

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

Jan J. Reinders^{1,2}, Wim P. Krijnen¹, Pieter Onclin², Cees P. van der Schans^{1,3} and Boudewijn Stegenga⁴

¹Research Group Healthy Ageing Allied Health Care and Nursing, Hanze University of Applied Sciences Groningen, Groningen, The Netherlands; ²Department of Community and Individual Oral Health Care, Center for Dentistry and Oral Hygiene, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands; ³Department of Rehabilitation Medicine, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands; ⁴Department of Oral and Maxillofacial Surgery, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands.

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 was to compare the attitudes of dentists and dental hygienists towards extended scope and independent dental hygiene practice. **Methods:** PubMed, AMED and CINAHL were screened by two independent assessors to identify relevant studies. Only quantitative studies that reported the percentages of dentists' and dental hygienists' attitude towards extended scope and independent dental hygiene practice were included. The random-effects model was used to synthesise possible heterogenous influences. **Results:** Meta proportions with regard to a positive attitude towards extended scope of practice are 0.54 for dentists and 0.81 for dental hygienists. Meta proportions of a positive attitude towards independent practice are 0.14 for dentists and 0.59 for dental hygienists. A meta analysis with regard to negative attitudes could only be performed on extended scope of practice and did not reveal a difference between the two professions. We obtained homogeneous outcomes of the studies included regarding negative attitudes of dentists. 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 among a majority of dentists and 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.

Key words: Dental practice, general dental practice, hygienist, oral health policy, primary oral health care

INTRODUCTION

Dentists and dental hygienists are the two most prominent professions within the community delivering oral health care. Since its establishment in 1913¹, the profession of dental hygiene has changed drastically². New legislation has enabled an extended scope and independent dental hygiene practice in many different countries^{3–10}. 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^{11,12}, reduce costs¹³,

increase patient comfort^{12,14,15} and make oral health care more accessible¹⁶. 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”¹⁷. A positive attitude of dentists and dental hygienists towards these policies is required for task shifting. Professional status, culture and professionalisation issues can provide cues to the expected directions and magnitude of attitudes towards professional change among dentists and dental hygienists^{18–23}. Several studies have

investigated attitudes of dentists and dental hygienists towards the extended scope of practice and independent practice of dental hygienists^{24–26}. The findings are somewhat fragmentary and inconclusive. Therefore, the purpose of this systematic review was 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 when considering if studies were suitable for inclusion: types of studies; types of participants; types of interventions; and types of outcome measures. All relevant cross-sectional surveys that focussed on extended scope of dental hygiene practice or independent dental-hygiene practice were included, as were all studies that provided information on 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: the proportions of practitioners with a positive or negative attitude towards an extended scope of dental hygiene practice; and the 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 that is good, useful, has good qualities, or of which one is being certain or sure that it is correct or true²⁷. 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 using 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]).

To overcome the problem of not identifying all relevant publications, the 'related articles' function in PubMed was used as replacement of a full search²⁸. This search function compares words from titles, abstracts and MeSH headings assigned using a powerful word-weighted algorithm²⁹. 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 & Olsen²⁶ was the first publication relevant to the purpose of this study. Next, the publications associated with the content of the study of Abelsen & Olsen²⁶ were identified using the related articles function in PubMed. Additionally, a search was performed in the AMED and CINAHL databases.

Data collection and analysis

Selection of studies

Two assessors (J.J.R. and P.O.) 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 Cohen's kappa coefficient³⁰. According to Fleiss³¹, kappa values below 0.40 should be regarded as poor agreement, those between 0.40 and 0.75 as fair to good agreement and those exceeding 0.75 as excellent agreement. Title screening was followed by a consensus meeting between the two assessors to make a final selection of titles. When in doubt, abstracts were screened to determine their relevance. Then, one assessor (J.J.R.) 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 the percentage or the 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 (P.O.).

Quality assessment

The quality of the cross-sectional surveys was evaluated using the Effective Public Health Practice Project (EPHPP) quality assessment tool for quantitative studies³². 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 judgments: strong; moderate; or weak. These are summarised in an overall quality score: strong (no 'weak' ratings); moderate (one 'weak' rating); or weak (two or more 'weak' ratings).

Data management and analyses

From each study, the operationalisation of attitude was extracted. Data reflecting attitude were extracted

Table 1 Eligibility criteria for the 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	Specialised 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

ADHP, advanced dental hygiene practitioner; GDP, general dental practitioner.

from eligible studies. Then, the percentages of dental and/or dental-hygiene practitioners with moderate to very positive or negative attitudes 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 attitudes may be influenced by cultural, economic and political climate, causing random variance. For this reason, the random-effects model was used to synthesise possible heterogenous influences; however, those from type of profession and year of publication are statistically tested. A descriptive overview of the results according to forest plots is combined with statistical testing of effects after mixed-model estimation³³. The forest plot³⁴ presents the number of respondents (dentists or dental hygienists) answering affirmative (i.e. yes) with regard to a positive or negative attitude towards an extended scope of dental hygiene practice. In addition, the proportion of affirmative replies, with its 95% confidence interval, is given for each study, together

with 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 inspect indication of publication bias. The latter is unlikely when the largest studies are near the average while the results of smaller studies are distributed evenly on both sides of the average. This is also investigated using the regression test for funnel plot asymmetry when at least 10 studies were available for analyses^{34,35}.

