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COMMUNITY DENTISTRY AND ORAL EPIDEMIOLOGY

A review of the global literature on dental therapists

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Abstract – *Objective:* Access to adequate oral health care is deficient in many parts of the world. Many countries are now using dental therapists to increase access, particularly for children. To inform the discussion on dental therapists in the workforce, particularly in the United States, the W.K. Kellogg Foundation funded a review of the global literature to identify as many documents as possible related to the practice of dental therapists since the establishment of the School Dental Service in New Zealand in 1921. *Methods:* Consultants in each of the countries considered to have a substantive literature on dental therapists were asked to participate in the research; seventeen in total. In addition to identifying and reviewing published articles, a focus of the research was on identifying 'gray' documents. Standard databases were searched for key words associated with dental therapists. In addition, searches were conducted of the governmental and dental association websites of all countries known to have dental therapists in their oral health workforce. *Results:* Fifty-four countries, both developing and developed, were identified where dental therapists are members of the workforce. Eleven hundred documents were identified from 26 of these countries, with over 2/3 of them cited in the published monograph. Reliable evidence from the related literature and verbal communication confirmed the utilization of dental therapists in an additional 28 countries. Thirty-three of the countries were members of the Commonwealth of Nations, suggesting a mechanism of spread from New Zealand.Variable lengths of training/education existed for dental therapists with the tradition being 2 years postsecondary. In a few countries, the training of therapists and hygienists is now being combined in a three academic year program. Historically, dental therapists have been employed by government agencies caring for children, typically in school-based programs. Initiatives in some countries allow limited care for adults by dental therapists with additional training. *Conclusions:* The evidence indicates that dental therapists provide effective, quality, and safe care for children in an economical manner and are generally accepted both by the public and where their use is established, by the dental profession.

Key words: access to care; dental therapists; oral health workforce

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Access to adequate oral health care is deficient in many parts of the world. Many countries are now utilizing dental therapists to increase access, particularly for children. Oral health is poor for many Americans, with barriers to accessing care creating significant oral health disparities among America's children (1–4). In addressing this issue, efforts have focused on the capacity of the oral healthcare workforce, with calls for expanding the workforce in the United States of America to include the development and deployment of individuals with skills in caring for children traditionally associated with the school dental nurse/dental therapist in New Zealand and many other countries (5, 6). A dental therapist is a 'limited' practitioner who can provide basic dental care in the same manner as a

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dentist (7, 8). Historically, the focus of a dental therapist has been on the prevention and treatment of dental disease in children; however, in some countries, they may provide care to adolescents and adults (9–21).

Although there is appreciable geographic variation, worldwide the scope of a dental therapist's practice generally includes the following: examination, diagnosis and treatment planning; exposing and interpreting radiographs; oral health education; preventive services such as prophylaxis, fluoride therapy, fissure sealants and dietary counseling; preparation of cavities in primary and permanent teeth and restoration with amalgam and composite; preformed stainless steel crowns; pulpotomies; and the extraction of primary teeth.(9) In some countries, they may also extract permanent teeth.(22–24).

The introduction of dental therapists to the oral healthcare team in the United States is controversial (25–28). Some of the controversy relates to an inadequate understanding of the utilization of dental therapists internationally as members of the dental team. To inform the discussion on dental therapists in the workforce, particularly in the United States, the W.K. Kellogg Foundation funded a review of the global literature to identify as many documents as possible related to the practice of dental therapists since the establishment of the School Dental Service in New Zealand in 1921. This article summarizes, for the referred literature, the extensive literature-based review of the history and practice of dental therapists throughout the world. The complete review of 460 pages was made available at the W.K. Kellogg Foundation website (29).

