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A comparison of a computer-based questionnaire and personal interviews in determining oral health-related behaviours

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Abstract – *Background:* A major challenge for survey-based research is to reduce bias. In an interview, subjects may claim more favourable behaviour to please the interviewer or comply with accepted norms. *Objectives:* This study aimed to: (i) determine if adolescents give different answers when using a self-completed computer-administered oral health questionnaire compared with a personal interview, (ii) ascertain if responses to a face-to-face interview are dependant on whether a dentist or nonclinical researcher administered the questionnaire and (iii) examine if responses were influenced by whether they undertook the computer questionnaire first or second. *Methods:* A randomized crossover design was used to investigate the responses to 15 closed questions on oral health-related practices. These were administered to 453, 12-year olds attending school dental inspections in South Wales. *Results:* A total of 449 valid pairings of computer/interview responses were available for analysis. Responses to the questionnaire variables demonstrated good to very good levels of agreement (κ 0.68–0.90) when comparing the face-to-face and computer-administered questionnaire. With the exception of questions on dental attendance, responses were not influenced by whether the questions were posed by the research officer or the dentist. A minimal order effect could be detected when undertaking the computer-administered questionnaire first. *Conclusions:* Whilst a study such as this cannot determine the true validity of the responses achieved, it is concluded that a computer-administered questionnaire, comprising closed questions, can be utilized to determine oral health-related behaviours in oral health surveys.

Key words: adolescents; computer or computer based; crossover trial; oral health behaviours; questionnaire; research methodology

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Introduction

A major challenge for survey-based research is to overcome bias. This is particularly so when investigating health behaviours, particularly if the behaviour is of a sensitive nature. Previous research has demonstrated that when questioned about injecting drug use (1), sexual behaviour (2) and women's gynaecological history (3), the responses which individuals gave in a face-to-face interview differed from those given when the same questions were administered by a self-completed computer-based questionnaire.

Whilst, questions relating to oral health-related behaviours may not be particularly sensitive, it is unknown to what extent respondents will give an expected answer, or modify their answer to please the interviewer. Previous work suggested that in

the course of a clinical dentifrice trial, participants reported different toothbrushing frequency when questioned by a clinician compared with a computer-administered questionnaire, and that they also gave different responses to different examiners (4). However, the question remains, to what extent would this apply outwith the context of a clinical trial and to other dentally related behaviours?

The objectives of the present study were therefore to:

- determine the level of agreement when 12-year olds answered oral health-related questions on a computer administered questionnaire, compared with a face-to-face interview
- examine if, in the face-to-face interview, responses differed depending on whether the question was asked by a dentist or a nonclinical researcher and
- investigate whether there was an order effect – that is, were the children more likely to give a different response if they undertook the computer questionnaire first or second.

Methodology

Study population

The study population comprised a convenience sample of 12-year olds attending one of four secondary schools in south Wales, which were selected to be representative of a range of geographic and socioeconomic settings. A total of 657 pupils were invited to take part in the study in conjunction with the annual school dental inspection.

Questionnaire

The questionnaire comprised 15 closed questions. It was adapted from that used in surveys conducted by the British Association for Community Dentistry in Wales (5). Four principle areas were explored, namely, oral hygiene practices, satisfaction with dental appearance, dietary behaviour and dental attendance. Both the questions asked on the computer and the associated responses, were identical to those administered in the face-to-face interview.

Face-to-face interview

The face-to-face interview was administered either by a dentist, immediately after the clinical dental inspection, or by a nonclinical researcher. Responses to the questions were recorded by the dentist/nonclinical researcher on paper forms and then subsequently transcribed to SPSS (SPSS Inc.) for analysis.

Computer-administered questionnaire

The computer-administered questionnaire was completed via laptop computers. The children were logged on to the computer by a study assistant, but thereafter, completed the questionnaire by themselves. They were required only to point and click the computer mouse. The programme led the children sequentially from one question to the next. The programme was written using Microsoft Visual Basic (V6.0 Microsoft Corp.).

Study design

A randomized crossover design was employed. The subjects were allocated to one of four cells, three containing 113 subjects and the fourth 114. One half of the participants (227) completed the computer-based questionnaire first, the other half (226) having the face-to-face interview first. Subjects were allocated at random to be interviewed by the dentist (227) and the nonclinical researcher (226). Both questionnaires were completed within 60 min.

Consent and ethical approval

Consent to participate in the study was obtained from both the children and their parents and the local research and ethics committee approved the study.