RESULTS

Description of studies

The exploratory literature search regarding synonyms or related terminology of task shifting resulted in the identification of 17 different terms. The following terms were found, besides extended scope of practice and independent practice: advanced hygienist skills³⁶; changing skill mix^{37,38}; changing task profiles³⁹; maximised scope of practice⁴⁰; expanding dental hygiene⁴¹; expanded duties⁴²; expanded function¹²; task division²⁶; expanding the role⁴³; task redistribution⁴⁴⁻⁴⁶; expanding the range of procedures⁴⁷; extended competencies⁴⁸; task sharing⁴⁹; task shifting⁵⁰; task transfer⁵¹; work distribution⁵²; and task reallocation⁵³.

Using the related articles search, 1119 articles were identified in PubMed. The search of AMED and CINAHL found no additional articles. The inter-rater 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 14^{24-26,42,54-63} fulfilled the eligibility criteria (Figure 1). The reasons for excluding studies were as follows: one study only reported practitioners with a very positive attitude; one 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; and one study focused on attitude towards interdisciplinary collaboration.

The studies included were conducted on five different continents: North America (four from the USA and one from Canada); Africa (two from South Africa); Oceania (two from New Zealand and one

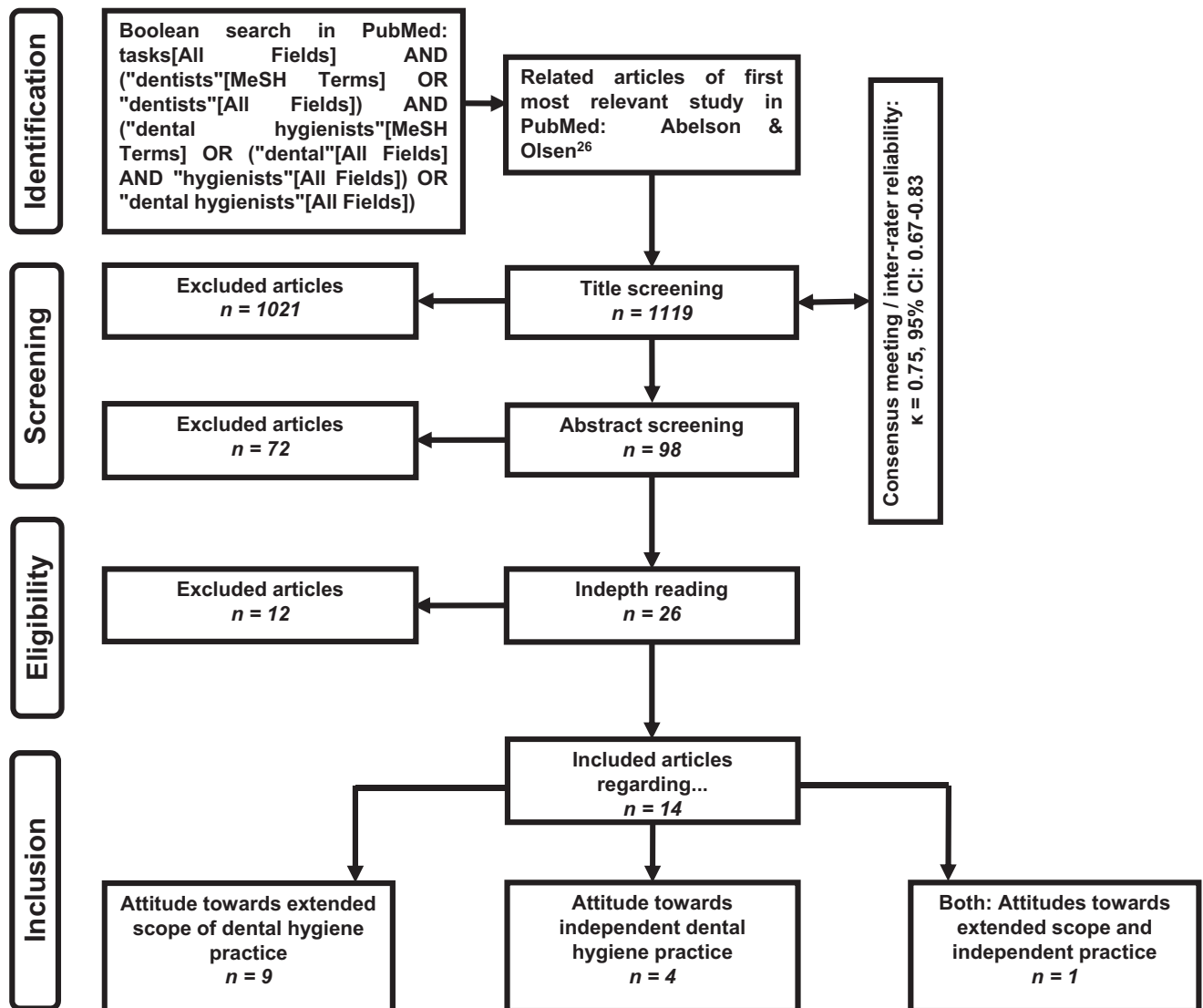


Figure 1. Flow chart of the literature-selection process (Moher *et al.*⁶⁴). 95% CI, 95% confidence interval.

from Australia); Europe (Finland, Norway, and the Netherlands); and Asia (Israel; *Table 2*). The response rate of the studies varied between 29.0% and 87.5%. Eight of the 14 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 was published in 2013.

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

The percentages of dentists with a negative attitude towards extended scope of dental hygiene practice were reported in three studies (*Table 3*). The percentages of dental hygienists with a negative attitude towards extended scope of dental hygiene practice were also reported in three studies. The percentages of dentists with a negative attitude towards independent dental-hygiene practice were reported in three studies, and one study reported the percentage of dental hygienists with a negative attitude towards independent dental hygiene practice.

Risk of bias among the studies included

Three of 14 studies included were classified as 'weak' (*Table 4*) as a result of non-randomised sampling and potential selection bias.

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 (state or province)	Sample type (size)	Response rate (%)	Gender distribution in sample % Female	Profession	Proportion of practitioners with a positive attitude	Operationalisation of attitude
