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Alice Sanwald, Engelbert Theurl

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Out-of-pocket expenditures of private households for dental services - Empirical evidence from Austria

Alice Sanwald[*]

Engelbert Theurl[**]

Abstract

Objectives: Dental services differ from other health services in several dimensions. One important difference is that a substantial share of costs of dental services – especially those beyond routine dental treatment - are paid directly by the patient out-of-pocket. We analyze the socio-economic determinants of out-of-pocket expenditures for dentals services (OOPE) in Austria on the household level. *Methods:* We use cross-sectional information on OOPE and on household characteristics provided by the Austrian household budget survey 2009/10. We apply a two-part model (Logit/GLM) and a one-part GLM. *Results:* The probability of OOPE is strongly affected by the life cycle (structure) of the household. It increases with adults' age, with income and partially with the level of education. The type of public insurance has an influence on the expenditure probability while the existence of private health insurance has no significant effect. In contrast to the highly statistically significant coefficients in the first stage the covariates of the second stage remain predominantly insignificant. According to our results, the level of expenditures is mainly driven by the level of education and income. The results of the one-part GLM confirm the results of the two-part model. *Conclusions:* Our results allow new insights into the determinants of OOPE for dental care. The household level turns out to be an adequate basis to study the determinants of OOPE, although we should be cautious to jump to conclusions for the individual level.

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* University of Innsbruck, Department of Economics and Statistics, Universitätsstrasse 15, A-6020 Innsbruck, Austria: E-Mail: Alice.Sanwald@uibk.ac.at, Tel: +43 (0) 512 507 7164, Fax: +43 (0) 512 507 2788

** University of Innsbruck, Department of Economics and Statistics, Universitätsstrasse 15, A-6020 Innsbruck, Austria: Email: Engelbert.Theurl@uibk.ac.at, Tel: +43 (0) 512 507 7159, Fax +43 (0) 512 2788

Introduction

Dental care services are to some extent different from other medical services and these differences might influence the mechanisms of service provision and financing. Dental diseases are normally not life threatening, their expenditures are not existence spoiling and the need for dental services is to some extent predictable and/or susceptible by preventive actions. Patients' ability to learn from experience on provider quality is at least partially possible. However, expenditure smoothing by public and/or private insurance arrangements offer lower space for welfare improvement and higher rates of copayment seem to be optimal. In fact, empirically out-of-pocket expenditures for dental services (OOPE) are higher compared to other medical services. In an unweighted OECD-average in 2011 OOPE account for 53 % of total dental service expenditures which is roughly threefold the level of overall out-of-pocket financing of health care services (1). In Austria the situation is similar. OOPE account for 50 % of dentists' service expenditures leaving 2 % to general government, 46 % to social health insurance and 2 % to private health insurance financing in 2011 (2). This high level of OOPE raises several equity and efficiency related questions. But before drawing any policy conclusions on these issues it seems to be necessary to identify the determinants influencing the level of OOPE. In this paper we exactly focus on this question on the private household level. Thereby we use cross-sectional information of OOPE and on several household characteristics provided by the latest Austrian household budget survey.

The paper benefits from several strands of previous research activities. It builds on research work on out-of-pocket health care expenditure based on micro data in general (3-9) and on the bounded literature on the demand for dental services in particular on OOPE (10-16). Finally, the paper benefits from research work which focuses on the link between the institutional background of health care service consumption and preferred empirical strategies (17-24). The paper contributes to the scarce empirical research on OOPE. It adds evidence from the perspective of the household and completes/adjusts findings available from the individual level. We study OOPE in a highly particularized

health care system which is based on Bismarckian principles and a specific two-tiered institutional architecture.

The remainder of this paper is organized in the following way. In the next section, we briefly describe the institutional setting of consuming dental services in Austria. We subsequently provide a brief description of the data, elaborate the econometric framework, present and discuss the empirical findings. We close the paper by summarizing our findings.

Institutional setting of dental care in Austria

With minor modifications, the general institutional design of demand and supply of outpatient health care services in Austria is also relevant for dental services. The social health insurance system represents the first tier of coverage against the risks of illness. Membership in this system is obligatory for wage earners both in the public and the private sector, for self-employed persons and farmers. Individuals with family ties to obligatorily insured persons and without own coverage obtain free health coverage. Overall, the social health insurance system covers around 99.3% of the population, excluding only marginal groups. Social health insurance is financed mainly by income-related contributions. Private health insurance and out-of-pocket payments constitute the second tier of the Austrian health care system.

