

Table 2

Results of the hierarchical analysis of dental services utilisation (n = 9233).

Fixed effects	Coefficient	Odds ratio (IC 95%)	p-Value
Intercept	3.74	42.25 (23.17–77.04)	0.000
• Median income in the department (<p 25%)	–0.35	0.70 (0.60–0.83)	0.000
• Median income in the department (<p 50%)	–0.17	0.84 (0.72–0.99)	0.033
• Median income in the department (<p 75%)	–0.14	0.87 (0.76–0.99)	0.037
• Median income in the department (>p 75%) (ref.)		1	
Individual income per consumption unit			
Unknown	–0.11	0.89 (0.70–1.13)	0.357
• Very low density of dental practitioners (<p 25%)	–0.57	0.57 (0.41–0.79)	0.001
• Low density of dental practitioners (<p 50%)	–0.40	0.67 (0.49–0.92)	0.014
• High density of dental practitioners (<p 75%)	–0.14	0.87 (0.64–1.17)	0.359
Less than 999 euros	–0.47	0.63 (0.50–0.78)	0.000
• Very low density of dental practitioners (<p 25%)	–0.48	0.62 (0.48–0.81)	0.001
• Low density of dental practitioners (<p 50%)	–0.21	0.81 (0.61–1.07)	0.139
• High density of dental practitioners (<p 75%)	–0.14	0.87 (0.69–1.09)	0.221
Between 1000 and 1999 euros	–0.20	0.82 (0.67–0.99)	0.040
• Very low density of dental practitioners (<p 25%)	–0.37	0.69 (0.55–0.86)	0.002
• Low density of dental practitioners (<p 50%)	–0.15	0.86 (0.70–1.05)	0.143
• High density of dental practitioners (<p 75%)	–0.23	0.79 (0.67–0.94)	0.008
More than 2000 euros (ref.)		1	
Age	–0.04	0.96 (0.95–0.97)	0.000
Gender			
Men	–0.22	0.81 (0.74–0.87)	0.000
Women (ref.)		1	
Educational level			
No degree or less than baccalaureat	–0.64	0.53 (0.45–0.63)	0.000
Baccalaureat	–0.43	0.65 (0.56–0.76)	0.000
More than baccalaureat (ref.)		1	
Complementary health insurance			
No complementary insurance	–0.23	0.79 (0.63–1.00)	0.052
CMUC beneficiaries	–0.44	0.65 (0.55–0.75)	0.000
Complementary insurance (ref.)		1	
Household size			
One people (alone) (ref.)		1	
Two people	0.12	1.13 (1.00–1.28)	0.054
Three people or more	–0.31	0.74 (0.63–0.86)	0.000
Dwelling place			
Rural place	–0.12	0.89 (0.78–1.01)	0.062
Urban place (ref.)		1	
Self-perceived general health (SPGH)			
Good or very good SPGH	–0.04	0.96 (0.85–1.09)	0.501
Fair SPGH	0.01	1.01 (0.91–1.11)	0.868
Poor or very poor SPGH (ref.)		1	
Impairment			
Not impaired in daily life	0.18	1.2 (1.03–1.40)	0.018
Slightly impaired in daily life	0.11	1.12 (1.00–1.25)	0.045
Very impaired in daily life (ref.)		1	

individual factors. The complex association between individual characteristics such as income and health insurance coverage, on the one hand, and the contextual factors such as the density of dental practitioners, on the other hand, has been examined using a multilevel modelling strategy.

The analysis conducted in this paper clearly demonstrates unequal utilisation of dental care across income groups of the elderly population: the low-income elderly group appears to be less likely to use dental care services compared with their wealthier counterparts (as reflected by the income gradient in the respective odds ratios of consulting a dentist). Generally, such finding is in line with those previously reported in several studies conducted

in developed countries [1,2,4,7,10,18–20]. However, by carefully considering the intricate relationship between individuals' incomes and the density of dental practitioners, results indicate that the higher the density of dental practitioners is the lower the role of income would be. Such results, which are captured by the variation in the odds ratios of dental care utilisation as per different degrees of density, suggest that the latter can rather play an important role in mitigating the prevailing income-related inequalities in this sector of healthcare.

The few studies which attempted to assess inequalities in dental care sector have produced some conflicting results. For instance, Bower et al. [11] found no significant

relationships between the effect of area-based measure of income and the number of healthy teeth when clustering of individuals and their characteristics are taken into account. Conversely, the area-based measure of income emerged to be an important determinant of dental care utilisation in studies conducted by Aggarwal [21], Locker and Ford [22], Locker and Ford [23]. While our results corroborate the latter findings on the role of area of living (e.g., living in an affluent area not only tend to increase the odds of consulting a dentist but also the overall health outcome), they also confirm the importance of taking into account not only individual clustering and their characteristics but also the contextual factors related to the supply-side of dental care services, density of practitioners as a main example.

Indeed, our results regarding the specific effect of supplier density on inequalities in dental care utilisation while strongly indicate the presence of economic barriers for not receiving dental services (e.g., individuals' incomes), suggest that such barriers can be largely mitigated through achieving a more adequate and equitable spatial distribution of dental care supply. Achieving a more unbiased distribution of dental care supply shall unleash the *suppressed demand* for dental care services, and finally, seems to improve the overall dental well-being of individuals regardless of their socio-economic status.

