FDI World Dental Federation

Leading the World to Optimal Oral Health

Optimal Oral Health through Inter-Professional Education and Collaborative Practice

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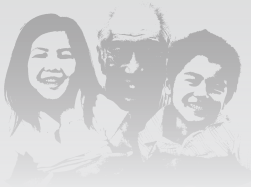

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Disclaimer

This report aims to initiate a dialogue among the members of FDI. Its intention is to be descriptive and informative on trends in the field; it is not prescriptive and should not be considered as a statement of FDI policy.

Optimal Oral Health through Inter-Professional Education and Collaborative Practice[1]

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VISION 2020

EDUCATION • ORAL HEALTHCARE • SOCIO-ECONOMIC DYNAMICS • PROFESSIONALS • RESEARCH AND TECHNOLOGY •

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[1]The sources of definitions used throughout this report on inter-professional education (IPE) and collaborative practice (CP) are based on those used by the World Health Organization (WHO)

Executive summary

Key messages

- Collaborative practice (CP) is more than just collaboration
  According to the World Health Organization (WHO), 'Collaborative practice (CP) happens when multiple health workers from different professional backgrounds work together with patients, families, carers and communities to deliver the highest quality care'.
- Dentists should play a leadership role
  Dentists are the front-line medical professionals in the prevention, early detection and treatment of oral and systemic diseases. They should therefore play a leadership role within the oral health profession and in relation to other health professions to improve oral health and thereby contribute to the improvement of general health and quality of life for all.
- CP increases efficiency and quality
  In terms of service delivery, CP improves access and quality. Furthermore, it contains costs. Evidence also indicates that CP improves mutual trust and accountability among providers and results in better coordinated care.
- Collaboration needs to be broadened and efficiently applied in everyday practice
  There has been great progress in the treatment of oral and dental diseases in recent years due to the special commitment of the dental profession and effective collaboration. This collaboration needs to be expanded and its efficiency increased in everyday practice.
- Inter-Professional Education (IPE) is an essential tool to prepare for CP
  There is a need for the dental professional to prepare itself through IPE. WHO defines inter-professional education (IPE) as occasions "when two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes."
- There is no one-size-fits-all approach to CP
  FDI recognizes that there is no one-size-fits-all approach and delivery of health services will depend on contextual factors and country needs.
- The dental profession should be recognized as a driving force behind CP
  The dental profession should be part of the political dialogue at national and global level and recognized as a central driving force behind the development of competencies for CP and the implementation of any CP model.

Context

Oral healthcare in the 21st century is characterized, on the one hand, by new technologies and knowledge that could transform dentistry, increase demand for state-of-the-art patient care, changing disease patterns, and aging populations; on the other, by pressure to contain costs and improve access to care.

Within this context, inter-professional collaboration and teamwork is increasingly recognized as a means of achieving higher quality care and enhancing the effectiveness and efficiency of services.

For the oral health team, such collaboration means acquiring a different mix of skills and competencies through inter-professional education (IPE).

Aim

Drawing inspiration from FDI Vision 2020, this report seeks to expand the dialogue on intra- and inter-professional collaborative practice and inter-professional education, through a review of the available literature and a series of case studies from around the world. Its aim is to facilitate the policy and advocacy work undertaken by National Dental Associations (NDAs) for the planning of the future oral health workforce (OHWF) and enhance the ability of the dental profession to lead change rather than have solutions imposed.

The literature review indicates that collaborative practice models, introduced within a variety of contexts, have the primary objective of improving different aspects of healthcare delivery: increasing access and quality, and improving practice productivity and efficiency, as well as patient clinical outcomes and satisfaction. A series of case studies serve to illustrate the application of CP models within a variety of contexts.

Intra-professional collaboration

A case study from the Netherlands describes the changing scene of oral health in the country, with a focus on prevention and the consequent introduction of the professions of dental hygienists and prevention assistants.

A second case study from Thailand demonstrates how implementing Universal Health Coverage has led to an increase in demand for dental nurses—first introduced to provide care to school-age children, later extended to include all age groups - particularly for preventive services.

An example from the United States illustrates intra-professional and multidisciplinary inter-professional collaboration serving to improve the oral health of communities. Dentists, dental hygienists, community dental health coordinators (CDHC) and dental assistants work side by side and collaborate with other professionals in healthcare, education and social services.

Further case studies from New Zealand, Alaska and Cameroon provide an overview of different practice arrangements involving dental nurses, dental therapists, traditional healers, and community dental health coordinators (CDHCs). These serve as a conduit between underserved communities in need of care, and dentists trained and licensed to provide that care.

Inter-professional collaboration

Examples of inter-professional collaboration are drawn from Lausanne (Switzerland) and Wales (United Kingdom). The former describes inter-professional collaboration at the University Hospital of Lausanne, where an oral health team comprising dentists, dental hygienists, assistants and technicians work with physicians to improve the overall health of patients.

The latter in Wales describes inter-professional teamwork between physicians, nurses, pharmacists, dieticians, and speech and language therapists to improve the health of adult patients in hospital ward settings.

Importance of professional associations

Collaborative Practice (CP) and Inter-Professional Education (IPE) are strategies, not goals, to improve access to care and achieve better quality of services efficiently. Optimal oral health is a function of a variety of factors such as need and demand, technological progress, socio-economic dynamics and satisfactory service delivery, in addition to collaborative education models. They all need to be balanced according to the context.

The practice of good oral health care is ultimately based on commitment to serve the patient. The bold leadership of the dental profession through effective collaboration with medicine, public health and other health disciplines, along with high-level advocacy, will facilitate the development of relevant workforce models, reduce service fragmentation and increase access to quality services through collaborative, person-centered care. Professional associations and regulatory bodies play an essential role in ensuring that delivery of care is provided by qualified and recognized health care professionals and preventing illegal practice.

Dentists can, through their affiliation with National Dental Associations (NDAs), exert great influence on the development of public policies related to workforce planning on the national, regional and global level.

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1. Introduction

The rapid demographic and epidemiological transitions with aging populations, along with the increasing burden of non-communicable diseases (NCDs), are a challenge in rich and poor countries alike (WHO 2012, WHO 2013). Combined with high incidence of infectious diseases and modest improvements in maternal and child health in resource-poor settings, there is pressure on healthcare systems globally to evolve and become more responsive to changing populations' needs and expectations. Greater emphasis is being placed on provision of the whole spectrum of services, from health promotion and disease prevention to treatment and rehabilitation, as well as addressing the underlying determinants of health in clinical settings.

The delivery of integrated preventive and curative health services will require changing intra- and inter-professional interactions, with a different skill mix and competencies of healthcare providers, in order to ensure continuity of care, patient safety and better health outcomes. In this regard, the importance of inter-professional collaboration and teamwork is increasingly recognized as a means of achieving higher quality care and improving the effectiveness and efficiency of health services

1.1 The dental profession in a changing environment

Dentistry is clearly a part of the wider health care system and is naturally affected by new demands, determinants, expectations and circumstances. Thus, these trends in the wider healthcare system highlight the need for dentistry to keep pace. Oral health is an integral part of general health. Poor oral health can be the result as well as a cause of poor general health. Oral health also shares common risk factors (e.g. poor diet, smoking, harmful alcohol use) with many chronic NCDs. Hence, oral health professionals of today and the future must have the knowledge and competencies to undertake complex tasks and address broader issues in oral health care delivery, including action on the social determinants of health.

Great progress in the prevention and the treatment of dental diseases has been made in the last 20 years, thanks to the work of dentists. Dentists are often the front-line medical professionals in prevention, early detection, and treatment of both oral and systemic diseases, and it is imperative that they become more involved in assessing and ensuring the overall health of their patients through screening, diagnosis and timely referral.

Dentists have traditionally worked in single-handed or small group practices in most parts of the world. However, to move towards more prevention-oriented, multidisciplinary, team-based care, the dental profession is expected to prepare itself for collaborative practice. Collaborative teamwork among dentists and other medical professionals, and a redefinition of the contemporary oral health care team, which includes a growing number of auxiliary professions, calls for a new model of care, with the dentist playing a leadership role both internally, within the oral health profession, and externally, in relation to other health professions.

It has to be stressed that *collaborative practice* is more than just *collaboration*. All healthcare professionals collaborate intermittently in the course of delivering services

to their patients. In contrast, collaborative practice is defined as a dynamic process when "multiple health workers from different professional backgrounds work together with patients, families, carers and communities to deliver the highest quality care" (WHO 2010). In this document, healthcare professionals are exclusively defined as qualified and legally recognized providers, and of course it does not include or support illegal practice of oral health under the excuse of collaborative practice.

Collaborative practice empowers participants to blend their talents and achieve more than either could alone. Facilitating conditions necessary for collaborative practice include, but are not limited to, "organizational mandate, clear sets of responsibilities, a team structure, a team process, and shared goals and outcomes as well as a supportive environment" (Schober & MacKey 2004).

Collaborative practice can only be accomplished through interdisciplinary or inter-professional education (IPE), defined as a learning strategy when "students from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes" (WHO 2010).

IPE provides an ability to share knowledge and skills among professions and is conducive to better understanding, shared values and respect for the roles of other health professionals. It produces a "collaborative practice-ready health workforce", which takes cooperation among health professionals one step further towards tackling emergent problems together to meet the challenges of the increasingly complex global health system (WHO 2010).

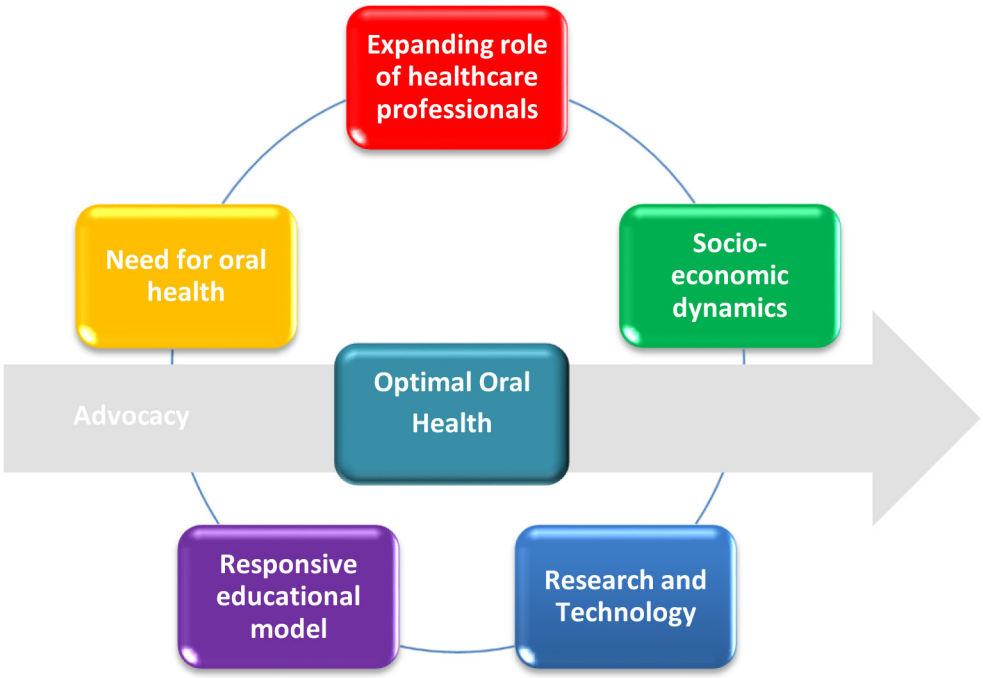
The literature does not distinguish between *intra-professional education*, when all students of the dental profession (e.g. dentists, dental therapists, dental assistants) are trained together and *inter-professional education*, when students of different health professions (e.g. dentists, physicians, nurses) have a joint educational curriculum. Therefore, this report uses the term "inter-professional education" (IPE) to refer to both intra- and inter-professional education.

