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Analysis of the perceived oral treatment need using Andersen's behavioural model

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Objectives: The aim of this study was to investigate the influence of specific components of Andersen's behavioural model on adult individuals' perceived oral treatment need. ***Methods:*** A questionnaire was sent to a randomly selected sample of 9,690 individuals, 20 to 89 years old, living in Skåne, Sweden. The 58 questions, some with follow-up questions, were answered by 6,123 individuals; a 63% response rate. Selected for inclusion in the multivariate logistic regression analysis were those questions relating to Andersen's behavioural model, phase five. Responses to "How do you rate your oral treatment need today?" were used as a dependent variable. The 62 questions chosen as independent variables represented the components: individual characteristics, health behaviour and outcomes in the model. ***Results:*** Of the independent variables, 24 were significant at the $p \leq 0.05$ level. Low educational level, previously unmet perceived oral treatment need, frequent visiting pattern, perception of worse oral health than one's peers, an external locus of control, and to have received information from one's dental caregiver about a need for oral treatment were all highly significant ($p<0.001$) variables correlating with high self-perceived oral treatment need. ***Conclusion:*** The Andersen behavioural model can be a useful theoretical tool for the study of perceived oral treatment need.

Key words: *self-assessment, needs and demand, health services, perceived need*

Introduction

Self-perceived oral treatment need precedes demand for and utilisation of oral health care. Gatekeeping processes between these steps have been found to be influenced by several factors including education, cultural differences and accessibility of services (Narby *et al*., 2007). Thus, factors that influence self-perceived need will indirectly influence demand for and utilisation of care. Furthermore, in studies of oral treatment need, a theoretical framework can be a useful aid in the selection of variables to be studied.

The theoretical behavioural model of health service use selected as a theoretical framework for this study was that first described by Andersen (1968) but since developed to become one of the most widely used in this field. It is a flexible model that allows the selection of variables and suitable methods related to the researchers' specific hypothesis and area of interest. Both perceived and evaluated treatment needs are individual characteristics in the model. Phase five of this model (Figure 1) describes how contextual, as well as individual, determinants fit the conceptual framework for health service use. Perceived treatment need is one individual determinant that influences an individual's health behaviour (e.g. use of health services) and subsequent health outcomes such as the individual's perceived and evaluated health status (Andersen *et al.*, 2007). Used mostly in general health studies, few studies have applied the model to oral health and oral treatment need.

Baker (2009) found support for the Andersen behavioral model when applied to perceived oral health and she concluded that further studies were needed to study the model's components in other countries with different structures of dental services and dental policies. Applying an earlier version of the model, Tennstedt *et al.* (1994) found that perceived need and attitudes toward dental care are important influences on use of care. Swank *et al.* (1986) also used an earlier version of the model when analysing preventive dental behaviour. The phase five version of Andersen's model has not so far been used to measure perceived oral treatment.

A study on young adults found that educational level and perception of, and concern with, oral health, were of greater importance than clinical findings in predicting individuals' perceived oral treatment need (Lundegren *et al*., 2004). Seremidi *et al.* (2009) found among adults a strong relationship between the presence of caries, badly broken or missing teeth and self-perceived need for oral care. However, studies on factors influencing individual's self-perceived oral treatment need are few.

Oral conditions, such as dental caries and periodontitis, are chronic diseases and largely lifestyle related, i.e. affected by health behaviours. To help patients change their habits and improve their lifestyle, dental professionals need to be aware of patients' perceived oral treatment need and factors affecting this perception. This knowledge could contribute to reducing perceived oral treatment need and improving individuals' oral health.

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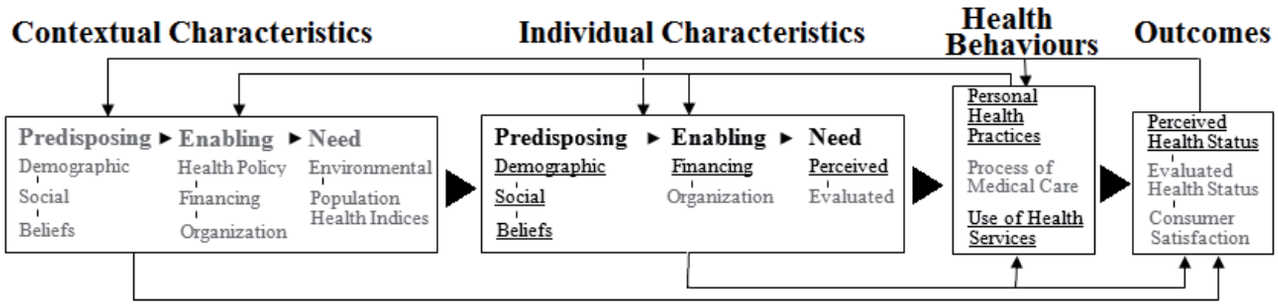

Figure 1. *The phase five of Andersen's behavioural model of health care utilisation with the fields included in this study's analysis underlined*

The aim of this study was to investigate the influence of specific components (individual characteristics, health behaviour and outcomes) of Andersen's behavioural model on the individual's perceived oral treatment need.

