A New Payment Model in Swedish Dental Care

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“Det dunkelt sagda, är det dunkelt tänkta”

Esaias Tegnér, 1820

Swedish poet

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ABSTRACT

The Public Dental Service introduced a new way of paying for dental care in 2007 in Region Västra Götaland, and in 2009 in all of Sweden. The new system, 'Dental Care for Health' (DCH), was based on capitation rather than the traditional fee-for-service (FFS) system. **The overarching aim** of this thesis was to conduct an evaluation of this new payment system with regard to patient attitudes, dental care and oral health.

The specific aims of the four included manuscripts were: **(I)** to describe potential differences in views on oral health and oral health behavior between the patients who chose the respective schemes; **(II)** to map the experiences and attitudes among the prepayment scheme patients with regard to the agreement, the dental care received, and the financial arrangements; **(III)** to compare the amount and type of dental care received by patients in the two payment schemes, respectively, and to conclude about the financial net of the prepayment scheme; and **(IV)** to measure over six years the development of oral health in terms of manifest caries incidence, in the two payment schemes.

Study I showed that patients who chose DCH reported themselves as being healthier and more engaged in health-promoting behaviors than patients in FFS. According to the qualitative analysis of interviews from **study II**, the DCH patients were satisfied with their choice and appreciated feeling secure when having an agreement with the PDS. **Study III** reported that DCH patients had more preventive treatment and less restorative treatment than FFS patients. The outcome for oral health, as described by the incidence of manifest caries from six years adherence to either of the payment schemes, showed, in **study IV,** a 50% increase in the risk for caries in FFS compared with DCH, when important background factors were controlled for.

Keywords: Dental care, Dental insurance, Capitation, Fee-for-service, Oral health, Lifestyle, Qualitative research, Patient preferences, Patient satisfaction, Dental caries.

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SAMMANFATTNING PÅ SVENSKA

Det övergripande syftet med denna avhandling var att beskriva effekter av att införa ett valfritt, kompletterande betalningssystem, Frisktandvård, i Folktandvården och att jämföra med det befintliga betalningssystemet, taxetandvård. Frisktandvård är ett betalningssystem där man som patient betalar ett fast pris för all tandvård man kommer att behöva under en 3-årsperiod.

För de enskilda studierna var delsyftena **(I)** att undersöka om patienterna som valde de olika systemen skiljde sig åt avseende synen på orala hälsa och på hälsorelaterade livsstilsbeteenden; **(II)** att kvalitativt kartlägga Frisktandvårdsväljarnas syn på och åsikter om betalningssystemets fördelar och nackdelar, om själva avtalets beståndsdelar, och om den behandling de fått; **(III)** att jämföra de två betalningssystemen avseende hur mycket, och vilken behandling som utförts, samt att fastslå om kostnaderna i modellen täcktes av intäkterna för Folktandvården; samt **(IV)** att jämföra utvecklingen av oral hälsa över tid, mätt som manifest karies, mellan de två betalningsmodellerna.

Resultaten visade att de patienter som valde Frisktandvård hade en mer uttalat positiv syn på sin orala hälsa och dess betydelse för välbefinnandet. De motionerade mer, rökte mindre, och var mer motiverade att följa egenvårdsråd, än patienter som valt att behålla den tidigare betalningsmodellen **(I).** Frisktandvårdspatienter var nöjda med att ha valt den nya modellen, kände sig trygga med ekonomin och avtalet som sådant. De var däremot inte säkra på att de fått all information om avtalets ingående beståndsdelar **(II).** Behandlingen patienterna fick i de två olika modellerna skiljde sig åt såtillvida att Frisktandvårdspatienterna fick mer förebyggande vård och mindre reparativ vård än de som betalade enligt den traditionella modellen. Frisktandvårdsmodellen visade ett positivt netto för hela treårsperioden, men inte varje år, i varje enskild riskgrupp **(III).** Mängden karies hos individerna i de två betalningsmodellerna skiljde sig åt efter 6 år: De patienter som valde att behålla den tidigare betalningsmodellen hade 50 % större risk för manifest karies, även om man tagit hänsyn till effekterna av ålder, kön, utbildning och tidigare mängd karies **(IV).**

LIST OF PAPERS

This thesis is based on the following studies, referred to in the text by their Roman numerals.

I. **Andrén Andås C**, Hakeberg M. *Who chooses prepaid dental care? - A baseline report of a prospective observational study.* BMC Oral Health 2014; 14:146. PMID: 25472465

II. Strand J, **Andrén Andås C**, Wide Boman U, Hakeberg M, Tidefors U. *A new capitation payment system in dentistry: the patients' perspective.* Community Dental Health 2015; 32:83-88. PMID: 26263600

III. **Andrén Andås C**, Östberg A-L, Berggren P, Hakeberg M. *A new dental insurance scheme – effects on the treatment provided and costs.* Swedish Dental Journal 2014; 38: 57-66. PMID: 25102716

IV. **Andrén Andås C**, Hakeberg M. *Payment systems and oral health in Swedish dental care: observations over six years.* Submitted for publication, Community Dental Health

CONTENT

ABBREVIATIONS

DCH	Dental Care for Health
PDS	Public Dental Service
VGR	Region Västra Götaland
FFS	Fee For Service
CP	Capitation payment
NDI	National Dental Insurance
CC	County Councils
NHS	National Health Service
R2	Digital risk assessment tool, presently used
RaT	Digital risk assessment tool, former
DCBS	Dental Care Benefits Scheme
ATB	General dental cost refund
DMFT/S	Decayed Missing Filled Teeth/Surfaces
WHO	World Health Organization

DEFINITIONS IN SHORT

Fee-for-service reimbursement (FFS)	The (dental) caregiver receives a fixed sum for each item of care provided. The money may emanate either out-of-pocket from the patient, or from any reimbursing authority, public or private – or from any combination of the two.
Capitation payment reimbursement (CP)	The (dental) caregiver charges a fixed, pre-determined fee, in advance, for all dental care that is considered to become needed by the individual patient, during a certain time span. The individual patient's fee might be differentiated according to estimated risk for dental disease, and the source of the money may vary in the same way as for FFS.

1 INTRODUCTION

Approaching the Institute of Odontology at Sahlgrenska Academy at the University of Gothenburg, from the city center, you pass a crossing named after a late Swedish politician, Edvard Wavrinsky, who was a member of the second chamber of the Swedish Parliament at the turn of the last century. Few on their way to the University or elsewhere know that Wavrinsky, in 1904, introduced the first parliamentary bill on providing community-based dentistry for school children and for young men in the military service. The rationale was to limit the extensive impact on health and performance from tooth decay and pain in a way that would also limit the class-based effects of the lack of dental professionals and the high charges. The bill was at first rejected, but the political awareness gradually developed and government-financed examinations of children's teeth at school were introduced [1]. The reasons for introducing a capitation payment system for adult patients in the Public Dental Service during the 1990s, which later developed into Frisktandvård, 'Dental Care for Health' (DCH), were, in part, the same: To enhance health improvement and to increase accessibility to care.

It should be pointed out that the results from the studies in this thesis are all related to the time and the situation when the DCH scheme was first introduced, and to the first few years of this new and developing regime. As such, any extrapolation to today's circumstances must be made with caution. Practical experience, familiarization with and further development of DCH could be assumed to have entailed changes, both to how the new system is understood and managed, and to the composition of the covered patient group.

1.1 How is dental care arranged and paid for?

1.1.1 International outlook

Health care in general

Schematically, the diversity of health care arrangements in different countries could be described on the axes of public/private financing and public/private production, respectively. The Scandinavian system will appear at the public end of both axes, in contrast with the health care system in Australia, which is publicly financed to the same extent, but with private production, the system in the Philippines, which is both

privately financed and produced, and health care in China, which is privately financed but publicly produced. These relationships are presented in a figure in a textbook on health economics [2].

Dental care

Dental care is reimbursed by public funds to a lesser extent than health care, and the source of the remaining funding and its distribution across groups of patients differs widely within, for instance, the European Union. The Nordic and Beveridgean (UK) systems are characterized by public reimbursement of care costs for children, adolescents and certain groups with greater needs, together with some sort of high cost protection for adult patients. In the Bismarckian system (Germany and many central European countries), the costs are reimbursed via sickness funds jointly financed by employers and employees. In southern Europe (Italy, Spain, Greece, among others) there is no public involvement in the financing of dental care, in most cases not even for children. In Eastern Europe, vast changes have taken place during the last decades, which has reduced public influence over what was previously a dental care sector that was almost completely publicly financed and produced [3].

There are also important differences between countries and systems concerning the degree of private or public production of dental care, as well as the practical organization of the dental care, for instance, through the use of different dental professions like dental hygienists.

There are also some notable differences between the Nordic countries. Dental care for children and adolescents is free of cost in all the Nordic countries except for Iceland, where the patient pays 25 % of the cost. Dental care for groups with special needs, though differently specified, is free in all the Nordic countries. Healthy adult patients pay for all their dental care themselves in Norway and Iceland. In Denmark, patients pay 80 % of the cost. In Finland, the patient share depends on the provider, and in Sweden, the patient pays 100, 50 or 15 %, according to a high-cost scheme. The payment is predominantly according to fee-for-service. Private insurances are common in Denmark and Finland, rare in Sweden and Norway, and non-existent in Iceland [4].

1.1.2 Sweden

Dental care arrangements

Dental care in Sweden is provided by the Public Dental Service in the 21 Regions/County Councils, and by private practitioners. Private dental

care is run either as small businesses, as producer cooperatives, or, to an increasing extent, as companies with employees. The history of the PDS goes back to as early as 1938, and its emergence was a result of poor oral health among school children [5]. Today, children as well as adults are free to choose any dental care supplier, PDS or private, with the PDS now covering > 95 % of dental care for individuals younger than 20 years of age, and some 40-45 % of dental care for adults (Table 1). For the Region Västra Götaland, where the studies in this thesis were carried out, the corresponding figures are 94 % of those younger than 20 years and 50 % of those above the age of 20 (Table 1).

The arrangement of the compensation to care providers, in terms of performance-based or fixed compensation, may vary a lot depending on employment status. Within the PDS, the earlier common arrangement with a share of the wages to the dentists being directly performance-based, has gradually been replaced by fixed salaries over the past decades.

Dental care payment

In 1974, the Swedish government launched the National Dental Insurance (NDI). The NDI was kept separate from the National Health Insurance and should cover all citizens, include all dental procedures and entail a maximum fee for each procedure [5]. The reimbursements were initially generous, included all types of dental care, and were primarily aimed at protection against high costs. As a result of the decline in state finances the reimbursement share was gradually eroded, except for children and adolescents up to 20 years of age and individuals with special needs. As a consequence of the reduced compensation to the patients, the NDI was reformed in 1999: the regulation of prices for dental care went from being determined in detail by the government to becoming practically free and up to the individual private care provider, or each Region/County Council. The number of privately practicing dentists accredited to work within the NDI in each geographical area was no longer restricted [6]. Since a larger, and growing, share of the population was essentially healthy as a result of a gradual improvement in oral health during the preceding decades [7], the reformed NDI was profiled towards promoting health rather than treating diseases. Thus, mainly basic dental care was reimbursed and complemented by a high cost protection scheme for expensive prosthetic treatment. The possibility to subscribe to dental care, i.e., a capitation payment arrangement, was also introduced as part of the health maintenance focus [8]. However, already in 2007, the NDI was changed again, and this

time it was fundamentally restructured. Reimbursements in the new Dental Care Benefits Scheme (DCBS) were based primarily on the specific oral diagnosis rather than the subsequently performed dental procedure. Again, it became more generous, but also regulated in detail and thereby complicated [6].

Regardless of the source of payment for dental care procedures, the cost may principally be referred to either of two units: Payment for each individual patient, called capitation payment (CP), or payment for each item of dental care carried out, called fee-for-service (FFS). From the start in 1974, dental care for children and adolescents has been remunerated according to the CP system, while FFS has been applied to adults. The introduction of a capitation payment arrangement in the DCBS paved the way for the PDS to proceed with DCH beyond the pilot stage, and make it optional for each adult patient within the PDS to exchange the FFS payment scheme for a CP alternative. No large-scale CP payment option is currently offered outside the PDS, i.e., among privately run dental care clinics or companies.

1.2 What is Frisktandvård - 'Dental Care for Health' (DCH)?

1.2.1 Background

Realizing an idea

The idea that health improvement might vary with the type of payment system arose in several County Councils (CC), independently of one another, towards the end of the 1980s [9]. Similar thoughts lay behind the introduction of Denplan in the UK in January 1987, with the difference that Denplan was a private CP scheme introduced as an alternative to public dental care within the NHS [10]. In 1991, a pilot capitation payment scheme was introduced and tested at two clinics, one in urban Gothenburg and one in the countryside in the adjacent CC of Bohuslän. The scheme was based on an assessment of the future risk of disease and need for dental care, essentially in according with the principles of Denplan [9]. Today's Denplan works somewhat differently from today's DCH by offering products not only to patients, but also to dental practitioners, companies and schools. In Denplan, dentists determine their own fees and plans are offered as packages: Only emergency treatments, examinations and preventive treatments, or with the addition of restorative treatments in the most comprehensive

capitation plan [11]. Compared with DCH, the Denplan capitation plan also excludes referrals, extractions of wisdom teeth and anything the dentist him/herself decides to exclude for the individual patient.

In 1999, a permanent amendment to the dental care act authorized the offering of a CP scheme in addition to the traditional FFS scheme in Swedish dental care. This led to the introduction of different versions of capitation schemes in a number of PDS organizations in the CCs, as well as a few that were accessible to the private dental care sector and managed by insurance companies. None of the private insurance schemes that focused on dental care at that time are still in business. The pilot capitation payment system in Gothenburg, on the other hand, kept operating; however, only at the urban clinic, until it was replaced by the regionwide scheme, implemented in 2007, called Frisktandvård ('Dental Care for Health', DCH). The DCH scheme was introduced in all 21 PDS organizations in Sweden two years later, in a slightly further developed form. The traditional FFS payment system was kept in parallel with the insurance-like capitation system DCH, which then became optional for patients attending the PDS.