A pending research question would be to verify whether the extra consultations offered in high DDP areas are really efficient and not a pure phenomenon of "*supplier-induced demand*" (SID) [24,25]. Sintonen and Linnosmaa [26], Grytten et al. [27] argue that a positive association between the dentist–population ratio and utilisation in a fixed price setting can be posited as an evidence of supplier-induced demand in dental care. Birch [28] suggests that a positive correlation between the number of dentists per capita and treatment content per visit may be a sufficient, but not necessary, evidence for SID. In our view, the fact that extra consultations benefit to the poorest people, generally under-deserved, seems to give an argument in favour of "efficient" extra consultations due to DDP. But we recognise that this is difficult to conclude in the lack of objective measurement of individual's dental-health outcomes (the survey only gives a subjective self-report assessment).

Lastly, our study shows that the probability of an annual dental visit in France is lower compared with the probability of GPs annual encounters. The odds of consulting a dentist during the previous year are also lower compared with other countries [29]. This might be related to what can be called "unrecognised need" or "dental anxiety". An advice from a medical professional such as a GP could help remove these barriers. Given the fact that results from the hierarchical model of the utilisation of GP care does not demonstrate the same social gradient as that of the dentist, the former can well be used to provide dental advice to individuals who confront difficulties in accessing dental services. This strategy to involve GP in promoting oral health has already been advocated by the United States Public Health Service Office of the Surgeon General [30] and by Hale [31]. However, instead of trying to

ask GP to diagnose oral diseases themselves, which seems unlikely, due to a lack of time and specific training [32], it could be better to use the GP as an advisor for dental care access.

Although the analysis conducted in this paper has shed light on the sources of inequalities in the utilisation of dental care services as well as the policy-relevant measures that can be used to mitigate them, some practical limitations of our study are worth mentioning. First, the analysis was conducted using self-reporting data. The latter is arguably considered to be less accurate compared with clinical observation. However, the HSM survey has provided us for the first time in France with reliable estimates that are nationally representative. Secondly, although, this paper has considered issues related to access to dental care services, our analysis was confined to the non-institutionalised and functionally independent segment of the elderly population, which constitute according to the last census, more than 95% of elderly (>60 years) [33].

5. Conclusion

Given the lack of previous studies in this specific area of research in France, this paper is expected to contribute to the ongoing debate surrounding the role of contextual factors affecting dental care service utilisation.

Despite their limitations, results presented in this study can help formulate appropriate policy measures to facilitate access to dental care services. Among these measures is the integration of dental services in the GP practices, which can then offer patients better information about oral health. A need is there to restructure the supply-side of dental care market through creating appropriate measures that can induce dental practitioners to be also installed in the underserved areas. This policy is, in our view, complementary to other mechanisms generally used to solve the shortages in patterns of service provision and utilisation, such as a "mixed" payment system (mix fee-for-service and capitation), or the existing market price mechanism, which is more at risk to create undesirable effects.

Conflicts of interests

None.

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Appendix A. Results of the hierarchical analysis of GP services utilisation (n = 9233)

Fixed effects	Coefficient	Odds ratio (IC 95%)	p-Value
Intercept	2.24	9.41 (2.86–30.95)	0.001
• Median income in the department (<p 25%)	−0.16	0.85 (0.49–1.49)	0.574
• Median income in the department (<p 50%)	0.42	1.52 (0.97–2.38)	0.067
• Median income in the department (<p 75%)	0.26	1.30 (0.83–2.04)	0.253
• Median income in the department (>p 75%) (ref.)		1	
Individual income per consumption unit			
Unknown	0.03	1.03 (0.64–1.66)	0.912
• Very low density of GP (<p 25%)	−0.43	0.65 (0.33–1.26)	0.202
• Low density of GP (<p 50%)	0.14	1.15 (0.50–2.62)	0.743
• High density of GP (<p 75%)	−0.11	0.89 (0.40–1.98)	0.784
Less than 999 euros	0.21	1.24 (0.83–1.86)	0.304
• Very low density of GP (<p 25%)	−0.78	0.46 (0.26–0.80)	0.007
• Low density of GP (<p 50%)	0.08	1.08 (0.65–1.80)	0.761
• High density of GP (<p 75%)	−0.06	0.94 (0.43–2.03)	0.871
Between 999 and 1999 euros	−0.04	0.96 (0.55–1.66)	0.877
• Very low density of GP (<p 25%)	−0.00	1.00 (0.55–1.82)	0.994
• Low density of GP (<p 50%)	0.20	1.22 (0.69–2.15)	0.502
• High density of GP (<p 75%)	0.55	1.73 (1.03–2.91)	0.039
More than 2000 euros (ref.)		1	
Age	0.03	1.03 (1.01–1.04)	0.001
Gender			
Men	−0.43	0.65 (0.55–0.78)	0.000
Women (ref.)		1	
Educational level			
No degree or less than baccalaureat	0.25	1.29 (0.96–1.73)	0.089
Baccalaureat	0.32	1.38 (1.03–1.85)	0.029
More than baccalaureat (ref.)		1	
Complementary health insurance			
No complementary insurance	−0.91	0.40 (0.30–0.55)	0.000
CMUC beneficiaries	−0.45	0.64 (0.43–0.93)	0.021
Complementary insurance (ref.)		1	
Household size			
One people (alone) (ref.)		1	
Two people	0.22	1.25 (0.98–1.60)	0.076
Three people or more	0.07	1.07 (0.78–1.47)	0.663
Dwelling place			
Rural place	−0.06	0.94 (0.67–1.32)	0.737
Urban place (ref.)		1	
Self-perceived general health (SPGH)			
Good or very good SPGH	−1.42	0.24 (0.15–0.38)	0.000
Fair SPGH	−0.37	0.69 (0.43–1.11)	0.123
Poor or very poor SPGH (ref.)		1	
Impairment			
Not impaired in daily life	−0.08	0.92 (0.63–1.36)	0.682
Slightly impaired in daily life	−0.74	0.48 (0.30–0.76)	0.002
Very impaired in daily life (ref.)		1	

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