Extended scope	Abelsen & Olsen ²⁶ , Norway	Random (453)	45.0	39.0	Dentist	0.60	'...desirable to delegate'
		Random (108)	42.0	99.1	Dental hygienist	0.55	
	Ayers <i>et al.</i> ⁵⁵ , New Zealand	Population (211)	73.2	95.3	Dental hygienist	0.81	'Interested in expanding range of procedures'
		Blue <i>et al.</i> ²⁴ , USA	Convenience (626)	76.3	19.0	Dentist	
	Gordon & Rayner ⁵⁷ , South Africa	Population (439)	51.0	Data not available	Dental hygienist	0.93	'wish to expand on current qualification'
	Hopcraft <i>et al.</i> ²⁵ , 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 <i>et al.</i> ⁵⁹ , 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 ⁶⁰ , New Zealand	Random (330)	66.8	30.4	Dentist	0.59	'consider employing a dual-trained Oral Health graduate'
	Murtomaa & Haugejorden ⁶¹ , Finland	Random (313)	85.0	65.6	Dentist	0.69	'...changes in the tasks performed by Extended Duty Dental Hygienist'
	Sgan-Cohen <i>et al.</i> ⁶² , Israel	Convenience (156)	87.5	data not available	Dentist	0.53***	'Expected functions of dental hygienist...'
	Van Wyk <i>et al.</i> ⁴² , South Africa	Random (138)	47.0	Data not available	Dental hygienist	0.87	'functions of the oral hygienist should be expanded?'
	Independence	Adams ⁵⁴ , Canada (Ontario)	Stratified (391)	62.0	45.5	Dentist	0.04
Stratified (383)			78.0	88.0	Dental hygienists	0.71	
Benicewicz & Metzger ⁵⁶ , USA		Stratified (4522)	49.6	Data not available	Dental hygienist	0.54	'...dentist's presence in the facility not always be required'
Hopcraft <i>et al.</i> ²⁵ , Australia (Victoria)		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	
Kaldenberg & Smith ⁵⁸ , USA (Oregon)	Random (385)	71.0	5.4	Dentists	0.10	'I support independent practice for hygienists'	
Van Dam <i>et al.</i> ⁶³ , the Netherlands	Convenience (304)	45.9	57.2	Dentist	0.67	'not afraid that the independent dental hygienist will become competitor of the dentist'	

Outcomes of studies included

The forest plot from the meta-analysis in *Figure 2* provides the number of respondents expressing a positive attitude towards extended scope of dental hygiene practice; the total numbers of dentists and dental hygienists; and the proportions of dentists and dental hygienists and corresponding 95% confidence intervals. All proportions were larger for dental hygienists than for dentists, with the study by Abelsen & Olsen²⁶ as the only exception. The meta proportion for the dentists was 0.54 (95% CI: 0.41–0.66) and for the dental hygienists was 0.81 (95% CI: 0.71–0.92). The Wald statistic³³ revealed no evidence for an effect

of year of publication (estimate = -0.002 , standard error = 0.004 , $t = -0.494$, $P = 0.634$), and strong evidence⁶⁵ for the difference in proportions of positive attitudes between the two professions towards extended scope of dental hygiene practice (estimate = -0.230 , standard error = 0.063 , $t = -3.631$, $P = 0.006$).