Recent development

About 25 % of the patients in Region Västra Götaland (2007-2009) chose DCH instead of FFS at their first possible opportunity to change payment systems. For the dental care staff, several aspects of this situation were new and untested: a great deal of new information had to be given to patients when performing and communicating the risk assessment. It has also been described how dental care personnel felt uncertain about the clinic's economic development as a result of the different source of revenue, and felt reluctant about having to "sell insurance", instead of practicing dentistry [12]. Initially, most included patients belonged to low risk categories and were thereby healthy and relatively young. During the following two to three years, the included patients were gradually distributed across a wider range of risk categories. Patients became more familiar with the system, as information was disseminated in the media and through word of mouth. Familiarity with the system also led to changes in staff attitudes. Similar scenarios occurred in other CCs and regions. In places where early versions of CP schemes had been implemented, the number of included patients grew faster. In mid-2015, in the CC of Södermanland, just south of the capital Stockholm, 52 % of the PDS-attending group over the age of 19 has chosen to pay for their dental care according to DCH. In Region Västra Götaland, 156 000

individuals have changed payment systems (Table 1). In Sweden as a whole, the PDS aims for a million contracts in 2018.

1.2.2 DCH in detail

Features

Frisktandvård (DCH) refers to the possibility for an individual dental care patient attending dental care in the PDS to sign a contract with the clinic for all necessary basic dental care during the coming three-year period at a fixed fee. The individual fee will be determined according to the risk of developing oral diseases during the period. Most basic dental care procedures are included, although limited by the requirements for reimbursement in the DCBS. Some procedures of prosthetic dentistry are included (i.e., single crowns and posts); however, no procedures to replace teeth missing in their entirety are included. Specialist treatments by referral are included, together with emergency visits to any other PDS clinic in Sweden. Apart from paying the determined fee per year or per month, the contract also includes committing to an individually designed self-care protocol that addresses preventive measures, such as oral hygiene procedures and the use of fluorides. Moreover, diet and its effect on oral disease is discussed. The full specifications of included and not included items of care in DCH are presented in Figure 1. The 2015 fees for the different risk groups in the VGR are described in Table 2.

Table 1. Number and share of individuals in dental care in Sweden in the PDS and as DCH contract-holding adults, by county.

Swedish county	**Individuals seeking dental care[1]**	**Individuals in PDS care[1]**	**Individuals with DCH contract[2]**	**Share seeking dental care in PDS[1]**	**Share in PDS choosing DCH[2]**
	N	*n*	*n*	%	%
Södermanland	126726	75111	38910	50	52
Skåne	574129	255281	111517	36	44
Kalmar	111329	74769	32122	49	43
Västernorrland	113047	67724	27601	45	41
Västra Götaland	772073	411601	157854	50	38
Uppsala	142767	111419	42379	49	38
Norrbotten	104074	92188	28982	63	31
Kronoberg	86930	44342	11363	39	26
Värmland	135775	88873	23027	51	26
Västerbotten	111924	94298	22467	57	24
Örebro	135364	90554	21138	48	23
Stockholm	865501	360000	71737	29	20
Gävleborg	130879	95474	18085	60	19
Jönköping	170716	121151	20129	52	17
Halland	145909	70854	11357	34	16
Östergötland	188582	127338	18057	42	14
Blekinge	73505	46896	4721	47	10
Jämtland	56150	38503	3494	45	9
Västmanland	118154	73454	3206	43	4
Gotland	28202	16554	381	44	2
Dalarna	122702	103848	875	46	1
Sum	**4322745**	**2460232**	**669404**		
Median/Mean				**48/46.6**	**23/27.2**

[1] During 2014. From Försäkringskassan (The Swedish National Social Insurance Agency), http://www.forsakringskassan.se/statistik/ovriga_ersattningar/tandvard/tandvard

[2] June 30, 2015. From Sveriges Folktandvårdsförening http://www.folktandvarden.se/in-english/

Table 2. Dental care cost during the contract period (3 yrs.) per risk group, in VGR, 2015-05-11.

Risk group	20-29 and >75 yrs.*		30-74 yrs.*	
	SKR/month	SKR/yr.	SKR/month	SKR/yr.
1	50	600	62	774
2	61	732	73	876
3	76	912	88	1056
4	110	1320	122	1464
5	166	1992	178	2136
6	223	2676	235	2820
7	317	3804	329	3948
8	446	5352	458	5496
9	653	7836	665	7980
10	885	10620	897	10764

* Age groups differ according to General Dental Cost Refund scheme (ATB), amounting to 150 SEK/yr. and SEK 300/yr., respectively.

Risk group assignment

Risk assessments play a significant role in dental care as a tool for treatment planning and evaluation, and for establishing an accurate interval for recall [13]. It could also be a useful tool in patient education [14]. In a capitation payment system, the risk assessment will be used to allocate the patients to an appropriate fee class, with the aim to match the patient fee to the expected treatment need for the scheduled contract period [15]. It will be important to have access to an accurate risk assessment, in terms both of validity and reliability. For the purpose of risk group assignment, the risk assessment needs to be able to pinpoint future treatment needs, to avoid endangering the economic survival of the capitation payment system. It should also be repeatable to be considered fair when applied in a large organization such as the PDS or other organizations capable of harboring a capitation scheme. In Denplan, for example, computer-aided tools for risk assessments based on algorithms have been used and evaluated [14]. In the present studies, two such computerized algorithm-based systems are used: RaT (until 2008) and its improved successor R2. In Study 1, risk group allocation was systematized using an analogous template for decisions, which

preceded the two digital systems that were to follow. In short, the algorithm in RaT and R2 weighed together anamnestic information with clinically retrieved measures to a compiled score between 1 and 5 (RaT) or 1 and 10 (R2). The resulting risk assessment score was used as a description of the patient's individual risk of future oral disease or need of dental treatment, and to determine the premium category to which the patient was allocated, as the cost of entering the DCH agreement. The digital risk assessment procedure is described in greater detail in the material and methods section; see below.

Included
• Regular dental care for a fixed monthly fee • Regular appointments, check-ups and preventive care • A tailored self-care programme • Repair of tooth decay or broken fillings • Surgical treatment, such as tooth extraction • Root canal treatment • Stomatognathic treatment • Treatment at a specialist dental clinic following referral from the Public Dental Service • Emergency dental care at clinic where the patient is registered or at another Public Dental Service clinic in Sweden
Excluded
• Orthodontic treatment • Care that is not covered by the reimbursement scheme, for example aesthetic dental care • Treatment following an occupational injury or accident • Rehabilitation care, i.e. payment for missing teeth; removable or fixed constructions • Prosthetics fitted into the jaw, i.e. implants/screws secured in the alveolar bone

The dental care that is included under the agreement must also qualify for reimbursement under the Dental Care Benefits Scheme, TLVFS 2008:1. The DCBS states that reimbursement of applicable dental care measures is further restricted to certain diagnoses; for description (in Swedish), see: http://www.tlv.se/Upload/Lagar_och_foreskrifter/Myndighetens-tidigare-regler/TLVFS-2008-1.pdf.

Figure 1. Specifications of dental care included and not included in the DCH contract.

1.3 Oral health

1.3.1 The concept of health

Health

Traditionally, health has been regarded as the absence of disease. However, already in 1946, the WHO launched their classic, much wider definition of health: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity" [16]. The concept of health has since moved gradually from a state declared to exist when medical experts disclaim signs of disease, into a perceived state when experienced by the person concerned; in other words, incorporating not only the health status, but also the individual's experienced function and perception of pain or discomfort. Such an extended meaning may have more profound consequences for Swedish-speaking people (and perhaps also other non-English speakers?), as there is only one word in Swedish for what in English would be described in greater detail as "illness" and "disease". However, also in English, the two words are used interchangeably to some extent; it is possible to have either of them without the other, but also both of them at the same time [17]. Eric J Cassell, Professor Emeritus of Public Health at Cornell University, pinpointed the distinction in 1978: "Disease, then, is something an organ has; illness is something a man has". Furthermore, the distinction can be followed through the treatment process: The disease is what needs to be cured, whereas illness is what needs to be reduced for the patient to experience treatment success. A third word, "sickness", is used to address the impact from both illness and disease, from a social and cultural perspective.

Oral health

The concept of *oral* health has attracted attention since the 1980s, when Cohen & Jago [18] formulated sociodental indicators, i.e., measures of oral health combined with socioeconomic indicators, and suggested those as suitable endpoints for the purpose of political decision. The term oral health has been criticized as constituting a contradiction to the holistic view on health, by introducing anatomical restrictions to a concept without limits, by definition [19]. According to the Department of Health in the UK [20], oral health has been rather comprehensively defined as "the standard of health of the oral and related tissues, which enables an individual to eat, speak, and socialize without active disease, discomfort or embarrassment and which contributes to general

wellbeing". When oral health, as defined above, has been further expanded to encompass all potential impacts on life, the term Oral Health Related Quality of Life (OHRQoL) has increasingly been used as an endpoint for the effects from mouth-related issues on how life is perceived [21].

1.3.2 Oral health assessment

Health, or absence of disease?

The approach to view health as the absence of disease has been supported by the fact that detecting disease has been easier than evaluating health. Since the estimation of an individual's health status has been in the hands of professionals [22], data on health have been collected quantitatively and have reflected a level of disease, rather than a state of health. Thus, the perspective has been that of the caregiver. As a result, much is known about the incidence of disease in the population, but less is known about how people consider their own oral health, its impact on their overall health or daily life, or how it is influenced by, for instance, dental care arrangements and payment [22]. At a Swedish consensus conference on oral health, Dorthe Holst from Denmark explained that listening to the individuals made it possible to distinguish determinants of health from determinants of disease. She concluded that there is still a lack of overarching research allowing an understanding of how oral health is perceived by individuals receiving dental care and how it might be related to Quality of Life [22].

Assessments by patients

In the transition from regarding health as something beyond the absence of disease, towards preferring QoL as the endpoint, *patient-based outcomes* have become increasingly important. The single question about self-assessed (oral) health has been determined as accurate in representing the patient's level of experienced health, including all aspects found individually relevant [23]. Hence, earlier investigations report that DCH contract holders report higher levels of general health and OHRQoL than FFS patients [24].

Quantitatively or qualitatively

However, for the final goal of understanding the pathway of influence on patients' wellbeing of, for instance, payment systems and the way they are arranged, there is a need to investigate what a payment system means to the patient, in an all-encompassing way. A study performed using a qualitative methodology describes how patients who choose

between DCH and FFS refer to a broad spectrum of aspects that influence their choice [25]. Quantitative and qualitative approaches consider a particular phenomenon from different perspectives, as the methods are based on different paradigms, i.e., different views of reality: The positivist quantitative paradigm describes reality as objective and independent of the observer. The interpretivist qualitative paradigm, on the other hand, claims no single reality, but suggests that reality is created when people interact and that it may thus appear differently to each individual involved [26]. "Qualitative research… is used in the exploration of meanings of social phenomena as experienced by individuals themselves, in their natural context", as described by Malterud [27]. In another paper, Malterud writes that clinical knowledge "consists of interpretive action and interaction—factors that involve communication, opinions and experiences", to which traditional quantitative methods only provide limited access [28]. Qualitative methods are also described as providing dental researchers with a deeper understanding of peoples' personal perspectives and beliefs than, for example, structured questionnaires [29]. Furthermore, Glaser & Strauss argued in favor of inductive qualitative methodologies (e.g., Grounded Theory), rather than repeated hypothesis testing, for theory building [30]. A questionnaire restricts the spectrum of captured patient experiences to the replies to a series of questions. Naturally, these questions picture and reflect the preconceptions of those who formulated them. Since there is a limited amount of research on what the patients actually consider important with payment models like DCH, a broader overview of DCH would not benefit from being restricted in any way. A qualitative approach could thus be expected to produce an even richer result than a quantitatively analyzed series of questions in a questionnaire.

Assessments by professionals

When determining *normative treatment needs*, patient-reported measures, like perceived caries status, have been found to be too poorly predictive to be of use [31]. Furthermore, patient and caregiver assessments of the oral health of patients, in terms of QoL, are repeatedly found to diverge [32, 33], as caregivers tend to overestimate the burden of oral disease. Accordingly, to quantify (oral) health as the outcome of a care-related issue (like DCH), a combination of patient-reported and caregiver-estimated measures may be needed to paint the most correct picture. Tsakos et al. argue for the benefits of combining clinical and patient-based scores in assessing outcomes of interventions and needs for dental care [34].

According to the 2010 Global Burden of Disease Study, untreated caries in permanent teeth was the most prevalent condition among 291 diseases in the world; however, Sweden belonged to the lowest incidence category [35]. Furthermore, caries is concluded to be the fourth most expensive chronic disease to treat. Today, the World Health Organization definition of caries, as being present when the lesions are cavitated, is preferred in epidemiological studies [36]. It might be discussed whether the widely used measure of DMFT/S (which includes a measure of past caries experience in addition to the present prevalence, in contrast to the caries prevalence or incidence only) most accurately reflects the burden of caries disease. The use of the incidence or prevalence of manifest caries as a measure of oral health has the benefit of a high level of agreement between examiners and, thus, comparability, but the disadvantage of being comparably blunt or insensitive [37].