Method

A questionnaire was sent to a randomly selected sample of 10,000 individuals aged 20 to 89 years and registered in 2006 as living in Skåne, a county in southern Sweden. Of this original sample, 121 individuals had moved out of the region, 166 had unknown addresses and 23 were deceased, leaving 9,690 individuals as the final sample. The questionnaire was answered by 6,123 individuals, i.e. a response rate of 63% comprising a study sample of 3,480 women (57%) and 2,643 men (43%).

The instrument's 58 questions, some with follow-up questions, concerned patient perception of oral health including perception of oral health care need, perception of pain, use of oral health care, dental materials and background factors. A more detailed description of the questionnaire has already been published (Lundegren *et al*., 2011).

The questions appropriate to the Andersen behavioural model were selected for multivariate logistic regression analysis and represented characteristics from three of the model's four components (Table 1). The component 'contextual characteristics' was neither represented in the questionnaire nor included in the analysis.

For analysis, ages were categorised into seven decades, 20-29 to 80-89 and logistic regression analysis performed with response/non-response as the dependent variable and age and gender as independent variables. Responses to "How do you rate your oral treatment need today?" were used as a dependent variable in the analysis after being dichotomised into "high" (very high/rather high) and "low" (neither high nor low/low/no need/do not know). In total 62 categorical variables from the questionnaire were chosen to serve as independent variables (Table 1). The variables representing the demographic, social, beliefs, financing, personal health practices, use of health services and perceived health status (symptoms and received information) characteristics in the Andersen's behavioural model were analysed using SPSS 18 for Windows with statistical significance taken as $p \leq 0.05$. The significant variables are further described by associations expressed as odds ratios with 95% confidence intervals.

Logistic regression analyses were performed for each independent variable separately, again using the perceived oral treatment need as the dependent variable. First, all respondents were included in these separate analyses, then individuals that had answered all of the 62 questions included in the multivariate analysis were analysed for each variable separately to investigate if there were differences between non-respondents to individual questions and those who responded to all questions.

Results

Non-response was not random and individuals in the youngest age group (odds ratio, OR=1.15) and men (OR=1.65) were less likely to answer the questionnaire. The non-response and the response group have been described by Lundegren *et al.* (2011).

Of all the 6,123 respondents answering the questionnaire, the 2,156 individuals not answering all the 62 questions did not differ from those 3,967 who did answer all, in such a way that it affected the results.

From the demographic and social characteristics, two variables were significant: gender ($p=0.026$) and educational level ($p < 0.001$). Women were more likely to perceive a high oral treatment need than men (OR=1.28). Individuals without a university education were more likely to perceive a high oral treatment need. Odds ratios were 2.09 for those with an education at upper secondary school level, and 2.31 if at elementary school level. Age, marital status, ethnicity, occupation and resident children <18 or ≥ 18-years-old, did not have any correlation with perceived oral treatment need. The financing characteristic variable, how much money one was prepared to spend on oral care, did not contribute to the model ($p=0.421$).

Variables with a significant contribution to the model from the beliefs, personal health practices, use of health services and perceived health status characteristics are accounted for in Tables 2-4. Other self-reported factors from the chosen characteristics found to influence the perceived oral treatment need were: to have needed but not sought care during the past year, an external locus of control regarding keeping teeth healthy and seeking dental care, to have been treated by a specialist dentist during the last year, regular check-ups, to rate one's oral health as good, to have been told by dental personnel about a need for prophylactic care or the need for replacement of lost teeth.

