Sackett et al. defined EBM as “a new approach to teaching the practice of medicine” and “a new paradigm of medical practice.”

[81] Specialist journals, such as the *ACP Journal Club* by the American College of Physicians, established 1991, were founded to further disseminate EBM ideas, providing clinicians with newly evaluated evidence and aiming to assist them putting evidence into practice.

[82] The *Evidence Based Medicine Journal* was publicized in an editorial in 1995 in the *British Medical Journal* which gave this description of EBM:

“... evidence based medicine is rooted in five linked ideas: firstly, clinical decisions should be based on the best available scientific evidence; secondly, the clinical problem - rather than habits or protocols - should determine the type of evidence to be sought; thirdly, identifying the best evidence means using epidemiological and biostatistical ways of thinking; fourthly, conclusions derived from identifying and critically appraising evidence are useful only if put into action in managing patients or making health care decisions; and, finally, performance should be constantly evaluated.”
In a 1996 editorial, Sackett et al. defined EBM as:

```
the conscientious, explicit, and judicious use of current best evidence in
making decisions about the care of individual patients.```

Critiques of EBM

There is no doubt that EBM is a powerful force in medicine. Initiatives to develop, manage and retrieve the best research evidence on safe and effective interventions continue to develop and succeed, and much has been achieved under the umbrella of EBM. However, EBM has not been accepted by everyone and it has faced debate and antagonism from the very beginning. The “new” hierarchy of evidence provoked immediate antagonistic reactions from defiant clinicians who argued that practicing EBM was not feasible because often the evidence from RCTs was either not relevant to clinical practice or there was no evidence for certain clinical problems.

Over the years, critics of EBM principles have fuelled an ongoing debate. Critics of EBM assert that there are not sound scientific reasons why EBM should lead to better medical outcomes. They also argue that EBM over-emphasises RCT-evidence, making it so important that it becomes difficult to integrate other forms of knowledge into clinical decision making, such as biological and physical manifestations of disease, clinicians’ observations and experience and factors particular to the patient. Critics have also argued that the EBM movement is in part politically motivated and lacks tolerance, flexibility and breadth of view,
which are all important to daily clinical decisions in which clinicians need to balance research evidence, their experience and patients values.\textsuperscript{77,85-93} Lastly, EBM is said to jeopardize the self-government of the doctor-patient relationship: some contend that EBM offers limited advantages to patients while reducing patients’ rights to choose what treatment or course of action is best in their particular circumstances.\textsuperscript{85-93}

Despite all of this criticism, it is important to note that critics of EBM have not suggested that high quality scientific evidence ought to be overlooked in the context of patient care. Rather, they have argued that high quality evidence is one factor of many that are present in a complex health care environment.

This debate highlights EBM’s strengths and weaknesses. On one side, EBM advocates that effective, safe and efficient interventions can be identified through RCTs, which will then be used to influence standards of care leading to a consistent and objective clinical decision-making process. While EBM can be a useful tool, its critics argue that it can present issues such as threatening the doctor-patient relationship and providing little reward for patients when used in isolation in a complex health care environment. As a response to these critics, a major change occurred in 2000 when EBM was re-defined as “the integration of the best research evidence with clinical expertise and patients’ values”.\textsuperscript{94} This definition was further expanded in 2002 to include the concept of “evidence-based patient choice” as a response to the criticism that EBM had excluded the patient
and was only focused on clinicians’ use of evidence in practice. At the present time, a perhaps modified form of EBM remains persuasive in most clinical care, and its influence has extended from medicine to other health professions.

1.6 Evidence-based dentistry

Dentistry is one of the fields to which EBM extended its influence. Soon after and similar to the developments in medicine, international dental organizations and centres were founded to identify, appraise and merge the best clinical evidence available into clinical practice guidelines and protocols. These were made available to dentists, the aim being to standardize dental treatments and procedures. Examples of those initiatives are The Cochrane Oral Health Group, established 1994; the Centre for Evidence-based Dentistry, established 1995; the Forsyth Centre for Evidence-Based Dentistry, established 2003; and the Virtual Centre for Improving Oral Health, established 2004. Specialist journals were also founded, such as the Evidence-based Dentistry Journal, established 1998, the Journal of Evidence-based Dental Practice, established 2001; and specialist training courses and conferences, such as the International Conference on Evidence-based Dentistry of the Journal of Evidence-based Dental Practice, established 2006; and the Evidence-based Dentistry Champions Conference of the American Dental Association (ADA), established 2010. More recently the American ADA launched the Center for Evidence Based Dentistry website which contains many resources for dentists and patients. This includes a section where
dentists can suggest clinical questions that they think lack a “science-based answer”.\textsuperscript{104}

In 2001, the American ADA applied the “evidence-based concept” to dentistry by developing a Policy on evidence-based dentistry (EBD). In the ADA policy statement, EBD was defined as follows:

“EBD is an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to the patient’s oral and medical condition and history, with the dentist's clinical expertise and the patient’s treatment needs and preferences.”\textsuperscript{105}

This definition of EBD has been used worldwide and it was formally adopted by the majority of Dental Institutions and Associations including the Australian Dental Association - whose EBD policy statement from 2002 is built around the American definition.\textsuperscript{106} In taking up this EBD definition, Dental Associations acknowledged that dentists have the “authority to recommend treatments” for each patient, and that patients “preferences” should be taken into account during treatment decisions. The American ADA policy further states that “EBD does not provide a "cookbook" that dentists must follow, nor does it establish a standard of care. The EBD process must not be used to interfere in the dentist-patient relationship, nor is it to be used solely as a cost-containment tool by third-party
Therefore, it is reasonable to say that EBD involves dentists making clinical decisions based on the integration of the best available research evidence, their clinical expertise and their patient’s values and needs.  

Dentists’ views about EBD and its use in practice

The published research on dentists’ views of EBD and the feasibility of adopting research evidence in practice suggests a variety of barriers, such as: lack of time to seek research evidence, apprehension and fear of losing autonomy, trust on peers’ advice, poor availability of research evidence, evidence-based treatments not being financially rewarded and patients’ demands acting as a barrier to EBD.  

Table 9 (Appendix C) presents the findings from a number of studies examining how general dental practitioners view EBD.

The content of EBD is new to many dental practitioners and is often not viewed with any great enthusiasm. In general, EBD is seen as too time consuming and serving only dental academics. Indeed there is a general belief that clinical skills and advice from peers are more important than academic research evidence. For example, Dutch dentists claimed they were apprehensive about EBD and feared losing their professional autonomy. This resistance to change is shown by findings from studies on Swedish, Belgium and American dentists. The common theme in the results is that research evidence did not provide clear answers to important clinical questions and all too often diverging findings added an extra complication. In addition, many
dentists noted that products used in clinical dental practice do not have sufficient appropriate research, so the evidence-based knowledge is not available. 115, 116, 119, 121

One way of improving the dissemination of evidence-based information could be to establish a “recognised” clinical education site for general dental practitioners, but the success of such a venture is highly dependent on robust internet access. 113, 117, 121 It seems that the most practical solution is to rely on the more “old fashioned” approach of setting up continuing education courses linked in with the registration authorities, who demand continuing professional development experience to maintain dental registration. The problem for those official Organisations seeking to improve the scientific knowledge of primary care dental practitioners is that studies have shown that dentists prefer to listen to their peers when seeking an answer to clinical problems. 112, 116, 117 Seeking knowledge from colleagues is common amongst Swedish and English dentists and it is one of the key reasons why an individual practitioner changes clinical practice. 118, 120

Financial constraints were also reported as barriers to EBD. 116, 117 Belgian and American dentists reported that evidence-based practice (EBP) is not financially rewarded. 116, 119 American dentists suggested that EBD could be promoted through the removal of financial and political barriers through changes in insurance coverage. 119 They also stated that there is a need to encourage dentists to be more open to changes by reducing the fear of “losing control of their
practice”. This suggests the importance of discussing EBD not as a dictatorial system, but as new knowledge that will supplement dentists’ clinical skills.

Finally, according to dentists, patients were also described as a potential barrier to the provision of evidence-based care or to change dental practices in general. Research findings have shown that dentists think that patients demand services that they are accustomed to, even when there is no need for it.

There are many barriers to EBD reported in the literature, but it is important to note that obstacles to the implementation of research evidence in practice have been reported for a range of different health care disciplines and not only in dentistry. Physicians appear to also lack time to implement evidence; they find research evidence inappropriate in some cases and the inaccessibility of scientific information has also been reported as a barrier. Doctors were also worried and fearful about losing their professional freedom when practicing EBM. Findings from a study comparing barriers experienced by Belgian psychiatrists with those of physicians, nurses, dentists, and physiotherapists suggested that different disciplines have common barriers, such as the ever expanding scientific literature, the lack of valid evidence, the lack of time to search for evidence, and a trend to adapt to patients’ expectations. Therefore, barriers to the use of research evidence exist in dentistry as in other health care fields. The next section will focus on factors hindering the transfer of evidence-based preventive non-operative dental care into practice.
1.7 What is hindering the transfer of evidence-based preventive non-operative dental care into dental practice?

The evidence reviewed so far in this chapter highlights that a restorative approach to managing early dental carious lesions has been dominant in dental practices, despite the availability of sound research evidence suggesting the contrary. So what is hindering the transfer of this knowledge into dental practice? The literature suggests potential explanations, such as: characteristics of dentists; characteristics of patients; characteristics of the dental practice environment; characteristics of the health system in place and a lack of active translation of new knowledge into practice.\textsuperscript{15, 35-40, 45, 59, 126-132}

Certain characteristics of dentists are associated with whether they provide restorative or preventive non-operative care

In general, demographic and work-related characteristics such as dentists’ age and years of working experience were not statistically associated with the adopted decisions of operative treatment in countries such as Australia, Canada and Scotland (Table 1, 2 and 4). However, the results from surveys performed since the year 2000 have shown a significant difference between younger and older dentists; younger dentists tended to postpone restorative treatment until a carious lesion had reached the dentine-enamel junction or had progressed into dentine
Dentists who attended postgraduate and/or continuing education courses on caries management tended to be less interventionist (Table 5 and 6). It could be argued that this change in younger dentists’ decisions to postpone the moment of providing a restorative service is not due to their age but to their acquisition of new knowledge during postgraduate and continuing education courses. In fact, attending continuing education courses on the management of dental caries was shown to be the only significant factor explaining dentists’ decisions to postpone the moment of providing a restoration in a recent survey (Table 6).

Dentists’ gender has also been shown to influence whether or not restorative care is provided. For example, female dentists in Australia, the USA and Iran have reported using less invasive approaches for treating approximal caries before they had reached dentine (Table 1, 6 and 7). This is in accordance with data reported by Brennan and Spencer who noted a higher provision of preventive services rates in Australia when dentists were female or aged 20-29 years. 61

Findings from surveys of American and Scandinavian dental practices within the Dental Practice-Based Research Network (DPBRN) showed that recently-graduated dentists, dentists who regularly perform caries risk assessment, and dentists who practice individualized caries prevention were “the most frequent users of caries prevention agents”. 62, 63 Dentists who frequently used in-office fluoride had a propensity to “make the most conservative restoration decisions”
and the majority of those dentists recommended at-home fluoride treatments for
50 per cent of their adult patients. 62, 63

Cultural and professional explanations have also been made in the literature.
Dentistry’s historical tradition of operative intervention has been suggested as an
explanation for dentists not adopting proven preventive non-operative approaches
to manage dental caries. 35-40 Some authors have suggested that the establishment
of Greene Vardiman Black’s principles of modern operative dental care at the
beginning of the 1900s in the USA added to this bias. Black’s principles of cavity
preparation and restoration became an essential guide to modern dental care and
were quickly adopted worldwide.35, 36 Some refer to this moment as the foundation
of dentistry’s historical bias towards restorative management of dental caries.
From this point, they argue, it was firmly established that treating dental caries
was a matter of developing faultless technique for cavity preparation and having
suitable materials to restore oral function.35, 36 Another factor that may well
maintain dentists’ historical restorative bias is the profession’s focus on
technology. A modern dental office with a state of the art chair and equipment is a
marker of professional success and shows that an individual dentist is providing
the best possible restorative care.37

It has also been argued that dentists’ inertia contributes to the lack of change in
dental practices. An example of inertia was noted in an editorial in 2006,38 where
Niederman protested that dentists continue to use restorations to treat dental caries
– a practice contrary to scientific evidence available for more than 30 years.

**Certain characteristics or perceived characteristics of patients are associated with whether or not dentists provide them with restorative or preventive non-operative care**

Patients’ age, risk of developing dental caries, insurance status, oral hygiene status and regularity of dental attendance has also been shown to influence the stage at which a restoration is undertaken (Tables 1, 2, 3, 4, 6 and 7).

Surveys in the 1990s showed that the majority dentists in Canada and Scotland would restore enamel lesions in adolescents compared to a minority of dentists who would do the same in adult patients (Table 2, 4). Since then, published research has focused on patients’ level of risk of developing dental caries rather than patients’ age in relation to dentists’ restorative thresholds. For example, when comparisons were made between patients at low and high risk of developing dental caries, the majority of dentists in Croatia, Iran and the USA reported that they would restore enamel lesions in a high risk patient, while a patient at low risk would receive a restoration when the caries lesion had reached dentine (Table 6 and 7). More recently, Gilbert et al. reported that American patients at high risk of developing dental caries were also less likely to receive topical fluoride treatments. 64
Patients’ insurance and socio-economic status has been shown to influence dentists’ provision of preventive care in countries such as Australia, the USA and France (Table 1, 3 and 7). In Australia, topical fluoride services were provided at lower rates to patients from lower socio-economic status areas compared with higher socio-economic status areas. During 2003-2004, the provision of topical fluoride applications in Australia increased when patients were of higher socioeconomic status, but this was not associated with patients’ age, gender, or insurance status. While in France, regular attendees who had private health insurance and a good level of oral hygiene were chosen to be given preventive care (Table 3).

Certain characteristics of practices are associated with whether or not patients are likely to receive restorative or preventive non-operative care

Characteristics of the practice in which patients are treated have also been shown to be strongly related to the care that patients receive. In an American study, dentists’ recommendation of a restoration on enamel caries lesions was associated with their practice location. For example, dentists who worked in large group practices and public health practices were less likely to recommend a restoration for enamel lesions as compared to those who worked in solo or small group private practices (Table 7).

Characteristics of dental practices were also shown to be related to fluoride receipt, independent of patients’ characteristics. For example, if dental practices tended to provide and/or recommend preventive services, such as in-office
fluoride application, fluoride gel or rinse for home use and blood pressure screening on a higher percentage of patients, then patients were more likely to receive fluoride applications. In Australia, a survey of dentists working during 1997-1998 reported a higher provision of preventive services rates for dentists who were working in solo practices or practicing in capital cities.

Certain characteristics of health systems in different countries are associated with whether or not patients are likely to receive restorative or preventive non-operative care. There is considerable evidence that dentists are driven to surgical intervention through financial incentives, and that prevention is unattractive to dentists because of a lack of financial incentive. In research examining barriers to changing dental practices, financial risk was identified as the key barrier; dentists have also cited limitations imposed by the regulations of insurance companies as influencing dental care. Insurers’ regulations may be contrary to evidence obtained from well-designed studies. However they determine reimbursement to patients for treatment, so can be strong drivers for patient satisfaction and motivation. In this way, they can become important in clinical decision making.

In Australia, Brennan and Spencer found that patients’ insurance status was not associated with fluoride use and that “initial carious lesions tend to be managed with restorative services rather than preventive services.” The authors noted that
this may be due to the fact that the majority of dental care in Australia is provided in the private sector, the structure of which does not control or direct the services that dentists provide, so cannot encourage adoption of preventive non-operative approaches. This fee-for-service based dental financing system also provides no incentive for dentists to provide preventive care. Similarly, a survey reported that French dentists rarely perform non-operative treatments to manage dental caries due to the fact that preventive dental care, with exception of fissure sealants, does not “generally qualify for reimbursement, which consequently discourages prevention and encourages operative care”. Conversely, Scandinavian countries have embraced preventive dental care as an integral part of their health system allowing dentists to practice in a more holistic manner.

Some work has suggested a modest effect of financial inducements in achieving non-operative care. Among dentists working in the Scottish National Health Service, for example, the introduction of a financial reward (fee per sealant) increased the placement of fissure sealants in children by 10 per cent compared to education on evidence-based practice only, or no intervention. Similarly, a survey among dentists in Washington State, USA, found that the percentage of dentists who regularly used fluoride varnish in adult patients increased by 12 per cent two years after reimbursement was offered for the service. However, financial reimbursement was not the only driver to increase the use of fluoride varnish; other significant factors were testing new products and having colleagues or friends using fluoride varnish.
Failure in active knowledge translation as a possible explanation

Some of the problems in changing dentists’ practice may be also attributable to a failure in active knowledge translation. Research has shown that evidence-based guidelines increase dentists’ knowledge, but do not create intentions to act differently.13-16 Only a small number of authors have suggested that by applying tailored knowledge translation strategies, a change in dentists’ clinical practice may be achieved.17,18 Bonetti et al., for example, applied psychological theory to identify factors predictive of dentists taking intra-oral radiographs.17 They concluded that “an intervention which specifically targets the role of radiographs in reducing risk to patients and which encourages dentists to plan in more detail when they will take radiographs as part of patient management (e.g. through persuasive statements delivered via a letter or during a professional development course) may increase the implementation of evidence-based practice.”17 These authors suggested that when more active translation of new knowledge is undertaken – such as encouraging dentists to consider the implications of new knowledge for their own practice or linking new practices to desired outcomes – intentions to act are more likely to be influenced.17,18 In a more recent study, Bonetti et al. concluded that dentists were more likely to decide to carry out a specific clinical procedure when they “had a prior action plan” about the procedure and if the procedure was something they were familiar with.18 The authors recommended that future interventions should be developed for assisting dentists to alter “their beliefs about the consequences” of a specific clinical
procedure – these interventions might facilitate dentists to routinely incorporate desired clinical procedures into their usual routines.\textsuperscript{18} This suggests that the means of translating new knowledge to practicing dentists may be as important as the new knowledge itself.\textsuperscript{58}

\section*{1.8 Rationale for the study}

In this chapter, I have argued that restorative management of early dental caries still predominates while the best evidence available in dentistry suggests that, in most cases, restorative intervention might not be necessary. Over the years EBD has been proposed by dental academics as an effective way to solve this gap between evidence and practice. However it is well-recognised that the availability of high-quality evidence will not necessarily change the way dentists practice. The literature suggests that certain characteristics of dentists, of patients, of the dental practice environment and of the health system in place, as well as a lack of active translation of new knowledge into practice, can help explain why many dentists continue to manage early dental carious lesions with restorations.

All the barriers and/or potential explanations reported in the literature are technical, financial, related to scientific knowledge acquisition and implementation or to dentists’ perceptions of patients’ preferences and behaviours. While these are all important factors to take into account, the dental care experience is an encounter of individuals, so it cannot only be about
technology, finance, science implementation and dentists’ perceptions. These individuals (dentist, a dental team member and a patient) have to effectively communicate with each other to create a suitable environment for a series of highly technical dental procedures to run smoothly. The complexity of this encounter has to be part of the explanation of why research evidence may not be taken up in dental practices.

There is considerable discussion about potential barriers to EBD in the dental literature, but there is a lack of empirical knowledge about what happens in dental practices on a daily basis when dentists, their teams and patients are asked to change their practices or oral health behaviours according to the best scientific evidence available. This prompted the questions I set out to answer in this thesis, which included:

- How do dentists, their teams and patients adopt evidence about preventive non-operative care?
- What are the barriers they face?
- What are the facilitators?
- What are the consequences of adopting preventive non-operative care?

Rather than simply inquiring about dentists’ general opinions on EBD, or testing their clinical decision making, I sought to understand what happens when an attempt is made to institute evidence-based practice. This study focused not just on why evidence-based preventive care might not occur, but also how it can
occur. This thesis offers novel insights about how, when and why preventive non-operative management of dental caries is provided and how patients experience it. I also offer an explanation of how dental practices can be oriented towards either preventive or restorative management of dental caries, together with some conditions that are necessary for dentists to provide leadership towards the preventive management of dental caries.

1.9 Aims of the thesis

The broad aim of this thesis is to contribute to a better understanding of how prevention and non-operative management of dental caries can be implemented in practice.

The specific aims of this thesis are to:

1. Provide a worked example of a grounded theory project through a detailed description of sampling, data collection, data analysis and interpretation; and to explain how these steps were consistent with grounded theory methodology, and show how they related to one another in the research process (Chapter Two).

2. Identify what dentists define as evidence and explain how they adopt it in practice (Chapter Three).

3. Understand and explain the process by which dentists and their teams incorporate evidence about preventive care into their practices, and explain variation in this process (Chapter Four).
4. Understand and explain how a group of dental patients experience preventive dental care (Chapter Five).

5. Consolidate and interpret all findings from this study in a model that explains how dental practices can be oriented towards either preventive or restorative care (Chapter Six).

1.10 Research questions

I have already suggested the broad questions that guided this project. My initial research questions were:

- What was the process of implementing (or not-implementing) the evidence-based preventive protocols (from the perspective of dentists, members of dental team, and patients)?
- How did this process vary?

These questions were slightly altered during the course of the study, as my understanding about how protocols were adopted began to consolidate and a theoretical framework to explain the process was developed (Chapter Two).

Below is a list of further research questions that guided the study:

- How do dentists adopt research evidence in practice? (Chapter Three)
- What kind of evidence do dentists trust? (Chapter Three)
- How do dentists adopt the most valued kind of evidence in practice? (Chapter Three)
• What conditions or elements are important during this process? (Chapter Three)

• What are the barriers for adopting preventive protocols? (Chapter Four)
• What are the facilitators for adopting preventive protocols? (Chapter Four)
• What are the consequences of adopting preventive protocols? (Chapter Four)
• Why are some dental practices unable to adopt preventive protocols? (Chapter Four)

• What was patients’ experience of dental care in practices without a structured approach to prevention? (Chapter Five)
• What was patients’ experience of dental care in practices with a structured approach to prevention? (Chapter Five)
• What were the barriers and facilitators for prevention for these patients? (Chapter Five)
• What did these patients value in dental care? (Chapter Five)

• Why might dentists offer – or fail to offer – preventive care to their patients? (Chapter Six)
• What other factors influence the provision of preventive care by dentists? (Chapter Six)
1.11 The context of this study: general dental practices in Australia

This study was conducted in New South Wales (NSW), Australia; hence in this final section I will provide some history and context regarding what it means to be a dentist working in a private general dental practice in Australia.

The concept of general private dental practices was established in Australia soon after the arrival of the first English dentists, who started two separate private practices in Sydney, NSW, in 1818. Currently, dental services are overwhelmingly delivered in the private sector, and not integrated into the medical system. General dentists provide the majority of care. Dental hygienists are employed in only a minority of practices. Most dentists are independent self-employed practitioners; they own their practices and lead their dental team. Many begin their practicing careers as associate dentists in private dental practices being remunerated by salary or commission before taking on a solo enterprise or forming partnerships with other experienced dentists.

Over 90 per cent of dentists in Australia are members of the Australian Dental Association (ADA) - branches of the Association exist in six States and one
Territory of Australia. The Australian ADA provides professional representation at government level, dento-legal guidance, local support and networking through divisions and groups, access to professional development courses, online educational resources, full text journals, e-books and research databases, practice management support, and discounts on a variety of services.

Federal governments have, over the years, had different views about the role of government in funding dental services, resulting in a history of varying dental health policies and programs. With the exception of some Commonwealth dental programmes – the Veterans Dental Scheme, Armed Forces and Army Reserve Dental Schemes, and dental services provided to particular population groups such as Aboriginal and Torres Straight Islanders – dental services have not been covered by the Medicare system, which provides coverage for medical services. However, all states and territories employ dentists in Government clinics and some states contract the services of private dentists. Public dental clinics, within public hospitals in capital cities or major regional centres, provide access to a restricted range of dental treatments to certain groups of the population. For example, in NSW, public dental care services are made available to holders of Pensioner Concession Cards, Commonwealth Seniors Health Care Cards and Health Care Cards (the latter are people receiving social security payments for reasons including unemployment and disability). This means that around 22 per cent of NSW residents are eligible to access public dental care which employs around 14 per cent of the total number of
dentists. As a result of these arrangements, dentists working in general private practices provide dental care to more than 80 per cent of NSW adults, and public services tend to have long waiting lists.

The NSW Oral Health Fee for Service Scheme, introduced in 2001, is an alternative way of providing dental care for patients who are eligible for treatment but cannot be seen because of long waiting lists in the Public Dental Service. This Scheme funds dental care through a voucher system by private dental practitioners and dental prosthetists. After an initial assessment, the Public Dental Service creates a voucher which details the type of dental care that the patient needs and has agreed to. The type of dental care that can be provided includes emergency treatment, general dental care and dentures. Patients then contact a private dental practitioner, who has registered with the Public Dental Service to provide dental care under the Scheme. Any additional care which is not covered by the value of the voucher is funded by the patient. Children younger than 18 years of age, and adults who are more than 18 years of age and are current holders of Pensioner Concession Cards, Commonwealth Seniors Health Care Cards or Health Care Cards – which are provided to social security recipients – are eligible to receive dental care through this Scheme. However, the greater part of the population is still responsible for the funding of most dental treatments in NSW.

The majority of adults in NSW visit a private general dental practice for a check-up at least once a year on average – for residents outside capital cities visits are less frequent. Most individuals visit the same private dental practitioner on a
long term basis. This study focused on dentists and patients in private practices – that is, on dentists and patients operating in a typical Australian clinical context. Following on from the Introduction, the remainder of the thesis is presented in the following sections:

- **Chapter Two**: How to do a grounded theory study: a worked example of a study of dental practices.
- **Chapter Three**: How do dentists understand evidence and adopt it in practice?
- **Chapter Four**: How do dentists and their teams incorporate evidence about preventive care? An empirical study.
- **Chapter Five**: Experiences of dental care: what do patients value?
- **Chapter Six**: What factors influence the provision of preventive care by general dental practitioners?

Chapters Two, Three, Five and Six have been published as a paper in the peer-reviewed literature. Chapter Four is under review.
References

10. Espelid I, Tveit A, Haugejorden O, Riordan P. Variation in radiographic interpretation and restorative treatment decisions on approximal caries


46. Elderton RJ, Nutall NM. Variation among dentists in planning treatment. 

47. Nuttal NM, Pitts NB. Restorative treatment thresholds reported to be used 

48. Kay EJ, Nuttall NM, Knill-Jones R. Restorative treatment thresholds and 
    agreement in treatment decision making. *Community Dentistry and Oral 

49. Kay EJ, Locker D. Variations in restorative treatment decisions: an 
    international comparison. *Community Dentistry and Oral Epidemiology*. 

50. Traebert J, Marcenes W, Kreutz JV, Oliveira R, Piazza CH, Peres MA. 
    Brazilian dentists’ restorative treatment decisions. *Oral Health and 

51. Traebert J, Wesolowski CI, de Lacerda JT, Marcenes W. Thresholds of 
    restorative decision in dental caries treatment among dentists from small 

    Survey of Croatian dentists’ restorative treatment decisions on approximal 

53. Ghasemi H, Murtomaa H, Torabzadeh H, Vehkalahti MM. Restorative 
    treatment threshold reported by Iranian dentists. *Community Dental 


73. The National Peri-natal Epidemiology Unit (NPEU) website. https://www.npeu.ox.ac.uk/. Accessed 17/05/2012.


76. The Cochrane Library.


94. Sackett D, Strauss S, Richardson WS, Rosenberg W, Haynes RB.  


98. The Forsyth Centre for Evidence-Based Dentistry.  


100. Evidence Based Dentistry Journal.  

101. Journal of Evidence-Based Dental Practice.  

103. EBD Champions Conference of the American Dental Association.  

   Accessed 15/5/2012.


   Accessed 15/5/2012.


143. Australian Dental Association – Careers in dentistry.  

144. State Branches of the Australian Dental Association.  


147. AIHW Dental Statistics and Research Unit 2008. The National
and research series no. 40. Cat. no. DEN 176. Canberra: AIHW.

148. Dental services - Parliament of New South Wales -
NSW Government.
149b588095ca25714200077d20/$FILE/FINAL-per cent20COMPILEDper
cent2030per cent20MARCH.pdf Accessed 17/05/2012.

149. AIHW Dental Statistics and Research Uni 2009. Oral health
behaviours in the Australian Population 2004-06. Cat. no. DEN 197.
CHAPTER TWO – How to do a grounded theory study: a worked example of a study of dental practices.

Correspondence

How to do a grounded theory study: a worked example of a study of dental practices

Alexandra Sbaraini1,*, Stacy M Carter1, R W Evans2 and Anthony Blinkhorn1

* Corresponding author: Alexandra Sbaraini alexandra.sbaraini@sydney.edu.au
For all author emails, please log on.

Published: 9 September 2011

Abstract

Background
Qualitative methodologies are increasingly popular in medical research. Grounded theory is the methodology most-often cited by authors of qualitative studies in medicine, but it has been suggested that many ‘grounded theory’ studies are not concordant with the methodology. In this paper we provide a worked example of a grounded theory project. Our aim is to provide a model for practice, to connect medical researchers with a useful methodology, and to increase the quality of ‘grounded theory’ research published in the medical literature.

Methods
We documented a worked example of using grounded theory methodology in practice.

Results
We describe our sampling, data collection, data analysis and interpretation. We explain how these steps were consistent with grounded theory methodology, and show how they related to one another. Grounded theory methodology assisted us to develop a detailed model of the process of adapting preventive protocols into dental practice, and to analyse variation in this process in different dental practices.

Conclusions
By employing grounded theory methodology rigorously, medical researchers can better design and justify their methods, and produce high-quality findings that will be more useful to patients, professionals and the research community.

Keywords: qualitative research; grounded theory; methodology; methods; dental care
How to do a grounded theory study: a worked example of a study of dental practices

Alexandra Sbaraini1,2*, Stacy M Carter1, R Wendell Evans2 and Anthony Blinkhorn1,2

Abstract

Background: Qualitative methodologies are increasingly popular in medical research. Grounded theory is the methodology most often cited by authors of qualitative studies in medicine, but it has been suggested that many 'grounded theory' studies are not concordant with the methodology. In this paper we provide a worked example of a grounded theory project. Our aim is to provide a model for practice, to connect medical researchers with a useful methodology, and to increase the quality of 'grounded theory' research published in the medical literature.

Methods: We documented a worked example of using grounded theory methodology in practice.

Results: We describe our sampling, data collection, data analysis and interpretation. We explain how these steps were consistent with grounded theory methodology, and show how they related to one another. Grounded theory methodology assisted us to develop a detailed model of the process of adapting preventive protocols into dental practice, and to analyse variation in this process in different dental practices.

Conclusions: By employing grounded theory methodology rigorously, medical researchers can better design and justify their methods, and produce high-quality findings that will be more useful to patients, professionals and the research community.

Keywords: qualitative research, grounded theory, methodology, methods, dental care

Background

Qualitative research is increasingly popular in health and medicine. In recent decades, qualitative researchers in health and medicine have founded specialist journals, such as Qualitative Health Research, established 1991, and specialist conferences such as the Qualitative Health Research conference of the International Institute for Qualitative Methodology, established 1994, and the Global Congress for Qualitative Health Research, established 2011 [1-3]. Journals such as the British Medical Journal have published series about qualitative methodology (1995 and 2008) [4,5]. Bodies overseeing human research ethics, such as the Canadian Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans, and the Australian National Statement on Ethical Conduct in Human Research [6,7], have included chapters or sections on the ethics of qualitative research.

The increasing popularity of qualitative methodologies for medical research has led to an increasing awareness of formal qualitative methodologies. This is particularly so for grounded theory, one of the most-cited qualitative methodologies in medical research [8, p47].

Grounded theory has a chequered history [9]. Many authors label their work 'grounded theory' but do not follow the basics of the methodology [10,11]. This may be in part because there are few practical examples of grounded theory in use in the literature. To address this problem, we will provide a brief outline of the history and diversity of grounded theory methodology, and a worked example of the methodology in practice. Our aim is to provide a model for practice, to connect medical researchers with a useful methodology, and to increase the quality of 'grounded theory' research published in the medical literature.