1.2 FDI Vision 2020 framework for optimal oral health

Oral health is an integral part of overall health and well-being. The best attainable level of oral health is the ultimate goal of an effective oral healthcare system improving general health, once unimpeded access to oral health services is guaranteed. This is especially important for populations already in poor health, children, the economically disadvantaged and the elderly.

The organization and delivery of services for optimal oral health is context-specific and depends on a complex interplay of multiple factors, as outlined in the FDI Vision 2020 Framework (Figure 1). These factors include the changing role of the dental health profession, adequate education and training of dental health professionals, the availability of essential technologies and health infrastructure, growing need and demand for oral healthcare and the socio-economic variables or the social determinants of health. The weighted importance of these factors varies from country to country, and a variety of strategies could be employed to achieve improved access to oral healthcare and enhance health outcomes.

Figure 1: FDI Vision 2020 Framework for Optimal Oral Health



Source: FDI Vision 2020

1.3 Raising awareness of the dental profession

The World Dental Federation (FDI), which serves as the principal representative body for more than one million dentists worldwide, undertook this analytical work to identify the examples of inter-professional collaborative practice and IPE in oral health globally. The goal of the study was not to be overly prescriptive, but to provide cases on a range of practices that vary in their rationale and in their organizational, legal and operational structures, and to explore their implications for the future role and position of the dentist.

This report provides several examples of inter- as well as intra-professional collaboration for optimal oral health and describes a variety of practices available around the globe. Emphasis is placed on the influence of the different practice arrangements on the role of the dentist as a leader of a dental team. Selected case studies are discussed more in-depth to demonstrate the range of different collaborative practice arrangements based on personal experiences of the experts who were willing to collaborate with FDI and contribute to the report.

The report starts with the background literature review to provide the context for the cases. The description of the cases encompasses examples of intra- and inter-professional collaboration in oral health and IPE. The cases are followed by the discussion section and conclusions.

More specifically, building on the momentum of FDI Vision 2020 and subsequent expert consultations, the purpose of this report is threefold:

(i) Provide the best available evidence to FDI National Member Associations (NDAs) regarding the changes taking place in the dental profession around the world;
(ii) Expand the dialogue on inter-professional education and collaborative practice in oral health;
(iii) Facilitate the NDAs' policy and advocacy work for the planning of a future oral health workforce capable of providing holistic, multifaceted, person-centered care for optimal oral health.

2.Background/Literature review

2.1 Factors influencing the change

Advances in science and discovery are growing exponentially in the 21st century, creating a wealth of new knowledge and technologies that have the potential to transform the wider health system and thus the dental practice. Traditional methods of care, and procedures that have served the public well, are being questioned in the context of changing disease patterns, population aging and expected standards of state-of-the-art patient care (Lacopino 2007). The continued evolution of health professions including the dental profession will depend on each discipline's ability to adapt and translate scientific and technological advances into integrated interdisciplinary services in clinical settings.

At the same time, pressures to contain rising healthcare costs and increase access to services, especially for underserved populations, continue. The problem of access and coverage are often magnified by shortage and geographic mal-distribution of dentists and oral health providers (Gallagher & Wilson 2009). The lack of economic resources worsen health conditions of people despite the availability of an adequately trained health workforce. However, socio-economic considerations are relevant factors for adequate prevention and treatment of the population.

Oral health issues and health workforce challenges are global matters and are not confined only to low-income countries. According to the WHO EU Health Report 2012 and the WHO World Health Report 2013, health inequalities are a major concern even for developed countries. Global evidence suggest that at least 25% of health inequalities are associated with lack of access to effective health care services, and maldistribution of health professionals is a common matter. The same is true for the dental profession and the problems of access and coverage are often magnified by shortage and geographic mal-distribution of dentists and other oral healthcare providers (Gallagher & Wilson 2009).

A recent survey conducted by the Oral Health Workforce Task Team of FDI among the member countries (Yamalik et al. 2014) confirmed difficulties and inequalities in access to dental care, oversupply or undersupply of dentists or specialists, uneven geographical distribution of dental practitioners and a gap between undergraduate dental education and the actual workforce needs. Among the responding countries only 12.5% of developed and 22.2% of developing countries reported having optimal number of graduates per year. Most developed countries (87.5%) did not feel that their regulations complied with the needs and demands of the population and most developing countries (62.5%) did not feel that their undergraduate dental education complied.

The changes in oral healthcare are also driven by *social, political and cultural factors*. These factors can be considered in *four* broad categories outlined by Nuffield Foundation (1993) as influencing the future workforce:

(i) *Trends in demography and disease*, with changing patterns of oral health conditions and increasing demand for prevention and cosmetic dentistry, along with more extensive need for traditional treatments among socially disadvantaged groups;

(ii) *The exponential growth in technology* and scientific advances that require skills for life-long learning;

(iii) *Policy and politics* that influence how healthcare delivery services are organized and providers are compensated; and
(iv) *Social and economic developments*. The dental profession will need to recognize the pressures of post-modern individualistic societies that place greater demands on providers of care, which has implications for team working (Gallagher & Wilson 2009). Healthcare itself is changing and moving towards risk assessment and not just treatment of disease. This needs to be taken into account to provide patient-centered care with an emphasis on prevention.

These broader global health trends inevitably influence dental workforce planning to ensure the delivery of needs-based, high-quality healthcare services for a more diverse patient base. A multidisciplinary collaborative team approach is needed, with dentists acting as team leaders providing more complex high-technology services together with dental auxiliaries, who may deliver less complicated services for specific groups in the population (Baltutis & Morgan 1998).

The review of the published medical and dental literature indicates that the introduction of collaborative practice models arise in different contexts, with the primary objective to improve different aspects of healthcare delivery ranging from increasing access and quality of services, to lowering costs and improving practice productivity and efficiency along with improving patient clinical outcomes and satisfaction. A model of primary dental care based on intra-professional collaboration is emerging whereby a dentist diagnoses, prescribes and delegates routine clinical care to a team of support professionals (Mouradian et al. 2008).

There is also growing consensus that oral health is part of overall health and that poor oral health may lead to initiation or complication of chronic inflammatory diseases, adverse pregnancy outcomes and low birth weight babies (Moliterno et al. 2005). Dentists will be increasingly required to collaborate inter-professionally with health workers in other disciplines to provide the complex care needed for an ageing population and patients with chronic conditions (Powell & Din 2008).

2.2 Dimensions of collaborative practice

Prior to discussing the major dimensions of inter-professional collaborative practice, it is important to understand the inconsistencies in terminology used in the literature. An important starting point is to distinguish *collaborative practice* from *collaboration*, since the terms are often used interchangeably. All healthcare professionals collaborate as part of their daily work, but collaborative practice goes further and has been described as "a dynamic process involving a commitment to interact on a professional level, thereby empowering participants to blend their talents and achieve more than either could do alone" (Thomson 1995). Others define inter-professional collaboration as "an interpersonal process through which members of different disciplines contribute to a common product or goal" (Hall 2005).

Consistent with the above definitions, this report uses the WHO (2010) definition of collaborative practice, which takes place in healthcare settings "when multiple health workers from different professional backgrounds provide comprehensive services by working with patients, their families, carers and communities to deliver the highest quality of care across settings. Collaborative practice includes both clinical and non-clinical

health-related work, such as diagnosis, treatment, surveillance, health communications and management." Health professionals in collaborative practice are referred to as a collaborative practice-ready workforce, which is comprised of healthcare professionals "who have learned how to work in an inter-professional team and are competent to do so" (WHO 2010).

2.2.1 Competencies

Although the number of competency domains of collaborative practice vary according to the setting, there is a striking convergence in terms of their content in the global literature. For example, the Inter-Professional Education Collaborative Expert Panel, a group composed of leaders from six health professions' national organizations, has identified four inter-professional collaboration competency domains, such as: (i) Values/ethics for inter-professional practice; (ii) Roles and responsibilities; (iii) Inter-professional communication; and (iv) Teams and teamwork. (IEC 2011).

The key competencies identified by the expert panel do not address the unique aspect of each health profession or the common clinical and public health knowledge base that health professionals share. However, they do provide a broad framework that each health profession can adapt to its own circumstances.

Similarly, Bronstein (2003) identifies five core components of inter-professional collaboration: (i) Interdependence; (ii) Newly created professional activities: (iii) Flexibility; (iv) Collective ownership of goals and (v) Reflection on process.

Interdependence refers to reliance on interactions among professionals, whereby each is dependent on the other to accomplish his or her goals and tasks. To be interdependent, professionals must have a clear understanding of the distinction between their own and their collaborating professionals' roles and responsibilities. Interdependence relates to integrative teamwork, when team members' ability to carry out their work is dependent on each other. The reliance on others for certain tasks and resources allows collaborators to spend their time doing what each knows and does best.

Newly created professional activities are a critical component of collaborative practice, as they maximize the expertise of each collaborator when they create unique purposes that do not replicate those of individual professionals or professional groups.

Flexibility refers to the process of adaptability that successful collaborators exhibit under changing conditions. To have integrative collaborative teams, some deliberate role-blurring and flexibility are required within the legal medical act framework.

The roles taken within a team should not necessarily depend on a professional's training, but on the needs of the patient, situation, organization and colleagues. Flexibility in roles also demands fewer hierarchical relationships.

The multidisciplinary literature on collaboration identifies *collective ownership of goals* as a core component for successful collaboration. Successful collaborative efforts include clearly defined realistic goals; a shared mission and vision, objectives and strategy; broad-based involvement in decision-making; and collaborators with the ability to compromise (Hall 2005).

Reflection on process refers to collaborators' open discussion and feedback on the collaborative process, with the aim to strengthen the effectiveness of collaborative relationships. Some studies identified successful service integration as incorporating a commitment to self-evaluation.

2.2.2 A multi-dimensional approach

Mertz at al. (2011) described three main dimensions of the forms of collaborative practice in US dental practice and identified a range that exists within these dimensions:

1. Organizational structure. This dimension considers:
(i) *Professional participants*, who may be independent practitioners in separate organizations or be employed by the same organization;
(ii) *Setting*, which refers to the legal and organizational structure present to monitor the collaborative agreement between providers. Collaborative practices may incorporate one or more individual practices or exist within a single organization. In some cases, providers may be required by law to practice in certain settings;
(iii) *System ownership*, which may exist within a public or private organization or between two independently owned organizations;
(iv) *Referral networks*, which can be informal, formal or exclusive within an organizational structure. Referral is a critical component of the collaborative practice and person-centered care, as when patients' needs exceed the competence of a given provider and they need to be referred to the next level of care;
(v) *Professional* relations, where trust, respect and shared goals are critical for the success of the collaborative practice.

2. Legal and institutional requirements may include:
(i) *Formal collaborative agreements*, which may or may not exist. However, such agreements are often required by law or by the organization where collaborative practice takes place;
(ii) *Protocols for clinical care delivery*, which may or may not be included in collaborative practice agreements. Some protocols may be tailored to individual practices or may be more generic legal templates;
(iii) *Supervision*, which typically falls under three main categories: *direct*, *indirect*, and *general*. Direct supervision requires the physical presence of the supervising clinician, while indirect supervision allows the person performing the activity to be independent, provided that the supervising provider is on-site. General supervision can be conducted remotely;
(iv) *Education*. Some providers may be exposed to inter-professional education in their pre-service training, while others may be introduced to the concept after they are employed by the organization;
(v) *Licensing and certification*. In the United States, state licensing is required, which defines the eligibility, education, training and testing requirements. Certification is a separate activity offered by the private sector and may be required by some states to meet the licensing requirements.