Dental services in Austria are offered by (i) private dentists, (ii) public dentists, (iii) dental services offered by the social health insurance system directly (so called dental laboratories) and (iv) by the dental ambulances of public and private hospitals. In our definition, public dentists are dentists that have a contract with the social health insurance system. Private and public dentists are self-employed and mainly work in single practices. Patients with social health insurance coverage are free to consult providers of categories (i), (ii), (iii), and with minor restrictions also providers of type (iv). However, the associated costs of utilization are considerably different.

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The consumption of public dentist services is based on a benefit-in-kind scheme. Basic dental services (e.g. filling and extraction of teeth) are offered with negligible cost-sharing elements. This is especially true for workers in the private sector (76 % of the population, insurance label: GKK). Public workers (8.6 % of the population, insurance label: BVA) and employers (8.4 % of the population, insurance label: SVA) face a proportional cost sharing scheme of 20 % for these services, farmers (4 % of the population, insurance label SVB) have to pay a lump sum fee quarterly when using dental services Patients are confronted with substantial amounts of cost sharing (approximately 50 % of the costs) when they undergo specialized treatments such as endodontic services, crowns and bridges, and prosthodontic and orthodontic services. A closer inspection of the arrangements reveals a quite heterogeneous mix of copayment methods (proportional and absolute cost sharing, public subsidies) for these dental services. Cost sharing designs differ between the different public sickness funds (GKK, BVA, SVA, SVB). In all sickness funds fixed prosthodontics are only co-financed by the social health insurance system in exceptional cases.

A similar regulation of service prices and copayment exists for dental services offered by the public health insurance system directly. Dental costs of private dentists' services are paid out of pocket, and/or by the social health insurance system. The latter only reimburses a portion of a private dentist's invoice. For basic services, the maximum refundable amount is fixed at 80% of the amount a public dentist is allowed to charge for the same service. For specialized private treatments, the remuneration schedules of contracted dentists are applied. Since the prices of private dentists for basic and specialized treatments are above the ones for contracted dentists, the financial burden for the utilization of private dentists is substantial. Private health insurance, which in general completes social health insurance coverage in Austria, plays only a very limited role in the coverage of dental expenditure risks. In 2011, 2 % of the total costs for dental services were paid by the private health insurance system (2).

Material and Methods

To analyze the determinants of OOPE empirically we use data from the latest household budget survey 2009/10 conducted by Statistics Austria. This periodically repeated survey (in the moment with a five year interval) is used to study the level and structure of private consumption of households within the System of National Accounts. The observation unit is the private household without institutionalized households. The total sample offered by Statistics Austria consists of 6,534 households with 15,540 members. We exclude 747 households with unclear household and/or social health insurance status and use a final sample size of 5,787 households. Households participating in the survey are asked to fill in a diary over 14 days in which they record every single expense. These expenditures are converted into monthly expenditures presented in Euros. The data set results in 52 overlapping weeks of bookkeeping. Selected socio-economic characteristics of the household are gathered by face-to-face interviews.

For econometric and economic reasons hurdle models, specifically two-part models serve as methodological cornerstones to explain health care utilization/expenditures (21). The first part is a binary model that focuses on the separation between users and nonusers. The second part explains the level/frequency of medical care use conditional on some use. Statistically the split in the estimation procedure is motivated by the specific characteristics of health care expenditures: (i) skewness, (ii) excess zeros, (iii) heavy right tails. From an economic perspective the split in the estimation procedure is motivated by the fact that the two decision stages are characterized by differences in the involved actors and decision covariates. The empirical strategy in the first step is normally based on explicit or reduced versions of the Grossman-model of demand for health services(25, 26). The patient seeking care decides autonomously whether to seek professional diagnostic and curative medical help at all. The modelling of the second step is influenced by principle-agent considerations leading to joint decisions of patients and their service suppliers. In a nutshell the ideal starting point of two-part models is the entire episode of medical services defined as a set of medical services received

by a patient in response to particular requests caused by a specific illness (for an extended discussion see Stoddart and Barer (24)). The data should picture individual behavior and should allow the separation between the initial spell and additional visits.