The history, diversity and basic components of 'grounded theory' methodology and method

Founded on the seminal 1967 book 'The Discovery of Grounded Theory' [12], the grounded theory tradition is
now diverse and somewhat fractured, existing in four main types, with a fifth emerging. Types one and two are the work of the original authors: Barney Glaser’s ‘Classic Grounded Theory’ [13] and Anselm Strauss and Juliet Corbin’s ‘Basics of Qualitative Research’ [14]. Types three and four are Kathy Charmaz’s ‘Constructivist Grounded Theory’ [15] and Adele Clarke’s postmodern Situational Analysis [16]: Charmaz and Clarke were both students of Anselm Strauss. The fifth, emerging variant is ‘Dimensional Analysis’ [17] which is being developed from the work of Leonard Schatzman, who was a colleague of Strauss and Glaser in the 1960s and 1970s.

There has been some discussion in the literature about what characteristics a grounded theory study must have to be legitimately referred to as ‘grounded theory’ [18]. The fundamental components of a grounded theory study are set out in Table 1. These components may appear in different combinations in other qualitative studies; a grounded theory study should have all of these. As noted, there are few examples of ‘how to do’ grounded theory in the literature [18,19]. Those that do exist have focused on Strauss and Corbin’s methods [20-25]. An exception is Charmaz’s own description of her study of chronic illness [26]; we applied this same variant in our study. In the remainder of this paper, we will show how each of the characteristics of grounded theory methodology worked in our study of dental practices.

Study background
We used grounded theory methodology to investigate social processes in private dental practices in New South Wales (NSW), Australia. This grounded theory study builds on a previous Australian Randomized Controlled Trial (RCT) called the Monitor Dental Practice Program (MPP) [27]. We know that preventive techniques can arrest early tooth decay and thus reduce the need for fillings [28-32]. Unfortunately, most dentists worldwide who encounter early tooth decay continue to drill it out and fill the tooth [33-37]. The MPP tested whether dentists could increase their use of preventive techniques. In the intervention arm, dentists were provided with a set of evidence-based preventive protocols to apply [38]; control practices provided usual care. The MPP protocols used in the RCT guided dentists to systematically apply preventive techniques to prevent new tooth decay and to arrest early stages of tooth decay in their patients, therefore reducing the need for drilling and filling. The protocols focused on (1) primary prevention of new tooth decay (tooth brushing with high concentration fluoride toothpaste and dietary advice) and (2) intensive secondary prevention through professional treatment to arrest tooth decay progress (application of fluoride varnish, supervised monitoring of dental plaque control and clinical outcomes)[38].

As the RCT unfolded, it was discovered that practices in the intervention arm were not implementing the preventive protocols uniformly. Why had the outcomes of these systematically implemented protocols been so different? This question was the starting point for our grounded theory study. We aimed to understand how the protocols had been implemented, including the conditions and consequences of variation in the process. We hoped that such understanding would help us to see how the norms of Australian private dental practice as regards to tooth decay could be moved away from drilling and filling and towards evidence-based preventive care.

Designing this grounded theory study
Figure 1 illustrates the steps taken during the project that will be described below from points A to F.

A. An open beginning and research questions
Grounded theory studies are generally focused on social processes or actions: they ask about what happens and how people interact. This shows the influence of symbolic interactionism, a social psychological approach focused on the meaning of human actions [39]. Grounded theory studies begin with open questions, and researchers presume that they may know little about the meanings that drive the actions of their participants. Accordingly, we sought to learn from participants how the MPP process worked and how they made sense of it. We wanted to answer a practical social problem: how do dentists persist in drilling and filling early stages of tooth decay, when they could be applying preventive care?

We asked research questions that were open, and focused on social processes. Our initial research questions were:

- What was the process of implementing (or not-implementing) the protocols (from the perspective of dentists, practice staff, and patients)?
- How did this process vary?

B. Ethics approval and ethical issues
In our experience, medical researchers are often concerned about the ethics oversight process for such a flexible, unpredictable study design. We managed this process as follows. Initial ethics approval was obtained from the Human Research Ethics Committee at the University of Sydney. In our application, we explained grounded theory procedures, in particular the fact that they evolve. In our initial application we provided a long list of possible recruitment strategies and interview
questions, as suggested by Charmaz [15]. We indicated that we would make future applications to modify our protocols. We did this as the study progressed - detailed below. Each time we reminded the committee that our study design was intended to evolve with ongoing modifications. Each modification was approved without difficulty. As in any ethical study, we ensured that participation was voluntary, that participants could withdraw at any time, and that confidentiality was protected. All responses were anonymised before analysis, and we took particular care not to reveal potentially identifying details of places, practices or clinicians.

C. Initial, Purposive Sampling (before theoretical sampling was possible)
Grounded theory studies are characterised by theoretical sampling, but this requires some data to be collected and analysed. Sampling must thus begin purposively, as in any qualitative study. Participants in the previous MPP study provided our population [27]. The MPP included 22 private dental practices in NSW, randomly allocated to either the intervention or control group. With permission of the ethics committee; we sent letters to the participants in the intervention or control group. With permission of the ethics committee:

Table 1 Fundamental components of a grounded theory study

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>STAGE</th>
<th>DESCRIPTION</th>
<th>SOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness</td>
<td>Throughout the study</td>
<td>Grounded theory methodology emphasises inductive analysis. Deduction is the usual form of analytic thinking in medical research. Deduction moves from the general to the particular. It begins with pre-existing hypotheses or theories, and collects data to test those theories. In contrast, induction moves from the particular to the general; it develops new theories or hypotheses from many observations. Grounded theory particularly emphasises induction. This means that grounded theory studies tend to take a very open approach to the process being studied. The emphasis of a grounded theory study may evolve as it becomes apparent to the researchers what is important to the study participants.</td>
<td>[8] p1-3, 15,16,43-46, [12] p2-6, [15] p4-21</td>
</tr>
<tr>
<td>Analysing immediately</td>
<td>Analysis and data collection</td>
<td>In a grounded theory study, the researchers do not wait until the data are collected before commencing analysis. In a grounded theory study, analysis must commence as soon as possible, and continue in parallel with data collection, to allow theoretical sampling (see below).</td>
<td>[8] p12,13, 301, [12] p102, [15] p20</td>
</tr>
<tr>
<td>Coding and comparing</td>
<td>Analysis</td>
<td>Data analysis relies on coding - a process of breaking down data into much smaller components and labelling those components - and comparing - comparing data with data, case with case, event with event, code with code, to understand and explain variation in the data. Codes are eventually combined and related to one another - at this stage they are more abstract, and are referred to as categories or concepts.</td>
<td>[8] p80,81, 265-289, [12] p101-115, [15] p42-71</td>
</tr>
<tr>
<td>Memo-writing (sometimes also drawing diagrams)</td>
<td>Analysis</td>
<td>The analyst writes many memos throughout the project. Memos can be about events, cases, categories, or relationships between categories. Memos are used to stimulate and record the analysts’ developing thinking, including the comparisons made (see above).</td>
<td>[8] p245-264,281, 282,302, [12] p108,112, [15] p72-95</td>
</tr>
<tr>
<td>Theoretical sampling</td>
<td>Sampling and data collection</td>
<td>Theoretical sampling is central to grounded theory design. A theoretical sample is informed by coding, comparison and memo-writing. Theoretical sampling is designed to serve the developing theory. Analysis raises questions, suggests relationships, highlights gaps in the existing data and reveals what the researchers do not yet know. By carefully selecting participants and by modifying the questions asked in data collection, the researchers fill gaps, clarify uncertainties, test their interpretations, and build their emerging theory.</td>
<td>[8] p304, 305, 311, [12] p45-77, [15] p96-122</td>
</tr>
<tr>
<td>Theoretical saturation</td>
<td>Sampling, data collection and analysis</td>
<td>Qualitative researchers generally seek to reach ‘saturation’ in their studies. Often this is interpreted as meaning that the researchers are hearing nothing new from participants. In a grounded theory study, theoretical saturation is sought. This is a subtly different form of saturation, in which all of the concepts in the substantive theory being developed are well understood and can be substantiated from the data.</td>
<td>[8] p306, 281,611, [12] p111-113, [15] p114, 115</td>
</tr>
<tr>
<td>Production of a substantive theory</td>
<td>Analysis and interpretation</td>
<td>The results of a grounded theory study are expressed as a substantive theory, that is, as a set of concepts that are related to one another in a cohesive whole. As in most science, this theory is considered to be fallible, dependent on context and never completely final.</td>
<td>[8] p14,25, [12] p21-43, [15] p123-150</td>
</tr>
</tbody>
</table>
on their clinically measured risk of developing tooth decay: we selected some patients whose risk status had gotten better, some whose risk had worsened and some whose risk had stayed the same. This purposive sample was designed to provide maximum variation in patients’ adoption of preventive dental care.

**Initial Interviews**
One hour in-depth interviews were conducted. The researcher/interviewer (AS) travelled to a rural town in NSW where interviews took place. The initial 18 participants (one dentist, five dental assistants and 12 patients) from Dental Practice 1 were interviewed in places
convenient to them such as the dental practice, community centres or the participant’s home.

Two initial interview schedules were designed for each group of participants: 1) dentists and dental practice staff and 2) dental patients. Interviews were semi-structured and based loosely on the research questions. The initial questions for dentists and practice staff are in Additional file 1. Interviews were digitally recorded and professionally transcribed. The research location was remote from the researcher’s office, thus data collection was divided into two episodes to allow for intermittent data analysis. Dentist and practice staff interviews were done in one week. The researcher wrote memos throughout this week. The researcher then took a month for data analysis in which coding and memo-writing occurred. Then during a return visit, patient interviews were completed, again with memo-writing during the data-collection period.

D. Data Analysis

Coding and the constant comparative method

Coding is essential to the development of a grounded theory [15]. According to Charmaz [[15], p46], ‘coding is the pivotal link between collecting data and developing an emergent theory to explain these data. Through coding, you define what is happening in the data and begin to grapple with what it means’. Coding occurs in stages. In initial coding, the researcher generates as many ideas as possible inductively from early data. In focused coding, the researcher pursues a selected set of central codes throughout the entire dataset and the study. This requires decisions about which initial codes are most prevalent or important, and which contribute most to the analysis. In theoretical coding, the researcher refines the final categories in their theory and relates them to one another. Charmaz’s method, like Glaser’s method [13], captures actions or processes by using gerunds as codes (verbs ending in ‘ing’); Charmaz also emphasises coding quickly, and keeping the codes as similar to the data as possible.

We developed our coding systems individually and through team meetings and discussions.

We have provided a worked example of coding in Table 2. Gerunds emphasise actions and processes. Initial coding identifies many different processes. After the first few interviews, we had a large amount of data and many initial codes. This included a group of codes that captured how dentists sought out evidence when they were exposed to a complex clinical case, a new product or technique. Because this process seemed central to their practice, and because it was talked about often, we decided that seeking out evidence should become a focused code. By comparing codes against codes and data against data, we distinguished the category of “seeking out evidence” from other focused codes, such as “gathering and comparing peers’ evidence to reach a conclusion”, and we understood the relationships between them. Using this constant comparative method (see Table 1), we produced a theoretical code: “making sense of evidence and constructing knowledge”. This code captured the social process that dentists went through when faced with new information or a practice challenge. This theoretical code will be the focus of a future paper.

Memo-writing

Throughout the study, we wrote extensive case-based memos and conceptual memos. After each interview, the interviewer/researcher (AS) wrote a case-based memo reflecting on what she learned from that interview. They contained the interviewer’s impressions about the participants’ experiences, and the interviewer’s reactions; they were also used to systematically question some of our pre-existing ideas in relation to what had been said in the interview. Table 3 illustrates one of those memos. After a few interviews, the interviewer/researcher also began making and recording comparisons among these memos.

We also wrote conceptual memos about the initial codes and focused codes being developed, as described by Charmaz [15]. We used these memos to record our thinking about the meaning of codes and to record our thinking about how and when processes occurred, how they changed, and what their consequences were. In these memos, we made comparisons between data, cases and codes in order to find similarities and differences, and raised questions to be answered in continuing interviews. Table 4 illustrates a conceptual memo.

At the end of our data collection and analysis from Dental Practice 1, we had developed a tentative model of the process of implementing the protocols, from the perspective of dentists, dental practice staff and patients. This was expressed in both diagrams and memos, was built around a core set of focused codes, and illustrated relationships between them.

E. Theoretical sampling, ongoing data analysis and alteration of interview route

We have already described our initial purposive sampling. After our initial data collection and analysis, we used theoretical sampling (see Table 1) to determine who to sample next and what questions to ask during interviews. We submitted Ethics Modification applications for changes in our question routes, and had no difficulty with approval. We will describe how the interview questions for dentists and dental practice staff evolved, and how we selected new participants to allow development of our substantive theory. The patients’
Table 2 Coding process

<table>
<thead>
<tr>
<th>Raw data</th>
<th>Initial coding</th>
<th>Focused coding</th>
<th>Theoretical coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q. What did you take into account when you decided to buy this new technology?</td>
<td>Deciding to buy based on cost, reliability</td>
<td>Seeking out evidence</td>
<td>The process of making sense of evidence and construction of knowledge</td>
</tr>
<tr>
<td>What did we.. we looked at cost, we looked at reliability and we sort of, we compared a few different types, talked to some people that had them.</td>
<td>Talking to dental colleagues on internet sites</td>
<td>Gathering and comparing peers’ evidence to reach a conclusion</td>
<td></td>
</tr>
<tr>
<td>Q. When you say you talked to some people who were they?</td>
<td>Comparing their experiences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some dental colleagues. There’s a couple of internet sites that we talked to some people... people had tried out some that didn’t work very well.</td>
<td>Looking at literature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q. So in terms of materials either preventive materials or restorative materials; what do you take into account when you decide which one to adopt?</td>
<td>Doing my own little research</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well, that’s a good question. I don’t know. I suppose we [laughs] look at reliability. I suppose I’ve been looking at literature involved in it so I quite like my own little research about that, because I don’t really trust the research that comes with the product and once again what other dentists are using and what they’ve been using and they’re happy with. I’m finding the internet, some of those internet forums are actually quite good for new products.</td>
<td>Not trusting research that comes with commercial products</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interview schedule and theoretical sampling followed similar procedures.

**Evolution of theoretical sampling and interview questions**

We now had a detailed provisional model of the successful process implemented in Dental Practice 1. Important core focused codes were identified, including practical/financial, historical and philosophical dimensions of the process. However, we did not yet understand how the process might vary or go wrong, as implementation in the first practice we studied had been described as seamless and beneficial for everyone. Because our aim was to understand the process of implementing the protocols, including the conditions and consequences of variation in the process, we needed to understand how implementation might fail. For this reason, we theoretically sampled participants from Dental Practice 2, where uptake of the MPP protocols had been very limited according to data from the RCT trial.

We also changed our interview questions based on the analysis we had already done (see Additional file 2). In our analysis of data from Dental Practice 1, we had learned that “effectiveness” of treatments and “evidence” both had a range of meanings. We also learned that new technologies - in particular digital x-rays and intra-oral cameras - had been unexpectedly important to the process of implementing the protocols. For this reason, we added new questions for the interviews in Dental Practice 2 to directly investigate “effectiveness”, “evidence” and how dentists took up new technologies in their practice.

Then, in Dental Practice 2 we learned more about the barriers dentists and practice staff encountered during the process of implementing the MPP protocols.

Table 3 Case-based memo

<table>
<thead>
<tr>
<th>Memo written after interviewing a practice manager</th>
</tr>
</thead>
</table>
| This was quite an eye opening interview in the sense that the practice manager was very direct, practical and open. In his accounts, the bottom line is that this preventive program is not profitable; dentists will do it for giving back to the community, not to earn money from it. I am so glad we had this interview; otherwise I am not sure if someone would be so up front about it. So, my question really is, is that the reason why dentists have not adopted it in other practices? And what about other patients who come here, who are not enrolled in the research program, does the dentist- in-charge treat them all as being part of the program or it was just an impression from the interview and what I saw here during my time in the practice... or will the dentist continue doing it in the next future?

I definitely learned that dentistry in private practice is a business, at the end of the day a target has to be achieved, and the dentist is driven by it. During the dentist’s interview, there was a story about new patients being referred to the practice because the way they were treating patients now; but right now I am just not sure, I really need to check that... need to go back and ask the dentist about it, were there any referrals or not?

Because this would create new revenue for the practice and the practice manager would surely be happy about it. On the other hand, it is interesting that the practice manager thinks that having a hygienist who was employed few months ago is the way to adopt the preventive program; she should implement it, freeing the dentist to do more complex work. But in reality, when I interviewed the hygienist I learned that she does not want to change to adopt the program, she is really focused on what she has been doing for a while and trust her experience a lot! So I guess, the dentist in charge might be going through a new changing process, different from what happen when the MPP protocols were first tried in this practice; this is another point to check on the next interview with the dentist. I just have this feeling that somehow the new staff (hygienist) is really important for this practice to regain and maintain profit throughout the adoption of preventive protocols but there are some personality clashes happening along the way.
confirmed and enriched our understanding of dentists’ processes for adopting technology and producing knowledge, dealing with complex cases and we further clarified the concept of evidence. However there was a new, important, unexpected finding in Dental Practice 2. Dentists talked about "unreliable" patients - that is, patients who were too unreliable to have preventive dental care offered to them. This seemed to be a potentially important explanation for non-implementation of the protocols. We modified our interview schedule again to include questions about this concept (see Additional file 3) leading to another round of ethics approvals. We also returned to Practice 1 to ask participants about the idea of an "unreliable" patient.

Dentists’ construction of the "unreliable" patient during interviews also prompted us to theoretically sample for "unreliable" and "reliable" patients in the following round of patients’ interviews. The patient question route was also modified by the analysis of the dentists’ and practice staff data. We wanted to compare dentists’ perspectives with the perspectives of the patients themselves. Dentists were asked to select “reliable” and “unreliable” patients to be interviewed. Patients were asked questions about what kind of services dentists should provide and what patients valued when coming to the dentist. We found that these patients (10 reliable and 7 unreliable) talked in very similar ways about dental care. This finding suggested to us that some deeply-held assumptions within the dental profession may not be shared by dental patients. 

At this point, we decided to theoretically sample dental practices from the non-intervention arm of the MPP study. This is an example of the ‘openness’ of a grounded theory study potentially subtly shifting the focus of the study. Our analysis had shifted our focus: rather than simply studying the process of implementing the evidence-based preventive protocols, we were studying the process of doing prevention in private dental practice. All participants seemed to be revealing deeply held perspectives shared in the dental profession, whether or not they were providing dental care as outlined in the MPP protocols. So, by sampling dentists from both intervention and control group from the previous MPP study, we aimed to confirm or disconfirm the broader reach of our emerging theory and to complete inductive development of key concepts. Theoretical sampling added 12 face to face interviews and 10 telephone interviews to the data. A total of 40 participants between the ages of 18 and 65 were recruited. Telephone interviews were of comparable length, content and quality to face to face interviews, as reported elsewhere in the literature [40].

F. Mapping concepts, theoretical memo writing and further refining of concepts

After theoretical sampling, we could begin coding theoretically. We fleshed out each major focused code, examining the situations in which they appeared, when they changed and the relationship among them. At time of writing, we have reached theoretical saturation (see Table 1). We have been able to determine this in several ways. As we have become increasingly certain about our central focused codes, we have re-examined the data to find all available insights regarding those codes. We have drawn diagrams and written memos. We have looked rigorously for events or accounts not explained by the emerging theory so as to develop it further to explain all of the data. Our theory, which is expressed as a set of concepts that are related to one another in a cohesive way, now accounts adequately for all the data we have collected. We have presented the developing theory to specialist dental audiences and to the participants, and have found that it was accepted by and resonated with these audiences.

<table>
<thead>
<tr>
<th>Table 4 Conceptual memo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Believing + Embracing + Developing = Adapting?</td>
</tr>
</tbody>
</table>

In these dental practices the adaptation to preventive protocols was all about believing in this new approach to manage dental caries and in themselves as professionals. New concepts were embraced and slowly incorporated into practice. Embracing new concepts/paradigms/systems and abandoning old ones was quite evident during this process (old concepts = dentistry restorative model; new concepts = non-surgical approach).

This evolving process involved feelings such as anxiety, doubt, determination, confidence, and reassurance. The modification of practices was possible when dentists-in-charge felt that perhaps there was something else that would be worth doing, something that might be a little different from what was done so far. The responsibility to offer the best available treatment might have triggered this reasoning. However, there are other factors that play an important role during this process such as dentist's personal features, preconceived notions, dental practice environment, and how dentists combine patients’ needs and expectations while making treatment decisions. Finding the balance between preventive non-surgical treatment (curing of disease) and restorative treatment (making up for lost tissues) is an every moment challenge in a profitable dental practice. Regaining profit, reassessing team work and surgery logistics, and mastering the scheduling art to maximize financial and clinical outcomes were important practical issues tackled in some of these practices during this process.

These participants talked about learning and adapting new concepts to their practices and finally never going back the way it was before. This process brought positive changes to participants' daily activities. Empowerment of practice staff made them start to enjoy more their daily work (they were recognized by patients as someone who was truly interested in delivering the best treatment for them). Team members realized that there were many benefits to patients and to staff members in implementing this program, such as, professional development, offering the best care for each patient and job satisfaction.
We have used these procedures to construct a detailed, multi-faceted model of the process of incorporating prevention into private general dental practice. This model includes relationships among concepts, consequences of the process, and variations in the process. A concrete example of one of our final key concepts is the process of “adapting to” prevention. More commonly in the literature writers speak of adopting, implementing or translating evidence-based preventive protocols into practice. Through our analysis, we concluded that what was required was ‘adapting to’ those protocols in practice. Some dental practices underwent a slow process of adapting evidence-based guidance to their existing practice logistics. Successful adaptation was contingent upon whether (1) the dentist-in-charge brought the whole dental team together - including other dentists - and got everyone interested and actively participating during preventive activities; (2) whether the physical environment of the practice was re-organised around preventive activities, (3) whether the dental team was able to devise new and efficient routines to accommodate preventive activities, and (4) whether the fee schedule was amended to cover the delivery of preventive services, which hitherto was considered as unproductive time.

Adaptation occurred over time and involved practical, historical and philosophical aspects of dental care. Participants transitioned from their initial state - selling restorative care - through an intermediary stage - learning by doing and educating patients about the importance of preventive care - and finally to a stage where they were offering patients more than just restorative care. These are examples of ways in which participants did not simply adopt protocols in a simple way, but needed to adapt the protocols and their own routines as they moved toward more preventive practice.

The quality of this grounded theory study

There are a number of important assurances of quality in keeping with grounded theory procedures and general principles of qualitative research. The following points describe what was crucial for this study to achieve quality.

During data collection

1. All interviews were digitally recorded, professionally transcribed in detail and the transcripts checked against the recordings.
2. We analysed the interview transcripts as soon as possible after each round of interviews in each dental practice sampled as shown on Figure 1. This allowed the process of theoretical sampling to occur.
3. Writing case-based memos right after each interview while being in the field allowed the researcher/interviewer to capture initial ideas and make comparisons between participants’ accounts. These memos assisted the researcher to make comparison among her reflections, which enriched data analysis and guided further data collection.
4. Having the opportunity to contact participants after interviews to clarify concepts and to interview some participants more than once contributed to the refinement of theoretical concepts, thus forming part of theoretical sampling.
5. The decision to include phone interviews due to participants’ preference worked very well in this study. Phone interviews had similar length and depth compared to the face to face interviews, but allowed for a greater range of participation.

Answering our research questions

We developed a detailed model of the process of adapting preventive protocols into dental practice, and analysed the variation in this process in different dental practices. Transferring evidence-based preventive protocols into these dental practices entailed a slow process of adapting the evidence to the existing practice logistics. Important practical, philosophical and historical elements as well as barriers and facilitators were present during a complex adaptation process. Time was needed to allow dentists and practice staff to go through this process of slowly adapting their practices to this new way of working. Patients also needed time to incorporate home care activities and more frequent visits to dentists into their daily routines. Despite being able to adapt or not, all dentists trusted the concrete clinical evidence that they have produced, that is, seeing results in their patients mouths made them believe in a specific treatment approach.

Concluding remarks

This paper provides a detailed explanation of how a study evolved using grounded theory methodology (GTM), one of the most commonly used methodologies in qualitative health and medical research [[8], p47]. In 2007, Bryant and Charmaz argued:

‘Use of GTM, at least as much as any other research method, only develops with experience. Hence the failure of all those attempts to provide clear,
mechanistic rules for GTM: there is no ‘GTM for dummies’. GTM is based around heuristics and guidelines rather than rules and prescriptions. Moreover, researchers need to be familiar with GTM, in all its major forms, in order to be able to understand how they might adapt it in use or revise it into new forms and variations.’ [[8], p17].

Our detailed explanation of our experience in this grounded theory study is intended to provide, vicariously, the kind of ‘experience’ that might help other qualitative researchers in medicine and health to apply and benefit from grounded theory methodology in their studies. We hope that our explanation will assist others to avoid using grounded theory as an ‘approving bumper sticker’ [10], and instead use it as a resource that can greatly improve the quality and outcome of a qualitative study.

Additional material

Additional file 1: Initial interview schedule for dentists and dental practice staff file containing initial interview schedule for dentists and dental practice staff.

Additional file 2: Questions added to the initial interview schedule for dentists and dental practice staff file containing questions added to the initial interview schedule.

Additional file 3: Questions added to the modified interview schedule for dentists and dental practice staff file containing questions added to the modified interview schedule.

Abbreviations

GTM: grounded theory methods; MPP: Monitor Dental Practice Program; NSW: New South Wales; RCT: Randomized Controlled Trial.

Acknowledgements

We thank dentists, dental practice staff and patients for their invaluable contributions to the study. We thank Emeritus Professor Miles Little for his time and wise comments during the project. Funding The authors received financial support for the research from the following funding agencies: University of Sydney Postgraduate Award 2009, The Oral Health Foundation, University of Sydney; Dental Board New South Wales; Australian Dental Research Foundation; National Health and Medical Research Council Project Grant 632715.

Author details

1Centre for Values, Ethics and the Law in Medicine, University of Sydney, Sydney, New South Wales, Australia. 2Population Oral Health, Faculty of Dentistry, University of Sydney, Sydney, New South Wales, Australia.

Authors’ contributions

All authors have made substantial contributions to conception and design of this study. AS carried out data collection, analysis, and interpretation of data. SMC made substantial contribution during data collection, analysis and data interpretation. AS, SMC, RWE, and AB have been involved in drafting the manuscript and revising it critically for important intellectual content. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Received: 17 June 2011 Accepted: 9 September 2011 Published: 9 September 2011

References

Additional file 1

Initial interview schedule for dentists and dental practice staff

- What do you think is the place of prevention in dental practice?
- Tell me about your experience of implementing this preventive approach to manage tooth decay. *
- Take me through your process of interaction with patients regarding the implementation of the preventive protocols.
  - At what stage did you get involved?
  - Explain the process (case example)
  - What was your specific role?
- When you look back on the implementation process, are there any other events that stand out in your mind? How did the event affect what happened? How did you respond to it?
- How easily were you able to implement the preventive protocols within this practice?
  - How did all staff working in the practice respond to the implementation? What were some of the issues?
  - What positive changes have occurred in this dental practice since the program was implemented?
  - What negative changes, if any, have occurred in this dental practice since the program was implemented?
- Given your experiences, do you have any suggestions as to how we could better implement a program such as this, both within your practice and to the wider dental community?
- Is there something else you think I should know to understand this implementation process?*
- Is there something you would like to ask me?*

* Source of questions Charmaz [14, p31].
Questions added to the initial interview schedule for dentists and dental practice staff

- What would a typical day in this surgery be like? What do you spend most of your time doing?
- Can you think back to a new treatment or technology that you’ve adopted in your surgery recently. What did you take into account when you decided to adopt it in your regular practice? What did influence your decision to adopt it?
- If you think now about a typical patient, when you are making a decision about how to treat a patient, what are the things that you would normally consider?
- From your perspective, what are the priorities of this dental practice?
- What are your priorities as a dentist/dental hygienist/dental therapist/dental practice staff?
- There is a lot of talk about preventive dentistry. How do you feel about the idea of preventive dental practice?
- What are the important things that you consider when deciding to intervene either by drilling and filling or by starting a preventive program with a patient?
- What do you think a dentist/dental hygienist/dental therapist role should be in a practice?
- In an ideal world, what do you think a dentist/dental hygienist/dental therapist should be able to do for their patients?
- To what extent is it possible to achieve this in the real world?
Questions added to the modified interview schedule for dentists and dental practice staff

- Have you ever made a big change in the way you practice dentistry or to the services you provide? Could you tell me about that change?
- In academic dentistry, we often say that the ideal would be to offer preventive treatment to everyone. How possible is this in the real world? [probe: are there patients who are ideal for prevention and patients who are not ideal?]
- What sorts of preventive services are offered to patients in this practice?
- Think back to when you first agreed to participate in the MPP: what led you to agree to participate?
- Have any aspects of the MPP carried over into your everyday practice now? [if yes, probe why those aspects; if not probe can you tell me about that]
- Think about the MPP preventive protocols. What would it take to make it possible for you to practice like that all the time? [Probe: whether patients will come back; whether the practice can survive financially]
- How likely is it that you would ever practice like that all of the time? [Probe for more info]
- How do you weigh up the financial aspects of practice and the clinical aspects of practice?
- Now I want you to think back to the last time that you decided to do a filling. Could you tell me about that patient? What was it about that patient that you had to fill the tooth?
- And now could you think of the most recent time when you saw a patient that you decided not to do a filling but to do intensive preventive care to manage their tooth decay. Could you tell me how and why you made that decision?
CHAPTER THREE – How do dentists understand evidence and adopt it in practice?

How do dentists understand evidence and adopt it in practice?
Alexandra Sbaraini, Stacy M Carter and R Wendell Evans
Health Education Journal 2012 71: 195 originally published online 5 January 2012
DOI: 10.1177/0017896911434427

The online version of this article can be found at:
http://hej.sagepub.com/content/71/2/195

Published by:
SAGE
http://www.sagepublications.com

Additional services and information for Health Education Journal can be found at:

Email Alerts: http://hej.sagepub.com/cgi/alerts
Subscriptions: http://hej.sagepub.com/subscriptions
Reprints: http://www.sagepub.com/journalsReprints.nav
Permissions: http://www.sagepub.com/journalsPermissions.nav
Citations: http://hej.sagepub.com/content/71/2/195.refs.html

Version of Record - Mar 1, 2012
OnlineFirst Version of Record - Jan 5, 2012
What is This?
How do dentists understand evidence and adopt it in practice?

Alexandra Sbarainia,b, Stacy M Cartera and R Wendell Evansb
aUniversity of Sydney, Centre for Values, Ethics and the Law in Medicine, Sydney Medical School, Australia
bUniversity of Sydney, Population Oral Health, Faculty of Dentistry, Australia

Abstract
Although there is now a large evidence-based dentistry literature, previous investigators have shown that dentists often consider research evidence irrelevant to their practice. To understand why this is the case, we conducted a qualitative study.

Objective: Our aim was to identify how dentists define evidence and how they adopt it in practice.

Methods: A qualitative study using grounded theory methodology was conducted. Ten dentists working in eight dental practices were interviewed about their experience and work processes while adopting evidence-based preventive care. Analysis involved transcript coding, detailed memo writing, and data interpretation.

Results: Findings revealed that dentists’ direct observations – referred to as clinical evidence – provided the most tangible and trusted evidence in practice and during discussions with colleagues. Dentists described a detailed process used to gather, compare and implement clinical evidence. This process began when they were exposed to novelty in daily practice and proceeded through self-driven testing, producing clinical or tangible evidence that clinicians could use in practice.

Conclusion: Based on these findings, we propose an alternative to the linear form of knowledge transfer commonly represented in the literature.

Keywords
dentists, evidence-based dentistry, grounded theory, qualitative research

Introduction
Many articles have been written about evidence-based dentistry (EBD).1 Models for translating evidence into clinical practice have been proposed, and potential barriers to adopting EBD have been identified.2–15 The EBD literature contains common themes. It suggests that dentists experience: (1) difficulties in interpreting research; (2) scepticism towards the quality of research...
evidence; and (3) a belief that research does not address important clinical questions and so is not relevant to clinical practice.\textsuperscript{1,5–15} However, there has been little empirical analysis of how dentists define evidence and how it may be adopted in practice.

This article addresses two research questions: (1) what kind of evidence is relevant to dentists? And (2) how do dentists adopt that evidence in daily practice? Throughout the article we explain how a group of dentists defined evidence and adopted it in their practices. The findings presented here form part of a larger qualitative study examining the process of adopting or not adopting evidence-based preventive protocols to manage dental caries in the private dental practice setting.

Methods

Background

This study was built on a previous Australian randomized controlled trial (RCT).\textsuperscript{16} Intervention practices in the RCT were provided with the Caries Management System (CMS) evidence-based preventive protocols to guide their treatment of dental caries.\textsuperscript{17} During the RCT, the numbers of decayed, missing and filled teeth (DMFT) were monitored. Outcomes in the intervention practices varied widely; the larger qualitative study was designed to explain that variation. Dentists, members of dental teams and patients were recruited from the RCT.

