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## Task shifting, interprofessional collaboration and education in oral health care

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# CHAPTER 2

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## Attitudes among dentists and dental hygienists towards extended scope and independent practice of dental hygienists

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**Abstract**

Aims - Attitudes of dentists and dental hygienists towards extended scope and independent dental hygiene practice are described in several studies, but the results are heterogenous. The purpose of this systematic review is to compare attitudes of dentists and dental hygienists towards extended scope and independent dental hygiene practice.

Methods – PubMed, AMED and CINAHL were used to identify relevant studies by two independent assessors. Only quantitative studies reporting percentages of dentists and dental hygienists attitude towards extended scope and independent dental hygiene practice were included. The random effects model was used to synthesize possible heterogenous influences.

Results – Meta proportions with regard to a positive attitude towards extended scope of practice are for dentists 0.54 and for dental hygienists 0.81. Meta proportions of a positive attitude towards independent practice are for dentists 0.14 and dental hygienists 0.59. A meta analysis with regard to negative attitudes could only be performed on extended scope of practice but did not reveal a difference between the two professions. Outcomes of included studies regarding negative attitudes of dentists were homogeneous. A minority of dentists hold negative attitudes towards extended scope of dental hygiene practice. Study outcomes regarding negative attitudes of dental hygienists were heterogeneous.

Conclusions - Positive attitudes are present in a majority of dentists as well as dental hygienists with regard to extended scope of dental hygiene practice, while for independent dental hygiene practice this holds for a minority of dentists and a majority of dental hygienists.

**Introduction**

Dentists and dental hygienists are two of the most prominent professions within the community oral health care. Since its establishment in 1913 (Fones, 1934), the profession of dental hygiene has changed drastically (Johnson, 2009). New legislation has enabled an extended scope and independent dental hygiene practice in many different countries (e.g. Heuvel van der, Jongbloed-Zoet, & Eaton, 2006; Jongbloed-Zoet, Bol-van den Hil, La Rivière-Ilsen, & van der Sanden-Stoelinga, 2012; ADHA, 2016; EDHF, 2015; GDC, 2013; NBHW, 2005; MHWS, 2006; CED, 2014). Both policies are part of task shifting. The latter consists not only of rational distribution of tasks (extended scope of practice) between dentists and dental hygienists, but also independent practice. Extended scope of practice and independent practice may enhance efficiency (Harris & Sun, 2012; DeAngelis & Goral, 2000), reduce costs (Fortner, 2008), increase patient comfort (DeAngelis & Goral, 2000; Lobene, 1979), Sisty LePeau, Nielson Thompson & Lutjen, 1992), and make oral health care more accessible (Edgington & Pimlott, 2000).

However, attitudes towards extended dental hygiene scope and independent dental hygiene practice and potential differences in attitudes between professions are currently unclear.

Attitude is defined as “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor” (Eagly & Chaiken, 1999). A positive attitude of dentists and dental hygienists towards these policies is required for task shifting. Professional status, culture, and professionalization issues can provide cues to the expected directions and magnitude of attitudes towards professional change among dentists and dental hygienists (Macdonald, 1999; Plager & Conger, 2006; Swanson Jaecks, 2009; Tajfel, Brown & Turner, 1979; Brewer, 2003; Adams, 2004a). Several studies investigated attitudes of dentists and dental hygienists towards the extended scope of practice and independent practice of dental hygienists (Blue et al., 2013; Hopcraft et al., 2008; Abelsen, & Olsen, 2008). The findings are somewhat fragmentary and inconclusive. The purpose of this systematic review is to compare attitudes of dentists and dental hygienists towards extended scope and independent dental hygiene practice.

## Methods

### Criteria for considering studies for this review

Four criteria were applied to consider studies: types of studies, types of participants, types of interventions, and types of outcomes measures. All relevant cross-sectional surveys that focus on extended scope of dental hygiene practice or independent dental hygiene practice. In addition, all studies that provide information regarding attitudes regarding these two policies. Furthermore, no interventions were considered or included in this study. Finally, two types of outcome measures were relevant to our review: proportions of practitioners with a positive or negative attitude towards an extended scope of dental hygiene practice and proportions of practitioners with a positive or negative attitude towards an independent dental hygiene practice according to dentists and dental hygienists. A positive attitude is defined as an evaluation of an entity which is good, useful, has good qualities, or of which one is being certain or sure that it is correct or true (Oxford Dictionaries, 2015). A negative attitude is defined as the opposite of a positive attitude.

### Search methods for the identification of studies

In order to determine synonyms or related terminology of extended scope of practice and independent practice, the MeSH database was used. In addition, an exploratory literature search regarding synonyms or related terminology was conducted in PubMed with a Boolean search: tasks[All Fields] AND (“dentists”[MeSH Terms] OR “dentists”[All Fields]) AND (“dental hygienists”[MeSH Terms] OR (“dental”[All Fields] AND “hygienists”[All Fields]) OR “dental hygienists”[All Fields]) OR (“oral” [All Fields] AND “hygienist” [All Fields])

In order to overcome the problem of not identifying all relevant publications, the 'related articles' function in PubMed was used as replacement of a full search (Chang, Heskett & Davidson, 2006). This search function compares words from titles, abstracts, and MeSH headings assigned using a powerful word-weighted algorithm (Lin, & Wilbur, 2007). The first most relevant publication as found in the Boolean search was used as a starting point of the related articles search. The publication of Abelsen & Olsen (2008) was the first publication relevant to the purpose of this study. Next, the publications associated with the content of the Abelsen & Olsen (2008) study were identified with the related articles function in PubMed. Additionally, a search was performed in the following databases: AMED and CINAHL.