The description of the data collection for OOPE in Austria makes clear that our data set does not perfectly fulfill these preconditions for using a two-part model. We react to these fact and use different econometric approaches. First, we apply a two-part model. The first stage of the model predicts the likelihood of any OOPE and was specified as Logit. The second part predicts the level of spending, conditional on having non-zero OOPE. For the latter part we use a generalized linear model (GLM). As an alternative modelling strategy we use a one-part GLM and estimate both decision stages jointly. In both GLM specifications we determine the link function and the relationship between the mean and the variance as suggested by e.g. Manning and Mullahy (27) and Matsaganis, Mitrakos (8). In a modified Park test the squared residuals of a provisional log-transformed OLS model or a provisional GLM model are regressed on the predictions from the same model. The estimated coefficient λ indicates which variance function is appropriate, suggesting either a constant variance model ($\lambda = 0$), a proportional to the mean model ($\lambda = 1$) or a standard deviation proportional to the mean model ($\lambda = 2$). The latter two models are sometimes also called "Poisson-like" model or respectively "Gamma-like" model (17). As suggested, the goodness of fit of competing model specifications will be evaluated by comparing the mean absolute error, the mean squared error and the R2 scores (8). Tests concerning model fit encompass Pregibon's Link test, Ramsey's Reset test, a modified Hosmer-Lemeshow test, Cook's distance and a goodness of fit test for the combined model.

We use monthly OOPE per household as dependent variable. We test for several socio-economic characteristics of the household: the household structure or the household life cycle, adults' age structure, adults' education level, public and private insurance characteristics, sex of the householder, income level and the degree of urbanization. In Table 3 (Annex) we give detailed information on the specification of these variables and the percentages of observations with a specific characteristic.

Table 1 presents the summary statistics of the dependent variable for the explanatory variables. We separate between the expenditure means and standard deviation (SD) for the total sample and those households with expenditures > 0 (1,384 households). The average OOPE for the total household size is 35.57 Euros (SD = 133.28). The mean for households with non-zero OOPE is 148.74 (SD = 239.72). The data show substantial differences in the OOPE level between households with different characteristics.

[Table 1 about here]

Results and Discussion

The econometric results of the two-part-model and the one-part GLM are summarized in Table 2. The probability to have OOPE is strongly influenced by the life cycle of the households. Especially larger observation units like full nest I[1], married couples without children and full nest II have a higher or respectively the highest probability of spending OOPE. These three household types further represent the largest observation units with on average 3.3 - 4 household members. As only one household member with non-zero OOPE is sufficient to classify the total observation unit as a household which consumes OOPE the higher probability of the mentioned household types might be - at least partially - explained. Furthermore, there is strong evidence of the relationship between adults' age and the probability of consuming OOPE. As increasing age is an important factor of seeking health care in general this is also true for dental health care. In our case, the age class of 65 - 85 years shows the highest probability of OOPE. The type of public insurance influences the probability of OOPE (reference group: GKK). Households being insured at BVA, SVB and SVA show a higher probability of OOPE, but the results for members of the SVA remain insignificant. This might reflect the higher proportion of cost-sharing in these sickness funds. The existence of private health insur-

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[1] For the specification of the household structure see table 3 in the appendix.

ance is without any statistically significant effect. A higher level of education and income increases the probability of having OOPE significantly.

[Table 2 about here]

In the second stage we tested for the kurtosis which verified a log link function and the estimated λ clearly suggests a standard deviation proportional to the mean model.[2] In contrast to the highly statistically significant coefficients in the first stage the covariates of the second stage remain predominantly insignificant. According to our results, the level of expenditures is mainly driven by the level of education and income. One explanation for this fact is the well-known attitude of these both groups to contact private dentists with higher service fees. Columns 5/6 show the results of the one-stage GLM. We tested for the kurtosis which takes the score 3.3 and therefore justifies a log link function. The applied Park test shows an estimated λ of 1.84 for the provisional OLS model with log-transformed dependent variable and an estimated λ of 1.60 for the provisional GLM model. In the evaluation process the standard deviation proportional to the mean model clearly outperformed the proportional to the mean model which will be used in the following analysis. The considered household types, income, adults' age and education level show a strong impact on the expenditure level. A negative effect of a lower degree of urbanization is revealed which might reflect a limited access to dental care facilities. To sum up, the findings of the one-stage GLM widely confirm the results the two-part-model.

