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# Factors behind change in knowledge after a mass media campaign targeting periodontitis

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**Abstract:** The aim of this study was to investigate changes in knowledge before and after a mass media campaign, in relation to social attributes, care system attributes and oral health aspects. The study was based on a questionnaire in a cohort design, sent out to 900 randomly sampled people aged 50–75 in Sweden. The response rate to the questionnaire before and after the campaign was 70% and 65% respectively. Sixty-four percent answered both questionnaires. Two questions addressed knowledge, while 10 questions aimed to measure social attributes, care system attributes and oral health aspects. Data were analysed for bivariate relations as to change in knowledge and social attributes, care system attributes and oral health aspects. Data were also analysed in multiple regression analysis with knowledge before, knowledge after and knowledge differences as dependent variables. The results showed that there were a number of independent variables with influence on the dependent variables. Of the social attributes, secondary education gave almost 10% ($P < 0.001$) better knowledge both before and after the campaign. Among care system attributes, high care utilization was related to knowledge both before and after the campaign. The most important factors for knowledge about periodontitis were education, care utilization and perceived importance of oral health. In conclusion, this study demonstrates that mass media might increase knowledge about periodontitis as a health promotion strategy.

**Key words:** education; mass media and campaigns; oral health and knowledge; promotion; social impact

## Introduction

From a public health viewpoint oral health is an essential component of a good life and also considered as an important part of general health (1). Improvements in oral health have occurred in Scandinavia and other industrialized societies during the last 50 years. This includes the two major dental diseases, caries and periodontitis (2). However, periodontitis is still prevalent in the adult population in Sweden (3) and its incidence and severity tend to increase with age (4). There are also possible associations between coronary heart disease (5, 6) and diabetes mellitus (7, 8). Therefore, periodontitis is an important target for oral health promotion.

Based on the hypothesis that behavioural change is preceded by information, improvement in knowledge is an essential part of health promotion. Education results in a change in knowledge (9), increasing the possibilities for people to take control over their own health options (10, 11). An important method in such a context is the use of media. Using mass media, the public can be updated about health risks and mass media can play a supporting role for disease prevention and health promotion (12). Mass media can be used to influence knowledge and attitudes by series of signs and symbols, encoded in the messages to raise attention and motivation for desired actions (13).

Knowledge and awareness through mass media can prepare individuals for lifestyle changes, influencing health and wellness (1). In an oral health context, media have also been used to increase public awareness and knowledge. Bakdash *et al.* (14) evaluated a mass media campaign targeting periodontal awareness, showing that individuals who had been exposed to the campaign could identify periodontal diseases better than those who had not. Campaigns aiming to increase knowledge and awareness about oral health based on 'women's magazines', 'television commercials' and 'materials for home use' have been reported to have a similar, but rather weak effect (15). Rise *et al.* (16) found that a campaign about periodontal disease had an effect on preventive knowledge and behaviour related to periodontal diseases. After a national campaign encompassing the adult population in Sweden regarding periodontal diseases, increased knowledge was found (17).

The knowledge about which factors have an effect on receptivity for media messages in an oral health context is scarce. In this paper, the aim was to analyse factors associated with knowledge of periodontitis. More precisely, changes in knowledge before and after the mass media campaign were analysed in relation to social attributes, care system attributes and oral health aspects.

## Methods

### The campaign

In 1999 the Swedish Association of Periodontology initiated a mass media campaign in Sweden with the purpose of increasing knowledge of periodontitis. It was also intended as a health promotion campaign. The campaign involved newspapers, radio, television and brochures. Information describing periodontitis was sent to approximately 300 newspapers and to the radio and television stations. This resulted in 40 newspaper articles, 25 radio broadcasts, six long radio programmes and five broadcasts on local television. There was also a programme about periodontitis on nationwide television (18).

### Study base

The study was carried out in collaboration with the Swedish Association of Periodontology and based on a mail questionnaire with a panel design to 900 randomly sampled individuals aged 50–75 in Sweden. The first questionnaire was sent to the respondents before the campaign ($n = 900$) and a second one after the campaign ($n = 874$). There were nearly 6 months between the first and the second questionnaires. The response rate to the questionnaire before the campaign was 70%, but 65% to the one after. In all, 64% ($n = 558$) of the respondents answered both questionnaires (17).