3. Operational and financial structure. This dimension includes:
(i) *Caseloads*. If the providers are employed by the same organization, the provider with more advanced competence will take more difficult cases. If the providers are independent, an appropriate referral should be administered based on the patient's needs;

(ii) *Financing*. Payments can be based on the services provided or a negotiated wage. In the United States, providers in collaborative practice have the same financing mechanisms available to them as do providers who are not in such practices: private insurance, Medicare and Medicaid and other government programs, Health Maintenance Organizations (HMOs) and patients paying out of pocket.

2.3 Benefits of collaborative practice

The above study (Mertz et al. 2011) of the collaborative practice in American dentistry evaluated the potential of collaborative practice models in the provision of primary care within the oral health delivery system in the United States. The various rationales for designing collaborative practice models were placed into three broad categories: *access, cost* and *quality*.

Improved access to oral healthcare - Collaborative practice is believed to increase access in two ways: First, it increases access if collaborating providers who work at separate sites in underserved communities, particularly in rural areas, can provide care at places that are closer to where patients live, learn and work. While a dentist can provide more comprehensive care, an allied health professional can provide first contact and primary services and administer a referral when needed, thereby moving patients, who may otherwise have forgone the care they needed, into the delivery system. In a second scenario, if collaborating providers are at the same location, their collaboration can increase the volume and efficiency of services and facilitate access to services.

Reduced Costs and Increased Productivity - In terms of cost containment, the assumption is that the use of lower-cost labor that is adequately trained to provide particular services should result in significant cost savings without jeopardizing the quality of care. Earlier studies indicated that when dental auxiliaries were added to the practice to perform routine tasks, the increase in productivity ranged from 30 to 80 percent, along with increasing efficiency of care (Baltutis & Morgan 1998).

Better quality of services - The final critical benefit from collaborative practice is that of quality of care, because collaborative practice, if implemented correctly, is believed to increase trust and accountability among providers, facilitate continuity of care resulting in better clinical outcomes for patients and improve overall health system performance. In addition, collaborative practice seems to improve participating providers' relationships by enhancing mutual trust and accountability.

Nevertheless, concerns about the quality of care provided by mid-level providers are at the heart of the arguments opposing the expanded scope of practice of emerging professions. So far the pilot projects evaluating the effectiveness of adding new providers across a wide range of professions have shown that new models of care did not compromise quality (Fulton et al. 2011).

According to the *Systematic Review of Oral Health Outcomes Produced by Dental Teams Incorporating Midlevel Providers*, there were no conclusive results of an increase in treated decay, or a decrease of decay incidence in practices that incorporated mid-level providers such as dental therapists versus a practice that employed dentists and their traditional team including dental hygienists and assistants (Wright, et al., 2013).

2.4 Barriers to CP and IPE

In terms of barriers to collaborative practice and IPE, the following issues have been reported in the literature:

- professional boundaries and "blurring" of the roles
- leadership
- attitudes of different health professions and "blurring" of the roles
- different definitions and interpretations of collaboration
- not being much aware of and familiar with other health professions
- regulatory and other structures hindering CP
- political and economic determinants.

For IPE and collaborative practice to be successful, it is paramount to overcome the "silo" approach and break down the stereotypes and misconceptions about different professional identities (Hall 2005).

The timing of introducing IPE in the educational curricula can also act as a potential barrier to change. A number of authors have emphasized the importance of addressing students' professional misconceptions early on in their professional training, as students who started IPE courses with negative attitudes reported gaining the least from training (WHO 2013).

Another potential barrier is the difference in the composition of the members of the 'team' and the significant differences between the defined roles and responsibilities as listed in rules and regulations, together with the differences in the circumstances, health needs and demands and care delivery systems and the challenges brought by fragmented health systems.

According to WHO, collaborative practice works best when it is responsive to the context in which it is introduced and is organized around the needs of the population being served. However, collaborative practice in and of itself does not guarantee the provision of optimal health services, unless a number of other practice-level mechanisms, broadly grouped under *institutional support*, *working culture and environment*, enable the effectiveness of collaborative practice (WHO 2010).

2.5 Intra-professional collaborative practice – the expanding oral health team

Dentistry has been developing competencies for the new dentist over the past decade. Among those competencies are to "participate with dental team members and other healthcare professionals in the management of health promotion for all patients" (Sanz et al. 2008). The changes over the past years included the evolution of the practice of new dental providers and the expansion of the oral health team led by a dentist. In order to provide comprehensive, person-centered oral healthcare with an emphasis on prevention, an expanded collaborative oral health team is needed (Nash et al. 2008).

Some authors suggest that dentists of the future will need to be "oral physicians as much as dental surgeons" to lead the evolving dental team and take on the role of team leader and maintain responsibility for overall treatment planning and quality assurance (Gallagher &

Wilson 2009). These arguments are supported by Tanaka et al. (2008) in Japan, who argues that the aging of the population and advances in healthcare necessitates this change and suggests a complete integration of dentistry and medicine. Opponents state that the dental profession's independence is important, and its identity would be lost if it were just another branch of medicine (Assael 2004).

2.5.1 Recognizing the national specificities about the dental team composition

Despite this academic debate, it is worth noting that the types and numbers of members of the oral healthcare team (workforce) will vary from country to country depending on their oral healthcare systems and other contextual factors. The terms used to characterize the roles of the expanded oral health team members and the scope of their practice also varies as reflected in the literature on the topic. The new members of the oral health team as a group are often referred to as dental auxiliaries, mid-level dental providers, or allied dental providers (Baltutis & Morgan 1998; Evans at al. 2007). However, no matter what terms are used, the primary difference will be the relative percentage of the team members, based on the country's prevalence of oral health problems, and its socio-economic, geographic, cultural and legal context.

Nash et al. (2008) describe a comprehensive oral healthcare team as one composed of generalist dentists; specialist dentists, including public health dentists in addition to clinical specialists; dental therapists and dental hygienists (in some cases integrated in function and designated as oral health therapists); denturists; expanded function dental assistants (in some countries, dental nurses); and community oral health aides/ workers. Supportive personnel (not involved in direct patient care) will also include dental laboratory technicians. See Annex 1 for a detailed description of the different categories.

2.5.2 Dentist as the leader of the dental team

While each member of the dental team has unique functions, contemporary oral health teams are structured in a semi-hierarchical way, with the dentist leading the team. The final responsibility for the quality of care provided and the patient outcomes rests with a dentist. Intra-professional collaboration has the potential to further strengthen the role of the dentist as the competent and responsible leader of the dental team.

However, the dentist should be able to delegate tasks to a dental auxiliary who is specifically trained to perform those tasks. Evans et al. (2007) demonstrated that 35.3% of patient visits and 43% of clinical time in the UK are devoted to duties that may be undertaken by dental hygienists and therapists. The practice will potentially free up dentists' time to concentrate on more complex aspects of care and increase the efficiency of services. A study in England and Wales showed that 40% of general dental practitioners would be willing to employ a dental therapist and that younger dentists were more likely to favor delegating work to a dental therapist than their older colleagues (Hay & Batchhelor 1993).

2.6 Inter-professional collaborative practice – linkages between oral health and systemic health

The link between oral and systemic health is well established. Poor oral health is itself a health concern, causing a significant disease burden and suffering, particularly among children, adolescents and older people. However, like many other chronic diseases, oral

health also has a broader impact. It has been linked to increased risk of cardiovascular disease, diabetes, and other chronic conditions. For example, research suggests a relationship between periodontal disease and diabetes (Bascones-Martínez 2012). Diabetic patients with periodontitis have six times higher risk of worsening glycemic control and the development of the macro- and microvascular complications of diabetes, in particular cardiovascular and kidney diseases (Watanabe 2011).

There is a growing amount of literature documenting the role of inflammation, common to periodontal disease and other systemic diseases (Cochran 2008; Genco 2008; Graves 2008; Ordovas and Shen 2008; Wilson 2008). Some research focuses on periodontal disease and bone loss (Cochran 2008), Alzheimer's disease (Rogers 2008), Metabolic Syndrome (Ordovas & Shen 2008), and Atherothrombosis (Ridker & Silvertown 2008). Other studies have demonstrated a significant association between dental infection and atherosclerosis or coronary heart disease (Slavkin & Baum 2000).

Studies have also shown that adults who lost their teeth have a lower intake of fresh fruits and vegetables, and poor nutritional habits are one of the proven risk factors of non-communicable diseases.

Dental health has even broader implications for children. Poor oral health has been shown to result in decreased academic performance and can adversely affect behavioral and social development. According to US Department of Health and Human Services over 51 million school hours are lost each year due to dental problems (US DHHS 2000). Dental health has national security implications as well. According to a study conducted by the U.S. Department of Defense, 52% of new military recruits were in dire need of dental treatment, which resulted in a delay of their deployment (Leiendecker et al. 2008).

2.6.1 A growing role for the dentist

Dentists are often on the front line of prevention, early detection, and, in many countries, treatment of both oral and systemic diseases, and are in a good position to provide screening, diagnosis and referral services for systemic diseases. There is an increasing trend of dental professionals treating oral conditions in patients with concomitant chronic diseases or who are taking medications for systemic conditions. This trend highlights the need for dentists to be able to manage patients with systemic implications and also to collaborate with the medical profession (Sanz at al 2008). An inter-professional collaboration between dentists and other medical professionals would be beneficial to patients, particularly in underserved areas, where access to specialist physicians may be limited.

In light of the growing importance of oral health to general health, there are proposals to integrate it into primary healthcare services (Petersen 2014). The introduction of certain primary healthcare activities as part of routine oral care can ensure that dentists better manage the overall health of their patients. The provision of primary healthcare services in the dental office should focus on activities that directly impact oral health, such as smoking cessation, screening for osteoporosis, identification of undiagnosed diabetes, obstructive sleep apnea, hypertension, and nutrition and obesity management (Lamster & Eaves 2011).

2.6.2 A common approach for different type of patients

A collaborative medical-dental approach is particularly important in pediatric care. The medical office is considered an opportune site to reach large numbers of children who seek medical care but avoid dental check-ups. Pediatricians are uniquely positioned to screen for early signs of dental diseases and refer patients to a dentist. The coordination of care between medical and oral health care providers can help prevent acute episodes of pain and emergency room visits or the need for expensive restorative treatment for complicated cases (Cruz at al. 2013).

Unfortunately, there is lack of evidence on the effectiveness of this important interface between medical and oral health care professionals. One systematic review of the topic found no studies on primary care provider practices to identify children who are 0 to 5 years of age and are at elevated risk for future dental caries (Bader at al. 2004). On a positive note, other studies found that after two to five hours of training, physicians, nurses and physician assistants were able to perform oral screenings suitable for the purposes of referral for a complete evaluation by a dentist (Pierce, Rozier & Vann 2004). Similarly, other research has noted opportunities for nursing and dental collaboration in addressing the oral health needs of the elderly (Coleman 2002; Coleman 2005).

In consideration of the expanding role of the dentist to attend to systemic diseases, the introduction of primary care activities into the dental office has the potential to benefit the patients who routinely seek dental services and also have concomitant chronic conditions.

As for those patients who generally do not utilize medical services but make emergency visits to their dentists, healthcare screenings may be performed during such visits. A referral can also be administered by a dentist to an appropriate healthcare professional. Furthermore, the benefit of sharing knowledge and skills among the inter-professional team members will be realized in a positive, synergistic manner and beneficially influence the patient outcomes (Lamster & Eaves 2011). In collaborative practice, dental and medical providers will work as a team to identify and analyze problems and provide well-coordinated care.

2.7 Inter-professional education

WHO defines inter-professional education (IPE) as occasions "when two or more professions learn *about*, *from* and *with* each other to enable effective collaboration and improve health outcomes. Professional is an all-encompassing term that includes individuals with the knowledge and/or skills to contribute to the physical, mental and social well-being of community." (WHO 2010). The proposition "with, from and about" are key to the learning experience. All three must be present for IPE to take place, which means that bringing students of different professional groups into the same classroom is not enough if the learning is not interactive.