For robustness checks we separated OOPE into the two components (i) routine dental services and (ii) specialized treatments (e.g. endodontic services, crowns, bridges). It turns out that (ii) is much more important. We observe 1291 households with positive OOPE (mean OOPE for the total sample: 27.41; mean OOPE for sample OOPE > 0: 122.88) in this expenditure category while only 157 households have positive OOPE for routine dental services (mean OOPE for the total sample:

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[2] The estimated λ of the provisional OLS model with log-transformed dependent variable takes a score of 2.04 and respectively a score of 2.004 in the provisional GLM model.

8.15; mean OOPE for sample OOPE > 0: 300.70). The econometric results (two-part model, one-part GLM) for category (ii) are very similar to the results for total OOPE while the results for category (i) are widely insignificant.

A comparison of our results with the results of previous research (10-16) is only partially useful. We focus on OOPE. The vast majority of the previous literature analyses utilization (measured by visits or by total dental expenditures). Additionally, we focus on the household while previous research is based on individual data. Finally, we extensively stress socio-economic household characteristics as explanatory variables and are not able to control for the dental health status and supply-related characteristics in detail. We only use "degree of urbanization" as a proxy for the access to dental service. Therefore we also abstain from drawing any supply side related conclusions from our results (see Nguyen and Häkkinen (14)). Previous evidence sometimes points to a u-shaped relationship between age and dental utilization/expenditures. We find an effect of age on OOPE which increases with age. Our finding is not contradictory to a u-shaped relationship. Our reference group consists of adults which are on average below 25. Children are only included in the household structure. Compared to Choi (10) the study presents new and dissenting findings on the role of public and private insurance characteristics on OOPE. The type of public insurance influences OOPE. Copayment mechanisms for routine dental services and especially for special treatment differ between the public sickness funds. This is an essential feature of the Austrian health care system in general although movements to harmonize the remunerations system of public dentists and the copayment schemes for specialized treatment are in process. Of course the differences in the OOPE levels of the members of the different public sickness funds might also be caused by unobserved heterogeneity between the members of the different insurance groups. Additional private health insurance is without any effect on OOPE. This could be interpreted as an indication for a sufficient public level of coverage against dental expenditure risks.

Conclusions

This paper analyzes the socio-economic determinants of OOPE of private households in Austria using data from the household budget survey 2009/10. Empirically the data show substantial differences in the expenditure levels between households with different characteristics. The characteristics of the data (household level data, period based data, short observation period) pose several challenges to the choice of the empirical estimation procedure. Therefore we supplement the two-part estimation strategy widely used in the explanation of health expenditure with a one-part GLM. The two-part model estimation reveals highly significant results for several household characteristics (household life cycle, adults' age, adults' education, income) when explaining the probability of OOPE while in the second stage (expenditure level) only income and education have significant coefficients. The one-part GLM estimation confirms the results of the two-part model. The existence of private insurance has no influence on the expenditure probability/level. Public insurance characteristics influence the expenditure probability. Public workers and farmers have a higher expenditure probability, which might be caused by higher net prices or higher quantities consumed. The household turns out to be an adequate basis to study the determinants of dental expenditures, although we should be cautious in deriving conclusions for the individual level.