## **Data collection and analysis**

### **1. Selection of studies**

Two assessors (JJR, PO) independently screened all identified titles and excluded studies clearly not relevant to the topic. After title screening, agreement between the two independent assessors was calculated using the Cohen's Kappa coefficient (Cohen, 1960). According to Fleiss (1981) kappa values below 0.40 should be regarded as poor, those between 0.40 and 0.75 as fair to good, and those exceeding 0.75 as excellent agreement. Title screening was followed by a consensus meeting between the two assessors in order to make a final selection of titles. When in doubt, abstracts were screened in order to determine their relevance. Then, one assessor (JJR) screened all abstracts of the final list of titles to verify whether the corresponding studies were surveys measuring attitudes of dentists or dental hygienists.

Eligibility criteria were used (Table 1) for final selection of articles such as cross-sectional surveys reporting percentage or proportion of dental or dental hygiene practitioners with respect to positive or negative attitude towards expanded scope of practice or independent practice. Qualitative studies or those using attitude measures based on multiple aspects were excluded. The relevance of the final list of included studies was verified by the second assessor (PO).

**Table 1.**

Eligibility criteria for literature selection process

Inclusion	Exclusion
Name or synonym of profession or discipline (e.g. dentist, GDP, dental hygienist or ADHP)	Other oral health professions (e.g. dental therapist)
Terms related to scope of practice, direct access independent practice and/or interprofessional or interdisciplinary change	Perspectives from a policy point of view
Terms related to attitude or perception	Publication based on one or few opinions
Quantitative research method	Qualitative research method
Terms or words referring to professional relationship between dental hygienists and dentists	Publication language other than English or Dutch
Indices related to percentages	Continuing professional development
Subjects related to specific clinical issues	Only faculty members or teachers
Attitude measures regarding task shifting and/or independent practice	Specialized dentists or dental hygienists
Percentages of dental or dental hygiene practitioners with a positive or negative attitude towards task shifting and/or independent practice	Students
	Attitude measures which cannot discriminate between practitioners with a positive, neutral or negative attitude
	Attitude measures concerning multiple aspects

## 2. Quality assessment

The quality of the cross-sectional surveys was evaluated using the Effective Public Health Practice Project (EPHPP) quality assessment tool for quantitative studies (Thomas, Ciliska, Dobbins & Micucci, 2004). The EPHPP tool covers three categories relevant to survey studies: selection bias, study design, and data collection methods. Each category consists of several questions allowing one of three possible judgements: strong, moderate, or weak. These are summarized in an overall quality score: strong (no 'weak' ratings), moderate (one 'weak' rating), or weak (two or more 'weak' ratings).

## 3. Data management and analyses

From each study, the operationalization of attitude was extracted. Data reflecting attitude were extracted from eligible studies. Then, the percentages of dental and/or dental hygiene practitioners with a moderate to very positive or negative attitude were retrieved. In addition, country and region, sampling type, response rate, gender distribution of practitioners, and sample size were collected. In three studies only subgroups of dentists or dental hygienists were reported. From these studies aggregated proportions were calculated.

The proportion of positive or negative attitude may be influenced by cultural, economic and political climate causing random variance. For this reason the random effects model was used to synthesize possible heterogeneous influences, however, those from type of profession and year of publication are statistically tested. A descriptive overview of the results by forest plots is combined with statistical testing of effects after mixed model estimation (Knapp & Hartung, 2003). The forest plot (Viechtbauer, 2010) presents the number of respondents (dentists or dental hygienists) answering affirmative with regard to a positive or negative attitude towards an extended scope of dental hygiene practice. In addition, the proportion affirmative replies with its 95% confidence interval per study and the meta effect of the proportion of positive or negative attitudes estimated from the random effects model based on each profession. A meta-analysis was performed when at least two studies of each comparison group (dentists and dental hygienists) were available. A funnel plot was used to visually inspect indication of publication bias. The latter is unlikely when the largest studies are near the average while smaller studies are spread evenly on both sides of the average. This is also investigated by the regression test for funnel plot asymmetry when at least ten studies were available for analyses (Viechtbauer, 2010; Harbord, Egger & Sterne, 2006).

## Results

### Description of studies

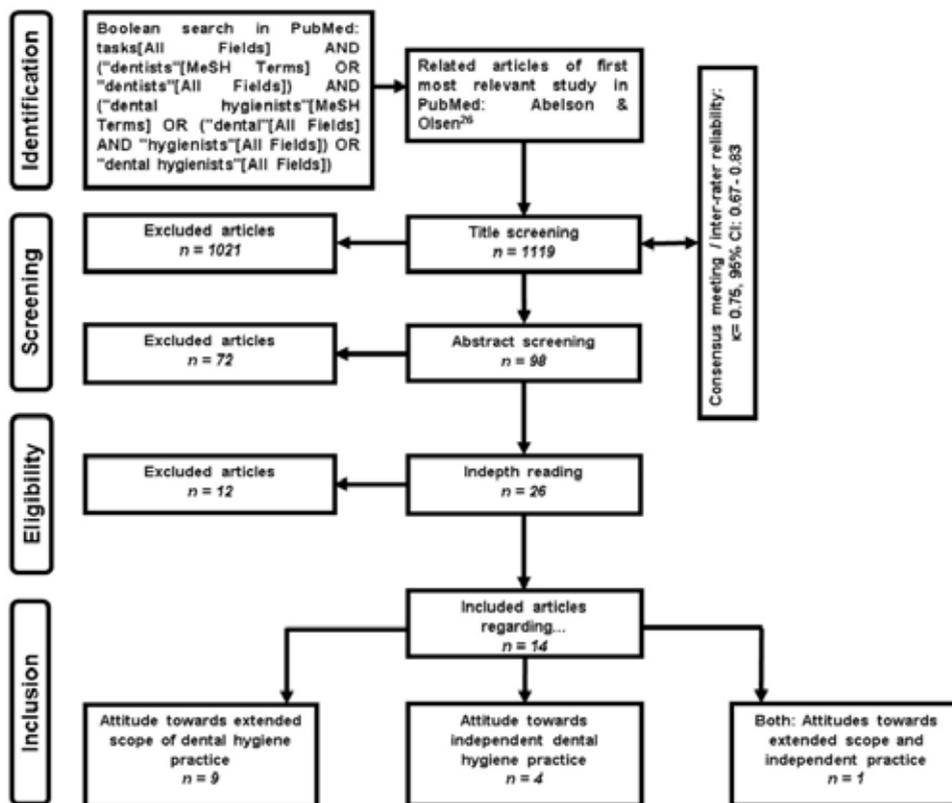
The exploratory literature search regarding synonyms or related terminology of task shifting resulted in the identification of seventeen different terms. The following terms were found,