Table 1. Variables included in the multiple logistic regression analysis, divided into characteristics corresponding to the Andersen's behavioural model. Except where there were two categories, the number of categories is shown in parentheses after each variable

Variables
Individual characteristics - Predisposing
Demographic
Age (7)
Gender
Marital status (3)
Social
Educational level (3)
Ethnicity (3)
Occupation (4)
Resident children <18 years old
Resident children >18 years old
Beliefs
Remaining teeth (3)
Number of dental fillings (5)
Artificial crowns
Fixed partial dentures
Dental implants
Removable dentures
Knowledge of caries etiology (3)
Need of care but not seeking care (3)
Decline of suggested treatment
Influence of dental personnel on healthy teeth
Own influence on healthy teeth
Influence of parents etc. on healthy teeth
Influence to seek oral care by dental personnel
Own influence to seek oral care
Viewpoint on selection of dental materials
Perceived importance of: Durability of dental materials; Aesthetics of dental materials; Cost of dental materials; Environment issues of dental materials
- Enabling, *Financing*
Money to spend on oral care (4)
- Health behaviour
Personal health practices
Frequencies of meals (4)
Alcohol consumption (6)
Use of cigarettes (4)
Use of snuff (4)
Tooth brushing habits (5)
Interproximal cleaning habits (3)
History of bleaching ones teeth (3)
Use of health services
Treatment at a dental specialist
Source for most of ones dental care (4)
Frequency of dental check-ups (3)
Latest dental check-up (3)
Outcomes, *Perceived health status*
Satisfaction with teeth
Dental health compared to peers (4)
Sore or bleeding gums
Teeth getting longer
Developed diastema
Loose tooth
Bad taste in the mouth
Bad breath
Dry mouth (4)
Difficult to chew hard food (3)
Pain in the face, jaw, or ear region (4)
Pain when opening the mouth or chewing (4)
Dentist told about need for: Prophylaxis; Artificial crown; Replacement of lost tooth
Dentist told about the presence of: Abrasions; Erosions; Damage due to tooth brushing; Initial caries; Gingivitis
Headaches (3)
General health compared to peers (4)
Use of prescription drugs (3)

Discussion

This study showed that variables, from a patient questionnaire that fit the Andersen behavioural model, phase five, affected the outcome of the self-perceived oral treatment need. The 63% response rate was considered typical for this kind of study in Sweden today (Lundegren *et al.*, 2011) and the effect of non-response to separate questions neither followed a pattern nor altered the results.

In multi-test analyses such as this, a number of tests would reach significance by chance using the criterion $p<0.05$. Therefore only the variables with the higher significance level, $p<0.001$, will be discussed, being the ones more certain to affect the perceived oral treatment need. Data on the other variables affecting the perceived oral treatment need are only presented in the tables. To reduce the problem of multi-collinearity in the model, some items from the questionnaire were not used in the logistic model. The information contained in these questions was very similar to the information included in the model.

The increased risk for high oral treatment need from having a low educational level should be of clinical relevance since the odds ratio was 2.09. Several studies have shown a connection between educational level and oral health. Fewer teeth (Eklund and Burt, 1994) and both greater periodontal disease (Boillot *et al.*, 2011) and caries prevalence (Paulander *et al.*, 2003) have been associated individuals with less educaional level. This agrees with the finding that those who perceived their oral health as being worse than that of their peers also perceived a high oral treatment need.

Individuals that during the past 12 months had perceived a need for dental care, but had not sought care, were more likely to perceive a high treatment need today. This seems logical since they had perceived an earlier need that had not been met. The decision not to seek care could be due to the cost of dental care and/or dental phobia (Scheutz and Heidmann, 2001).

Individuals attending for check-ups more than once every six months, perceived a higher oral treatment need than those who went less often or did not go regularly. The same was found for those who had seen a specialist dentist during the past year. Tennstedt *et al.* (1994) also found that perceived need and attitudes towards dental care were important factors affecting the use of oral care. Individuals recommended by their dentist/dental hygienist to go for frequent check-ups, or did so on their own initiative, were more likely to have bad oral health. The same was true regarding seeing a specialist.

Number of remaining teeth is a good measurement of oral health and has been found to be a good indicator of oral health service use (Scheutz and Heidmann, 2001; Suominen-Taipale *et al.*, 2001). Thomson *et al.* (2010) found the opposite when studying younger adults. They found that routine dental visits were associated with lower experience of dental caries and missing teeth, and better self-rated oral health. In this study, the patients' perception of number of remaining teeth was significant for the perception of oral treatment need, but not highly so.

Individuals in this study rating their oral health as worse than their peers, were four times as likely to have perceived a high oral treatment need than those rating their oral health as better than their peers. This corresponded

Table 2. Logistic multivariate regression analysis for patients' self-perceived oral treatment need today, used as a dependent variable, in relation to individual characteristics (predisposing) variables. Dependent variable is categorised as either low, 0, or high, 1, 69.6% and 30.4% respectively. The analysis controlled for variables included in the Andersen's behavioural model. For the entire analysis n=3,967. When analysed separately, n and p-value for each independent variable are given in parentheses.