Methods

Consultants in each of the countries considered to have a substantive literature on dental therapists were asked to participate in the research; seventeen in total. Additional consultants were sought for other countries identified as employing dental therapists during the review. However, none could be found. All consultants were knowledgeable academics/public health officials in their respective countries with a history of having dealt with the issue of the dental workforce. In addition to reviewing published articles, a focus of the research was on identifying 'gray' documents, that is, reports of governmental and nongovernmental organizations (NGOs), which addressed the practice of dental therapists, but were not in the academic literature. In addition to obtaining copies of the documents, consultants also translated those that were in languages other than English and prepared written summaries.

The following databases were searched: ISI Science Citation Index; ISI Social Science Citation Index; Clinical Controlled Trials Register, Cochrane Library; Cumulative Index to Nursing and Allied Health Literature; Database of Abstracts of Reviews of Effects (DARE); System of Indexing Grey Literature in Europe (SIGLE); Medline; Pub Med. Google Scholar; and the Google search engine were also searched. Key words searched were 'dental nurse', 'school dental nurse', 'dental therapist', 'school dental service', 'school dental therapist', 'school--based dental care', 'dental auxiliaries', and 'dental workforce'. In addition, searches were conducted of the governmental and dental association websites of all countries known to have dental therapists in their oral health workforce.

The focus of this research was to identify and annotate the available world literature related to the use of dental therapists in the oral health workforce. No attempt was made to conduct a 'systematic' review of the literature.

Results

Eleven hundred (1100) documents were identified that directly or indirectly related to the utilization of dental therapists in the global oral health workforce and were included in the bibliography of the W.K. Kellogg report; two-thirds of these documents were cited in the body of the document (29). Themes identified in the literature were the following: history and distribution of dental therapists; education/training; legislation, registration and licensure; scope of practice and practice settings; oversight, supervision, and safety of care; access to and effectiveness of care; quality of technical care; perspectives of the dental profession; and perspectives of the public (29). These are summarized in the sections that follow:

History and distribution of dental therapists

The utilization of dental therapists in the global oral health workforce began in New Zealand in 1921 (30, 31). Subsequently, other countries, lacking an adequate oral health workforce, followed New Zealand's lead.

The research identified 54 countries where dental therapists currently are utilized, most often in school-based programs for children. Literature was identified from 26 of these countries: Anguilla, Australia, Bahamas, Botswana, Brunei, Canada, Fiji, Guyana, Hong Kong, Jamaica, Malaysia, Netherlands, New Zealand, Papua New Guinea, Samoa, Seychelles, Singapore, South Africa, Sri Lanka, Suriname, Tanzania, Thailand, Trinidad and Tobago, United Kingdom, United States, and Zimbabwe (29).

No documents were able to be identified for the other 28 countries. However, there was evidence that dental therapists practice in 16 of these 28 other countries. They are Barbados, Cook Islands, American Samoa, Federated States of Micronesia, Granada, Kiribati, Marshall Islands, Nepal, Palau--Belau, Solomon Islands, Tokelau, Tonga, Vanuatu, Vietnam, and Northern Mariana Islands. There is anecdotal evidence that dental therapists practice in the other 12: Belize, Benin, Burkina Faso, Costa Rica, Gabon, Gambia, Laos, Mali, Malawi, Myanmar, Togo, and Swaziland.

Early adopters of the dental therapists include the following: Malaysia (1948) (15), Sri Lanka (1949) (32), Singapore (1950) (33), Tanzania (1955) (23), and the United Kingdom (1959) (34). Additional countries added dental therapists to their oral health workforce later, including Australia (1966) (35), Thailand (1968) (36), Jamaica (1970) (17), Canada (1972) (11), Fiji (1973) (37), Trinidad and Tobago (1975) (38), Seychelles (1974) (21), South Africa (1975) (22), Suriname (1976) (39), and Hong Kong (1978) (40).

The utilization of dental therapists is more common in countries that were members of the British Commonwealth. Of the 54 countries employing dental therapists, 33 are members of the Commonwealth of Nations (29).