Ethics approval and ethical issues

Initial ethics approval was obtained from the Human Research Ethics Committee at the University of Sydney. As in any ethical study, we ensured that participation was voluntary, that participants could withdraw at any time, and that confidentiality was protected. All responses were anonymized before analysis, and we took particular care not to reveal potentially identifying details of places, practices or clinicians. Prior to being interviewed, all participants had the study explained to them and signed a consent form.

Research design

Qualitative research methods are routinely used to study the meanings of health and illness and processes of health care and self-care.\textsuperscript{18,19} Qualitative methods are increasingly common in dentistry, contributing novel insights to dental research.\textsuperscript{20,21} Charmaz’s grounded theory methodology\textsuperscript{22} was employed to examine the process of adopting evidence-based preventive care in dental practices.\textsuperscript{23} Grounded theory is one of the oldest and most-used methodologies in qualitative health research.\textsuperscript{24, p. 47} Grounded theory uses a systematically applied set of procedures to generate rather than test theory, to understand participants’ points of view rather than test pre-existing hypotheses.\textsuperscript{22–24}

Sample recruitment

In grounded theory studies, constant analysis of the data guides sampling decisions.\textsuperscript{22–24} Participants in the previous RCT\textsuperscript{16} 22 private dental practices in New South Wales (NSW), Australia – provided our population. We invited dentists from this population, by letter, to participate in this qualitative study.

Clinical outcomes in the dental practices following the CMS protocols\textsuperscript{17} varied from substantial to little DMFT reductions during the previous RCT: dentists were recruited from these practices at
all points in this range. We were interested not just in how the protocols from the RCT were adopted, but in dentists’ adoption of any preventive protocols or guidelines. Thus dentists from control practices in the previous RCT were recruited to examine how their adoption of new evidence was similar or different from the intervention practices. A total of 10 dentists working in eight dental practices were recruited (Table 1).

**Sample size and saturation.** Sample size in qualitative studies is determined by reaching a complete understanding of the problem being studied – referred to as saturation – and not by statistical power considerations. Saturation is determined by the data analyst. When analysts find that new interviews do not add new information to the analysis – that is, become repetitive with prior interviews – and that central concepts are fully understood, they determine that they have reached saturation. In this study, the last three dentists interviewed confirmed our analysis rather than adding new concepts. We then ceased data collection because our understanding was well supported by the existing data. It is considered unethical to continue recruiting after saturation, as the additional participants will not contribute significantly to the knowledge produced.

As in all qualitative research, this study was not designed to estimate proportions in a wider population, quantify relationships between pre-determined variables, or provide a representative or average view. Instead, this study intended to explain the variation in participants’ practices and understandings. For this reason we recruited a smaller sample compared to those in quantitative studies, and we recruited informative participants rather than statistically-representative participants.

**Interviews**

Participants were interviewed for approximately one hour in locations convenient to them such as dental practices, community centres or homes. Some preferred to be interviewed over the phone when the same format was used as for face-to-face interviews. Sturges and Hanrahan have reported that telephone interviews give the same in-depth data as face-to-face interviews. Semi-structured interviews were based on the research questions, were digitally recorded, professionally transcribed in detail, and the transcripts checked against the recordings.

During interviews, participants were encouraged to talk at length, to tell their story of adopting evidence, using new technologies or of learning to work preventively, and to explain what these processes meant to them. For example, all interviews started with an invitation to describe a ‘typical day’ in the practice, and then progressed with specific questions about participants’ experiences of adopting evidence in practice. We found that we did not need to prompt dentists to talk about

<table>
<thead>
<tr>
<th>Site</th>
<th>Professionals</th>
<th>Previous RCT group</th>
<th>Clinical experience (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental practice 1</td>
<td>1 dentist</td>
<td>intervention</td>
<td>25</td>
</tr>
<tr>
<td>Dental practice 2</td>
<td>3 dentists</td>
<td>intervention</td>
<td>10 to 30</td>
</tr>
<tr>
<td>Dental practice 3</td>
<td>1 dentist</td>
<td>control</td>
<td>20</td>
</tr>
<tr>
<td>Dental practice 4</td>
<td>1 dentist</td>
<td>control</td>
<td>25</td>
</tr>
<tr>
<td>Dental practice 5</td>
<td>1 dentist</td>
<td>control</td>
<td>23</td>
</tr>
<tr>
<td>Dental practice 6</td>
<td>1 dentist</td>
<td>control</td>
<td>20</td>
</tr>
<tr>
<td>Dental practice 7</td>
<td>1 dentist</td>
<td>intervention</td>
<td>25</td>
</tr>
<tr>
<td>Dental practice 8</td>
<td>1 dentist</td>
<td>intervention</td>
<td>28</td>
</tr>
</tbody>
</table>
evidence as they talked about evidence constantly. The interview questions that particularly generated talk about evidence were:

- Have you ever made a big change in the way you practice dentistry or to the services you provide? Could you tell me about that change?
- Can you think back to a new treatment or technology that you have adopted in your surgery recently. What did you take into account when you decided to adopt it in your regular practice? What did influence your decision to adopt it?
- What kind of preventive services do you usually have in the practice to offer? How did you implement these preventive services? Why did you do so?
- When you are making a decision about how to treat that patient, what are the things that you normally consider?

Participants from the control practices were asked similar questions about evidence and technologies they had applied. Dentists interpreted and answered these questions in relation to the meaning of evidence and how they used evidence in practice. As the study progressed, our understanding about what dentists considered ‘evidence’ and how they adopted it in practice began to consolidate and we developed a theoretical framework to explain this process. All dentists were interviewed more than once which contributed to the refinement of theoretical concepts.

Data analysis

Charmaz’s iteration of the constant comparative method was used during the data analysis. This involved coding of interview transcripts, detailed memo writing and drawing diagrams. The transcripts were analyzed as soon as possible after each round of interviews in each dental practice. All researchers saw detailed excerpts from the data and two worked together in the development of the early coding frameworks. Coding was conducted primarily by AS, supported by team meetings and discussions when researchers compared their interpretations. The primary analyst also wrote extensive memos which documented the development of the codes, what they meant, how they varied, and how they related to the raw data.

A recent review highlighted the need to achieve ‘depth of insight and methodological rigour in qualitative dental research’; we believe that both were achieved during this study. Table 2 illustrates the points that were critical for this study to achieve rigour and quality.

Findings

Dentists were able to define what evidence meant to them and how they made sense of it, and were able to explain how they had been adopting evidence in practice over the years.

Defining evidence

The meaning of ‘evidence’ varied. One of the most important variations was the degree of tangibility of the evidence. When we analyzed participants’ accounts, we found that they talked about evidence as varying along a scale from most tangible to least tangible (Figure 1). In their accounts, clinical evidence – that is, concrete evidence seen in their patients’ mouths – was talked about as the most tangible. Tangible evidence was the most valued and the most trusted, both in the practice
Table 2. Rigour and quality during study

Throughout the study
1. It was important to acknowledge that, as researchers, we had some pre-existing concepts in mind due to our academic backgrounds in dentistry and public health, although we deliberately remained open to what participants would tell us about their experiences.

During data collection
1. Interviews were digitally recorded, professionally transcribed in detail and the transcripts checked against the recordings.
2. Interview transcripts were analyzed as soon as possible after each round of interviews in each dental practice sampled.
3. By carefully selecting participants and by modifying the questions asked during data collection, we filled gaps, clarified uncertainties, and tested our interpretations.
4. Writing case-based memos right after each interview while being in the field allowed the researcher/interviewer to capture initial ideas and make comparisons between participants’ accounts. These memos assisted the researcher to make comparisons among her reflections, which enriched data analysis and guided further data collection.
5. Having the opportunity to contact participants after interviews to clarify concepts and to interview dentists more than once contributed to the refinement of concepts.
6. The decision to include phone interviews due to participants’ preference worked very well. Phone interviews had similar length and depth compared to the face-to-face interviews, but allowed for a greater range of participation.

During data analysis
1. Detailed analysis records were kept which made it possible to write an explanatory paper.
2. The use of the constant comparative method enabled: (1) the concept of evidence to be explained; and (2) the analysis to produce not just a description but a model, in which depth of insight about the process of making sense of evidence was gained.
3. All researchers supported analysis activities; a regular meeting of the research team was convened to discuss and contextualize emerging interpretations, introducing a wide range of disciplinary perspectives.

Figure 1. Scale of evidence

Most Tangible/Most Trusted

- Concrete evidence in patients’ mouths
  ‘A lot of my evidence is based on my clinical experience and on what I have seen in patients’ mouths and feel will work on that particular patient’, Dentist

- Peers’ and specialist dentists’ experience (conferences, continuing education courses)
  ‘The hardest thing for human beings is to change anything and I guess I would be talking to my peers, “Have you tried this? What have you found?” Tell me their experience and what they’ve discovered and their evidence to support or not’, Dentist

- Research done in private practice
  ‘I think it’s an important thing for the research to be based in private practice. I think that’s a better indication of dentistry really than hospital based research’, Dentist

Least Tangible/Least Trusted

- Controlled clinical trials results
  ‘Research results from controlled trials that I read in journals backs up what I am doing; and justify that I am on the right track; there might be a slight difference but most of it is supporting what I already do’, Dentist

- Academic lecturers and international speakers
  ‘[The ideas presented by international lectures are not always relevant because]…on Monday morning when you’re going out to your office, and you can do what the lecturer was talking about on the first of the patients. Then, the moment you start running a bit late, and you’re under pressure again, you go back to walking the path of least resistance’, Dentist

- Research that comes with commercial products
  ‘I don’t really trust the research that comes with the product’, Dentist
setting and during discussions with colleagues. Dentists said that seeing the rate of dental caries incidence ‘plummeting in patients’ mouths’ or caries lesions ‘vanishing on x-rays’ – visual concrete evidence – led them to believe in specific preventive materials or treatment approaches. Treatment decisions were guided by this concrete clinical evidence, accrued over years of clinical experience.

If dentists had not yet experimented with a certain material or technique in their patients’ mouths, they would ask their peers about it or get information about it while attending continuing education courses. Thus their peers’ clinical evidence could be considered the next most tangible evidence, and would inform their decision to try a new material. However, dentists trusted some colleagues more than others. The most trusted colleagues were friends and specialist dentists who participated in the same study group. Key opinion leaders who presented continuing education courses were also trusted, provided they were also practicing dentists.

Dentists associated research done in private practice with ‘real world’ dentistry. They reported that research conducted in the private practice setting answered the clinical problems important to their daily practice better than results from hospital-based trials. Clinical trial results were defined as the least tangible and least trusted evidence. Clinical trial results were only interesting when they confirmed familiar procedures that dentists had already tested and accepted in their own practices: that is, they were convenient when they supported what dentists already knew, but were otherwise considered irrelevant. The advice of international speakers and non-clinical dental academics was not considered tangible and trustworthy. Dentists felt that non-clinical dental academics did not share their clinical experiences and did not understand the hurdles they faced in practice.

**The process of making sense of evidence and construction of knowledge**

Dentists also described a process of making sense of evidence during interactions with colleagues and through testing evidence in their own practices (Figure 2).

This process began when dentists were exposed to a complex case, a new product or technique, or a new treatment approach. For example, a common problematic situation described by these participants was when a patient at high risk of developing dental caries presented with failing restorations. After many unsuccessful attempts to solve that situation, dentists would initiate the process, described next. Alternatively, the process could be triggered when dentists read or heard about a new treatment approach or material that related to a common problem experienced on a daily basis. There were five stages within this process.

**Stage 1: Seeking out evidence.** Dentists sought out the most valued kind of evidence; that is, ‘tangible’ clinical evidence as experienced by their peers. They purposefully participated in certain activities to gather peers’ evidence, such as internet forums about dental products and techniques, study groups, and continuing education courses.

**Stage 2: Sharing evidence.** Dentists shared the evidence they gathered in stage 1 with their peers.

**Stage 3: Comparing peers’ evidence to reach a conclusion.** After gathering clinical experience/evidence from a number of peers, dentists would sort through the accumulated information and decide on what evidence was relevant and how it might solve the problem in their practice.

**Stage 4: Acting on my conclusions.** Dentists referred to this stage as ‘doing their own mini research’ as they finally trialled new products and/or techniques on their patients. Dentists felt the need to
produce their own clinical evidence. They had the perfect research setting – their own dental practice.

Stage 5: Seeing concrete results in my patients’ mouths. This ‘mini research’ produced tangible ‘findings’. Dentists saw concrete results in their patients’ mouths. For them, this was the most trusted type of evidence to support the use of a certain product or treatment approach in daily practice.

Each time dentists were exposed to a new product or treatment approach or to a complex case which they did not yet have concrete evidence about, they would re-enter this process of making sense of evidence, constructing knowledge via interaction with peers, and testing evidence in their own practices. Only at the end of this process would they routinely adopt the approach or technology in their practice.

Discussion

Our initial research questions were focused on the process of adopting evidence-based preventive protocols more or less successfully. However, our findings revealed that research evidence – the evidence from RCTs – was not the main focus for this group of dentists. The professionals valued and sought out evidence of a different kind; that is, tangible clinical evidence. Dentists described a detailed process used to gather, share, compare, implement and develop tangible clinical evidence in their practices. Dentists were sometimes challenged by complex cases, and this was one stimulus for seeking out and testing evidence. However, dentistry is also driven by new technologies: materials,
products and techniques. While participants said they did not trust the research claims by manufacturers of commercial products, new technologies created challenges for dentists and forced them to spend time talking to trusted colleagues and seeking evidence they could trust. Previous studies support our findings about dentists asking for advice from trusted colleagues when faced with clinical uncertainties.14, p.589, 15,p.1338

So, how should we use these findings to facilitate the uptake of evidence-based treatment in dental practice? Seeing clinical evidence – present, concrete and visible in patients’ mouths – was fundamental to these dentists’ way of working. RCTs will remain the key source of evidence about dental treatments, but this study suggests that their results may be better trusted and adapted into practice if the statistical results are presented alongside concrete clinical illustrations (e.g. case reports showing before and after scenarios; before and after patients’ x-rays, intra-oral photographs and study models). Seeing relevant tangible concrete evidence should encourage dentists to experiment with a technique or new material in their practices.

However, by itself this may not be sufficient to encourage uptake as participants only trusted peers and key opinion leaders. They were sceptical of non-clinical dental academics. Perhaps key opinion leaders – who are practising dentists – could be prevailed upon to address some of the important clinical questions that dentists want answered. For example, in the United States and Scandinavia, an important initiative has been the creation of the Dental Practice-Based Research Network (DPBRN) where clinical trials conducted in network practices are focused on answering issues that dentists themselves define as relevant.28 In this context, registered DPBRN dentists become clinical investigators and, therefore, have a direct role in the production of research evidence in their practices.29–31 Our study suggests that such clinical investigators will take on the role of trusted key opinion leaders who are uniquely placed to translate evidence for their peers.

Conclusion

This research shows that the promotion of evidence-based dental care is not a simple task. Dentists emphasized the importance of talking about real patients’ cases with colleagues. Dentists also valued having the opportunity to experiment with new products and techniques in order to see the evidence directly in patients’ mouths. They valued tangibility, and trusted evidence that they had generated and tested the most. Translating evidence to practising dentists in a way that reflects these values and practices may therefore be as important as the evidence itself.

This qualitative study suggests future directions for intervention research, which could test whether the implementation of EBD improves when evidence is: (1) made tangible; (2) communicated through trusted networks; and (3) experienced personally by seeing changes in the oral health of patients.

Acknowledgements

This study was funded by the National Health and Medical Research Council Project Grant 632715; Oral Health Foundation, University of Sydney; Dental Board New South Wales; and Australian Dental Research Foundation. We thank participants for their invaluable contributions.

References


Sbaraini A, Carter SM, Evans RW, Blinkhorn A. (Under review on Community Dentistry and Oral Epidemiology Journal)
Title: How do dentists and their teams incorporate evidence about preventive care? An empirical study.

Running title: Dentists and their teams’ adoption of preventive care.

Authors: Alexandra Sbaraini*,†, Stacy M. Carter*, R.Wendell Evans†, Anthony Blinkhorn*†

Institutional affiliations:

*Centre for Values, Ethics and the Law in Medicine, University of Sydney.

†Population Oral Health, Faculty of Dentistry, University of Sydney.

Address for correspondence:

Alexandra Sbaraini
Centre for Values, Ethics and the Law in Medicine, University of Sydney.
Address: Medical Foundation Building K25 The University of Sydney NSW 2006 Australia.
Email: alexandra.sbaraini@sydney.edu.au
Abstract and keywords

Objective: To identify how dentists and their teams adopt evidence-based preventive care.

Methods: A qualitative study using grounded theory methodology was conducted. We interviewed 23 participants working in eight dental practices about their experience and work processes while adopting evidence-based preventive care. During the study, Charmaz’s grounded theory methodology was employed to examine the social process of adopting preventive dental care in dental practices. Charmaz’s iteration of the constant comparative method was used during the data analysis. This involved coding of interview transcripts, detailed memo-writing and drawing diagrams. The transcripts were analysed as soon as possible after each round of interviews in each dental practice. Coding was conducted primarily by AS, supported by team meetings and discussions when researchers compared their interpretations.

Results: Participants engaged in a slow process of adapting evidence-based protocols and guidelines to the existing logistics of the practices. This process was influenced by practical, philosophical and historical aspects of dental care, and a range of barriers and facilitators. In particular, dentists spoke spontaneously about two deeply held “rules” underpinning continued restorative treatment, which acted as barriers to provide preventive care: 1) dentists believed that some patients were too “unreliable” to benefit from prevention; and 2) dentists believed that
patients thought that only tangible restorative treatment offered “value for money”. During the adaptation process, some dentists and teams transitioned from their initial state – selling restorative care – through an intermediary stage – learning by doing and educating patients about the importance of preventive care – and finally to a stage where they were offering patients more than just restorative care. Resources were needed for the adaptation process to occur, including: the ability to maintain the financial viability of the practice, appropriate technology, time, and supportive dental team relationships. Whether or not dentists were able to adapt to prevention, all participants believed in concrete clinical evidence; they looked for results in their patients’ mouths before believing in academic evidence-based preventive care options.

Conclusions: The findings from this study show that with considerable effort, motivation and coordination it is possible for dental practices to work against the dental ‘mainstream’ and implement prevention as their clinical norm. This study has shown that dental practice is not purely scientific but it includes cultural, social and economic resources that interfere with the provision of preventive care. (381 words)

**Key words:** qualitative research, dentists, evidence-based dentistry, prevention
**Introduction**

Evidence-based dentistry (EBD) is usually conceptualized as dentists making clinical decisions based on the integration of the best available research evidence, their clinical expertise and their patient’s values and needs (1-4). Since the beginning of the EBD movement in the late 1980s many models and frameworks have been proposed for embedding EBD in dental practice (1-5).

Most researchers in this area have focused on the facilitators and barriers to implementing EBD in practice (6-17). The published research suggests that dentists are apprehensive and fear losing autonomy, which delays the adoption of EBD in practice (6, 8, 9, 13). Dentists claim that they lack time to seek out research evidence, and argue that this evidence does not provide clear answers to important clinical questions (2, 6, 8, 9, 12-14). Some studies have suggested that dentists’ clinical performance does not change as a result of being provided with evidence-based knowledge (7, 15-17); others that evidence-based dental care is more likely to be adopted if already used by dentists’ peers (10). These studies reveal some variables associated with adoption or non-adoption of evidence in dental practice. However, few have investigated how evidence-based protocols are implemented in dental practices, or how dentists and their teams might experience that process.

In this paper, we report on a study of dentists and their teams’ uptake of evidence about preventive care in their practices, guided by two research questions:
• How do dentists and their teams incorporate evidence about preventive care into their practices?
• What happened during the process and how people interacted while adopting preventive care?

Methods
Background
This study was conducted in New South Wales (NSW), Australia, where more than 80 per cent of dentists work in private general dental practices (18), general dentists provide the majority of care and dental hygienists are employed in only a minority of practices (19). The majority of dentists are independent self-employed practitioners; they own their practices and lead their dental team. Many begin their practicing careers as associate dentists in private dental practices being remunerated by salary or commission before taking on a solo enterprise or forming partnerships with other experienced dentists.

In Australia, most people pay for their own dental treatments, or for the private health insurance that partly covers the cost of dental care (20). The majority of adults in NSW visit a private general dental practice for a check-up at least once a year on average (20). Most individuals visit the same private dental practitioner on a long term basis (21). This study focused on dentists and dental team members working in private practices, that is, in a typical Australian clinical context.
This study was built on a previous Australian randomized controlled trial (RCT) (22). Intervention practices in the RCT were provided with the Caries Management System (CMS) evidence-based preventive protocols to guide their treatment of dental caries (23). During that RCT, the numbers of decayed, missing and filled teeth (DMFT) were monitored. Outcomes in the intervention practices varied widely; this qualitative study was designed to explain that variation. This paper reports on findings from interviews with 10 dentists, two dental hygienists, nine dental assistants, and two practice managers from eight dental practices around NSW, Australia (Table 1).

**Research design**

In a previous article we described our sampling, data collection, data analysis and interpretation in detail (24). We employed Charmaz’s grounded theory methodology (25) to examine the process of adopting evidence-based preventive care in dental practices and to understand how participants made sense of this process while interacting with each other. Charmaz’s methodology suggests a systematically applied set of procedures to understand social processes, actions and interactions between individuals (25). Charmaz’s methodology led us to be interested in what it meant to dentists to practice dentistry in a certain way, how it felt to adopt new routines, what this process meant to participants, what happened during the process and how people interacted while adopting preventive care.
Grounded theory studies begin with open questions: researchers begin by assuming that they may know little about the meanings that drive the actions of their participants (25). Accordingly, we sought to learn from participants how the RCT process worked and how they made sense of it. We asked research questions that were open, and focused on social processes.

Our initial research questions were:

- What was the process of implementing (or not-implementing) the CMS protocols (from the perspective of dentists, members of dental team, and patients)?
- How did this process vary?

These questions were slightly altered during the course of the study, as we will discuss below. Charmaz’s grounded theory methodology (25) assisted us to develop a detailed model of the process of adapting preventive protocols into dental practice, and to analyse variation in this process in different dental practices.

**Ethics approval and ethical issues**

Initial ethics approval was obtained from the Human Research Ethics Committee at the University of Sydney. Appropriate to grounded theory procedures, our methods evolved during the study, and each evolution was approved via a modification application to the ethics committee. As in any ethical study, we
ensured that participation was voluntary, that participants could withdraw at any time, and that confidentiality was protected. All responses were anonymised before analysis, and we took particular care not to reveal potentially identifying details of places, practices or clinicians. Prior to being interviewed, all participants had the study explained to them and signed a consent form.

Sample
All qualitative research starts with purposive sampling: sampling the participants best-placed to answer the research questions. In grounded theory this is followed by theoretical sampling (25), in which constant analysis of the data guides further sampling decisions. Participants in the previous RCT (22) – 22 private dental practices in NSW – provided our population. We invited participants from this population, by letter, to participate in this qualitative study. Eight dental practices agreed to participate.

Interviews began with participants from Dental Practice 1, where substantial DMFT reductions were achieved in the RCT, providing the best possible access to the process of successfully implementing the protocols (24) After the analysis of the initial interviews, participants from Dental Practice 2 were theoretically sampled. In this practice the uptake of the preventive protocols had been very limited according to data from the RCT trial (24). This strategy allowed comparisons between two practices in which outcomes had been different and considered to be a proxy for the degree to which the preventive protocols had been implemented. After analysing interviews from Dental Practice 2, participants from
another six practices were recruited. This included two intervention practices that had achieved moderate DMFT reductions, for comparison with Dental Practices 1 and 2. It soon became apparent that some practices had followed, or continued to follow, other preventive protocols. In these practices, the interviewees compared their experiences in implementing the preventive protocols provided during the RCT with those of other protocols. Thus, professionals from four control practices in the RCT were sampled to examine the process of adopting preventive methods in general.

**Interviews**

Participants were interviewed for approximately one hour in locations convenient to them such as dental practices, community centers or homes. Some preferred to be interviewed over the phone, when the same format was used as for face to face interviews. Sturges and Hanrahan (26) have reported that telephone interviews give the same in-depth data as face to face interviews. Semi-structured interviews were based on the research questions, were digitally recorded, professionally transcribed in detail, and the transcripts were checked against the recordings.

Since the interview process was designed to gain an in-depth understanding of each participant’s experience of adopting prevention in their practices, participants were encouraged to talk at length, to tell their story of using protocols or of learning to work preventively, and to explain what this process meant to them. For example, all interviews started with an invitation to describe a “typical
day” in the practice, and then progressed with specific questions about participants’ experiences of implementing protocols such as, (1) “how easily were you able to implement preventive protocols in this practice?” and (2) “what did this implementation process entail?” Participants from the control practices were asked similar questions about preventive protocols or guidelines they had applied. As the study progressed, our understanding about how protocols were adopted began to consolidate and we developed a theoretical framework to explain the process. New interview questions were added to further investigate insights developed during the analysis of transcripts from earlier interviews (24). We had the opportunity to contact the participants again to clarify concepts. All dentists were interviewed more than once which contributed to the refinement of theoretical concepts.

Data analysis

Coding and the constant comparative method

Charmaz’s iteration (25) of the constant comparative method was used during the data analysis. This involved coding of interview transcripts, detailed memo writing and drawing diagrams. The transcripts were analyzed as soon as possible after each round of interviews in each dental practice. All researches saw detailed excerpts from the data and two worked together in the development of the early coding frameworks. Coding was conducted primarily by AS, supported by team meetings and discussions when researchers compared their interpretations.
Coding occurred in stages. In initial coding, we generated as many ideas as possible inductively from early data. In Charmaz’s form of grounded theory, codes take the form of gerunds (verbs ending in ‘ing’) which emphasises actions and processes. In focused coding, we pursued a selected set of central codes throughout the entire dataset and the study. This required decisions about which initial codes were most prevalent or important, and which contributed most to the analysis. In theoretical coding, we refined the final categories and related them to one another (25).

Memo-writing

The primary analyst also wrote extensive memos which documented the development of the codes, what they meant, how they varied, and how they related to the raw data (transcripts). Two types of memos were written: case-based and conceptual memos (24). Case-based memos were written after each interview – containing the interviewer’s impressions about the participants’ experiences and the interviewer’s reactions – memos were also used systematically to question some of our pre-existing ideas in relation to what had been said in the interview. Conceptual memos, on the other hand, were a form of (1) making sense of initial codes; (2) examining participants’ meanings; (3) understanding processes, including when they occurred and changed and what their consequences were. In these memos, we compared data in order to find similarities and differences. Ideas were systematically indexed in memos. This process raised new questions, which were investigated in continuing interviews.
Sample size and saturation

Qualitative data collection aims to achieve saturation, a state determined by the data analyst. When analysts find that new interviews do not add new information to the analysis – that is, become repetitive with prior interviews – and that central concepts are fully understood, they determine that they have reached saturation (27). In this study, the last three participants (three dentists) interviewed confirmed our analysis rather than adding new concepts. We then ceased data collection because our understanding was well-supported by the existing data. It is considered unethical to continue recruiting after saturation, as the additional participants will not contribute significantly to the knowledge produced (27).

During the study, dental hygienists were employed in two dental practices, but only those from Dental Practice 1 agreed to participate. Despite that, we were able to recruit 23 participants.

Methodological rigor

A recent review highlighted the need to achieve “depth of insight and methodological rigor in qualitative dental research” (28). Both were achieved during this study, in keeping with grounded theory procedures and general principles of qualitative research. Throughout the study it was important to acknowledge that as researchers we had some pre-existing concepts in mind due to our academic backgrounds in dentistry and public health, although we deliberately remained open to what participants would tell us about their experiences. By carefully selecting participants and by modifying the questions
asked during data collection, we filled gaps, clarified uncertainties, and tested our interpretations (24).

Results

Dental practices in this study appeared to be more or less typical of Australian private practices. All dental practices were located in central areas in either major cities or towns in NSW. A previous publication has illustrated in detail the combined characteristics of all eight dental practices that participated in this study and provided a model of how dental practices come to be oriented toward either preventive or restorative care (29). This paper presents a component of the analysis that contributed to that more abstract paper. Each practice was owned by a dentist-in-charge, who was the leader of the dental team and oversaw all activities within the practice; all practices had dental assistants who ensured the smooth running of the practice by supporting and implementing the dentist’s decisions; dental hygienists, practice managers and additional dentists were employed sometimes, but not always. In the absence of a practice manager, the dentist-in-charge shared this task with an accountant. The combination of staff was less important to the outcome than the way in which members of the dental team were led and organized to adapt to prevention. We found that when dental hygienists were employed and given responsibility for oral hygiene instruction and preventive maintenance visits, they freed dentists to concentrate on more complex restorative work and made preventive care more sustainable. Despite participating in a previous RCT, the majority of participating
dentists were not usually involved in research projects or dental faculties’ activities. However, they did attend continuing education and practice management courses regularly, and some participated in community projects with a focus on oral health; so they may have been more open to prevention than a ‘typical’ private practice dentist.

The patients in the study had private dental insurance; they were used to visiting the dentist once to twice a year for check-up appointments and for restorative treatment when needed. They were not used to being treated by a dental hygienist. These practice and patient characteristics are similar to the Australian average, based on the results of The National Survey of Adult Oral Health 2004–06 NSW (20).

**Being preventively-oriented**

At the beginning of this study our focus was on understanding the process of adopting the CMS protocols used in the previous RCT (22). However we soon realized that dentists talked about how “preventively-oriented” they were, independent of whether they were using the CMS protocols. Our focus rapidly moved from explaining the process of implementing the CMS protocols, to explaining the process of implementing preventive care in general.

The concept of being “preventively-oriented” was defined by dentists as “putting patients first” while educating them about their mouths, the role of saliva, life
style issues (diet, smoking, alcohol consumption and exercise) and about how patients could prevent and stop oral disease progression via oral hygiene and preventive products applied at home or by the dentist. Avoiding the unnecessary removal of tooth structure during a restorative procedure was also a prerequisite for being a “preventively-oriented” dentist. Participants said that ‘most dentists’ were supportive of these practices:

“On the whole, most dentists are conscientious and put the patient first, which means you must practice preventively. At the end of the day, we probably gain monetary wise from performing restorations and more complex treatments, rather than preventively, because we are not paid for the time that we spend doing prevention. But, ethically and morally, we have to; and most dentists do.” Dentist.

Although most dentists talked about themselves as being “preventively-oriented”, actual practice varied widely. Such practices included: 1) using the CMS or other preventive protocols; 2) seeking out and using other, less formal, preventive guidelines – for example, from continuing education courses; and 3) not using the CMS, other protocols or guidelines despite defining oneself as “preventively-oriented”.

The adaptation process: before, during and after

When dentists and their teams changed their practices in line with the CMS or another preventive protocol, they did not follow protocols slavishly. Rather, they adapted protocols to incorporate them into their established practice management systems. Dentists and their teams talked about the periods before, during and after
this adaptation process (Table 2). They discussed the adaptation process itself, and the consequences of adaptation. We will first discuss participants who were able to change their established practice systems to become more preventive; we will later discuss reasons why some practices were not able to make such changes.

**Before the adaptation process**

Before being exposed to the CMS or other preventive protocols, dentists talked about themselves as “assessing patients and selling restorative treatment”. They discussed practical/financial, historical and philosophical facets of their situations (Table 3). Practically, the need to secure financial viability was critical: private dental practices are small businesses and dentists are subject to financial drivers. Historically, restorative care was strongly embedded in the dental culture, and this created a conflict within individual dentists. They would describe themselves as being biased towards prevention, but conditioned to deliver restorative care. When no established system existed in a practice for providing preventive care, it was difficult to move away from restoration and towards prevention.

**Barriers to adaptation**

Dentists spoke spontaneously about two “assumptions” or “rules” underpinning continued restorative treatment. They said that these assumptions were deeply held, and acted as a barrier to preventive care. The first “assumption” that some dentists held was that some patients were too “unreliable” to benefit from prevention:
“Is it worth to put the effort in to prevent, repair or save a tooth? Or are they somebody who is just not interested and you are better off taking out the tooth rather than putting any effort into trying to make it better for them. So, if I thought they were absolutely unreliable, I would probably just do a filling.” Dentist

The second “assumption” that some dentists held was that patients thought that only tangible restorative treatment offered “value for money”. They said that patients perceived oral hygiene instruction or preventive treatments as intangible treatments and did not wish to pay for these or any other preventive care:

“Some patients may not want preventive when you mention about doing fluoride, duraphat varnish. It all takes time, and they may not want that if they are not getting anything back from their health fund.” Dentist

In addition to these assumptions, some of the elements listed in Table 3 acted as barriers, such as: making money from prevention; being too busy; having a restorative background; being focused on cutting cavities; and not having a system for providing preventive care.