Data analysis

First, the level of agreement between the responses to the different questionnaire methodologies, i.e. interviewer administered questionnaire and computer-administered questionnaire, was assessed using Kappa values. Strength of agreement was based on the criteria defined by Altman (6), where 0.61–0.80 = good; 0.81–1.00 = very good.

Next, the agreement between responses given in face-to-face and computer based questionnaires, dependant on whether the participants were interviewed by the research officer or the dentist, was also determined by Kappa.

Finally, the effect of undertaking the computer administered questionnaire first or second was investigated. Kappa statistics were again used to estimate agreement between questionnaire methodologies. Thereafter, period effects were investigated using the Mainland-Gart test for binary outcomes (7). This involved the testing of the association of measurement order with the period

Table 1. Comparison of responses to face-to-face interviews and computer-administered questionnaire on toothbrushing habits and analysis of agreement between methods

Do you brush your teeth?	Interview questionnaire		Yes	No	Kappa statistic κ (95% CI)
	Computer questionnaire	Yes	443	5	*
		No	1	0	
If yes, did you brush them last night?	Interview questionnaire		Yes	No	
	Computer questionnaire	Yes	355	10	0.89 (0.83–0.94)
		No	5	74	

If yes, how often do you brush them?	Interview questionnaire		A few times a week but not every day	Once a day	Two or more times a day	
	Computer questionnaire	A few times a week but not every day	16	5	1	0.81 (0.75–0.87)
		Once a day	5	96	6	
		Two or more times a day	3	18	294	

If you brush your teeth, how long do you normally spend brushing then?	Interview questionnaire		30 sec	30 sec–1 min	1–2 min	More than 2 min	
	Computer questionnaire	30 sec	30	1	0	0	0.79 (0.75–0.84)
		30 sec–1 min	5	99	4	0	
		1–2 min	0	13	171	15	
		More than 2 min	1	1	22	82	

*Of the 449 respondents, 443 claimed to brush their teeth when questioned using both methods indicating a very high level of agreement, but no kappa value was calculable for this question because of the distribution of variables within the two-way table.

preference (ignoring ties) using Fisher's exact test. Ordered categorical outcomes were treated as binary preferences for the purpose of the period adjusted tests.

Results

Of the 657 children invited to participate in the study, 453 consented. Of these, two failed to undertake the face-to-face interview and one did not complete the computer questionnaire. A duplicate record was found within the data collected via the computer, leaving 449 valid pairs for comparison.

Comparison of response frequencies

Comparison of response frequencies during the face-to-face interview and computer administered questionnaire are shown in Tables 1–4. These respectively illustrate answers to questions on toothbrushing habits; satisfaction with appearance, use of mouthwashes and dental floss; dietary habits; and dental attendance. Thus for example, from Table 1, it can be observed that 355 claimed to have brushed their teeth last night in both the face-to-face and computer administered interviews. A further 74 consistently claimed not to have brushed their teeth last night. This left 15 (3.4%), who changed their response to the question between methodologies.

The level of agreement as determined by Kappa values are also illustrated in Tables 1–4 and ranged from 0.68 to 0.90. The questions with highest and lowest levels of agreement, were those which enquired after preference for diet/sugar free (light) and ordinary[1] drinks and the frequency with which participants ate chocolate and sweets respectively (Table 3). When asked about preference for drinks, only 10 of the 413 participants who said that they drank fizzy[2] drinks, gave a different answer between computer and face-to-face questionnaires. In contrast, at the other extreme, 95 of the 449 respondents differed in their claimed frequency of sweet and chocolate eating between the two questionnaires.

Influence of interviewer on response

Agreement between face-to-face interviews and the computer based questionnaire, dependant on whether the interview was conducted by the research officer or the dentist is shown in Table 5. In all

[1]Term commonly used in South Wales for regular or sugar containing beverages.

[2]Colloquial term for carbonated beverage.