besides extended scope of practice and independent practice: advanced hygienist skills (Brian, & Cooper, 1997), changing skill mix (Buchan, Ball & O'May, 2001; Falcon, 2010), changing task profiles (Petrén et al., 2005), maximized scope of practice (Christensen, 1995), expanding dental hygiene (Nash, 2009), expanded duties (Van Wyk, Toogood, Scholtz & Stander, 1998), expanded function (DeAngelis & Goral, 2000), task division (Abelsen, & Olsen, 2008), expanding the role (Bernie, 2001), task redistribution (Lecca, Valentine & Lyons, 2003; Jerković-Ćosić, Van Offenbeek & Van der Schans, 2012; Bruers, Van Rossum, Felling, Truin, & Van 't Hof, 2003), expanding the range of procedures (Ayers, Thomson, Rich & Newton, 2008), extended competencies (Corbey-Verheggen, 2001), task sharing (Widström, Eaton & Luciak-Donsberger, 2010), task shifting (WHO, 2006), task transfer (Kidd et al., 2006), work distribution (Wang, 2000), and task re-allocation (Nash, Friedman, Kavita & Mathu-Muju, 2012).

With the related articles search 1119 articles were identified in PubMed. In AMED and CINAHL no additional articles were found. The interrater reliability regarding title screening was Cohen's Kappa=0.75 (95% CI 0.67; 0.83). Twenty-six studies were selected by title screening among which fourteen studies (Blue et al., 2013; Hopcraft et al., 2008; Abelsen, & Olsen, 2008; Van Wyk et al., 1998; Adams, 2004b; Ayers, Meldrum, Thomson & Newton, 2006; Benicewicz & Metzger, 1989; Gordon & Rayner, 2004; Lambert, George, Curran, Lee, & Shugars, 2009; Moffat & Coates, 2011; Murtomaa & Haugejorden, 1987; Sgan-Cohen, Mann & Greene, 1985; Van Dam, Den Boer & Bruers, 2009) fulfilled the eligibility criteria (Figure 1). Reasons for excluding studies were as follows: One study only reported practitioners with a very positive attitude. Another study reported attitudes towards several specific tasks and not extended scope in general. Two studies reported specific motives regarding attitude towards extended scope of practice. In one study the attitude statement consisted of multiple aspects. Two studies described to what degree extended scope of practice was related to productivity. Three studies primarily focused on job or career satisfaction related to extended scope of practice. One study concerned attitude of dentists towards dental hygienists in general. One study focused on attitude towards interdisciplinary collaboration.

Figure 1.

Flow chart of the literature selection process



(Moher, Liberati, Tetzlaff, Altman &amp; The PRISMA Group, 2009)

The included studies were conducted on five different continents: North America (four from USA and one from Canada), Africa (two from South Africa), Oceania (two from New Zealand and one from Australia), Europe (Finland, Norway, and The Netherlands), and Asia (Israel; Table 2). It can be observed that the response rate of the studies varied between 29.0% and 87.5%. Eight out of fourteen studies reported a response rate higher than 60%. Sample sizes varied between 67 and 4522. Most sample sizes exceeded 300 participants. The oldest study was published in 1985 and the newest study in 2013.

Percentages of dentists with a positive attitude towards extended scope of dental hygiene practice are reported in six studies (Table 2). Percentages of dental hygienists were also reported in six studies. Percentages of dentists with a positive attitude towards independent dental hygiene practice were reported in four studies and in three studies of dental hygienists.

**Table 2.** Characteristics of studies included in the two meta-analyses regarding a positive attitude towards expanded scope and independent practice of dental hygienists

Positive attitude towards	Study and country (& region)	Sample type (& size)	Response rate (%)	Gender distribution in sample		Profession	Proportion practitioners with positive attitude	Operationalization of attitude
				Female	Male			
<b>extended scope</b>	Abelsen & Olsen, 2008, Norway	Random (453)	45.0%	39.0%		Dentist	0.60	'...desirable to delegate'
		Random (108)	42.0%	99.1%		Dental Hygienist	0.55	
	Ayers et al., 2006, New Zealand	Population (211)	73.2%	95.3%		Dental Hygienist	0.81	'Interested in expanding range of procedures'
	Blue et al., 2013, USA	Convenience (626)	76.3%	19.0%		Dentist	0.54	'...a positive impact on provision of quality dental care.'
	Gordon & Rayner, 2004, South Africa	Population (439)	51.0%	data not available		Dental Hygienist	0.93	'wish to expand on current qualification'
	Hopcraft et al., 2008, Australia (Victoria)	Random (183)	64.7%	15.6%		Dentist	0.62*	'Dental hygienists should be able to increase the scope of practice'
		Random (67)	77.0%	95.5%		Dental Hygienist	0.82	
	Lambert et al., 2009, USA (Colorado, Kentucky and North Carolina)	Stratified (389)	29.0%	97.3%**		Dental Hygienist	0.89**	'Overall level of support for' extended function dental hygienist
	Moffat & Coates, 2011, New Zealand	Random (330)	66.8%	30.4%		Dentist	0.59	'consider employing a dual-trained Oral Health graduate'

