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Recall intervals and time used for examination and prevention by dentists in child dental care in Denmark, Iceland, Norway and Sweden in 1996 and 2014

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Objective: The purpose of the present study was to explore intervals between regular dental examination and the time dentists spent for examination and preventive dental care of children in 1996 and 2014. ***Participants and Methods:*** In Denmark, Norway and Sweden, random samples of dentists working with children were included, while in Iceland all dentists were mailed questionnaires. Complete information was provided by 1082 of 1834 dentists (64%) in 1996 and 1366 of 2334 dentists (59%) in 2014. Results were assessed using chi-square and analysis of variance with post-hoc tests. ***Results:*** Some trends were consistent in all countries, but considerable differences in routines between the countries persisted during the period. The most used and maximum planned recall intervals were on average 14.8 (sd 4.8) and 18.5 (sd 4.6) months in 2014, respectively 3.1 and 3.5 months longer than in 1996 ($p<0.05$). In 2014 dentists used ample time delivering preventive care to children. Dentists reported spending significantly more time providing preventive care for caries risk children than for other children both in 1996 and 2014. Concurrent with extended intervals, dentists reported spending longer performing routine examinations in three of the four countries in 2014 than in 1996. ***Conclusions:*** This study of trends in dental care delivered by dentists during recent decades showed moves towards extended recall intervals and preventive care individualized according to caries risk. In addition, extending intervals could necessitate more time for a routine dental examination.

Key words: Dental check-ups, dentists, female dentists, prevention, professional practice, recall interval, trends

Introduction

Denmark, Iceland, Norway and Sweden have developed similar systems for child dental care, which aim to provide cost-effective high quality services for all children. The public dental services in all countries except Iceland have, for decades, provided comprehensive dental care including preventive oral care to children and adolescents free of charge. In Iceland, parents have had to pay for parts of dental care provided by private dentists.

Promoting the oral health of children includes activities directed at individuals, groups of children and the community (Petersen *et al*., 1999). Oral health legislation approved in the 1980s in Denmark, Norway and Sweden particularly emphasized preventive care (Folketinget, 1986; Socialstyrelsen, 1985; Sosialdepartementet, 1983), while in Iceland emphasis on preventive care was introduced in 2004 (Ministry of Health and Social Security, 2004). Caries preventive interventions are intended to reduce disease and the cost of dental care, and may thereby benefit both individuals and society in the long run. However, few preventive methods are evidence-based (Mejáre *et al*., 2015), preventive care is time-consuming and may be considered costly from the perspective of policy makers.

Denmark, Iceland, Norway and Sweden are countries with similar cultures, traditions and socioeconomic conditions. In northern European and other western countries the decline in and polarization of dental caries in children has been well documented during recent decades (Norderyd *et al*., 2015; Pitts *et al*., 2007). From 1995 to 2014, the proportion of children who developed dentinal caries fell by 20% among 12-year-old children in Norway (Statistics Norway, 2017). Similar changes have been observed in Denmark, 18% (Sundhedsstyrelsen, 2016) and Sweden, 18% (Socialstyrelsen, 2006, 2015; Wang *et al*., 1995). Iceland experienced a major financial crisis in 2008, reimbursement of preventive services for children was reduced and dentists reported increasing caries prevalence (Sveinsdottir and Wang, 2014).

Despite the overall decline in dental caries, the disease remains a public health problem among children and efforts to limit the burden it causes are still warranted. During recent years, the individualization of preventive care has been advocated (Pienihäkkinen et al., 2005; Wang *et al*., 1995) on top of population or community-based programs. This proposes that risk assessment should be linked to appropriate preventive care and that recall intervals should be based on individual needs (Twetman, 2016).

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Preventive care provided to children was investigated in Denmark, Iceland, Norway and Sweden in 1996 (Källestål *et al*., 1999; Wang *et al*., 1998). That study concluded that substantial resources were invested in all counties, and that routines in care varied widely between the countries, despite similar prevalence of oral diseases. Considering the decline in caries prevalence in children over recent decades, one might expect that the resources required for preventive dental care programs would change. The purpose of the present study was to explore changes in length of the intervals between regular dental examinations and time dentists spent for examination and preventive care of children in Denmark, Iceland, Norway and Sweden in 1996 and 2014.