1.4 What can be expected from Frisktandvård - 'Dental Care for Health' (DCH)?

There is a lack of knowledge about the total impact from payment systems on oral health. Since there are three different parties involved in the transaction of payments for dental care (the patient, the caregiver and the government agency) who all have their own—overt or hidden—objectives or goals, the resulting effect is opaque and difficult to trace. Health economic theories describe how a payment system may influence the type and amount of dental care that is demanded, recommended and, ultimately, carried out. Theories from behavioral science suggest explanations for the individual patients' differently expressed preferences, choices and actions. Accordingly, the impact of an agreement like DCH may differ between individual patients, as well as amplify any differences between patients, depending on their choice, as groups. Economic incentives are only one of a vast variety of factors that may affect patients' and caregivers' course of action in terms of payment system choice, and health-promoting behaviors. However, from a theoretical perspective, such incentives may still have a significant influence on the resulting oral health. Changed economic incentives have, indeed, been shown to alter the type and amount of dental care carried out [38], and, as a consequence, possibly also the result in terms of achieved oral health [39] and/or experienced Oral Health-Related Quality of Life [40].

1.4.1 DCH and aspects of how the scheme is constructed

Demand for health care

Peoples' demand for health care is described by Grossman [41] as, in fact, not depicting our demand for health care, but essentially our demand for good health. Grossman describes good health as a commodity, of which we are born with a certain amount, but which depreciates with age. We can make investments in our individual (good) health by allocating a combination of market goods (such as medical care, housing, diet and exercise) and time. The efficiency of the investment is considered to be altered by the individual's level of education. Good health is sought after for two reasons: Being ill reduces both income and the time and ability to engage in other, preferred activities. The quantity of health that will be pursued is dependent on its shadow price; i.e., what else could be achieved with an equivalent investment. This individual choice of how to optimize resources is traditionally described by a utility function, a mathematical notation of the individual choice that would provide maximum satisfaction, or utility. The purpose would be to reflect how the demand for health, for example, is dependent on other demands, and how time and monetary resources impose restrictions on the demand. Utility functions visualize opportunity costs and describe the choices of individuals as constants, determined on the basis of perfect information [42]. It could, however, be argued that the economist's perspective is somewhat restricted, as perfect information is difficult to presume. Furthermore, some important factors in the pursuit of good (oral) health are difficult to exchange for others, based on a value estimated only in terms of time and financial resources.

Insurance and market failure

A capitation payment scheme such as DCH has structural similarities with optional health insurance schemes, by being optional and ensuring all dental care potentially needed in exchange for a predetermined fixed amount of money. (It should, however, be pointed out that the insurance analogy is incomplete, as the purpose of insurance would be to protect the policyholder against *unexpected* costs, and the CP premium also includes paying for *expected* (and mandatory) items of regular dental care.) Seen as insurance, the DCH payment scheme will be subjected to market forces, to so-called market failures due to asymmetric information, as well as to measures undertaken to counteract such failures. An important prerequisite for a functioning market would be equal access for the seller and the buyer—or the patient and the

caregiver—to all the information necessary to determine the right price [43]. This is said never to be the case when it comes to insurance: The patient is considered to know more about his/her state of health than the caregiver, and the caregiver to have better knowledge about different available treatment options and their appropriateness [44]. This potential asymmetry of information is believed to threaten the stability of the insurance in two fundamentally different ways, called skewed selection and moral hazard, respectively.

Asymmetric information—skewed selection

Skewed selection addresses the possibility that those with the highest risk (poorest predicted oral health) would be those most inclined to enter into a DCH agreement, that is, to sign up to dental care for the price of one, fixed payment, regardless of how much dental care will be needed. This type of skewness is called *adverse selection*. If all patients, regardless of risk, have the same price in their contracts, two scenarios could potentially be predicted: (i): That those with the lowest risk opt out, as they believe that they are not getting their money's worth from the agreement, and (ii): that those adhering to the agreement would be found, over time, to request more treatment than was calculated when costing the contract. In the latter case, it will be necessary to increase the fees, which, in turn, would cause the above scenario to be continuously repeated like a vicious circle, and eventually, lead to the failure of the payment scheme. The opposite situation, when healthier patients are those who prefer the agreement, would be called advantageous selection. The result of advantageous selection would, obviously, not entail the same risk of collapse [45]. Regarding optional health insurances, reports diverge as to whether or not the matter of adverse selection is likely to present an actual problem. Theory, and some investigators, claim that there is evidence indicating that adverse selection may pose a problem, for instance, one study from the dental health field [46]. More frequently, however, recent research has pointed to the opposite [47, 48]. With data from a scheme similar to DCH, Grönqvist suggests that a seemingly inconclusive net effect might be explained by the presence of adverse selection in high-risk groups *in combination with* advantageous selection in low-risk groups [49].

Asymmetric information—moral hazard

Moral hazard appears in two different forms, ex-ante, and ex-post. Ex-ante moral hazard is explained as loss of the incentive to protect oneself from damage (i.e., from dental disease, by demanding dental care according to the contract) through self-care measures, once the patient

has surrendered the responsibility for maintaining good oral health to the insurer by paying the fee. Possible manifestations of ex-ante moral hazard in dental care would be deteriorating oral status once the prepayment agreement has been entered into, in terms of increasing levels of plaque and gingivitis in the short term, and caries and periodontitis in the longer term. As it is difficult to verify patients' true behavior at home, there are no studies on estimating the effect of ex-ante moral hazard. In DCH and similar schemes, a clause on self-care measures in the contract is intentionally included to counteract such an undesirable effect of prepayment.

In comparison, an ex-post moral hazard occurs when the patient requests more dental care procedures than considered appropriate, due to the desire to get the most out of the insurance already paid for. The number of patients arguing for more expensive treatment for a given diagnosis may also increase when the cost is the same. Both varieties might initiate and maintain the same vicious circle as skewed selection of continuously increasing the costs, and may also result in a corresponding insurance scheme failure [50]. Arguments have been raised as to whether dental care is able to attract overconsumption. Either way, there is evidence of an increase in the amount of dental care carried out in prepayment schemes: In a DCH-like scheme, Grönqvist showed that the treatment costs increased more for individuals in the CP scheme than in FFS [51]. In a randomized trial in the US, Manning et al. showed that the costs of dental care were 43 % higher in an insurance plan with no deductibles than with 95 % co-payment [38]. Consequently, co-payment, when a patient pays some part of the cost of treatment in addition to the premium at the time of treatment, is shown to regulate the effect of ex-post moral hazard, also within a capitation scheme.

1.4.2 DCH and the type and amount of dental care carried out

Amount of treatment carried out

The fee-for-service and the capitation payment systems entail different economic incentives for both patients and suppliers of dental care [52]. Fee-for-service, for example, has been suggested to entail a risk of overtreatment, as the diagnostician will also profit from carrying out the treatment and get paid for whatever amount or level of dental care procedures he/she regards as appropriate [53]. On the other hand, capitation payment is similarly related to a risk of undertreatment. Once a caregiver has received payment from a patient, earnings can be

increased by using the time paid for to take on additional patients, rather than spend that time with those who have already paid. Another possibility would be to postpone procedures indefinitely, rather than fail to take adequate measures for all diagnostic findings, so-called supervised neglect [54]. The effect of overtreatment in the fee-for service system is considered self-regulatory as long as the caregiver's agenda is fully booked [55], and the undertreatment effect in a capitation system may be controlled through extending the caregiver's responsibility over time with a contract. In such a long-term relationship, the result of ignored treatment needs at one point in time may lead to even more time-consuming (and thus, cost-consuming) treatments to be carried out at a later time by the same caregiver. A comparison between a CP and a FFS system among British adolescents showed fewer filled teeth in CP than in FFS, but no more extracted teeth due to caries. The authors concluded that the adolescents had "satisfactory dental health, with little evidence of 'supervised neglect'." [56].

However, both the potential undertreatment and overtreatment effects are presumably significantly reduced if the caregiver receives a fixed salary instead of being salaried directly from patient fees. The economic gain, which would be the driving force in both undertreatment and overtreatment scenarios, would then no longer directly benefit the person responsible for the choice of therapy [55, 57, 58].

Furthermore, the theoretical rationale behind overtreatment in FFS is called supplier-induced demand. This is considered a potential effect when the caregiver is compensated directly from patient fees, *in combination with* determining and communicating the appropriate level of dental care needed. The effect of an increased demand guided by the caregiver also presupposes information asymmetry: The patient naturally relies on the dental caregiver to decide about the most suitable therapy. Reports from the (Swedish) dental care field have pointed at such an effect when there is excess dental care capacity [53, 55]. In addition, the effect of supplier-induced demand may be further amplified if neither the caregiver, nor the patient has any incentive to reduce the financial cost of the treatment. This may be the case if a third-party financier contributes substantially. For example, in a former high-cost reimbursement scheme in the Swedish NDI, for patients ≥65 years of age, directed specifically to prosthetic treatments, treatments costs increased by 500 % [6].

Type of treatment carried out

In addition to the direct economic incentives, the two payment systems may also influence the type of dental care carried out [59]. As described above, regarding supplier-induced demand in a fee-for-service system, the choice between treatment options may be influenced, in part, by the revenue in relation to the expected expenditure of time. In a capitation system, there may be reasons to expect changes in terms of either a decrease or an increase in the amount of preventive treatment, compared with fee-for service. Like any other type of treatment, prevention may, of course, be subjected to undertreatment; also described above. But, again, in a contract scenario, the caregiver may be attracted into supplying additional preventive measures. Such an approach may benefit dentists, due to the potentially reduced need for restorative treatment over time as a result of better patient adherence to compellingly promoted self-care advice. In that way, the time spent on restorative procedures (that could instead be used for profitable activities) could be expected to decrease. This scenario might be one possible explanation why the number of fillings in CP decreased while the number of fissure sealants simultaneously increased, as reported in the study on British adolescents earlier referred to [56].

1.4.3 DCH and the individual patient's choices and actions

A rational decision?

The mode of action of economic incentives is based on utility functions, which presuppose that decisions are based on perfect information and that they are rational. It might be argued, however, that such utility functions fail to consider all aspects that influence the decision on whether or not to enter into the agreement. More often than not, the information is probably incomplete, and the decision often appears to be irrational [60]. Evidently, some people who choose *not* to enter an agreement such as DCH would have been expected to benefit from its content. Others, who do choose to enter, would appear to have limited need, for example, for financial protection [24].

The decision not to enter a potentially beneficial agreement might be caused by lack of money, but also by lack of appropriate information. Theoretically, the lack of information may arise from a reluctance and/or incapacity to collect the information needed for an advantageous deal, which, in turn, could be explained by restrictions of time, effort or financial resources. Some often suggested explanations of seemingly

irrational decisions are so-called "status quo bias"—preferring to keep things the way they have always been—or underestimation of the risk involved in the decision [61].

Decision-making when facing a risk

Using Grossman's theory of expected utility [41] as a model when studying decisions about different risks has also been criticized by economists. The prospect theory tries to explain inconsistencies in peoples' decisions, where the options involve different risk exposure. In short, individuals tend to further underestimate the likelihood of outcomes that are already unlikely to occur, as well as overestimate the likelihood of more probable outcomes [62]. The result of such an overweighting of low probabilities may be an increased interest in taking risks, as in gambling, as well as seeking to avoid risks, as when entering into an agreement like DCH.

Individuals are further believed to comprehend risk in two separate ways in an analytical system and an experimental system. The analytical system would be based on logical algorithms, require a great deal of information and be time-consuming. The experimental system, on the other hand, would be intuitive, based on feelings, non-controllable to a high degree, and immediate [63]. The experimental system would thus provide an explanation of the seemingly irrational way individuals decide in response to risky choices. The experimental system's response to risk is described as being dependent on affect (a feeling that is either good or bad), and thereby thought to precede the slower decision made by the analytical system [64]. The importance of relying on affect for creating a heuristic for quick decisions has been argued to originate in the survival-of-man concept in early human development [65]. Thus, in which way and at what pace patients consider a DCH agreement may vary considerably.

Furthermore, emotions guiding decisions can be divided into the actually *experienced* emotions when facing the decision situation, and the *expected-to-be-experienced* emotions concerning the outcome of the decision (as compared to expected emotions from alternative decisions) [66]. As such, the course of the decision will be dependent on both the emotional state at the time of the decision, the individual assessment of expected emotions, and the (comprehended) set of alternatives. Thus, the atmosphere in the dental office, as well as the information given by the caregivers and how it is presented, might be of relevance for the patient's decision on whether to accept the DCH agreement or not.

Moreover, risk-taking seems to differ between genders. Men showed a more risk-prone approach than women to 14 out of 16 situations where there was a risk of an undesirable outcome [67]. Gender also seems to influence choices concerning health, inasmuch as women seek care—health care as well as dental care—more often than men [68, 69].

1.4.4 DCH and the distribution of health and resources

Unfair distribution of health

Health, as one part of what might be called life opportunities, differ widely between countries, as well as within countries between socioeconomic positions. Health is positively associated with socioeconomic position across countries and societies [70]. Differences in health are labeled inequitable if they are systematic, and may be "avoidable by reasonable action", as described by the Black Report [71]. Another way to depict inequitable differences in health, taking the individual's context into account, has been to describe them in terms of upstream and downstream determinants. There will be factors close to the individual, like the family situation, and more distant factors, such as access to education organized by society [72]. Thus, the influence on health of several, more or less unavoidable, individual, family-related or community-induced overarching factors is highlighted.

Unfair distribution of oral health

Oral health has repeatedly been concluded to affect people's everyday life and their wellbeing [73]. For instance, broken or lost teeth are seen as stigmatizing from a social perspective, often more pronouncedly so than defects or conditions in other parts of the body [1]. Furthermore, recent results from a cross-national data collection on oral health and welfare state regimes, indicate that socioeconomic position produces a gradient in the oral impact on daily life in all European political systems [74]. The largest relative inequalities between individuals with different occupations and levels of education with regard to edentulousness were found in Scandinavia and Southern Europe [75]. This was somewhat in contrast to the findings of the lowest *prevalence* of edentulousness /no functional dentition in Scandinavia, and the higher prevalence of the *oral impact* of edentulousness on daily life in Southern Europe [76].

