

Socioeconomic Inequalities in Oral Health-related Behaviors in 18-Year-Old Adolescents: A Cross-sectional Study

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Received : 07-06-21
Revised : 15-08-21
Accepted : 15-08-21
Published : 30-11-21

ABSTRACT **Aims:** This study aimed to assess the socioeconomic inequalities in oral health-related behaviors, such as frequency of toothbrushing, flossing, and dental appointments, in 18-year-old Portuguese adolescents. **Materials and Methods:** Data were obtained from the third National Prevalence Study of Oral Health Diseases (III ENPDO), which was carried out in Portugal between 2012 and 2013. This study included 1075 adolescents aged 18 years. The information on socioeconomic status and oral health behaviors was collected using a semi-structured questionnaire. Binary logistic regression models were used to assess the association between social determinants and oral health-related behaviors. Unadjusted and adjusted odds ratios and confidence intervals were estimated. **Results:** The results found that father's educational level and both father's and mother's employment status were associated with adolescents not visiting a dental professional before the last 12 months. Male sex, living in a rural area, and lower adolescent's educational level were associated with toothbrushing less than twice a day. Furthermore, father's educational level and mother's employment status were also associated with a lower frequency of toothbrushing, whereas only mother's employment status was associated with a lower frequency of flossing. **Conclusion:** These findings demonstrated that socioeconomic inequalities in oral health-related behaviors of 18-year-old adolescents were associated with parental employment status and educational level, adolescent's educational level, sex, and residential zone.

KEYWORDS: Adolescent, oral health-related behavior, socioeconomic factor, socioeconomic inequality

INTRODUCTION

Oral health conditions are still a major public health problem and have serious health and financial burdens on both developed and developing countries. These conditions may have a huge impact on people's daily lives by affecting their self-esteem, quality of life, overall health, and well-being.^[1] The impact of oral health conditions is not only limited to the individual but also to the society through greater financial costs and burdened health systems.^[2] This burden is higher among underprivileged and disadvantaged individuals.^[3]

The two most prevalent oral health conditions, dental caries and periodontal diseases, are multifactorial diseases and largely preventable through good oral health behaviors such as toothbrushing twice a day, daily flossing,^[4] and use of regular dental care services.^[5] These oral health behaviors play a crucial role in the prevention of oral conditions. Besides, these behaviors may also have a positive impact on the overall health as there are associations between periodontal diseases

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How to cite this article: da Mata LL, Azevedo A, Pereira ML. Socioeconomic inequalities in oral health-related behaviors in 18-year-old adolescents: A cross-sectional study. J Int Soc Prevent Communit Dent 2021;11:703-11.

Access this article online

Quick Response Code:



Website: www.jispcd.org

DOI: 10.4103/jispcd.JISPCD_184_21

and a wide range of systematic conditions such as cardiovascular disease^[6] and diabetes mellitus.^[7]

Daily toothbrushing, flossing, and the use of fluoride toothpaste help to prevent dental caries and periodontal diseases.^[8] Additionally, regular dental visits are also known to benefit oral health by reducing the progression of such conditions and are therefore key to prevent their development.^[9] A good level of oral hygiene practices in association with regular visits to a dental professional potentially prevents dental caries and periodontal disease and helps maintain oral health.^[8]

Adolescence is a period of life marked by great physical, psychological, and social changes with an increase of autonomy and a decrease of appreciation of help from adults. Therefore, adolescents may engage in behaviors that greatly impact their general and oral health.^[10,11] Furthermore, adolescence is a key stage of life because during this period many health-related behaviors usually commence and establish. They may be carried over into adulthood.^[12] Preventive interventions that focus on adolescents may help to prevent the effects of poor oral health behaviors from being carried over into adulthood.

Evidence has shown that behaviors can play a role in explaining health inequalities in which unhealthier oral behaviors usually cluster among the underprivileged and disadvantaged individuals.^[13] Moreover, studies have shown that social class, education level, income, and employment status are strongly associated with oral health outcomes.^[14] In general, the disadvantaged are at a higher risk of developing oral health problems. They are also less likely to visit a dentist and often have unhealthy habits. Additionally, the use of dental services is less frequent among those with lower socioeconomic status^[15] and those with a lower frequency of toothbrushing and flossing.^[16] The most disadvantaged adolescents are less likely to visit a dentist and brush at least twice a day than those least disadvantaged.^[17]

In this context, this study aimed to assess the socioeconomic inequalities in oral health-related behaviors such as daily hygiene behaviors and frequency of oral appointments in 18-year-old Portuguese adolescents.