Method

Dentists in Denmark, Iceland, Norway and Sweden were included in the study. In cooperation with the national associations for dentists, competency centres, health authorities and chief dental officers, a questionnaire was distributed by electronic mail to dentists providing dental care to children. In Denmark, Norway and Sweden, random samples of public health dentists were included, while in Iceland all dentists were approached.

Dentists with invalid addresses and those who were retired, specialists, practicing abroad or who returned incomplete questionnaires were excluded. To obtain response rates of 50% or higher in all countries, two remainders were distributed in Norway and Sweden, three in Denmark and four remainders in Iceland.

In 2014, complete data were obtained from 65% of dentists in Denmark, 62% in Iceland, 60% in Norway and 51% in Sweden. In total, information from 1366 of 2334 dentists (59%) was used in the analyses.

In 1996 information was obtained from 67% of dentists in Denmark, 48% in Iceland, 72% in Norway and 74% in Sweden, providing information from 1082 of 1690 dentists (64%) (Källestål *et al*., 1999; Wang *et al*., 1998). The number of dentists included by country and year of study are presented in Table 1.

The questionnaires in 2014 were similar to those used in 1996 (Källestål *et al*., 1999; Wang *et al*., 1998). Most questions were identical, while some were modified to obtain the relevant information about the situation in 2014. The questionnaire was piloted among Norwegian dentists working with children to eliminate misunderstandings and in the other countries with similar languages, the researchers made some minor adjustments to adapt to the national systems. The Icelandic author, also fluent in Norwegian translated the questionnaire into Icelandic.

The questionnaire enquired about the gender and age of the dentists and about their work situation, number of years working with children, whether they worked full time or not and the proportion of working time the dentists spent with children.

Resource use for child dental care was assessed by questions about the intervals between routine examinations; the maximum and the most frequently planned interval (months) between routine examinations for children and the time (in minutes) used for routine oral examination.

The time used for preventive care was ascertained with questions about the proportion of clinical time dentists used to deliver preventive care and the proportion of time used for prevention directed towards groups and the child population. The number of minutes dentists spent giving preventive care to children with and without elevated risk of caries was reported.

The statistical analyses were performed using Statistical Package for the Social Sciences (SPSS, Inc. Chicago, USA, version 24). Data files from 1996 and 2014 were linked. Data according to country and year are presented in cross tables. Proportions of dentists are given in Tables 2-5 and the numbers of dentists are given in Table 1; the internal dropout was minimal. Differences were tested using chi-square and analyses of variance with post-hoc tests not assuming equal variance (Dunnett T3). Test results of pairwise comparisons between Denmark (D), Iceland (I), Norway (N) and Sweden (S) are given beneath the tables. P-values less than 0.05 were considered statistically significant.

Participation in this study was voluntary and data were treated anonymously. Answered and returned questionnaires were regarded as giving consent. The study was reported to the Norwegian Social Science Data Services and judged not to need further approval by the Regional Committee for Medical and Health Research Ethics in south-eastern Norway. In the other countries no additional approval was required.

Table 1. Numbers of participating dentists in Denmark, Iceland, Norway and Sweden in 1996 and 2014 (N=2448).

	Denmark	*Iceland*	*Norway*	*Sweden*	*Total*
1996	262	113	405	302	1082
2014	440	161	588	177	1366
All	702	274	993	479	2448

Results

Table 2 shows the dentists' gender and age, number of years they had been working with children, whether they worked full time and the proportion of working time they spent with children, in 1996 and 2014 in Denmark, Iceland, Norway and Sweden.

More female dentists were working with children in 2014; substantial increases (12%, 18% and 26%) were found in Sweden, Norway and Iceland ($p<0.05$). In Denmark the already high proportion of females in child dental care in 1996, had increased from 85% to 90% in 2014 ($p<0.05$). In total, the mean ages of dentists working with children in 1996 and 2014 were similar (ns), 46 years of age (sd=10) and 44 years of age (sd=13). The exception was Norway, where the age of dentists working with children was lower in 2014 than in 1996 ($p<0.05$). The length of the dentists' work experience spent on child dental care was slightly reduced during the study period in Denmark and Norway ($p<0.05$) but remained unchanged in Iceland and Sweden (ns).

Nearly all dentists in Denmark and most in Norway spent most of their working time with children, while in Iceland and Sweden few dentists spent most of their working time with children in either 1996 or 2014 (Table 2).