The adaptation process

Despite facing the barriers mentioned above, many dentists did try to implement preventive protocols, including the CMS protocols. The adaptation process involved is illustrated in Table 4. Dentists became familiar with the information and procedures contained in the protocols, and worked out how to lead their teams
to incorporate them within their established practice systems. We note that this section reports on practices that had been able to implement preventive care.

During the adaptation process some dentists ran training sessions for their teams. In these sessions, they shared knowledge about preventive care and discussed step-by-step descriptions of how to implement it in the practices. As a result these dentists became aware of each team member’s abilities to execute different preventive care responsibilities. This allowed the delegation of preventive tasks to other team members, so that dentists could concentrate on complex restorative work and, hence, their working day flowed more efficiently.

"It is a team effort. Patient starts off for a recall exam in my chair, in my room, and I introduce myself and say what we do because most of the patients here have never even heard of a hygienist. I explain to them about the gingival condition and I say "[the dentist] is going to come in and interrupt us and [the dentist] is going to do a check up and when [the dentist] comes in [the dentist] is going to ask me what I have found". [The dentist] says, "So, what are things looking like in here?" And what that does for me as a hygienist is that gives me confidence, it is demonstrating to the patient that [the dentist] is highly confident in me - and [the dentist] verbalises that all the time, and it makes the patient feel better that they are in good hands and it demonstrates we work together."

*Dental Hygienist.*

In some dental practices, dental hygienists were given responsibility for oral
hygiene instruction and preventive maintenance visits, becoming a fundamental part of the adaptation process. As a result, team members felt empowered, enjoyed their daily work, and felt recognized by patients as someone who was truly interested in delivering the best dental care; dental assistants saw the importance of preventive care, understood why less restorative work was being carried out, and were able to adjust to the new routine. Patients were also educated about the importance of oral hygiene and fluoride applications.

“I think the staff was really keen; they liked doing the saliva tests, learning about fluoride and being part of it. I got the feeling, they were really quite enthusiastic to have some variety and something interesting and to know what was going on.” Dentist

“If we got to do a saliva test or got to talk to patients about their diet and fluoride a bit more, we thought, “Oh, there is something different than what we did yesterday and it was fun.” Dental assistant

In addition to education and role changes, new practice routines were required to ensure the financial viability of the practices. Dental assistants and practice managers were responsible for establishing new practices according to instructions given by the dentist-in-charge. New practices included reorganizing the materials supply, physical space and the schedule of the practices. For example, surgeries had to be stocked with preventive materials, and if formal protocols were being used, laminated copies of the protocols were needed in
practice rooms. New arrangements for ordering supplies had to be put in place. To allow for efficient time use of rooms, dedicated space for coaching tooth brushing and flossing had to be found. The length of appointments changed, and this had implications for practices’ schedule of fees. Appointment lengths had to be adjusted to accommodate explanations of the new treatment approach and for caries risk assessment. Initially, the fee for the first appointment tended to be maintained at the previous rate, despite the consulting time being longer, because dentists felt that this was what patients expected. Conversely, monitoring and maintenance visits were shorter than the typical restorative care appointment, fees for this follow-up service tended to initially be scaled down. It took some time for the practices to figure out the time schedule for the new services and to adjust their fee schedules accordingly. These are examples of ways in which practices did not adopt protocols in a simple way, but needed to adapt them and their own routines as they moved toward a more preventive practice.

“So, I had to have that basic belief that at some point soon, which I did, I would work out appointments systems and work out a way of making it pay and making it more in my comfort zone in terms of I knew what I had to do quicker so it did not take so much of my time, and time is money. So, I guess I did not expect it to take so much time. Then, after I think it has helped me make more money, which I had not expected because I think we put fluoride on more often and we get people back more often.” Dentist
Facilitators of adaptation

At the beginning of the adaptation process, dentists said that they had underestimated how difficult it would be to change their established practice systems. Despite this difficulty, they remained open to change. Dentists needed to provide leadership, but also relied on team communication and trust for the adaptation process to develop. Those who followed the CMS protocols valued the step by step guidance which eased the task of adaptation:

“I guess the protocols gave some structure to something that we have always paid lip service to and done in an ad hoc sort of way.” Dentist

“Now I have this plan and because I like systems, I like the plan that there are both medium, or low or high risk patients and this is the plan and this is the system and this is what we will do. And this suits me; this is how we run the practice”. Dentist

Technology also played an important role in adaptation, as it facilitated dentists’ communication with their patients. For example, digital x-rays and intra-oral cameras were used in the majority of practices as a communication tool to educate and show patients images of whether their carious lesions were or were not progressing over time. Dentists and team members reported that it was easier for patients to understand what needed to be done when they saw images on a computer screen: patients started to think about what was going on inside their mouth and were more motivated to undertake home care to retain their teeth and
keep their mouths healthy.

“I think the main thing is to try and get patients to give you the answers. So, try and get them to ask, “What is ‘demineralised’?” and I have digital imaging. I tend to show them all on the x-ray. And especially ones that I put fluoride on and I tile the images in the computer screen so I can show it getting better. But you do not tell them, you show both images and say, “This is this part of the tooth last year. And this, when it is black it means, you know the decay has gone through. And this is the tooth now. So, what do you think?” Because you need patients to say it; and that all takes time... So they have to take ownership of it. And I had to work out how to do that in a limited time in my practice”. Dentist

Consequences of the adaptation process

Dentists and team members talked about the adaptation process as transformational. They said that following adaptation they realized that their practice philosophy had metamorphosed, it was a “different practice”. As shown in Table 5, participants described practical/financial, historical and philosophical aspects of this new state. Dentists had integrated preventive protocols within their established practice systems, and team members had found their own way of practicing prevention. For example, in practices where the CMS protocols were in use, dentists incorporated fluoride varnish as a preventive tool – as prescribed – but continued, concurrently, to use other preventive agents that were not part of the protocols. This is another example of adaptation of formal protocols.
Practically, practices were rewarded when they developed a reputation for prevention, and thus gained new patient referrals; they also experienced increased sales of preventive products. Dentists felt stronger medico-legally as a consequence of adapting to the protocols. They were no longer as concerned about patients searching the Internet, comparing what dentists did, and criticizing them for doing too many restorations.

In comparison to their prior historical situation — being biased toward prevention but trained to deliver restorative care — dentists talked about breaking the automated circuit of “cutting teeth”. They had learned to trust that if they resisted “cutting teeth”, they would be rewarded by preservation of tooth structure. All participants talked about moving to a more holistic view – monitoring disease activity, quality of patients’ saliva, diet, and the practice of oral hygiene and avoiding unnecessary restorative treatment. Clinical outcomes provided important reinforcement. Dentists and team members who had implemented the CMS or other protocols said that while they learned the steps to follow, they did not believe in the efficacy of the procedures until they saw concrete positive results in their patients’ mouths.

Dentists saw benefits both for patients and their staff who were involved in the process. They observed that their patients were starting to take ownership of their oral health and were less emotionally stressed during visits. Dental team members
felt empowered by the adaptation process. Most dentists who had implemented the CMS protocols concluded that they could not go back to the way they had practiced before. However, dentists still believed that some patients continued to be too unreliable to benefit from a preventive program. We observed that dentists offered prevention only to patients who they judged to be motivated, cooperative and who valued preventive care.

“People walked in the door who I knew would not be appropriate for prevention and I knew they were not reliable. Even though they said, and that was the interesting thing, some of them clearly said, “I will be fine; I will do that. And I am happy to turn up for three years of this research.” And I thought, “I am not sure about you.” And they have not. So, when we picked the patients, we tried and picked ones that we thought would be reliable and who valued prevention.” Dentist

Not adapting to preventive protocols

As previously noted, in some practices there was little evidence of preventive activity. This was attributed by dentists and their teams in part to the barriers mentioned previously: perceiving patients as “unreliable” and as not valuing preventive care; needing to make money from prevention; being too busy; having a restorative background; being focused on cutting cavities; and not having a system for providing preventive care.

“The reason that you had a lot of dentists that probably was not quite so
keen to put the effort in would have been a lot to do with the financial side of it. Effectively, the dentist who is in the program would be partially funding the cost of it through reduced income for the period that they are involved. It is their money and they are choosing either to have a reduced income or have to work longer hours to get the same income.” Practice manager

“Opening the doors, there is a cost involved, so you have got to figure out how you can make it work. So that is pretty simple from my side, but to get a patient to accept it, it is a bit difficult. There is no point in me telling patients anything, if they are not going to listen.” Dentist

“A problem was had to spend more time talking about disease prevention I think, yeah, because traditionally we have seen that as non-productive time and I tend not to charge for that.” Dentist

However, it was also a product of problems related to dental practice logistics and dentist-dental team relationships. In these practices, it was claimed that there was not enough physical space to accommodate all activities needed for the adaptation to preventive protocols. Preventive activities were perceived as being outside their usual routine and not able to be integrated into established practice systems. Although dental assistants in these practices worked together to make daily tasks run smoothly, the dentists appeared to have poor communication among themselves and with their staff. For example, rather than the practice operating as
a team, in which everyone provided coordinated care oriented toward prevention, where spaces were dedicated to preventive procedures, dentists in these practices would work in isolation in their dedicated rooms. This meant that one dentist might use fluoride on a tooth surface, while the dentist in the next room would provide restorative care. These inconsistencies revealed that failing to involve all staff in the preventive adaptation process could be a major setback for a practice. For example, in one intervention practice, only one dentist was aware of the CMS protocols (Dentist A). Two other dentists and a hygienist also worked in the practice. A patient who was being managed preventively by Dentist A returned for a maintenance visit and was seen by one of the other dentists. Unfortunately, during this visit, tooth surfaces that were previously being managed preventively were restored, thus eliminating the potential benefit of the preventive care.

“I think, we did not institute it [protocols] as well as we could have done, looking back, and there are a number of reasons for that. One is being far too busy all the time to spend the time with people doing these preventive things. We see a lot of patients and there is a lot of pressure for us to see more patients because there are people who are making demands on our time. Also, I think my own understanding of the program was not good. The other thing was that I did not get the whole staff involved, which would have been good, preferably all the dentists, too. In my practice, spending that extra time with patients in the study and not charging for this time was a big issue. And now even if we wanted to try again, not that we do, we do not have a spare room now to accommodate such activities.
**Discussion**

A deeper understanding about incorporating research evidence into dental practices was gained during this study. Our findings have shown that adapting research evidence into practice is a slow and complex process, requiring more than the removal of barriers. We began by asking: 1) How do dentists and their teams incorporate evidence about preventive care into their practices? and 2) How can we explain variation in this process? We will now summarize the answers to these questions, and consider their implications for practice.

*How do dentists and their teams incorporate evidence about preventive care into their practices?*

First, we note that even within the formal structure of a RCT of a specific preventive protocol, dentists and their staff drew on a wide range of preventive protocols and guidance. Although all participants said they were committed to prevention, the degree to which prevention was practiced varied widely. The RCT protocol (the CMS) was not ‘transferred’ into practice in a straightforward way. Rather, through our analysis, we concluded that dental practices underwent a slow process of adapting a range of protocols and guidelines to existing practice logistics.

This was not just a matter of removing expected barriers to EBD. Adaptation
occurred over time and involved practical, historical and philosophical aspects of dental care. Participants transitioned from their initial state – selling restorative care – through an intermediary stage – learning by doing and educating patients about the importance of preventive care – and finally to a stage where they were a “different practice” and offered patients more than just restorative care. During this adaptation process, “finding the balance between preventive non-surgical care (curing of disease) and restorative treatment (making up for lost tissues)” was a daily challenge – “regaining profit, reassessing team work and surgery logistics, and mastering the scheduling art to maximize financial and clinical outcomes were important practical issues tackled in some of these practices” (24, p.7).

*How can we explain variation in this process?*

We propose that the mechanism which explains variation in the implementation of evidence-based preventive care is a differing ability to adapt, or not adapt, new protocols into established practice systems. To achieve optimal preventive practice, dentists-in-charge had to be open to change, to be able to communicate with and to engage all members of the dental team. Successful adaptation was contingent upon whether (1) the dentist-in-charge brought the whole dental team together – including other dentists – and got everyone interested and actively participating during preventive activities; (2) whether the physical environment of the practice was re-organized around preventive activities, (3) whether the dental team was able to devise new and efficient routines to accommodate preventive activities, and (4) whether the fee schedule was amended to cover the delivery of
preventive services, which hitherto was considered as “unproductive time”.

Previous studies support our findings about barriers to EBD, including the historical professional tradition of restorative intervention; time constraints; dentists’ inertia; financial risk, patients’ treatment preferences and inappropriate health funding systems (8, 9, 12, 13, 30-36). In this study, participants described some patients as being too “unreliable” to benefit from preventive care. This is consistent with previous research that shows that dentists may find it difficult to treat patients who do not value oral health, are disinterested or ‘uncooperative’ (36-38), providing them with a different quality of dental care (36, 39). This study provides evidence that this is particularly salient to how dentists’ approach prevention – that their deeply-held beliefs about the motivation, values or cooperativeness of patients may be an important explanatory factor in determining whether or not prevention is offered. Watt et al. (11) showed that patients were also described as a potential barrier to the provision of evidence-based care or to change dental practices in general. According to the authors, dentists think that patients demand services that they are accustomed to even when there is no need for it, and that patients lack interest in oral health and have irregular attendance patterns (11). In this study, regular attendance was shown to be important for both maintaining a dental practice financially viable and for motivating dentists to offer preventive care.

In this study, dentists also argued that some patients chose not to have preventive
care because of the limitations imposed by the regulations of health insurance companies. This is consistent with Brennan and Spencer’s observation that in Australia there is a “lack of incentives” to adopt preventive non-operative approaches “under a fee-for-service remuneration system” that encourages restorative care (38). Elsewhere, dentists have also cited limitations imposed by the regulations of insurance companies as a barrier to provide evidence-based dental care (9). Insurers’ regulations may be contrary to evidence obtained from well-designed studies, however since these limitations determine the degree to which patients are reimbursed for treatment, they are strong drivers for patient satisfaction and motivation, and can thus become important in clinical decision making (8, 9, 11). Conversely, some work has suggested a modest effect of financial inducements in achieving preventive care. Among dentists working in the Scottish National Health Service for example, introduction of a financial reward (fee per sealant) increased the likelihood of fissure sealant placement by 10% compared to education on evidence-based practice only, or no intervention (32).

Finally, some of the problems in changing dentists’ practice may be also attributable to a failure in active knowledge translation. Research has shown that evidence-based guidelines increase dentists’ knowledge, but do not create intentions to act differently(7, 15-17) Only a few authors have suggested that by applying tailored knowledge translation strategies change in dentists’ clinical practice may be achieved (39). In a recent study, Bonetti et al. concluded that
dentists were more likely to decide to carry out a specific clinical procedure when they “had a prior action plan” about the procedure and if the procedure was something they were familiar with (39). The authors recommended that future interventions should be developed for assisting dentists to alter “their beliefs about the consequences” of a specific procedure – these interventions might facilitate dentists to routinely incorporate desired clinical procedures into their usual routines (39).

**Concluding remarks**

Based on our findings we suggest some practical strategies for getting evidence-based preventive care into private dental practices. This study suggests that flexibility may be needed from both dental academics and dentists-in-charge of practices to advance preventive care in general dental practice. Adapting evidence into dental practice was shown to be a slow and complex process, requiring more than just the removal of barriers. Research evidence offered by academics will have to be incorporated somehow into existing dental practice systems. This process might not happen identically in all practices. Dentists will need to adapt their everyday practices to conform more closely to evidence-based recommendations. They should be encouraged to look at preventive care as a central part of their practices and not simply as advice given to patients, usually referred as “unproductive/not reimbursed” time. Hiring dental hygienists can facilitate the adaptation process and free dentists to focus on more complex cases. This group of dentists and their dental teams trusted preventive protocols,
including the CMS protocols, only after they saw results in patients’ mouths. RCTs will remain the key source of evidence for evaluating the efficacy of dental treatments, but this study suggests that their results may be better trusted and adapted into practice if the statistical results are presented alongside concrete clinical illustrations (e.g. case reports showing before and after scenarios).

These strategies conform to the findings from a recent study, which showed that “variation and even contradictions” present in clinical settings can be used as “real opportunities for learning” if participants are able to “abandon old ways of addressing problems and try new ways of working” (40, p.1, 6, 7) to attain common aims. This study has provided new, practical insights into the implementation of preventive care in dental practice. Future intervention research could examine the usefulness of these strategies across a wide range of dental practices and contexts.

Acknowledgments: This study was funded by the National Health and Medical Research Council Project Grant 632715; Oral Health Foundation, University of Sydney; Dental Board New South Wales; and Australian Dental Research Foundation. We thank participants for their invaluable contributions.
References


doi: 10.1016/j.socscimed.2011.02.00
### Tables 1 to 5

**Table 1** Characteristics of Participants (N=23)

<table>
<thead>
<tr>
<th>Site</th>
<th>Participants</th>
<th>Previous RCT group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Practice 1</td>
<td>1 dentist, 2 dental hygienists, 5 dental assistants, 1 practice manager</td>
<td>intervention</td>
</tr>
<tr>
<td>Dental Practice 2</td>
<td>3 dentists, 4 dental assistants, 1 practice manager</td>
<td>intervention</td>
</tr>
<tr>
<td>Dental Practice 3</td>
<td>1 dentist</td>
<td>control</td>
</tr>
<tr>
<td>Dental Practice 4</td>
<td>1 dentist</td>
<td>control</td>
</tr>
<tr>
<td>Dental Practice 5</td>
<td>1 dentist</td>
<td>control</td>
</tr>
<tr>
<td>Dental Practice 6</td>
<td>1 dentist</td>
<td>control</td>
</tr>
<tr>
<td>Dental Practice 7</td>
<td>1 dentist</td>
<td>intervention</td>
</tr>
<tr>
<td>Dental Practice 8</td>
<td>1 dentist</td>
<td>intervention</td>
</tr>
</tbody>
</table>
**Table 2 The Adaptation Process**

<table>
<thead>
<tr>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessing patients and selling restorative treatment:</td>
<td>Learning by doing: dentists and team members had to learn the protocol system to implement it</td>
<td>Becoming a different dental practice:</td>
</tr>
<tr>
<td>Making money</td>
<td>Educating patients: about why oral hygiene and home care are important</td>
<td>Experiencing new patient referrals</td>
</tr>
<tr>
<td>Being too busy to adopt protocols</td>
<td>Establishing new routines: shifting of dental practice logistics, solving of scheduling issues</td>
<td>Learning that the system works</td>
</tr>
<tr>
<td>Spending unproductive time</td>
<td></td>
<td>Experiencing less emotional stress during visits</td>
</tr>
<tr>
<td>Having a restorative background</td>
<td>Barriers to adaptation</td>
<td>Breaking the circuit and getting rewards</td>
</tr>
<tr>
<td>Being focused on cutting cavities</td>
<td>Patients being too “unreliable” and thinking that only tangible restorative treatment offered “value for money.”</td>
<td>Seeing results in patients’ mouths</td>
</tr>
<tr>
<td>Being slow to change</td>
<td>Facilitators of adaptation</td>
<td>Simplifying dentistry</td>
</tr>
<tr>
<td>Being biased towards prevention</td>
<td>Dentists’ leadership</td>
<td>Looking at the whole picture</td>
</tr>
<tr>
<td>Not having a system for providing preventive care</td>
<td>Dentists’ trust in dental team</td>
<td>Empowering staff</td>
</tr>
<tr>
<td></td>
<td>Having good communication with dental team</td>
<td>Being in a stronger medico-legal position</td>
</tr>
<tr>
<td></td>
<td>Having technology for prevention</td>
<td>Never being able to go back</td>
</tr>
</tbody>
</table>
Table 3 Dentists’ and team members’ experiences before the adaptation process

<table>
<thead>
<tr>
<th>1) Practical/Financial</th>
<th>2) Historical</th>
<th>3) Philosophical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Making money</td>
<td>Having a restorative background</td>
<td>Being biased towards prevention</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“The bottom line is that you need to make money”, Dentist</td>
<td>“It has always been like that, where dentistry, historically, has been an intervention. We are dental surgeons; we perform surgery”, Dentist</td>
<td></td>
</tr>
<tr>
<td>Being too busy to adopt protocols</td>
<td>Being focused on cutting cavities</td>
<td>Not having a system for providing preventive care</td>
</tr>
<tr>
<td>“We are far too busy to spend the time. If I feel like I have not time because I already have to fulfil a certain treatment in that ½ hour I tend to just think “Oh well I will do that [preventive care] next time,” so it is probably a time issue”, Dentist</td>
<td>“Well I think you realise when you cut a cavity that the more cavities you cut the better you are going to be at it, and you want to feel comfortable doing that and you want to be able to do them in different situations. It is what you want to keep doing because you want to get better at it because every time you do it”, Dentist</td>
<td></td>
</tr>
<tr>
<td>Spending unproductive time</td>
<td>Being slow to change</td>
<td>“Prevention always interested me, but I did not have it logically placed in my mind”, Dentist</td>
</tr>
</tbody>
</table>
“We are not paid for the time that we spend doing preventive care”, Dentist

“Dentists are good at going to conferences, listening to lectures, buying new equipments, but slow to change their mode of practice”, Dentist
<table>
<thead>
<tr>
<th>Table 4 Dentists’ and team members’ experiences during the adaptation process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning by doing:</strong> dentists and team members had to learn the protocols’ system to implement it</td>
</tr>
<tr>
<td><strong>Educating patients:</strong> about why oral hygiene and home care are important</td>
</tr>
<tr>
<td><strong>Establishing new routines:</strong> shifting of dental practice logistics, solving of scheduling issues</td>
</tr>
</tbody>
</table>
Table 5 Dentists’ and team members’ experiences after the adaptation process

<table>
<thead>
<tr>
<th>1) Practical/Financial</th>
<th>2) Historical</th>
<th>3) Philosophical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiencing new patient referrals</td>
<td>Breaking the circuit and getting rewards</td>
<td>Empowering staff</td>
</tr>
</tbody>
</table>
| “People will send me at risk patients because they feel that I, we will assess them or treat them differently than other practices”
Dentist                               | “Dentists need to have the courage to get off the little rat wheel and most break that circuit and take that decision knowing that they are not going to see instant results; and most of the rest of the time we see quick results on a lot of things, so that they can trust that down the track there will be rewards for that”, Dentist |
| "Patients perceived value in it and recommended it to their friends”, Dentist |                                                                                           |
| Learning that the system works         | Seeing results in patients’ mouths and simplifying dentistry | Being in a stronger medico-legal position |
| “When patients started coming back, I learnt that the preventive system worked, with exceptions when people did not comply”, Dentist | “Once you start seeing the results and the benefits in patients’ mouths, you see that patients are really open to the information and quite excited about it; you suddenly realise that you could actually simplify. It's very easy to over complicate the whole thing and I think the dental profession thinks that it has this great big thing that they are going to have to do, when in fact it is really not much more complicated than taking a set of bite-wings, assessing patients risk and applying fluoride; but we are just not |
|                                                                                           |                                                                                           |
|                                                                                           | “I think because of this program we have a more systemised way of being a more preventive practice. I think that is certainly ... medico-legally; I think that is a very good thing”, Dentist |                                                                                           |
used to thinking of it that way”, Dentist

<table>
<thead>
<tr>
<th>Experiencing less emotional stress during visits</th>
<th>Looking at the whole picture</th>
<th>Never being able to go back</th>
</tr>
</thead>
<tbody>
<tr>
<td>“It takes a lot of stress off a patient, because there are a lot of dental phobic patients around; so if they know they are just coming in to see us and have fluoride put on their teeth rather than having a needle, that is less stressful”, Dental assistant</td>
<td>“We are taking more of an interest possibly in preventive... there are options for patients rather just than having things filled - that you look at diet, saliva, oral hygiene – that you look at the whole picture”, Dental Hygienist</td>
<td>“Certainly doing this is one of the things that I would say is one of the top 20 things I have done in dentistry, that I have learned from, that I would never go back to how it was before”, Dentist</td>
</tr>
</tbody>
</table>
Date: Sun, 1 Jul 2012 20:57:58 -0400 [10:57:58 EST]

From: beverly.ellis@adelaide.edu.au
To: alexandra.sbaraini@sydney.edu.au

Subject: Community Dentistry and Oral Epidemiology - Manuscript ID CDOE-11-473.R2

Printed By: Alexandra Sbaraini

01-Jul-2012

Dear Mrs. Sbaraini:

Your manuscript entitled "How do dentists and their teams incorporate evidence about preventive care? An empirical study." has been received by the editorial office of Community Dentistry and Oral Epidemiology. Review procedures will now be handled by the editor.

Your manuscript ID is CDOE-11-473.R2.

Please mention the above manuscript ID in all future correspondence or when calling the office for questions. If there are any changes in your street address or e-mail address, please log in to ScholarOne Manuscripts at http://mc.manuscriptcentral.com/cdoe and edit your user information as appropriate.

You can also view the status of your manuscript at any time by checking your Author Center after logging in to http://mc.manuscriptcentral.com/cdoe.

Thank you for submitting your manuscript to Community Dentistry and Oral Epidemiology.

Sincerely,

Community Dentistry and Oral Epidemiology Editorial Office
CHAPTER FIVE – Experiences of dental care: what do patients value?

Research article

Experiences of dental care: what do patients value?

Alexandra Sbaraini1,*, Stacy M Carter1, R W Evans2 and Anthony Blinkhorn1

* Corresponding author: Alexandra Sbaraini alexandra.sbaraini@sydney.edu.au
For all author emails, please log on.

Published: 24 June 2012

Abstract

Background

Dentistry in Australia combines business and health care service, that is, the majority of patients pay money for tangible dental procedures such as fluoride applications, dental radiographs, dental fillings, crowns, and dentures among others. There is evidence that patients question dentists’ behaviours and attitudes during a dental visit when those highly technical procedures are performed. However, little is known about how patients’ experience dental care as a whole. This paper illustrates the findings from a qualitative study recently undertaken in general dental practice in Australia. It focuses on patients’ experiences of dental care, particularly on the relationship between patients and dentists during the provision of preventive care and advice in general dental practices.

Methods

Seventeen patients were interviewed. Data analysis consisted of transcript coding, detailed memo writing, and data interpretation.

Results

Patients described their experiences when visiting dental practices with and without a structured preventive approach in place, together with the historical, biological, financial, psychosocial and habitual dimensions of their experience. Potential barriers that could hinder preventive activities as well as facilitators for prevention were also described. The offer of preventive dental care and advice was an amazing revelation for this group of patients as they realized that dentists could practice dentistry without having to “drill and fill” their teeth. All patients, regardless of the practice they came from or their level of clinical risk of developing dental caries, valued having a caring dentist who respected them and listened to their concerns without “blaming” them for their oral health status. These patients complied with and supported the preventive care options because they were being “treated as a person not as a patient” by their dentists. Patients valued dentists who made them aware of existing preventive options, educated them about how to maintain a healthy mouth and teeth, and supported and reassured them frequently during visits.

Conclusions

Patients valued having a supportive and caring dentist and a dedicated dental team. The experience of having a dedicated, supportive and caring dentist helped patients to take control of their own oral health. These dentists and dental teams produced profound changes in not just the oral health care routines of patients, but in the way patients thought about their own oral health and the role of dental professionals.

Keywords: Qualitative research; Dentish-patient relationship; Prevention
Experiences of dental care: what do patients value?

Alexandra Sbaraini1,2*, Stacy M Carter1, R Wendell Evans2 and Anthony Blinkhorn1,2

Abstract

Background: Dentistry in Australia combines business and health care service, that is, the majority of patients pay money for tangible dental procedures such as fluoride applications, dental radiographs, dental fillings, crowns, and dentures among others. There is evidence that patients question dentists’ behaviours and attitudes during a dental visit when those highly technical procedures are performed. However, little is known about how patients’ experience dental care as a whole. This paper illustrates the findings from a qualitative study recently undertaken in general dental practice in Australia. It focuses on patients’ experiences of dental care, particularly on the relationship between patients and dentists during the provision of preventive care and advice in general dental practices.

Methods: Seventeen patients were interviewed. Data analysis consisted of transcript coding, detailed memo writing, and data interpretation.

Results: Patients described their experiences when visiting dental practices with and without a structured preventive approach in place, together with the historical, biological, financial, psychosocial and habitual dimensions of their experience. Potential barriers that could hinder preventive activities as well as facilitators for prevention were also described. The offer of preventive dental care and advice was an amazing revelation for this group of patients as they realized that dentists could practice dentistry without having to “drill and fill” their teeth. All patients, regardless of the practice they came from or their level of clinical risk of developing dental caries, valued having a caring dentist who respected them and listened to their concerns without “blaming” them for their oral health status. These patients complied with and supported the preventive care options because they were being “treated as a person not as a patient” by their dentists. Patients valued dentists who made them aware of existing preventive options, educated them about how to maintain a healthy mouth and teeth, and supported and reassured them frequently during visits.

Conclusions: Patients valued having a supportive and caring dentist and a dedicated dental team. The experience of having a dedicated, supportive and caring dentist helped patients to take control of their own oral health. These dentists and dental teams produced profound changes in not just the oral health care routines of patients, but in the way patients thought about their own oral health and the role of dental professionals.

Keywords: Qualitative research, Dentist-patient relationship, Prevention

* Correspondence: alexandra.sbaraini@sydney.edu.au
1Centre for Values, Ethics and the Law in Medicine, University of Sydney, Sydney, NSW, Australia
2Population Oral Health, Faculty of Dentistry, University of Sydney, Sydney, NSW, Australia

© 2012 Sbaraini et al; licensee BioMed Central Ltd. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/2.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.
Background
This study was built on a previous randomized controlled trial (RCT) undertaken in private general dental practices in New South Wales (NSW), Australia [1]. During the previous RCT, 22 practices were randomly allocated to either the intervention (n = 12) or the control group (n = 10). A total of 847 patients were recruited (intervention group n = 427; control group n = 420) within the 22 dental practices between May 2005 and March 2006 [1].

Intervention practices in the RCT were provided with evidence-based preventive protocols to offer a less invasive approach to the treatment of dental caries [2]. The protocols focused on primary prevention of new dental caries (via tooth brushing with high concentration fluoride toothpaste and dietary advice) and intensive secondary prevention through professional treatment to arrest dental caries progression (applying fluoride varnish and monitoring the success of tooth brushing by recording the levels of dental plaque on the teeth) [2].

During the RCT, the numbers of decayed, missing and filled teeth (DMFT) were monitored over time. The RCT final results showed a highly significant difference in the incremental DMFT score in favour of the intervention group (two-year mean difference: 0.8; p < 0.001, three-year mean difference: 0.9; p < 0.001) [3]. Patients in the intervention group had fewer repeat dental fillings at both two (p < 0.001) and three (p < 0.001) years [3]. Having an increased risk of developing dental caries was observed in 11% of patients in the intervention group compared to 24% in the control group (p < 0.001) [3]. Dentists, members of dental team and patients from the practices involved in the RCT were asked to participate in this qualitative study [4].

The context of this study: Dentists and patients operating in a typical Australian clinical context

Dentistry as practiced in Australia combines business and health care. More than 80% of dentists work in private general dental practices [5]. General dentists provide the majority of care and dental hygienists are employed in only a minority of practices [5,6]. The majority of dentists are independent self-employed practitioners; they own their practices and lead their dental team.

Apart from its private practice essence, dental services differ from other outpatient health care fields because of a focus on providing tangible treatments; patients leave a dental practice fully aware that procedures were done in their mouths, and sometimes are told to re-attend for further physical interventions in follow-up appointments.

This is in contrast to a visit to a doctor where the focus might be receiving health advice, routine exams and/or drug prescriptions.

In Australia, most people pay for their own dental treatments, or for the private health insurance that partly covers the cost of dental care [7]. The majority of adults in NSW visit a private general dental practice for a check-up at least once a year on average; residents outside capital cities visit less frequently [7]. Most individuals visit the same private dental practitioner on a long term basis [8].

This study focused on dentists and patients in private general dental practices – that is, on dentists and patients operating in a typical Australian clinical context.