Table 2. Comparison of responses to face-to-face interviews and computer-administered questionnaire on happiness with appearance, and use of mouthwash and dental floss and analysis of agreement between methods

Are you happy with the appearance of your teeth?	Interview questionnaire / Computer questionnaire		Yes	No	Kappa statistic κ (95% CI)	
		Yes	316	19	0.80 (0.73–0.86)	
		No	16	98		
Do you use a mouthwash?	Interview questionnaire / Computer questionnaire		Never	Sometimes	Every day	
		Never	166	54	2	0.75 (0.70–0.81)
		Sometimes	2	170	8	
		Every day	0	1	46	
Do you use dental floss?	Interview questionnaire / Computer questionnaire		Yes	No	I do not know what floss is	
		Yes	70	14	1	0.73 (0.66–0.80)
		No	7	309	22	
		I do not know what floss is	0	6	20	

Table 3. Comparison of responses to face-to-face interviews and computer-administered questionnaire on dietary habits and analysis of agreement between methods

How often do you eat chocolate or sweets? (do not include crisps)	Interview questionnaire / Computer questionnaire		≥2 times per day	Once every day	Not every day	Never	Kappa statistic κ (95% CI)
		≥2 times per day	124	13	1	0	0.68 (0.63–0.74)
		Once every day	24	103	28	0	
		Not every day	9	19	125	1	
		Never	0	0	0	2	
Do you drink fizzy drinks like Coke or Fanta?	Interview questionnaire / Computer questionnaire		Yes	No	Kappa statistic κ (95% CI)		
		Yes	413	6	0.83 (0.72–0.93)		
		No	4	26			
If yes, how many fizzy drinks do you have in a day?	Interview questionnaire / Computer questionnaire		<1 per day	1 per day	2 per day	≥3 per day	Kappa statistic κ (95% CI)
		<1 per day	54	13	2	1	0.72 (0.67–0.77)
		1 per day	9	111	10	3	
		2 per day	3	15	90	13	
		≥3 per day	0	2	14	73	
Do you prefer diet/sugar-free drinks or ordinary?	Interview questionnaire / Computer questionnaire		Diet/ sugar-free	Ordinary	Kappa statistic κ (95% CI)		
		Diet/Sugar-free	159	5	0.90 (0.86–0.94)		
		Ordinary	15	234			

cases levels of agreement were good or very good (6). It was however apparent that for the questions relating to dental visits and the need to see a dentist, mean kappa values tended to be lower when the face-to-face interview was conducted by the dentist, although not significantly so.

Effect of order on agreement

The effect of undertaking the computer questionnaire first or second on agreement between the two methodologies is reported in Table 6. Kappa scores varied from 0.70 to 0.96 irrespective of the order the questionnaires were administered, indicating good or very good levels of agreement (6). Period adjusted analysis indicated that in three of the 15 questions, namely, those on mouthwash use, frequency of sweet eating and preference for diet or sugar-containing drinks, responses were significantly affected by the order of questioning. For these three questions only, the number of children answering in the same way for both methods was reduced in the group that answered using the computer first.

Discussion

This study was designed primarily to compare computer and face-to-face interviews in determining

Table 4. Comparison of responses to face-to-face interviews and computer-administered questionnaire on dental attendance and analysis of agreement between methods

When did you last visit the dentist?	Interview questionnaire / Computer questionnaire	In the last 6 months	In the last 6 months	In the last year	>1 year but <2 years	>2 years ago	Kappa statistic κ (95% CI)
		In the last 6 months	361	10	6	3	0.71 (0.62–0.80)
		In the last year	9	40	4	0	
		>1 year but <2 years	0	0	6	1	
		>2 years ago	0	2	2	3	

Why did you go to the dentist last time?	Interview questionnaire / Computer questionnaire	Having trouble with teeth	Had a note from school	Went for a check-up	Went for treatment	Went to have work on a brace	Went for some other reason	Kappa statistic κ (95% CI)
	Having trouble with teeth	14	0	1	2	1	0	0.71 (0.65–0.77)
	Had a note from school	0	3	0	0	0	0	
	Went for a check-up	6	1	266	8	5	9	
	Went for treatment	4	2	7	46	4	9	
	Went to have work on a brace	0	0	2	1	35	0	
	Went for some other reason	2	0	2	0	6	11	

Do you think you need to see your own dentist soon?	Interview questionnaire / Computer questionnaire	Yes	No	Kappa statistic κ (95% CI)
	Yes	240	29	0.78 (0.72–0.84)
	No	19	161	
If yes, why do you think you need to see your dentist soon? (data not shown)				0.75 (0.68–0.72)

oral health-related practices in 12-year olds. As such the presentation of the results and the following discussion concentrate on a comparison of the methodologies rather than the quantitative findings of the study and their implication for oral health or oral health promotion policy and practice.