MATERIALS AND METHODS

This is a cross-sectional study using the data from the third National Prevalence Study of Oral Health Diseases (III ENPDO)^[18] and presented following the Strengthening the Reporting of Observational

Studies in Epidemiology (STROBE) guidelines.^[19] The III ENPDO is a national survey that was carried out between 2012 and 2013 by the General Directorate of Health, Portugal (DGS).^[18] This survey was conducted in full accordance with the World Medical Association Declaration of Helsinki and approved by DGS. The sample size ($n = 1075$) was computed based on the number of adolescents in one health region and the prevalence of cavities found in the last national survey. By region, the standard error was 7% and 2.5% for the entire territory.

The participants were randomly selected thus ensuring that the drawn sample represented the study population and there is a minimum potential selection bias. Our study was specifically focussed on 18-year-old adolescents presented at the National Defence Centres at the National Defence Day and living in Portugal. The focus of the study was this age group, as it was the only data provided to our study. None of the adolescents refused to participate in the study and they signed an informed consent.

All participants answered a semi-structured questionnaire. The questionnaire included questions from the National Health Survey, the second National Prevalence Study of Oral Health Diseases, Eurobarometer Special Edition 330—Report Oral Health February 2010, and the European Global Oral Health-Indicators Development Program (Health Surveillance in Europe—Oral Health Interviews Clinical Surveys: Guidelines), as described elsewhere.^[18] Clinical examinations were performed by trained dentists who were assisted by dental hygienists. However, the clinical data were not used in our study.

This questionnaire covered several dimensions such as sociodemographic characteristics, oral health behaviors, and frequency of dental appointments. The collected sociodemographic variables were sex (male/female), residential zone (urban/peri-urban/rural), adolescent's educational level (basic schooling or less/more than basic schooling), parents' employment status (employed/unemployed/other: students, housemaker, retired, not able to work), and educational level (equal or less than basic school/secondary education/college degree). Regarding oral health-related behaviors, participants were asked about their frequency in toothbrushing and flossing, use of fluoride toothpaste, and other sources of fluoride. They were also asked if they have ever seen a dental professional, when was their last dental appointment, how many times they have had an appointment in the last 12 months, the reason for their last visit, and other questions related to dental appointments.

The variable “How many times a day do you brush your teeth?” was categorized into adequate (brushed their teeth twice or more a day) and inadequate (brushed once or less a day). The variable “Do you use dental floss?” was categorized into adequate (used dental floss daily) and inadequate (used dental floss less than once a day). In addition, the variable “How many times have you gone to a dental appointment in the last 12 months?” was categorized into adequate (had their last appointment in the last 12 months) and inadequate (had their last appointment before the last 12 months).

STATISTICAL ANALYSIS

The frequency table for all sociodemographic and oral health-related behaviors was reported. The influence of the sociodemographic variables on inadequate toothbrushing, flossing, and having their last dental appointment in more than 12 months was assessed using binary logistic regression, based on the Enter method (using all selected variables). Crude and adjusted (for sex, if statistically significant) odds ratios (ORs) and respective confidence intervals (95% CIs) were estimated for all sociodemographic variables. A multicollinearity test was performed to verify the correlation between the independent variables. We considered a significance level of 0.05. The Statistical Package for the Social Sciences software (IBM Corp., Released 2019, IBM SPSS Statistics for MacOS, Version 25.0, IBM Corp., Armonk, NY, USA) was used for the statistical analyses.

RESULTS

The sample size of this study was 1075 participants of which 51.2% were female, 53.2% lived in urban areas, and 71.3% had more than basic schooling. Regarding the parents' educational level, 57.6% of mothers had basic schooling or less and 25.1% had secondary education, whereas 62.7% of fathers had basic schooling or less and 23.2% had secondary education. Concerning parents' employment status, 70.3% of mothers and 76.4% of fathers were employed [Table 1].