Positive attitude towards	Study and country (& region)	Sample type (& size)	Response rate (%)	Gender distribution in sample		Profession	Proportion practitioners with positive attitude	Operationalization of attitude
				Female				
extended scope	Murtomaa & Haugejorden, 1987, Finland	Random (313)	85.0%	65.6%		Dentist	0.69	'...changes in the tasks performed by Extended Duty Dental Hygienist'
	Sgan-Cohen et al., 1985, Israel	Convenience (156)	87.5%		data not available	Dentist	0.53***	'Expected functions of dental hygienist...'
	Van Wyk et al., 1998, South Africa	Random (138)	47.0%		data not available	Dental Hygienist	0.87	'functions of the oral hygienist should be expanded?'
independence	Adams, 2004 (54), Canada (Ontario)	Stratified (391)	62.0%	45.5%		Dentist	0.04	'Dental hygienists should be allowed to practice independently of dentists'
	Boniewicz & Metzger, 1989, USA	Stratified (383)	78.0%	88%		Dental Hygienists	0.71	
	Hopcraft et al., 2008, Australia (Victoria)	Stratified (4522)	49.6%		data not available	Dental Hygienist	0.54	'...dentist's presence in the facility not always be required'
	Kaldenberg & Smith, 1990, USA (Oregon)	Random (183)	64.7%	15.6%		Dentist	0.27*	'Dental hygienists should be allowed to practice independently'
		Random (67)	77.0%	95.5%		Dental Hygienist	0.52	
		Random (385)	71.0%	5.4%		Dentists	0.10	'I support independent practice for hygienists'
	Van Dam et al., 2009, The Netherlands	Convenience (304)	45.9%	57.2		Dentist	0.67	'not afraid that the independent dental hygienist will become competitor of the dentist'

\*percentage aggregated over employer and nonemployer dentists / \*\*percentage aggregated over states / \*\*\*percentage aggregated over dental school faculty and dentists without any academic affiliation

Percentages of dentists with a negative attitude towards extended scope of dental hygiene practice were reported in three studies (Table 3). Percentages of dental hygienists were also reported in three studies. Percentages of dentists with a negative attitude towards independent dental hygiene practice were reported in three studies and in one study of dental hygienists.

**Table 3.** Characteristics of studies included in the two meta-analyses regarding a negative attitude towards expanded scope and independent practice of dental hygienists

Negative attitude towards	Study and country (& region)	Sample type (& size)	Response rate (%)	Gender distribution in sample		Profession	Proportion practitioners with negative attitude	Operationalization of attitude
				Female	Male			
extended scope	Abelsen & Olsen, 2008, Norway	random (453)	45.0%	39.0%		Dentist	0.40	'...desirable to delegate'
		random (108)	42.0%	99.1%		Dental Hygienist	0.45	
	Ayers et al., 2006, New Zealand	population (211)	73.2%	95.3%		Dental Hygienist	0.19	'Interested in expanding range of procedures'
		random (330)	66.8%	30.4%		Dentist	0.41	'consider employing a dual-trained Oral Health graduate'
	Murtomaa & Haugejorden, 1987, Finland	random (313)	85.0%	65.6%		Dentist	0.31	'...changes in the tasks performed by Extended Duty Dental Hygienist'
		random (138)	47.0%	data not available		Dental Hygienist	0.04	'functions of the oral hygienist should be expanded?'
independence	Adams, 2004b, Canada (Ontario)	stratified (391)	62.0%	45.5%		Dentist	0.96	'Dental hygienists should be allowed to practice independently of dentists'
		stratified (383)	78.0%	88%		Dental Hygienists	0.29	
	Kaldenberg & Smith, 1990, USA (Oregon)	random (385)	71.0%	5.4%		Dentists	0.82	'I support independent practice for hygienists'
		convenience (304)	45.9%	57.2%		Dentist	0.16	'not afraid that the independent dental hygienist will become competitor of the dentist'

\*percentage aggregated over employer and nonemployer dentists / \*\*percentage aggregated over states / \*\*\*percentage aggregated over dental school faculty and dentists without any academic affiliation

### Risk of bias among included studies

Three out of fourteen included studies were classified as 'weak' (Table 4) due to non-randomized sampling and potential selection bias.