WHO considers IPE essential to the development of a "collaborative practice-ready" health workforce, when healthcare professionals work together as a team to provide comprehensive services in a variety of healthcare settings (WHO 2010). It is worth noting that although "inter-professional" is a widely accepted term, "multidisciplinary" and "multi-professional" are often used interchangeably.

2.7.1 Why start with education?

Several factors have triggered increased interest in IPE for collaborative practice. Some were explored in a paper by the Lancet Commission in 2010. The Commission was assembled to develop a shared vision and strategy for the education of health professionals. The Commission stressed the occurrence of "the mismatch of professional competencies to patient and population priorities because of fragmentary, outdated and static curricula producing ill-equipped graduates" and used the term "professional silos," referring to professions working only within their professionally defined boundaries (Frenk et al. 2010).

Other additional factors, such as population ageing, the shift from acute service delivery to a more complex chronic care model, alongside the increased focus on integrated and patient-centered care, underlined the necessity of preparing the health workforce for team-based care that requires outstanding communication and understanding of members' roles and responsibilities for optimum patient outcomes, safety and satisfaction. Hence, it seems logical to include collaborative practice in health professional curricula and explore the most effective ways of teaching (Thistlethwaite 2012).

Research indicates that IPE is more effective when:
(i) Principles of adult learning are used (e.g. problem-based learning and action learning);
(ii) Learning methods reflect the real world experiences of students;
(iii) Interaction occurs among students (WHO 2010).

A WHO Study Group on Inter-Professional Education and Collaborative Practice determined the following six competencies or learning outcomes of IPE: *teamwork, roles and responsibilities, communication, learning/reflection, the patient, and ethics/attitudes* (WHO 2013). Several authors emphasized that it is not the educational experiences but also the socialization process which occurs simultaneously during the training period, which serves to solidify the professional's unique worldview (Hall 2005). Other IPE studies concluded that students' early professional socialization plays a powerful role in dispelling some of their stereotypical perceptions of other healthcare providers (Rafter et al. 2005).

2.7.2 A new model for dental schools

In a review of the literature prior to 2006, Rafter et al. (2005) found minimal involvement of dental students in IPE. The authors also surveyed a convenience sample of leaders of seven academic health centers in the United States and showed that IPE was not a high priority and not likely to be integrated into already crowded curricula. In the literature published more recently, other researchers were able to demonstrate more positive attitudes towards IPE among students.

Cameron et al. (2009) reported on an experimental IPE session with first-year students from nine disciplines (dentistry, medical radiation services, medicine, nursing, occupational therapy, pharmacy, physical therapy, speech language pathology, and social work). Pre- and post-session questionnaires showed a significant positive change in students' attitudes and perceptions from before to after a 2.5 hour IPE session. Particular improvements were demonstrated in promoting teamwork and team-building, understanding the roles of various professions, and increasing trust in the judgment of others. Germany and Switzerland have practiced this kind of learning strategy ever since sharing the same educational curriculum for dentists and physicians.

A recent survey of the U.S. and Canadian Dental Schools on IPE found that the majority of schools (thirty-nine of the fifty-one dental schools) that had a medical school on campus collaborated with it. Although opportunities for collaboration existed between dental schools and dental hygiene programs, there was less interest in collaborating with dental assistant training programs, with only 10% of the schools reporting the collaboration. As dental education continues to explore IPE, there will be enough room to focus attention on teamwork within the dental workforce as well as across other health professions (Formicola et al. 2012).

At Boston University, one pioneering course aimed to prepare public health, medical, and dental students for their combined roles in community health settings. This cross-disciplinary, practice-based education model could meet students' learning objectives and exceed expectations of community partners. It was also possible to overcome formidable obstacles related to the "silo" nature of academic institutions and the competing priorities within overburdened community organizations (McCloskey et al. 2011).

There appears to be sufficient interest among dental schools toward IPE, but leadership within schools, faculty champions and additional funding may be required to provide necessary resources for IPE programs. Active coursework should include fields beyond medicine and dentistry, such as nursing, social work, physical therapy, public health and other disciplines to ensure that dentists of the 21st century are well prepared to face the challenges of complex patient care for better health outcomes. The Commission on Dental Accreditation (the only accrediting body for dental schools in the United States) recently added a standard for pre-doctoral dental programs:

Standard 1-9: The dental school must show evidence of interaction with other components of the higher education, health care education and/or health care delivery systems.

This inclusion in the standards for dental schools assures that dental students will be participating in inter-professional education as part of the college's dental curriculum. In Boston's Northeastern University, there is an entire department dedicated to inter-professional education. The Northeastern University's Bouve College of Health Sciences hosts the *Innovation in Inter-Professional Oral Health* resource center. Here medical-dental education programs collaborate in service learning projects and participate in joint educational opportunities.

2.8 Moving towards collaborative practice

The literature review and case studies demonstrate that epidemiological and demographic transitions, increased focus on oral disease prevention, along with scientific and technological advances, disparities in oral health among different socio-economic groups within and between countries, and a growing recognition of dental health care as part of overall health and well-being, create a pressure for the dental profession to redefine its future and lead the change rather than have solutions imposed upon it.

The **American Dental Association's Action for Dental Health** is a community-based, grassroots movement to provide care now to people who suffer from untreated dental

disease, to strengthen and expand the public/private safety net and to bring disease prevention and education into communities through eight initiatives. Of these eight initiatives, five are inter-professional and collaborative in nature. The five initiatives that are inter-professional in nature are highlighted below:

Emergency Room Referral

Many people without dental coverage don't seek treatment until their dental pain grows so severe that it sends them to a hospital emergency room. But most hospitals can't provide comprehensive care, so the problem often isn't solved. Dentists around the country are working with hospitals to get these patients out of the ER and into the dental chair, the right place for the right treatment.

Community Dental Health Coordinators

Community Dental Health Coordinators (CDHCs) address barriers to oral health by providing patient navigation for people who typically do not receive care for a variety of reasons—among them poverty, geography, language, culture, and a lack of understanding of oral hygiene and the importance of regular dental visits. CDHCs typically work in inner cities, remote rural areas and Native American lands; they are the perfect example of both inter and intra- professional collaboration. The CDHC works with other professions to identify patients that have dental needs and navigate those patients into dental care. In dental offices, the CDHC provides education and assists with managing patient's appointments. According to several dental clinics that employed a CDHC, the patient no-show rate improved from 50% no-show to 0% no show. In addition to the improvement in no-show rates in clinics, patients reported 100% satisfaction of their dental experiences in clinics that employed CDHCs.

Medicaid Reform

Most state Medicaid dental programs fall short of providing the amount and extent of care—both preventive and restorative—needed by their low-income beneficiaries. This is especially true for low-income adults, many of whom have virtually no access to dental care through Medicaid. The American Dental Association advocates for increased dental health protection under Medicaid, especially in states that have yet to agree to Medicaid expansion, and helps more dentists work with community health centers and clinics.

Nursing Home Programs

America's vulnerable elderly face the greatest barriers to accessing dental care of any population group. But delivering dental care to the nearly 1.3 million seniors in nursing homes has been problematic. Now, dentists across the country are adopting nursing homes in their communities, with the cost of care offset by a little-known provision in Medicaid. It's an immediate and affordable solution for nursing home residents.

Collaborations with other Health Professionals and Organizations

Better collaboration among dental and medical professionals can help more families understand their dental health is a crucial part of their overall health. The dental health of a pregnant woman or a mother can affect the health of the baby. Diabetes and gum disease are often interrelated. With minimal training, physicians, nurses, and others can dramatically increase the number of patients and caregivers who receive basic dental health education. These professionals also can be trained to recognize conditions needing diagnosis and possible treatment by a dentist. (American Dental Association, 2014).

In light of these global trends, collaborative practice is recognized as a means to achieve higher quality of care and increase the effectiveness and efficiency of services. Enhanced collaboration among healthcare professionals with appropriate and complementary skill sets is seen as a prerequisite to the improved coordination and continuity of care that leads to better patient outcomes. Collaborative practice also has an additional benefit of improving mutual trust and accountability of healthcare providers, which positively influence the quality of services and increase patient satisfaction.

Collaborative practice has been part of the medical profession for some time. Chronic disease management, geriatrics, mental health and palliative care are the areas where patients' needs are complex, and inter-professional teams have become necessary to provide the full spectrum of services from prevention to treatment and rehabilitation. In this regard, the practice of task shifting, when certain tasks are delegated to existing or new cadres with less training or narrowly tailored training, has been commonplace in medicine. Studies of task shifting, particularly the development of new professional cadres to increase efficiency and reduce the time needed to scale up, demonstrated that the practice increased access to services and saved costs through a reduction in health worker training time and lower salary costs (Bailit et al. 2012).

In contrast, the dental profession has been somewhat lagging in this respect, even though the potential for delegation in dentistry for routine tasks and collaboration with other health professions is high. As evidence accumulates to support the integration of medical and dental care, with appropriate attention to collaboration across all healthcare disciplines as well as public health, interdisciplinary collaborative dental care for optimal oral health is necessary. Furthermore, collaborative practice in dentistry implies expanding oral health teams, as well as collaboration with other health professions.

3. Changing roles of the dentist - selected examples of collaborative practice

In the light of the global epidemiological, social and policy trends in global health, along with the anticipated changes in the clinical practice of dentistry, the sections below depict the examples of both intra- and inter-professional collaborative practice in oral health. The examples provide a description of evolving dental health teams and the subsequent expanding role of dentists as leaders of these teams, as well as leaders of multidisciplinary teams across health professions, with the aim of addressing patients' oral health needs systematically and holistically. The necessary changes in education and training of future dentists are also discussed.

3.1 Intra-professional collaborative practice

3.1.1 The dentist as the leader of an expanding oral health team

The changes in global disease patterns with aging populations and the decrease in tooth loss and edentulism requires oral care at the two ends of the spectrum: an increased focus on prevention and the provision of minimal simple interventions, along with the need for complicated high-technology treatments. To ensure the delivery of services from prevention to treatment, the active engagement of the various members of the dental team, in addition to a dentist, is required.

In dentistry, teamwork is part of everyday practice. However, the composition of the dental team varies between and within countries depending on the socio-economic, cultural and political factors and the organization of healthcare systems, as well as population needs. As highlighted in the literature review section, oral healthcare is opening up to new providers and changing the skill mix, with a greater emphasis on new ways of working in order to capitalize on the oral disease prevention, improve access to and quality of care, ensure patient satisfaction and contain costs.

The increasing focus of dentistry on team effort, as is the case with other primary healthcare providers within the medical profession, requires dentists to assume the role of team leader, who would delegate tasks to auxiliary dental members who are specifically trained to perform those tasks. Delegation would allow dentists to focus on more complex procedures that cannot be delegated, thus increasing the efficiency of the service delivery.

The drivers of change in the workforce composition and practice are context-specific, and the functions and roles of the so-called allied health professionals also vary in different settings. As the literature review showed, the terms used to describe the allied health workers as a group is not uniform either. Most frequently they are referred to as allied health professionals, midlevel workers or dental auxiliaries. Oral health professionals commonly implied in this group are dental therapists, dental hygienists and/or dental nurses. The scope of practice also varies from country to country, but is often limited to basic dental care in a specific setting (e.g. school-based or community clinics, public sector and underserved areas) under the supervision of a dentist.

Below are provided several examples of intra-professional collaboration to illustrate various arrangements for an oral health team, with dentists assuming extended responsibility as leaders of the team for the diagnosis, treatment and quality control.

It is worth noting that there is a growing literature on intra-professional collaborative practice and the changing role of midlevel oral health providers. The practice is well documented in high- as well as low-income countries, such as, for example, in the United States, Canada, UK, New Zealand, Australia, Malaysia, and Tanzania (Nash et al. 2008).