The funnel plot in *Figure 3*, with the standardised residuals *versus* standard errors of the mixed model for meta-analysis, revealed the Abelsen & Olsen²⁶ study among dental hygienists as outlying to the left. A further sensitivity analysis indicated this study to be influential according to a studentised residual of -4.381 and a Cooks distance of 1.426 . The funnel

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 (state or province)	Sample type (size)	Response rate (%)	Gender distribution in sample % Female	Profession	Proportion of practitioners with a negative attitude	Operationalisation of attitude
Extended scope	Abelsen & Olsen ²⁶ , Norway	Random (453)	45.0	39.0	Dentist	0.40	'...desirable to delegate'
		Random (108)	42.0	99.1	Dental hygienist	0.45	
	Ayers <i>et al.</i> ⁵⁵ , New Zealand	Population (211)	73.2	95.3	Dental hygienist	0.19	'Interested in expanding range of procedures'
	Moffat & Coates ⁶⁰ , New Zealand	Random (330)	66.8	30.4	Dentist	0.41	'consider employing a dual-trained Oral Health graduate'
	Murtomaa & Haugejorden ⁶¹ , Finland	Random (313)	85.0	65.6	Dentist	0.31	'...changes in the tasks performed by Extended Duty Dental Hygienist'
Independence	Van Wyk <i>et al.</i> ⁴² , South Africa	Random (138)	47.0	Data not available	Dental hygienist	0.04	'functions of the oral hygienist should be expanded?'
		Adams ⁵⁴ , Canada (Ontario)	Stratified (391)	62.0	45.5	Dentist	
		Stratified (383)	78.0	88.0	Dental hygienists	0.29	'Dental hygienists should be allowed to practice independently of dentists'
	Kaldenberg & Smith ⁵⁸ , USA (Oregon)	Random (385)	71.0	5.4	Dentists	0.82	'I support independent practice for hygienists'
	Van Dam <i>et al.</i> ⁶³ , the Netherlands	Convenience (304)	45.9	57.2	Dentist	0.16	'not afraid that the independent dental hygienist will become competitor of the dentist'

Table 4 Quality assessment of included studies

Study	Selection bias	Study design	Data-collection methods	Global rating
Abelsen & Olsen ²⁶	Moderate	Strong	Strong	Strong
Adams ⁵⁴	Moderate	Strong	Moderate	Strong
Ayers <i>et al.</i> ⁵⁵	Strong	Strong	Strong	Strong
Benicewicz & Metzger ⁵⁶	Moderate	Strong	Moderate	Strong
Blue <i>et al.</i> ²⁴	Weak	Weak	Moderate	Weak
Gordon & Rayner ⁵⁷	Moderate	Moderate	Moderate	Strong
Hopcraft <i>et al.</i> ²⁵	Moderate	Strong	Moderate	Strong
Kaldenberg & Smith ⁵⁸	Moderate	Strong	Moderate	Strong
Lambert <i>et al.</i> ⁵⁹	Moderate	Strong	Strong	Strong
Moffat & Coates ⁶⁰	Moderate	Strong	Moderate	Strong
Murtomaa & Haugejorden ⁶¹	Strong	Strong	Moderate	Strong
Sgan-Cohen <i>et al.</i> ⁶²	Weak	Weak	Weak	Weak
Van Dam <i>et al.</i> ⁶³	Weak	Weak	Weak	Weak
Van Wyk <i>et al.</i> ⁴²	Moderate	Strong	Strong	Strong

plot regression test indicated some degree of asymmetry ($t = -2.612$, d.f. = 8, $P = 0.031$)³⁵. All studies but one were within the boundaries, thus indicating no publication bias.

The forest plot from the meta-analysis in *Figure 4* provides the number of respondents expressing a positive attitude towards independent dental hygiene practice; the total numbers of dentists and dental hygienists; and the proportion of dentists and dental hygienists and corresponding 95% confidence intervals. All proportions for dental hygienists were larger

than those for dentists. The estimated meta proportion for the dentists was 0.14 (95% CI: 0.05–0.23) and for the dental hygienists was 0.59 (95% CI: 0.48–0.71). The Wald statistic³³ revealed no evidence for an effect of year of publication (estimate = 0.005, standard error = 0.006, $Z = 0.882$, $P = 0.428$), and strong evidence⁶⁵ for the difference in proportions of positive attitudes between the two professions towards extended scope of dental hygiene practice (estimate = -0.476, standard error = 0.081, $Z = -5.860$, $P = 0.004$). Data could not be analysed