A convenience sample was selected, although the four participating schools were chosen from different areas in the county to give a balance in terms of geographic location. The response rate at 69% (453 of the 657 invited to participate), was probably influenced by the need to obtain written positive consent from both parents and children to participate in the study. It is entirely possible that the 31% who did not consent were in some way different from the study participants. However, a sample of 453 is sufficiently large to allow comparison between the questionnaire methodologies, particularly as the objective of the study was to compare the questionnaire methodologies, rather than obtain a representative estimation of oral health-related behaviours *per se*.

From the results presented in Tables 1–4, it can be concluded that levels of agreement were high and it makes little difference whether the questionnaire is administered by computer or by interview. It can therefore be concluded that unlike the studies on more sensitive health topics, which prompted this study (1–3), it has not been possible to demonstrate consistent differences in answers given to the computer and in person.

We have been unable to identify previous studies on the use of computers to collect oral habits data, although Berthelsen and Stilley have concluded that a computer-administered questionnaire can be used as an alternative to pen and paper for

Table 5. Agreement between face-to-face interview and computer based questionnaire dependant on whether interviewed by the research officer or the dentist

Question	Effect of interviewer	
	Interviewed by Research Officer Kappa (95% CI)	Interviewed by Dentist Kappa (95% CI)
Are you happy with the appearance of your teeth?	0.81 (0.72–0.90)	0.78 (0.69–0.87)
Do you brush your teeth?[a]	–	–
If yes, did you brush your teeth last night?	0.89 (0.83–0.97)	0.87 (0.79–0.96)
If yes, how often do you brush them?	0.86 (0.79–0.93)	0.76 (0.66–0.85)
If you brush your teeth, how long do you normally spend brushing then?	0.85 (0.78–0.91)	0.74 (0.67–0.81)
Do you use a mouthwash?	0.74 (0.66–0.82)	0.76 (0.68–0.84)
Do you use dental floss?	0.68 (0.57–0.80)	0.77 (0.68–0.86)
How often do you eat chocolate or sweets?	0.76 (0.69–0.84)	0.61 (0.52–0.69)
Do you drink fizzy drinks like Coke or Fanta?	0.79 (0.62–0.95)	0.87 (0.73–0.99)
If yes, how many fizzy drinks do you have in a day?	0.76 (0.68–0.83)	0.68 (0.60–0.76)
Do you prefer diet/sugar-free drinks or ordinary?	0.87 (0.81–0.94)	0.92 (0.87–0.97)
When did you last visit the dentist?	0.81 (0.71–0.92)	0.60 (0.46–0.75)
Why did you go to the dentist last time?	0.80 (0.72–0.87)	0.63 (0.54–0.72)
Do you think you need to see your own dentist fairly soon?	0.85 (0.77–0.92)	0.70 (0.61–0.80)
If yes, why do you think you need to see your dentist soon?	0.87 (0.79–0.95)	0.66 (0.60–0.77)

[a]No kappa value was calculable for this question because of the distribution of variables within the two-way table.

Table 6. Agreement between face-to-face interview and computer based questionnaire, dependant on whether the participants undertook the computer-administered questionnaire first or second

Question	Effect of order	
	Computer first Kappa (95% CI)	Computer second Kappa (95% CI)
Are you happy with the appearance of your teeth?	0.76 (0.66–0.85)	0.84 (0.75–0.92)
Do you brush your teeth?[a]	–	–
If yes, did you brush your teeth last night?	0.85 (0.77–0.94)	0.93 (0.86–0.99)
If yes, how often do you brush them?	0.74 (0.65–0.83)	0.90 (0.83–0.97)
If you brush your teeth, how long do you normally spend brushing then?	0.76 (0.69–0.84)	0.82 (0.76–0.88)
Do you use a mouthwash?	0.67 (0.58–0.76)	0.82 (0.75–0.88)
Do you use dental floss?	0.72 (0.62–0.82)	0.74 (0.64–0.84)
How often do you eat chocolate or sweets?	0.65 (0.56–0.73)	0.72 (0.65–0.78)
Do you drink fizzy drinks like Coke or Fanta?	0.80 (0.64–0.96)	0.86 (0.72–0.99)
If yes, how many fizzy drinks do you have in a day?	0.70 (0.62–0.77)	0.74 (0.67–0.82)
Do you prefer diet/sugar-free drinks or ordinary?	0.84 (0.76–0.91)	0.96 (0.92–0.99)
When did you last visit the dentist?	0.71 (0.58–0.83)	0.70 (0.57–0.84)
Why did you go to the dentist last time?	0.69 (0.60–0.78)	–[b]
Do you think you need to see your own dentist fairly soon?	0.76 (0.64–0.82)	0.83 (0.75–0.90)
If yes, why do you think you need to see your dentist soon?	0.71 (0.59–0.82)	0.83 (0.71–0.88)

[a]No kappa value was calculable for this question because of the distribution of variables within the two-way table.
[b]Two participants claimed 'note from school' when using computer but not in interview. Asymmetrical variables prevents calculation of kappa.

collecting health history data in patients attending a dental clinic (8).