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Table 1: Descriptive statistics according to households' characteristics and structures

Total households	Dental Care Expenditures				
	Average expenditures		Expenditures > 0		
	Mean	S.D.	Mean	S.D.	N
Household structure					
Single person I	23.75	116.86	141.57	255.19	126
Single person II	24.15	101.76	136.49	208.26	172
Unmarried couple	48.19	236.65	181.64	433.94	91
Married couple	36.12	121.22	165.35	214.82	128
Empty nest	42.77	135.90	149.14	220.51	232
Full nest I	29.74	124.98	129.84	235.45	164
Full nest II	58.80	151.77	167.71	218.01	271
Married couple w/o childs	38.16	116.47	129.61	185.51	106
Single parents	24.52	104.07	122.86	206.25	92
Degree of urbanization					
High urbanization	41.21	158.53	169.37	285.82	502
Average urbanization	36.60	138.14	148.69	246.92	369
Low urbanization	29.65	99.95	128.59	175.06	513
Age structure					
Age < 25	7.07	35.41	86.46	94.51	17
Age 25-45	31.13	131.35	134.12	246.17	506
Age 45-65	43.96	144.97	170.07	244.81	588
Age 65-85	32.49	122.11	133.78	219.01	273
Education level					
Primary education	13.15	47.19	74.56	89.96	130
Other education	38.40	140.15	154.93	247.46	1125
Tertiary education	42.79	150.56	169.61	262.05	129
Insurance characteristics (public)					
GKK	30.09	126.79	137.51	242.35	892
BVA	49.75	153.49	174.31	246.88	302
SVA	47.03	127.38	161.43	193.33	141
SVB	46.11	156.38	159.03	259.34	49
Private health insurance (1)	45.56	122.36	179.77	250.98	290
Private health insurance (2)	43.59	145.52	147.91	183.19	207
Total households	35.57	133.28	148.74	239.72	1,384
N (households)	5,787		1,384		

Notes: (1) corresponds to one adult of the household which has an additional private health insurance. (2) corresponds to both adults of the households which have an additional private health insurance. This also includes households consisting of one individual (single person I and single person II). Dummy variables for female householders and income are not reported in the table.

Table 2: Econometric results of the Two-Part Model and the one-part GLM

	Dental Care Expenditures					
	Probability (Logit)		**Conditional (GLM)[a]**		**GLM[a]**	
	Coeff.	Rob. S.D.	Coeff.	Rob. S.D.	Coeff.	Rob. S.D.
Household structure						
Single person II	-0.287*	0.169	-0.005	0.048	-0.154	0.226
Unmarried couple	0.478**	0.194	-0.005	0.052	0.775***	0.266
Married couple	0.125	0.178	-0.068	0.053	-0.137	0.255
Empty nest	0.267	0.186	-0.005	0.049	0.107	0.259
Full nest I	0.390**	0.165	-0.075*	0.043	0.162	0.237
Full nest II	0.690***	0.162	0.008	0.040	0.496**	0.231
Married couple w/o childs	0.464**	0.205	-0.081	0.057	-0.040	0.297
Single parents	0.011	0.189	-0.033	0.050	0.012	0.246
Degree of urbanization						
Average urbanization	-0.041	0.095	-0.022	0.024	-0.019	0.136
Low urbanization	-0.135	0.089	-0.022	0.023	-0.287**	0.126
Age structure						
Age 25-45	0.997***	0.315	0.062	0.116	1.343***	0.306
Age 45-65	1.301***	0.322	0.105	0.117	1.873***	0.321
Age 65-85	1.420***	0.341	0.035	0.121	1.861***	0.345
Education level						
Other education	0.272**	0.132	0.089**	0.042	0.694***	0.174
Tertiary education	0.282	0.185	0.090*	0.051	0.832***	0.253
Insurance characteristics (public)						
BVA	0.288***	0.095	0.028	0.025	0.323**	0.139
SVA	0.170	0.129	0.024	0.029	0.304	0.192
SVB	0.531***	0.205	0.066	0.045	0.668**	0.311
Private health insurance (1)	0.179	0.113	0.013	0.026	0.150	0.170
Private health insurance (2)	0.016	0.096	0.007	0.023	0.121	0.134
Other characteristics						
Female householder	0.214**	0.095	0.028	0.025	0.121	0.137
Income (log)	0.235**	0.095	0.129***	0.026	0.466***	0.124
Constant	-4.795***	0.759	0.268	0.218	-2.684***	0.955
Observations (households)	5,787		1,384		5,787	

*Notes: a) GLM with log-link and gamma distribution. (1) corresponds to one adult of the household which has an additional private health insurance.
(2) corresponds to both adults of the households which have an additional private health insurance. This also includes households consisting of one individual
(single person I and single person II). Reference groups: single person I, high urbanization, age class 18- 25, primary education, GKK, no additional private
health insurance and male householder. Significance level *** p<0.01, ** p<0.05, * p<0.1.*