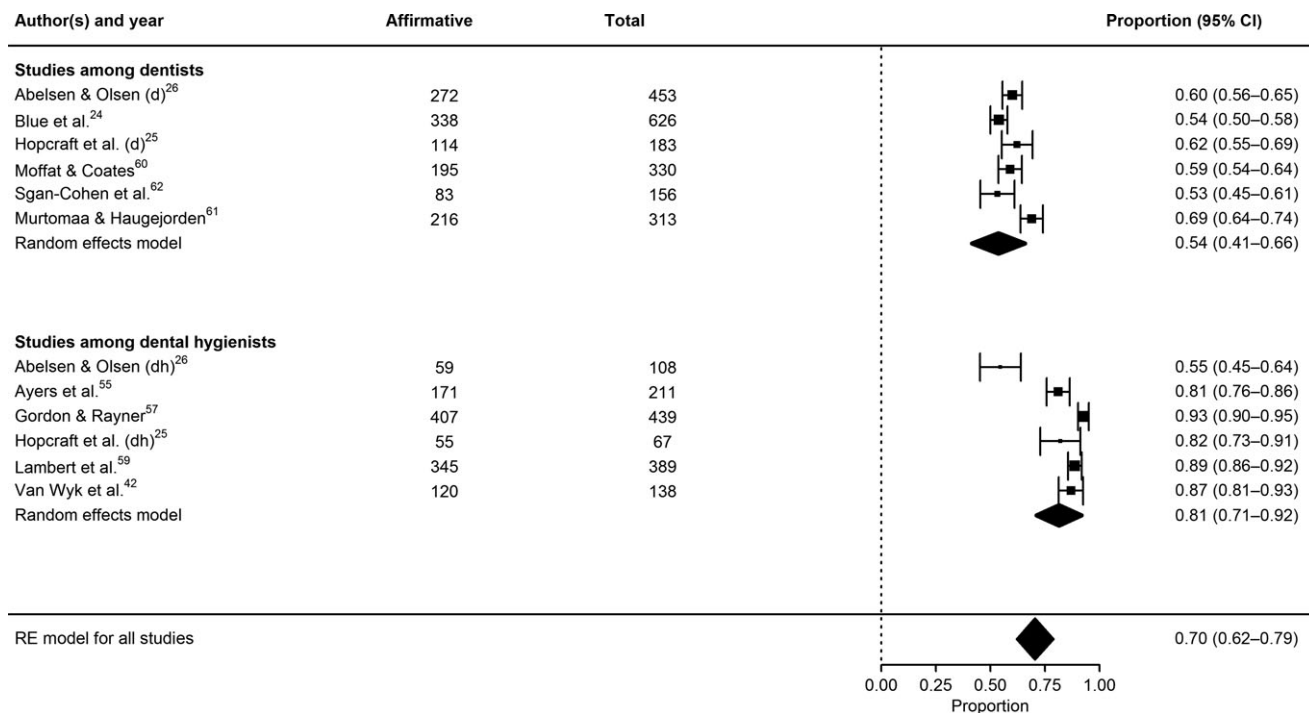


Figure 2. Forest plot from the meta-analysis showing the number of respondents in each study expressing a positive attitude towards extended scope of dental hygiene practice (Affirmative), the total numbers of dentists and dental hygienists in each study, and the proportion and 95% confidence interval (95% CI) of the number of respondents in each study with an affirmative response. d, dentists; dh, dental hygienists; RE, random effects.