Measuring patients’ satisfaction and expectations of care

‘Patient satisfaction’ is generally conceptualized as a construct that can be measured with standardized quantitative instruments and compared between sites or treatments. These instruments are often modified for use in specific settings or topic areas, with primary research and systematic reviews conducted regarding patient satisfaction with particular types of treatment. For example, in dentistry, questionnaire surveys have been used to evaluate patients’ uneasiness before treatment, their dislikes during treatment as well as their opinions about certain aspects of the service such as dentists’ technical ability, treatment costs and service facilities [9,10]. In the medical literature, there is also some research into the relationship between satisfaction and general aspects of care that are shared across different clinical contexts such as shared decision making [11]. In addition, a parallel stream of qualitative and social research provides a broad-based outlook while seeking to understand patients’ experiences of care on patients’ own terms. Entwistle and colleagues recently completed an interpretive synthesis of this literature and argued that “the characteristics and actions of health care services and staff, and the ways they relate to patients, have implications for patients’ experiences of being enabled (or not) to feel, be and do what they value feeling, being and doing – in the course of their health care contacts and beyond. Experiences of health care delivery matter because they shape and represent capabilities that are key to how well people’s lives can go” [12], p4. Therefore, this study is focused on understanding dental patients’ experience on its own terms, rather than evaluating patient satisfaction using standardized methods.

What do we know about patients’ expectations when visiting a dental practice?
The dentist-patient relationship literature provides some clear advice about patients’ expectations and perceptions when visiting a dental practice. These expectations are
less related to the technical competence of dentists, and more to do with the attitudes and communication skills [9,13-16]. In particular patients want a dentist who listens to them, has a friendly caring attitude, explains treatment options and procedures, and inspires confidence [9,15,17]. This is consistent with research findings in the medical literature which shows that “the most important health service factor affecting” patient satisfaction is the quality of the doctor-patient relationship [18].

While we know from the dental literature what patients expect from their dentists, it is not clear how patients experience different approaches to treat dental caries, what hurdles they might encounter when asked to change their routines to comply with self-care recommendations, and what is important and valued during the dental care experience. This paper reports on one aspect of the overall qualitative study: patients’ experiences of dental care, particularly on the relationship between patients and general dental practitioners during the provision of preventive care and advice, and on what patients valued in dental care. Accordingly, the final research questions for this component of the study were:

1) What was patients’ experience of dental care in practices without a structured approach to prevention?
2) What was patients’ experience of dental care in practices with a structured approach to prevention?
3) What were the barriers and facilitators for prevention for these patients?
4) What did these patients value in dental care?

Methods
Study design
A previous paper has described the sampling, data collection, analysis and interpretation in detail [4]. During the study, Charmaz’s grounded theory methodology was employed to examine the social process of adopting preventive dental care in dental practices [19]. Charmaz’s methodology suggests a systematic set of procedures to study and understand social processes, actions and interactions between individuals [19]. Accordingly, we sought to learn from patients how the process of adopting prevention worked and how they made sense of it. Throughout the study it was important to acknowledge that as researchers we had some pre-existing concepts in mind due to our academic backgrounds in dentistry and public health, although we deliberately remained open to what patients would tell us about their experiences [4].

Sampling strategy
Two dental practices (Dental Practice 1 and 2) which had offered the preventive care program consented to send letters of invitation to participate in this study to all patients previously enrolled in the RCT. Patients who agreed to participate in the study differed based on their clinically measured risk of developing dental caries: some patients whose risk status had decreased, some whose risk had increased and some whose risk had stayed the same over the previous RCT study were interviewed (Table 1). This purposive sampling allowed comparisons between dental care experiences of patients with different clinical outcomes, as we expected that this might be different. After analysing the first round of interview data from Dental Practice 1, patients from Dental Practice 2 were interviewed. This allowed comparisons between patients in a practice where the preventive protocols were successfully implemented (Dental Practice 1), and those who were treated in a practice where the program had been less successful (Dental Practice 2).

Sample size and saturation
Qualitative researchers generally seek to reach ‘saturation’ in their studies [4]. Often this is interpreted as meaning that the researchers are hearing nothing new from patients during interviews. In a grounded theory study, theoretical saturation is sought [4]. This is a subtly different form of saturation, in which all of the concepts in the substantive theory being developed are well understood and can be substantiated from the data [19]. Accordingly, saturation is determined by the data analyst. When new interviews become repetitive with prior interviews and central concepts are fully understood, the analyst determines that saturation was reached [20]. In our study, data from the last four patients interviewed (two from each dental practice sampled) confirmed our findings rather than adding new concepts. Therefore data collection ceased. In total 17

Table 1 Patients’ characteristics (n = 17)

<table>
<thead>
<tr>
<th>Patients characteristics</th>
<th>Dental Practice 1</th>
<th>Dental Practice 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients interviewed</td>
<td>N=12</td>
<td>N=5</td>
</tr>
<tr>
<td>Option of location for interview</td>
<td>At dental practice: n=4</td>
<td>By phone: n=5</td>
</tr>
<tr>
<td></td>
<td>At community centre: n=4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>At patients’ home: n=1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>By phone: n=3</td>
<td></td>
</tr>
<tr>
<td>Age range</td>
<td>18-65 years old</td>
<td>25-55 years old</td>
</tr>
<tr>
<td>Gender</td>
<td>Female: n=7</td>
<td>Female: n=3</td>
</tr>
<tr>
<td></td>
<td>Male: n=5</td>
<td>Male: n=2</td>
</tr>
<tr>
<td>Risk of developing dental caries</td>
<td>Decreased: n=6</td>
<td>Decreased:</td>
</tr>
<tr>
<td></td>
<td>Increased: n=3</td>
<td>n=1 Increased:</td>
</tr>
<tr>
<td></td>
<td>Stayed the same: n=3</td>
<td>n=2 Stayed the same: n=2</td>
</tr>
</tbody>
</table>
patients, ranging in age from 18 to 65 years old, participated in the interview process (Table 1).

Interviews
Patients were interviewed for approximately one hour in locations convenient to them such as dental practices or homes. Some preferred to be interviewed over the phone, when the same format was used as for face to face interviews. Sturges and Hanrahan have reported that telephone interviews give the same in-depth data as face to face interviews [21]. The semi-structured interviews were digitally recorded, professionally transcribed in detail, and the transcripts were checked against the recordings. Table 2 details questions that guided interviews. The researcher/interviewer (AS) explored how patients experienced dental care, what dental care in general and preventive care meant to patients, how and why they did or did not adopt the prescribed preventive care, and how this was influenced by their social context. Interviews were conducted between October 2009 and November 2010.

Ethics approval and ethical issues
Initial ethics approval was obtained from the Human Research Ethics Committee at the University of Sydney. As in any ethical study, we ensured that participation was voluntary, that patients could withdraw at any time, and that confidentiality was protected. All responses were anonymised before analysis, and we took particular care not to reveal potentially identifying details of places, practices or clinicians. Prior to being interviewed, all patients had the study explained to them and signed a consent form. It was also explained to patients that their decision to participate (or not) in the study would not affect their relationship with their dentists and dental team.

Data analysis
Coding and the constant comparative method
Charmaz's iteration [19] of the constant comparative method was used during the data analysis. This involved coding of interview transcripts, detailed memo writing and drawing diagrams [4]. The transcripts were analyzed as soon as possible after each round of interviews in each dental practice. Coding was conducted primarily by AS, supported by team meetings and discussions when researchers compared their interpretations.

Coding occurred in stages. In initial coding, we generated as many ideas as possible inductively from early data. In Charmaz's form of grounded theory, codes take the form of gerunds (verbs ending in ‘ing’) which emphasise actions and processes [19]. In focused coding, we pursued a selected set of central codes throughout the entire dataset and the study [4]. This required decisions about which initial codes were most prevalent or important, and which contributed most to the analysis [4]. In theoretical coding, we refined the final categories and related them to one another [19].

Memo-writing
The primary analyst also wrote extensive memos which documented the development of the codes, what they meant, how they varied, and how they related to the raw data (transcripts) [4]. Two types of memos were written: case-based and conceptual memos [19]. Case-based memos were written after each interview – containing the interviewer's impressions about the patients’ experiences and the interviewer's reactions – memos were also used systematically to question some of our pre-existing ideas in relation to what had been said in the interview [4]. Conceptual memos, on the other hand, were a form of (1) making sense of initial codes; (2) examining patients’ meanings; (3) understanding processes, including when they occurred and changed and what their consequences were. In these memos, we compared data in order to find similarities and differences. Ideas were systematically indexed in memos. This process raised new questions, which were investigated in continuing interviews [4].

Results
At the beginning of the study, we wrongly assumed that the instructions provided within the RCT would either be implemented or not implemented by patients, and our task would be to understand why they were or were not implemented. Through data analysis however, we realised that what patients were describing was not simply treatment compliance. Patients were talking about a series of issues: their experience when visiting dental practices with and without a structured preventive approach in place; potential barriers that could hinder preventive activities as well as facilitators for prevention, and the nature of the relationship between dentists and patients.

Although we had selected patients with different clinical outcomes, during the course of the study we realized that they were describing similar experiences and sharing the same values about dental care. So, while from the RCT outcomes data it might be reasonable to presume that these patients were not implementing the suggested preventive self-care to the same extent, they still understood dental clinical care in similar ways. During interviews, patients described at length their experiences and the interviewer’s impressions about the patients’ experiences and the interviewer’s reactions – containing the interviewer's impressions about the patients’ experiences and the interviewer's reactions – memos were also used systematically to question some of our pre-existing ideas in relation to what had been said in the interview [4]. Conceptual memos, on the other hand, were a form of (1) making sense of initial codes; (2) examining patients’ meanings; (3) understanding processes, including when they occurred and changed and what their consequences were. In these memos, we compared data in order to find similarities and differences. Ideas were systematically indexed in memos. This process raised new questions, which were investigated in continuing interviews [4].

Although we had selected patients with different clinical outcomes, during the course of the study we realized that they were describing similar experiences and sharing the same values about dental care. So, while from the RCT outcomes data it might be reasonable to presume that these patients were not implementing the suggested preventive self-care to the same extent, they still understood dental clinical care in similar ways. During interviews, patients described at length their experience of dental care in practices which they had previously attended. These were dental practices that had not been included in the previous RCT study. Patients compared those experiences with their experiences in the practice they currently attended (Dental Practice 1 or 2), where they had been offered a structured approach to prevention.
We noted in the Methods section that we recruited patients with high, medium and low caries risk, and patients attending two quite different practices. However we note that by the end of the study we were unable to discover any systematic differences between patients, despite careful comparison between them.

Patients’ experience of dental care in a practice without a structured approach to prevention

During the course of interviews patients wanted to report their earlier experiences of receiving dental care in practices which did not have a structured approach to prevention. It is important to note that those dental practices were not part of the previous RCT study. When spontaneously recalling these past periods, they talked about being trapped in a situation of having “degenerating teeth” and this had historical, biological, financial, psychosocial and habitual dimensions (Table 3).

Various aspects of patients' histories were relevant: family history, personal history, and history of fluoridation. “Having degenerating teeth” – that is, having “poor teeth”, “toothache” and “bleeding gums” – was

<table>
<thead>
<tr>
<th>Table 2 Examples of questions asked during interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opening questions</strong></td>
</tr>
<tr>
<td>We are going to start by talking about oral health.</td>
</tr>
<tr>
<td>o When I say oral/dental health, what is the first thing that comes to your mind?</td>
</tr>
<tr>
<td>o Everyone's experience of oral/dental health is different. In your own case:</td>
</tr>
<tr>
<td>• How would you describe your oral/dental health at the moment?</td>
</tr>
<tr>
<td>• How important to you is attending a dental appointment? Why?</td>
</tr>
<tr>
<td>• In general, what do you expect to get from your dental appointment?</td>
</tr>
<tr>
<td>• Could you describe a typical visit to the dentist?</td>
</tr>
<tr>
<td>• What is it that you like about seeing the dentist?</td>
</tr>
<tr>
<td>• What is it that you dislike about seeing the dentist?</td>
</tr>
<tr>
<td><strong>Transitional questions</strong></td>
</tr>
<tr>
<td>Now we are going to talk about changes to your oral health and dental care.</td>
</tr>
<tr>
<td>o If you think back in the last year, how many times did you visit the dentist?</td>
</tr>
<tr>
<td>o Could you tell me about what led you to go or not go?</td>
</tr>
<tr>
<td>o Could you tell me what happened during those visits (what kind of treatment?)</td>
</tr>
<tr>
<td>• Has the care you received changed in the last 2 years?</td>
</tr>
<tr>
<td>• How has it changed?</td>
</tr>
<tr>
<td>• What was it like before?</td>
</tr>
<tr>
<td>• What do you think made it change?</td>
</tr>
<tr>
<td>• Who and what was important in this process?</td>
</tr>
<tr>
<td>• How do you feel about this change?</td>
</tr>
<tr>
<td>o If you could change the dental care that you receive, how would you change it? How would you like it to be different?</td>
</tr>
<tr>
<td>o Over the past two years, your dentist introduced a new system for the treatment of tooth decay.</td>
</tr>
<tr>
<td>• Do you remember hearing or being told about this system in the practice?</td>
</tr>
<tr>
<td>• Can you tell me the story of how you found out about it?</td>
</tr>
<tr>
<td>• How did you feel about it?</td>
</tr>
<tr>
<td>• Did you have any opportunity to follow the system?</td>
</tr>
<tr>
<td>• If so: what tasks were you able to perform?</td>
</tr>
<tr>
<td>• If so: what made it possible for you to perform those tasks?</td>
</tr>
<tr>
<td>• If so: did it make any difference for you?</td>
</tr>
<tr>
<td><strong>Concluding questions</strong></td>
</tr>
<tr>
<td>Now I am just going to sum up what I think I have learned about your oral health over the last two years [SUM UP HERE]. Does that sound right? Now, can I just double check with you to make sure I haven’t missed anything?</td>
</tr>
<tr>
<td>• Is there anything else that has changed in your relationship with your dentist?</td>
</tr>
<tr>
<td>• Is there anything else that has changed in your understanding of your teeth?</td>
</tr>
<tr>
<td>• Is there anything else that has changed in the way you look after your teeth?</td>
</tr>
<tr>
<td>• Is there anything else you think I should know?</td>
</tr>
<tr>
<td>• Is there anything you would like to ask me?</td>
</tr>
</tbody>
</table>

We noted in the Methods section that we recruited patients with high, medium and low caries risk, and patients attending two quite different practices. However we note that by the end of the study we were unable to discover any systematic differences between patients, despite careful comparison between them.
explained by these historical elements. Patients, who had grown up without fluoride, reported a “family history of bad teeth”, or regretted losing teeth when they were younger. “Having degenerating teeth” had serious implications both in the past and present. Patients also described themselves as “forking money out” due to toothache, or not being able to afford restorative treatment despite being in pain. They wanted to “keep” their teeth, and they were frustrated that their “teeth kept cracking”, but were not necessarily able or motivated to solve the problem. They described themselves as having become accustomed to receiving repeated fillings and being “lazy” about their oral hygiene.

Patients’ experience of dental care in a practice with a structured approach to prevention

While visiting the dental practices that participated in the previous RCT, patients reported that they no longer felt that they were trapped in a situation of having degenerating teeth as they were able to achieve lifestyle change by working with the dental team. The dimensions shown in Table 3, which had a “degenerative” effect, were being changed into reinforcing outcomes by the preventive program experience (Table 4). Patients realized that preventive care was better than the “old drill and fill” and that they could have solid strong teeth and their general oral health would be better off in the long term. They also understood that preventive care required ongoing changes in their daily routine, took time, and had a cost. However they were “prepared to pay” to “keep their teeth”. More importantly, for the first time these patients felt in personal control of their own oral health and were prepared to brush effectively, use floss and keep regular appointments with the dental team.

Barriers and facilitators

While patients valued these reinforcing changes, they also described potential barriers that could have

<table>
<thead>
<tr>
<th>Table 3 Patients’ experience of dental care in practices without a structured approach to prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Historical dimension:</strong> refers to patients’ dental history, their dental caries experience and fluoride exposure over time.</td>
</tr>
<tr>
<td><strong>Biological dimension:</strong> refers to patients’ experience of dental caries’ clinical signs and symptoms</td>
</tr>
<tr>
<td><strong>Financial dimension:</strong> refers to the financial burden of dental caries</td>
</tr>
<tr>
<td><strong>Psychosocial dimension:</strong> refers to the psychological and social aspects of patients’ oral health, including patients’ emotional suffering due to dental caries</td>
</tr>
<tr>
<td><strong>Habitual dimension:</strong> refers to customary activities related to or consequences of dental caries</td>
</tr>
</tbody>
</table>

| **Being trapped in a situation of having degenerating teeth** |
| **Growing up without Fluoride** |
| “I had gone in and I had a lot of holes because I grew up on a farm with no fluoride.” |
| **Having a family history of not having good teeth** |
| “My mother did not have good teeth and I do not have good teeth. My father has no teeth. He has these bloody ugly, awful bloody false teeth that do not fit him properly. He has had teeth problems all his life, so have I.” |
| **Having toothache and bleeding gums** |
| “I had pain and bleeding and when I flossed I used to bleed a lot.” |
| **Being someone with poor teeth and losing teeth** |
| “In the past, I got cavities and then got major problems and lost teeth.” |
| **Forking money out** |
| “I have been forking money out; because when you are in pain you will pay anything to get the pain to go away.” |
| **Not being able to afford restorative treatment** |
| “I could not afford to go and have my teeth fixed.” |
| **Wanting to keep my teeth** |
| “I would like to keep my own teeth and not have false teeth.” |
| **Being frustrated** |
| “It is just disappointing that at certain times I just keep cracking the teeth…” |
| **Being accustomed to have repeated fillings** |
| “You keep getting more and more fillings in the one tooth.” |
| **Being ‘lazy’ (oral hygiene)** |
| “My worst habit is probably not cleaning my teeth regularly before I go to bed, well; I reckon I am a bit lazy.” |
hindered preventive activities as well as facilitators for prevention during the process.

**Barriers to prevention**

There were three main barriers: uncertainty about prevention, competing priorities and existing habits. Patients reported that, at first, they were uncertain about the value of preventive treatments:

"Just getting used to some of the new techniques in the respect of, "We will not drill, we will do this and its okay", that was a complete change from that point of view."

"My biggest fear was that it was not going to work and it was going to be a waste of money."

Home care activities (tooth brushing and flossing) were seen as time consuming and not a priority:

"I just get so busy with home and kids and stuff that it [tooth brushing and flossing] just comes down the ladder of priority a little bit."

Old habits were also hard to change:

"Lifestyle changes are the most difficult, yeah, flossing everyday all the time especially. I think we are all

<table>
<thead>
<tr>
<th>Table 4 Patients’ experience of dental care in practices with a structured approach to prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Historical outcomes</strong>: refers to how patients’ dental history changed overtime after being exposed to intensive preventive care.</td>
</tr>
<tr>
<td>Having a way to address my dental history</td>
</tr>
<tr>
<td>&quot;Before, I used to go to the dentist if I was in pain or had a broken tooth. Now, I understand that it is not good for me coming to the dentist if my teeth are all falling out – it is a bit late then, right?&quot;</td>
</tr>
<tr>
<td>Having strong teeth (despite having a family history of poor teeth)</td>
</tr>
<tr>
<td>&quot;I feel more confident now, and my teeth just sort of feel a bit stronger.&quot;</td>
</tr>
<tr>
<td><strong>Biological outcomes</strong>: refers to patients’ experience of not having dental caries’ clinical signs and symptoms.</td>
</tr>
<tr>
<td>Prevention being better than the ‘old drill and fill’</td>
</tr>
</tbody>
</table>
| "It [prevention] is better than going back and having three, or four, or five filling type situations and then going from there."
| Having a better outlook |
| "Well, to floss, to use the mouthwash, which – yeah, that is good – I like that because it makes you feel cleaner. If you feel clean and comfortable you operate better – your whole outlook is better." |
| **Financial outcomes**: refers to the cost of preventive care and the absence of a financial burden in the long term. |
| Knowing that it is an ongoing investment |
| "I realized that taking care of my teeth is an ongoing thing, but I am prepared to pay for it, if it means keeping my teeth."
| Being better off in the long term |
| "I am hoping it [prevention] will help me in the longer term with my teeth. Then, I will not need to keep paying for broken teeth to be fixed."
| **Psychosocial outcomes**: refers to the psychological and social aspects of patients’ improved oral health |
| Feeling in control |
| "I guess emotionally you feel you have addressed that and I am in control now; and I manage it with my regular appointments, the brushing and the flossing."
| Feeling satisfied |
| "I feel like I have really achieved something, and that is continuing because I am still maintaining and looking after my teeth." |
| **Habitual outcomes**: refers to customary activities related to and/or consequences of preventive care. |
| Changing visits to dentist |
| "Rather than just making an appointment when I got a sore tooth, I was preventing that happening by keeping my regular appointments and having fluoride."
| Being part of life |
| "I have found that flossing has made quite a big difference, and so I just do that all the time now. It was difficult to start with, but then it was fine; and now it is sort of just a part of life" |
guilty of it, we have routines and then we get sloppy sometimes and maybe miss things.”

Facilitators for prevention
Patients talked about important facilitators for prevention. These included having more treatment options, being able to go back to work without a numb lip after receiving dental treatment, gaining a new understanding about what they could do to take care of their teeth and being “treated as a person” by their dentist.

Patients were attracted to prevention because it gave them treatment options apart from restorative care:

“The dentist has reassured me that I can strengthen the teeth that I have; so it was not just a matter of ripping out fillings and putting in new ones.”

Patients also valued receiving dental treatment without consequent numbness from anaesthetic injections. By avoiding the “dead mouth feeling” after treatments, they could visit the dentist and go back to work afterwards, which was previously not possible. This made it easier to fit attendance into a patient’s schedule.

“It is probably better in the way that you do not go away feeling sore or feeling numb with a dead mouth feeling and all that sort of thing. I used to take time off to come here where now I just make the appointment, work my day around it, jump in here, take off and just go straight to work.”

Patients talked about gaining new knowledge and beginning to understand what they could do at home to manage their oral health.

“They [dentist and dental team] helped me to understand a bit more that starting from before I go to the actual dentist I can start to take care of my teeth for a long time, even after I left the dentist from that appointment.”

Once preventive knowledge was gained, it had to be put into practice. Some patients were not used to tooth brushing twice a day or flossing at least once a day.

“I used to clean my teeth at night before I went to bed, sometimes in the morning, and I had to be more diligent than that, but I am probably still not diligent enough, but I try to clean them at least twice a day now.”

They also had to visit the dentist more often for fluoride treatments and oral hygiene coaching.

“I just think that if I have to go every 3 months or so to get fluoride put in to strengthen my teeth, I would rather do that then not go for 12 months and then I need a filling.”

All these activities took time and were slowly incorporated into patients’ busy daily routines, which included taking care of their children, work and home duties. However, when patients perceived that dentists and members of dental team were genuinely listening to their concerns and making an effort to help them “keep their teeth” it made them feel respected and reassured, increasing their motivation to follow home care instructions and take responsibility for their teeth.

“I think that I am treated in a more of a one person to person way, a bit more like the same level. It is not just assuming that I have the knowledge.”

“It is just more and more of a personal level than patient-dentist level and I feel more inclined to follow their instruction. Besides, I know now that if I do not look after my teeth I will be a lot worse off.”

What did patients value in their dental care?
All patients, regardless of the practice they came from or their level of clinical risk of developing dental caries wanted a caring dentist who would respect them and listen to their concerns without “blaming” them for their oral health status.

“As in most things it is a two-way relationship. So it is the gentleness, it is the trust, it is the respect, it is actually the transparency that has being able to build up a relationship where you can trust your dentist to give you a very open and honest answer about any treatment.”

“I do not have knowledge but the dentist acknowledges that I am person of intelligence as well. So I suppose, it is how [the dentist] explains the information without making me feel like [the dentist] has been speaking to me condescendingly.”

“I have dropped dentists in the past. I think that how they were able to relate to me as a person was probably the biggest indicator of whether I felt comfortable with what they were doing. I suppose if you have a choice of five people with the same skill set, it is how they are able to deliver that skill set that is more important than the skill set as such.”

When reflecting on their new preventive care experiences, patients suggested that there were two types of
dentists and two different ways of practicing dentistry which we categorized as “old-school dentistry” and “new-school dentistry”. Patients described the “old-school” dentist as one who had a “mandate for doing fillings”, would not give patients preventive options and lacked communication skills. Some patients wondered if there was an “old-school institution” that graduated dentists without any knowledge of preventive options.

“I wonder whether old-school dentists have got a mandate on what they do or whether that is easier or they make more money from continually filling teeth.”

“The dentists never mentioned to me any possibility of fluoride treatments. So I just think that there must be an old-school where this is the way it is done.”

“They [dentists] just think that you have got nothing else going on in your life and you are 100% focused on dealing with this one issue, which is just one facet of your life. They should listen to what patients say in the first place.”

On the other hand, patients said they had also met “new-school dentists” over the years.

“I have been fairly better educated in this practice. I used to just go to other dentist and get my teeth fixed and no one really ever said what to do in between.”

“I always think that it is better if the dentist explains it to you and shows you what to do. My dentist is quite proactive and supportive.”

“Dentists should at least offer the preventive treatment. Because I think there are a lot of people out there that do not have enough knowledge about the fluoride that you need. It is just too easy to say, “Okay that needs root canal” or “that needs to be removed” or, “that needs a filling” before it gets to that actual stage.”

These “new-school dentists” were greatly valued. Patients valued “new-school dentists” because they educated patients, monitored and reassured them frequently during visits and made them aware of preventive options.

Discussion
Transferability of findings and limitations of the study
As with all qualitative research, judgments about the transferability of these findings to other settings rely on understanding the context of this study. This was a study of private dental practices in the state of NSW, Australia – where dental services are overwhelmingly delivered in the private sector and not integrated into the medical system [5]. Dental practices in this study appeared to be more or less typical of Australian private practices. It seems likely that these results will be readily transferable to other private general dental practices in Australia and jurisdictions where the characteristics of practices and funding systems are similar. The degree to which they are transferable to other clinical or political contexts is a question for future empirical investigation.

The patients in the study had private dental insurance; they were used to visiting the dentist once to twice a year for check-up appointments and for restorative treatment when needed. They were not used to being treated by a dental hygienist. These practice and patient characteristics are similar to the Australian average, based on the results of The National Survey of Adult Oral Health 2004–06 NSW [7].

As in all qualitative research, the patients in this study were selected because they were expected to be information-rich cases, rather than as being representative of a broader population. As previously discussed, the sample was made up of people who had been exposed to structured preventive care, with a wide range of oral health states from high risk to low risk of developing dental caries as assessed using a standard instrument during the RCT. Patients were all attending a dentist and participating in a structured preventive program; people who rarely or never attend the dentist may respond differently. As in most research, there may be some selection bias resulting from patients having to actively opt-in to the research process (that is, being willing to participate and replying to the invitation letter.).

Brief overview of findings and its relevance to the dental literature
During this study we developed a better understanding of how patients experienced dental care. Historical, biological, financial, psychosocial and habitual dimensions of patients’ experience were revealed (Table 3 and 4). We saw marked differences between patients’ experience of dental care in dental practices with and without a structured approach to prevention in place. Patients transitioned from their initial state of being trapped in a situation of having degenerating teeth through a stage where they had achieved lifestyle changes and experienced reinforcing outcomes. Through this process patients gained new knowledge, developed new clinical relationships and established new practices. Patients were amazed by their experience of dental care without “drilling and filling” teeth and characterised dentists as either “old-school” or “new-school” based on the
patients in both practices, and for patients at all levels of risk of developing dental caries, that is, with healthy and less healthy mouths. Without preventive care, the existing vulnerability caused by a history of poor oral health was progressing to worsening oral health. People were either unable to pay for care and living with pain, or were continuously paying for restorative work; although they were unhappy with this situation, they felt unable to address it. Patients were initially uncertain about the effectiveness of structured prevention, and about their ability to implement it given competing priorities and existing habits. However this changed once structured preventive care had been experienced. Patients reported a new sense of ownership of their oral health, and no longer felt trapped in a situation of having degenerating teeth. They were now prepared to invest in an active program of oral health care. They appreciated some of the more concrete aspects of the new regimen, such as greater treatment choice and treatment without anaesthesia. But their motivation was substantially increased by their growing understanding of their oral health and what they could do to improve it. An even more significant motivator was a perceived change in the dentist-patient relationship: patients felt better respected. A key question to consider in concluding, then, is the degree to which this new sense of respect was dependent on dentists offering structured prevention. Surely, a dentist who offered only restorative care could provide a respectful and thus valued relationship as well.

Contrary to this, we argue that the respect that dentists offered and patients valued was intrinsically bound up with the provision of structured preventive care. This was so much the case that patients contrasted “old-school” and “new-school” dentists, the former offering only restoration and the latter offering structured prevention. “New-school” or “preventive” dentists were perceived as caring, non-judgemental, transparent and communicative. They provided patients with the knowledge and skills they needed to understand, take charge of, and self-manage their oral health. They offered monitoring, evidence-based information and reassurance rather than taking the automatic route of “drilling and filling” teeth. The very provision of prevention was seen to be a respectful act. Structured prevention – which necessarily involved more communication, education and skill development in patients – instituted a fundamentally different type of relationship between dentists and patients.

While all dental care – in fact, all clinical care – should be provided in a respectful manner, we propose that structured preventive care will be understood by patients to institute a particular and highly-valued type of respect. It seems unlikely that the kind of respect described here can be replicated inside a traditional,
restoratively-oriented clinical encounter. The experience of having a dedicated, supportive and caring dental team helped patients to take control of their own oral health. These dental teams produced profound changes in not just the oral health care routines of patients, but in the way patients thought about their own oral health and the role of dental professionals. We believe that the distinction patients made between ‘old’ and ‘new-school’ dentists warrants further investigation, as does the relationship between prevention and respectful care. We conclude that, based on the results of this study, not only patients but private practice dentists have much to gain by reorienting their services towards systematic prevention.

Abbreviations
RCT: Randomized Controlled Trial; DMFT: number of decayed, missing and filled teeth; NSW: New South Wales.

Competing interests
The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Acknowledgments
We thank patients for their invaluable contributions to the study.

Funding
The authors received financial support for the research from the following funding agencies: University of Sydney Postgraduate Award 2009, The Oral Health Foundation, University of Sydney; Dental Board New South Wales; Australian Dental Research Foundation; National Health and Medical Research Council Project Grant 632715.

Authors’ contributions
All authors have made substantial contributions to conception and design of this study. AS carried out data collection, analysis, and interpretation of data. SMC made substantial contribution during data collection, analysis and data interpretation. AS, SMC, RWE, and AB have been involved in drafting the manuscript and revising it critically for important intellectual content. All authors read and approved the final manuscript.

Received: 23 January 2012 Accepted: 24 June 2012

References
CHAPTER SIX – What factors influence the provision of preventive care by general dental practitioners?


This chapter includes a Research Summary published in the British Dental Journal following the publication of the paper:
What factors influence the provision of preventive care by general dental practitioners?

A. Sbaraini

Background What factors influence a general dental practitioner to offer preventive care to patients? A potential answer to this question is presented based on the findings of a qualitative study recently undertaken in general dental practice in Australia. Method A model of how practices come to be oriented towards preventive or restorative care is described, condensing all of the findings of the study into a single framework. Eight practices were studied and highlighted the interaction between two factors: leadership in practice and prioritisation of cultural, social and economic resources. Results In this model, dentists’ leadership to reorient the prioritisation of resources towards preventive care was crucial. Ideally a whole practice changed to preventive philosophy, but change was also possible in a single dentist within a practice. Prioritisation of resources was also key and interacted with dentist leadership. Prioritisation could be seen in the reorganisation of space, routines and fee schedules. During this process, one key support factor for dentists was their external networks of trusted peers and respected practicing dentists. These peers were crucial for transferring preventive knowledge within small networks of dentists who trusted one another; their influence was reportedly more important than centrally produced guidelines or academic advice. In order to help dentists change their practices towards preventive care, the findings from our study suggest that it is important to intervene in these local networks by identifying local dental opinion leaders. During this study, the key conditions needed for practices to reorient to preventive care included the presence of a committed leader with a prevention-supportive peer network, and the reorientation of space, routines and fee schedules to support preventive practice.

INTRODUCTION

This study was built on a previous randomised controlled trial (RCT) undertaken in private general dental practices in New South Wales (NSW), Australia. Intervention practices in the RCT were provided with evidence-based preventive protocols to offer a less invasive approach to the treatment of dental caries. The protocols advised dentists to systematically apply preventive techniques to prevent new dental caries and to arrest the early stages of dental caries, thereby reducing the need for restorative care. The protocols focused on primary prevention of new dental caries (via tooth brushing with high concentration fluoride toothpaste and dietary advice) and intensive secondary prevention through professional treatment to arrest dental caries progress (applying fluoride varnish and monitoring the success of tooth brushing by recording the levels of dental plaque on the teeth).2 Dentists, members of the dental team and patients from the practices involved in the RCT were invited to participate in this qualitative study.