**Table 4.**

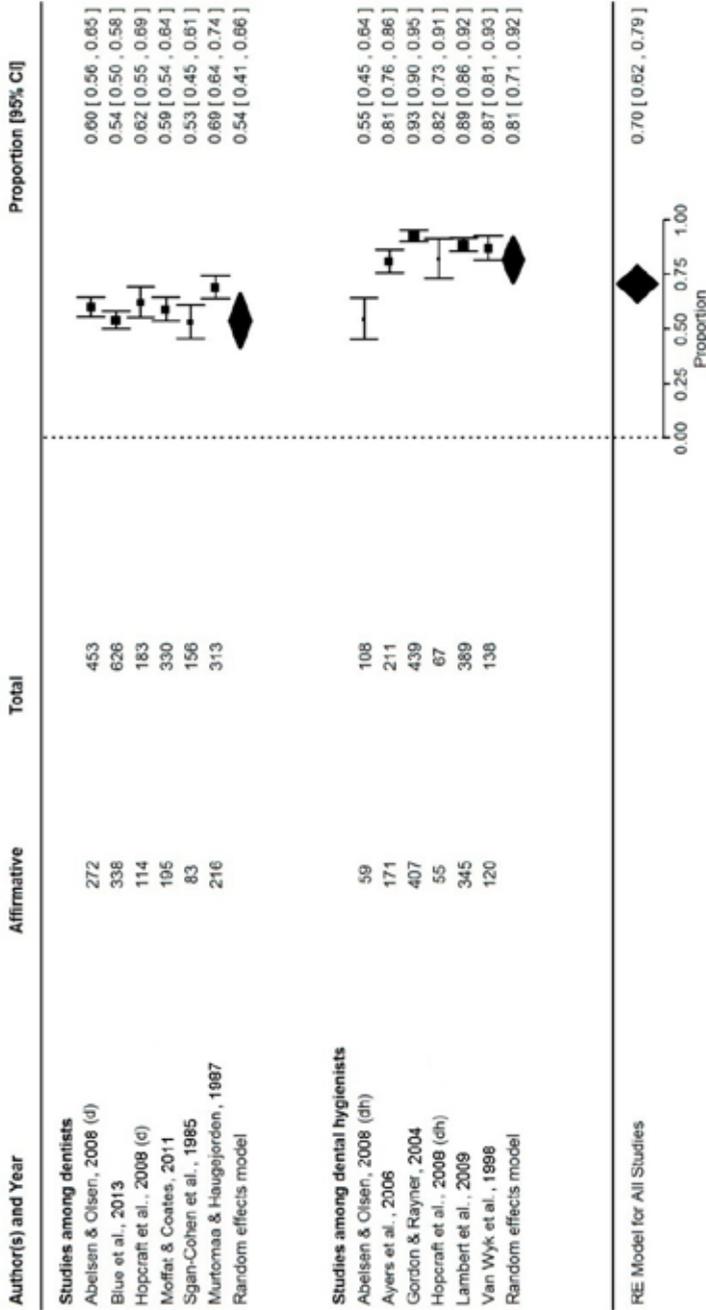
Quality assessment of included studies

Study	Selection bias	Study design	Data collection methods	Global rating
Abelsen & Olsen, 2008	moderate	strong	strong	strong
Adams, 2004b	moderate	strong	moderate	strong
Ayers et al., 2006	strong	strong	strong	strong
Benicewicz & Metzger, 1989	moderate	strong	moderate	strong
Blue et al., 2013	weak	weak	moderate	weak
Gordon & Rayner, 2004	moderate	moderate	moderate	strong
Hopcraft et al., 2008	moderate	strong	moderate	strong
Kaldenberg & Smith, 1990	moderate	strong	moderate	strong
Lambert et al., 2009	moderate	strong	strong	strong
Moffat & Coates, 2011	moderate	strong	moderate	strong
Murtomaa & Haugejorden, 1987	strong	strong	moderate	strong
Sgan-Cohen et al., 1985	weak	weak	weak	weak
Van Dam et al., 2009	weak	weak	weak	weak
Van Wyk et al., 1998	moderate	strong	strong	strong

### Outcomes of included studies

The Forest plot from the meta-analysis in Figure 2 gives, for each study, the number of respondents expressing a positive attitude towards extended scope of dental hygiene practice, the corresponding totals of dentists and dental hygienists, respectively, the proportion and corresponding 95% confidence intervals. It can be observed that all proportions among dental hygienists are larger compared to those from the dentists, with the Abelsen & Olsen (2008) study as the only exception. The meta proportion for the dentists is 0.54 (95% CI 0.41; 0.66) and for the dental hygienists is 0.81 (95% CI 0.71; 0.92). The Wald statistic (Knapp & Hartung, 2003) revealed no evidence for an effect of year of publication (estimate=-0.002, se=0.004,  $t=-0.494$ ,  $p=0.634$ ), and strong evidence (Sellke, Bayarri & Berger, 2001) for the difference in proportions of positive attitudes between the two professions towards extended scope of dental hygiene practice (estimate=-0.230, se=0.063,  $t=-3.631$ ,  $p=0.006$ ).

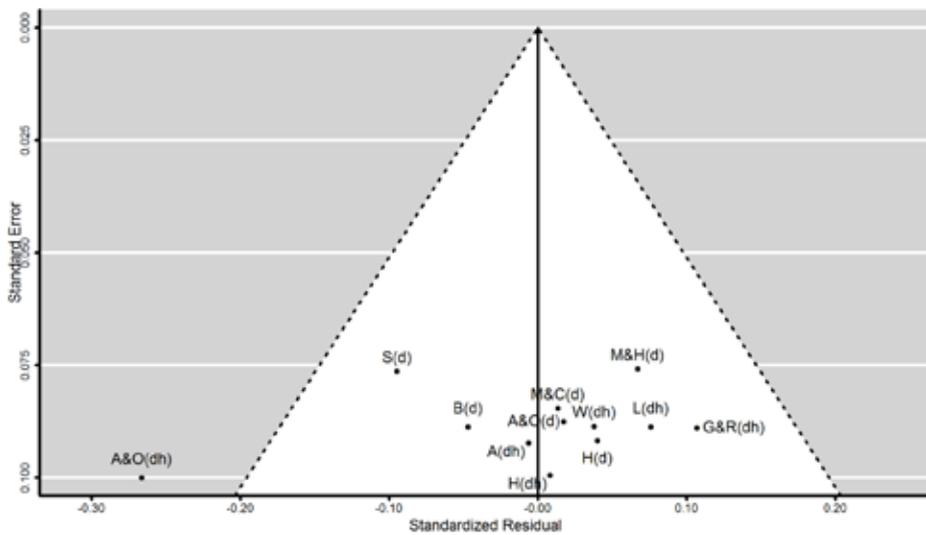
Figure 2. Forest plot from the meta-analysis with the number of respondents expressing a positive attitude towards extended scope of dental hygiene practice, the corresponding totals of dentists and dental hygienists, respectively, the proportion and corresponding 95% confidence intervals



The funnel plot in Figure 3, with the standardized residuals versus standard errors of the mixed model for meta-analysis, reveals the Abelsen & Olsen (2008) study among dental hygienists as outlying to the left. A further sensitivity analysis indicates this study to be influential according to a studentized residual of -4.381 and Cooks distance of 1.426. The funnelplot regression test indicates some degree of asymmetry ( $t = -2.612$ ,  $df = 8$ ,  $p = 0.031$ ) (Harbord et al., 2006). All but one studies are within the boundries indicating no publication bias.