Patient empowerment and shared decision making

Consequently, at individual level it would be considered important to address all possible ways to mobilize the individual's personal resources for health improvement. Patients have been reported to express a desire

to be involved in the decision-making about their own care, especially when the issue does not require medical expertise [77, 78]. The process, when the care provider and the patient jointly consider probabilities and preferences in order to reach a mutual agreement about care procedures, has been referred to as shared decision-making [78]. Communication including such empowerment features has been argued to promote patients' informed and reasoned choices [79]. Moreover, in educational literature, emphasis has been placed on intrinsic motivation; the individual's wish (to learn, or to change his/her behavior), as the most important factor for achieving a goal [80].

Satisfaction with care

Satisfaction with one's (dental) care seems to be important for good (oral) health, and satisfaction with care seems to be facilitated by good communication with the caregiver and control over costs: Oral Health-Related Quality of Life has been shown to be positively correlated with satisfaction with dental care in a Swedish study [81]. Being satisfied with received dental care has also been shown by British researchers to have a beneficial impact on adherence to treatment, and as a result, on the quality of the care [82]. Experiencing the communication between patient and caregiver as rewarding has been reported to be the most influential factor for achieving satisfaction with dental care, according to an HTA report, among other studies [83, 84]. The degree of satisfaction has been described as a measure of how well prior expectations of the dental care are considered as having been fulfilled [85]. If the patient is dissatisfied, a study on satisfaction with endodontic treatment has pointed to the cost as the primary concern [86]. Consequently, payment can be considered to be a crucial factor for satisfactory dental care, together with control of the dental care situation. With regard both to controlling the costs and having the possibility to make a choice, DCH entails a potential difference compared with FFS.

For the individual person, evidence has been presented from a UK reform, which shows that the removal of restrictions on choice options in health care may increase patient welfare and decrease mortality [87]. Kaplan suggests the rationale for such a gain in HRQoL to be either due to the perception of control or as a result of the making of informed choices [88]. We know, for instance, that appropriate oral self-care prevention—which might be considered an informed choice—affects oral health favorably [89]. Empowering patients by including them in dental care proceedings might therefore prove useful, in order to

provide incentives to seek knowledge and to strengthen the sense of control.

1.4.5 DCH – risks and opportunities

Diversification of the payment options could be considered to entail a societal gain, merely by introducing the possibility to choose between two different ways to pay for dental care, compared with being limited to a single option. On the other hand, at the same societal level, health inequalities risk being increased, due to a widened gap between those with the capability to detect potential personal benefits for themselves, and those less capable of detecting personal benefits [90].

In the light of what has been described earlier, a capitation payment system like DCH includes properties that might work to increase patient security, empowerment and improved self-care. At the same time, a capitation payment system involves a risk that healthy individuals benefit from the system, possibly at the expense of those already in a weaker position. In traditional health economics, that would make societal gain impossible from a Pareto perspective [2].

The dental care situation might be considered problematic from several perspectives, including economic, communication-related, and feelings of vulnerability. Does the introduction of an optional way of paying for dental care address or impact any of these shortcomings?

2 AIMS

The overarching aim of this thesis was to conduct an evaluation of a new payment model within the Public Dental Service in Region Västra Götaland, Sweden, and analyze its effects on performed dental care, patient attitudes and oral health. The hypothesis was that there would be a difference concerning performed dental care, patient attitudes and oral health between DCH and FFS.

Study 1 was conducted to test whether there were any differences concerning a variety of aspects of self-rated health and views on health behavior between the group of individuals who chose DCH and those who chose to stay in the FFS payment scheme.

The scope for Study 2 was to explore experiences and attitudes among the patients who chose to change payment systems, with regard to the contract, the risk assessment, the care content, the economy, as well as the advantages and disadvantages of the new optional way to pay for dental care.

In Study 3 we compared the type and amount of dental care provided to patients in the two payment systems, respectively. We also wanted to investigate the net economic balance of a capitation system over a full contract period.

The 4th study analyzed the development of dental health measured as manifest caries incidence, over a six-year period, between the two groups of patients divided by their choice of payment system: the traditional fee-for service system or the new optional insurance-like prepayment (capitation) system DCH.

3 MATERIALS AND METHODS

3.1 Papers I, IV

3.1.1 Study design

Paper I
This study was designed as a prospective observational cohort study, as it was based on data from the baseline questionnaire collected *just before* the first possible opportunity for the individual patient to choose freely between the traditional fee-for-service payment system and the new insurance-like capitation payment system DCH. The inclusion criteria for this study were the same as for the DCH data collection, as described below.

Paper IV
Study IV was a prospective cohort study, where register data were analyzed longitudinally, starting with baseline and pre-baseline caries data, and concluding at study end, after six years. To be included in this study, adherence to the same payment system from baseline and for the whole six-year period was considered necessary, as well as having a registered dental visiting time for the same period of a minimum of 180 minutes.

3.1.2 The DCH data collection

Data was collected from 13719 consecutively recruited regular dental care patients from 20 Public Dental Service clinics in Region Västra Götaland in southwest Sweden. The selection of 20 clinics out of the total of 111 clinics was made strategically to cover rural/urban areas, differently sized clinics, and the four geographically based administrative subdivisions of the Region. The data collection was initiated at the time of implementation of DCH, in the spring of 2007, and was concluded when all participants had completed six years. Data included both clinical and questionnaire data (Figure 2).

Patients were consecutively included in the study at their regularly scheduled appointment, if they met the inclusion criteria: Age ≤20 yrs., able to read and understand Swedish, and willing to participate by filling in the questionnaire. The questionnaire covered demographics, self-reported dental and general health, lifestyles, dental care habits,

preventive measures, experiences of dental care, and attitudes to health and disease (Appendix 1). The participants completed the questionnaire before they were subjected to a clinical examination, risk group assessment and a premium category proposition.

The questionnaire was produced by a panel of research experts within the areas of health economics, behavioral sciences and odontology. It was pilot-tested in two independent groups of adults and checked with regard to comprehensibility. Clinical data were routinely collected during clinical examinations, and comprised information on previously received dental care and measurements of caries activity, periodontitis and gingivitis. The clinical data were entered in the computer-based patient chart system T4 (T4 Practice Management software, Carestream Dental, Stockholm, Sweden), together with information on risk group classification and chosen payment system.

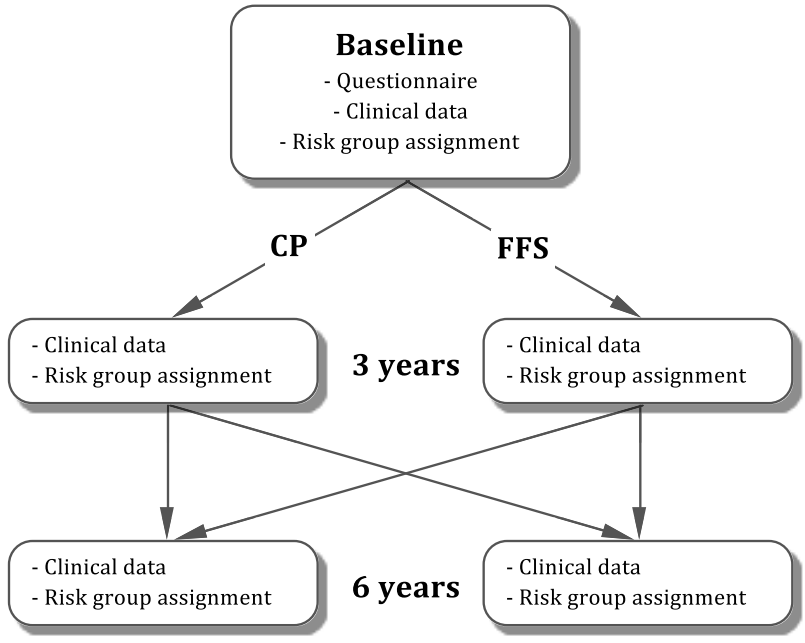


Figure 2. The DCH data collection setting (Papers I and IV).

Paper I
Study I used baseline questionnaire data, together with information on payment system choice from the subsequent clinical examination.

Paper IV
In Study IV, the data were retrieved from the baseline questionnaire (background variables), and from clinical registrations (manifest caries lesions and fillings) at the final registration, and from pre-baseline and baseline registrations.

3.1.3 Risk assessment

All patients included in the study were offered to enter the DCH payment system at a cost corresponding to their individually established risk group between one and five (2007-2008), or between one and ten (from October 1st 2008). The risk group assignment was aided by RaT, and later by R2.

RaT
The suggested risk group was presented as a compiled score between 1 and 5. The compiled score, in turn, was based on scoring within the main categories presented in Appendix 2; some were determined by data from the T4 digital chart system and some were determined manually. Influence from subcategories was taken into account, as described in Appendix 2. The determined levels within the subcategories and the main categories displayed a great number of possible combinations. These combinations were, in short, given index values between 1 and 100. An algorithm transformed the indices into an estimation of the anticipated treatment (time) need, presented as a risk group between one and five.

R2
R2 replaced RaT from October 1st 2008. R2 is based on RaT and discriminates between ten instead of five risk groups. R2 is presented with a graphic interface with the possibility to interact, which adds patient communication possibilities to the earlier objectives of a risk grouping digital tool, i.e., treatment planning and risk group allocation. The manner in which the main categories are influenced by subcategories and together result in a seven-step oral health profile, which, in turn, is compiled into a risk group proposition, is described in Figure 3.

3.1.4 Variables

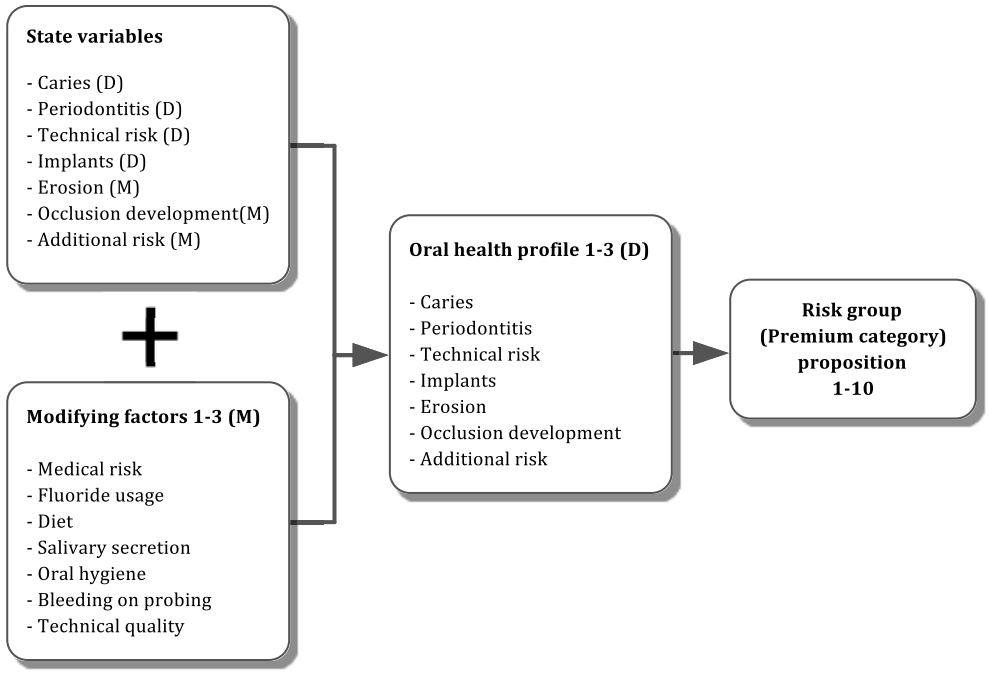
Paper I

The two payment systems that the patients chose between, i.e., CP and FFS, were the dependent variables.

The independent variables were the items from the questionnaire, according to Appendix 1. Systematically, all items were trichotomized, merging the two lowest, least affirmative response options into one.

Paper IV

The number of manifest carious lesions defined clinically or radiographically as having exceeded the enamel-dentin border, as primary or secondary caries was used as the dependent variable. A number of background variables from the baseline questionnaire—age, gender and education—made up the independent variables. Information on payment system choice, the number of fillings at baseline and at study end, as well as pre-baseline registration of manifest carious lesions was collected from clinical register data. Concerning the independent variable "education", the item from the questionnaire was dichotomized, merging the three lowest, least affirmative response options into one.



Capital letters in brackets refer to how procedures are added; D = digitally, retrieved directly from chart, or M = manually, self-rated by patient or estimated by dental personnel.

Figure 3. Merging variables into proposed risk group in R2.

3.1.5 Statistical analysis

Paper I

Chi-square analysis and the Mann-Whitney U Test were used to detect statistically significant differences in the distribution of questionnaire responses between the two payment schemes.

Logistic regression was used to analyze the influence of the independent variables on the choice of payment system. A model was built on our clinically based experience of how different personal opinions and attitudes, expressed as answers to questions from the questionnaire, influenced the choice of payment system. A stepwise forward strategy was used, where all single variables, but no interaction terms, were finally included. The traditional payment system was used as the

reference category. The influence of the independent variables on the choice of payment system was analyzed. The odds ratio for choosing CP (compared with choosing FFS), *if* selecting a certain response option for the item in the questionnaire, was considered for each item when the effect of all other items was included (*bivariably),* and when the influence from all the other included answers to questions were kept constant *(multivariably).* The analyses were performed using the software SPSS (IBM SPSS Statistics).

Paper IV

The dependent variable in this study was count data, which was determined to have a negative binomial distribution. Descriptive statistics were performed using chi-square analysis and t-test (comparing means, thus normally distributed). The multivariate analysis investigating the influence from the payment system and other potentially influential independent variables, including pre-baseline caries incidence, was performed using a negative binomial regression model. The analyses were performed using the software SPSS (IBM SPSS Statistics).

3.1.6 Ethical considerations

The Regional Ethical Review Board in Gothenburg approved the study (No. 323-07).