### Dropout

As a first step in the analysis, non-response was studied in relation to the sample of 558 persons who responded to both questionnaires. There was a difference in age ($P = 0.043$, $t$-test) but no difference in gender ($P = 0.665$, chi-square test) in relation to the study population (17). There was also a sizeable internal non-response, regarding the knowledge questions, leaving a net of 316 (36%) respondents with complete data on all questions on both occasions. Because of the large internal non-response rate, the net sample was assessed for representativity. Non respondents were analysed with the variables gender, age and education. There was no significant difference between the respondents and non-respondents according to gender ($P = 0.575$). There was, however, a significant difference in age ($P < 0.0005$). The respondents were younger than the non-respondents. A significantly higher share of non-respondents was also found in the group with 'primary education' in relation to the group with 'secondary education' ($P = 0.001$).

### Questionnaire design

The questionnaire contained 20 questions concerning attitudes about teeth, quality of life, and questions about diagnosis, symptoms and treatment of periodontitis. Two questions from the questionnaire were selected for evaluation of the difference in knowledge about periodontitis before and after the campaign. The response alternatives to the questions were to be linked with periodontitis. The term 'periodontitis' was used in the questionnaire without explanation or definition, as the intention was to assess whether the term was known among the public.

The first knowledge question was: 'You can note in various ways that you are suffering from a dental disease, such as caries or periodontitis. Do you know which of the following troubles and symptoms might indicate that you suffer from caries or periodontitis?' The response alternatives were: black and brown plaque on the teeth, gingival bleeding, sensitive teeth, toothache, mobile teeth, bad breath, aching mouth, coated tongue and increased space between the teeth. Gingival bleeding, mobile teeth and increased space between the teeth were chosen as correct answers in analyses of the question.

The second question was: 'Dental diseases can be treated in many ways. There are also many types of examinations in dentistry. Do you know which of the following types of treatments and examinations are intended for caries or periodontitis?' The response alternatives were: scaling, gingival surgery, careful dental hygiene, cleaning between the teeth, pocket probing, X-ray examination, filled teeth, polishing of discoloured teeth, sealing with fluoride and fluoride tablets. Scaling, gingival surgery, careful dental hygiene, cleaning between the teeth, pocket probing and X-ray were chosen as correct answers in analyses of the question.

In combining these questions, the maximum number of correct answers was nine. The combination was used for three variables: knowledge before (A), knowledge after (B) and knowledge difference (B−A). In this study, these questions were used as dependent variables in the statistical analyses.

Ten additional questions from the questionnaire were used as independent variables in relation to the knowledge questions. The questions were taken from three different domains: social attributes, care system attributes and oral health aspects.

### Social attributes

Regarding social attributes the following variables were used:

Age in years was given from the sampling frame, as was gender. Gender was used as a binary variable with the alternatives 'female' and 'male', with female set as 1 and male as 0.

Marital status was measured by the question: 'What marital status do you have at present?' Response alternatives were: 'married/live together', 'single/living alone'. It was used as a binary variable with the two alternatives 'single' and 'married'. Those who were single were set as 1 and those married as 0.

Ethnicity status was measured by the question: 'How long have you been living in Sweden?' Response alternatives were: 'always', 'grew up in Sweden' and 'arrived to Sweden as an adult'. It was used as a binary variable with the alternatives 'born in Sweden' and 'born outside Sweden'. Those who were born in Sweden were set as 1 and outside Sweden as 0.

Work was measured by the single question: 'How many hours per week do you work?' Response alternatives were: 'full-time job' (more than 35 hours/week), 'part-time job' (15–34 hours/week), '1–14 hours per week' and 'not working at all'. The variable was used as is, coded in four ordinal categories.

Education was measured by the question: 'What education do you have?' Response alternatives were: 'elementary school/nine-year compulsory school', 'junior secondary school/'folk high school'/'two years' high school', 'three or four years' high school', 'university education' and 'other education'. This question too was used as a binary variable with the alternatives 'primary education' including 'elementary school/nine-year compulsory school', 'junior secondary school/folk high school/two years' high school' and 'secondary education' including 'three or four years' high school', 'university education' and 'other education'. Those who indicated secondary education were set as 1 while primary education was set as 0.

### Care system attributes

Regarding care system attributes, the following variables were used:

Utilization of dental care was measured by the question: 'How often do you visit a dental clinic?' Response alternatives were: 'twice a year or more', 'once a year', 'every second year', 'infrequently' and 'don't remember'. It was used as a binary variable with those who indicated twice a year or more set as 1 and the others as 0.

Another question about care system attributes was: 'Where did your most recent visit to a dental clinic occur?' Response alternatives were: 'public dental care', 'private dental care', 'specialist dental care', 'hospital dental care', 'dental school' and 'don't remember'. It was used as a binary variable with those who indicated public dental service including 'public

dental care', 'specialist dental care', 'hospital dental care' and 'dental school' set as 1 and private dental service set as 0.