The majority of the participants (79.7%) brushed their teeth two or more times per day, while 15.2% brushed only once a day. In contrast, 66.7% of the participants did not floss their teeth at all, whereas only 7.7% used dental floss daily. The use of fluoride toothpaste was reported by 94.8% of adolescents, and 62.1% reported that they did not use any other types of fluoride products. Regarding the dental appointment, the majority of the participants (95.1%) reported having had a dental appointment, with 62.2% declaring to have their last dental appointment in less than 1 year

and 61.4% have gone to a dental appointment two or more times in the last 12 months (T1).

As shown in Table 2, father's educational level along with mother's and father's employment status was statistically and significantly associated with the dental visit for more than 12 months ($P < 0.05$). Adolescents whose fathers had some basic schooling or less (OR = 1.556, 95% CI: 1.042–2.326) had greater odds of not visiting a dental professional in the last 12 months. Furthermore, adolescents whose mother's employment status was unemployed (OR = 1.889, 95% CI: 1.334–2.677) and other (OR = 1.841, 95% CI: 1.264–2.682) and father's employment status was unemployed (OR = 1.522, 95% CI: 1.023–2.264) were two times more likely not to visit a dental professional in the last 12 months when compared with their counterparts.

Table 3 shows the results regarding the binary logistic regression test performed to assess the association between social determinants and frequency of toothbrushing and flossing. Our findings showed that only father's employment status was not associated with the frequency of toothbrushing, whereas all the other sociodemographic variables were statistically and significantly associated ($P < 0.05$). Boys were three times more likely to have a lower frequency of toothbrushing, with less than twice a day (OR = 3.451, 95% CI: 2.494–4.776) when compared with girls. Adolescents who lived in the rural area (OR = 1.606, 95% CI: 1.147–2.570) and had basic schooling or less (OR = 1.876, 95% CI: 1.370–2.570) had two times more odds of having a lower frequency of toothbrushing when compared with their counterparts. Furthermore, adolescents whose mothers have had basic schooling or less (OR = 1.516, 95% CI: 1.015–2.263), mother's employment status that was classified as other (OR = 1.597, 95% CI: 1.008–2.213), and fathers had basic schooling or less (OR = 1.872, 95% CI: 1.114–3.146) were two times more likely to have a lower frequency of toothbrushing. After adjusting the ORs for sex, all the sociodemographic variables, except for the father's employment status, remained statistically associated with the lower frequency of toothbrushing ($P < 0.05$).

Our results showed that only sex and mother's employment status were statistically associated with a lower frequency of flossing ($P < 0.05$). The male sex (OR = 2.994, 95% CI: 1.796–4.992) and mother's employment status, classified as other (OR 2.630, 95% CI: 1.121–6.172), were associated with lower frequency of flossing than their counterparts. After adjusting for sex, the mother's employment status remained statistically significant ($P < 0.05$) [Table 3].

Table 1: Characterization of the sociodemographic and oral health-related behavior variables

Variable	Frequency (N)	Percentage (%)
Sex (<i>n</i> = 1075)		
Male	525	48.8
Female	550	51.2
Adolescent's education level (<i>n</i> = 1047)		
Basic schooling or less	300	28.7
More than basic schooling	747	71.3
Residential zone (<i>n</i> = 1075)		
Urban area	572	53.2
Peri-urban area	268	24.9
Rural area	235	21.9
Mother's educational level (<i>n</i> = 1020)		
Basic schooling or less	588	57.6
Secondary education	256	25.1
College degree	176	17.3
Mother's employment status (<i>n</i> = 1,061)		
Employed	756	70.3
Unemployed	148	13.8
Other (student, housemaker, retired, not able to work)	171	15.9
Father's educational level (<i>n</i> = 990)		
Basic schooling or less	621	62.7
Secondary education	230	23.2
College degree	139	14.0
Father's employment status (<i>n</i> = 990)		
Employed	821	76.4
Unemployed	123	11.4
Other (student, housemaker, retired, not able to work)	131	12.2
How many times a day do you brush your teeth? (<i>n</i> = 1074)		
Less than 1 time per day	55	5.1
1 time per day	163	15.2
2 or more times per day	856	79.7
Do you use fluoride toothpaste? (<i>n</i> = 710)		
Yes	673	94.8
No	37	5.2
Do you use other types of fluoride products? (<i>n</i> = 1075)		
Pills	2	0.2
Mouthwash	319	29.72
Other	21	
No	668	62.1
Did not know or no answer	65	6.1
Do you use dental floss? (<i>n</i> = 1068)		
No, do not use	712	66.7
Yes, use but not daily	274	25.7
Yes, use daily	82	7.7
Have you ever visited a dental professional? (<i>n</i> = 1075)		
Yes	1022	95.1
No	47	4.4
Did not know or no answer	6	0.6
When was the last time that you had a dental appointment? (<i>n</i> = 1006)		
More than 1 year	380	37.8
Less than 1 year	626	62.2
How many times have you gone to a dental appointment in the last 12 months? (<i>n</i> = 647)		
Never	24	3.7
1 time	207	32.0
2 or more times	397	61.4
Did not know or no answer	19	2.9