In the present study, the participants found no difficulty using the computer. The programme itself was relatively simple to write, and although not formally evaluated in this study, completion of the questionnaire took no more time than the face-to-face interview. On this basis, the methodology could be recommended for utilization in routine oral health surveys. This has the potential to reduce the cost of such surveys in terms of personnel needed to administer a face-to-face interview.

However, it is acknowledged that there are circumstances when other factors need to be borne in mind when selecting different data collection methodologies. In this study, closed questions were asked. It is possible that if more expansive questions, with open responses were utilized, then

differences between the methodologies may emerge, particularly as interview based questions offer the possibility of asking supplementary or follow-up questions. This would be difficult to achieve via a self-administered, computer-based questionnaire. On the contrary, using a face-to-face interview method, on a short, simple and highly structured questionnaire, may be considered a waste of resource. Face-to-face interviews may also have benefits when completion rates are an issue.

As to the effect of the interviewer, as reported in Table 5, there is evidence of the influence of the dentist as questioner, in relation to questions on dental attendance. This is however small and the overall level of agreement was good. Gerbert and colleagues questioned patients attending a primary care clinic on sensitive health risk behaviours (9). These included seat belt wearing and tobacco use. They concluded that whilst advanced assessment methods (e.g. computers) elicited greater risk disclosure, patients were not less willing to disclose health risks to a research assistant, knowing that this information would be shared with their physician, than when told the information would remain known only to the research assistant. From this and from the present study, we conclude that the influence of the interviewer was not as great as we had anticipated at the outset.

The order in which the questionnaires were administered had little effect on levels of agreement (Table 6), leading to the conclusion that the impact of the order in which the questionnaires were administered was not of importance. However, because of the crossover nature of the trail, it was important to investigate carry-over effects, and thus a period-adjusted analysis was undertaken (7). In only three of the 15 questions was it possible to demonstrate an order effect. The items concerned related to mouthwash use, frequency of sweet eating and preference for drinks. Those children who undertook the computer first were more likely to differ in their response between methods to these questions. It is unclear why this effect should be apparent for these three questions. It may be that having undertaken the computer questionnaire, participants gave a more immediate response in the face-to-face interview and did not wait to be offered all the possible response variables.

For practical and organisational reasons, both questionnaires were administered within 60 min of each other. It could be argued that undertaking the questionnaires on different days would have made the study design more robust. However, it may be that having undertaken the questionnaire, children would subsequently change their behaviour thereby introducing an additional variation in comparing the methodologies.

It should also be borne in mind that the questionnaires were administered in conjunction with the annual school dental inspection. The effect of conducting this study in this context is not known, nor is the effect of the dentist asking the questions after the clinical examination as opposed to before, or indeed without a clinical examination at all.

From a wider public health perspective, this study has demonstrated that computer administered questionnaires may be used to collect oral health data. This is potentially of interest to those with responsibility for oral health programmes beyond the UK. Although the questionnaire was derived from a British survey, the behaviours explored are relevant to oral health in general. It would be interesting to observe whether similar levels of agreement would be found between these methodologies in a different geographic location and is an area for further possible research.

Finally, a key question, which of course cannot be answered by this study, is the validity of the responses given, either to the computer or in the interview. Reported dental attendance is similar to that recorded in the Welsh national surveys (5), and the claimed frequency of brushing was similar to that observed in previous surveys of Scottish (10) and English (11) teenagers.

However, it should be remembered that behaviours and attitudes obtained are reported as opposed to validated.

Conclusions

In contrast to other health behaviours, the response of respondents answering oral health related questions were similar when questions were posed in a computer-administered questionnaire, compared with a face-to-face interview. The level of agreement between the methodologies, albeit using only closed questions, was good and although a minority of responders on occasion changed their response, there was no discernable pattern in the direction of change. Further work would be required to determine the level of agreement between other questionnaire methodologies, such as open questions. Whilst a study such as this cannot determine the true validity of the responses achieved, it is concluded that a computer-administered

questionnaire can be utilized to determine oral health-related behaviours in surveys.

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