In the United States, the Alaska Native Tribal Health Consortium introduced dental therapists to care for Alaska Natives in tribal villages in 2005 (41–43). In 2009, the state of Minnesota authorized the training and practice of dental therapists to care for underserved segments of its population, with the first dental therapists entering practice in 2011 (44, 45).

Dental therapists are utilized in both developed and developing countries. Five of the top six countries of the world on the Human Development Index employ dental therapists in their oral health workforce, at least to some extent: Australia, Netherlands, New Zealand, Canada, and recently the United States. Other countries employing dental therapists in the top 50 countries of the Index are: Hong Kong, Singapore, United Kingdom, Brunei and Barbados (29).

No countries were identified where dental therapists are the sole providers of care, which does not mean that they do not exist. It is also possible that there are areas of subpopulations of countries where the only dental treatment available is from dental therapists.

The training/education of dental therapists

New Zealand pioneered the development of dental therapists, with the first class of 29 school dental nurses graduating from a 2-year posthigh school vocational training program in Wellington, New Zealand in 1923 (30). They were trained to provide dental care for primary school children and were deployed to serve in a public school dental service.

Vocational training in a 2–3 year curriculum is the norm in most countries utilizing dental therapists, with the awarding of a certificate or diploma on completion. In some countries, the training/education of dental therapists has moved to university settings, sometimes in combination with the dental hygienists, with curricula of 2 ¼–3 years in length; though, in one country, the curriculum is of 4 years duration (9, 46–48).

Gaining knowledge of the basic biomedical sciences supporting dental practice and the acquisition of perceptual motor skills tend to be the focus of the initial period of curricula, with intense clinical training taking place subsequently. A strong emphasis on community oral health promotion and disease prevention exists in the curricula.

The training/education programs of some countries present opportunities for dental therapists that include dual training/education as dental therapists/dental hygienists, as well as graduate degree education (8, 49, 50). Continuing education modules and/or formal education programs are available in some countries, enabling dental therapists to add skills to their scope of practice (9, 51).

Legislation, registration, and licensure

The legislation relating to the current attempt to add dental therapists to the workforce in the United States is pertinent to this review. In 1949, legislation directed the Massachusetts Department of Public Health to provide dental hygienists two years of training after which they would be permitted to prepare and fill cavities in children's teeth under the supervision of a dentist (52). Under

pressure of the dental associations, the law was rescinded a year later (53). Again in the 1970s, authorization was provided for the '*Forsyth Experiment*', which successfully trained dental hygienists to provide basic dental services. However, under pressure from dentists, the program was terminated before its conclusion (54).

In 2003, the Alaska Native Tribal Health Consortium (ANTHC) sent Native American Alaskans to New Zealand to train to become dental therapists (41, 42). They returned to be employed as Dental Health Aide Therapists (DHATs). The American and Alaska Dental Associations sued the ANTHC and the individual DHATs for the illegal practice of dentistry, but the suit was withdrawn once the Alaska attorney general ruled that the DHATs were practicing under federal legislation, thus not subject to state law (55). Supervising dentists establish the DHAT's scope of practice by documenting in 'standing orders' those services they can perform under indirect and general supervision (56).

In 2009, the Minnesota state legislature authorized the creation of two categories of dental therapists, a dental therapist (DT), and an advanced dental therapist (ADT). As the legislation was passed to enhance access to care, DTs and ADTs are only permitted to practice in settings serving low-income and underserved populations (44).

Literature on legislation, registration, and licensure of dental therapists is sparse for most countries. As most countries limit dental therapists to governmental service, they are not necessarily licensed or registered. Their scope of practice regulates their provision of care, with responsibility for supervision and review designated to their respective ministries of health.

Legislation, registration, and licensure vary from country to country. National, state, or provincial legislation authorizes the practice of dental therapists. Regulation is generally by Dental Councils (Dental Boards). In many countries where dental therapists are public employees in school dental services, they are certified and regulated directly by the government's ministry of health, or their employing service. In a few countries where more autonomy for practice is granted, dental therapists are licensed as professional practitioners just as are dentists.

