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# A pilot study of research utilization practices and critical thinking dispositions of Alberta dental hygienists

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**Abstract:** In order to test interventions for increasing uptake of research findings into dental hygiene practice, we must first identify factors that influence research use. There has been little work on this topic in dental hygiene, but much in other disciplines that can provide exemplars of how others have approached the study of this phenomenon. *Objectives:* A pilot study was conducted to determine if protocols used to study research utilization (RU) behaviours and critical thinking dispositions (CTD) in nursing could also be applied to dental hygiene. *Methods:* A cross-sectional survey design was used with a random sample of 640 practicing dental hygienists in Alberta, Canada. Three questionnaires were included: one to capture measures of RU including direct, indirect and symbolic RU; the California Critical Thinking Dispositions Inventory (CCTDI) and a demographics questionnaire. *Results:* Mean responses for the three types of RU were highest for indirect at 3.52 (SD 0.720), followed by direct at 3.13 (SD 0.903) and symbolic 2.86 (SD 0.959). The majority (74.8%) scored between 280 and 350 on the CCTDI (maximum 420). Cronbach's alpha reliability for the RU measures and four of the seven sub-scales were over .7, indicating internal consistency reliability. *Conclusions:* The instruments proved reliable for this population, but other challenges, including a low response rate, were identified during the process of using the RU questionnaire in the context of dental hygiene practice. Pilot testing identified the need for improvements to the presentation of scales to reduce cognitive load and improve the response rate.

**Key words:** CCTDI; critical thinking dispositions; dental hygienist; evidence based practice; pilot studies

## Pilot studies

Pilot studies serve an important function in a developing body of science by providing knowledge about a study design prior to its application. Research is a major undertaking, requiring considerable resources on the part of those conducting the study, as well as on the part of the study participants. Investigators should approach such an undertaking with a reasonable amount of confidence that the study design, in the given context, will provide the necessary data to answer the research question. There are few published studies in the dental hygiene literature that are specifically identified as pilot studies. Furthermore, a limitation of these studies is that they have focused more on the research outcomes rather than on the contribution of the pilots to our knowledge of the research design's usefulness for dental hygiene. The developing body of dental hygiene science will benefit from the type of knowledge we can obtain from pilot studies.

An important attribute of pilot studies is that they are intentional (1) and are planned from the beginning as a test of the research design, and not principally as a source of data used to answer a research question. This is in anticipation of using the process knowledge learned to inform the design and implementation of the larger study that follows (2). A small convenience sample used to obtain feedback on time needed to complete a questionnaire is more appropriately described as a pretest of the instrument, as it does not itself test the study design. Where an inadequate sample size has been obtained, it would be unethical for a researcher to label it retrospectively as a pilot study (1). Even when a pilot study identifies a breakdown of the research plan such that the main study fails to proceed, publication of the pilot phase is useful to alert other researchers to possible problems in the design, instrument, or other aspects of the study (3).

This knowledge can assist future researchers as they set out to design similar studies or to use the same instruments (3). van Tiejlingen *et al.* (4) suggest that 'researchers have an ethical obligation to make the best use of their research experience by reporting issues arising from all parts of a study, including the pilot phase' (p. 293). We need to encourage dental hygienist researchers to publish their pilot studies to continue to advance dental hygiene science.

Data from the pilot study can provide constructive statistical information and support for the reliability and validity of the instruments, and the suitability for use in the required context. This preliminary data can enable the researchers to test data analysis techniques prior to designing the main study. Pilot studies also provide beneficial information on variability for the sample and the population, important for power calculations and sample size determination for the main study. The findings from pilot studies should not normally be used for generalization, otherwise there would be little need for the main study (1). Rather, results from the pilot should be used to inform the choices made for the subsequent main study. The pilot can identify issues that arise during implementation, including recruitment and retention of participants, adequacy of the sampling frame and technique, survey item and unit response, and training needed for research assistants and data collectors (4).