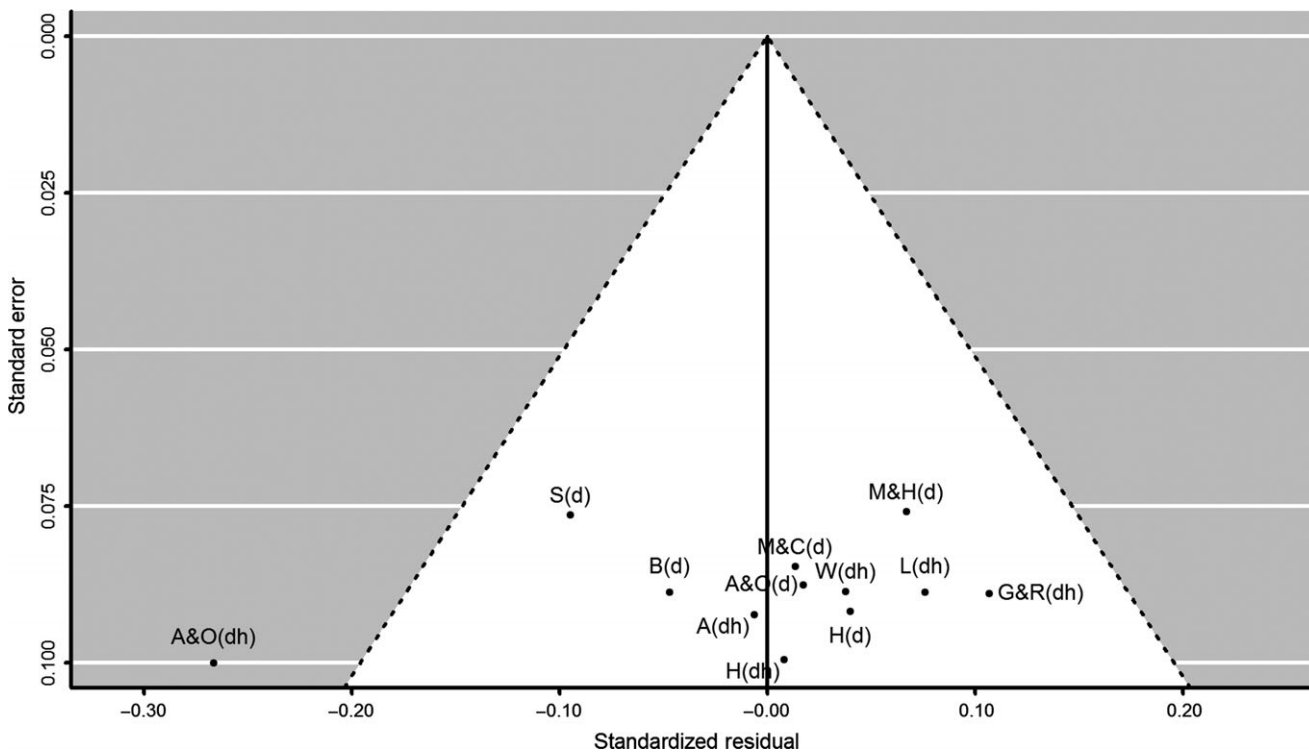


Figure 3. Funnel plot with standardised residuals versus standard errors from meta-analysis of studies on proportions of dentists and dental hygienists with a positive attitude towards extended scope of dental hygiene practice. A; A&O(d) A&O(dh), Abelsen & Olsen²⁶; B, Blue *et al.*²⁴; G&R, Gordon & Rayner⁵⁷; H(d) H(dh), Hopcraft *et al.*²⁵; L, Lambert *et al.*⁵⁹; M&C, Moffat & Coates⁶⁰; M&H, Murtomaa & Haugejorden⁶¹; S, Sgan-Cohen *et al.*⁶²; d, dentists; dh, dental hygienists.

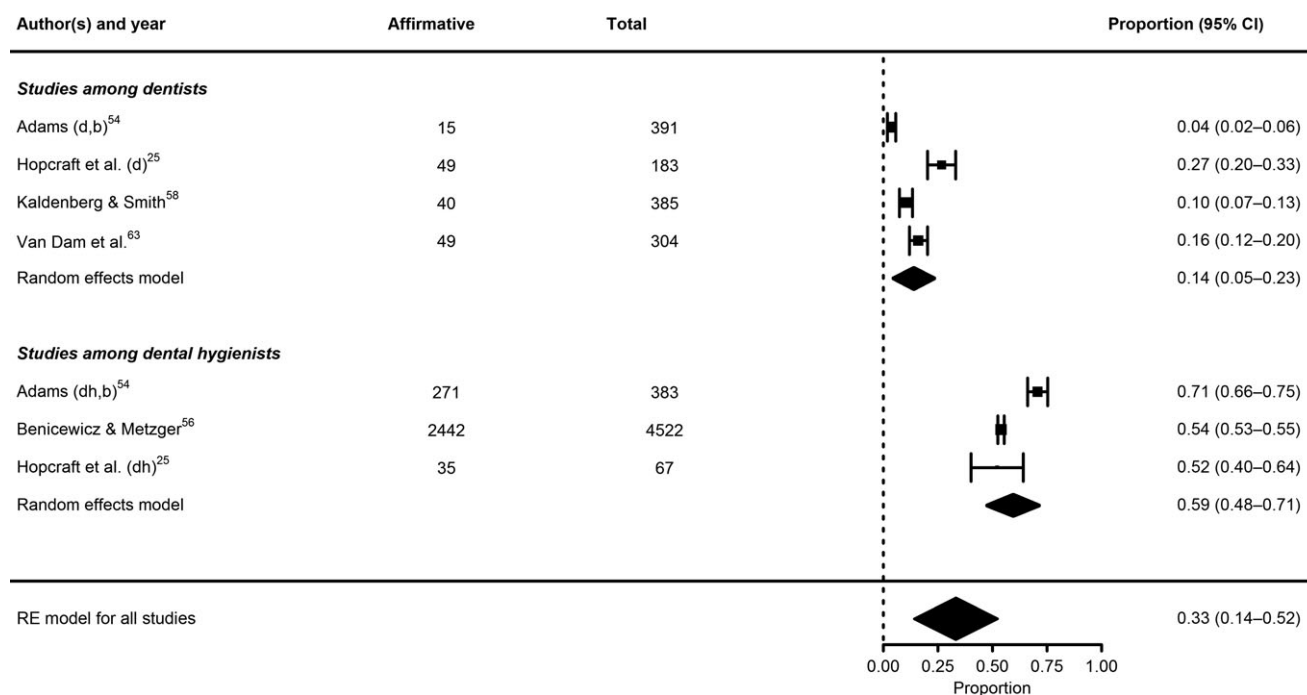


Figure 4. Forest plot from the meta-analysis showing the number of respondents in each study expressing a positive attitude towards independent dental-hygiene practice (Affirmative), the total numbers of dentists and dental hygienists in each study, and the proportion and corresponding 95% confidence interval (95% CI) of the number of respondents in each study with an affirmative response. b, both dentists and dental hygienists; d, dentists; dh, dental hygienists; RE, random effects.

using a funnel plot because fewer than 10 studies were included⁷⁷.