Independent variable – categories for beliefs	*Level of measurement*	*p value*	*Odds ratio*	*95 % CI*
How many of your own teeth do you have left?		0.023		
(for n=5,994 p-value <0.001)	All	Ref.cat		
	Missing 1-4	0.86	1.234	0.970-1.570
	Missing ≥ 5	0.006	1.718	1.166-2.530
How many dental fillings do you have?		0.006		
(for n=5,924 p-value <0.001)	A few, don't know how many	Ref.cat		
	None	0.505	1,215	0.685-2.156
	1-4	0.470	1.175	0.758-1.821
	5-10	0.292	1.245	0.828-1.870
	>10	0.004	1.878	1.220-2.891
Have you during the past 12 months needed dental		**<0.001**		
care but did not seek care?	No	Ref.cat		
(for n=5,983 p-value <0.001)	Yes	<0,001	2.395	1.834-3.129
	Don't know	0.036	3.370	1.084-10.476
How important are the dental care personnel for keeping your teeth healthy?		**<0.001**		
(for n=5,822 p-value <0.001)	Very	<0.001	1.845	1.449-2.349
How important are your parents, partner etc. for keeping your teeth healthy?		**<0.001**		
(for n=5,134 p-value <0.001)	Very	<0.001	1.605	1.259-2.046
Who makes you seek dental care?		**<0.001**		
(for n=6,123 p-value <0.001)	Dental care personnel	<0.001	1.823	1.347-2.467
How important is the cost when choosing the material for a dental filling?		0.044		
(for n=5,533 p-value <0.001)	Important	0.046	1.301	1.005-1.685

well with the increased perceived need of those who frequently went for regular check-ups or to a specialist. The rating of one's own oral health as worse than one's peers', was the factor with the highest odds ratio and was the most important predictor of the perceived oral treatment need. This was not a surprising finding since the need of treatment means the presence of a condition that needs treatment.

Individuals considering other people more important than themselves when it came to keeping their teeth healthy and making them seek dental care, were more likely to have perceived a high oral treatment need. To leave the control of one's oral health in the hands of others might thus have left the individuals with a sense of an unmet need. An external locus of control was described by Kneckt *et al.* (1999) to be correlated with worse oral health status, in this case a higher caries prevalence. Individuals that experienced an external locus of control would therefore also have had a high evaluated oral treatment need. For policymakers and dental caregivers the findings from this study can be useful especially regarding how the patient's locus of control is connected to the self-perceived oral treatment need. The advantage of an internal locus of control is not just a better oral health but also a more satisfied patient with a lower self-perceived oral treatment need. A satisfied patient should be the goal for both the dental caregiver and dental policymakers and adequate resources should therefore be allocated to aid this process.

To have been told by your dentist or dental hygienist that you needed prophylactic care or that you needed to replace one or several lost teeth with a prosthetic construction, appeared to influence the perceived oral treatment need. In particular, the prosthetic need increased the likelihood of a high perception of treatment need to threefold. The individual's own perception of remaining teeth also appeared as significant but not highly significant, suggesting that missing teeth greatly affected an individual's perception of his/her oral health and thus the perceived need for dental care. It seemed that the patients were well aware of the information they had received from their caregiver when the information concerned the need for treatment. Several variables regarding information from the individuals' caregivers were significant, but not all highly significant.

Dental professionals' view of the patients' oral health and oral treatment need was not included in this study and, if included in a new model, this information may change the results. Other components and characteristics in the Andersen model that were not included in the analysis (Figure 1) may also affect the perceived oral treatment need.

Table 3. Logistic multivariate regression analysis for patients' self-perceived oral treatment need today, used as a dependent variable, in relation to health behaviour. Dependent variable is categorised as either low, 0, or high, 1, 69.6% and 30.4% respectively. The analysis controlled for variables included in the Andersen's behavioural model. For the entire analysis n=3,967. When analysed separately, n and p-values for each independent variable are given in parentheses.