The context of this study: general dental practices in Australia

This study was conducted in Australia where more than 80% of dentists work in private general dental practices.3 General dentists provide the majority of care and dental hygienists are employed in only a minority of practices.4 The majority of dentists are independent self-employed practitioners; they own their practices and lead their dental team.

The problem: dentists’ management of dental caries

The restorative approach to dealing with all forms of dental caries is common practice for general dental practitioners worldwide, despite the plethora of evidence that a non-operative preventive approach should be the first clinical option when dealing with early carious lesions.5–10 The scale of the information gap between science and practice can be demonstrated by the findings from surveys in different countries. Evidence from surveys of dentists in Australia and overseas suggests that restorative care has been the dominant approach used to manage the initial stages of dental caries, which could have been controlled with preventive non-operative care.11–14 What does preventive dental care mean to dentists?

A recent review in the British Dental Journal (BDJ) concluded that ‘there is a lack of evidence relating to dentists’ perceptions of prevention and its application in practice’.15 The author suggested that qualitative research was needed to explore the ‘meaning of prevention’ and
its ‘application’ in dental practice.13 This article responds to this suggestion by consolidating the findings of a grounded theory study completed in general dental practices in Australia.16,17 All grounded theory studies aim to produce an overall explanation that brings all of the analysis together.

This paper presents that overall explanation; which is more abstract than the other empirical papers published out of this study because it brings the entire context together into a single explanatory framework. A model is presented explaining how practices came to be oriented towards either preventive or restorative care. This model demonstrates an interaction between two key factors:

1. Dentists’ leadership
2. Prioritisation of the cultural, social and economic resources available within practices towards prevention.

Suggestions are made of some conditions that are necessary for dentists to provide leadership toward preventive care.

METHODS

A previous paper has described the sampling, data collection, analysis and interpretation in detail.16 During the study, Charmaz’s grounded theory methodology18 was employed to examine the social process of adopting preventive dental care in dental practices. Charmaz’s methodology suggests a systematic set of procedures to study and understand social processes, actions and interactions between individuals.19 Accordingly, this study was interested in what it meant to dentists to practice preventive dentistry; how it felt to adopt new routines; what happened during the process and how people interacted while adopting preventive care.

Research questions

Grounded theory studies begin with open questions: researchers begin by assuming that they may know little about the meanings that drive the actions of their participants.18 Accordingly, research questions asked were open and focused on social processes. The initial research questions were:

- What was the process of implementing (or not-implementing) the preventive protocols (from the perspective of dentists, members of the dental team, and patients)?
- How did this process vary?

Sampling strategy

All qualitative research starts with purposive sampling: sampling the participants best placed to answer the research questions. In grounded theory this is followed by theoretical sampling, in which constant analysis of the data guides further sampling decisions.18 Participants in the previous RCT were invited, by letter, to participate in this qualitative study. Eight dental practices agreed to participate (Table 1).

Sample of dentists and practice staff

During the previous RCT, the numbers of decayed, missing and filled teeth (DMFT) were monitored over time. Interviews began with participants from Dental Practice 1, where substantial DMFT reductions were achieved in the RCT, providing the best possible access to the process of successfully implementing the protocols.16 After the analysis of the initial interviews, participants from Dental Practice 2 were theoretically sampled. In this practice the uptake of the preventive protocols had been very limited according to data from the RCT trial.16 This strategy allowed comparisons between two practices in which outcomes had been different and considered to be a proxy for the degree to which the preventive protocols had been implemented. After analysing interviews from Dental Practice 2, participants from another six practices were recruited. This included two intervention practices that had achieved moderate DMFT reductions, for comparison with Dental Practices 1 and 2. It soon became apparent that some practices had followed, or continued to follow, other preventive protocols. In these practices, the interviewees compared their experiences in implementing the preventive protocols provided during the RCT with those of other protocols. Thus, professionals from four control practices in the RCT were sampled to examine the process of adopting preventive methods in general.

Sample of patients

Two dental practices (Dental Practice 1 and 2), which had offered the preventive care program during the previous RCT, consented to send letters of invitation to participate in this study to their patients. These participants were purposively selected based on their clinically measured risk of developing dental caries; some whose risk status had decreased, some whose risk status had increased and some whose risk status had stayed the same over the previous RCT study were selected. This purposive sampling allowed comparisons between dental care experiences of participants with different clinical outcomes. After analysing the first round of interview data from Dental Practice 1, participants from Dental Practice 2 were interviewed. This allowed comparisons between patients in a practice where the preventive protocols were successfully implemented and those who were treated in a practice where the program had been less successful.

Interviews

All participants were interviewed for approximately one hour in locations convenient to them such as dental practices, community centres or homes. Some preferred to be interviewed over the phone, when the same format was used as for face-to-face interviews. Sturges and Hanrahan have reported that telephone interviews give the same in-depth data as face-to-face interviews.19 Semi-structured interviews based on the research questions were digitally recorded and professionally transcribed in detail. Transcripts were checked against the recordings.

The interview process was designed to gain an in-depth understanding of each dentist and practice staff’s experience of adopting prevention in their practices. Participants were encouraged to talk at length, to tell their story of using protocols or of learning to work preventively and to explain what this process meant to them. For example, all interviews started with an invitation to describe a ‘typical day’ in the practice and then progressed with specific questions about participants’ experiences of implementing protocols such as:

1. ‘How easily were you able to implement preventive protocols in this practice?’
2. ‘What did this implementation process entail?’16

© 2012 Macmillan Publishers Limited. All rights reserved.
Participants from the control practices were asked similar questions about preventive protocols or guidelines they had applied. Patients were asked about their experience of dental care, what dental care and preventive care meant to them in general, how and why they did or did not adopt the prescribed preventive care and how this was influenced by their social context. As the study progressed, the understanding about how protocols were adopted began to consolidate and a theoretical framework was developed to explain the process. New interview questions were added to further investigate insights developed during the analysis of transcripts from earlier interviews. All dentists were interviewed more than once which contributed to the refinement of theoretical concepts.

Data analysis

Charmaz’s iteration of the constant comparative method was used during the data analysis. This involved coding of interview transcripts, detailed memo-writing and drawing diagrams. The transcripts were analysed as soon as possible after each round of interviews in each dental practice. Coding was conducted primarily by the author, supported by team meetings and discussions when researchers compared their interpretations.

Coding occurred in stages. In initial coding, as many ideas as possible were generated inductively from early data. In Charmaz’s form of grounded theory, codes take the form of gerunds (verbs ending in ‘ing’) which emphasises actions and processes. In focused coding, a selected set of central codes were pursued throughout the entire dataset and the study. This required decisions about which initial codes were most prevalent or important and which contributed most to the analysis. In theoretical coding, the final categories were refined and related to one another.

Memo-writing

The primary analyst wrote extensive memos, which documented the development of the codes, what they meant, how they varied, and how they related to the raw data (transcripts). Two types of memos were written: case-based and conceptual memos. Case-based memos were written after each interview, containing the interviewer’s impressions about the participants’ experiences and the interviewer’s reactions. Memos were also used systematically to question some of our pre-existing ideas in relation to what had been said in the interview. Conceptual memos, on the other hand, were a form of:

1. Making sense of initial codes
2. Examining participants’ meanings
3. Understanding processes, including when they occurred and changed and what their consequences were.

In these memos, data were compared in order to find similarities and differences. Ideas were systematically indexed in memos. This process raised new questions, which were investigated in continuing interviews.

Consolidating and interpreting all findings

After the writing of previous papers had ceased, I went back and I reviewed interviews, memos, field notes and diagrams used during data analysis. It was clear that there were important elements within dental practices that interacted to allow the adaptation to preventive care to occur. Those elements provided an overall explanation about the factors that influence the provision of preventive care by general dental practitioners. Dentists and dental team members described two key elements shaping adaptation to evidence-based preventive care: leadership in practices, and prioritisation of a practice’s cultural, social and economic resources.

The distinction between cultural, economic and social resources was drawn from Bourdieu.

Sample size and saturation

Sample size in qualitative studies is determined by reaching a complete understanding of the problem being studied – referred to as saturation – and not by statistical power considerations. Saturation is determined by the data analyst. When new interviews became repetitive with prior interviews and central concepts were fully understood, the analyst determined that saturation was reached. In this study, data from the last three participants interviewed (three dentists) confirmed findings rather than adding new concepts. Therefore data collection ceased. In total, 40 participants, ranging in age from 18 to 65-years-old, participated in the interview process (Table 1).

Ethics approval for the study was obtained from the Human Research Ethics Committee at the University of Sydney.

FINDINGS

In their interviews, dentists and the dental teams talked about adapting to evidence-based preventive care in the complex social environments of general dental practices. Patients reported different experiences of dental care in different practices. During data collection and analysis, differences between dental practices were observed. Some practices had a structured preventive approach in place (either the preventive protocols from the RCT or other protocols) while others had not.

Table 1 Characteristics of participants (n = 40)

<table>
<thead>
<tr>
<th>Site</th>
<th>Participants</th>
<th>Previous RCT group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Practice 1</td>
<td>1 dentist, 2 dental hygienists</td>
<td>intervention</td>
</tr>
<tr>
<td>Dental Practice 2</td>
<td>3 dentists</td>
<td>intervention</td>
</tr>
<tr>
<td>Dental Practice 3</td>
<td>1 dentist</td>
<td>control</td>
</tr>
<tr>
<td>Dental Practice 4</td>
<td>1 dentist</td>
<td>control</td>
</tr>
<tr>
<td>Dental Practice 5</td>
<td>1 dentist</td>
<td>control</td>
</tr>
<tr>
<td>Dental Practice 6</td>
<td>1 dentist</td>
<td>control</td>
</tr>
<tr>
<td>Dental Practice 7</td>
<td>1 dentist</td>
<td>intervention</td>
</tr>
<tr>
<td>Dental Practice 8</td>
<td>1 dentist</td>
<td>intervention</td>
</tr>
</tbody>
</table>
At the ‘structured preventive practices’ dentists performed caries risk assessment for all patients, following some kind of preventive protocol and offering a mix of preventive products to patients. A preventative philosophy of care was the basis of the practice and a restoration was rarely placed if patients had bleeding gums or active caries lesions. On the other hand, at the ‘restorative practices’ dentists did not perform caries risk assessment and there were not preventive protocols in place. Preventive care was offered by chance without systematically considering patients’ real need for it. Patients with irregular patterns of attendance, who might have benefited from preventive care, were offered restorations. Regular patients were offered applications of topical fluoride at every visit because they were used to it.

**How can we explain the orientation towards preventive or restorative care in different dental practices?**

When dentists and their teams changed their practices in line with the preventive protocols from the RCT or another preventive protocol, they did not follow protocols slavishly. Rather, they adapted protocols to incorporate them into their established practice management systems. Dentists and the dental teams described two key elements shaping adaptation to evidence-based preventive care: leadership in practices and prioritisation of a practice’s cultural, social and economic resources.

The first key element was the dentists’ leadership of other members of the dental team. In the beginning of this study, I had no preconceived idea about the role of leadership in the provision of preventive dental care. However, practice staff and patients talked about dentists’ leadership a lot during interviews. Dental assistants, practice managers, dental hygienists and patients described a dentist who was the leader of their practice: the dentist-in-charge. This dentist was seen by all as ‘the bonding agent’: someone who was crucial for the practice to remain the great place it was, someone who inspired practice staff and patients and deserved their respect.

‘I think my dentist is a pretty good manager who gets things sorted out very well in here. My dentist is someone you truly learn to respect. From what I have seen in this practice I think that my dentist was born to lead these people.’ – Patient, Dental Practice 1.

To lead a practice, dentists had to be highly skilled clinicians, respected and trusted by their dental team. Leading a dental practice involved communicating ideas in an effective and precise manner to all staff, building relationships with all staff members and providing solutions for daily practical problems as they arose. Some dentists excelled in building relationships of trust and respect, which produced fruitful interactions with staff and patients.

‘The dentist-in-charge of this practice is very good at the new things on board and we do what we are told. We are all comfortable to tell the dentist-in-charge if we think it is not working [sic].’ – Dental assistant, Dental Practice 1.

‘To me it is a constant thing of trying to do it better; to deliver a better treatment for the patient and to make it a better environment for the staff. And my belief is that the day you do not want to make it better for the staff and you do not want to make it better for patients is the day you stop working as a dentist.’ – Dentist-in-charge, Dental Practice 1.

However, dentists also had to have effective leadership in terms of prioritising the allocation of different kinds of resources within practices. Intuitively, one might imagine that practices with more resources might be better able to change to implement preventive care. However, in this study all of the participating practices were well resourced. The most significant issue was not the possession of resources, but their prioritisation towards prevention. Prioritising resources towards prevention was not a simple task as it involved cultural, social and economic elements.

Cultural resources were those elements that defined the dentists’ identities within a social setting: who they were, what they did, what they trusted and what credentials they had. In this study, dentists defined who they were by describing their long-standing behaviours, attitudes, beliefs and dispositions. For example, many saw themselves as being ‘dental surgeons’ and ‘performing surgery’, that is intervening mechanically to repair and restore oral function. For ‘performing surgery’, dentists needed to possess particular goods which were present in all practices – namely state-of-the-art instruments, materials and equipment for providing the best possible dental care.

All dentists shared common training or credentials and this was for the most part focused on restorative care. This meant that they lacked established systems for practicing evidence-based preventive care. Two implicit ‘rules’ were also shared by all dentists and underpinned continued restorative treatment. They believed that some patients were too ‘unreliable’ to benefit from prevention and only tangible restorative treatment offered ‘value for money’, which would satisfy their patients.

‘We just do not make the appointment anymore for those patients who just do not care; we just leave it up to them. We stress why it is important but they just do not even turn up to the appointment so we are not going to waste our time on unreliable people. So they come in when they need treatment, which is usually restorative.’ – Dentist-in-charge, Dental Practice 8.

‘Some patients may not want preventative when you mention using fluoride, duraphat varnish. It all takes time, and they may not want that if they are not getting anything back from their health fund.’ – Dentist-in-charge, Dental Practice 2.

Dentists also shared cultural norms and values about evidence. In particular, they valued results seen in their patients’ mouths as important evidence and trusted this more than academic research.

‘A lot of my evidence is based on my clinical experience and on what I have seen in my patients’ mouths and feel will work on that particular patient.’ – Dentist-in-charge, Dental Practice 1.

‘I probably trust my own clinical experience more than anything, because, after all you keep doing something that is not working, you are going to stop, aren’t you? My own clinical experience is what I trust the vast majority of the time.’ – Dentist-in-charge, Dental Practice 7.

Social resources were defined as a network of individuals whom dentists trusted and connected with. Dentists invested time and effort in establishing these relationships. There were networks inside and outside of dental practices. The internal network of a dental practice was made up of members of the dental team, clinical and...
non-clinical working staff. External networks, in contrast, were a social resource for the individual dentist, not directly integrated with daily practice activities and the dental team. Dentists who were members of a professional society or association benefited from networking and exchanging valuable information with other members during meetings and social events. They also participated in less formal activities to establish networks and exchange information with peers, such as internet forums about dental products and techniques, study groups, and continuing education courses. For example, all individual dentists had a personal network of trusted peers and key opinion leaders. Members of these networks were practicing dentists. The dentists in this study said that non-clinical dental academies were not legitimate social resources, as they did not share their clinical experiences or understand the challenges of general practice.17

‘I and six other dentists meet and talk about patients’ cases and I get to see what clearly has worked or not worked in my patients and what other dentists have done. And that all becomes part of my evidence base or my inherent knowledge of what I will do in practice.’ – Dentist-in-charge, Dental Practice 1.

Economic resources were defined as dental services exchanged for money. In the privatised landscape of Australian dentistry, dentists felt they were under constant pressure to remain financially viable – a predictable income and patient flow were critical resources to be protected.

‘A problem has been having to spend more time talking about disease prevention, I think, because traditionally we have seen that as non-productive time and I tend not to charge for that.’ – Dentist-in-charge, Dental Practice 4.

How did leadership and resources interact to explain adaptation to preventive care?

The interaction of leadership and resources was investigated by building a four quadrant model based on the contrasting circumstances that were observed across the eight practices participating in the study (Fig. 1).

The model shows four scenarios, which will be explained further below. First, it was observed that all participating dentists talked about themselves as ‘being preventively-oriented’ as they ‘put patients first’ and educated them about their mouths, the role of saliva, life style (diet, smoking, alcohol consumption and exercise), oral hygiene and the use of preventive products. Avoiding the unnecessary removal of tooth structure during a restorative procedure was also part of their conceptualisation of a preventively-oriented dentist. However, although most participants talked about themselves as being ‘preventively-oriented’, actual practice varied widely. This variation is reflected in the differences identified for each of the four case-scenarios presented in Figure 1.

Explaining differences between dental practices

Figure 1 shows four hybrid hypothetical practices which were created from elements of the eight practices in this study and used to explain the differences observed across all eight practices. The model illustrates:

1. How social, cultural and economic resources worked in practice
2. The way that dentist’s leadership changed the use of resources, that is, the way resources were prioritised towards or away from preventive care because of the leadership of the dentist.

The best case scenario for prevention (Quadrant 1) happened when a dentist (practice owner) was the leader for prevention and prioritised the resources of the whole practice towards preventive care. Conversely, the worst case scenario (Quadrant 3) happened when there was absence of leadership, which perpetuated habitual, reactive restorative care throughout a practice. Quadrant 2 shows a situation where dentists (practice owners) were leaders for restorative care and prioritised resources in that direction, leading to the uniform practice of restoration. In Quadrant 4, practice owners allowed a single employee to prioritise preventive care; the practice remained oriented to restorative care, but one small section of the practice systematically implemented prevention.
practice for more than 20 years. There was a strong tradition of internal continuing education and collegiality among all members of the dental team. This internal network of people shared knowledge, that is, cultural resources. For example, there were team meetings to discuss published case reports, educational courses (such as first aid) delivered at the dental practice, dental industry practical workshops about new products and practice management courses.

'We do a lot of training here. So, they [practice staff] are always growing and learning. We have meetings every week or so when we discuss a paper in a magazine, or we might have someone to give us a talk about patient resuscitation or someone from a dental company who comes here and tells us what they have that is new for our practice.' – Dentist-in-charge, Dental Practice 1.

These opportunities to meet and discuss various topics benefitted all members of the dental team in two ways. Firstly it was a way of acquiring the cultural resource of new knowledge and secondly it strengthened their relationships, that is, internal social resources. The quality of the relationships among members of the dental team was important for achieving stability and cohesion during daily activities.

When the earlier RCT project began, the lead dentist took actions to completely reorient the routines of the practice in the direction of preventive care, including but not limited to implementation of the RCT protocols. The dentist hired a dental hygienist to deliver oral hygiene instruction and run maintenance visits; reorganised the physical environment and routines of the practice to accommodate preventive activities, such as coaching of tooth brushing and flossing; and changed the fee schedule to cover the delivery of preventive services to protect the income of the practice.

'I had to decide how to do it and to work out what we were doing with the protocols. To start with I kept looking at the protocols and thinking, ‘God, what do you have to do?’ Then, I would train the staff, and I used to constantly refer to the home fluoride measures and then after a while you just know them. So, then it became easy. I had the Duraphat here. I had the high concentration fluoride toothpaste here. I had the stuff you need for saliva testing. I had the computer system. I had digital imaging. So, it was not a hard thing to do. It was more the mental thing and thinking, ‘this is what I am doing’ and I had to sell it to my staff and then I was selling it to my patients.' – Dentist-in-charge, Dental Practice 1.

This set a new direction for the whole practice, through their reputation for prevention they gained new patient referrals and experienced increased sales of preventive products. The lead dentist felt stronger medico-legally as a consequence of prioritising resources towards preventive care. Participants also talked about practicing prevention as offering the best care for each patient.16

‘Prevention is a huge and now subconscious part of how I practice. My staff and I believe that we are doing the best thing for the patients and that is positive. I believe that we are doing it better than we used to do.' – Dentist-in-charge, Dental Practice 1.

Quadrant 2: leadership and prioritisation of resources towards restorative care

Three practices were assigned to Quadrant 2. The lead dentists, who owned the practices, retained a strong commitment to restoration and were opposed to change. Members of the dental team were encouraged to ‘sell’ restorative care to every patient. Preventive activities were seen as ‘unproductive time’ and the focus was on restorative care including crowns, implants and aesthetic dentistry, particularly tooth whitening and veneers.

‘I just could not really see that a formal risk assessment was going to materially alter the outcomes for my patients. The patients come to us and they are expecting to be treated the way they have always been treated and have a check up, some x-rays and a filling and come back after one year for the same again.’ – Dentist-in-charge, Dental Practice 3.

Quadrant 3: absence of leadership perpetuating automated restorative care routines

As in Quadrant 1, only one practice was allocated to this quadrant and the case had been selected as an extreme case (of poor outcomes in the RCT) to allow for the full range of possibilities. It was discovered that in this practice, the absence of a team leader meant resources could not be prioritised towards preventive care. The owner and the employees practiced dentistry in a ‘default mode’, simply reacting to whatever clinical problem presented, but with a focus on predominately providing restorative care. Members of the dental team were either not interested or unaware of the potential value of preventive care. Dentistry was practiced as an assembly line perpetuating the automated routines of ‘drilling and filling’. There was a sense of alienation as team members did not feel empowered in any way to help patients to improve their oral health. The dental assistants and dentists performed predictable, set tasks and the patients were passive participants.

‘I see 20 patients a day and it is mainly restorative work. I do not feel I can control any of the other people that work here in terms of what kind of care they provide.’ – Dentist-in-charge, Dental Practice 2.

‘We were a bit too busy to implement the protocols. I did not have time to teach the staff about them. The other thing was that our practice manager left and then we had a different one, but things are still a bit messy.’ – Dentist-in-charge, Dental Practice 2.

Quadrant 4: a single dentist pursuing preventive care

There were three different practices in Quadrant 4, with only one dentist in each practice with an interest in prevention. The practice owner and leader of the whole practice was not involved in the process, but allowed one employee to prioritise limited resources towards preventive care. The ‘preventive dentist’ shared knowledge with a dental assistant in the practice, who developed an interest in preventive care. As a result, preventive activities were included as part of the usual routines of that dentist and the dental assistant. However, there were practical differences from the scenario in Quadrant 1, as preventive activities were part of the usual recall appointment fee, so ‘prevention’ was not financially valued and the rest of the practice was still oriented towards restorative care.

‘I suppose if I did not have support from my practice management I could not work
the way I do. Not having this support is a big issue these days because lots of people are just working for big practices that are running as businesses. I think charging for prevention is the hardest thing. Getting it accepted by other dentists is difficult too because they might be filling in everything.’ – Dentist employed at Dental Practice 6.

Implications for patients

Patients had different experiences in different practices. During the study patients were recruited from two dental practices. These practices were allocated in Quadrants 1 and 3 (Fig. 1). Patients who visited the practice in Quadrant 1 reported that their visit was friendly and mutually respectful. They were offered preventive options and were educated about self-care at home. As a result, patients talked about having ‘strong teeth’ and ‘being in control’ of their oral health. Conversely, those patients who visited the practice located in Quadrant 3 described their relationship with dentists as dictatorial because dentists had a ‘mandate for doing fillings.’ The patients felt they were not made aware of preventive options and their teeth were ‘degenerating.’ This group of patients characterised dentists as either ‘old-school dentists’ (Quadrant 3) or ‘new-school dentists’ (Quadrant 1) based on the treatment options provided and the clinical relationship offered.16 ‘I wonder whether old-school dentists have got a mandate on what they do or whether that is easier or they make more money from continually filling teeth...’ – Patient, Quadrant 3.

‘The dentists never mentioned to me any possibility of fluoride treatments. So I just think that there must be an old-school where this is the way it is done.’ – Patient, Quadrant 3

‘I have been fairly better educated in this practice. I used to just go to a dentist and get my teeth fixed and no one really ever said what to do in between.’ – Patient, Quadrant 1

DISCUSSION

What is the relevance of these findings to the future of preventive care in general dental practices?

In this study, restorative care was the ‘default mode’ observed in the majority of the practices. Figure 1 shows that this was particularly the case in Quadrants 2 and 3, where strong commitments to restorative care meant preventive treatments were actively resisted or a lack of leadership made restoration the ‘default’ option. The dental leader in Quadrant 1 had adapted completely to prevention, while the employee dentists in Quadrant 4 engaged in prevention but had little support.

The difference between Quadrants 1 and 4 was the degree of leadership offered in the whole practice and thus the proportion of practice resources prioritised towards prevention. In Quadrant 4, the single dentist and a dental assistant created a ‘preventive oasis’ inside a dental practice still oriented towards restorative care. In contrast, in Quadrant 1 the whole dental team, guided by the lead dentist, were engaged and established preventive care as central to their daily practice routines.

This study suggests that leadership is imperative if there is to be a movement away from a ‘default’ restorative focus towards preventive care. Such leadership is potentially a challenging task, requiring an individual dentist to persuade all members of a dental team to make preventive care a central part of daily life of a general dental practice. Willcocks in his BDJ opinion article described this form of leadership as ‘transformational leadership’, when the lead dentist inspires and motivates all members of the dental team, engaging them to support change or transformation.16 Our findings provide empirical support for this view that an individual dentist’s leadership role is vital for effecting change in a dental practice. Other researchers have shown that other factors also influence change in dental practices: adopting a team approach, allowing autonomy within the dental team and being part of professional networks.22 These were all present in Quadrant 1, while having autonomy to practice prevention was essential in Quadrant 4.

In this study, dentists’ cultural identity, that is, their long-standing beliefs and dispositions, defined their daily practices of restorative care. For example, dentists described their daily activities as ‘performing surgery’ and this was part of what it meant to be a dentist. While on the surface this may seem trivial, it potentially has a profound impact on the likelihood that dentists will practice preventive care. If dentists are asked to provide preventive care, meaning that there is no need for the customary focus on restorative care, the move away from an interventionist approach of care could profoundly challenge their professional identity.8,9,24–26

In addition, dentists’ deeply-held beliefs about the motivation, values or cooperativeness of patients also determined whether or not prevention was offered. This is consistent with previous research that shows that dentists may find it difficult to treat patients who do not value oral health or are disinterested, providing them with a different quality of dental care.27,28

How can dentists be encouraged to develop a preventive outlook?

This study suggests that it is critical to convince practice leaders that it is possible to sustain their income while moving towards a preventive care focus. External networks of trusted peers and key opinion leaders (practicing dentists) could potentially be mobilised to promote preventive care. For example, a strong opinion leader (who is a practicing dentist within a local network) could be identified to work with dental practices as an agent of change. Opinion leaders could also set up study groups to discuss clinical cases and highlight practical strategies for practice leaders to have the confidence to prioritise resources towards prevention. Based on our findings, such opinion leaders could have a strong effect within their network of dentists. Other authors have also suggested that knowledge transfer relies on small networks of dentists who trust each other.29–31

This may be a disheartening conclusion for dental academics who hope that dental professionals will embrace the paradigm of evidence-based dentistry simply because the RCT evidence is compelling. However this study has shown that dental practice is not purely scientific, it is also cultural, social and economic. While we can publish papers about the need for evidence-based preventive care and discuss it in dental meetings, this study suggests that until we get access to the influential local networks in which decisions about the practice of dentistry are made on a daily basis, we will not change knowledge transfer inside practices. Future intervention research should not only be consistent with the best
RCT evidence, but should address practice leadership, the prioritisation of cultural, social and economic resources towards practicing prevention and the need to communicate research evidence through trusted networks of dental professionals.

I am thankful for the guidance and support provided during this project from Dr Stacy M. Carter and Emeritus Professor Miles Little, the Centre for Values Ethics and the Law in Medicine, University of Sydney; Professor Anthony Blinkhorn and Associate Professor Wendell Evans, Population Oral Health, Faculty of Dentistry, University of Sydney. Funding: financial support for the research was received from the following funding agencies: University of Sydney Postgraduate Award 2009; The Oral Health Foundation, University of Sydney; Professor Anthony Blinkhorn and Emeritus Professor Miles Little, the Centre for Values Ethics and the Law in Medicine, University of Sydney; National Health and Medical Research Council Project Grant 632,715.

1. Curtis B, Evans R W, Sbaraini A, Schwarz E. The Oral Health Foundation; National Health and Medical Research Council; Faculty of Dentistry, University of Sydney; Professor Anthony Blinkhorn and Emeritus Professor Miles Little, the Centre for Values Ethics and the Law in Medicine, University of Sydney. Funding: financial support for the research was received from the following funding agencies: University of Sydney Postgraduate Award 2009; The Oral Health Foundation, University of Sydney; Professor Anthony Blinkhorn and Emeritus Professor Miles Little, the Centre for Values Ethics and the Law in Medicine, University of Sydney; National Health and Medical Research Council Project Grant 632,715.

Summary of: What factors influence the provision of preventive care by general dental practitioners?

A. Sbaraini

Background What factors influence a general dental practitioner to offer preventive care to patients? A potential answer to this question is presented based on the findings of a qualitative study recently undertaken in general dental practice in Australia. Method A model of how practices come to be oriented towards preventive or restorative care is described, condensing all of the findings of the study into a single framework. Eight practices were studied and highlighted the interaction between two factors: leadership in practice and prioritisation of cultural, social and economic resources. Results In this model, dentists’ leadership to reorient the prioritisation of resources towards preventive care was crucial. Ideally a whole practice changed to preventive philosophy, but change was also possible in a single dentist within a practice. Prioritisation of resources was also key and interacted with dentist leadership. Prioritisation could be seen in the reorganisation of space, routines and fee schedules. During this process, one key support factor for dentists was their external networks of trusted peers and respected practicing dentists. These peers were crucial for transferring preventive knowledge within small networks of dentists who trusted one another; their influence was reportedly more important than centrally produced guidelines or academic advice. In order to help dentists change their practices towards preventive care, the findings from this study suggest that it is important to intervene in these local networks by identifying local dental opinion leaders. During this study, the key conditions needed for practices to reorient towards preventive care included the presence of a committed leader with a prevention-supportive peer network, and the reorientation of space, routines and fee schedules to support preventive practice.

EDITOR’S SUMMARY

What would make you and your team members choose a preventive approach? Despite a large amount of evidence to support non-operative care of early carious lesions the vast majority of dentists are still choosing to pursue a restorative rather than preventive course of action. There is a significant gap between science and practice. But why? What factors might influence the preventive choice?

According to this Australian study of dental practices by Alexandra Sbaraini, leadership and prioritisation of resources within practices were found to be key in implementing preventive techniques. Sbaraini looked at eight practices in Australia where the majority of dentists are independent, self-employed practitioners. These practices implemented preventive protocols and both patients and the dental team were interviewed regarding the experiences and outcomes of employing these methods. Some practices followed a structured preventive care regime whereas the ‘control’ group of practices used a more general preventive approach without performing a caries risk assessment. Questions asked included: ‘How easily were you able to implement preventive protocols in this practice?’ and ‘What did this implementation process entail?’

Transformational leadership is highlighted in the results of the study as imperative in driving a move from restorative to preventive care. The research suggests that the practice leaders must firstly be convinced that a preventive care approach will not result in a drop in practice income. Reorganisation of resources, such as space and fee schedules, towards a preventive philosophy are also required to ensure a successful reorientation.

The facts and the science are there for all to see but the change needs to be made to happen through a shift in culture. The study identifies knowledge transfer and support of trusted dental networks as important in pushing this cultural change towards preventive care. In this age of Web 2.0 and social media there are ample opportunities to meet and exchange ideas and experiences both in the ‘real’ world and through the internet, eg BDA communities http://community.bda.org/.

Through the evaluation of the experiences of these Australian practices, the changes required to help move your practice towards preventive care are highlighted in this detailed and interesting study.

The full paper can be accessed from the BDJ website (www.bdj.co.uk), under ‘Research’ in the table of contents for Volume 212 issue 11.

Ruth Doherty
Managing Editor

DOI: 10.1038/sj.bdj.2012.496
TO ACCESS THE BDJ WEBSITE TO READ THE FULL PAPER:
- BDA Members should go to www.bda.org.
- Click the ‘login’ button on the right-hand side and enter your BDA login details.
- Once you have logged in click the ‘BDJ’ tab to transfer to the BDJ website with full access.

IF YOUR LOGIN DETAILS DO NOT WORK:
- Get a password reminder: go to www.bda.org, click the login button on the right-hand side and then click the forgotten password link.