Table 2: Association between social determinants and attendance to a dental appointment visit more than 12 months, among 18-year-old adolescents

Variable	The last dental appointment was more than 12 months. Crude ORs
Sex	
Female [†]	
Male	1.277 (0.989–1.648)
Residential zone	
Urban area [†]	
Rural area	0.973 (0.711–1.331)
Adolescent's educational level	
More than basic schooling [†]	
Basic schooling or less	1.296 (0.972–1.728)
Mother's educational level	
College degree [†]	
Secondary education	1.050 (0.699–1.579)
Basic schooling or less	0.954 (0.667–1.367)
Father's educational level	
College degree [†]	
Secondary education	1.261 (0.797–1.995)
Basic schooling or less	1.556 (1.041–2.326) f
Mother's employment status	
Employed [†]	
Unemployed	1.889 (1.334–2.677)*
Others	1.841 (1.264–2.682) #
Father's employment status	
Employed [†]	
Unemployed	1.522 (1.023–2.264) μ
Others	0.965 (0.644–1.446)

[†]Reference class

* $P < 0.001$, # $P = 0.001$, $f P = 0.031$, $\mu P = 0.038$. Results statistically significant are highlighted in bold

DISCUSSION

This study focussed on 18-year-old participants as late adolescence is an important period of transition between childhood and adulthood. During this period, new practices, values, attitudes, and behaviors are adopted along with increased autonomy and decreased appreciation of help from adults. This may lead adolescents to engage in risky situations and behaviors that negatively impact their general and oral health.^[20] Additionally, adolescence is an important period for learning and maintaining health-related behaviors as they are more likely to be carried over into adulthood.^[21]

Adequate oral hygiene plays a crucial role in the prevention of most oral health conditions, periodontal diseases, and dental caries. However, a large proportion of individuals are unable in maintaining a sufficient level of oral hygiene, mainly during their youth.^[22] Furthermore, toothbrushing twice a day is a universally accepted recommendation for maintaining oral health^[4] and may be considered a social norm. Therefore, toothbrushing is considered a fundamental self-care behavior to maintain a good level of oral health and to

prevent further oral health conditions.^[23] In our study, we found that the majority of adolescents (79.7%) brushed their teeth two or more times per day. When we compared our findings with other southern European countries, we observed that 70% of Italian, 49% of Spanish, and 47% of Greek adolescents brushed more than once a day.^[24] This showed that our age group had a better level of frequency for brushing than the given countries. However, when we compared our findings with Northern European countries, Norwegian, Danish, and Swedish adolescents reported a frequency of 80%, 81%, and 83% of brushing more than once a day,^[24] respectively, being slightly higher than the current group.

Our findings showed that boys were more likely to have an inadequate frequency of toothbrushing when compared with girls. Likewise, another Portuguese study found that girls have better oral hygiene habits than boys.^[25] These findings could be explained by the fact that women usually care more about their body and appearance; therefore, they may be more concerned about adopting behaviors and habits which

Table 3: Association between social determinants and brushing less than twice a day and flossing less than once a day, among 18-year-old adolescents