However, the cases presented below have benefited from the personal experiences of the experts, in addition to the information derived from the literature. Hence, these cases are described in greater detail, highlighting the context that led to the redefinition of oral health teams in different countries and the resulting collaborative practices. Irrespective of settings in which they arose, intra-professional collaborative practice models demonstrate that dentists and allied dental professionals can work together as a team, each offering unique professional expertise for optimal patient care (Jaeks 2009).

3.1.2 Case 1: Collaboration for Increased Oral Health Promotion and Disease Prevention - The Netherlands

The Netherlands is an example of how countries are coming to realize the importance of adding dental hygienists to their oral health workforce. Low health disparities and the generally good oral health of the population in the Netherlands necessitated a shift from treatment to prevention and from care to cure. Rising expectations for higher quality of life in society, enhanced knowledge of health and the related need for medical care, increases the demand for oral health services, including cosmetic dentistry.

Apart from these demographic and cultural changes, there is a tendency toward a more cooperative dental team. Within the team, after suitable training, the mid-level practitioners take on preventive and some curative functions and free up the dentist's time to perform more complex tasks. Hence, the Dutch policy is intended to reduce costs and improve access to preventive along with curative care (Northcott et al. 2013).

The Netherlands has one dentist per 2,064 people, which is low in comparison to the average for Europe of one dentist per 1,515 individuals (Widstrom, Eaton, Luciak-Donsberger 2010). The traditional dental team consists of a dentist, dental hygienist, prevention assistant and prosthodontist, with a dentist responsible for the outcomes of the care. The number of the members in the team depends on the size of the practice, as demonstrated in Table 1:

Table 1: Dental team members in relation to number of patients served

Size of practices			
Team	Number	TFE	Patients
Dentists	3.0	1.8	3000
Dental hygienists	2.4	2.0	5040
Size of practices	3.6	1.6	3960
Size of practices	9.0	5.4	12000

Source: Tolmeijer 2013

As Table 2 demonstrates, larger practices employ a greater number of dental hygienists and prevention assistants. Therefore, they are in a position to provide more preventive services to patients.

Table 2: Number of dental team members in relation to number of seats in practice

	1-4 Seats	5-16 Seats	Total
Dentists	1.3	2.7	1.5
Other dental personnel:	1.8	5.9	2.2
» Dental assistants	1.4	3.2	1.6
» Prevention assistants	0.2	1.5	0.4
» Dental hygienists	0.2	1.0	0.3
» Prosthodontists	0	0.1	0
Other staff	0.3	1.8	0.5
Total	3.4	10.5	4.2

Source: Tolmeijer 2013

A growing shortage of oral health providers, coupled with changing disease patterns and more need for prevention, led to changes to the structure of the oral health services. A new and improved system focusing on suitability, effectiveness, accessibility and quality improvement was introduced in 2000, and is aimed to increase the intake of

dental hygienists to 300 per year and reduce the intake of dentists by 20%. The reform emphasized the importance of structured collaboration between dentists and hygienists and proposed revisions in educational programs for oral care professionals, with a focus on task reallocation. From 2002-2003 dental hygienists' education in the Netherlands was extended to four academic years, which results in the award of a bachelor's degree. The new curriculum utilized more competency-based education and legitimized a practice of task delegation (Tolmeijer 2013).

In the new system, patients are cared for by dentists, hygienists and dental assistants, not according to hierarchical structure, but according to the need of the patient to achieve optimal oral health. Accordingly, there is also a new definition of tasks:

- The main responsibility of the dentist is to focus on general diagnosis and coordination of the patient's care and treatment by his/her team, when appropriate; the dentist provides curative services to patients with complex problems
- Dental hygienists are focused on prevention (primary, secondary, and tertiary), screening and monitoring the basic dental care
- Dental assistants perform primary prevention, organize the practice and assist the dentist and the dental hygienist.

Dental hygienists, who practice across many countries, undertake very different clinical duties around the world, depending on the legislative environment in which they practice. Dutch dental hygienists are qualified to execute their functions autonomously without supervision, with the exception of the actions that are in the professional domain of the dentist: the administration of local anesthesia through injection (infiltration and conduction anesthesia), taking X-rays, and the treatment of primary caries by means of restoration with moldable filling materials. For these actions, a dentist's order is necessary. Agreements with dentists about the execution of restricted actions should be in writing in the form of a specified protocol. For actions beyond the hygienist's competence, the dental hygienist should make a referral to a dentist or a physician. (Nash et al. 2012).

The evidence on the effectiveness or the quality of care provided by the new-type dental hygienists in the Netherlands is limited. One study found that the new hygienists worked more often in dental offices instead of being self-employed, and worked more hours per week than old-style hygienists. They also performed tasks dealing with caries diagnoses and treatment more often, and undertook fewer prevention-related tasks. In general, respondents with a full scope of practice had more varied skills, but less autonomy and feedback than those focusing on traditional tasks. The task redistribution between dentists and hygienists allowed for more variety for the latter but did not increase in complexity. Based on this single study, it was concluded that the job satisfaction of dental hygienists may depend more on the work setting and structuring than the scope of practice (Jerkovic et al. 2010).

3.1.3 Case 2: Collaboration for Unimpeded Access to Oral Health for Children - Minnesota, USA

In 2009, Minnesota adopted legislation to create two new types of dental providers: dental therapist (DT) and an advanced dental therapist (ADT). Such models have worked in New Zealand since 1921 and in Canada since 1972 (Nash et al. 2012).

The DT is educated in an entry level program at the University of Minnesota Dental School in a 28-month program awarding a bachelor's degree. A DT will also pass a comprehensive, competency-based clinical exam and obtain a license from the Minnesota Board of Dentistry.

The DT in Minnesota can provide education and counseling, patient charting, X-rays, polishing of teeth, fabrication and removal of spacers under the general supervision of a dentist. The DT must be supervised by an on-site dentist (indirect supervision) when drilling and filling cavities, placing temporary fillings and crowns and repairing of dental prosthetics.

The ADT is currently educated at Metropolitan State University in a 26-month master's degree program. DTs are accepted to this program if they have a license approved by the Minnesota Board of Dentistry and completed 2,000 hours of dental therapy practice under direct or indirect (on-site) supervision provided by a dentist. Upon completion of the master's program, ADTs must pass a competency exam and obtain a license from the Minnesota Board of Dentistry.

The ADT's scope of work includes all the tasks permitted to the DT. However, ADTs can perform these tasks under general supervision of a dentist rather than indirect (on-site) supervision. ADTs are also allowed to perform more advanced clinical procedures, such as oral health assessment, formulating and authorizing a treatment plan with the collaborating dentist of the Collaborative Management Agreement (see below), and "non-surgical" extractions of teeth that are not permitted to DTs. ADTs can also provide and dispense medications, but are not allowed to prescribe.

Dental hygiene services are not within the legislated scope of practice for DTs in the State. A special license is required for dental hygienists (DH) for providing services. However, ADTs, who are graduates of the Metropolitan State Program are also licensed DHs and can provide preventive and hygiene services beyond the scope of ADT's practice. Minnesota has 10 accredited dental hygiene programs, including programs at the University of Minnesota, Minnesota State University, six state community and technical colleges and two private non-Minnesota colleges offering online classes in Minnesota.

The main role of the DTs and ADTs is to improve access to oral health for the underserved populations in Minnesota, where there is a shortage of dentists. For example, they work in community clinics, schools, nursing homes, correctional facilities, public health clinics, homeless shelters and in rural communities.

To become part of the oral health team, DHs enter into collaborative agreements with dentists. Similarly, DTs and ADTs sign collaborative management agreements with dentists. A dentist is not permitted to supervise more than five DTs or ADTs at a time. To provide more information about collaborative agreements to interested persons, the Minnesota Department of Health has developed a series of on-line courses that are available free of charge.

Since the 2009 legislation, only 42 DTs have been licensed at the time of writing, and only a few among them are employed more than 30 miles from a metropolitan area. Hence, it is too early to make any meaningful conclusions about the influence of the new oral healthcare delivery model on improving patients' health in the whole state. However, a recent evaluation of the impacts of DTs in Minnesota did find that nearly one-third of surveyed patients experienced a reduction in waiting as well as travel times and improved their access to care, particularly in rural areas. Two-thirds of the clinics employing DTs also noted significant personnel cost savings, increased dental team productivity and patient satisfaction (MDA 2014).

Despite these positive developments, financing of dental health care for the disadvantaged still continues to be a problem in Minnesota, and the measures to expand dental teams will not be sufficient to improve access to care until adequate Medicaid reimbursement rates are implemented. Further research and detailed analysis is needed for a definitive outcome of this project.

3.1.4 Case 3: Collaboration for Universal Oral Health Coverage - Thailand

Thailand has been implementing a Universal Health Coverage (UHC) scheme since 2001, and basic oral healthcare is part of that package. The expansion of the public health system resulted in a gradual increase in the number of dentists, physicians, pharmacists and nurses. For example, the dentist to population ratio was 1:19,677 in 1994, and it increased to one dentist per 15,143 people in 2004 and reached 1:6.000 in 2012 (Nash et al. 2012).

Despite these improvements, the maldistribution of health personnel, who tend to concentrate in urban areas, continues to be a problem in Thailand. There have been multiple efforts by the Thai government to remedy the situation. In 1968, the government launched a new policy requiring medical students to work in the public sector for three years upon graduation. Eventually this policy was extended to other healthcare professionals as well, such as dentists, pharmacists and nurses.

Currently, five out of 10 dental schools run IPE programmes. Dentists train with medical students in medical schools for the first three years of education, and spend the following three years at dental school, where the curriculum covers the basic dental sciences as well as clinical skills. Students are also offered field training to practice dentistry in communities and work side by side with health volunteers, health workers and community hospital staff (Nash et al. 2012). In the public sector, the largest agency is the Ministry of Public Health, with two-thirds of all hospitals across the country. Health services are provided at the Primary Health Care (PHC) level by the network of community health centers with a population catchment area of 5,000 – 10,000 people. The services at this level are delivered by a team of professionals composed of a family physician, public health nurse, health educator, dental nurse, health worker and nurse aid. Oral health services comprise only basic prevention and emergency care (Phantumvanit 2014).

The next level of care is delivered at community district hospitals by a team of practitioners, including general practice physicians, registered nurses, medical technicians, 2-3 dentists and dental nurses, pharmacists and other auxiliary personnel. Community hospitals serve from 30,000 to 50,000 people. Oral health services include oral health promotion and simple treatment, such as extractions, complex restorations, periodontics and simple prosthodontics. General hospitals provide more complex oral health services, such as oral surgery, fixed prosthodontics, endodontics, periodontics and restorative procedures. Healthcare providers include specialist physicians, board certified dentists (5-6), dental nurses and dental technicians (Phantumvanit 2013).

Dental nurses in Thailand must practice only at public hospitals or health centers and under the supervision of a dentist. However, only 40% of dentists are employed by the Ministry of Public Health. Dental nurses are not allowed to work in private practice either in a clinic or hospital. The registration of dental nurses is officially with the Ministry of Public Health and, informally, with the Thai Dental Nurses Association (Phantumvanit 2014).

The introduction of dental nurses in Thailand was inspired by New Zealand's School Dental Service Nurse model to provide care to school-age children. However, in 1986 the role of the dental nurses was changed to include all age groups. With the introduction of the Universal Health Coverage (UHC) system, there is more demand for dental nurses, particularly for preventive services. The nurses are expected to spend 30-50% of their time on oral health promotion and preventive care, especially for pre-school and primary school children, and the rest of the time on clinical care (Nash et al 2012).