Practice settings and scopes of practice

In many countries, the setting for the practice of dental therapists has expanded from school-based clinics to community-based health centers, hospital clinics, and mobile dental units. However, the service has continued to focus on caring for school children, though not exclusively, as care is provided to adults in some countries (22–24, 46, 48, 57, 58). Dental therapists in some jurisdictions are permitted to work in private practices.

The following countries utilize dental therapists as public employees serving children in a school dental service: New Zealand; Australia; Hong Kong; Singapore; Malaysia; Jamaica; Trinidad and Tobago; Bahamas; Anguilla; Papua New Guinea; Sri Lanka; Seychelles; Brunei Darussalam; Guyana; Samoa; Suriname; and the United Kingdom (29). In the several countries for which literature was not able to be obtained, it was reported that dental therapists also function primarily in caring for school children. In these countries, the dental therapist's scope of practice is similar and includes basic procedures for providing primary preventive and restorative care for children as indicated previously.

While dental therapists' scope of practice typically is restricted to children, an increasing number of countries permit dental therapists, frequently with additional training, to treat adults as well. In New Zealand and Australia, dually qualified dental hygienists/dental therapists may provide dental therapists' treatments to children and adolescents and dental hygiene care for adults. Dental therapists may provide care to adults if the therapist is educated and registered in that scope of practice (59).

Oversight, supervision, and safety of care

The literature on dental therapists emphasizes their oversight and supervision by dentists to protect the public. As the majority of dental therapists work with children in public school-based programs, supervision is by a government dentist, who may or may not be on site. Dental therapists adhere to standing orders and policy frameworks that define their scope of practice, which are determined by the government service in which they work.

Levels of supervision vary among countries and in different settings within the same country. In some countries, dental therapists may practice independently without dentist supervision and in others independently, but with a collaborative/consultative relationship with a dentist.

The literature did not reveal any issues of safety or harm as a result of care provided by dental therapists (29).

Quality of technical care

There have been many evaluations of the technical quality of care provided by dental therapists over the past 60 years. These studies vary in their design and quality but have consistently found that the quality of technical care provided by dental therapists (within their scope of competency) was comparable to that of a dentist and in some studies was judged superior (54, 60–76).

The continued utilization of dental therapists in the 54 countries identified provides tacit documentation of an acceptable quality of technical care provided by dental therapists.

Access to care and effectiveness of care

The impetus for adopting dental therapists as part of the oral health workforce has typically been to improve access to care with the intention of improving the oral health of children.

Studies from countries where dental therapists are public health employees of school dental programs demonstrate the positive impact of this delivery model upon the care of children, especially in reducing the amount of untreated decay. Studies show high enrollment in school dental programs over time and reveal their positive influence in improving access to care for large numbers of children, often the entire population of elementary school children.

Evaluations of dental services based on the oral health of the population must take into account falling levels of dental caries due to other factors, such as fluoridation, and the many factors that mediate the relationship between service provision and population health. However, the proportion of dental caries in children that has been effectively treated can be considered a proxy indicator of the accessibility and effectiveness of dental care.

For example, in 1964 in New Zealand, 72% of all the elementary school children's teeth affected by dental caries had been restored. The equivalent figure for the United States was 23% (77). The average number of untreated decayed teeth per 15- to 19- -year-olds in New Zealand fell from 3.2 in 1962 to 1.3 in 1976 (78). Findings of a 2009 oral health survey by the Ministry of Health found that 81.7% of the teeth requiring care had been treated (79).

Again in New Zealand in 2010, over 60% of children, aged 2–4, were enrolled in and utilized the publicly funded child oral health services; 98% of 5- to 13-year-olds were enrolled (79). As 2003 data indicate, essentially all carious teeth of the elementary school children had been restored or extracted (primary teeth) at the end of a school year (80). Using 1988-1994 data, the percentage of carious primary teeth, through age 14, that had been restored in the United States was 63.3%; for the permanent teeth, it was 74%. The percentages dropped to 48.7% for primary teeth for children at 100% of the federal poverty level; and 72.3% of permanent teeth of children in that socioeconomic group (81). One study reported that only 22% of all children in the United States 6 years of age or younger had received any dental care (82).