Variable	Brushing less than twice a day		Flossing less than once a day	
	Crude ORs (95% CIs)	Adjusted ORs ^Ψ (95% CIs)	Crude ORs (95% CIs)	Adjusted ORs ^Ψ (95% CIs)
Sex				
Female [†]				
Male	3.451 (2.494–4.776)*		2.994 (1.796–4.992)*	
Residential zone				
Urban area [†]	1.606 (1.147–2.250) f	1.534 (1.084–2.172) β	1.271 (0.712–2.269)	1.198 (0.668–2.151)
Rural area				
Adolescent's educational level				
More than basic schooling [†]				
Basic schooling or less	1.876 (1.370–2.570)*	1.560 (1.127–2.160) f	1.004 (0.601–1.679)	0.824 (0.487–1.394)
Mother's educational level				
College degree [†]				
Secondary education	1.164 (0.742–1.826)	1.190 (0.747–1.898)	0.630 (0.268–1.482)	0.620 (0.262–1.467)
Basic schooling or less	1.516 (1.015–2.263) δ	1.584 (1.046–2.398) χ	0.536 (0.248–1.155)	0.523 (0.241–1.134)
Father's educational level				
College degree [†]				
Secondary education	1.096 (0.598–2.008)	0.991 (1.004–0.534)	0.550 (0.239–1.265)	0.772 (0.354–1.686)
Basic schooling or less	1.872 (1.114–3.146) α	1.929 (1.132–3.289) χ	0.782 (0.360–1.698)	0.504 (0.217–1.170)
Mother's employment status				
Employed [†]	0.940 (0.597–1.482)	1.049 (0.657–1.676)	1.320 (0.662–2.631)	1.447 (0.722–2.901)
Unemployed	1.597 (1.091–2.339) γ	1.493 (1.008–2.213) ε	2.630 (1.121–6.172) β	2.456 (1.042–5.789) Ω
Other				
Father's employment status				
Employed [†]				
Unemployed	1.054 (0.657–1.689)	1.046 (0.644–1.699)	1.425 (0.638–3.183)	1.040 (0.517–2.092)
Other	1.448 (0.945–2.220)	1.481 (0.952–2.303)	1.040 (0.520–2.080)	1.420 (0.632–3.191)

[†]Reference class. ^ΨAdjusted for sex. Results statistically significant are highlighted in bold

**P* < 0.001, #*P* = 0.001, *f P* = 0.006, *γ P* = 0.016, *α P* = 0.018, *β P* = 0.026, *χ P* = 0.030, *μ P* = 0.038, *Ω P* = 0.040, *δ P* = 0.042, *ε P* = 0.046

promote their oral health.^[26] Another fact that should be considered is that women have better oral hygiene habits than men.^[27]

Furthermore, the frequency of toothbrushing is also influenced by socioeconomic statuses such as father's and mother's educational level.^[28] A Portuguese study observed that a low level of maternal education is associated with a lower frequency of toothbrushing.^[25] Our findings observed the same association in which adolescents whose mothers had lower educational levels had greater odds of inadequate toothbrushing when compared with others. Besides, parental educational levels are directly associated with the family's socioeconomic status, which can have a great impact on oral health. Parental attitudes toward oral health also depend on their education level. Better educated parents care more about their children's oral health.^[29] In general, having a higher level of education results in further opportunities of adopting healthier

habits, using health services, and benefitting from health promotion activities.^[30]

Dental flossing is an indispensable part of an effective oral hygiene routine. Daily flossing is a self-performed preventive strategy and should be combined with toothbrushing to prevent dental problems and improve oral health. However, a great proportion of individuals floss their teeth less than the recommended times.^[31] Our findings demonstrated that only 7.7% of the participants did use dental floss daily, while 66.7% did not floss their teeth at all. Similar results were found in an English study in which 8.2% reported using floss every day.^[32] In our study, the boys had an inadequate frequency of flossing compared with girls. Another study showed that women had better oral health behavior and a higher frequency of flossing than men.^[27] As discussed earlier, women normally are more concerned about their appearance^[24,26] and also have higher dental literacy than men.^[27]

Table 4: Oral health education and promotion measures

Population	Measures
Adolescents	Schools can play an important role in promoting oral health education by including it in the curriculum. Topics related to oral health and creating healthy environments, such as healthy eating, no sugar, tobacco, or alcohol, and encouraging oral hygiene after meals, can be added. Additionally, the parents can be involved in oral health promotion activities.
Parents	The workplace can also play an important role in disseminating oral health education measures and also creating healthy environments such as nutritional and low sugar meals in canteens or anti-smoking campaigns. This will provide opportunities for those with low levels of oral literacy to increase their knowledge and can therefore contribute to reducing oral health disparities.
Parents/ adolescents	The National Health Services should provide a free consultation with a dentist to unemployed parents and adolescents so that they can maintain their oral health levels and not allow deterioration during their unemployment period.