3.2 Paper II

3.2.1 Study design

A qualitative analysis of semi-structured interviews was considered the most favorable technique to extract a maximum of opinions, attitudes and beliefs, while minimizing the influence from preconceptions, among patients who had chosen to pay for dental care according to DCH instead of the FFS system.

3.2.2 Data collection

A total of 26 DCH-paying patients were contacted by telephone after having been invited either by their dentist or through written information at the respective clinics. Twenty individuals were finally interviewed. Three individuals did not respond to telephone calls, two did not show up for the arranged appointment, and one changed her mind since the interview was not conducted on the phone. All individuals

were recruited at one of five PDS clinics in a metropolitan city, where the clinics were chosen by convenience; however, the individuals were selected and invited with the aim to cover different genders and ages. The interviews followed a semi-structured protocol (Appendix 3), developed in collaboration between the interviewers who were psychologists/researchers, and dental professionals, to cover the widest possible range of topics of interest from both perspectives. The interviews took place at university offices of the psychologists /researchers during the spring 2013, and were tape-recorded and transcribed verbatim.

3.2.3 Analysis

The transcribed data were analyzed by thematic analysis, a theoretically flexible, foundational technique for extracting themes from statements through an inductive, "bottom-up" approach. Thematic analysis is not dependent on epistemological position or theory, and has been described as "a tool to be used across different methods", to "identify, analyze and report patterns within data" [91].

Firstly, after reading and re-reading all the transcripts to familiarize themselves with the material, the two non-dental professionals marked, condensed, and assigned a suitable code to all the statements in the transcripts that corresponded to the study aim. Secondly, they discussed the inductively formulated codes until consensus was reached about the most suitable coding scheme and the relative relationships between the codes. The codes were compiled into sub-themes and themes, were reviewed, together with the coded extracts, and judged to follow the original transcripts and the research question aimed at. The final review procedure was carried out in collaboration with an author with a dental professional background (CAA) to strengthen the credibility and reliability by evaluating the reasonability of the analysis and the result from the dental professional perspective.

3.2.4 Ethical considerations

The study was approved by the Regional Ethical Review Board in Gothenburg (No. 220-10).

3.3 Paper III

3.3.1 Study design

The study was designed as a case-control study comparing the outcome for patients in a capitation payment system at a test clinic, where the capitation payment model was run as a pilot version, with fee-for-service-paying patients. The recruitment of FFS patients took place both at the test clinic and at a control clinic where no possibility to pay in a capitation fashion was offered. The control clinic was chosen on the basis of having a similar socioeconomic profile, due to its inner city location and similarity of housing categories, share of the population born outside Sweden, and social welfare disbursement per citizen.

3.3.2 Data collection

Individuals providing data for the study were recruited by consecutively including capitation-paying patients who were matched with fee-for-service patients by age group and gender, from both clinics. (Table 3). Data were collected on four occasions: at baseline and after one, two and three years, according to the capitation contract period. The dropout share was small, but differed somewhat between the clinics. The analysis revealed differences between the groups with regard to age, with those below the age of 30 dropping out to a significantly higher degree, but not with regard to gender.

3.3.3 Risk assessment

Patients in the CP were placed in a premium category between 0 and 4 according to their individual risk. The dental care provider determined the individual risk group with guidance from the interpretation chart described in Appendix 2. No risk group allocation was performed in FFS.

Variables

- Costs and gains: Costs in the two payment systems were calculated as the individually pooled treatment time for each patient for each year, multiplied with the current tariff for 2007, being SEK 800 per hour for dental hygienists and SEK 1600 for dentists. Gains in FFS were calculated as the sum of the revenues for all supplied items of dental care. In CP, gains were calculated as the individual annual patient fee differentiated by risk group (SEK 420, 1080, 1800, 3036

or 4788), plus the revenue from the NDI of SEK 200 per patient and year.

- Type of dental treatment: The types of dental treatment, as defined by the options in the NDI, were combined into groups and counted per patient: Examinations (by dentist and by dental hygienist, respectively), preventive treatment, restorative treatment (fillings), and emergency treatment. The respective treatments were then all pooled into a total number of treatments.

Table 3. Distribution of background variables by payment system.

Age group (yrs)		**CP** (*N*=1650)	**FFS** (*N* =5043)
22-39	*n*	337	1294
	%	22.8	25.7
	women %	51.2	51.9
	men %	48.8	48.1
30-39	*n*	526	1634
	%	31.9	32.4
	women %	52.7	52.5
	men %	47.3	47.5
40-49	*n*	466	1357
	%	28.2	26.6
	women %	56.9	57.2
	men %	43.1	42.8
50-59	*n*	210	569
	%	12.7	11.3
	women %	59.0	58.7
	men %	41.0	41.3
≥60	*n*	71	189
	%	4.3	3.7
	women %	60.6	60.8
	men %	39.4	39.2

3.3.4 Statistical analysis

Due to the skewness of the sample, the chi-square and the Mann-Whitney U Test were used to detect any significance of the statistical differences among the distribution of the independent variables between the two payment systems. The analyses were performed using the software SPSS (IBM SPSS Statistics).

3.3.5 Ethical considerations

The study followed the ethical regulations of the Swedish Research Council and complied with the principles of the Helsinki declaration.

4 RESULTS

4.1 Paper I

4.1.1 Study population

The baseline questionnaire in the DCH data collection was completed by 13719 active regular PDS patients, 52.7 % women and 48.3 % men, with a mean age of 40.3 years. The study sample was extracted from the approximately 485 000 patients who attended dental care in the PDS in Region Västra Götaland in 2007, equivalent to approximately 40 % of the total adult population in the area. Among those 485 000 individuals, 52 % were women and 48 % men. At the following optional payment system change, 23.3 % chose to change from FFS to CP, 10.5 % opted out of the PDS, and 65.4 % kept their original FFS payment system.

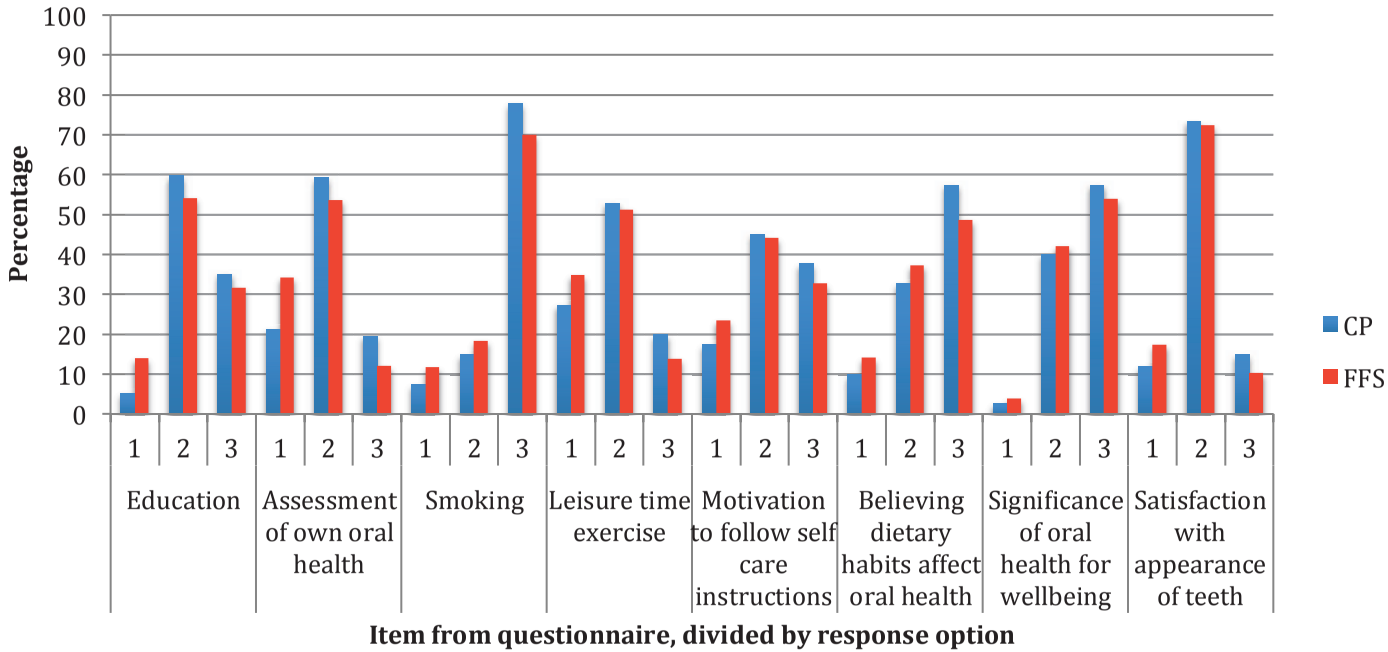
4.1.2 Outcome

There were differences between the groups of participants who chose the different payment systems: In the CP group, the individuals were more often female (56 % compared to 51 %), and younger (34 years compared to 43 years).

The distribution of answers over the optional responses showed statistically significant differences concerning every item in the questionnaire. The answers of individuals choosing CP were consistently shifted towards higher ratings (Figure 4).

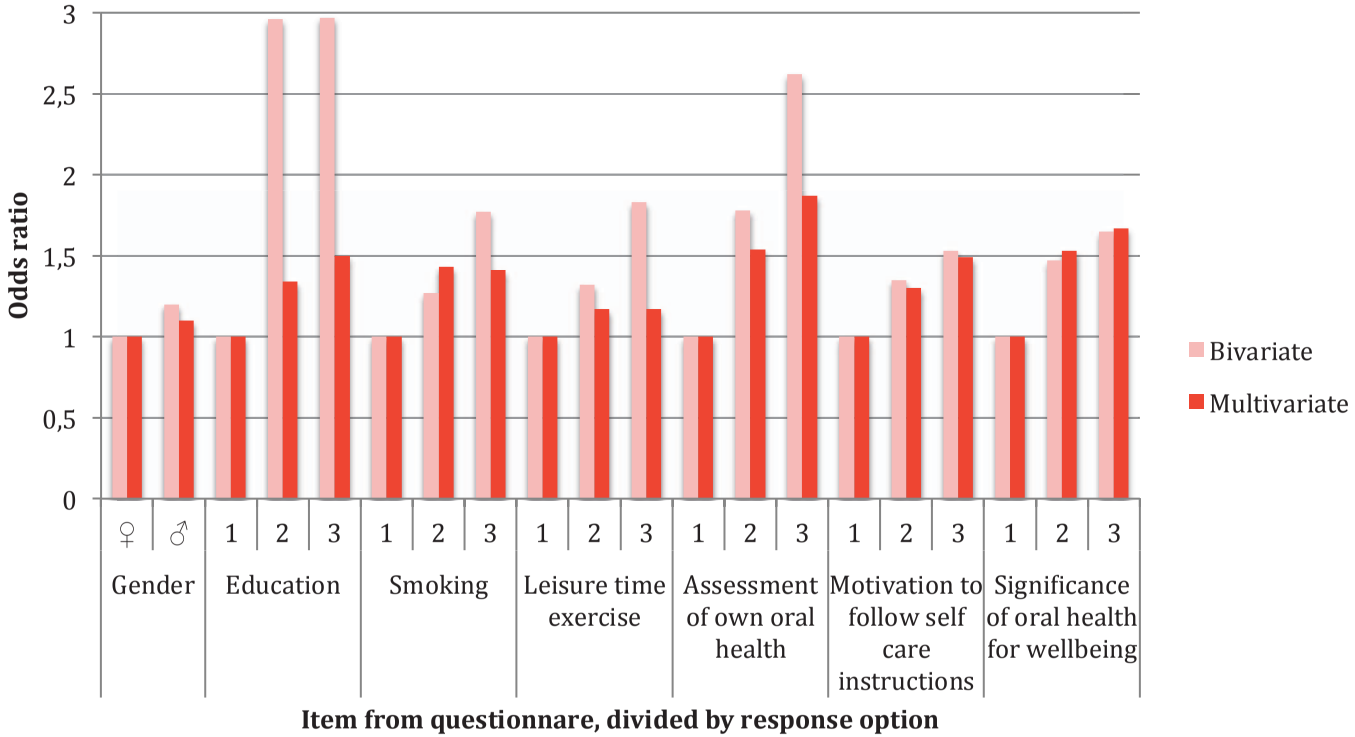
The logistic regression analysis described how choosing a higher grade response option to a question on lifestyle attitudes and performance predicted more strongly the choice of the prepayment scheme DCH in relation to FFS. With a few exceptions, this pattern was maintained from the bivariate to the multivariate analysis (Figure 5).

The items that showed the strongest prognostic value were *"Assessment of own oral health"* (OR 1.78/2.62, 1.54/1.87 for response options 2/3 (compared with the reference category, response option 1), for the bivariate and multivariate analyses, respectively), and *"Significance of oral health for wellbeing"* (1.47/1.65, 1.53/1.72) (Figure 5).



Categories 1 through 3 indicate the lowest, intermediate, and highest affirmative (being "no" for smoking) response option.

Figure 4. Results from questionnaire, by response option and payment system (Paper I).



The lowest, or least affirmative, category (being "yes" for smoking) was used as the reference category.

Figure 5. Odds ratios for different variables in the questionnaire, for the likelihood of choosing DCH as compared to FFS (Paper I).

4.2 Paper II

4.2.1 Study population

The study populations consisted of 12 women and 8 men, aged 24 to 60 years. Of the final 20 patients, three were university students, 15 employed, one unemployed, and one on disability pension. All but one were born in Sweden.

4.2.2 Outcome

The analysis resulted in two main themes—the choice and the commitment—with four or three subthemes, respectively (Table 4).

Table 4. Themes and subthemes from the analysis, Paper II.