The forest plot from the meta-analysis in *Figure 5* provides the number of respondents expressing a negative attitude towards extended scope of dental hygiene practice; the total numbers of dentists and dental hygienists; and the proportion of dentists and dental hygienists and the corresponding 95% confidence intervals. Compared with dentists, the proportions among dental hygienists were more heterogeneous. The meta proportion for the dentists was 0.37 (95% CI: 0.31–0.43) and for the dental hygienists was 0.23 (95% CI: –0.01 to 0.46). The Wald statistic³³ revealed no evidence for an effect of year of publication (estimate = 0.008, standard error = 0.007, $t = 1.161$, $P = 0.330$), and no evidence⁶⁵ for the difference in proportions of negative attitudes between the two professions towards extended scope of dental hygiene practice (estimate = 0.166, standard error = 0.118, $t = 1.407$, $P = 0.254$). A funnel plot was not constructed because fewer than 10 studies were available⁶⁶.

No forest plot or funnel plot was made for negative attitude towards independent dental-hygiene practice because only three studies among dentists and a single study among dental hygienists were available (*Table 3*). The majority of dentists from two 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

Regarding dentists, we found that a majority have a positive attitude and a minority have a negative attitude towards extended scope of dental hygiene practice. A minority of dentists have a positive attitude towards independent dental-hygiene practice. The analysis of studies included, regarding a negative attitude of dentists towards independent dental hygiene practice, was not conclusive. The different attitudes of dentists towards extended scope and independent dental-hygiene practice can be explained by the following. People in high-status occupations, like dentists, advance by delegating lower-status skills and roles to subordinate groups, such as dental hygienists^{67,68}. This could explain why 54% of dentists had a positive attitude towards an extended scope of dental hygiene practice but only 14% had a positive attitude towards independent dental hygiene practice. If dental hygienists became independent, they would no longer be subordinate and the dental profession would lose control over the treatment provided.

Our finding, that a majority of dental hygienists have a positive attitude towards an extended scope of