About information, one question was used: 'Did you at your latest dental visit receive any information about…?' Response alternatives were: 'oral hygiene', 'diet', 'fluoride', 'tobacco', 'estimates of costs', 'caries' and 'periodontitis'. Those indicating information of periodontitis were set as 1 and the remainder as 0.

#### Oral health aspects

Regarding oral health aspects, the following variables were used:

Satisfaction was measured by the question: 'Are you satisfied with your teeth?' Response alternatives were: 'yes, very pleased', 'yes, pleased', 'neither pleased, nor displeased', 'rather displeased' and 'very displeased'. The variable was coded in five ordinal categories.

Another satisfaction question was: 'Are you able to chew all kinds of food such as nuts and apples?' Response alternatives were: 'yes, very well', 'well', 'fairly well', 'no, not really well', 'no poorly' and 'no, very poorly'. The variable was coded in six ordinal categories.

In the questionnaire after the campaign, one additional question was used: 'Have you since your latest dental examination experienced that you have had more information about periodontitis from dental personnel?' The response alternatives were: 'yes', 'no difference since before' and 'have not visited a dental clinic'. It was used as a binary variable with the alternatives 'yes' and 'no'. Those who indicated 'yes' were set as 1 and those who indicated 'no' were set as 0. The variable was named 'New information about periodontitis'.

Six questions about the importance of general health in relation to oral health were used. The questions were:

**1** How important is it to able to chew all kinds of food?
**2** How important is it not to have any visible missing teeth?
**3** How important to you is oral health in relation to general health?
**4** How important is it to be able to travel and have pleasure?
**5** How important is it to have a pleasant residence?
**6** How important is it to have regular personal dental care?

All questions had scale alternatives from 1 to 5, where 1 meant 'of no importance' and 5 meant 'of great importance'. The questions were factor-analysed, resulting in two factors called 'perceived importance of oral health' including questions 1, 2, 3 and 6 and 'importance of living conditions' including questions 4 and 5. In Tables 1 & 2, the factor 'importance of health' was regarded as belonging to the oral health domain, while the factor 'importance of living conditions' was regarded as a social attribute.

#### Statistical methods

Data were analysed for bivariate relations as to change in knowledge and social attributes, care system attributes and oral health aspects. Independent sample *t*-test and Spearman rank order correlation were used (19). Data were also analysed by multiple regression analysis with knowledge before (A), knowledge after (B) and knowledge difference (B−A) as dependent variables. Cook distances, change in dependent variable when excluding a case, were calculated for detection of influential outliers. Residual plots were inspected for signs of heteroscedasticity, i.e. uneven distribution of residuals (19). For statistical analyses SPSS for Windows 11.0 was used (SPSS, Inc, Chicago, IL, USA). Statistical significance was defined as $P < 0.05$.

## Results

Significant differences were found between primary and secondary education in knowledge of periodontitis before and after the mass media campaign in the bivariate analyses. There was also a difference as to marital status. Married had better knowledge after the mass media campaign. Individuals receiving information about periodontitis from dental personnel had significantly better knowledge both before and after the mass media campaign. No statistically significant association with knowledge difference was found, except for 'Perceived importance of oral health' (Table 1).

In the multiple regression models of knowledge before and after the campaign, there were a number of independent variables showing influence on the dependent variables. Of the social attributes, the most important variable was secondary education, which gave an almost 10% higher score both in knowledge before and knowledge after, compared with those with primary education. There were no differences as to gender and ethnicity. Among the care system attributes, high care utilization was related to knowledge both before and after the campaign. Respondents who had received information about periodontitis had nearly 20% better knowledge before than those who did not. Visiting a dental clinic twice a year or more was also related to knowledge. The oral health related variable 'chewing ability' was connected with the dependent variable knowledge after. Respondents with poorer capability to chew had less knowledge. In the model of knowledge difference, there were no independent variables significantly associated with the dependent variable (Table 2).