A pilot study can be very advantageous to support applications submitted to external funding agencies. Pilot work signifies to the funding body that the research team has the skills to successfully implement the main study (3), it can demonstrate the significance and feasibility of the proposed main study (1) and can be used to help persuade the funding agency and other stakeholders that the proposed study merits funding (4).

Perry suggests that authors identify the study as a pilot in the abstract, introductory paragraph and where appropriate in the title (1). To extend our knowledge about the design, she further recommends that the important aspects to be included are: barriers encountered and how they were overcome; information about strategies used to obtain and retain participants; and discussion of the validity, reliability and suitability of the instrument(s) for the research context of the study.

This paper intends to contribute to that science by reporting on a pilot study that was developed to test the application of a research design in a dental hygiene setting that had originally been used in nursing science. This pilot study used questionnaires on Research Utilization (RU) and Critical Thinking Dispositions (CTD). The process and findings for the subset of the RU questionnaire dealing with sources of practice knowledge are reported elsewhere (5). In addition this paper reports some of the lessons learned from the implementation of this pilot study in one province, and how this informed the design of the subsequent larger national study.

Although not normally reported in a pilot study, a preliminary description of the findings related to RU behaviours and CTD are included, as these extend our understanding of the topic. We chose to take this approach for two reasons. There is little in the dental hygiene literature on RU and no studies that use this RU tool. Examining measurement validity adequately in the larger main study can be more readily accomplished when the reader has access to the findings of other studies on the topic and given that this is the only other study with this RU instrument we believe it is necessary to provide

these preliminary results. While this may seem inconsistent with the purpose of pilot studies, we believe it is important to the underdeveloped field of dental hygiene. Also, it is through the presentation of results that we can begin to identify where problems exist with the instruments used in the study. The purpose of this study was to conduct a pilot to test the instruments and the study design for the context of dental hygiene.

## Background

The Canadian Dental Hygienists Association acknowledges the need to respond to the expanding body of dental hygiene literature, changing disease patterns and an increased need for quality oral health services (6). Among the guiding principles, this policy document identifies 'it is essential that dental hygiene services are evidence-based' (p. 105) and among the specified graduate outcomes is the ability to 'manage and use large volumes of scientific, technological and client information' (p. 106).

Evidence-based decision making is broadly considered to be the 'systematic application of the best available evidence to the evaluation of options and to decision making in clinical, management and policy settings' (7, p. 6). The dynamic nature of health and health care, and the continually evolving nature of the evidence used in decision-making suggest a need for a culture that continually adapts and progresses with the system and the evidence.

The Evidence-based medicine working group considers skills necessary to practice evidence-based medicine to be the ability to define a patient problem and the information needed to resolve the problem, to conduct an efficient search of the literature, to identify, retrieve and evaluate relevant studies (8). The Evidence-based medicine working group also suggests that clinicians skilled in interpreting current literature and differentiating stronger from weaker evidence are apt to be more cautious in their selection of therapy. Nurse theorists identify a relationship between CTD and RU in evidence-based nursing practice (9).

Forrest and Miller call for evidence-based decision making to support contemporary dental hygiene practice and education, and identify strategies for incorporating evidence-based decision making into dental hygiene education, practice and research (10). Both the Canadian and American Dental Hygienists' Associations (CDHA, ADHA) support practice based on current research evidence, yet recent studies show variation in approaches at the individual level (11–14). This points to a need to identify factors that influence the uptake of research findings in dental hygiene practice.

Research utilization is considered to be the use of findings from research in any aspects of practice. Three types of RU have been described in the literature – instrumental/direct, conceptual/indirect and symbolic/persuasive (15–17). Instrumental or direct use of research is the use of research (dental or non-dental) where findings are directly used in providing dental hygiene therapy. Direct research use often results in protocol, procedure, routine or policy development. Conceptual or indirect use of research includes the use of research findings (dental or non-dental) to change thinking or opinions about how to approach certain patient care or client situations. Conceptual use involves using research for general enlightenment. Indirect research use usually does *not* result in protocol, procedure, routine or policy development. Persuasive or symbolic (18) use of research is the use of research findings (dental or non-dental) to persuade others, who are usually in decision making positions, to make changes in conditions, policies, or practices relevant to dental hygienists, patients/clients and/or the health of individuals or groups. Overall RU is the use of any kind of research findings (dental or non-dental), in any kind of way, in any aspect of work as a registered dental hygienist. Estabrooks reported the construct validity of a model that explains the conceptual structure of RU using these measures (19).