Appendix

Table 3: Overview of variable specification and the corresponding share of observations

Variables	Percentage of observations	S.D.	Definition
Household structure			
Single person I	12.98	0.44	*Household consists of 1 adult, single.*
Single person II	16.80	0.49	*Household consists of 1 adult, either married, divorced or widowed.*
Unmarried couple	5.93	0.31	*Household consists of 2 adults, unmarried.*
Married couple	10.13	0.40	*Household consists of 2 adults, married, members are below 60 years.*
Empty nest	13.98	0.46	*Household consists of 2 adults, married, members are above 60 years.*
Full nest I	12.37	0.43	*Household consists of 2 adults, members are below 40 years, at least one child.*
Full nest II	13.36	0.45	*Household consists of 2 adults, members are above 40 years, at least one child.*
Married couple w/o childs	6.22	0.32	*Household consists of more than 3 adults, married, no children.*
Single parents	7.97	0.36	*Household consists of one adult, at least one child.*
Degree of urbanization			
High urbanization	35.65	0.63	*Areas with a population of at least 50,000 and more than 500 inhabitants per square kilometer.*
Average urbanization	25.90	0.58	*Areas with a population of at least 50,000 and 100 - 500 inhabitants per square kilometer.*
Low urbanization	38.45	0.64	*All other areas.*
Age structure			
Age < 25	3.59	0.24	*Average age of both adults. Refers to householder, if household consists of one adult.*
Age 25-45	37.67	0.64	*Average age of both adults. Refers to householder, if household consists of one adult.*
Age 45-65	39.31	0.64	*Average age of both adults. Refers to householder, if household consists of one adult.*
Age 65-85	19.42	0.52	*Average age of both adults. Refers to householder, if household consists of one adult.*
Education level			
Primary education	12.74	0.44	*Both adults have a primary education level. This also includes households consisting of one adult.*
Other education	78.43	0.54	*Both adults have a mixed or secondary education level. This also includes households consisting of one adult.*
Tertiary education	8.83	0.37	*Both adults have a secondary education level. This also includes households consisting of one adult.*
Insurance characteristics (public)			
GKK	70.43	0.60	*Workers in the private sector. Refers to householder's insurance type.*
BVA	18.28	0.51	*Public servants. Refers to householder's insurance type.*
SVA	8.36	0.36	*Employers. Refers to householder's insurance type.*
SVB	2.92	0.22	*Farmers. Refers to householder's insurance type.*
Additional private health insurance (1)	11.61	0.42	*One adult of the household has an additional health insurance.*
Additional private health insurance (2)	20.67	0.53	*All adults have an additional health insurance. This includes households consisting of one adult.*
Other characteristics			
Female householder	32.73	0.62	*Householder is female.*
Income	2986.40	2025.56	*Monthly household income in Euros.*

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Working Papers in Economics and Statistics

Alice Sanwald, Engelbert Theurl

Out-of-pocket expenditures of private households for dental services - Empirical evidence from Austria

Abstract
Background: Dental services differ from other health services in several dimensions. One important difference is that a substantial share of costs of dental services - especially those beyond routine dental treatment - are paid directly by the patient out-of-pocket. Objectives: We analyze the socio-economic determinants of out-of-pocket expenditures for dentals services (OOPE) in Austria on the household level. Methods: We use cross-sectional information on OOPE and on household characteristics provided by the Austrian household budget survey 2009/10. We apply a two-part model (Logit/GLM) and a one-part GLM. Results: The probability of OOPE is strongly affected by the life cycle (structure) of the household. It increases with adults' age, with income and partially with the level of education. The type of public insurance has an influence on the expenditure probability while the existence of private health insurance has no significant effect. In contrast to the highly statistically significant coefficients in the first stage the covariates of the second stage remain predominantly insignificant. According to our results, the level of expenditures is mainly driven by the level of education and income. The results of the one-part GLM confirm the results of the two-part model. Conclusions: Our results allow new insights into the determinants of OOPE for dental care. The household level turns out to be an adequate basis to study the determinants of OOPE, although we should be cautious to jump to conclusions for the individual level.