- Use a recommended browser: we recommend Microsoft Internet Explorer or Mozilla Firefox.
- Ensure that the security settings on your browser are set to recommended levels.

IF YOU HAVE NOT YET SIGNED UP TO USE THE BDA WEBSITE:
- Go to www.bda.org/getstarted for information on how to start using the BDA website.

COMMENTARY

‘Everybody says that prevention is better than cure, and hardly anyone acts as if they believed it.’ The premise of this statement is as pertinent today as it was in 1953 when written by J. M. Mackintosh, professor of public health at the University of London. While community dental public health efforts in the main are preventively focused (community water fluoridation, oral health promotion activities), when it comes to oral health care services themselves, they remain clearly in the realm of repair and reconstruction, not prevention and health maintenance. Who can blame the providers of these services? As Mackintosh continued: ‘treatment is more tangible, more immediately rewarding than prevention.’ When we provide dental care today, it doesn’t seem that there has been a significant shift from the situation identified by Mackintosh. It is enlightening to read, therefore, that there are identifiable, measurable and practical opportunities that might be useful in engineering changes in the manner in which dental practices and individuals within those practices, see the world around them and respond. Activities identified in this study give some hope that support for professionals who may well be wishing to move out of the ‘restorative cycle’ of practice is possible – and from both their, and the communities perspective, this is a desirable move. ‘Palliatves take precedence over prevention, and the health services are overloaded with salvage’ noted Mackintosh. Sounds familiar! Possibilities such as identification of key opinion leaders with transplantation into susceptible dental care environments or the establishment of influential local networks are offered by the authors of this paper. Quite rightly in my view, despite being a necessary precursor, change will not just arise merely from modifying university education. A crucial element lies in those places where the services are provided – in this case, the workplace of the dental practitioner. While many might scoff at such options as being unworkable, the alternative of doing nothing and accepting the patch up path that we’ve been doggedly following also seems unlikely to succeed – just as it hasn’t in the six decades since 1953.

Professor Mike Morgan
Melbourne Dental School
Faculty of Medicine,
Dentistry & Health Sciences
The University of Melbourne


IN BRIEF

- To inform the reader of the factors that influence a general dental practitioner to offer preventive care to patients.
- To provide a model of how dental practices come to be oriented towards either preventive or restorative care.
- To highlight the resources that dentists require for providing leadership towards preventive care.

AUTHOR QUESTIONS AND ANSWERS

1. Why did you undertake this research?
Being a dentist and a young researcher, who is aware of the fact that research evidence clearly demonstrates that non-surgical management of dental caries is efficacious, has instigated me to question why Australian dentists persist with invasive surgical management of enamel and dentine lesions that, if managed non-surgically, would be likely to remineralise. Then, for my PhD thesis, I conducted a grounded theory study of how evidence-based preventive dental care could be adapted into a group of dental practices and how this process varied between practices. This paper provides an overall explanation based on all findings from my PhD project.

2. What would you like to do next in this area to follow on from this work?
Translating research findings into dental practice is an important research topic. Dental care is expensive and providing treatments that are not based on evidence is a waste of resources and can be potentially harmful to patients. In a future project I would like to assess the factors that influence whether dentists will change their clinical behaviour according to research evidence in general and potentially develop new ways to support the translation of evidence-based dental practice in Australian and international general practice.
CHAPTER SEVEN – CONCLUSIONS
The broad aim of this thesis was to contribute to a better understanding of how prevention and non-operative management of dental caries was used in private general dental practices in NSW. During the study, I investigated how preventive dental care could be “adapted” into a group of dental practices. I have presented new arguments about:

- The meaning of evidence to dentists and how it is taken up in dental practices (Chapter Three).
- The adaptation of research evidence and structured prevention into dental practices (Chapter Four).
- Patients’ experience of preventive dental care (Chapter Five).

I have also presented an explanation, based on all of these findings, of how dental practices can be oriented toward either preventive or restorative care (Chapter Six). In the following sections I will discuss each of the specific aims of this thesis, the respective study outcomes and the contribution they have made to the literature.
7.1 Answering the aims of this thesis

Aim 1. To provide a worked example of a grounded theory project through a detailed description of sampling, data collection, data analysis and interpretation; and to explain how these steps were consistent with grounded theory methodology, and show how they related to one another in the research process.

An illustrative explanation of the grounded theory methodology used and how each of its characteristics worked in this study was given in Chapter Two. This paper, published in BMC Medical Research Methodology, provides one of the few detailed ‘how to do’ grounded theory examples in the methodological literature. This work has already being utilized internationally. For example, Dr Marijke Kars, a researcher and lecturer from the University Medical Center Utrecht (one of the largest academic centres in the Netherlands) recently advised me that she will be using the published papers from Chapters Two and Three to teach grounded theory in a general qualitative research course.

Aim 2. To identify what dentists define as evidence and explain how they adopt it in practice.

In my introductory chapter I argued that although there is now a large EBD literature, previous investigators have shown that dentists often consider research
evidence irrelevant to their practice. This is thought to be because they have difficulties in interpreting research findings and are sceptical towards the quality of scientific evidence.¹⁻¹² This thesis provides a novel contribution about what evidence means to dentists and how it is taken up in dental practices (Chapter Three). Dentists made it clear that research evidence was not their main focus; instead they valued and sought out tangible clinical evidence. Dentists valued having the opportunity to experiment with new products and techniques in order to see the evidence directly in their patients’ mouths.

Dentists in this study said they did not trust research that came with commercial products. Robins has suggested that research reports sponsored by dental manufacturers and presented in a “non-commercial format” influence dentists’ adoption of new products into practice.¹³ Rather than suggesting Robins is incorrect, I propose that the findings from this study imply that, like most clinicians, dentists are influenced without being aware of it. Research consistently finds that clinicians think they are not influenced by commercial interests, even when objective assessments show that they are.¹⁴ There is, however, an important new idea in these findings: that dentists particularly value their own ‘clinical evidence’ and seeing how a product works in their patients’ mouths. This suggests that any agency trying to influence dentists, whether commercial or academic is likely to have a greater impact if they provide opportunities for dentists to experiment with new products and techniques and provide extremely concrete evidence about progress in individual clinical cases.
Dentists placed most trust in the evidence that they had generated and tested. This was fundamental to these dentists’ way of working. Dentists were sceptical of non-clinical dental academics and they emphasised the importance of talking about “real patient” cases with colleagues when faced with any uncertainties. Previous studies support my findings about dentists asking for advice from trusted colleagues.\textsuperscript{11, 12} These are controversial findings, because they go against the basic tenets of EBM and EBD, but they were consistent across all of my interviews with dental professionals. Given this, it is understandable that transferring evidence-based preventive protocols into these dental practices would be a time-consuming and challenging process.

Aim 3. To understand and explain the process by which dentists and their teams incorporate evidence about preventive care into their practices, and explain variation in this process.

At the beginning of this study, my focus was on understanding the process of adopting the evidence-based preventive non-operative protocols\textsuperscript{15} used in the previous RCT.\textsuperscript{16} However, through data analysis, I concluded that what was required was ‘adapting to’ those protocols in practice, which is contrary to how previous researchers have described the process of adopting, implementing or translating evidence-based knowledge into practice.\textsuperscript{1, 17-19} Participants’ descriptions of a process of adapting research evidence into existing dental practices logistics (Chapter Four) provides a novel contribution to the dental literature. I have described the way in which this process was influenced by
practical, philosophical and historical aspects of dental care, together with a range of barriers and facilitators.

Dentists spoke about two deeply held “rules” underpinning continued restorative treatment, which acted as barriers to providing preventive care:

- Dentists believed that some patients were too “unreliable” to benefit from prevention
- Dentists believed that patients thought that only tangible restorative treatment offered “value for money”.

These deeply held “rules” acted as barriers for providing preventive care. In some practices there was little evidence of preventive activity. This was attributed by dentists and their teams, in part, to the barriers identified in this study:

- Perceiving patients as “unreliable” and as not valuing preventive care;
- Needing to make money from prevention;
- Being too busy;
- Having a restorative background;
- Being focused on cutting cavities;
- Not having a system for providing preventive care; and
- Experiencing problems related to dental practice logistics and dentist-team relationships.
Previous studies support the findings presented in this thesis about barriers to EBD, including the historical professional tradition of restorative intervention; time constraints; dentists’ inertia; financial risk; patients’ treatment preferences and inappropriate health funding systems. My finding regarding dentists’ belief that some patients were too “unreliable” to benefit from preventive care consolidates an idea that has previously been discussed in the literature. Other studies have shown, for example, that dentists may find it difficult to treat patients who they believe do not value oral health, or who they perceive as disinterested or ‘uncooperative’, resulting in a different quality of dental care. This study provides evidence that this is particularly salient to how dentists approach prevention – that their deeply-held beliefs about the motivation, values or cooperativeness of patients may be an important explanatory factor in determining whether or not prevention is offered.

Dentists also argued that some patients chose not to have preventive care because of the limitations imposed by the regulations of health insurance companies. This is consistent with Brennan and Spencer’s observation that in Australia there is a “lack of incentives” to adopt preventive non-operative approaches “under a fee-for-service remuneration system” that encourages restorative care. Elsewhere, dentists have also cited limitations imposed by the regulations of insurance companies as a barrier to provide evidence-based dental care. Insurers’ regulations may be contrary to evidence obtained from well-designed studies; however they determine reimbursement to patients for treatment so can be strong
drivers for patient satisfaction and motivation. In this way, they can become important part of clinical decision making.\textsuperscript{8,31}

This study has shown that despite these barriers it is possible for dental practices to implement prevention systematically. To achieve optimal preventive practice, dentists-in-charge had to be open to change, to be able to communicate with and to engage all members of the dental team. Successful adaptation was contingent upon whether (1) the dentist-in-charge brought the whole dental team together – including other dentists – and got everyone interested and actively participating during preventive activities; (2) whether the physical environment of the practice was re-organized around preventive activities, (3) whether the dental team was able to devise new and efficient routines to accommodate preventive activities, and (4) whether the fee schedule was amended to cover the delivery of preventive services, which hitherto was considered as “unproductive time”.

\textbf{Aim 4. To understand and explain how a group of dental patients experience preventive dental care.}

This thesis also provides important knowledge about patients’ experiences of preventive dental care (Chapter Five). Patients had different experiences in different practices. Patients described their experience of dental care in dental practices with and without a structured approach to prevention in place. As a result of implementing structured prevention, patients transitioned from being
trapped in a situation of having degenerating teeth to achieving lifestyle changes and experiencing reinforcing outcomes. Participants were amazed by their experience of dental care without “drilling and filling” teeth and characterised dentists as either “old-school” or “new-school” based on the treatment options provided and the clinical relationship offered. This suggests that the way in which dentists practice has an effect on the way the profession of dentistry is perceived. If dentists want to be perceived as professionals with patients’ best interests at heart, they would be well advised to practice prevention. Patients will not necessarily be unsatisfied in practices with a restorative focus as long as they are treated respectfully. However, I found that all patients valued a caring relationship and prevention, because there were things that they intrinsically valued about what prevention does for them, such as, having strong teeth, feeling in control and being more satisfied with their oral health status.

Changes in the patients’ experiences of dental care occurred in the context of a relationship with a dentist and the dental team. Having a preventive structured approach in place helped individual patients to feel that their dentist respected their views and concerns. This is consistent with literature that suggests that patients’ perceptions of the quality of dental care and the likelihood of them seeking care are related to their perceptions of dentists as caregivers. Several studies have described perceived characteristics of dentists that are likely to increase care-seeking or satisfaction with care including: communication skills,
informing patients about treatment options, and dental teams’ behaviour during dental visits. 32-41

Patients have confidence in dentists who are friendly, kind, not victim blaming, are patient focused rather than income focused and who take time to explain procedures. 36, 37 Similarly, in this study, patients talked about being compliant with preventive care recommendations because they felt they were being “treated as a person and not as a patient.” There was a perception that the offer of preventive care was a caring action; by making this offer, the dentist demonstrated that he or she was committed to working with a patient to “keep their teeth”. In contrast, many patients wondered why their previous care had been mainly restorative, and were concerned that they had not been offered the benefits of preventive care earlier in life.

Despite having different clinical experiences (restorative versus preventive care), patients in this study talked in similar ways about what they wanted when visiting a dental practice. Their evaluation of the dental care experience was simple: either they were respected as a person or not, offered a chance to keep their teeth or not. In situations where patients perceived their dentist as having a genuine caring attitude about their problems this persuaded them towards treatment compliance. This suggests that even the most “uncooperative” patients may have the potential to be more cooperative in the context of such a relationship. It was also possible for the dental team to effect profound changes in not just the oral health
care routines of patients, but in the way patients think about their own oral health and the role of dental professionals.

Aim 5. To consolidate and interpret all findings from this study in a model that explains how dental practices can be oriented towards either preventive or restorative care.

In Chapter Six, I provided a summary of all study findings bringing them together into a single set of conclusions. Once the results chapters were finished, I went back and reviewed interviews, memos, field notes, and diagrams used during data analysis. It was clear that there were important elements within dental practices that interacted to allow the adaptation to preventive care to occur. Those elements provided an overall explanation about the factors that influence the provision of preventive care by general dental practitioners. Dentists and the dental team members described two key elements shaping adaptation to evidence-based preventive care:

- Leadership in practices.
- Prioritization of a practice’s cultural, social and economic resources.

A model of how practices came to be oriented towards preventive or restorative care is presented in Chapter Six. This is the first such model to be published in the dental literature.

The distinction between cultural, economic and social resources was drawn from
Bourdieu. Cultural resources were those elements that defined the dentists’ identities within a social setting; who they were, what they did, what they trusted and what credentials they had. Economic resources were defined as dental services exchanged for money. Social resources were defined as a network of individuals whom dentists trusted and connected with.

Restorative care was the “default mode” observed in the majority of the practices studied. Hence, dentists’ leadership to reorient the prioritization of resources towards preventive care was crucial. This study shows that leadership is imperative if there is to be a movement away from “default” restorative focus toward preventive care. Such leadership is potentially a challenging task, requiring an individual dentist to persuade all members of a dental team to make preventive care a central part of daily life of a general dental practice.

In a recent opinion piece, Willcocks described this form of leadership as “transformational leadership”, when the lead dentist inspires and motivates all members of the dental team, engaging them to support change or “transformation”. The findings from this thesis provide empirical support for this view that an individual dentist’s leadership role is vital for effecting change in a dental practice. Other researchers have shown that other factors also influence change in dental practices: adopting a team approach, allowing autonomy within the dental team and being part of professional networks. These were all present in a dental practice where a dentist was the leader for prevention and prioritised
the resources of the whole practice towards preventive care, while having autonomy to practice prevention was essential in a practice where a single dentist pursued preventive care.

7.2 Transferability of findings

As with all qualitative research, judgments about the transferability of these findings to other settings rely on understanding the context of this study. This was a study of private dental practices in the state of NSW, Australia – where dental services are overwhelmingly delivered in the private sector, not integrated into the medical system, and where dental hygienists are employed in only a minority of practices.44, 45

Within this group of dentists, there were those who owned their practices and led their dental team and those who were employed as associate dentists being remunerated by commission or a salary. Each practice was owned by a dentist-in-charge, who was the leader of the dental team and oversaw all activities within the practice. In some practices the leader of the dental team was not necessarily the leader for preventive care. All practices had dental assistants, who ensured the smooth running of the practice, and practice managers; additional dentists and dental therapists were employed in some practices. In the absence of a practice manager, the dentist-in-charge shared this task with an accountant. The combination of staff was less important to the outcome than the way in which
members of the dental team were led and organized to adapt to prevention. I found that when dental hygienists were employed and given responsibility for oral hygiene instruction and preventive maintenance visits, dentists were able to concentrate on more complex restorative work. This made preventive care more sustainable.

All dentists were members of the Australian Dental Association (NSW Branch). They had established a set of strong connections with other dentists through local and National Division meetings and Continuing Education Symposiums. This networking was described as central for knowledge exchange activities. Despite participating in a previous RCT, the majority of participating dentists were not usually involved in research projects. However, they did attend continuing education and practice management courses regularly, and some participated in community projects with a focus on oral health; so they may have been more open to prevention than a ‘typical’ private practice dentist.

The patients in the study had private dental insurance; they were used to visiting the dentist once to twice a year for check-up appointments and for restorative treatment when needed. They were not used to being treated by a dental hygienist. These practice and patient characteristics are similar to the Australian average, based on the results of The National Survey of Adult Oral Health 2004–06 NSW.46
7.3 Implications for action

Table 1 shows a summary of the key findings from this study and its respective implications for practice and future research.
Table 1: Key findings and implications for action

<table>
<thead>
<tr>
<th>Key findings from this thesis</th>
<th>Implications for practice</th>
<th>Implications for future research: this study suggests that future research could...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentists valued clinical evidence. Dentists trusted preventive protocols only after they saw results in patients’ mouths.</td>
<td>RCTs results may be better trusted and adapted into practice if the statistical results are presented alongside concrete clinical illustrations (e.g. case reports showing before and after scenarios).</td>
<td>Explore dentists’ views of evidence and how evidence-base influences their daily practice in a larger sample.</td>
</tr>
<tr>
<td>Dentists valued their peers’ opinion. They did not trust academics. Dentists had their own way to adopt evidence.</td>
<td>Dentists who become clinical investigators could take on the role of trusted key opinion leaders who are uniquely placed to translate evidence for their peers.</td>
<td>Test whether the implementation of research evidence improves when evidence is made tangible, communicated through trusted networks, and/or experienced personally by seeing changes in the oral health of patients.</td>
</tr>
<tr>
<td>Prevention was adapted into some dental practices’ established routines.</td>
<td>Flexibility is needed from both dental academics and dentists-in-charge of practices to facilitate knowledge translation.</td>
<td></td>
</tr>
<tr>
<td>This process varied in different practices; it was a slow and complex process, with barriers and facilitators.</td>
<td>Dentists will need to adapt their everyday practices to conform more closely to evidence-based recommendations.</td>
<td></td>
</tr>
</tbody>
</table>

181
<table>
<thead>
<tr>
<th>Key findings from this thesis</th>
<th>Implications for practice</th>
<th>Implications for future research: this study suggests that future research could...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients valued a caring relationship and they valued preventive care.</td>
<td>The way in which dentists practice has an effect on the way the profession of dentistry is perceived; if dentists want to be perceived as professionals with patients’ best interests at heart, they would be well advised to practice prevention.</td>
<td>Examine the prevalence and significance of categorization of dentists as “old-school” or “new school” dentists, and of dentists contrasting “reliable” and “unreliable” patients.</td>
</tr>
<tr>
<td>Leadership is needed to change dentists’ practices. Economic, social and cultural resources have to be allocated towards preventive dental care to make it feasible.</td>
<td>Dentists should be encouraged to look at preventive care as a central part of their practices and not simply as advice given to patients, usually referred as “unproductive/not reimbursed” time. Hiring dental hygienists can facilitate the adaptation process.</td>
<td>Future research in dental knowledge translation should examine the importance of practice leadership, the cultural, social and economic aspects of practicing prevention, and the need to communicate research evidence through trusted networks of dental professionals.</td>
</tr>
</tbody>
</table>

To achieve movement toward preventive care, dentists may need to be supported to alter the economic, social and cultural aspects of their practice, not just the treatment they provide in the chair to patients.
Implications for advancing preventive care

This study suggests that flexibility may be needed from both dental academics and dentists-in-charge of practices to advance preventive care in general dental practice. Adapting evidence into dental practice was shown to be a slow and complex process, requiring more than just the removal of barriers. Research evidence offered by academics will have to be incorporated somehow into existing dental practice systems. This process might not happen identically in all practices. Dentists will need to adapt their everyday practices to conform more closely to evidence-based recommendations. They should be encouraged to look at preventive care as a central part of their practices and not simply as advice given to patients, usually referred as “unproductive/not reimbursed” time. Hiring dental hygienists can facilitate the adaptation process and free dentists to focus on more complex cases.

The way in which dentists practice dentistry was shown to have an effect on the way patients perceive the dental profession as a whole. Patients valued a caring relationship and they valued preventive care outcomes. This suggests that if dentists want to be perceived as professionals with the patients’ best interests at heart, they would be well advised to practice prevention.
Implications and suggestions for future research

This study has provided new, practical insights into the meaning of evidence and its adoption in practice (Chapter Three). Future qualitative research could examine differences in understanding of evidence within different funding structures and practice cultures. Survey research could apply the findings of this study to explore dentists’ understanding of evidence with a larger and more diverse sample. Future intervention research could test whether the implementation of research evidence improves when tangible evidence is communicated through trusted networks and experienced by seeing changes in the oral health of patients.

A deeper understanding about the adaptation of research evidence about preventive care into dental practices was gained during this study (Chapter Four). The findings suggest that dentists in Australia should be part of the process of generating research evidence, as this is likely to improve their perception of the relevance of that research to their practice. This is already occurring in the dental practice based networks in the United States and Scandinavia – where dentists become clinical investigators and, therefore, have a direct role in the production of research evidence in their practices. This study suggests that such clinical investigators could take on the role of trusted key opinion leaders who are uniquely placed to translate evidence for their peers. Future research could test these strategies across a wide range of dental practices.
I have shown that it is possible for dental teams to effect profound changes in not just the oral health care routines of patients, but in the way patients think about their own oral health and dental professionals (Chapter Five). The categorization of dentists as “old-school” or “new school” dentists, and the dentists contrasting “reliable” and “unreliable” patients require further study. These categorizations may be potentially important in the provision of quality oral health care.

Finally, a key point of any intervention will be to support dentists’ capacity for leadership by providing cultural and social resources oriented towards prevention, and by supporting them to sustain their ability to generate an income while implementing preventive care in practice (Chapter Six). External networks of trusted peers and key opinion leaders (practicing dentists) could potentially be mobilised to promote preventive care. For example, a strong opinion leader (who is a practicing dentist within a local network) could be identified to work with dental practices as an agent of change. Opinion leaders could also set up study groups to discuss clinical cases and highlight practical strategies for practice leaders to have the confidence to prioritize resources towards prevention. This would require not just finding the best ways of communicating research evidence to dentists, but also actively supporting them to address the social, cultural and economic aspects of transitioning to a more preventive model. Based on the findings presented here, such opinion leaders could have a strong effect within
their network of dentists; other authors have also suggested that knowledge transfer relies on small networks of dentists who trust each other.\textsuperscript{11, 47, 48}

In conclusion, this thesis has offered a comprehensive, detailed and deeper understanding about how prevention and non-operative management of dental caries was used in private general dental practices in NSW. This is the first detailed empirical account in the dental literature of the conditions required to implement systematic preventive care in private dental practices dependent on financial systems that are biased toward restoration. The findings presented in this thesis show that with considerable effort, motivation and coordination it is possible for an individual dental practice to work against the dental ‘mainstream’ and implement prevention as their clinical norm. In addition, this thesis presented a model of how practices came to be oriented to preventive or restorative care. This is also the first such model to be published in the dental literature. During this study, the key conditions needed for practices to reorient to preventive care included the presence of a committed leader with a prevention-supportive peer network, and the reorientation of space, routines and fee schedules to support preventive practice. This study has shown that dental practice is not purely scientific: it is also cultural, social and economic. Therefore, future intervention research should not only be consistent with the best RCT evidence, but should address practice leadership, the prioritization of cultural, social and economic resources toward practicing prevention, and the need to communicate research evidence through trusted networks of dental professionals.
References


APPENDIX A

List of search terms:

exp dental care/

exp delivery of dental care/history

exp oral health/, exp dental caries/

decision making, dental caries/diagnosis

dental caries/therapy

dental restoration, permanent/statistics & numerical data, exp dentists’ practice patterns/ exp “history of dentistry”/

exp preventive dentistry/

health services and practice variation. mp.

exp evidence-based dentistry/

exp evidence-based practice/

exp dentistry/

exp general practice, dental/ exp dentistry, operative/

exp practice guideline/

dental patient.mp.

preventive dentistry/definition

preventive dentistry

reviews and preventive dentistry, general articles
Tooth Structure

© 2011 Encyclopædia Britannica, Inc.

Tooth decay leaflet

Tooth Decay

Tooth decay, can be stopped, reversed, and prevented.

Hidden decay can be seen on your x-rays.

Holes in teeth need to be cleaned out and then filled by your dental practitioner.

What can your dental practitioner do to stop decay?
- give you the latest information on diet management and decay prevention
- show you a tooth brushing method tailor-made for you
- clean out and fill any teeth that have holes
- seal any deep groves on your chewing surfaces
- put concentrated fluoride on your teeth
- see you for regular checks

What can you do at home to prevent and stop decay?
- use fluoridated water for drinking and preparing food
- eat and drink less sugary things between meals to stop the acid attack and aid the process of natural repair
- brush twice daily with a fluoride toothpaste - before bed and in the morning
- take care to do a good job with your brushing
- use fluoride gel, paste, or rinse if recommended
- use an antibacterial gel or rinse if recommended

Your situation is shown on the chart below:

<table>
<thead>
<tr>
<th>X-ray shadow</th>
<th>Number of surfaces affected</th>
<th>The most likely situation is</th>
<th>Treatment need</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Outer 1/2 of enamel</td>
<td>The surface has minimal decay which is most likely non-active or arrested.</td>
<td>Normal home care.</td>
</tr>
<tr>
<td>C2</td>
<td>Inner 1/2 of enamel</td>
<td>The surface has slightly more decay which may be non-active or arrested.</td>
<td>Normal home care.</td>
</tr>
<tr>
<td>C3</td>
<td>Just into dentine</td>
<td>Decay on this surface is just under the enamel layer, but is probably not a hidden cavity.</td>
<td>Special home care for at risk (high).</td>
</tr>
<tr>
<td>C4</td>
<td>Outer 1/3 of dentine</td>
<td>Decay extends under the enamel layer, and it may or may not be a hidden cavity.</td>
<td>Special home care and, depending on risk, filling.</td>
</tr>
<tr>
<td>C5</td>
<td>Inner 2/3 of dentine</td>
<td>This deep decay needs urgent attention.</td>
<td>Filling plus special home care.</td>
</tr>
</tbody>
</table>

Your current risk of decay is □ Low □ Medium □ High

You are strongly recommended to attend your next appointment on ..................................

MORE INFORMATION ON TOOTH DECAY

What is tooth decay?
Tooth decay is caused by bacteria in the dental plaque (a soft creamy coloured film) that builds up daily and sticks to teeth. These bacteria ferment sugar and produce acids which dissolve the hard tooth enamel and may cause a hole.

How is tooth decay prevented?
The ways to prevent decay:
- reduce sugar intake between meals
- remove plaque with your toothbrush
- drink water and use a fluoride toothpaste.

How is tooth decay managed?
The management of decay involves (1) care by a dentist and (2) home care, of which home care is the most important.

Why should I avoid having holes and fillings?
- when decay is cut out of a tooth, the tooth is usually weakened
- fillings need replacing from time to time
- replacement fillings are larger and weaken the tooth further
- fillings do not prevent decay from coming back

What are the benefits of dental care?
- decay is stopped without weakening the tooth
- your situation is monitored with follow-up x-rays
- your risk of new decay will be greatly reduced

You need an urgent dental appointment
- if your teeth become sensitive to cold foods or drinks
- if you get a hole in your tooth
- if a part of your tooth breaks off

APPENDIX C

Tables 1 to 9

Table 1: Dentists’ and dental therapists’ restorative intervention in Australia


Study design: questionnaire survey sent to 49 dentists (mean graduation year: 1975) and 247 dental therapists (mean graduation year: 1980); Response rate: 92% of dentists and 84% of dental therapists.

Main findings: 60% of dentists would restore caries lesions in dentine; 53.2% of dental therapists would restore enamel lesions; 60% of all respondents thought that a cavity was present when the lesion was confined to enamel. Respondents’ opinions about cavity formation were the most important predictor of choice of treatment; those who would restore at an early stage were more likely to believe in cavitation at an early stage (p = 0.0001). There was no statistically significant difference between operators based on year of qualification.


Study design: questionnaire survey in 1996 sent to 550 dentists who were selected systematically (every fourth dentist) from the register of the Dental Board of Victoria. Both general and specialist practitioners were included. Response rate: 64% = 36 dentists (graduation year 1947-1959); 158 dentists (graduation year 1960-1979); 164 dentists (graduation year 1980-1996): Total: 358 dentists.

Main findings: 50% of responding dentists selected an operative intervention for radiographic lesions confined to enamel. There were no statistically significant differences in treatment decision responses across groups, as defined by the controlling variables (year of graduation, fluoridation status of the local water supply or the current experience in caries treatment), except that significantly more females than males (61% vs. 52%) selected a non-invasive approach for the scenario where the radiolucency was at the dentine-enamel junction (p<0.05). For all other radiographic situations, there were no significant gender differences in treatment decision-making.

Study design: A longitudinal design involving a sample of 10% of male dentists and 40% of female dentists was randomly drawn from the dental registers for each State or Territory in Australia in 1983. In 2003–2004, this sample was surveyed by mailed questionnaire, providing a response rate of 76%. Age group: 72 dentists (20-29 years), 143 dentists (30-39), 178 dentists (40-49), 90 dentists (50-59) and 28 dentists (60+). A total of 511 dentists completed a questionnaire related to their current practice experience and recorded the types of services provided over one self-selected typical day of practice; services provided for patients attending with a diagnosis of dental caries ranging from initial enamel lesions, cavitated lesions into dentine and deep caries were also reported.

Main findings: Restorative rates were higher for insured patients. Restorative services were provided at higher rates for cavitated carious lesions (RR = 2.38; p<0.05). However, comparisons between service types showed that carious lesions in enamel only tend to be managed with restorative services rather than preventive services (mean number of service per visit: 1.2 restorative care vs. >0.2 fluoride application; p<0.01). There was little differentiation in service profiles between initial and cavitated carious lesions. However, gross carious lesions were managed through lower restorative rates and higher rates of radiographs, endodontic treatment and extractions compared to both initial and cavitated carious lesions. Topical fluoride services were provided at lower rates to patients from lower socio-economic status areas (RR = 0.41) compared with higher socio-economic status areas, but at higher rates for initial carious lesions (RR = 3.00) compared with gross carious lesions. The effect of dentists' age was not reported. No significant differences were observed by age of patient for any type of service.
Table 2: Dentists' restorative intervention in Canada


Study design: A questionnaire survey using patients’ scenarios to assess dentists' restorative thresholds was mailed to a randomly selected group consisting of one-half of general dentists in Ontario in 1992. Dentists’ names were drawn from the Royal College of Dental Surgeons list. Target population: 4938 general dentists in Ontario; response rate: 62%.

Main findings: 60% of dentists indicated that they would restore enamel lesions that had not reached dentine in a 12-year-old patient, whereas with 30 and 55-year-old patients, 28% and 20%, respectively, would do so. There was no difference by year of graduation.


Study design: 16 dentists working part-time in both private practice and the school dental clinics of the North York (Ontario) Public Health Department who, in addition to caries depth and restorative decision data, examined 15 pairs of experimental bitewing radiographs and provided their restorative treatment thresholds. The bitewings were hypothetically from a 16-year-old patient who would attend their practice on a subsequent occasion in a year. Previous caries experience and oral hygiene levels were average, i.e., better than their worst patients, but not as good as their best patients of the same age. The patient's attitude to treatment was cooperative.

Main findings: 12 out of 16 dentists stated that their treatment thresholds for approximal caries restoration in a 16-year-old were in the enamel when the lesion has reached the dentine-enamel junction but has not reached the dentine. Four dentists believed the appropriate time to restore was when the caries had reached dentine. It was also evident that dentists disagreed with one another in these decisions and even with themselves relative to their stated restorative thresholds.
Table 3: Dentists' restorative intervention in France


Study design: Questionnaire survey assessing French dentists' restorative decisions to caries lesions at different stages of progression in a hypothetical 20-year-old patient. The questionnaire was sent to a random sample of 2003 registered dentists in France; 41.4% replied, 37 were excluded, 793 dentists were included in the survey.

Main findings: Around 50% of dentists would restore a carious lesion confined to enamel on an occlusal surface, while 88% of dentists would restore a carious lesion present on the dentine-enamel junction on an approximal surface.


Study design: 100 private practitioners registered in one of the 22 French metropolitan regions were randomly selected and sent a letter with a ‘‘Reply Paid’’ envelope inviting them to participate in the study. Of the 100 dentists invited, 33 agreed to participate in the study. Of the 33 dental practitioners who agreed to participate, 26 effectively completed the study by recording, on a form, the characteristics of 35 consecutive preventive and/or restorative treatments that were conducted on vital permanent teeth in their dental practice.