Therefore, they frequently adopt more oral health-related behaviors.

Regular visits to a dental care professional are a primary preventive strategy, thus aiding early diagnosis and treatment of oral diseases resulting in better prognosis and prevention behavior.^[33] However, adolescents are among the least likely to use health services.^[34] We observed in our study that 62.2% of the adolescents had visited a dental professional in the last 12 months. These findings might be explained by the social and economic crisis that Portugal has undergone in the last few years. Oral health care is not a part of the public health system and is mainly provided by the private sector. Hence, costs associated with private dental care might be the main reason for a lower percentage of participants visiting a dentist in the last 12 months. This behavior could lead to poorer oral health problems.

We observed that both parents' employment status was associated with not visiting a dental professional in a year. Many studies have shown the association between family income and the lack of annual dental appointments.^[35] Our results corroborated previous studies on the role of occupational status in dental appointments in adolescents.^[36] Furthermore, in our study, paternal educational level was associated with not visiting a dental professional in the last 12 months. Our findings corroborated with other studies that have demonstrated an association between dental visits before the last 12 months and the educational status of parents.^[30]

One of the strengths of our study was the sample size and the statistical power. Also, this study was a randomized representative sample of the 18-year-old Portuguese population as they were present at the National Defence Day at National Defence Centres. They were living in Portugal which was a prerequisite for their attendance to defense centers. Additionally, this is a key age group as it is a critical period of life when patterns of behaviors are established and may be carried over into adulthood. Some limitations should

nevertheless be considered. First, our study was based on a cross-sectional survey and therefore cannot demonstrate causality. Secondly, reporting and memory bias must be considered while using self-questionnaires, even anonymous, as it may lead to overestimation of good behaviors and underestimation of the factors' influence. Thirdly, there is a potential for bias in the sample due to differential response and missing values resulting in a slight underestimation of the association.

CONCLUSION

The current study reported that oral health-related behaviors in Portuguese 18-year-old adolescents were consistent with the literature on this subject. These behaviors seem to be similar to those of teens in Northern European countries and better than Southern European countries, although there was still a concern concerning the use of floss.

Overall, the socioeconomic inequalities in oral health-related behaviors in 18-year-old Portuguese adolescents were associated with lower paternal educational level, parental unemployment or another employment status, male sex, living in the rural area, and lower adolescent's educational level. These findings suggested that future approaches in oral health should be focussed on a holistic perspective of the patient rather than just clinical symptoms.

Oral health-related behaviors are generally acquired early and often reflect the individual's family environment. Oral health education and promotion should not be the only concern of the dental care team in clinical settings. Table 4 shows some measures that vulnerable families could benefit from to increase oral health literacy and change their oral health-related behaviors.

FUTURE SCOPE/CLINICAL SIGNIFICANCE

Our study shows which social groups among 18-year-old adolescents have worse oral health-related behaviors which allow the government and policymakers to develop oral health programs to target these groups.

This is done to tackle and reduce social inequalities, therefore improving oral health-related behaviors. The results from this study can also be used to compare with the results from a future national survey to evaluate the effectiveness of oral health programs that have been implemented.

Acknowledgements

The authors would like to thank the General Directorate of Health—Portugal for providing access to the data.

FINANCIAL SUPPORT AND SPONSORSHIP

The authors did not receive any funding for this study.

CONFLICTS OF INTEREST

The authors have no conflict of interest to declare.

AUTHORS CONTRIBUTIONS

Data acquisition: Maria de Lurdes Pereira. Concept and design of the study: Leopoldo Lucio da Mata, Maria de Lurdes Pereira, and Alvaro de Azevedo. Data analysis and data interpretation: all authors. Manuscript writing, editing, and approval of final draft: all authors.

ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

The third National Prevalence Study of Oral Health Diseases (III ENPDO) was approved by the General Directorate of Health, Portugal, and was conducted in full accordance with the World Medical Association Declaration of Helsinki (2008).

PATIENT DECLARATION OF CONSENT

All patients signed an informed consent.

DATA AVAILABILITY STATEMENT

The dataset used in the current study is not available for the public. The dataset is owned by the General Directorate of Health, Portugal and was kindly provided to be used in our study.

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