Table 1. **Bivariate relations between knowledge and social attributes, care system attributes and oral health aspects**

| | Knowledge before (A) | | | Knowledge after (B) | | | Knowledge differences (B–A) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | *n* | *P* | Mean | *n* | *P* | Mean | *n* | *P* |
| Social attributes* | | | | | | | | | |
| Gender | | | | | | | | | |
| Female | 2.89 | 260 | | 3.87 | 182 | | 0.65 | 157 | |
| Male | 2.98 | 247 | 0.718 | 3.65 | 181 | 0.444 | 0.32 | 159 | 0.119 |
| Marital status | | | | | | | | | |
| Married | 3.04 | 390 | | 4.01 | 286 | | 0.43 | 248 | |
| Single | 2.55 | 116 | 0.078 | 2.86 | 75 | 0.001 | 0.74 | 67 | 0.223 |
| Ethnicity | | | | | | | | | |
| Not born in Sweden | 2.65 | 58 | | 3.34 | 45 | | 0.35 | 37 | |
| Born in Sweden | 2.98 | 449 | 0.384 | 3.83 | 317 | 0.165 | 0.50 | 279 | 0.632 |
| Work† | –0.10 | 507 | 0.019 | –0.11 | 329 | 0.054 | –0.05 | 316 | 0.363 |
| Education | | | | | | | | | |
| Primary | 2.46 | 331 | | 3.22 | 210 | | 0.52 | 190 | |
| Secondary | 3.85 | 175 | <0.0005 | 4.57 | 147 | <0.0005 | 0.43 | 126 | 0.677 |
| Importance of living conditions† | 0.05 | 503 | 0.242 | –0.04 | 329 | 0.465 | –0.07 | 314 | 0.217 |
| Care system attributes‡ | | | | | | | | | |
| Care utilization | | | | | | | | | |
| Other | 2.63 | 315 | | 3.54 | 223 | | 0.55 | 192 | |
| Twice/year or more | 3.46 | 191 | 0.001 | 4.35 | 130 | 0.005 | 0.42 | 119 | 0.575 |
| Care system | | | | | | | | | |
| Private dental service | 2.94 | 336 | | 3.99 | 231 | | 0.45 | 204 | |
| Public dental service | 2.94 | 168 | 0.918 | 3.54 | 109 | 0.142 | 0.71 | 94 | 0.265 |
| Information about periodontitis | | | | | | | | | |
| No | 2.74 | 462 | | 3.64 | 317 | | 0.46 | 278 | |
| Yes | 4.93 | 45 | <0.0005 | 4.58 | 46 | 0.025 | 0.65 | 38 | 0.558 |
| Oral health aspects | | | | | | | | | |
| Satisfaction | | | | | | | | | |
| With teeth† | 0.01 | 507 | 0.796 | –0.02 | 331 | 0.731 | –0.09 | 316 | 0.096 |
| Chewing ability† | 0.13 | 507 | 0.004 | –0.14 | 331 | 0.012 | –0.02 | 316 | 0.762 |
| Perceived importance of oral health† | 0.10 | 503 | 0.021 | 0.02 | 329 | 0.723 | 0.13 | 314 | 0.015 |

*Knowledge difference (B–A) analysed from the questionnaire before the campaign.
‡Knowledge difference (B–A) analysed from the questionnaire after the campaign.
†Spearman rank order correlation.

## Discussion

In a previous report it was found that a mass media campaign was associated with increased knowledge about periodontitis (17).

In this paper, it was shown that education, utilization and high subjective importance of oral health were related to knowledge, both before and after the campaign. Age and information about periodontitis from dental clinics were associated with knowledge of periodontitis before the campaign. The finding that education may be an important determinant for knowledge of periodontitis is not surprising. Similar results have been reported earlier. Paulander *et al.* (20) reported that education was related to need for treatment of periodontitis and Norderyd *et al.* (4) found that respondents with no bone loss had higher education. Also Unell *et al.* (21) reported that those with higher education had fewer damaged teeth.

Utilization of dental care was also associated with knowledge of periodontitis before and after the mass media campaign. This result is in accordance with Bader *et al.* (22), who reported that individuals regularly visiting dental clinics were rather well informed about periodontal diseases. The dentist or dental hygienist may give information about periodontitis. Persons visiting dental clinics are more often open to assimilating dental messages. Bakdash *et al.* (14) reported that regular dental visitors viewed and recalled messages about periodontal disease from a periodontal television campaign more frequently than irregular visitors.

There was also a relation between age and knowledge of periodontitis before the campaign, similar to the relation between age and having the disease (4, 23). Older people were generally more knowledgeable about treatment and signs of periodontitis (22). However, in this paper we did not find that the knowledge of periodontitis increased after the campaign in relation to age.