Ohrn *et al.* compared RU behaviours among Swedish dental hygienists with varying educational backgrounds (1 year of professional preparation versus 2 years of professional preparation), and found significant differences between the two groups on a number of variables (20). Dental hygienists with longer educational preparation (2 years) had a more positive attitude toward research, used research to a greater extent in their work, and had greater availability of and support for research in their workplace. Dental hygienists with more education were more likely to share research findings with colleagues and to have access to research-related resources. However, they did find overall low reporting of availability of research-related resources.

Their findings regarding length of education are consistent with those of Finley-Zarse *et al.*, who compared educators and practitioners and found educators used a wider variety of information sources (21). Chichester *et al.* found that baccalaureate programs included more curriculum content related to research and evidence-based practice, such as database searches and critical appraisal (22). Both Ohrn *et al.* (20) and Finley-Zarse *et al.* (21) found reading research articles to be among the most frequently-reported research-related behaviours, yet reading research is not sufficient to result in the translation of these findings into practice. As in other studies, Ohrn *et al.* reported

time as a barrier to research use, and they suggest the use of systematic reviews and practice guidelines as mechanisms to reduce this obstacle. Sixty-five percent of their respondents worked in public rather than private dentistry, and they reported greater support and access to research, not surprising given the differences in their work setting. Cobban and Profetto-McGrath, in a pilot study (5), found information from the client, personal experience, inservices/conferences, dental hygiene program and articles published in dental hygiene journals as the top knowledge sources. Respondents in this study worked predominantly in private practice settings.

Critical thinking dispositions are individual characteristics or behaviours that are conducive to critical thinking (CT). A number of authors have studied nurses and their CTD, and suggest that nurses who are disposed to thinking critically are 'more likely to make high-quality judgements and draw valid conclusions' (9, p. 323). The American Philosophical Association developed the following definition of CTD:

The ideal critical thinker is habitually inquisitive, well informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgements, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit (23, p. 3).

The CCTDI was developed by Facione and Facione based on this definition (24), and measures seven sub-scales: truth-seeking, open-mindedness, analyticity, systematicity, critical-thinking self-confidence, inquisitiveness and maturity.

Preliminary studies with nurses have demonstrated a relationship between CTD and RU behaviours. Profetto-McGrath and her colleagues studied critical-thinking dispositions (CTD) and research-utilization (RU) behaviours of practicing nurses on seven hospital units across four hospitals to examine whether a relationship existed between nurses' CTD and their use of research (9). They found a statistically significant relationship between RU and both overall CTD and some of the CTD sub-scales. They suggest this finding supports the belief that 'nurses who have attributes consistent with the ideal critical thinker' are more likely to use research findings in their work as nurses (p. 334).

Beyond studies of information-seeking behaviours of dental hygienists, there is little in the literature on either RU or CTD. The purpose of this pilot study is to determine if protocols used to study these relationships in nursing could be used in dental hygiene, and whether these protocols would uncover similar relationships between RU behaviours and CTD of practicing dental hygienists in Alberta.

## Methods

A cross-sectional survey design was used for a pilot study with a random sample of practicing dental hygienists in the province of Alberta, Canada. The formula used for sample size calculation for estimation of a single proportion was: $n = 15.4 * p * (1-p)/W^2$ where $n$ = the required sample size, $p$ = the expected proportion and $W$ = width of confidence interval (25). Thus our sample size calculation, with the proportion not known (using 50% when proportion not known), was: $n = 15.4 * p\ (0.50) * (1\text{–p } 0.50)/W^2$ where the $W$ is 0.10 with a 95% confidence interval. This resulted in a sample of 385, and with over-sampling to account for a projected response rate of 60% this led to a final sample size of 640. The Health Research Ethics Board, Panel B, of the University of Alberta, gave ethics approval for the study.