1. The choice	**1.1** Avoiding embarrassment
	1.2 No more mistakes
	1.3 An (un)informed choice
	1.4 An influenced choice
2. The commitment	**2.1** Economic security
	2.2 A safe habit
	2.3 Known and unknown rules

Main categories

The first main category, "The choice", stated that choosing DCH was to choose (what is good for) one's teeth. The contract was seen like an investment in taking care of one's teeth; however, it was not clear to the patients exactly why that would be the result. They seemed uncertain about having had or having absorbed all the information about the agreement, or if any or the information they might have missed would have been essential. The informants had heard about DCH from different sources they trusted. What they had heard was positive, and had influenced their choice.

The second main category, "The commitment", described that being in DCH meant feeling safe. Some underlined the benefits of knowing how much their dental care would cost and the advantage of being able to pay

a part of the fee every month. Others pointed to the benefit of being called for regular examinations instead of having to remember to schedule visits themselves, and some emphasized the need to be regularly reminded about good and bad habits. Some informants questioned whether the dentist really provided the expected amount of care. The informants were often markedly positive; however, in many cases clearly hesitant about what was expected of them according to the contract.

Sub-categories

Avoiding embarrassment concerned the fear of possible consequences of "having bad teeth", and referred to the capitation payment system as a potential way to prevent such consequences from occurring.

No more mistakes described use of the agreement as an instrument helping the individual to comply with what was believed to be good for him/her.

An (un)informed choice: The informants' knowledge about the details in the prepayment scheme diverged: some were fully informed about the agreement whereas others had accepted it almost without question. Some requested further information, whereas others were happy to accept the PDS as a reliable contract partner, regardless of their perceived level of information.

An influenced choice described how the informants mostly made their decision to accept the prepayment contract on the basis of the recommendations of others; for instance, mothers, friends, relatives or dental professionals.

Economic security referred to how the prepayment scheme was considered to address one important aspect of the discomfort of dental care; the problem brought about by its unpredictable nature, i.e., the worry about sudden and uncontrollably high costs.

A safe habit referred to several aspects of experienced safety. The contract was considered to provide a sense of safety, simply by being put on paper. Safety also came from clarity. The responsibility of the dental clinic was clear, and seen as welcome support in the endeavor to control one's own oral health: to ensure that the individual would be recalled on a regular basis, preferably to see the same dental professional on each occasion. However, the individual's responsibility was somewhat more

obscure and not always understood as being equally important for maintaining good oral health: to pay, to appear, and to follow the advice given about oral self-care and habits.

Known and unknown rules described how the individuals' knowledge differed about whether the contract included any commitments on his/her part, from full awareness to more or less non-existent knowledge. The reason for the individuals' lack of knowledge was attributed either to own shortcomings or to insufficient information from the dental professionals. Whether or not known rules were followed or considered relevant or important also differed widely between the participants.

4.3 Paper III

4.3.1 Study population

In total, the study included 6693 individuals. Table 1 describes the distribution across age groups and gender, i.e., the result of the matching process.

The total study population consisted of a somewhat larger proportion of women than men (54.7 % and 54.9 % women in CP and FFS, respectively), as the matching process reflected the individuals' free choice of CP. The number of participants in the age groups >50 years was smaller than the number in younger age groups, which was also reflected in the distribution of participants across the risk groups in CP: 50.2 % in group 0, 26.4 % in group 1, 20.5 % in group 2, and 2.8% in group 3. No individuals were included in risk group 4. There were statistically significant differences in age among men and women in both CP and FFS.

4.3.2 Participation rate

The dropout rate was low, but differed somewhat between the clinics and payment systems: CP 1.8 %, FFS (test clinic) 2.6 %, and FFS (control clinic) 10.7 %. The analysis showed no gender differences within any of the groups; however, statistically significant differences in age, where patients below 30 years of age had a higher dropout rate in both the CP and FFS test groups.

4.3.3 Outcome

The cost-revenue ratio was positive for the aggregated risk groups and the three-year period from the perspective of the PDS. However, all risk groups, except risk group 1, presented a negative balance during one of the years 2 or 3.

The economic outcome for the individual patient, calculated as the mean net summation, showed a negative score for both men and women in all four risk groups for the aggregated three-year period, with the exception of women in risk group 0, who received more treatment than they paid for during the contract period.

The number of treatment measures received by CP-paying patients in relation to FFS-paying patients from the test clinic and from the control clinic differed statistically significantly ($p < 0.05$) for all treatment types. However, for some treatment types, the mean number of measures per individual was more similar within the two FFS-paying groups (Figure 6). For other treatment types, the mean values were more similar within the test clinic (Figure 7); thus, with regard to groups from different payment models.

4.4 Paper IV

4.4.1 Study population

The extended inclusion criteria for Study IV compared with Study I, with the requirement to be included in the same payment system for the whole study period and having a recorded dental visiting time of a minimum of 180 minutes for the whole six-year period, resulted in 6299 included individuals. The distribution of descriptive variables are described and compared in Table 5.

4.4.2 Participation rate

On the one hand, due to the register-based nature of this study, the participation rate was 100%, as it was only limited by the exclusion criteria. However, compared with the baseline registration in the original DCH data collection, the sample in Study IV was reduced by 40 %, due to the patients having had less than 180 minutes treatment time over the six-year period, and by another 14 % who did not adhere to the same payment system for the whole six-year period. The 6299 included

individuals amounted to 46 % of the number of individuals included in the original data collection, at baseline.

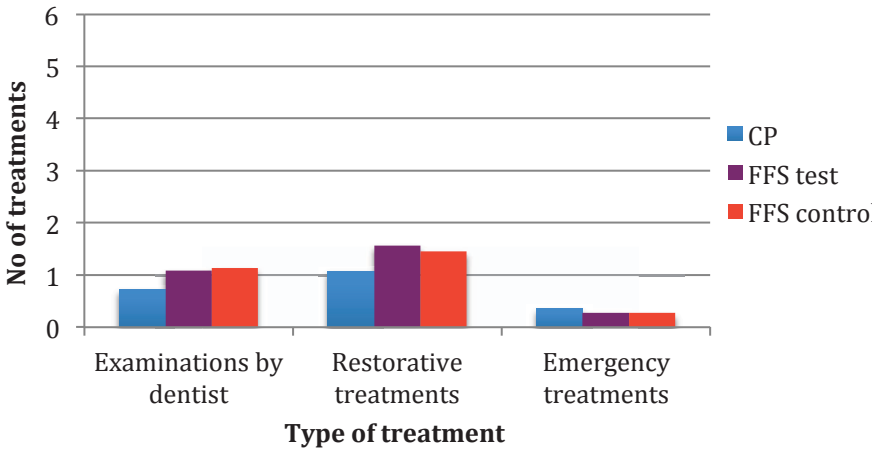


Figure 6. Number of treatment measures per type per patient during 3 yrs. Similarities within payment model (Paper III).

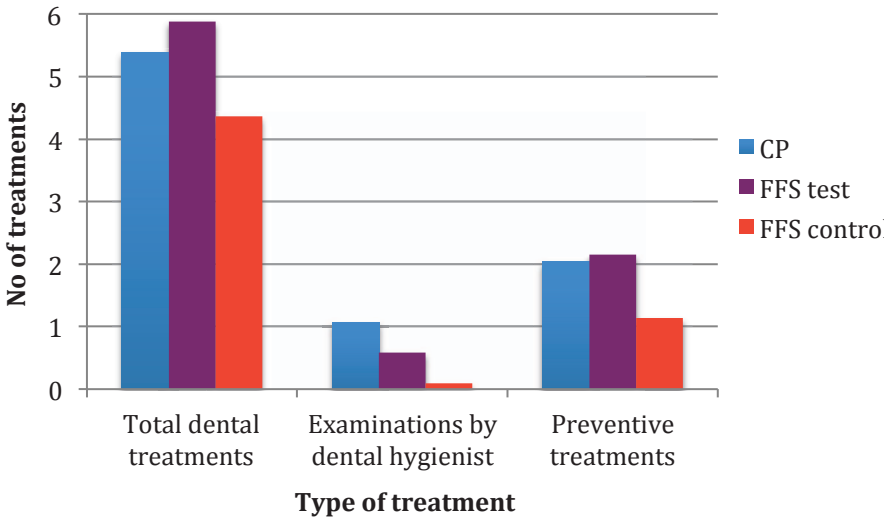


Figure 7. Number of treatment measures per type per patient during 3 yrs. Similarities within clinic (Paper III).

Table 5. Distribution of variables in the DCH data collection, compared to the subset included in Paper IV.

	DCH data collection	Subset Paper IV
Payment system	**%**	**%**
FFS	73.8	73.4
DCH	26.2	26.6
Education	%	%
≥13 yrs.	32.7	33.0
<13 yrs.	67.3	67.0
Gender	%	%
women	52.7	53.2
men	47.3	46.8
Age	mean	mean
yrs.	40.3	44.0

4.4.3 Outcome

There were differences as well as similarities between those who chose DCH and FFS, respectively, compared with the whole sample in Study IV. The gender distribution did not differ. However, those who chose DCH were younger and less educated than those who chose FFS. In addition, the individuals in DCH were more often found in the lower categories concerning manifest carious lesions pre-baseline, and had fewer filled surfaces at baseline and at study end, as well as a lower rate of increase of fillings over the six-year period.

Patients who adhered to FFS for six years showed an incidence rate ratio for manifest carious lesions of 1.5, compared with those who adhered to DCH. This figure was the result of a multivariate regression analysis that controlled for age, gender and pre-baseline manifest caries incidence. Pre-baseline manifest caries showed a higher predictability for the six-year caries incidence than the choice of payment system (IRR=1.51), if ≥ 3 lesions (IRR=2.63), but not if 1-2 lesions (IRR=1.40) (Figure 8).

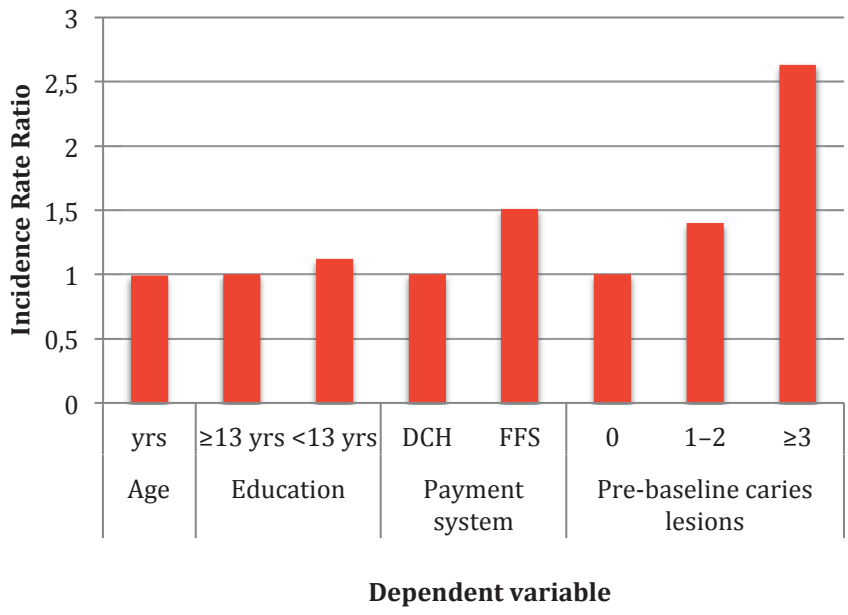


Figure 8. Incidence Rate Ratios for the number of manifest carious lesions after six years' adherence to the same payment system. Derived from a multivariate negative binomial regression analysis (Paper IV).

5 DISCUSSION

The aim of this thesis was to assess and consider effects of a new payment model in dentistry with regard to performed dental care, patient attitudes and oral health.

Payment system changes, like other societal reforms, are inevitable in a developing and progressing society. In a nationwide perspective, it will affect large groups of people—individuals with diverging points of departure or interests—who draw different conclusions about benefits and limitations. Thus, the change *will* influence people, but the exact result will be difficult to predict. In addition, change demands efforts and resources in terms of time and money, both of which are limited and might have served some other purpose better. Consequently, an evaluation is well justified but difficult to carry out accurately. It is necessary to determine what should be measured, or compared.

Three actors—the patient, the dental care personnel, and the government agency—can be identified as being involved in the dental care transaction. All three actors influence the amount or type of dental care carried out, although with different intentions. The patient and the government agency provide the financial resources, and the dentist or dental hygienist provides the dental care. The resulting outcome of the dental care transaction, as a collaboration exercise involving all three actors, can be described as a level of health or wellbeing, as experienced by the patient him/herself, as estimated by the caregiver, or in relation to the aimed at or affordable levels determined by the government agency. Thus, some potential endpoints of interest in an evaluation of a payment system change could be identified: The amount (and type) of dental care carried out, the monetary flow, and the resulting health/wellbeing. From a clinical perspective, however, the resulting health or wellbeing of the patient may be considered the most important, or final, endpoint in evaluating a payment system for care, also when applying the overall aspect of gain in a welfare perspective.

As discussed earlier in this text, it is necessary to consider both the patients' and the caregivers' perspective, in order to arrive at the most comprehensive estimation of the level of health or wellbeing. Arguments have also been raised that link health to the patient's perception of control and satisfaction. Thus, the four papers in this thesis seek to describe caregiver registrations of dental care (III) and dental disease

(IV), patient estimations of quantifiable behavior (I), and their descriptive reports about attitudes (II).

5.1 Methodological considerations

5.1.1 Clinic effect or cluster effect?

The differences in the type and amount of provided dental care between the payment systems, i.e., more preventive and less restorative treatments in DCH, are described elsewhere [59], and possible explanations have been suggested [55]. It should, however, be noted that the amount of preventive treatment received by the DCH patients was exceeded by the amount received by patients paying according to FFS, but attending the same clinic. Since the DCH pilot scheme had been going for more than ten years at the test clinic, it is feasible that a somewhat changed approach to dental health and health care had been adopted and had an impact on the clinic's way of working. However, the difference in the amount of preventive treatment may also be the result of a cluster effect. Variables based on the dental caregivers' choice have been described to demonstrate higher correlation figures than variables related to the individual patient, in a study on restorative material [92]. It might be argued, however, to what extent the caregiver directs the choice of payment system.