Table 2. **Multiple regression models of knowledge before and knowledge after the campaign and differences in knowledge**

| | Knowledge before (0–9) (A), $n = 499$ | | Knowledge after (0–9) (B), $n = 327$ | | Knowledge differences (B–A), $n = 310$ | |
|---|---|---|---|---|---|---|
| *Independent variable* | *b* | *P* | *b* | *P* | *b* | *P* |
| Social attributes | | | | | | |
| Age (in years) | −0.06 | 0.001 | 0.02 | 0.303 | 0.03 | 0.161 |
| Gender (female) | 0.02 | 0.921 | 0.27 | 0.321 | 0.29 | 0.177 |
| Marital status (married) | −0.32 | 0.225 | 0.01 | 0.970 | 0.33 | 0.192 |
| Ethnicity (born in Sweden) | 0.56 | 0.126 | 0.72 | 0.094 | 0.19 | 0.567 |
| Work (1–5) | 0.13 | 0.209 | 0.02 | 0.878 | −0.12 | 0.339 |
| Education (secondary) | 1.24 | <0.0005 | 1.42 | <0.0005 | 0.04 | 0.868 |
| Importance of living conditions (4–10) | 0.02 | 0.838 | −0.16 | 0.154 | 0.08 | 0.333 |
| Care system attributes | | | | | | |
| Care utilization (high) | 0.69 | 0.003 | 0.76 | 0.010 | 0.08 | 0.739 |
| Care system (private) | 0.15 | 0.516 | −0.16 | 0.583 | 0.08 | 0.717 |
| Information about periodontitis | 1.98 | <0.0005 | 0.40 | 0.390 | 0.03 | 0.939 |
| Oral health aspects | | | | | | |
| Satisfaction with teeth (1–5) | 0.19 | 0.211 | 0.34 | 0.098 | 0.00 | 0.963 |
| Chewing ability (1–6) | −0.28 | 0.060 | −0.52 | 0.003 | 0.01 | 0.933 |
| Perceived importance of oral health (9–20) | 0.18 | 0.003 | 0.16 | 0.034 | 0.01 | 0.830 |
| New information about periodontitis | | | 0.78 | 0.111 | 0.62 | 0.103 |
| Adj $R^2$ | 0.16 | | 0.14 | | −0.01 | |
| *F*/d.f. 1/d.f. 2 | 8.28/13/486 | | 4.80/14/313 | | 0.78/14/296 | |
| Model significance | <0.0005 | | <0.0005 | | 0.695 | |

Perceived importance of oral health was associated with knowledge about periodontal disease both before and after the campaign. This is not surprising. Higher salience of oral health ought to be followed by greater interest and thus better knowledge.

A weakness in this study is the high dropout of complete data on the knowledge questions. Non-response of 30–35% is usually regarded as acceptable for questionnaires (24). In our study there was a response rate of 64% ($n = 558$) answering both questionnaires. Still only 36% of the sampling frame answered with complete data on both occasions to the knowledge differences variables. In the dropout analysis it was found that there was a higher share of non-respondents in the group of primary education. This might have improved the results and therefore the results have to be interpreted with caution.

There are biases in questionnaire validity. It could therefore be difficult to determine, e.g. whether there was an association between exposure to the campaign and outcome. Some of the items in the questionnaire in our study were taken from other questionnaires (25, 26), and were partly tested for validity. Due to the nationwide address of the campaign, it was not possible to have a control group.

The effects in this study were analysed by questionnaires in a cohort design (27). The valuable for the study was that the same respondents received the questionnaire before and after the campaign. A cohort design also has to consider the time elapsed between the implementation and the outcome measure. In this study there were approximately 6 months between our two questionnaires. A longer time span would probably have resulted in less knowledge improvement, since the campaign was not continuous but rather limited in duration.

Mass media can be useful for oral health promotion and education to many people in a specified period of time. Oral health promotion comprises a range of complementary approaches including building healthy public policy, creating supportive environments and strengthening public policy. These aspects were not studied here. A disadvantage in the use of media is that there is no direct contact with the audience missing the possibility of dialogue and feedback with the respondents. Mass media campaigns have other drawbacks. Many people will not be exposed to the campaign, many will not pay any attention, some will not understand or believe the message and some are not motivated to act or will forget the message. Therefore, a successful outcome of a campaign cannot be taken for granted (29).

However, Tones (28) says that the lack of informative depth in the mass media can be compensated by the capability to influence a large number of people. Public health campaigns can therefore be a useful tool for oral health promotion and education.

## Conclusion

In conclusion, this study does not contradict that there could be an effect of a mass media campaign in increasing knowledge about periodontitis. The small changes and the sizeable non-response make conclusions about any such effect uncertain.

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