A survey questionnaire previously developed to study RU (RU) in nursing was modified for dental hygiene practice settings (18, 26). Permission was obtained from authors of both studies to revise their questionnaires for use in dental hygiene. The questionnaire was pretested with a convenience sample of ten dental hygiene clinical instructors, who provided feedback related to clarity and ease of completion. This instrument was designed to identify the types of RU – instrumental, conceptual, or symbolic, as well as assessing contextual factors that support RU in practice. The questionnaire included a sub-set of items on knowledge sources, which has been reported elsewhere (5).

The CCTDI (CCTDI) is a standardized test developed to assess dispositions toward CT, based on the APA's definition (24). During the development of this test, item-total correlations were used to identify and eliminate questionable or ambiguous items from 150 proposed items. Factor analysis of the remaining items resulted in the retention of 75 items loading highest on seven factors, which were subsequently retained as seven sub-scales. Cronbach's alpha reliability for the overall instrument, measuring the overall disposition toward CT, was 0.91. Alpha reliabilities for the seven individual subscales in the initial pilot sample ranged from 0.71 to 0.80, which remained stable over later administrations (27).

A demographic questionnaire, the CCTDI and the RU questionnaire were mailed to a random sample of 640 active practicing dental hygienists registered with the Alberta Dental Hygienists Association (ADHA, currently known as the College of Registered Dental Hygienists of Alberta). Randomly

generated mailing labels were provided by the Canadian Dental Hygienists Association. A follow-up complete mailing was sent to non-respondents 4 weeks later in order to increase response (28).

Data were entered into SPSS version 12, and basic descriptive statistics were completed on demographic characteristics, CTD and RU measures. Demographic characteristics of respondents were compared to demographic characteristics of the total population of active practicing dental hygienists. Further analysis was performed to determine correlations between overall RU and overall CTD scores, and between overall RU and the various CTD sub-scales. Cronbach's alpha statistics were calculated to determine internal consistency reliability for each instrument and sub-scale.

## Results

One hundred and sixty-one responses were received, for a response rate of 25.2%. Five respondents indicated they were not in active practice and were not included in the analyses. Two questionnaires did not have an adequate number of items completed for the CCTDI so were excluded from analysis, thus $n$ = 154. As per instructions from the provider of the standardized CCTDI, missing items were coded as 3.5. The mean age of respondents was 40.29 years. The majority (72.1%) were university diploma graduates, and had practiced a mean of 13.94 years. Private practice was the dominant practice setting with 87.7% reporting employment in this setting. Respondents to this survey tended to be somewhat older than the general age distribution of Alberta dental hygiene practitioners (ADHA, personal communication), as is illustrated in Table 1.

### Research utilization findings

The instrument used to measure RU contained a Likert-type scale with five response choices for frequency of research use in the previous year: 1 (never), 2 (on 1 or 2 work days), 3 (on about half my work days), 4 (nearly every work day) and 5 (do not know). Response choices of 5 (do not know) were removed for analysis, leaving a scale of four points. Mean response scores for the three types of RU were highest for conceptual/indirect at 3.52 (SD 0.720), followed by instrumental/direct at 3.13 (SD 0.903) and persuasive/symbolic at 2.86 (SD 0.959). The mean response score to a question on overall RU was 3.58 (SD 0.651), indicating dental hygienists self-report that they perceive themselves to use research frequently in practice, especially in a conceptual or indirect way. Cronbach's alpha for the items directly questioning overall RU and the three types of RU was 0.791, demonstrating good internal consistency reliability for these items. Figure 1 below illustrates the frequency distribution for the variable direct RU. It also illustrates one of the challenges of working with survey data – an ordinal scale with a small range will not approximate a normal distribution on a single item. Normality is an assumption for use of parametric statistical tests, which are more powerful than non-parametric statistics and thus careful consideration was required in choosing tests for correlations with these RU measures.