Table 2. Characteristics of dentists by country in 1996 and 2014.

		1996		*2014*		*Change 1996-2014*
		Mean	*Sd*	*Mean*	*Sd*	*p-value*
Age, years[1]	Denmark	47	6	46	13	ns
	Iceland	45	12	46	12	ns
	Norway	46	10	41	13	<0.05
	Sweden	44	9	46	13	ns
	All countries	46	9	43	13	<0.05
Working with children, years[2]	Denmark	20	9	18	13	<0.05
	Iceland	18	11	19	12	ns
	Norway	20	10	14	12	<0.05
	Sweden	18	9	19	14	ns
	All countries	19	9	16	13	<0.05
		Proportion of dentists				
Female[3]	Denmark	85		90		<0.05
	Iceland	24		42		<0.05
	Norway	47		73		<0.05
	Sweden	60		72		<0.05
	All countries	57		74		<0.05
Working full time[4]	Denmark	63		61		ns
	Iceland	87		(+)		-
	Norway	84		80		ns
	Sweden	61		62		ns
	All countries	73		70		ns
Use 50% or more of working time with children[5]	Denmark	100		92		<0.05
	Iceland	35		9		<0.05
	Norway	74		71		ns
	Sweden	21		19		ns
	All countries	59		63		ns

(+) Question not posed

Differences ($p<0.05$) between two countries; Denmark (D), Iceland (I), Norway (N) and Sweden (S)

1996:
[1] S-D
[2] N-S, D-S
[3] D-I, D-N, D-S, I-N, I-S, N-S
[4] D-I, D-N, I-S, N-S
[5] D-I, D-N, D-S, I-N, I-S, N-S

2014:
[1] N-I, N-S, N-D
[2] N-I, N-S, N-D
[3] D-I, D-N, D-S, I-N, I-S
[4] D-N, N-S
[5] D-I, D-N, D-S, I-N, I-S, N-S

The proportions of dentists who spent more than half of their working time serving children was considerably lower in Iceland in 2014 than 18 years earlier ($p<0.05$).

Table 3 shows the duration of recall intervals between examinations reported by dentists in the four countries in 1996 and 2014. In all countries, the most used interval and the maximal recall intervals were longer in 2014 than in 1996 ($p<0.05$). The intervals in Iceland were substantially shorter than in the other countries both in 2014 and in 1996 ($p<0.05$), while in Denmark the most used interval increased by 5.5 months and the maximal interval by 6.3 months during the study period.

In 1996, the mean time dentists spent performing a routine examination varied between the countries from 14 minutes in Sweden to 23 minutes in Norway ($p<0.05$) (Table 3). The examination time was unchanged 18 years later in Norway (ns), while in the other countries it had increased by 2 to 6 minutes ($p<0.05$).

Table 4 shows the proportion of clinical time dentists used for prevention and the proportion of preventive activities directed towards groups and population. Of total clinical time, 20% to 30% was spent on preventive care in all countries in 2014, varying from 18% in Sweden to 31% in Iceland ($p<0.05$). Minimal changes were reported from 1996 except in Iceland where substantially less time was reported for preventive dental care ($p<0.05$). In all countries, dentists directed no or a very low proportion of their preventive time on groups or the population in either year.

Table 5 shows that in all countries, dentists reported using considerably longer time for preventive care on caries risk than non-risk children. Small or no differences in time used for prevention were reported for both caries risk children and non-risk children between countries and over time. In Denmark, a small reduction in time used for preventive care of risk children was reported over time, but still in 2014 the time for prevention spent on risk children in Denmark was longer than in the other countries ($p<0.05$).

Table 3. Recall intervals, most used and maximum routine recall intervals for children and time used for routine oral examination per child.