5.1.2 Responses are never free from the reflections of the inquirer

Ever since the beginning, the issue of DCH has been controversial and the subject of diverging opinions among Swedish dental professionals. Hence, it was considered vital to ensure that the data collection and analysis for a qualitative study on the experiences and attitudes of DCH patients were not exposed to the risk of being influenced by the pre-understanding of the dental professionals. As a result, non-dental professionals performed the interviews and the data analysis. Furthermore, in the dental care situation, the distribution of perceived power between the patient and the dental caregiver risks being skewed [93]. For this reason, it was considered appropriate to let others than dental professionals cooperate with the study's dental care patients in collecting the data, especially since the desired data occasionally brought up circumstances like economic status, childhood experiences, guilt, and fear. Such circumstances might be perceived as sensitive subjects but are nevertheless important, as they have been shown to impact, for example,

oral health, self-esteem and dental care utilization [94, 95]. However, the tool for analysis and interpretation in qualitative methodology is the inquirer himself/herself. The interviewers with a non-dental profession needed to have a broad understanding of the field of knowledge they were going to discuss with the informants. The interviewers and dental professional researchers thus worked together in preparing the interview guide, by discussing potentially occurring scenarios and sidetracks. To ensure rigor, described in terms of validity and reliability as they might be interpreted in the qualitative context, the inquirer needs to be transparent and continuously reflect on his/her own view and position and the consequent influence on the collection and interpretation of data [27, 96]. In Paper II, the effect of interviewers from outside the dental area of expertise may have produced a result that is possibly more concerned with the entire individual patient and his/her relationship with previous situations and surrounding people, than focused on issues strictly related to their oral health. A researcher from within the dental profession was included in reading the transcripts and in the last step of the analysis, to further ensure the applicability of the results to DCH in the clinical setting. Still, there will always be more than one possible way to interpret a large and rich set of words and expressed meanings from a varied sample of individuals with different personal backgrounds.

5.1.3 Caries as the clinical measure of oral health

A clinical measure of oral health was thought to add information beyond the patient-reported questionnaire, as the discriminative power of patient-reported measures for treatment need has been determined to be too low (precision limited to the number of existing teeth) [97]. Registrations of caries was selected to represent clinically determined oral health, as the caries disease exerts a major influence all over the world and across societies, by being common as well as expensive to treat [35, 98]. Furthermore, caries registrations were considered the most valid of our collected disease variables.

Manifest cavitated caries is considered a crude measure for early treatment of caries [99]. It has been concluded that with the current diagnostic tools, the overall caries experience at population level is significantly underestimated [100]. However, reports have indicated that non-cavitated caries lesions are the most underestimated [101]. Among the current diagnostic tools, the sensitivity, specificity and predictive value of digital bite-wing radiographs for diagnosing approximal

manifest caries by has been described as "fair", and equal to the conventional radiographic technique [102].

The WHO focuses on estimating *untreated caries* in epidemiological studies [36], whereas the DMFT/S measure, widely used for many years, describes the total present *and* past caries experience. The M measure, in particular, used to estimate past caries experience, has attracted attention as a source of misclassification: The reason why a tooth was lost might be exposed to recall bias. Moreover, there has been a debate on how many surfaces a lost tooth should be equaled to, and whether all the surfaces in reality had caries, or even reasonably could have been exposed to caries [103]. In the light of these objections to the DMFT/S, the incidence rate, or density, has been used and suggested [35, 103].

5.2 Limitations and strengths

Some of the limitations of these studies were also their strengths: The quasi-experimental design, and the number of study centers and investigators. When assessing the result of a reform actually being implemented in society and affecting a broad section of the general public, it will neither be possible to randomize between options for the sake of experimental testing, nor will it be necessary to test the specifications of the reform in a more controlled experimental setting than reality provides us with. Thus, we were left with the quasi-experimental design and two self-selected groups. This need not only be a limitation, as the reform includes two possible options, making the self-guided selection process interesting in itself. However, selection bias *will* be present in the sense that the study groups, consisting of patients choosing different payment systems, will differ from one another. Consequently, any attempt towards causal inference will require additional statistical techniques than simply comparison of groups. Furthermore, the questionnaire on background data was deliberately collected before the examination took place and before the choice between payment systems was offered for the first time, suggesting that the questionnaire reports were at least not confounded by the examination result or the choice of payment system.

To ensure the representativity of the sample, a large number of clinics collected data for Papers I and IV, and for those, as well as for Study III, an even larger number of investigators were involved. Such a large number of investigators entail a risk of misclassification. However, the large sample of patients, as well as the wide distribution of clinics and

investigators, would limit the risk of differential misclassification creating a systematic error.

The strongest benefit of the (quantitative) studies is the large samples, collected from clinics in one organization, which ensures a degree of homogeneity. Furthermore, the reform was of such a construction that no anticipatory effects could be expected in advance, such as postponing treatments while awaiting lower or higher prices, as might have been the case in other payment reforms. Thus, any measurements before or at the time of the reform may be considered to reflect an actual, non-skewed situation.

Finally, the thesis as a whole benefits from the addition of a study based on a qualitative methodology. It was considered important to avoid imposing any presumptions about DCH within the dental care field onto the results. Thus, non-dental professionals and researchers, together with the informants, collected the data set. However, the interviewers' limited knowledge of the dental field may or may not have had an impact on the interview situation. Nevertheless, the qualitative study (Study II) turned out to provide the most clinically meaningful results: What the DCH patients actually had experienced by having DCH.

5.3 General considerations

5.3.1 The characteristics of those who chose DCH challenge traditional insurance theory

The comparison of self-reported attitudes and actions concerning own oral health and oral health care showed that the group of individuals who later chose to change to the pre-payment DCH scheme answered more positively affirmatively on all items. They were also more often female and younger than those who chose to maintain their traditional payment system. This is consistent with other recent studies on health insurance, but contrasts with traditional economic theory [48, 104]. One reason might be differences in the influence of economic incentives on the demands of individuals when it comes to entering into an insurance agreement concerning one's own health, as compared with insurance on tangibles. Consequently, some other incentives may be more important for guiding the choice. It might be reasonable to assume that own health and wellbeing is considered more determinative than money, especially for individuals who state their interest in the matter by declaring an

awareness about exercise, diet and smoking habits. The advantageous selection demonstrated by Grönqvist in lower risk groups in a similar scheme fits such an explanation [49].

5.3.2 Adverse or advantageous selection?

In Study III, the revenues in DCH exceeded the costs for the PDS in all risk groups, for a full contract period. To a certain extent, this needs to be the case, in order to provide coverage for development and administration costs. It also provides initial information that the threat from skewed selection may be limited. This would be a prerequisite for sustainability in the long-term perspective [43]. The costs for the PDS were higher in subsequent years than in the first year, which might be anticipated, as the initial treatment needs would have been taken care of before the patients entered into the agreement. It might also be attributed to an increased demand for dental care when the out-of-pocket cost is low, as shown by Manning et al. [38].

The pilot capitation scheme showed financial stability over one contract period. Nevertheless, the costs increased towards the end of the contract period. The study length is too short to rule out any critical effects of adverse selection. However, as described above, advantageous selection may be suspected in the low-risk groups. The likelihood of adverse selection would be increased in higher-risk groups, but there were too few patients in the highest risk group in Study III to draw any such conclusions. It is possible, despite the financial stability over one contract period, that both effects did occur, but to different degrees in high-risk and low-risk groups, as earlier described and shown in other studies on health insurance [47, 48].

5.3.3 Moral hazard or undertreatment?

The amount of restorative treatment decreased (Study III) for DCH patients, but from these data, it is not possible to rule out the influence of undertreatment or supervised neglect. However, fewer manifest carious lesions *together with* fewer fillings after a six-year period (Study IV) rather support the theory of improved health than the undertreatment explanation. Such results are also consistent with the results from a review article on the comparison of treatment panoramas between a CP scheme and FFS in dental care [59].

Moreover, DCH patients slightly more frequently demanded emergency treatment. However small, an increase in (emergency) treatment

demanded by DCH patients might constitute an ex-post moral hazard, or represent a previously neglected treatment need. Grönqvist has estimated the moral hazard effect in a CP scheme in Sweden to amount to an increase by 15-22 % in the demand for emergency treatment [51]. Grönqvist further, perhaps reasonably, suggests that it is "surprising to find moral hazards for services like tooth extraction and root-filling", which indicates that if we had known the nature of each emergency treatment we might have had the possibility to discriminate between undertreatment and moral hazard.

5.3.4 DCH patients feel secure and satisfied

The patients in Study II put the emphasis on aspects of security. Several of the subthemes in the results from Study II deal with issues closely related to feeling secure, like appreciating to see the same dentist, feeling safe and familiar with their PDS clinic, and feeling reassured, both about being recalled and being informed about when. Still, none of these features should, in fact, be specifically restricted to DCH. Nevertheless, the patients' experiences are apparently different in DCH compared with FFS, even though DCH patients to some extent report that they were less than appropriately informed.

According to the way DCH patients describe their situation, they seem to experience affinity with something or someone surrounding their dental care arrangement, possibly in contrast to FFS. And they are content with that, indicating that they now have something they have felt a need for. Patient-experienced quality of care has been shown elsewhere to depend on the relation to the caregiver, the feeling of security, and the possibility to influence one's own oral care [78, 83]. It may be suggested that these three factors appeal to individuals who have features like the DCH patients described themselves in Study I: assessing their health as being very good, oral health being very significant for wellbeing, and health-related behavior as being very important. Possibly, these individuals seek knowledge, influence and control, and found it in DCH.

5.3.5 Are DCH patients healthier after six years than FFS patients?

After six years, the risk for manifest caries was 1.5 times higher in FFS than in DCH, when a number of known, influential factors were controlled for. Several possible contributing factors may be identified:

– *DCH patients showed greater interest in their oral health, as well as in profitable health behavior, at baseline.* They rated oral health as being very significant for wellbeing to a greater extent than FFS patients. They exercised more, were more motivated to oral self-care, and believed more explicitly that dietary habits affect oral health (I). Thorough oral self-care has been shown to precede good oral health [105].

– *The dental care among DCH patients was more oriented towards prevention during one contract period.* They had more preventive care and less restorative care than FFS patients (III). They also had fewer fillings and fewer manifest carious lesions (IV). Neither too much, nor too little restorative treatment has been indicated as having a beneficial impact on health, with respect to caries [106].

– *DCH patients were invited to share the responsibility for their own oral health.* Shared responsibility was offered through the contract *per se*, and in a section of the contract on oral self-care commitment (II). Self-efficacy in own oral health care has been shown to improve oral hygiene status [107].

– *DCH patients were provided with foreseeable costs and a clear time plan for costs and visits.* The cost overview concerning the amount and time needed gave the DCH patients a sense of security (II). Control over costs has been reported to enhance patient-reported quality of care [85, 88] and to facilitate adherence to the recall plan, which, in turn, may promote good oral health and OHRQoL [108, 109].

Nevertheless, using a negative binomial regression method, the multivariable analysis indicated a more positive oral health outcome for DCH than FFS patients, taking into account important and known predictors of future caries experiences, such as previous caries experience, gender and socioeconomic position [109, 110]. However, the magnitude of the likelihood to get manifest caries is moderate with respect to payment model. Other powerful risk factors may be present albeit not measured nor included in the presented analysis.

5.3.6 Is the choice about something else than a payment scheme?

In Study I, the regression model's degree of explanation, expressed as Nagelkerke's R^2, was a modest 0.17. The interpretation would be that the model's combination of independent variables explains an estimated 17

% of the value of the dependent variable, i.e., the choice of payment system. Thus, other factors, or variables, explain the remaining 83 %, which makes this a rather weak model for explaining the choice. There will naturally be a large variety of factors other than the examined variables that may influence the decision to accept or decline a prepayment offer. Considering the actual course of events, the patients are not only facing a choice between available payment systems, but also finds themselves at a crossroads between an active choice to enter into an agreement or passively refraining from making a decision, or simply postponing the issue. Additionally, patients confronted with the choice need to feel they can spare the money. They also need to feel able to cope with considering all the necessary information at the same time as being in a potentially stressful situation. Actual feelings, as well as anticipated emotions, like regret, disappointment and elation, are also known to have an impact on such decisions [61]. And, as shown in Study II, the decision was rarely made solely as a result of one's own initiative or conclusion, but clearly influenced by relatives and friends and by the dental care personnel. Also previous experience of the dental care situation is said to be important, as are perceptions transferred from family members.

Finally; Somewhat surprisingly, the individuals who continued with their payment system for the whole six-year period turned out to have the opposite distribution in educational level than expected, with FFS patients representing the higher level of education at group level. This result may be to some extent confounded by a lower age among patients in the DCH group. A speculation might also be that the younger and less educated individuals rather chose DCH as described by DCH patients in Study II: "An easy pick."

6 CONCLUSIONS

6.1 Main results

I. There was a difference concerning the health-related attitudes and actions between patients in the two payment systems (i, ii).
II. Security and safety, from more perspectives than solely the economic aspects, were considered important for the patients who accepted the DCH agreement (i, ii).
II. DCH patients were content with their choice (i, iii).
III. There was a difference in the amount of preventive treatment, restorative treatment and emergency treatment that was received by the patients in the two payment systems (i, ii, iii).
III. The pilot DCH scheme was financially stable over one contract period (ii).
IV. There was a lower risk for manifest caries in DCH than in FFS after six years (i, iii).
IV. Fewer fillings had been carried out in DCH than in FFS after six years (i, iii).

6.2 What can be concluded about DCH from these studies?

(i): Patients who chose DCH instead of FFS are possibly at a lower risk for future unfavorable oral health behaviors and oral health.

(ii): It is conceivable, although not possible to prove, that the effect of adverse selection did not occur to a larger extent than what was compensated for by advantageous selection. If so, the insurance scheme will not be financially threatened by asymmetric information.