This instrument also contained sections on knowledge sources (reported elsewhere), and support for research use, which are not reported here.

Table 1. **Frequency distribution of respondent age compared with age of population**

| Age range | Respondents, $n$ = 148 | ADHA members |
|---|---|---|
| ≤24 | 0 | 5.8% |
| 25–29 | 10.8% | 18.6% |
| 30–34 | 17.6% | 19.3% |
| 35–39 | 19.6% | 17.5% |
| 40–44 | 20.3% | 14.8% |
| 45–49 | 17.6% | 13.9% |
| 50–54 | 8.8% | 5.9% |
| 55–59 | 5.4% | 2.9% |

### California critical thinking dispositions inventory findings

This instrument includes 75 statements with a six-point forced choice scale. Items are combined to compute sub-scale scores. A maximum score of 60 can be obtained on each of the seven sub-scales: truth-seeking, open-mindedness, analyticity, systematicity, critical-thinking self-confidence, inquisitiveness and maturity. A score below 40 is considered to be weak in that

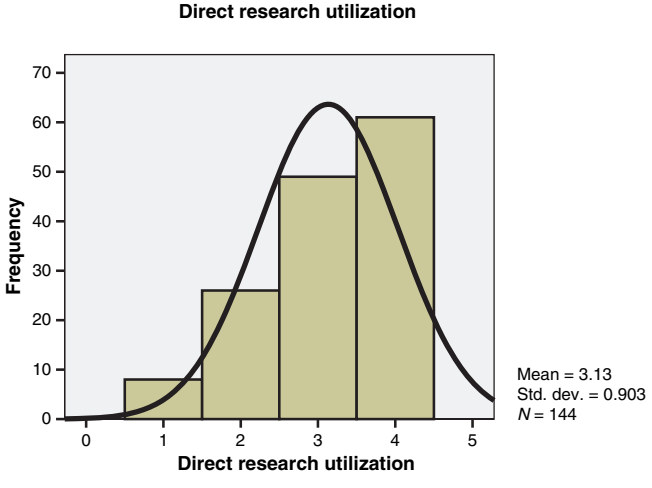


*Fig. 1.* In the past year, how often have you used research findings in a direct way in dental hygiene practice?

dispositional aspect, and a score above 50 is considered to be strong in that dispositional aspect. The overall scale has a maximum score of 420, and scores below 280 are considered to be weak in CTD, whereas scores above 350 demonstrate high CTD. The majority, 74.8%, scored between 280 and 350 on the CCTDI. Just under one-fifth of respondents, 17.2%, scored below 280, indicating a weakness in CTD. A small percentage, 7.9%, scored above 350. Many of the sub-scale scores had similar ranges, with the smallest range for the Analyticity sub-scale (32–55) and the greatest range for the CT self-confidence sub-scale (21–59). None of the sub-scales mean scores for respondents were over the high point of 50, but all were over the target score of 40. Participants scored highest overall in the Maturity sub-scale (Mean 47.25, SD 5.618) and scored lowest in CT self-confidence sub-scale (mean 40.70, SD 6.927) (Table 2).

Cronbach's alpha reliability for this administration was high at 0.914, but alpha is inflated with a large number of items, and this scale contained 75 items. Alpha scores for each subscale ranged from 0.607 to 0.823. Scores over 0.7 are generally considered an indication of reliability (29, 30). Three sub-scale scores, truth-seeking, maturity and open mindedness, fell marginally below this point. Sub-scale – overall CCTDI scale correlations ranged from 0.603 to 0.810, moderate to strong, and all were significant ($P < 0.01$). Table 3 presents the reliability measures for each sub-scale.