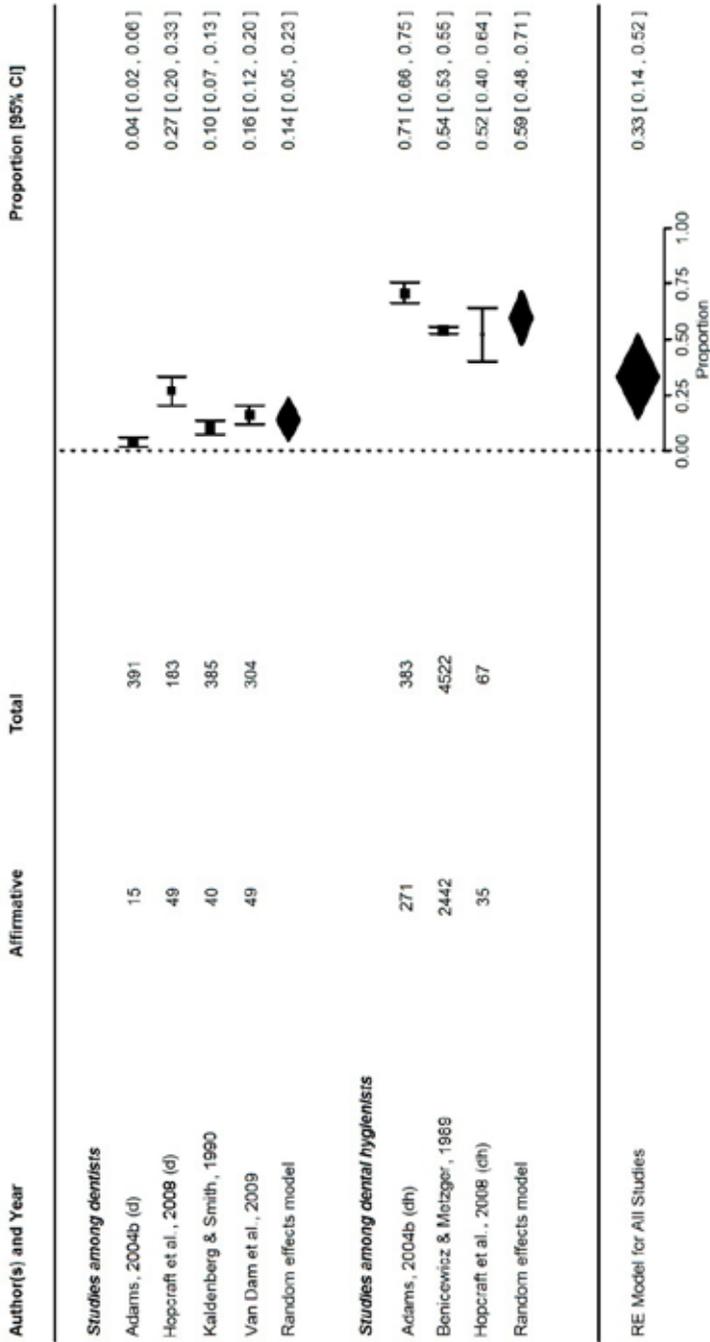
**Figure 3.**

Funnel plot with standardized residuals versus standard errors from meta-analysis of studies on proportions of positive attitude towards extended scope of dental hygiene practice among dentists and dental hygienists (A&O = an included study: Abelsen & Olsen, 2008 / (d) = dentists / (dh) = dental hygienists)



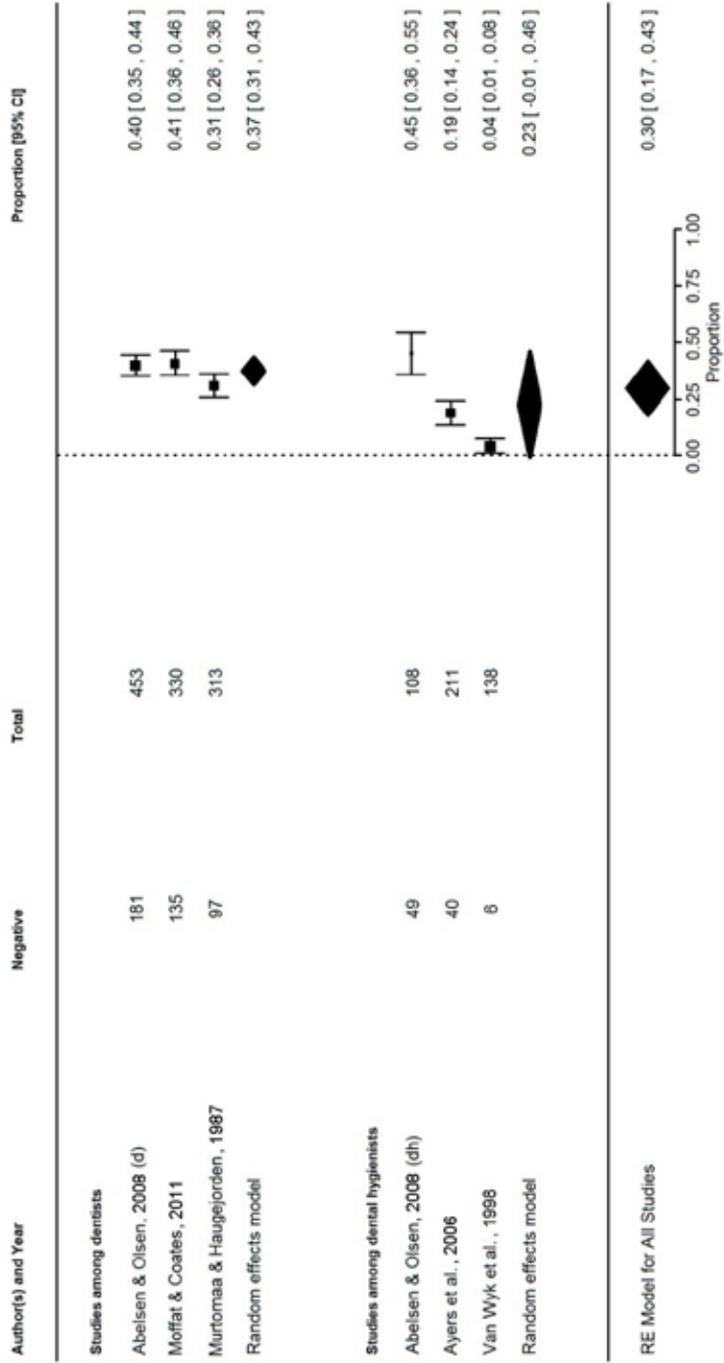
The Forest plot from the meta-analysis in Figure 4 gives, for each study, the number of respondents expressing a positive attitude towards independent dental hygiene practice, the corresponding totals of dentists and dental hygienists, respectively, the proportion and corresponding 95% confidence intervals. It can be observed that all proportions among dental hygienists are larger compared to those from the dentists. The estimated meta proportion for the dentists is 0.14 (95% CI 0.05; 0.23) and for the dental hygienists 0.59 (95% CI 0.48; 0.71). The Wald statistic (Knapp & Hartung, 2003) revealed no evidence for an effect of year of publication (estimate=0.005, se=0.006,  $z=0.882$ ,  $p=0.428$ ), and strong evidence (Sellke et al., 2001) for the difference in proportions of positive attitudes between the two professions towards extended scope of dental hygiene practice (estimate=-0.476, se=0.081,  $z=-5.860$ ,  $p=0.004$ ). A funnel plot could not be analyzed since less than ten studies were included<sup>78</sup>.