Independent variable - categories	*Level of measurement*	*p value*	*Odds ratio*	*95 % CI*
Personal health practices				
Have you bleached your teeth?		0.009		
(for n=5,834 p-value=0.014)	Yes, but not by dental personnel	Ref.cat		
	Yes, by dental personnel	0.008	3.349	1.363-8.227
	No	0.256	1.541	0.731-3.249
How often do you drink wine, beer or spirits?		0.015		
(for n=5,765 p-value <0.001)	Every day	Ref.cat		
	A few times/week	0.838	1.064	0.586-1.933
	Once/week	0.197	1.479	0.816-2.679
	A few times/month	0.117	1.619	0.887-2.954
	Once a month	0.123	1.601	0.881-2.909
	Never	0.778	1.093	0.589-2.028
What are your tobacco smoking habits?		0.022		
(for n=5,728 p-value <0.001)	I have never smoked	Ref.cat		
	I have quit smoking	0.509	1.082	0.856-1.368
	I smoke sometimes	0.005	1.772	1.189-2.641
	I smoke daily	0.061	1.319	0.987-1.762
How many meals/snacks do you eat per day?		0.001		
(for n=5,731 p-value <0.001)	3	Ref.cat		
	4-5	<0.001	0.648	0.525-0.799
	6-7	0.042	0.645	0.423-0.985
	>7	0.955	0.959	0.225-4.082
Use of health services				
Have you been treated by a specialist dentist during the last year?		**<0.001**		
(for n=5,741 p-value <0.001)	Yes	<0.001	2.006	1.405-2.866
When was your latest dental check-up at the dentist?		0.001		
(for n=5,762 p-value <0.001)	0-2 years ago	Ref.cat		
	3-5 years ago	0.059	1.391	0.988-1.959
	>5 years ago	<0.001	2.411	1.492-3.897
How often do you go for check-ups to the dentist or the dental hygienist?		**<0.001**		
(for n=5,755 p-value <0.001)	> once in 6 months	Ref.cat		
	6 months - once a year	<0.001	0.492	0.387-0.625
	Do not go regularly	0.157	0.729	0.470-1.129

Conclusion

Variables from all the characteristics in Andersen's behavioural model represented in this study made a significant contribution to the logistic regression model, demonstrating that the model can be a useful theoretical tool for the study of perceived oral treatment need. To validate the model for the purpose of studying perceived oral treatment need, further studies including all of the model's characteristics needs to be undertaken.

Important factors for the prediction of a high oral treatment need were low educational level, previous unmet perceived oral treatment need, frequent visiting pattern, perception of worse oral health than one's peers, an external locus of control, and to have received information from one's dental caregiver about a need for oral treatment.

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Table 4. Logistic multivariate regression analysis for patients' self-perceived oral treatment need today, used as a dependent variable, in relation to outcomes. Dependent variable is categorised as either low, 0, or high, 1, 69.6% and 30.4% respectively. The analysis controlled for variables included in the Andersen's behavioural model. For the entire analysis n=3,967. When analysed separately, n and p values for each independent variable are given in parentheses.

Independent variable - categories of perceived health status	*Level of measurement*	*p value*	*Odds ratio*	*95 % CI*
Are you in general satisfied with your teeth? (for n=5,805 p-value <0.001)		0.002		
	No	0.002	1.426	1.143-1.779
How do you rate your oral health compared to your peers? (for n=5,805 p-value <0.001)		**<0.001**		
	Better	Ref.cat		
	The same	0.003	1.448	1.132-1.853
	Worse	<0.001	3.934	2.767-5.593
	Don't know	0.102	1.495	0.923-2.420
Have you noticed that any teeth feels loose? (for n=6123 p-value <0.001)		0.008		
	Yes	0.008	1.668	1.141-2.440
Have you noticed bad taste in your mouth? (for n=6123 p-value <0.001)		0.035		
	Yes	0.033	1.401	1.027-1.912
Can you chew hard things like hard bread or apples? (for n=6,015 p-value <0.001)		0.044		
	Yes, without difficulty	Ref.cat		
	Yes, carefully	0.063	1.295	0.986-1.701
	No, not at all	0.055	2.098	0.986-4.466
Do you feel pain when you open your mouth or when you chew? (for n=5,958 p-value <0.001)		0.016		
	No	Ref.cat		
	Once a month	0.015	1.639	1.099-2.445
	Once a week	0.022	2.047	1.107-3.786
	Several days a week	0.150	1.491	0.866-2.568
At your latest examination, were you told that you needed prophylactic care? (for n=5,929 p-value <0.001)		**<0.001**		
	Yes	<0.001	1.692	1.335-2.144
At your latest examination, were you told that you needed prosthetic care to replace lost teeth? (for n=5,929 p-value <0.001)		**<0.001**		
	Yes	<0.001	2.865	1.871-4.387
Has your dentist or dental hygienist told you that you have damages on your teeth due to tooth brushing? (for n=6,123 p-value=0.030)		0.044		
	No	0.046	1.298	1.005-1.675
At your latest examination, were you told that your gums are bleeding or that your gums are inflamed? (for n=5,971 p-value <0.001)		0.020		
	Yes	0.019	1.313	1.046-1.649

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