Main findings: Non-invasive treatments represented only 15% of the initial treatments collected in the survey, indicating that preventive dentistry was little used and that dentists rarely utilized recent concepts in caries management. The stage at which a restoration was undertaken was influenced by patient’s health insurance coverage (p = 0.001), oral hygiene (p = 0.011) and regularity of dental attendance (p = 0.038). Minimally invasive restorations were preferentially offered to patients who were young, regular attendees, with good oral hygiene or with a private complementary insurance. Authors suggested that the low use of non-invasive therapies could be explained by different factors related to dentists’ knowledge, patient demand, or to health system.
Table 4: Dentists' restorative intervention in Scotland


Study design: A postal request was sent to 64 general dental practitioners in the local dental list. 15 agreed to participate (7 dentists worked within the general dental services of the National Health Service and 8 dentists worked at Dundee Dental Hospital). They had been registered for 2 to 22 years, the average being 12 years. The 15 dentists examined 18 patients, bitewings radiographs were available.

Main findings: The number of tooth surfaces planned for restoration ranged from 20 to 153. Only 41% of the restorative treatment decisions made were agreed upon by more than half of the dentists. For each surface planned for filling by one dentist, on only 40% of occasions would a second dentist have agreed with the first dentist. The effect of dentists' years of experience was not reported.


Study design: A questionnaire survey to test dentists restorative treatment threshold in a 12-year-old and in a 30-year-old patient was posted to all dentists practicing in Scotland in 1987 (n=1726). An overall response rate of 72% was obtained; 926 dentists worked at the General Dental Services and 201 dentists worked at the Community Dental Services.

Main findings: The majority of dentists would intervene earlier in lesions affecting approximal surfaces, buccal/lingual surfaces and occlusal surfaces in a 12-year-old patient. 44% of dentists would fill a lesion confined to enamel in a 12-year-old patient, compared to 20% of dentists who would fill the same lesion in a 30-year-old patient. Almost 26% of dentists considered that when lesions had reached the dentine-enamel junction it was time to intervene in a 12-year-old patient; while 19% of dentists would do the same for a 30-year-old patient. 55% of dentists would restore non-cavitated occlusal lesions in a 12-year-old patient compared to 22% in a 30-year-old patient. Fewer dentists opted for restoration of approximal lesions (24% for a 12-year-old and 9% for a 30-year-old). There was non-linear association between dentists’ choice of restorative intervention and a list of dentists’ characteristics including demographics, year of graduation, diagnosis and treatment preferences.

Study design: 20 randomly selected general dental practitioners from Glasgow were provided with a list of descriptions of caries lesions affecting a 16-year-old patient who was described as having moderate caries experience and attended the dentist once a year. Each dentist was asked to indicate the point at which a filling would be required. The dentists were then asked to make restorative decisions on the basis of 30 bitewing radiographs presented in pairs, which had been taken from extracted teeth mounted to simulate a real mouth. Dentists were asked to view the radiographs in the manner as they did in their practice.

Main findings: 3 out of 20 dentists would restore all carious lesions which extended beyond half of enamel, 8 dentists indicated that any lesions which had reached the dentine-enamel junction should be restored and 9 dentists felt that a lesion should only be treated restoratively when it had penetrated into dentine in the hypothetical 16-year-old patient. Regarding the examination of bitewing radiographs, the number of fillings planned was not significantly different between groups of dentists who said they would intervene at different stages in the carious process. This study suggested that the restorative treatment thresholds reported by dentists may have little or no relationship to what dentists actually plan to do in practice on the basis of radiographic examination.
Table 5: Dentists’ restorative intervention in Brazil


Study design: A cross-sectional interview study was carried out in 3 capital cities of Brazil. 929 general dental practitioners were invited to participate; they were selected by a single draw from the General Dental Council list. A response rate of 89.4% was obtained. A total of 840 dentists were interviewed. Age group: 28.3% (21-30); 28.8% (31-40); 21.5% (41-50); 15.5% (51-60); 5.6% (>60). 

Dentists were asked questions about their treatment thresholds in situations where the penetration of the carious lesion, based on the observation of bitewing radiographs, varied from the external part of the enamel to deeper areas of the dentine in a hypothetical 16-year-old patient. This patient was described as a regular attendee at the dental clinic and with a check-up scheduled for one year’s time. The previous caries experience of such a patient, as well as sugar consumption and hygiene levels, were average. Dentists were also told that the attitude of the patient in relation to treatment was one of cooperation and that the patient was able to bear the costs of any type of treatment.

Main findings: 31.5% of dentists would restore lesions in the outer half of enamel; 54.5% of dentists would restore lesions reaching the inner half of the enamel; 79% of dentists would restore lesions reaching the dentine-enamel junction; and almost 22% of dentists would restore dark fissures without signs of demineralization (loss of tooth mineral structure). Dentists qualified for less than 10 years were more conservative in clinical situations presenting caries lesions on the external half of enamel (p<0.01) and for lesions in the inner half of enamel (p=0.003). Those who had attended postgraduate courses were less interventionist when caries lesions were present in the inner half of enamel (p<0.01) and when lesions had reached the dentine-enamel junction (p<0.01).


Study design: All 89 dentists working in the Midwest region of the Southern Brazilian State of Santa Catarina were invited to participate in the study. A structured interview was performed by a single trained dentist during working hours and at the dentists’ dental surgery. In the interview, four different radiographs of extracted pre-molars fixed upon a plaster base were shown. These teeth were extracted for orthodontic reasons and the radiographs were taken in the
parallel plane. The radiographs showed caries lesions of different depth from the outer half of enamel to outer and inner half of dentine. The radiographs were hypothetically assigned to a 16-year-old patient with the same characteristics described in the study done in 2005 by these authors (see above). A total of 84 dentists were recruited; Age group: 40 dentists (22-35) and 44 dentists (36-65).

**Main findings:** 16.7% of dentists would restore a carious lesion confined to the outer half of the enamel; 33% would restore a carious lesion in the outer and inner half of the enamel. 91.7% of dentists would restore lesions in the outer half of dentine. Dentists who had attended postgraduate courses in specific areas such as restorative and paediatric dentistry and cariology tended to adopt a more conservative treatment when compared with dentists who had not attended (p < 0.01).
Table 6: Dentists' restorative intervention in Croatia and Iran


Study design: Croatian translation of the questionnaire assessing restorative treatment decisions on approximal caries previously validated and used in Norway (Espelid et al. 1985) was distributed to a random sample of Croatian dentists. The dentists were selected using a random number table: 400 from the list of dental practitioners of the Croatian Dental Society and 400 from a list of dentists attending congresses. The questionnaire assessed dentists’ treatment threshold for hypothetical approximal caries and the most favoured types of restorative techniques and materials. All questions referred to a hypothetical 20-year-old patient who visited the dentist annually, had good oral hygiene, and low caries activity. A total of 307 dentists replied; Age group: 202 dentists (<45) and 105 dentists (>45).

Main findings: 42% of dentists would prepare a cavity for an approximal lesion confined to the enamel; while 39% of dentists would restore a lesion at the dentine-enamel junction. Respondents 45 years old and younger would postpone the restorative treatment until a more advanced stage of lesion progression than would older respondents (p < 0.001).

Study design: A self-administered questionnaire was given to general dental practitioners who had attended two dental meetings in Tehran, Iran on December 2004 and July 2005. The dentists filled and returned the questionnaire during the meetings days. Dentists were asked to report their restorative treatment threshold for hypothetical 20-year-old patients; one at low risk and the other at high risk of developing caries. A total of 980 dentists responded the questionnaire completely (response rate was not reported); 63% were male; mean age was 37.4 years (SD=7.7).

Main findings: For the high risk patient, 77% of dentists reported that they would fill an approximal lesion confined to enamel: 28% in the outer half and 49% in the inner half of enamel. Within the age group of 35-44 year-olds, more men than women chose to fill a lesion in the outer half of enamel (34% vs. 22%, p=0.01). Reporting restorative intervention in the outer half of enamel was less frequent for dentists with more than 7 years of experience (25% vs. 32%, p=0.04). Dentists who had participated in continuing education courses on caries prevention in the last year were less likely to restore an approximal caries lesion in enamel (p=0.02). Attending continuing education courses on caries prevention remained the only significant factor explaining dentists’ decision to fill the lesion in dentine (OR=1.4, p=0.005) when analysed together with dentists’ age, gender, practice-related factors and reading of dental journals.

For the low risk patient, filling a lesion in the outer half of dentine was the most frequent reportedly choice (58%) among all choices. 32% of dentists chose to restore the lesion restricted to enamel; 7% in the outer half and 25% in the inner half of enamel; significantly more men than women (p=0.003). Female gender appeared as the only significant factor (OR=1.5, p=0.01) explaining dentists’ choice to restore a lesion no earlier than in dentine.
Study design: The study population consisted of dentists working in outpatient dental practices who have enrolled in the DPBRN in five regions: AL/MS, Alabama/Mississippi; FL/GA, Florida/Georgia; MN, dentists in Minnesota, either employed by HealthPartners (Bloomington, Minn.) or in private practice; PDA: Permanente Dental Associates, in cooperation with Kaiser Permanente’s Center for Health Research in Portland, Ore.; and SK: Denmark, Norway and Sweden. A cross-sectional study design employing the DPBRN “Assessment of caries diagnosis and treatment” questionnaire was used. The questionnaire was administered once to all DPBRN dentist practitioner-investigators whose DPBRN enrolment questionnaire indicated that they perform at least some restorative dentistry in their practices (n = 901). A total of 500 dentists replied (response rate=56%; 412 male and 88 female). Dentists were presented with a case scenario describing the patient’s characteristics and a series of five radiographic images taken during the progressive stages of caries (located on the interproximal surface of a mandibular premolar) that portrayed increasingly deep caries.

Main findings: 39% of dentists reported that they would restore a carious lesion in the inner half of the enamel for a patient at low caries risk, while 2% of dentists would restore when the lesion was still in the outer half of the enamel; however, 54% would not intervene unless the lesion was into the outer third of the dentine. Among patients with a higher caries risk, the majority of dentists (75%) reported that they would intervene with a restoration when a lesion was in the outer or inner half of the enamel. For a low caries risk patient, male dentists would intervene significantly more often in enamel surfaces than female dentists (p = 0.002), while dentists in practices that are “not busy enough” would intervene significantly more often in enamel surfaces (p = 0.018). Significant differences were found based on DPBRN region (p < 0.001): dentists from the Alabama/Mississippi and Florida/Georgia regions were more likely to recommend restoration of enamel lesions. Dentists in Scandinavian dental practices chose not to restore lesions that were limited to enamel; restorative treatment was predominantly recommended for surfaces that involved dentine. Dentists who worked in large group practices and public health practices were less likely to recommend a restoration on enamel lesions as compared to those who worked in...
solo or small group private practices (p < 0.001). The odds of recommending a restoration in enamel were significantly lower for dentists in large group practices compared to those in small group practices (OR = 0.11, 95% CI = 0.05, 0.23).


Study design: The study population and study design were the same as the one described above. Out of the 901 dentists, a total of 517 dentists replied (response rate = 57%; 424 male, 93 female). Dentists were asked to indicate whether they would intervene surgically in a series of cases involving occlusal caries.

Main findings: For patients at low risk of developing caries, 63% of dentists indicated that they would restore inner enamel lesions, while 90% of dentists would restore teeth with lesions located in outer dentine. For patients with a high risk of developing caries, 77% of dentists would restore inner enamel lesions and 94% reported that they would restore lesions located on the outer dentine surface. Dentists in Scandinavian practices chose not to restore lesions that were limited to enamel; they chose to restore lesions in occlusal surfaces that involved dentine. Dentists in solo practice or a private practice with fewer than four dentists were more likely to restore enamel lesions than were dentists in large group practices with four or more dentists (p < 0.001).
Table 8: Dentists' restorative intervention in Scandinavian countries


Study design: A questionnaire was sent to a random sample of 741 dentists in March 1983. They were drawn from the Norwegian Dental Association's register. Dentists were asked about their opinions, experiences and routines in relation to approximal caries lesions. A total of 616 dentists (83%) responded; mean age 42 (SD=10.8).

Main findings: 66% of dentists responded that they would prefer to restore lesions before they extended into dentine on radiographs; 30% would defer restoration until the lesion had reached the outer third of dentine. Dentists' opinion about the presence of a cavity, based on radiograph examination, was the best predictor for their restorative decision. The effect of dentists' age was not reported.


Study design: The study population was the same as for the above study (Espelid et al.1985). Out of the 616 dentists, 243(69%) agreed to examine radiographs of approximal tooth surfaces. Dentists were asked to diagnose caries and to say if they would restore the observed lesions.

Main findings: Restorative treatment was proposed for more than 90% of lesions judged to penetrate dentine, for 22% of outer half enamel lesions and for more than 75% deeper enamel lesions. Half way through enamel was suggested to be a borderline for dentists to opt for restorative care. The effect of dentists’ age was not reported.

Study design: A questionnaire was sent to a random sample of 758 dentists in November 1995. They were drawn from the Norwegian Dental Association’s register. Dentists were asked about their treatment criteria for approximal caries lesions based on radiographic examination. A total of 640 dentists (84.4%) responded; mean age 45.4 (SD=10.6).

Main findings: Only 19% of dentists stated that they would restore approximal lesions confined to enamel, with 81% opting to wait until lesions had reached dentine. The effect of dentists’ age was not reported.


Study design: A pre-coded questionnaire was sent to a random sample of 923 dentists in October 1996. The sample was drawn from the Swedish National Board of Health and Welfare's register of authorized dentists. Responses were received from 651 (70.5%) dentists. Out of these, 61 had ceased to practice and were therefore excluded from the analysis. Of the remaining 590 responses, 52% were employed by the Public Dental Health Service, 42% were private practitioners and 6% were not practicing at the time of the study. A total 575 dentists answered the criteria for restoring approximal caries and 572 dentists answered the criteria for restoring occlusal caries. The majority of dentists were aged between 35-44 (33.7%) and 45-54 (33.8%).

Main findings: 42% of dentists would restore an approximal lesion in the outer third of dentine; 52% would not automatically restore until the lesion had reached half of dentine; while 1% of dentists would restore a lesion confined to enamel. Younger more often than older dentists would postpone restorative treatment of approximal caries until the lesion had reached a more advanced stage (p < 0.005). For occlusal caries, 67% of dentists would not consider immediate restorative treatment of an occlusal surface unless obvious cavitation and/or radiographic signs of dentine caries could be observed; while 26.7% of dentists would restore caries in the middle third of dentine; and 5.9% when there was no radiographic sign of caries.

Study design: A pre-coded questionnaire was sent to a random sample of 759 dentists in Norway, 923 in Sweden, and 173 in the Danish Public Dental Health Service inquiring about caries and treatment strategies. They were drawn from the registers of authorized dentists of the Norwegian Dental Association and the Swedish National Board of Health and Welfare. The same questionnaire was answered by 173 dentists working in the Danish Public Dental Health Service who had subscribed for a course about caries and treatment strategies. A total of 1403 dentists responded to the questionnaire, with a reply rate of 84.4% in Norway and 70.5% in Sweden; the Danish material was collected as a pre-course questionnaire given 100% reply rate. Final sample: 640 dentists in Norway, mean age 45.4 (SD=10.7); 590 in Sweden, mean age: 46.1 (SD=9.3); and 173 in Denmark, mean age: 45.5 (SD=8.0).

Main findings: close to 70% of dentists in the three countries would not restore occlusal caries until they registered a moderately sized cavity and/or any radiolucency in dentine. 26.7% of Swedish dentists, 24.3% of dentists in Denmark and 11.5% Norwegian dentists would postpone restoration until the lesion had a large cavity and/or until radiolucency could be observed in the middle third of the dentine. The effect of dentists’ age was not reported.


Study design: A questionnaire was emailed to all dentists with an email address in the member register of the Norwegian Dental Association in March 2009. A total of 3654 email addresses were registered. Questions were asked about treatment criteria for approximal caries based on drawings illustrating different radiographic stages of approximal caries, preferred type of preparation and filling material (same questions were used by Espelid et al 1985 and Tveit et al 1999). Sample: 2375 dentists responded the questionnaire (response rate=61.3%), mean age: 46.2 (SD=11.9).

Main findings: Only 7% of dentists would restore approximal lesions confined to enamel, compared to 66% in 1983 (Espelid et al. 1985) and 18% in 1995 (Tveit et al. 1999). Younger dentists were more likely to defer restorative treatment of approximal lesion until the lesion was visible in dentine (OR=4.94; 95% CI 1.88-13; p=0.001).
Table 9: Dentists’ views of EBD and its use in practice


Study design: A cross-sectional questionnaire survey was sent to 300 general dental practitioners in the North West region of England. A list of practitioners working in the North West was obtained and their names were drawn at random. Out of the 300 questionnaires sent out, 204 replies were received (69.6%) and 7 were returned due to wrong addresses. Out of the 204 replies, 6% were from dentists who worked with private patients; 52% worked with patients on National Health Service; and 42% had a mixed patient base. 62% of dentists had been working in practice for more than 15 years.

Main findings: A majority of dentists had some understanding of evidence-based practice (EBP) but only 29% were able to correctly define the term. 60% of dentists turned to friends and peers for help and advice when faced with clinical uncertainties. Despite the majority of dentists being interested in EBP, they considered the application of evidence in practice time consuming.


Study design: A cross-sectional questionnaire survey was mailed with the December 2001 issue of the Journal of the Canadian Dental Association to all 17,648 registered dentists in Canada. Dentists were asked about research utility, accessibility and dental research priorities. A response rate of 15.8% was obtained. 90% of dentists worked in general practice and 3% were dental teachers. Age group: 10% (21-30); 43% (31-45); 39% (46-60); 8% (60+).

Main findings: Although 64% reported research as easily available, more than 80% of dentists felt that availability could be improved through journals, internet and continuing education courses. 88% of dentists reported research as useful; the majority of general dentists opted for reading research commentaries or a piece translating research into practical guidelines. Dental teachers and specialists were happy to read reports in specialist journals. The majority of respondents claimed to have altered an aspect of their practice after having learned the results of “some form of research”; however the authors did not state what “some form of research” meant. The uses of a dental material and/or an operative treatment are examples of clinical practice changes reported by dentists. The younger dentists
were less likely to alter their care. The likelihood of changing care increased with age with exception for dentists older than 60 years (p<0.001).


Study design: Questionnaire survey assessing Dutch dentists' opinions about the development, use and barriers to evidence-based guidelines. The questionnaire was sent to 1656 general dental practitioners randomly selected from a total of 5692 dental practitioners practicing in the Netherlands in 1998. A response rate of 73% was obtained. Dentists' mean age was 44 (range 25-67); mean year of graduation was 1979 (range 1954-1996). 91.1% worked in general dental practices in a private or community setting.

Main findings: 54% of dentists supported the development of guidelines, however they saw guidelines as merely supportive of daily practice. The greatest barrier to successful implementation of clinical guidelines was the fear of dentists that they would restrict their professional autonomy. Only 35% of dentists felt that guidelines would reduce large variations in treatment between dentists.


Study design: qualitative study (six focus groups) exploring Belgian dentists’ experience in the implementation of evidence in practice. A group of 6 academics were chosen because of their status of good informants of evidence-based dentistry. The remaining groups were made of 73 dentists who were recruited from local peer groups. Age (years): mean age 42 (range 27 to 62).

Main findings: Dentists talked about having difficulty in keeping up-to-date with new research findings; lacking evidence for many devices and products; having difficulties in interpreting research results; reading contradictory information in the scientific literature; lacking clear answers to clinical questions; and academic journals being too expensive. Dentists felt that reimbursement systems were outdated and that evidence-based practice was not financially rewarded. They said that patients prefer treatments that are reimbursed above evidence-based ones.
Dentists believed that potentially subjective results are presented when commercial companies sponsor research. The concept of evidence-based dentistry (EBD) was new to many dentists and EBD was perceived as serving dental academics only. Dentists believed that their skills strongly influence treatment outcomes. They relied on peers’ advice when faced with problems. Dentists’ heavy workload was also perceived as a barrier.


Study design: A questionnaire survey was carried out to assess Swedish dental professionals’ attitudes, awareness, and perceived barriers to evidence-based dentistry (EBD). All professionals listed in local branch organisations, in the regional centre of specialist dentistry and in the Halmstad County Hospital received the questionnaire: a total of 290 dental professionals (91 dental hygienists, 182 general dentists and 17 specialist dentists) in the county of Halland, Sweden. A response rate of 76% was obtained including: 60 dental hygienists (75% aged between 40-59 years); 123 general dentists (68% aged between 40-59 years) and 15 specialist dentists (47% aged between 40-59 years).

Main findings: All professionals considered EBD, at least partly, useful in daily practice. With exception of general dentists in private practice, the majority of professionals thought that EBD would improve dental care. Only specialist dentists were aware of the Cochrane reviews and had searched the Medline database. Lack of time for practicing EBD was the main barrier reported by dental hygienists and general dentists, while poor availability and information about the evidence was cited by specialist dentists.


Study design: A cross-sectional survey, involving all dentists in the Malaysian state of Selangor, was conducted using a self-administered questionnaire. This state has both the highest population rate in Malaysia and the highest number of dentists per state with a dentist to population ratio of 1:9,490. A total of 193 dentists completed the questionnaire (50.3% of the total dental practitioners in
Selangor). 41 responses came from Selangor dentists who attended a conference, and the remaining 152 came from postal questionnaires.

Years in practice: 20+ =37%, 15-19=15%, 10-14=24%, 5-9=18%, <5=6%

Main findings: 135 out of the 193 dentists had heard about evidence-based practice (EBP). 98% of the 135 respondents who had heard of EBP agreed that EBP improved their knowledge, skills and treatment quality. 98% of respondents were interested to learn further information about EBP. Lack of time (64%), financial constraints (40%), and lack of knowledge (28%) were reported as main barriers to EBP. Due to barriers, 91% dentists preferred getting information from colleagues and 83% consulted textbooks for advice instead of seeking evidence from electronic databases.

Wårdh I, Axelsson S, Tegelberg Å. Which evidence has an impact on dentists' willingness to change their behavior? JEBDP. 2009; 9:197-205.

Study design: The study consisted of 2 parts: a quantitative analysis performed through a postal questionnaire to all 177 dentists with more than 50% of full-time employment in a local area, the county of Vastmanland, Sweden. The participants were 154 general practicing dentists and 23 senior consultants with competence in one of the approved dental specialities in Sweden. The response rate was 85%. When the results of the questionnaire were analysed, a request about their interest in participating in a focus group was sent to the respondents. From those who accepted this request, a strategic sample was made to compose 3 groups, each with 5 dental professionals with different backgrounds of knowledge and experiences.

Main findings: General dentists mainly seek new knowledge from colleagues, while specialists also seek information from books, international scientific journals, and databases. General dentists preferred getting new knowledge from conferences than research databases. An added bonus was their collegial contacts during conferences. Specialists and younger dentists were more familiar with the concept of evidence-based dentistry. Dentists felt that studies pointing to diverging results create confusion.

**Study design:** A convenience sample of dentists who had made substantial efforts toward practicing evidence-based dentistry (EBD) was selected. These early-adopting participants were self-selected from 127 dentists who attended the 2008 EBD Champion Conference. Seven months after the conference, these dentists were invited via e-mail to complete an online questionnaire. 43 (34%) conference attendees completed the survey: 29 males, 7 females, and 7 undeclared who mainly worked in private practice (61%) or academia (25%), were general dentists (75%), and were at least 45 years old (range ¼ 25 to 65+ years). They graduated between 1964 and 2003, with half graduating after 1981.

**Main findings:** Dentists identified as barriers to EBD implementation a great difficulty in changing their current practice model, resistance and criticism from colleagues, and a lack of trust in research evidence. Barriers perceived as serious problems had to do with lack of up-to-date evidence, lack of clear answers to clinical questions, and contradictory information in the scientific literature.


**Study design:** qualitative study including a focus group with dentists and researchers followed by interviews with dentists. All participants worked in primary care dentistry in the North West of England. The focus group was undertaken with dentists and researchers who had been involved in primary care dental research (n=6). Subsequent interviews were undertaken with primary care dentists with a range of research experiences (n=18).

**Main findings:** Dentists held conflicting views: they thought that evidence-based dentistry (EBD) was important but at the same time they allowed clinical practice to be informed by their clinical experience, advice from peers and hands-on experimentation. Changes in practice were greatly influenced by the views and practice of other dentists whose clinical work they admired. Dentists believed that there was limited evidence for primary care dentistry and that dental academics' opinions differed from theirs. Early adopters of research were identified as dentists who had an interest in research and grappled with research to apply it into their practice. These dentists were more likely to discuss research with peers. Late adopters were reluctant to stray from undergraduate training. Patient and practice management articles were their primary interest in reading dental journals.

Study design: A questionnaire was designed to assess awareness, knowledge and practice of evidence-based dentistry (EBD) amongst general dentists and specialists working in the Ministry of Health in Kuwait. A total of 742 general dentists and specialists worked in the Ministry in 2008. A sample of 150 dentists working in five specialty centres and 15 polyclinics was approached after applying a multi-stage random sampling method. A response rate of 16% was obtained. General dentists comprised 55.8% of the sample; only 32.5% had more than 10 years of clinical experience, the rest having 10 years or less of clinical experience. Age group: >30 (43%), 31 to 40 (39%), 41 to 50 (13%), >50 (5%).

Main findings: 54% of dentists reported using EBD most of the time; 58.4% claimed to have had some form of EBD training, but 87% also wanted to have more formal EBD training. 56% of dentists lacked time to adopt EBD; 67.5% had no access to scientific evidence. Not having computers at workplace (88%), experiencing inaccessibility to international journals (92%) and lacking training on critical appraisal (85%) were also identified as barriers to EBD. The mean EBD knowledge score for the group was 9.03, with 40.8% of the group being above the mean. In comparing those above and below the mean score in relation to a number of characteristics, there were a number of significant differences, district (p < 0.05), gender (p< 0.05), country of first dental degree (p< 0.05), clinical experience (p = 0.05), and whether the dentist had EBD training or not (p < 0.05). More than half of the Capital and Farwanya dentists had knowledge scores above the group mean. In addition, more female dentists, graduates from Kuwait and Europe, dentists with <10 years of clinical experience, and those who had received some EBD training, had knowledge scores above the group mean. The only characteristic that showed no significant difference was the field of practice. There was no consistent association between EBD knowledge and the stated use of various information sources. Whereas referring to medical journals such as Lancet or the British Dental Journal had no association, using sources like the Cochrane Library (p < 0.05), PubMed/Medline (p < 0.05) and evidence-based websites (p < 0.05) were significantly associated with higher EBD knowledge scores. Using international guidelines for clinical practice was associated with higher knowledge scores (p < 0.05).
PARTICIPANT INFORMATION STATEMENT

Title of Project: The Monitor Dental Practice Program: an evaluation of the perceptions and expectations of patients, dentists, and practice staff during the implementation process.

Names of Investigators:
A/Prof Wendell Evans, Prof Eli Schwarz, Dr Bradley Curtis, Dr Alexandra Sbaraini, Dr Stacy Carter, and Dr Evelyn Howe.

What is the study about?
As you know, you are participating in a study, The Monitor Dental Practice Program, concerned with the treatment of tooth decay. This treatment aims to stop further decay and speed up natural repair and avoid cavities. We want to know how you feel about being involved in this study and whether we can improve the way we manage the treatment protocols to bring about better oral health outcomes.

Who is carrying out the study?
The study is being carried out by researchers from the Population Oral Health Research Unit at the University of Sydney, already familiar to you.

What does the study involve and how much time will it take?
The study involves an interview with patients, dentists, and dental practice staff regarding their perceptions and expectations about the implementation of the Monitor Dental Practice Program. It is anticipated that the interview will take approximately 60 minutes of your time. The interviews will be recorded and subsequently transcribed for analysis. If you agree to participate in this study, we will arrange to conduct an interview with you. The interviews will be conducted by Alexandra Sbaraini at a time and location convenient to you.
Can I withdraw from the study?
Participation in this study is entirely voluntary. There is no pressure on you to take part if you prefer not to. You can change your mind and withdraw from the study at any time. Should you decide not to participate in this study or choose to withdraw from it, this will not prejudice you and will not affect your relationship with your dentists or other practice staff or with any member of the research team.

Will anyone else know the results?
All aspects of the study, including the results, will be strictly confidential, and only the investigators will have access to information on participants. All responses will be anonymised before being analysed. Results from the study will be submitted for publication, but individual participants will not be identifiable.

Will the study benefit me?
There is no anticipated direct benefit to you as a participant, although it is sometimes the case that participants gain value from the opportunity to talk about their experiences.

Can I tell other people about the study?
Yes, that is entirely up to you.

Contact details
Should you have any questions about this study, please feel free to contact Alexandra Sbaraini on 02 89214369 or 0409609916 or asbaraini@mail.usyd.edu.au.

What if I have a complaint or concerns?
Any person with concerns or complaints about the conduct of a research study can contact the Senior Ethics Officer, Ethics Administration, University of Sydney on (02) 9351 4811 (Telephone); (02) 9351 6706(Facsimile) or gbriody@mail.usyd.edu.au (Email).

This information sheet is for you to keep
PARTICIPANT CONSENT FORM

Title: The Monitor Dental Practice Program: an evaluation of the perceptions and expectations of patients, dentists, and practice staff during the implementation process.

I, ................................................... , give consent to my participation in this research project.
In giving my consent I acknowledge that:

1. The interview procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.

2. I have read the Participant Information Statement and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s.

3. I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher(s) or my health professionals now or in the future.

4. I understand that my involvement is strictly confidential and no information about me will be used in any way that reveals my identity.

Signed: ....................................................................................................................................

Name: ....................................................................................................................................

Date: ......................................................................................................................................
Dear Dr. Evans,

Title: The Monitor Dental Practice Program: an evaluation of the perceptions and expectations of patients, dentists, and practice staff during the implementation process

Ref. No.: 12-2007/10558

Authorised Personnel: A/Prof. Wendell Evans
Prof. Eli Schwarz
Dr. Bradley Curtis
Dr. Alexandra Sbaraini
Dr. Stacy M. Carter
Dr. Evelyn Howe
The Human Research Ethics Committee, at its Executive Meeting held on 11 August 2009, considered and approved the following request received 1 July 2009 to modify the above protocol as follows:

- Alteration to question route via additional questions.

The Committee found that there were no ethical objections to the modification and therefore recommends approval to proceed.

**Chief Investigator / Supervisor’s responsibilities to ensure that:**

1. All serious and unexpected adverse events should be reported to the HREC as soon as possible.
2. All unforeseen events that might affect continued ethical acceptability of the project should be reported to the HREC as soon as possible.
3. The HREC must be notified as soon as possible of any changes to the protocol. All changes must be approved by the HREC before continuation of the research project. These include:
   - If any of the investigators change or leave the University.
   - Any changes to the Participant Information Statement and/or Consent Form.
4. All research participants are to be provided with a Participant Information Statement and Consent Form, unless otherwise agreed by the Committee. The Participant Information Statement and Consent Form are to be on University of Sydney letterhead and include the full title of the research project and telephone contacts for the researchers, unless otherwise agreed by the Committee and the following statement must appear on the bottom of the Participant Information Statement. *Any person with concerns or complaints about the conduct of a research study can contact the Manager, Ethics Administration, University of Sydney, on (02) 8627 8175 (Telephone); (02) 8627 8180 (Facsimile) or gbriody@usyd.edu.au (Email).*
5. Copies of all signed Consent Forms must be retained and made available to the HREC on request.
6. It is your responsibility to provide a copy of this letter to any internal/external granting agencies if requested.
7. A report and a copy of any published material should be provided at the completion of the Project.
Yours sincerely

Associate Professor Philip Beale
Chairman
Human Research Ethics Committee

c: Dr. Alexandra Sbaraini, email: asba3356@usyd.edu.au

Encl: Approved Draft Interview Schedule – Dentists and dental practice staff
   Approved Draft Interview Schedule – Patients
Ref: IM/AS

27 January 2010

Associate Professor Wendell Evans

Faculty of Dentistry, The University of Sydney

Email: w.evans@dentistry.usyd.edu.au

Dear Associate Professor Evans

Title: The Monitor Dental Practice Program: an evaluation of the perceptions and expectations of patients, dentists, and practice staff during the implementation process

Reference: 12-2007/10558

Thank you for forwarding the Annual Report Form for the above protocol. The Executive Committee at its meeting held on 17 December 2009 considered and approved the report.

Your protocol has been renewed to December 2010.

Yours sincerely,

[Signature]

Associate Professor Ian Maxwell, Chair, Human Research Ethics Committee