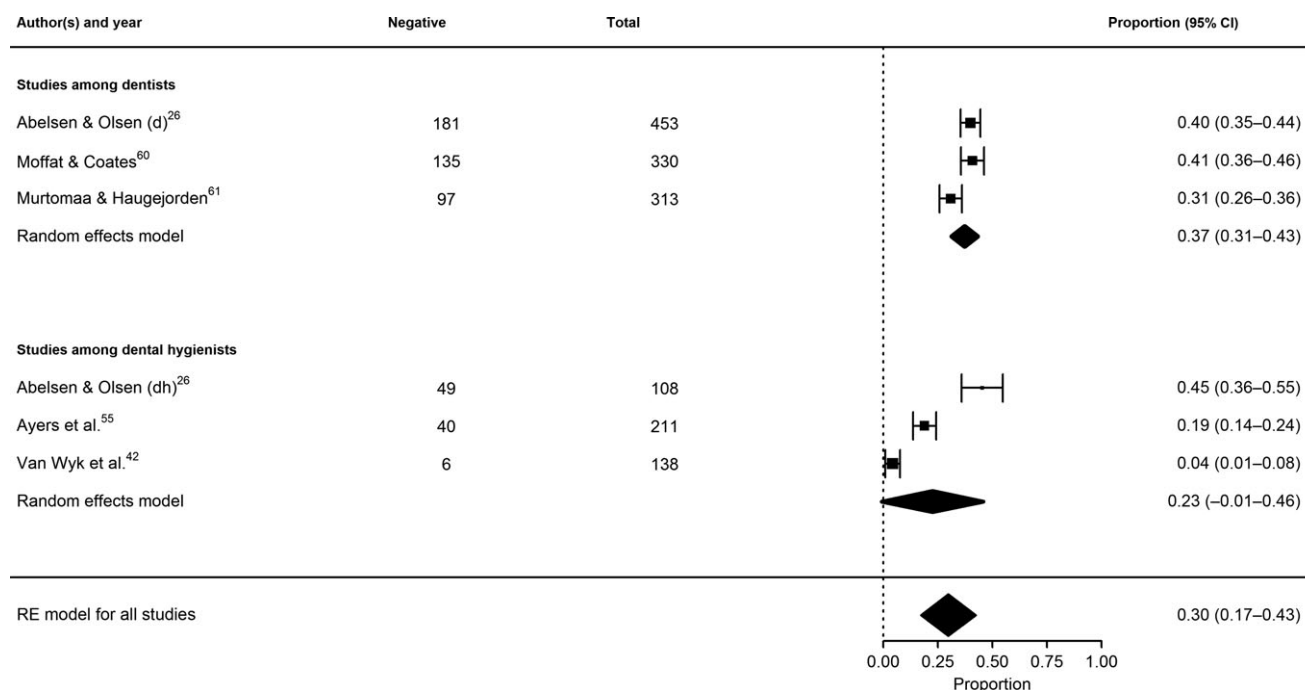


Figure 5. Forest plot from the meta-analysis showing the number of respondents in each study expressing a negative attitude towards extended scope of dental hygiene practice (Negative), the total numbers of dentists and dental hygienists in each study, and the proportion and corresponding 95% confidence interval (95% CI) of the number of respondents in each study with an affirmative response. d, dentists; dh, dental hygienists; RE, random effects.

practice, can be explained by the following. The expanded function of the dental hygienist is considered necessary for providing the appropriate dental hygiene care^{12,39}, for example local anaesthesia^{12,14,15} and dental radiographs^{69,70}. 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 satisfaction⁷¹. Finally, an extended scope of practice and independent practice can contribute to higher professional status⁷² and stronger professional identity²¹.

Possible explanations for the difference between dentists and dental hygienists in attitude are fear of potential economic loss⁷³ and perceived threat to quality of care⁷⁴, by dentists. Dentists want to maintain control over other oral health care occupations^{75,76}, and 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 favour of independent dental hygiene practice. Furthermore, independent dental hygiene practice enables dental hygienists to practice without supervision; some dentists have doubts about the competence of dental hygienists⁵⁴ and some dental hygienists do not feel confident enough to practice independently⁷⁷.

Even though 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 various countries. Eleven studies of the 14 included were of high quality. The outcomes of the three low-quality studies did not deviate from the other studies in the forest plots. Finally, with the Abelsen and Olsen study²⁶ as the only exception, no publication bias was found with regard to studies concerning extended scope and independent practice. A weakness of the present study was the relatively small number of studies found to be suitable for inclusion. A potential explanation for this is the heterogenous terminology in use for extended scope of practice, making identification of relevant studies more difficult. However, because the related articles search function was used, it is very likely that all relevant studies were detected. According to Chang *et al.*²⁸, a related articles search yielded considerably more publications compared with a Boolean search. Another weakness is that a regression test for funnel plot asymmetry concerning independent practice could not be applied because only seven studies were 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 10 studies are available⁶⁶. However, this recommendation is based not only 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-analysis⁷⁸.

Several factors could influence the attitudes of dentists and dental hygienists. Variations in legislation is one variable that might explain different attitudes. However, the study of Lambert⁵⁹ was conducted in three different American states with varying supervision levels: direct (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 the general response rate of 29% as a possible explanation for not finding significant differences.

Legislation in some countries, such as Australia, Canada, Switzerland and the USA, is multi-jurisdictional and has a regional basis⁷⁹. Of the studies included, data on independent dental hygiene practice were reported by three 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 to perform 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 with 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 with non-employers. Dentists who oppose independent dental hygiene practice from the Victoria, Ontario and Oregon studies argued that 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 with negative attitudes. This could introduce a bias. Ten of the fourteen studies included 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 provided data 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 confirms 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 disunity of their profession. This emerging profession consists of different generations of dental hygienists with different qualifications and privileges owing to changes in policy and regulations in a relatively short period of time². Dentistry is a much older occupation and has a well-established professional status⁸⁰. The latter is reflected by the 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, such as different ratios of dentists and dental hygienists in each country, attitude related to specific tasks, position and maturity of profession. With regard to the ratio of these two professions: in the USA the ratio is almost equal⁸¹; whereas the number of dental hygienists in New Zealand are clearly in a minority compared with the number of dentists⁸². However, the proportions of dentists with a positive attitude towards extended scope of dental hygiene practice are very similar in these two countries^{24,60}. Whether 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 role⁸³. Because of the limited information that is available on the attitude of practitioners with regard to specific tasks, more research is needed in this matter. In addition, motives in favour of and against task shifting should be identified. Social position might also influence attitudes. Some dentists still perceive dental hygienists as a dental auxiliary²⁰. However, little is known about the social and psychological implications of task shifting and independent practice^{84,85}. 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 in New Zealand 1988^{86,87}. However, there seems to be no relationship 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, and 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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Correspondence to:
Jan Jaap Reinders MSc B Th Ed,
Center for Dentistry and Oral Hygiene,
University Medical Center Groningen,
PO Box 275 NL-9700 VB Groningen,
The Netherlands.
Email: j.j.reinders@umcg.nl