**Figure 4.** Forest plot from the meta-analysis with the number of respondents expressing a positive attitude towards independent dental hygiene practice, the corresponding totals of dentists and dental hygienists, respectively, the proportion and corresponding 95% confidence intervals



The Forest plot from the meta-analysis in Figure 5 gives, for each study, the number of respondents expressing a negative attitude towards extended scope of dental hygiene practice, the corresponding totals of dentists and dental hygienists, respectively, the proportion and corresponding 95% confidence intervals. It can be observed that proportions among dental hygienists are more heterogeneous compared to those from the dentists. The meta proportion for the dentists is 0.37 (95% CI 0.31; 0.43) and for the dental hygienists is 0.23 (95% CI -0.01; 0.46). The Wald statistic (Knapp & Hartung, 2003) revealed no evidence for an effect of year of publication (estimate= 0.008, se=0.007, t=1.161, p=0.330), and no evidence (Sellke et al., 2001) for the difference in proportions of negative attitudes between the two professions towards extended scope of dental hygiene practice (estimate=0.166, se= 0.118, t=1.407, p= 0.254). A funnel plot was not constructed made since less than ten studies were available (Sterne, Egger, & Moher, 2008).

**Figure 5.** Forest plot from the meta-analysis with the number of respondents expressing a negative attitude towards extended scope of dental hygiene practice, the corresponding totals of dentists and dental hygienists, respectively, the proportion and corresponding 95% confidence intervals



No forest plot and funnel plot were made for negative attitude towards independent dental hygiene practice since only three studies among dentists and a single study among dental hygienists were available (Table 3). The majority of dentists from two out of three studies held a negative attitude. The study that reported a minority of dentists with a negative attitude originated from The Netherlands. The only study concerning dental hygienists reported a minority of practitioners with a negative attitude.

## Discussion

We found that a majority of dentists have a positive attitude and a minority has a negative attitude towards extended scope of dental hygiene practice. A minority of dentists have a positive attitude towards independent dental hygiene practice. Analysis of included studies regarding a negative attitude of dentists towards independent dental hygiene practice is not conclusive. The different attitudes of dentists towards extended scope and independent dental hygiene practice can be explained by the following. High status occupations like dentists advance by delegating lower status skills and roles to subordinate groups like dental hygienists (Kronus, 1976; Larkin, 1983). This could explain why 54% of dentists have a positive attitude towards an extended scope of dental hygiene practice but only 14% of them have a positive attitude towards independent dental hygiene practice. When dental hygienists would become independent, they would no longer be subordinate and the dental profession would lose control over the provision treatment.

Our finding that a majority of dental hygienists have a positive attitude towards an extended scope of practice, can be explained by the following. The expanded function of the dental hygienist is considered necessary to provide the appropriate dental hygiene care (DeAngelis & Goral, 2000; Petrén et al., 2005), for example local anaesthesia (DeAngelis & Goral, 2000; Lobene, 1979; Sisty LePeau et al., 1992) and dental x-rays (Jansson, Lavstedt & Zimmerman, 2000; Laurell, Romao & Hugoson, 2003). Another explanation is the perceived need of dental hygienists for job enrichment. Extended scope of practice may contribute to more skill variety which increases job satisfaction (Hackman & Oldham, 1980). Finally, an extended scope of practice and independent practice can both contribute to higher professional status (Omark, 1978) and stronger professional identity (Tajfel & Turner, 1979).

Possible explanations for the difference between dentists and dental hygienists in attitude are a potential economic loss feared by dentists (Freidson, 1978) and perceived threat to quality of care by dentists (Ross, Ibbetson & Turner, 2007). Dentists want to maintain control over other oral health care occupations (Adams, 1999; Cotton, 1990). Independent dental hygiene practice may reduce this control. As a consequence, dentists may have less influence on billing and, for this reason, are less likely to be in favor of independent dental hygiene practice.

Furthermore, independent dental hygiene practice enables dental hygienists to practice without supervision requirements while some dentists have doubts about the competence of dental hygienists (Adams, 2004b) and some dental hygienists do not feel confident enough (Virtanen, Tseveenjav, Wang & Widström, 2011).