Repeated evaluations show very high utilization rates of similar school dental services elsewhere including 80% of Saskatchewan schoolchildren before the program was terminated (83), 95% of primary schoolchildren in Hong Kong (84), and 96% of elementary and 67% of secondary school children in Malaysia (85). Children from lower socioeconomic groups are more likely to benefit from school dental programs staffed with dental therapists.

A number of reports indicate the economic value of dental therapist-led school dental services. The school dental programs in New Zealand and Australia cost less than private fee-for-service systems for the same service (86–89). For example, the average cost of school-based dental care in New Zealand is $99 (US)/child (90). In the private sector in New Zealand, an examination, radiographs, and cleaning alone would be similarly priced, and a simple restoration would cost an additional $99; a fissure sealant $47 (90).

Recent data from Hong Kong indicate that the average cost of care for the 315,000 children participating in the school dental service was approximately $78/year (US).

The opportunity for more economical care is related, in part, to the salary differential between dental therapists and dentists. An average New Zealand therapist earns $30–45,000 (US), whereas the average private practicing dentist earns $120,000–$150,000/year (US) (86).

Data from the Saskatchewan program in Canada indicated that the cost of treating a child fell over 271%, from $341.89 in private practice in 1974 to $91.98 in 1986 in the school dental service (91). In a 2011 report, Canadian Center for Policy Alternatives analyzed the financing of the Saskatchewan school-based program of the 1980s that included 85% of 5- to 14-year-olds in the province. The report concluded that if the program existed throughout Canada today, the inflation adjusted cost for comprehensive preventive and restorative

care would be $176.25/child. As a comparison, a general dentist's fee in the private sector today is approximately $225 for a pulpotomy and stainless steel crown. Such a public, school-based program utilizing dental therapists for treating all of Canada's 5- to 14-year-olds would cost $560 million, representing a dramatic savings in expenditures (92).

Perspectives of the dental profession toward dental therapists

The perspective of the dental profession is well represented in the literature on dental therapists. A comprehensive range of views is evident, but in general, these views polarize into opponents and proponents. In some cases, the intellectual quality and tone of the debate has reflected poorly on the dental profession.

Many dentists and professional dental associations in the United States are opposed to the inclusion of dental therapists on the dental team (25–27, 93). They have asserted that dental therapists threaten the health and safety of the public by providing a lower quality of care, and that they open a wedge for unqualified individuals to practice dentistry. Dental therapists have been described variously as a hazard and 'a menace to the public, a menace to the [dental] profession, and an injustice to those seeking to enter the ranks of the profession'(94).

Proponents of dental therapists refute these assertions and accuse the opponents of having a hidden agenda, particularly of looking after their own economic interests (95–97). They cite a study that has shown that dentists, despite not knowing who dental therapists are or what they do, oppose them anyway (98).

Proponents note that dental therapists' care has been evaluated on numerous occasions and in multiple countries. They argue that they provide high quality, safe, and effective care equal to that of dentists working under the same conditions and do so at a lower cost. Dental therapists included on the dental team are thought to liberate dentists' for more complex treatment. They also argue that services employing dental therapists extend the geographic reach of dentistry, increase access to care, and provide a safety net for those who cannot otherwise obtain care. Proponents equate the use of dental therapists with the utilization of 'mid-level providers', such as nurse practitioners, who function effectively in other areas of health care.

Both proponents and opponents of dental therapists have attributed views to the general public, often in the absence of evidence. Proponents claim that 'patients—both adults and children—of every socioeconomic stratum will find care delivered by dental therapists to be entirely acceptable'(99). Opponents have argued that they would not be accepted by the public and might be resented by individuals in lower socioeconomic groups as providing second-class, inferior care (63).