Table 2. **CCTDI overall and sub-scale scores**

| CCTDI sub-scales | Min | Max | Range | Mean | SD |
|---|---|---|---|---|---|
| Maturity | 34 | 60 | 26 | 47.25 | 5.618 |
| Inquisitiveness | 35 | 59 | 24 | 46.37 | 5.971 |
| Systematicity | 29 | 60 | 31 | 44.18 | 6.144 |
| Open-mindedness | 25 | 56 | 31 | 42.90 | 5.138 |
| Analyticity | 32 | 55 | 23 | 42.76 | 5.517 |
| Truth-seeking | 32 | 58 | 26 | 42.31 | 5.233 |
| Critical thinking self-confidence | 21 | 59 | 38 | 40.70 | 6.927 |
| CCTDI total | 245 | 404 | 159 | 306.48 | 29.229 |

Table 3. **Reliability measures for sub-scales**

| CCTDI sub-scales | Pearson's correlation with CCTDI | Cronbach's alpha |
|---|---|---|
| Maturity | 0.603* | 0.670 |
| Inquisitiveness | 0.810* | 0.749 |
| Systematicity | 0.774* | 0.748 |
| Open-mindedness | 0.667* | 0.607 |
| Analyticity | 0.734* | 0.730 |
| Truth-seeking | 0.659* | 0.648 |
| Critical thinking self-confidence | 0.769* | 0.823 |

*Correlation significant at 0.01 level (two-tailed).

### Relationship between RU and critical thinking dispositions

The data for the CCTDI subscales and overall scale were normally distributed, but the data for the RU measures were not. An assumption for the use of parametric statistics is normality, so correlations were performed using both non-parametric (Spearman's rho) and parametric (Pearson's product moment) statistics. Table 4 illustrates that there was little difference between the results of correlations between CTD measures and overall RU using both types of statistical tests. Since parametric statistics are more powerful, we used Pearson's product moment statistic for the balance of our correlations.

Overall CTD was not significantly correlated with instrumental/direct RU ($r = 0.149$, $P = 0.074$), and was weakly correlated with conceptual/indirect RU ($r = 0.171$, $P = 0.041$) and overall RU ($r = 0.168$, $P = 0.043$). Persuasive/symbolic RU showed a moderate correlation with overall CTD ($r = 0.388$, $P = 0.000$). The highest correlations were found between persuasive/symbolic RU and CTD sub-scales, as shown in Table 5.

The survey questionnaire contained a space at the end where respondents were invited to share their comments.

Table 4. **Correlation of overall research utilization measure and CCTDI sub-scales and overall scale using both parametric and non-parametric statistics**

| CCTDI sub-scales and overall RU | Pearson's correlation | Spearman's rho |
|---|---|---|
| Maturity | 0.097 | 0.099 |
| Inquisitiveness | 0.084 | 0.107 |
| Systematicity | 0.185* | 0.188* |
| Open-mindedness | 0.091 | 0.093 |
| Analyticity | 0.086 | 0.088 |
| Truth-seeking | 0.092 | 0.077 |
| Critical thinking self-confidence | 0.175* | 0.178* |
| CCTDI overall scale | 0.168* | 0.169* |

*Correlation significant at 0.05 level (two-tailed).

Table 5. **Research utilization and critical thinking dispositions correlations**

| CCTDI sub-scales | Direct RU | Indirect RU | Persuasive RU | Overall RU |
|---|---|---|---|---|
| Maturity | –0.014 | 0.108 | 0.138 | 0.097 |
| Inquisitiveness | 0.120 | 0.101 | 0.345† | 0.084 |
| Systematicity | 0.224† | 0.162 | 0.355† | 0.185* |
| Open-mindedness | –0.015 | 0.115 | 0.217* | 0.091 |
| Analyticity | 0.159 | 0.125 | 0.309† | 0.086 |
| Truth-seeking | –0.011 | 0.003 | 0.171* | 0.092 |
| Critical thinking self-confidence | 0.226† | 0.201 | 0.358† | 0.175 |
| CCTDI Total | 0.149 | 0.171* | 0.388† | 0.168 |

*Correlation significant at 0.05 level (two-tailed).
†Correlation significant at 0.01 level (two-tailed).