		1996		*2014*		*Change 1996-2014*
		Mean	*Sd*	*Mean*	*Sd*	*p-value*
Recall interval, most used, months[1]	Denmark	9.1	2.0	14.7	3.5	<0.05
	Iceland	7.4	2.2	9.5	2.7	<0.05
	Norway	13.5	2.3	16.0	3.5	<0.05
	Sweden	13.1	3.0	16.5	4.1	<0.05
	All counties	11.7	3.4	14.8	4.8	<0.05
Recall interval, maximum, months[2]	Denmark	10.8	2.1	17.1	3.7	<0.05
	Iceland	9.9	2.8	12.1	2.8	<0.05
	Norway	17.0	3.8	20.8	3.3	<0.05
	Sweden	17.9	5.1	20.1	4.5	<0.05
	All counties	15.0	5.0	18.5	4.6	<0.05
Examination time per child, minutes[3]	Denmark	17	7	19	5	<0.05
	Iceland	16	8	22	8	<0.05
	Norway	23	7	24	7	ns
	Sweden	14	6	20	9	<0.05
	All counties	18	8	21	7	<0.05

Differences ($p<0.05$) between two countries; Denmark (D), Iceland (I), Norway (N) and Sweden (S)
1996 [1] N-I, N-D, I-S, I-D, S-D 2014: [1] N-I, N-D, I-S, I-D, S-D
[2] N-I, N-D, I-S, I-D, S-D [2] N-I, N-D, I-S, I-D, S-D
[3] N-I, N-S, N-D, S-D [3] N-I, N-S, N-D, I-D

Table 4. The proportion of clinical time used for prevention and the preventive time directed towards groups/population of total preventive time.

		1996		*2014*		*Change 1996-2014*
		Mean	*Sd*	*Mean*	*Sd*	*p-value*
Time for prevention, % of clinical time[1]	Denmark	24	18	23	16	ns
	Iceland	50	23	31	21	<0.05
	Norway	18	13	21	16	<0.05
	Sweden	(+)	-	18	16	-
	All counties	24	19	22	18	ns
Preventive time directed at groups/population, % of preventive time[2]	Denmark	6	10	2	6	<0.05
	Iceland	1	3	0*	-	-
	Norway	1	6	3	10	<0.05
	Sweden	0*	-	2	8	-
	All counties	3	8	2	9	ns

(+) Question not posed * Estimated by the national researcher
Differences ($p<0.05$) between two countries; Denmark (D), Iceland (I), Norway (N) and Sweden (S)
1996: [1] N-I, N-D, I-D 2014: [1] N-I, I,-S, I-D, S-D
[2] N-D, I-D [2] ns

Table 5. Time used for preventive care of non-risk and risk children.

		1996		*2014*		*Change 1996-2014*
		Mean	*Sd*	*Mean*	*Sd*	*p-value*
Time for preventive care of non-risk children, minutes[1]	Denmark	13	10	12	10	ns
	Iceland	19	11	18	17	ns
	Norway	9	6	11	15	<0.05
	Sweden	8	7	13	20	<0.05
	All counties	11	9	12	15	<0.05
Time for preventive care of risk children, minute[2]	Denmark	46	36	40	29	<0.05
	Iceland	33	23	33	24	ns
	Norway	32	24	29	25	ns
	Sweden	26	21	29	25	ns
	All counties	34	27	33	26	ns

Differences ($p<0.05$) between two countries; Denmark (D), Iceland (I), Norway (N) and Sweden (S)
1996: [1] N-I, N-D, I-S 2014: [1] N-I, I-D
[2] N-S, N-D, I-D, S-D [2] N-D, I-D, S-D

Discussion

The purpose of this study was to describe trends in preventive care delivered by dentists during recent decades in Denmark, Iceland, Norway and Sweden. During the study period, intervals between routine examinations were extended in all four countries, while the time used for preventive care was largely unchanged. Although some trends were consistent in all countries, differences in routines between the countries persisted during the period.

All questionnaire studies have inherent limitations, but in this study questions were related to the daily work of dentists and it was likely that recall and report errors were randomly distributed. Similar questionnaires were used in 1996 and 2014 to secure comparable data. Results were based on answers from a considerable number of dentists, and the response rates (range 48% to 72%) were in line with those obtained in similar studies. Selection bias cannot be ruled out, but is likely to be similar in all countries and over time. It is worth noting that the response rates were lower in Iceland in 1996 and in Sweden in 2014.

A notable finding of this study was that, since 1996, a substantial increase in the proportion of female dentists working with child dental care had occurred in all four countries (Table 2). This finding was consistent with the increasing proportion of women choosing to study dentistry. This may be a consequence of the equal opportunity policies in Scandinavian countries (O'Connor, 1993). If this trend continues, within a few years, most dentists responsible for dental care for children will be women. Traditionally, professions dominated by women have been documented to have lower income and status than male dominated professions (O'Connor, 1993). One may speculate whether this will influence the dental profession in the future.