The dental profession in the countries reviewed is generally supportive of the role dental therapists play in caring for the oral health of the population, specifically with regard to children (100–103). To the extent that concern or dissatisfaction could be identified in the literature, it typically related to dental therapists treating adults or practicing independently (104). The evidence suggests that once dental therapists have been introduced in a country, professional support for them increases over time.

Harold Hillenbrand, the respected Executive Director of the American Dental Association from 1946 to 1970, said: 'When the dental history of our time is eventually written, I believe the New Zealand Dental Nurse Program will be considered one of the landmark developments in the practice of dentistry and dental public health'. He went on to say New Zealand has 'pioneered in a very effective method for delivering dental health services to children'. Finally, he concluded, 'the New Zealand experience proves that we can develop an auxiliary program—and a very advanced one—that is acceptable to and approved by the profession of the country involved'(105).

Perspectives of the public toward dental therapists

In the United States, philanthropic foundations frequently provide leadership for the public in identifying societal problems and funding pilot projects to stimulate both private and public sectors in resolving them. The problem of access to health care and its negative impact on the health of poor and underserved populations has been a focus of several US foundations in recent years. With respect to oral health issues, these foundations have recognized that dental therapists in the oral health workforce can assist in addressing the problems of access and disparities. They have provided funds for research, advocacy, and implementation of oral healthcare programs. Among the foundations are the following: Robert Wood Johnson

Foundation; Pew Charitable Trust; Rasmuson Foundation; W.K. Kellogg Foundation; and the Macy Foundation (29).

The W.K. Kellogg Foundation commissioned a national survey on the views of Americans on the issue of access to dental care. 'More than three--quarters of respondents (78%) support an effort to train a new dental provider—a licensed dental practitioner—to work under the supervision of a dentist to provide preventive, routine care to people without regular access to care'(106).

The high level of utilization of school dental services employing dental therapists in a large number of countries is strong evidence they can provide care that is acceptable to and valued by parents, who have to provide consent for their children to enroll and be treated. Numerous and detailed evaluations of these programs, summarized in this literature review, reveal strong patient and parental support for dental therapists (29).

The people of New Zealand consider the School Dental Service with its dental therapists a New Zealand '*icon*'. Another report states: 'The School Dental Service has become an integral component of the New Zealand culture. To Kiwis it is like motherhood, apple pie and the flag' (5).

Parents in Saskatchewan were '*outraged*' at the termination of the school-based plan and the transfer of the children to the private sector for their dental care (107).

No evidence could be found to indicate that the public perspective of dental therapists in any country was other than positive.

Conclusions

While the evidence base for the utilization of dental therapists is variable in quality and could be enhanced; nonetheless, the global literature indicates the following:

- Dental therapists practice in 54 countries, including highly developed, industrialized ones, as well as developing countries.
- There are variable lengths of training for dental therapists, from 2 to 4 years, existing in a variety of vocational training/academic environments.
- Dental therapists typically practice as registered auxiliaries, but in some jurisdictions practice as licensed professionals.
- Dental therapists practice primarily in public clinics, typically associated with caring for school children.
- Dental therapists' scope of practice is primarily in caring for children, although several countries permit caring for adults, and others are moving in that direction.
- Dental therapists typically practice with general supervision by dentists.
- Dental therapists provide technically competent care in accordance with their scope of practice.
- Dental therapists improve access to care, specifically for children.
- Dental therapists are effective in providing oral health care within their scope of practice.
- Dental therapists have a record of providing oral health care safely.
- In general, the dental profession in a country accepts the care provided by dental therapists in its country as valuable.
- The public values the role of dental therapists in the oral health workforce.
- There is a movement in a few countries to integrate the training, and therefore scopes of practice, of the dental therapist and dental hygienist.
- Dental therapists included in the oral health workforce have the potential to decrease the cost of care, specifically for children.

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