Some of the comments illustrated the challenges associated with attempting to measure a construct such as RU. For example, one participant stated 'I have no way to quantify how much research info I use in any aspects of my life'. Other comments related to the respondents' burden of completing three questionnaires, such as, 'Too long', 'A little long & wordy' and 'This was a difficult questionnaire to get through'. Still others suggest recognition of the value of RU, as reflected by such statements as 'Important topic!!' and 'I think that continuing education and research are extremely valuable'.

## Discussion

The purpose of this pilot study was to determine whether protocols used to study the relationship between RU behaviours and CTD in nursing could be reliable and valid in dental hygiene. Pilot studies enable researchers to determine issues arising from study designs, and to test the application of statistical approaches.

Reliability measures for the instruments, including Cronbach's alpha to measure internal consistency and sub-scale-total correlations, showed that this administration of the instruments demonstrated acceptable reliability. Content validity was established *a priori* by expert review of the RU instrument and by pretesting the entire questionnaire. The limitation to this *a priori* review was that experts were available either in RU or in dental hygiene, but not both as this topic is still relatively new to dental hygiene.

The CCTDI is a well-established tool, but has not been used extensively in dental hygiene other than with dental hygiene students (31). As with the nursing study on which this pilot was patterned, dental hygienists scored highest on the maturity sub-scale and lowest on the CT self-confidence subscale. Unlike nurses, dental hygienists scored above the target score of 40 on all sub-scales. Alpha was lower than 0.7 for two of the sub-scales: truth-seeking 0.648 and open-mindedness 0.607. Profetto-McGrath *et al.* (9) question whether the subscales remain stable when used with different populations. This particular finding may be reflective of the respondents' demographic characteristics. Further study with larger samples can add to our understanding of the performance of the subscales with a dental hygiene population.

In the study of nurses there was a significant moderate correlation between overall RU and the overall CTD scale, but our pilot study with dental hygienists found a significant but weak correlation ($r = 0.168$, $P = 0.043$). This may be due to differences between the two populations, or may be due to response bias, or to some other unknown measurement error, possibly related to differences in the practice contexts that aren't readily apparent from these measures.

As with nurses, dental hygienists reported using research on about half their work days in the previous year. Dental hygienists also reported that they used conceptual/indirect RU most frequently, and reported persuasive/symbolic RU the least frequently used, as did nurses.

This pilot study found weaker relationships between CTD and RU behaviours than the study with nurses. This may in part be influenced by response bias given the smaller than desired response rate. A larger response rate with demographic characteristics more similar to the study population may produce different findings.

This study has a number of limitations. The first is the response rate of 25.2%, which introduces the potential for non-response bias and limits inference to the population, despite the random sampling approach. Since this is a pilot study with no intent to generalize the findings, rather the findings are being used for determining the suitability of this design and the reliability and validity of the instruments for this purpose, it is less of a concern than it would be in a large study.

We suspect some coincidences may have influenced the response rate. One day after mailing the 15-page questionnaires to the random sample of 640 dental hygienists, the provincial regulatory body also mailed a 22-page competency review to all members. Given two large questionnaires, some members may have chosen to only complete one or the other if they did not have the time or willingness to complete both. The regulatory body reported that approximately 16% responded to their review (32), suggesting that our response rate for the pilot study was higher at 25.2%, which was encouraging in light of the disappointing return.

The demographic characteristics of participants showed they were older than the population distribution. Some possible reasons can be suggested for this. Perhaps older hygienists have fewer family responsibilities than younger hygienists who may have young children at home, and consequently may have more time to complete lengthy questionnaires. Research utilization is a relatively unfamiliar concept in the dental hygiene literature and there is some suggestion that the survey response is influenced by participants' familiarity with, and the salience of, the subject under investigation (33, 34).