The changing role of the dental nurse is reflected in nursing education. The dental nurse curriculum was upgraded to a four-year bachelor degree, with an emphasis on oral health promotion and disease prevention. The changed training and practice model of dental nurses in Thailand corresponds to the integration of the training and practice of dental therapists and hygienists in other countries.

There is some evidence that the clinical dental treatment provided by dental nurses is of good quality and that the public finds it acceptable, since the scope of care is limited and there is an option of referring the patient to a dentist if there is a need for more treatment. Studies also indicate that public health dentists who work with dental nurses in public hospitals and clinics appreciate the education and the preventive and clinical care that nurses provide. With the growing demand for oral health services and the UHC, deploying dental nurses has improved access to dental services significantly. The Thai Dental Council published a plan indicating that there is a need to train even more dental nurses to serve as members of the dental team to free dentists' time to treat more complex cases (Nash et al. 2012). Table 3 below provides some characteristics of the oral health care in Thailand incorporating a dental nurse.

Table 3: Some Characteristics of the Oral Health System in Thailand

	Dentist	Dental nurse
Education	6 years (after high school)	4 years
Healthcare structure	Community and general hospitals	Health centers and hospitals
Funding	Public and private	Only public, low cost
Provider satisfaction	Acceptable	Career path needed
Patient satisfaction	Satisfied	Acceptable
Barriers	None	NDA's concern

Source: Phantumvanit 2013

Thailand can also serve as an example of inter-professional collaboration to address the common risk factors for NCDs, such as, for example, tobacco smoking and chewing. Since the 1970s dental professionals have become increasingly aware of the damage that tobacco consumption causes to oral health, such as tooth discoloration, periodontitis and oral cancer. Oral health team members are in an ideal position to address this addiction in the dental office and also to coordinate with other healthcare providers for comprehensive care. In Thailand, a collaborative anti-tobacco health promotion campaign was launched through the National Health Promotion Foundation, involving dental and medical students as well as dental and medical clinics and hospitals, to stop smoking in order to prevent lung disease and oral cancer along with periodontal disease and halitosis (Phantumvanit 2013).

3.2 Selected Countries - Collaboration to Improve Oral Health in Underserved Communities

Barriers to oral health services in underserved communities, particularly in rural areas, where there is a shortage of dental health professionals, is an issue in rich and poor countries alike. Ensuring unimpeded access to dental health for disadvantaged groups requires a comprehensive approach, including expanding the pool of oral health providers, broadening the scope of their dental skills and developing a supportive policy environment. Adequate access to oral healthcare is particularly important for children. Children are among the most vulnerable population groups, with accumulating evidence that children from low-income and minority families experience more oral disease and receive less care (Nash 2009). To address the problem throughout the world, the use of dental therapists to provide care for children has grown in popularity.

3.2.1 Case 4: Improved Oral Health for Children - New Zealand

As mentioned earlier, in 1921 New Zealand pioneered a two-academic-year program to train dental nurses. The nurses were then assigned to school-based dental clinics to offer routine preventive and restorative services to children under the supervision of a dentist. Eventually the name "nurse" was changed to a "dental therapist".

Today there are over 600 dental therapists in New Zealand. They are assigned to every elementary and middle school and care for 97% of school-aged children in the country. The dental therapists are authorized to perform simple procedures, such as cleanings, fillings, and application of dental sealants without a dentist being on-site or examining the patient first, but a dentist has to be available to consult when needed. The system ensures that children are seen without delays, which might not be the case if a dentist's constant presence were required (Pew 2013)

The recent review of New Zealand's children's oral health shows that all children in any given school year who had presented with caries had received treatment. The New Zealand model of oral health was replicated in more than 50 countries worldwide. The international evidence indicates that the quality of care provided to children by dental therapists in terms of diagnostic, preventive, and technical skills has been comparable to that of a general dentist (Nash 2009).

3.2.2 Case 5: Improved Oral Health for Tribal Communities - Alaska, USA

Another well-documented model of oral healthcare in underserved communities is that of Alaska, where the majority of the native population lives in remote villages accessible only by airplane, boat or snow mobile. Due to a chronic shortage of dentists and a high prevalence of dental disease, with 62% of children ages 2 to 5 having untreated caries, the unmet need for dental services was one of the highest in the USA.

To address this need, the Alaska Native Tribal Health Consortium, with the support of the Indian Health Service, in 2003 sent six Alaskans to be trained in dental therapy at the University of Otago, New Zealand's national dental school. They returned to Alaska to start practicing in rural areas. Initially, the innovation was opposed by the American Dental Association on the grounds that the practice was illegal. Eventually, the Association agreed to join forces to improve the oral health of Alaskans. An independent evaluation of the program has concluded that the dental therapists met all the quality standards and were well-received by the communities they served. There are currently 11 therapists trained in New Zealand, who practice under the general supervision of the dentists and perform cleanings, restorations and uncomplicated extractions (Wetterhall et al. 2010).

3.2.3 Case 6: Improved Oral Health for Vulnerable Populations - USA

Experiments with the innovative oral health workforce models in the USA also include the community dental health coordinator (CDHC), which started as a pilot program in several US states in 2012. CDHC is a new program implemented by ADA to increase access, especially for underserved people. ADA defines CDHC as "a new team member who serves as a conduit between underserved communities and dentists." CDHCs are described as community health workers with dental skills focusing on education and prevention. CDHCs main responsibility is to provide oral health education and disease prevention in the communities which they serve; they also act as a link between patients and dentists when care is needed. CDHCs are recruited from the communities they serve, in contrast to the advanced dental health therapists in Minnesota, who are mostly drawn from the existing dental hygiene workforce.

The CDHCs are required to complete 1872 hours of instruction followed by an internship. The curriculum incorporates biomedical, dental and clinical sciences. The students are taught to provide patient education and routine preventive services and help patients navigate health care system. The CDHCs focus on community outreach and improving access to oral health for underserved populations in their respective populations, such as children, high-risk groups (HIV/AIDS patients, diabetes patients, perinatal patients, low-income groups and senior citizens). Apart from community outreach, the CDHC's scope of work includes patient navigation, education, and preventive services such as fluoride varnish (ADA 2014).

Even though the program is new, so far the results have been encouraging. It has been shown that introducing the CDHC had a significant positive impact on access to oral health care. Forty-three percent of CDHCs were shown to use this initiative for

preventative care and/or routine dental care after case intervention was implemented, when compared to 27% of the control group. The difference was found to be more prominent for lower income levels. Over the nine-month period of the program's implementation, CDHCs, working only a day per week, provided services to 114 patients in a rural tribal community diabetes clinic. The missed appointment rates dropped to zero, compared to an 18% clinic-wide rate. A CDHC working in solo-dentist practice in a remote rural area nearly doubled the clinical productivity compared to the previous year, when the CDHC was not employed. More importantly, the patient self-reported satisfaction rates in dental practices working with CDHCs was 100% (ADA 2013).

3.3 Inter-professional collaborative practice

The extent to which different healthcare professions work well together affects the quality of healthcare they provide. There is growing consensus that interventions based on inter-professional collaboration (IPC) are strategies that improve provider interactions, continuity of care and quality of services, as well as patient satisfaction.

The UN High Level Meeting on Non-Communicable Diseases in 2011 formally recognized oral diseases as a public health problem and called member states to address oral health within the framework of NCDs, based on the fact that dental diseases and NCDs share common risk factors (UNGA 2011). With the acknowledgment that oral health is a critical and integral dimension of general health and well-being, and the evidence to support the benefits of tighter integration of medical and dental care, the need for interdisciplinary and inter-professional collaboration in oral health has never been greater. In addition, inter-professional collaboration models have the potential to further integrate oral health into overall health and establish the dentist as a key member of the health care professional team.

Located in the United States' Pacific Northwest, Permanente Dental Associates P.C. has a relationship with the Kaiser Permanente Foundation of the Northwest and Northwest Permanente Physicians P.C. Over 229,000 of the 500,000 Kaiser Permanente members in Oregon and Washington receive dental care through Kaiser Permanente's Dental Care Program. There are over 10 million Kaiser Permanente (KP) medical members in the United States. Permanente Dental Associates dentists practice integrated care with their physician colleagues. An example of the direct link between oral health and overall health was found in a study regarding diabetes control and dental care. Through this study, Kaiser Permanente's Center for Health Research found that patients receiving dental care hah lower costs per member per month than those not receiving dental care. Particularly, the diabetic population receiving dental care had $129 per member per month lower healthcare costs overall than those not receiving dental care. Additional integration includes encouraging patients to close preventive "care gaps" (HEIDIS metrics) following their dental visit (examples: colon cancer screening, breast cancer screening, tobacco cessation).

Although the literature acknowledging the importance of inter-professional collaboration in oral health is growing, particularly literature on the need for collaboration between dentists and physicians and between dentists and nurses to better coordinate care for children and chronically ill patients, there is a lack of documented successful cases on the topic.

The cases below provide examples from experts documenting collaborative practices of dentists engaging with other healthcare professionals to achieve a common shared goal of optimal patient care.

3.3.1 Case 7/8: Lausanne, Switzerland – Dentist as a Guardian of General Health

Switzerland has a compulsory health insurance system regulated by the Swiss Federal Law on Health Insurance. Part of the insurance plan is financed through insurance premiums and out-of-pocket contributions, and the second part comes from general taxes.

Basic health insurance reimburses dental treatment only for some severe and unavoidable diseases of the masticatory system; dental treatment required due to a critical general medical condition and its complications; and oral conditions caused by accidents.

Routine dental care, such as dental check-ups (except those provided for children in schools), fillings and extraction, amalgam replacement and corrective dentistry are not included in the basic health insurance package, and patients must pay out of pocket or purchase a supplemental private dental insurance plan. However, only 10% of the population has private dental insurance. (Roubach 2010).

Switzerland has a coordinated strategy towards prophylaxis programs to prevent caries in children. Strategy is defined at the cantonal (district) level, while city-level authorities are in charge offunding and execution of prophylaxis plans. There is no federal law mandating prophylaxis programs, and the decision is in the hands of cantonal health departments.

The Swiss dental prophylaxis program stresses the role of the dentist and the dental hygienist. Dentists train for 10 semesters. The first two years are identical to the training for physicians. Further education is received separately in one of the four dental schools at the Universities of Basel, Bern, Geneva or Zurich. Graduates must pass a federal examination, which grants a basic dental training qualification. After that there are different options. The Swiss Dental Medical Association grants a specialty title for dentofacial orthopaedics. Other titles are in periodontology, prosthetics, and oral surgery and medicine (Roubach 2010).

The majority of dental services are provided by dentists in independent practice or growing private polyclinics employing foreign dentists. In addition, dentists are employed in polyclinics at university teaching hospitals and dental check-ups and oral health education are provided in schools. Typically, dentists have a role of leader of the oral health team, which consists of dental hygienists, dental assistants, and prophylaxis assistants. Dental technicians typically work in prosthetic labs and provide services to different dentists and clients. Their roles are as follows:

Dental hygienists: Following three years of qualification in school, they are allowed to perform simple periodontal scaling, oral hygiene instruction and application of sealants. Although allowed to work independently, they typically work under a dentist's supervision in most cantons and can be employed in both public and private practices.

Dental technicians: They train for four years in a laboratory to become qualified and registered by the federal government. Prior to that, they receive both technical and general theoretical education in professional schools. Only a few cantons require federal registration. Dental technicians are not allowed to work directly with patients, although work with patients is frequently tolerated due to lack of dentists in those locales.

Dental assistants: They go through a three-year qualification program, which trains them in chairside assisting, office administration, patient management and organization of materials and equipment. They are also allowed to take dental impressions and intra- and extra-oral radiographs. Dental assistants are employed in both public and private practice.