Eventhough this study has limitations, it also has some clear strengths. Attitude towards extended scope or independent practice did not depend on year of publication. In addition, the findings regard studies across varies countries When assessing the quality of the included studies, eleven out of fourteen studies have a strong quality. The outcomes of the three weak studies did not deviate from the other studies in the forest plots. Finally, with the Abelsen and Olsen study (2008) as the only exception, no publication bias was found with regard to studies concerning extended scope and independent practice. A weakness of this study is the relatively small number of studies found. A potential explanation for this is the heterogenous terminology in use for extended scope of practice, making identification of relevant studies more difficult. However, since the related articles search function was used, it is very likely that all relevant studies were detected. According to Chang et al. (2006) a related articles search yield considerable more publications compared with a Boolean search. Another weakness is that regression test for funnel plot asymmetry concerning independent practice could not be applied since there are only seven studies available. The same applies for studies reporting negative attitudes towards extended scope and independent practice. In these analyses only six and four studies were included, respectively. For conclusiveness it has been recommended not to use the funnel plot asymmetry test when fewer than ten studies are available (Sterne et al., 2008). However, this recommendation is not only based on the number of included studies but also on the heterogeneity in meta-analysis. The test performance for funnel-plot asymmetry is somewhat poor with a small number of studies and a large heterogeneity in meta-analysis (Ioannidis & Trikalinos, 2007).

Several factors could influence the attitudes of dentists and dental hygienists. Variations of legislation is one variable that might explain different attitudes. However, the study of Lambert (2009) was conducted in three different American states with varying supervision levels: direct supervision (dentist off-site), collaborative (dentist on-site and off-site), and independent. In this study no significant differences with regard to supervision level and attitude could be found. The authors explicitly mentioned that the general response rate of 29% as a possible explanation for not finding significant differences.

Legislation of some countries is multi-jurisdictional and has a regional basis like Australia, Canada, Switzerland and the US (Johnson, 2009). Of the included studies regarding independent dental hygiene practice, three studies reported data on a regional level: Australia (Victoria), Canada (Ontario), and USA (Oregon). Dental hygienists were not allowed to practice independently at the time of publication. However, dental hygienists were allowed

independent practice during the publication of a Dutch study. The Dutch study reported a much higher proportion of dentists with a positive attitude towards independent dental hygiene practice compared to the other studies. In addition, in the Canadian study, dentists who employed a dental hygienist held more positive attitudes towards independent dental hygiene practice compared nonemployers. Dentists who oppose independent dental hygiene practice from the Victoria, Ontario, and Oregon studies argued dental hygienists lack training or knowledge to practice independently from the dentist. It seems that the experience of working with dental hygienists might explain these attitudinal differences. Unfortunately, the number of studies is too small to perform a separate meta-analysis.

More studies reported percentages of practitioners with positive attitudes related to two types of task shifting compared to negative attitudes. This could introduce a bias. Ten out of the fourteen included studies measured negative attitudes of which eight studies actually reported these attitudes. More specifically, with regard to extended scope of dental hygiene practice, three studies provided data on negative attitudes of dentists and three studies on negative attitudes of dental hygienists. Outcomes regarding negative attitudes of dental hygienists were rather heterogeneous, the outcomes regarding negative attitudes of dentists were homogeneous. The latter confirmed that the majority of dentists are not opposed to an extended scope of dental hygiene practice. However, not enough studies regarding negative attitudes towards independent practice were available for a thorough meta-analysis. The heterogeneity of study outcomes within the group of dental hygienists with regard to a negative attitude towards extended scope of practice, could be explained by a disunity of their profession. This emerging profession consists of different generations of dental hygienists with different qualifications and privileges due to changes in policy and regulations in a relatively short time (Johnson, 2009). Dentist is a much older occupation having a well-established professional status (Morison, Marley, Stevenson & Milner, 2008). The latter is reflected by a more homogenous outcomes of studies regarding attitudes of dentists towards task shifting.

Many variables could have influenced attitudes towards extended scope of practice and independent practice like different ratios of dentists and dental hygienists per country, attitude related to specific tasks, position and maturity of profession. With regard to the ratio of these two professions: in the United States the ratio is almost equal (Yamalík, Ensaldó-Carrasco, Cavalle & Kell, 2014), while dental hygienists in New Zealand are clearly a minority compared to the number of dentists (Dental Council New Zealand, 2015). However, the proportions of dentists with a positive attitude towards extended scope of dental hygiene practice hardly differ between these two countries (Blue et al., 2013; Moffat & Coates, 2011). If the same applies to the dental hygienists of these two countries is not known. With regard to the reasons related to specific tasks: some dental tasks are perceived by dental hygienists as important to their professional role (Petrén et al., 2005). Because of the limited information that is available about the attitude of practitioners with regard to specific tasks, more research

is needed in this matter. In addition, motives in favor and against task shifting should be identified. Social position might also influence attitudes. Some dentists still perceive dental hygienists as a dental auxiliary (Swanson Jaecks, 2009). However, not much is known about the social and psychological implications of task shifting and independent practice (McKeown, Sunell, Wickstrom, 2003; Gillis, 2000). Another factor that may influence attitudes in this study is maturity of the dental hygiene profession, as this is different between countries. More specifically, the first year of legislation of practice in the USA was 1917, in Canada 1952, in South Africa 1969, in Australia and Finland 1972, in The Netherlands 1974, in Israel 1978, in Norway 1979, and New Zealand 1988 (Coates, Kardos, Moffat & Kardos, 2009; Danner, 2002). However, there does not seem to be any relation between professional maturity and the proportion of practitioners with a positive attitude. For example, dentists in the USA and in Israel are similar with regard to a positive attitude towards extended scope of dental hygiene practice and to Australian and New Zealand dental hygienists with regard to independent dental hygiene practice.

### **Conclusion**

Dentists and dental hygienists differ in their attitude towards extended scope of dental hygiene practice but differ mostly with regard to independent dental hygiene practice. Positive attitudes are present in a majority of dentists as well as dental hygienists with regard to extended scope of dental hygiene practice, while for independent dental hygiene practice this holds for a minority of dentists and a majority of dental hygienists.

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### **Competing interests statement**

None declared.

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