Krosnick suggests that non-response in survey research may be influenced by cumulative cognitive load, or the amount and difficulty of cognitive effort is required to complete the series of questions (35). This survey had a high cognitive load, and one respondent wrote 'too long' on her form and mailed it back incomplete. The response scales on the original nursing

questionnaires referred to numbers of shifts during which different RU behaviours had occurred in the previous year, extent of support in the work environment for different forms of RU behaviours, frequency of use of a variety of knowledge sources, and a standard questionnaire with 75 items related to CTD. Although items were modified to reflect dental hygiene practice, the response structures remained more or less intact. These included different measurement scaling in different portions of the questionnaires, particularly in the RU questionnaire. These measurement scales varied in terminology and ranged from five to eight response options, depending on the different sections of the questionnaire. We suspect this variation contributed to cognitive load.

Response rates with the original questionnaires and this study protocol were higher in studies with nurses. The literature on non-response suggests that responses to surveys are influenced by the respondents' interest or experience with the subject under investigation (34). As RU is a relatively unfamiliar phenomenon in the dental hygiene literature compared with the nursing literature, the inconsistent and unfamiliar measurement scales may have combined to increase the cognitive load and subsequently led to lower responses. To address this possible limitation, changes were made to the questionnaires for use in the main study. These included changing measurement scales to use consistent terminology and consistent units of measurement and numbers of response options and terms, in an effort to reduce cognitive load.

The survey research design has inherent limitations from self-reporting and recall bias. It is difficult to recall accurately how, or even if, someone used research nearly a year ago. While the standardized instrument CCTDI was designed with mechanisms to reduce social desirability bias, given the prominence of evidence-based practice currently it is possible that practitioners would be loath to report that they hadn't used research at all, or very little, in the previous year, even if that were the case. This limitation suggests a cautious use of findings from this study design.

What do these findings add to what is already known? This RU questionnaire had not been used in dental hygiene prior to this pilot study, so the findings provide an interesting reference point. What is problematic in this data is that the stronger correlations were between measures that had been lowest in their own domain, i.e. persuasive RU and CT self-confidence were lowest of their type of scores, yet most strongly correlated. Correlations were lower for measures that were highest in their individual domains, i.e. maturity and conceptual RU.

This raises a number of questions: is the RU instrument valid for this population? Should we be trying to use the Pearson correlation statistic with a normally distributed variable and a variable that isn't normally distributed? Non-parametric statistics produced results that were not markedly different, suggesting this approach was not inappropriate. Why were the nursing findings different from the dental hygiene findings? Reliability statistics – alpha and sub-scale-overall CCTDI correlations – showed that the instruments performed reliably, leaving us with questions about the content and construct validity of the RU instrument for this population. Did the low response and age of respondents influence this in any way? These questions need to be explored further in a subsequent main study.

## Conclusions

Our pilot study set out to determine whether a design and instruments used to study the relationship between CTD and RU with nurses could also be used to study this relationship with practicing dental hygienists. Both the CCTDI and the RU instruments performed reliably, achieving acceptable alpha levels. Scores on the CCTDI and RU measures were similar to those of practicing nurses. However, unlike scores of nurses, dental hygienists demonstrated the highest correlations between persuasive/symbolic RU and CTD sub-scales and overall scale. It is difficult to determine whether this result is related to the specific demographics of the respondents, which were older than the general population, whether the instrument did not function appropriately in the different practice context, or indeed whether dental hygienists are more likely to think critically in relation to persuasive RU than other types of RU even though they report this type of RU least frequently. Given that the purpose of a pilot study is to test the design and instruments and not to generalize from the data, further study is warranted to answer these questions. We have chosen to go beyond the presentation of only process findings of this pilot study to include presentation of statistical findings. This will enable us to compare findings from the subsequent main study with the pilot, and determine if modifications made as a result of the pilot were effective. This in turn will lend support for the use and reporting of pilot studies, increasing their presence in dental hygiene literature and their value to dental hygiene science.

The low response rate is a concern. There are many possible reasons for this, including cognitive load. Changing items to reflect scales that are more consistent in terminology and in response choices will reduce cognitive load in a subsequent main study, thus reducing the potential for bias from this source.

Research utilization behaviours and CTD are valuable attributes for health care practitioners in a climate that values evidence-based practice, and where the evidence is continually evolving. Further study of these attributes and their relationship is warranted, as this knowledge will help us to understand how we can support their continued development.

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