Most characteristics of the dentists were stable over time in all countries and any differences between the countries persisted (Table 2). The data illustrate a trend: proportionately fewer dentists used a large part of their time serving children in 2014 than in 1996. This may be a consequence of declines in caries prevalence during recent decades and may imply that individual dentist acquire less experience with children's care. If this trend continues, the need for specialists and guidelines may increase in pediatric dentistry. In Norway, the age and experience of dentists in paediatric dentistry were lower and work experience shorter in 2014 than earlier, a change that also may lead to increased demand for specialists and guidelines.

One main change in services for children from 1996 to 2014 was that recall intervals had been extended in all studied countries (Table 3). In this period, in all the countries except Iceland, a substantial decline in caries prevalence has been reported (Socialstyrelsen, 2006, 2015; Statistics Norway, 2016; Sundhedsstyrelsen, 2016). In Iceland, dentists report increased caries prevalence (Sveinsdottir and Wang, 2014) probably associated with a major financial crisis in 2008, or because reimbursement for child dental care was approximately 50% of total charge until 2013 and dental services were provided by private dentists. These data were in line with results of field studies in Norway in the 1990s that suggested intervals could be extended without deterioration of dental health (Wang *et al*., 1992; Wang *et al*., 1995). Fifty years ago, Sheiham (1977) questioned the scientific basis for short recall intervals used and recommended longer intervals. National guidelines in Norway in 1996 recommended dental personnel to extend recall intervals up to a maximum 24 months after individual assessment of risk (Statens helsetilsyn, 1999). A consequence of long recall intervals may potentially be a more cost-effective dental service with fewer routine visits and less time spent on examinations. The literature on recall interval is scarce, and there is a need for further research of the consequences when recall intervals are individualized and extended, studying both caries development and total time spent for dental care of children (Beirne *et al*., 2006; Riordan, 1995).

The present study showed that, concurrent with extending intervals, there was a tendency for dentists to spend longer performing routine examinations in three of the four countries in 2014 than in 1996 (Table 3). This may suggest that dentists considered it necessary to perform more thorough examinations when they examined children less frequently. If this tendency continues, it could reduce the potential cost benefits resulting from extending recall intervals. Another explanation for the longer examination time may be that dentists spend more time on behavioural management or that new tasks, such as discouraging tobacco use have been introduced.

The dentists reported spending minimal or no time on preventive activities directed at groups or populations and the share of clinical time dentists reported using on prevention varied widely (Table 4). This may well be because preventive care, and especially public health work is increasingly delegated to dental hygienists and assistants, who have more training in these topics and deliver them more cost-effectively than dentists. The limited and different changes that were reported in the countries are probably linked to the local availability of auxiliary personnel.

The time dentists spent on preventive care for caries risk and other children was fairly similar in 1996 and 2014 (Table 5), in spite of the decline in the proportion of children with caries in this period. With less caries to prevent, the health utility of the preventive care may diminish. Preventing caries in children and adolescents is regarded as a priority as it is often considered more cost-effective than treatment. In a public dental system where dental services are provided free of charge by dentists with fixed salaries, there may be incentives to use time for preventive care. This may entail a risk of using preventive methods without a documented effect (Mejáre *et al*., 2015).

The difference between the time dentists reported using for caries prevention in risk and non-risk children indicated that dentists deliver risk-based preventive care, a practice that has been advocated to bridge dental health inequalities and conserve resources (Pienihäkkinen *et al*., 2005; Twetman, 2016; Wang *et al*., 1995). These results suggest disease prevention was targeted at those children most in need for care. Both in 1996 and 2014, dentists reported using a considerable amount of time delivering preventive care. This observation suggests that there are potential cost savings in child dental services by delegating preventive tasks to less costly auxiliary personnel.

Conclusion

During recent decades with reduced and increasingly skewed caries prevalence in the child population, dentists increased the time interval between recalls and individualised the time for preventive care. These changes suggested that routines in the dental services were adjusted to match caries risk. In addition, the trends may indicate that extending recall intervals could entail more time for the routine dental examinations and showed that in 2014, dentists continued to use a substantial amount of time delivering preventive care to children, a task that could be delegated to auxiliary personnel.

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