The Policlinique Médicale Universitaire (PMU) of Lausanne is located near the Centre Hospitalier Universitaire and provides a range of general health services, including oral health. The dental team of the clinic is composed of 12 dentists, 15 dental assistants, 2 dental hygienists, 2 prophylaxis assistants and 4 dental technicians (and two trainees). They also have administrative staff consisting of medical secretaries, accountants and desk officers. The clinic is well known in the area and attracts from 15,000 to 17,000 dental patients a year. The services offered are broad in scope and include preventive as well curative care, such as crowns, fillings, extractions, dentures, dental implants, oral surgery and microsurgery. The clinic also offers tailored treatment catering to patients' needs related to their general health, and requiring special precautions during the dental treatment. The integration of medical and oral health necessitates intra- and inter-professional collaboration across healthcare professionals in order to provide a wide spectrum of services. The dentist has the role of the leader of the oral health team and is responsible for diagnosis, treatment planning and the quality of oral care provided.

The aging population and the increasing number of medically compromised patients requires the dentist to have the knowledge and skills to diagnose and adapt dental treatment to patients' systemic diseases and their medication history. This calls for the ability to communicate, delegate and collaborate within the dental team and with other health professions (e.g. cardiac surgeons, pediatricians, oncologists, dermatologists) along with the desk/administrative team. The latter has the important function of receiving patients, analyzing requests, identifying patients' dental and/or medical insurance and selecting appropriate health professionals on a case-by-case basis.

The clinic also increasingly faces the need to treat emergency cases and accept patients from disadvantaged groups, such as low-income families, prisoners, and asylum seekers. However, treatment of such cases is medically and administratively complicated, since the government authorizes the payment and the list of reimbursable services is limited.

Healthcare professionals involved in inter-professional collaborative practice, where they work side by side to cater for patients' complex health problems, are given an opportunity for inter-professional training. For example, dentists are offered training courses on systemic diseases and internal medicine. Physicians receive orientation on linkages between oral health and systemic diseases, and pediatricians are given a course on oral medicine in children. In addition, opportunities for training abroad in relevant programs are also made available (Madrid 2013).

3.3.2 Case 8/9: Dentists as Expert Advisors in Wales – Improving Mouth Care for Patients in Hospitals

In 2003, the Welsh Government launched a policy called Fundamentals of Care, which aimed to improve the quality of health and social care for adults. The initiative grew out of increasing evidence of inconsistent quality across healthcare services, an overemphasis on improving the efficiency of care and reducing cost at the expense of quality, and a mismatch of patients' expectations and the quality of care they received.

Fundamentals of Care incorporates a set of indicators around the 12 aspects of healthcare identified by patients and caregivers as the most important for acutely and chronically ill, frail and disabled patients. Oral health and hygiene has been identified as one of the most important aspects of care, along with communication and information; respecting people; ensuring safety; promoting independence; relationships; rest, sleep and activity; ensuring comfort and alleviating pain; personal hygiene and appearance; eating and drinking; toilet needs, and preventing pressure sores.

Oral health is an important part of treatment for all patients, particularly those who require assistance with their daily activities. The state of a patient's oral health can have a significant impact on their oral health outcomes, particularly on psychological well-being, respiratory health, and nutritional status.

However, oral health and hygiene are often overlooked in hospital ward settings. Routine oral care is often the responsibility of the nurse or health assistant, who may not have the necessary knowledge and skills, or clear hospital protocols to follow. The need for nurses to routinely assess oral health status and determine what assistance is required to maintain good oral health, especially in older patients who are unable to self-manage their oral health care, has led to the establishment of an improvement collaborative focusing on mouth care for adult patients in hospitals, as part of Public Health Wales, 1000 Lives Service Improvement Unit, the national quality improvement program in NHS Wales.

1000 Lives Plus superseded the 1000 Lives Campaign, which aimed to prevent 1,000 avoidable deaths and 50,000 instances of harm in Welsh healthcare in two years. The Campaign was inspired by the 100,000 Lives Campaign run by the Institute for Healthcare Improvement in the USA, which also aimed to reduce unnecessary hospital deaths.

1000 Lives Plus was supported by all 10 NHS Wales organizations, including the seven regional health boards in Wales. The work to improve mouth care was coordinated by multidisciplinary teams in each organization, including nurses and community dental service teams.

The improvement work empowered nurses to take the lead in order to enhance the integration of oral healthcare within routine nursing practice. It used a patient-centered approach and included oral health care as a component of all documentation of nursing care.

The guidance for improving care for adult patients in hospitals consists of: (i) Mouth care resource and practice guide; (ii) Mouth care risk assessment tool; (iii) Mouth care plans and a (iv) Mouth care monitoring form. These tools are used to improve mouth care standards for adult patients in hospitals, and staff are encouraged to take ownership of the program and work in teams. The teamwork includes intra-professional collaboration within the dental profession as well as inter-professional teamwork with physicians, nurses, pharmacists, dieticians, speech and language therapists.

The work is nurse-led, with dentists and dental teams acting as expert advisors and providing feedback on the resources and improvement projects. Dental teams have developed a range of supporting literature and teaching resources, including an e-learning package and posters to support use of the risk assessment tool.

The new ways of working were introduced in 2011, but early results have already been encouraging. Recognition that current practices were not adequate provided an opportunity to embed evidence-based care, which has been owned by the local teams who have developed and tested approaches.

Reduced patient complaints and positive patient stories also point to the program's success. These findings are also supported by objective measurements. Inter-professional education, with pre- and post-intervention assessment, indicated a significant increase in the level of staff's knowledge of oral health as well as an increase in the level of confidence to provide mouth care. Given the link between patient outcomes and nursing care, the program has the tremendous potential to both improve patients' oral health and to lessen the burden of systemic diseases.

Regarding sustainability, the program integrates economics, social aspects of culture, health, and the work force to:

- Sustain health through the early detection of oral disease
- Reduce consumption of inappropriate resources
- Build and embed evidence-based practice
- Increase the knowledge and skills of both the existing and the future work force

This extends the oral health skills of other health and care professionals and moves oral health into the wider arena of health care.

1000 Lives Plus has recently evolved into 1000 Lives Service Improvement, a national service based in Public Health Wales, supporting NHS Wales organisations in tackling their priorities for improvement. Improving care for adult patients in hospitals is one area that is continuing to deliver clear benefits for patients (Davies 2013).

Table 4 provides comparisons of the selected cases in a summary matrix across the following dimensions: intra- and inter-professional education and collaboration, the role of dentist, drivers of change, inhibitors of change, funding, provider satisfaction and patient satisfaction.

Table 4: Matrix to compare case studies across several dimensions

	Minnesota	Lausanne	Netherlands	Thailand	Wales
Intra-Professional Collaboration	Yes	Yes	Yes	Yes	Yes
Inter-Professional Collaboration	No	Yes	No	Yes	Yes
Role of dentists	Leader of the dental team	Leader of the dental team	Leader of the dental team	Leader of the dental team	Expert Advisor
Drivers of change	» Impeded access to care » Need for prevention	Patient-centered care	» Changing demographic and disease epiemiology » Focus on access to preventive care » Growing shortage of dentists	» Changing demographic and disease epiemiology » Focus on access to preventive care	» Fundamentals of Care (WG audit)) » Patient-centered care
Barriers	» Low reimbursement » Initial opposition of the dental profession	» Lack of funding for medical training of dentists for vulnerable groups	N/A	N/A	» Strong nurse leadership » Funding & capacity of the dental team to provide training
Funding	Public	Public & private	Public & private	Public	Public
Provider satisfaction*	Acceptable	Good	Good	Acceptable	Good
Patient satisfaction**	Acceptable	Good	Good	Good	Good

* Referring only to the aspects of provider satisfaction involving inter- or intra-professional collaborative practice

** Referring only to the aspects of patient satisfaction involving inter- or intra-professional collaborative practice

4. Interprofessional education

4.1 Preparing dentists for inter-professional collaborative practice

Enabling students to interact as an inter-disciplinary healthcare team is a prerequisite for preparing a collaborative practice-ready workforce. Historically, medical, dental, and allied health programs have functioned as "professional silos" and provided very little collaborative, interdisciplinary education to their students. However, demographic changes, in particular aging populations, increased incidence of chronic, non-communicable diseases (NCDs), technological advances, the patient safety agenda and workforce pressures necessitated new models of care, with increased collaboration among healthcare providers (Thistlethwaite 2012).

According to WHO, inter-professional education enables effective collaborative practice, which leads to strengthening health systems, optimization of the delivery of health services and improved health outcomes (ref collaborative WHO report). Inter-professional education (IPE) is defined as "occasions when two or more professions learn from, with and about each other to improve collaboration and quality of care" (WHO 2010). IPE provides the opportunity to share knowledge and skills among professionals so they can better understand and respect the roles of other healthcare professions, for the shared value of patient-centered, good quality care.

With respect to dentistry's role as part of comprehensive healthcare teams, the literature review demonstrates that there is a limited inclusion of dental health professionals as members of interdisciplinary teams (Wilder et al. 2008). The barriers to IPE in dentistry include an already-crowded curriculum, lack of leadership support, not having IPE facilities at universities or universities not willing to be engaged, and intra- and inter-professional resistance to this type of education. Irrespective of these challenges, Formicola et al. (2012) identified four main reasons why dental education should engage in IPE:

1. Dentistry is a critical component of primary healthcare, and dentists should be able to effectively communicate with other healthcare providers.
2. Management of chronic NCDs, such as diabetes or cancer, requires special attention to patients' oral health needs. Coordination of care between dentists and other healthcare professionals is key in such cases.
3. Prevention and treatment of oral diseases can only be achieved when members of the oral health team work well together and with other healthcare professionals.
4. Oral health teams should collaborate with public health professionals to improve access to care and implement community-wide preventive measures.

Even though IPE in dentistry is not yet common practice globally, there are successful examples of institutions that have inter-professional initiatives involving multiple colleges and disciplines. A recent survey of the US and Canadian dental schools indicated that the majority of the schools that responded to the survey had established IPE programs, most frequently with medical and nursing schools and dental hygiene programs. Other collaborative programs were with occupational therapy, optometry, public health and nutrition. The likelihood of collaboration was higher when the programs were offered on the same campus (Table 5):

Table 5: Respondents' reports of other health professions' programs on their campus and collaborations with other programs (on or off campus), by number and percentage of responding dental schools (N=62)

Other health professionsl program	Other program on campus	Collaborate with other programe
Medical school	51 (82%)	39 (63%)
Nursing school	51 (82%)	29 (47%
Pharmacy school	40 (65%)	22 (36%)
Physical therapy program	40 (65%)	21 (34%)
Psychology department	40 (65%)	9(15%)
Social work program	34 (55%)	18 (29%)
Dental hygiene program	31 (50%)	36 (58%)
Other	21 (34%)	20 (32%)
Other allied oral health program	9 (15%)	5 (8%)
Dental assisting program	6 (10%)	11 (18%)
Dental therapy program	1 (2%)	1 (2%)

Source: Formicola et al. 2012

While there were a variety of approaches to the design and management of IPE content in the surveyed schools, there were three common traits that contributed to a successful implementation of collaborative educational programs:

1. Using a small group format to maximize student interactions
2. Including active learning/project assignments
3. Offering foundation knowledge courses to students at the start of their course

The subject matter and methods of instruction also varied among the surveyed schools. For example, courses at the University of Florida emphasized the themes of family health and tobacco cessation, while collaborative courses at the Medical University of South Carolina used on-line discussions and root cause analysis projects. The University of Colorado engaged people with chronic diseases as health mentors to interact with the inter-professional student teams (Formicola et al. 2012). However, all IPE programs shared a common goal: to engage students of multiple professions in order to learn together and develop a sound understanding of the value of the team approach to patient care. In the USA, Smiles for Life is the nation's only comprehensive oral health curriculum. Developed

by the Society of Teachers of Family Medicine's Group on Oral Health and now in its third edition, the curriculum is designed to enhance the role of primary care clinicians in the promotion of oral health for all age groups through the development and dissemination of high-quality educational resources (Clark MB, 2010).