(iii): There is evidence to support that the effect of DCH might be interpreted as protecting health rather than seeking financial gain by neglecting treatment needs.

7 FUTURE PERSPECTIVES

The conclusions from this thesis state that there might be reasons to believe that DCH and FFS attract different types of individuals, that the treatment panoramas differ between DCH and FFS over time, that DCH patients in general are positive to the new payment model, and that six years in DCH or FFS may lead to a different outcome with regard to one marker of oral health. For the future, the evaluation of DCH might benefit from analyzing health outcomes and perceptions of the payment models with respect to different age groups. Moreover, including individuals who change payment models over time and investigating the reasons and the possible influence on oral health, health behavior and costs, would provide more detailed knowledge about the impact of different payment models, specifically DCH.

The scope of the studies in this thesis did not include the dental caregivers. Research referred to in the text describes dental personnel as having an important influence on how DCH is perceived, understood and requested by the patients. A qualitative study could provide a map of information on the caregivers' DCH experiences, attitudes and application in the current stage of development of DCH, and identify potential areas for improvement.

Paper II did not include any former DCH patients who chose to return to FFS. Their experiences and views are important for evaluating DCH. Thus, information on costs, negative and positive features of the DCH, as well as treatment received over three years may contribute to our understanding of how DCH and FFS work in general dental practice.

Finally, it is important to carry out a classic health economic analysis. Such an analysis would provide information on health outcomes in relation to direct and indirect costs in the two payment models and enable comparisons. Together with previous results on DCH, an evaluation of this kind would provide more complete information on DCH versus FFS than can be gleaned from earlier knowledge on dental care and costs for patients, caregivers and third parties.

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APPENDIX

Appendix 1

Questionnaire (Papers I, IV)

Dagens datum.....

Bakgrundsfrågor

Ditt personnummer:.....……..

Vilken av följande utbildningar är din högsta avslutade utbildning?

❍ Ej avslutad grundskola
❍ Grundskola
❍ Gymnasieskola/folkhögskola
❍ Universitet/högskola

Tandvårdserfarenheter

1. Hur ofta går Du till tandvården?

❍ 2 gånger/år
❍ 1 gång/år
❍ 1 gång vartannat år
❍ Mer sällan än vartannat år
❍ Endast vid akuta besvär
❍ Aldrig

2. När besökte Du tandläkaren/tandhygienisten sist för en undersökning?

❍ Mindre än 1 år sedan
❍ 1-2 år sedan
❍ 3-5 år sedan
❍ Mer än 5 år

3. Om det var mer än 5 år sedan du besökte tandvården, vad berodde det på? (flera alternativ kan besvaras)

❍ Har inte haft något behov
❍ Har inte blivit kallad
❍ Har beställt tid, står på kölista
❍ På grund av kostnad
❍ På grund av rädsla
❍ På grund av sjukdom
❍ Har inte haft tid
❍ Behövt, men har inte gått

4. Har Du avstått från någon tandbehandling de senaste 5 åren på grund av att Du tycker att kostnaden är/har varit för hög?

❍ Nej
❍ Ja, någon gång
❍ Ja flera gånger
❍ Ja, många gånger

5. Hur bedömer du att Din tandhälsa är idag?

❍ Dålig
❍ Någorlunda
❍ Bra
❍ Mycket bra

Några frågor om ditt allmänna hälsotillstånd och rökvanor.

6. Hur bedömer Du Ditt allmänna hälsotillstånd jämfört med andra i Din ålder? Är det …

❍ Bättre
❍ Ungefär likadant
❍ Sämre

7. Röker Du?

❍ Ja
❍ Nej, men har rökt tidigare
❍ Nej

8. Snusar Du dagligen?

❍ Ja
❍ Nej

9. Hur mycket motion får Du på Din fritid? Välj det alternativ som passar bäst in på Dig.

❍ Får praktiskt taget ingen motion alls
❍ Motionerar lite då och då (t.ex. kortare promenader)
❍ Motionerar regelbundet ungefär en gång i veckan
❍ Motionerar regelbundet minst två gånger i veckan
❍ Motionerar regelbundet ganska hårt minst två gånger i veckan

Hur lång är Du? _____ cm

Hur mycket väger Du? _____kg

Frågor om Dina tandvårdserfarenheter

1. Tycker Du att det är svårt att få tid på tandvårdskliniken vid behov?

❍ Nej
❍ Ja, någon gång
❍ Ja, ganska ofta
❍ Ja, mycket ofta

2. Har Du svårt att hinna med att besöka tandvården/tandläkare/tandhygienist?

❍ Nej
❍ Ja, någon gång
❍ Ja, ganska ofta
❍ Ja, mycket ofta

3. Är Du rädd för att gå till tandläkare/tandhygienist?

❍ Nej
❍ Ja, lite rädd
❍ Ja, ganska rädd
❍ Ja, mycket rädd

4. Har Du svårigheter att sköta Din munhygien?

❍ Nej
❍ Ja, mindre svårigheter
❍ Ja, ganska stora svårigheter
❍ Ja, mycket stora svårigheter

5. Tycker Du att det är svårt att följa tandläkares/tandhygienisters råd och anvisningar?

❍ Nej
❍ Ja, mindre svårigheter
❍ Ja, ganska stora svårigheter
❍ Ja, mycket stora svårigheter

6. Är Du motiverad att följa de råd och anvisningar som Du har fått om Din munhälsa?

❍ Nej
❍ Ja, lite motiverad
❍ Ja, ganska motiverad
❍ Ja, mycket motiverad

7. Tror Du att regelbunden tandvård förebygger tandsjukdomar?

❍ Nej
❍ Ja, lite grann
❍ Ja, ganska mycket
❍ Ja, väldigt mycket

8. Tror Du att regelbunden tandborstning kan förebygga tandköttsinflammation/ tandlossning?

❍ Nej
❍ Ja, lite grann
❍ Ja, ganska mycket
❍ Ja, väldigt mycket

9. Tror Du att regelbunden användning av fluor kan förebygga karies (’hål i tänderna’)?

❍ Nej
❍ Ja, lite grann
❍ Ja, ganska mycket
❍ Ja, väldigt mycket

10. Tror Du att dina kostvanor påverkar din tandhälsa?

❍ Nej
❍ Ja, lite grann
❍ Ja, ganska mycket
❍ Ja, väldigt mycket

11. Hur stor betydelse har en god tand/munhälsa för Ditt allmänna välbefinnande?

❍ Ingen betydelse
❍ Liten betydelse
❍ Ganska stor betydelse
❍ Mycket stor betydelse

12. Hur nöjd är Du med Dina tänders utseende?

❍ Mycket nöjd
❍ Ganska nöjd
❍ Ganska missnöjd
❍ Mycket missnöjd

Följande påståenden handlar om Dina tidigare tandvårdserfarenheter. Välj det svarsalternativ som Du tycker passar bäst in på Dig och markera med ett kryss!

13. Jag är nöjd med det som tandläkaren/tandhygienisten gör.

1	2	3	4	5
Stämmer inte alls	Stämmer ganska dåligt	Vet ej	Stämmer ganska bra	Stämmer helt

14. Tandläkaren/tandhygienisten verkar veta vad han/hon gör under mina tandvårdsbesök.

1	2	3	4	5
Stämmer inte alls	Stämmer ganska dåligt	Vet ej	Stämmer ganska bra	Stämmer helt

15. Tandläkaren/tandhygienisten är noggrann under behandlingen.

1	2	3	4	5
Stämmer inte alls	Stämmer ganska dåligt	Vet ej	Stämmer ganska bra	Stämmer helt

16. Jag har fått tillräckligt med information om mitt tandvårdsbehov och planerad tandvård.

1	2	3	4	5
Stämmer inte alls	Stämmer ganska dåligt	Vet ej	Stämmer ganska bra	Stämmer helt

Följande sex påståenden handlar om hälsoproblem som man kan råka ut för i munnen (problem med tänder eller andra delar av munnen). Välj det svarsalternativ som Du tycker passar bäst in på Dig själv och markera med ett kryss!

17. Får jag problem med min munhälsa så är det i första hand mitt eget handlande som avgör hur problemet utvecklas.

❍ Tar helt avstånd
❍ Tar avstånd till största delen
❍ Tar avstånd i viss mån
❍ Instämmer i viss mån
❍ Instämmer till största delen
❍ Instämmer helt

18. Jag har själv kontroll över mitt munhälsotillstånd.

❍ Tar helt avstånd
❍ Tar avstånd till största delen
❍ Tar avstånd i viss mån
❍Instämmer i viss mån
❍ Instämmer till största delen
❍ Instämmer helt

19. Jag har mig själv att skylla om jag får problem med min munhälsa.

❍ Tar helt avstånd
❍ Tar avstånd till största delen
❍ Tar avstånd i viss mån
❍ Instämmer i viss mån

❍ Instämmer till största delen
❍ Instämmer helt

20. Det är vad jag själv gör som är det viktiga för min munhälsa.

❍ Tar helt avstånd
❍ Tar avstånd till största delen
❍ Tar avstånd i viss mån
❍ Instämmer i viss mån
❍ Instämmer till största delen
❍ Instämmer helt

21. Om jag vårdar mig själv kan jag undvika ohälsa i munnen.

❍ Tar helt avstånd
❍ Tar avstånd till största delen
❍ Tar avstånd i viss mån
❍ Instämmer i viss mån
❍ Instämmer till största delen
❍ Instämmer helt

22. Om jag handlar rätt kan jag bibehålla en god munhälsa

❍ Tar helt avstånd
❍ Tar avstånd till största delen
❍ Tar avstånd i viss mån
❍ Instämmer i viss mån
❍ Instämmer till största delen
❍ Instämmer helt

Stort tack för Din medverkan!

Response options (Paper I, IV)

Item	Label	Response options
"When were you born?"	yymmdd	
"Please indicate your gender"		0 Female 1 Male
"How tall are you?"	cm	
"How much do you weigh?"	kg	
"What is your highest completed level of education?"		1 Elementary School, not finished 2 Elementary School, finished 3 Upper Secondary School 4 University
"How do you assess your own dental health at present?"		1 Bad 2 Somewhat bad 3 Good 4 Very good
"Do you smoke?"		1 Yes 2 No, but used to 3 No
"How much do you exercise in your spare time?"		1 Almost no exercise at all 2 Short walks, now and then 3 Regularly, once a week 4 Regularly, twice or more a week 5 Hard, at least twice a week
"Have you been motivated to follow advice and instructions that you have received concerning your oral health?"		1 No 2 Yes, a bit motivated 3 Yes, quite motivated 4 Yes, very motivated
"In your opinion, do your dietary habits affect your oral health?"		1 No 2 Yes, a little 3 Yes, somewhat 4 Yes, very much
"In your opinion, how significant is good oral health for your general wellbeing?"		1 Not at all significant 2 A little significant 3 Somewhat significant 4 Very significant
"How satisfied are you with the appearance of your teeth?"		1 Very dissatisfied 2 Quite dissatisfied 3 Quite satisfied 4 Very satisfied

Appendix 2

Risk assessment guidance in the pilot capitation scheme (Paper III)

Risk	0	1	2	3	4
General risk	In summary: very low risk	Low	Elevated	High	In summary: very high risk
Previously received care		- Few fillings - Good quality crowns - Root fillings without remarks	- Several fillings - Root fillings with some risk of need for revision	- Extensive fillings - Deep restorations - Root fillings with imminent risk of need for revision	
TMD		No symptoms	Clinical signs of bruxism, no TMD	Bruxism and/or TMD	
Caries		No active caries	Active caries in a few sites	- Active caries in several sites - Frequent meals	
Periodontitis		- No active pockets ≥6mm - Minimal bone resorption	- A few active pockets ≥6mm - ≤2/3 marginal bone resorption	- Several active pockets ≥6mm - ≥2/3 marginal bone resorption - Bifurcations	
Wisdom teeth		Minimal risk for complications	Few sites with risk for complications	Several sites with risk for complications	
Oral hygiene		Good	Approximal plaque	Poor	

Variables regulating RaT main categories (Papers I, IV)

	Main variable	Influential sub-category
Caries	No of teeth with progressing carious lesions	Diet, Oral Hygiene, Fluoride, Saliva
Periodontitis	No of teeth with active pockets >5mm AND age ≥34≤	Oral Hygiene
Technical risk	No of teeth with fillings other than occlusal	Technical quality: no of root-fillings/quality of fillings, bruxism
Other risk	Future need of endodontic treatment, wisdom teeth ill health	

Appendix 3

Semi structured interview protocol (Paper II)

- Background data; Age, education, occupation
- How did you experience accepting the agreement?
  - Who posed the question?
  - Were there pros and cons? Which?
  - Was the time constraint or were there time for reflection?
  - Do you think every patient gets the opportunity/offer? If no – who does/doesn't?
  - How do you perceive the dentist's/hygienist's state of mind while discussing the agreement?
  - Which were your internal arguments while considering/accepting the agreement?
  - Since you are here, you obviously did not decline – but how do you imagine you would have experienced to do so?
  - Did you decide immediately, or did you go home and contemplate the offer? Did you consult anyone? Who?
  - Did you know of anyone who had accepted the offer? Did this person tell you about it? What did he/she tell you?
  - Do you pass on information about the agreement to anyone? What do you say?
- About your prior dental care-related experiences;
  - Please describe how thoughts and experiences of dental health and dental care were transferred to you at home, during your childhood!
  - Describe your memories of visits to the dentist as a child.
- How do you experience being covered by the agreement?
  - Pros, and cons?
  - The agreement is accompanied by regulations – do you follow them? Did they alter your behavior? How?
  - Did the agreement have impact on your pattern of visits to the dentist7dental hygienist?
  - Which are your thoughts and reactions when you meet someone with poor teeth?
  - How would you think or behave if others could notice that you have poor teeth?
  - Do you expect to maintain this agreement? For how long?