The *Bright Futures in Practice: Oral health* pocket guide is a tool created for physicians, pediatricians, and other primary care physicians. Itoffers a useful tool and overview of preventive oral health supervision for five periods- pregnancy, infancy, early childhood, middle childhood, and adolescence. (Cassamassimo & Holt, 2014)

Successful IPE examples are not confined to schools in the USA and Canada. According to a study commissioned by WHO, which employed a thorough literature review along with a survey of countries in all six WHO regions, IPE is taking place in Australia, USA, Canada, Sweden, UK, Belgium, Denmark, Finland, Greece, Hungary, Iran, Ireland, Japan, Malaysia, New Zealand, Norway, Poland and South Africa. Among the many benefits of IPE, respondents noted practice- and policy-related positive outcomes, such as improved access to care, health outcomes and quality of care, as well as workforce morale, practices and productivity. In terms of learning benefits, the real-world experiences and insights provided by IPE were most commonly reported (Rodger & Hoffman 2010).

5. Discussion

5.1 Drivers of change

As the cases demonstrate, the drivers of change that triggered the introduction of new policies varied from country to country. These changes can still be grouped under the categories of evolving *demographic*, *epidemiological* and *health service delivery* factors. In the case of the Netherlands, the change was triggered by the move from the curative oral healthcare model to the model oriented towards prevention. However, demographic and epidemiologic trends in the Netherlands have also come into play, indicating that a higher percentage of the population is growing older, with low levels of edentulousness and demanding more sophisticated forms of restorative treatments that are well beyond the basic (primary) healthcare and prevention programmes. As a result, dentists need to provide care to older populations with more complex oral and general health problems, as well as assume responsibility as a leader of the expanded dental team, to ensure a comprehensive high quality care encompassing health promotion, disease prevention and treatment.

Hence, in addition to complex dental treatments requiring highly specialized skill sets, the need to implement population-based preventive and educational strategies remains. The cases of Minnesota, Thailand and the Netherlands and the CDHC intervention in the USA for underserved populations demonstrated that shifting these tasks to new members of the dental team created recognized professional groups that would undertake these functions and improve access to oral health services in underserved communities.

5.2 Need for additional non-clinical skills

The trend of expanding oral health teams highlighted in all cases the fact that patients will increasingly be selecting an appropriate dental professional for specific needs. Extended teams will free up the dentist's time to provide more complicated treatments. However, the required infrastructure to accommodate a change in the scope of practice for oral health professionals may need to be altered to enable newly permitted functions. In this respect, the role of financial incentives should not be overlooked. For example, in the case of Minnesota, the low level of reimbursement by Medicaid deters dentists from providing services to low-income patients, which may lead to devastating consequences for patients' health.

In light with these developments, the dentist, as the leader of the team, ultimately responsible for quality of care and patient safety, must also develop the skills to communicate and manage the expanding dental team and collaborate both within the team and with other health professions to provide patient-centered care. Practice-based skills may also include the ability to develop partnerships, along with advocacy and lobbying skills.

These non-clinical skills are of paramount importance for dentists to build closer ties with the medical profession (Reynolds 2008). Inter-professional collaboration is particularly critical with pediatrics and geriatric medicine. Oral healthcare is an essential part of pediatric as well as elderly care, and is particularly important for older hospitalized patients

who may not be able to maintain good oral health practices due to their conditions. In addition, the dentists of the future may need to collaborate with healthcare professionals from unregulated professions, such as community workers and/or traditional healers, since these professions are often the only oral health providers in resource-poor settings, as described in the case of Cameroon.

5.3 Need for inter-Professional education

To develop the needed skills, a responsive educational model with a comprehensive curriculum, which incorporates dental and clinical competencies, is required. The new inter-professional educational model, based on the collaboration of dentistry, medicine and other health professions, should prepare dentists to assume the responsibility for the expanding dental team for diagnosis, treatment and quality assurance. This is also an opportunity for dentists to play a more important role in the provision of primary health care services and involvement in the monitoring of patients with NCDs.

Since teamwork is an integral part of dental practice, shared learning or inter-professional education is the necessary condition to prepare a collaborative practice-ready dental workforce. As described in the cases of Thailand and Switzerland, dentists are trained with physicians for the first three years of practice. In Thailand the new graduates also have an opportunity to work in the community and hone their communication and practice-based skills, in order not only to address dental problems, but also to tackle oral health inequalities and take action on the social determinants of health. There are several other successful models of IPE, primarily in the USA and Canada, but for IPE to become more mainstream and be incorporated into academic and clinical settings, there are a number of challenges to be overcome.

The most commonly cited challenges to inter-professional collaboration and education in the literature are the professional cultures and stereotypes. To develop collaborative skills that bring down professional silos, the introduction of IPE early in the education of healthcare professions will be paramount. When students from dentistry, medicine, dental hygiene, nursing and pharmacy are trained together, the practice will be more easily transferred into clinical settings and include multidirectional referral and reinforcement of health and wellbeing messages, especially for the prevention and management of chronic NCDs.

Other barriers associated with IPE can be grouped into three categories: *administrative*, *academic* and *student*. Administrative barriers include scheduling issues, funding and external issues, such as support from professional associations, regulatory bodies, healthcare systems and community stakeholders. In this regard, collaboration between national dental associations and dental schools as the two major institutions representing national organized dentistry is of utmost importance. Academic barriers include reluctance of the dental schools to take on new roles, preconceived bias against IPE and career advancement issues. Student barriers consist of workload issues and relevance issues, when silo-based approaches occur in the curriculum in various professions. The IPE learners need to view their experience as relevant and valuable to their current stage of education and practice to make it successful.

In summary, to prepare a collaborative practice-ready workforce in oral health, it is critical to develop a solid educational foundation coupled with inter-professional clinical immersion to fully incorporate and sustain new models of integrated oral-systemic care.

5.4 Professional associations' role in advocacy

In light of the global challenges that oral health in general and the dental profession in particular are facing today, the NDA and dental school partnerships in the area of dental education, dental practice and public policy can be invaluable. However, the collaboration between these two important stakeholders in oral health leaves much room for improvement. A recent study by Yamalik et al. (2013) on the extent and efficiency of collaboration between dental schools and NDAs in the European Region found that about 50% of universities had only "occasional" relationships with NDAs and 88% of NDAs were not involved in the development of the undergraduate curriculum.

Maximizing the synergy between NDAs and academia will be critical in the future when considering the fact that dental schools exert influence on policy makers regarding dental workforce issues, economic/political matters, implementation of new technologies and improvement of national oral health in general.

The NDAs, as representatives of organized dentistry, may be able to encourage various collaborative initiatives to improve oral health and increase preventive services, for example for underserved communities, for the provision of the right care in the right setting, and for organizing public education outreach programs.

The dental profession's participation in global workforce issues can also be made more significant through professional associations. Dentists can exert great influence on the development of public policies at national, regional and global levels through their affiliation in NDAs. Global oral healthcare is undergoing unprecedented changes within the context of evidence-based rationales and emerging information technologies. Such transformation requires carefully thought-out strategies to ensure success. The bold leadership of the dental profession through effective collaboration with medicine, public health and other health disciplines as well as high-level advocacy and participation in policy development will be critical to this success.

6. Conclusion

Collaborative practice and inter-professional education are the strategies to improve access to care and achieve better quality of services efficiently. Practice of good oral health ultimately is based on the commitment to serve the patient.

The findings presented in this report are consistent with the Vision 2020 Framework introduced in the beginning of the report (Figure 1). Optimal oral health is a function of a variety of factors, such as the need and demand for oral health, technological advancements, socio-economic dynamics and adequate service delivery, in addition to collaborative education models that need to be balanced according to the context.

To ensure that those in need receive the care they require, attention should be focused on developing the relevant workforce models, reducing service fragmentation and increasing access to quality services through collaborative patient-centered care.

Annex: The dental team

➢ Dental hygienists

Traditionally, dental hygienists worked in the private sector in dentists' offices and provided oral health education and promotion as well scaling and polishing of teeth (Johnson 2003). Currently, there is a tendency to combine the training of dental therapists and hygienists, so they can provide preventive and treatment services for dental caries and prevention and treatment of periodontal disease. For example, the Netherlands has combined the two roles and is training 300 of these individuals each year. At the same time, the number of dentists is being reduced by 20% (Northcott at al. 2013). In Australia, such dually trained professionals are designated as oral therapists (Nash, Freidman et al. 2008).

➢ Denturists

Denturists are members of the oral healthcare team who can fabricate, with or without the prescription of a dentist (depending on local regulations), removable prosthetic appliances (dentures) to replace missing teeth. The length of their training varies throughout the world, ranging from 18 months to three years (Tuominen 2003).

➢ Expanded function chair-side assistants (dental nurses)

The term for the role varies by country, and their work is typically focused on assisting dentists in preparing instruments, completing procedures that have been initiated, and developing radiographs. They may also, in some jurisdictions, place dental sealants and restore teeth with biomaterials prepared by dentists (Roubach 2010)

➢ Community oral health workers/aides/coordinators

The role of oral community health workers is to promote oral health through education, as well as to screen, coordinate and administer referral when needed. This type of health worker has been widely used around the world for diverse activities in promotion, including oral health in areas when health professionals are not readily available.

In Thailand, general community health workers have been used as oral examiners and oral health educators. The community care model in Thailand also trained secondary school graduates in a two-week program to scale teeth, sterilize instruments, control pain and make appropriate referrals (Anumanrajadhon et al. 1996). Even though community health workers are not formal oral health team members, they may play an important support role to the professionals.

Community Dental Health Coordinators are recruited in some states of the USA from the same communities in which they serve. Typically they work in underserved rural, urban and Native American communities and focus on oral health education and disease prevention. Community Dental Health Coordinators receive 1,872 hours of instruction and work under dentists' supervision (ADA 2013).

➢ Dental therapists

Dental therapy evolved in New Zealand and has spread to many other countries around the world. In 1921, New Zealand developed a two academic year program to train high school graduates to become dental nurses (Nash at al. 2012). The nurses were then assigned to school-based dental clinics throughout New Zealand.

Today 97% of New Zealand's children are cared for by dental therapists (the name changed in 1980) who are assigned to every elementary and middle school in the country (Nash 2004). The dental therapists work under the general supervision of a district dental officer. The model developed by New Zealand was subsequently followed by other countries in an attempt to improve access to oral health services, particularly for children. There are 54 countries documented in the literature where dental therapists are currently being used, most often in school-based programs for children (Nash 2005).

It is notable that dental therapists serve in both developed and developing countries. Early adopters of dental therapists include Malaysia (1948), Sri Lanka (1949), Singapore (1950), Tanzania (1955) and the United Kingdom (1959). Later on some additional countries added dental therapists to their workforce: Australia (1966), Thailand (1968), Jamaica (1970), Canada (1972), Fiji (1973), South Africa (1975), Trinidad and Tobago (1975), Suriname (1976) and Hong Kong (1978) (Nash et al. 2012).

In the United States, the Alaska Native Tribal Health Consortium introduced dental therapists in Alaska in 2005 (Wetterhall et al. 2010). In 2009, the state of Minnesota authorized the new profession of dental therapists to provide care to underserved communities. The first dental therapists entered practice in Minnesota in 2011 (MDH 2014).

Originally designated as dental nurses, dental therapists traditionally worked in the public sector to improve access to oral health services for underserved populations. In some countries, dental nurses are permitted to work in private practices as well and provide a range of services from prevention to restoration of primary and young permanent teeth, pulpotomies, placement of stainless steel crowns and extraction of primary teeth. Typically, dental therapists receive 18 months of training (2400 hours of curriculum) for qualification (Nash et al. 2012).

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