

RESEARCH ARTICLE

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## Predictive Factors for Successful Smoking Cessation in Tunisian Smokers, Sousse-Tunisia: 2015-2020

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### Abstract

**Objective:** Since 2009, the unit of smoking cessation at Sahloul University Hospital – Tunisia was founded. In this context, the objective of our study was to determine the factors associated with smoking cessation in Tunisian smokers. **Methods:** It was a descriptive prospective study over five-years-period 2015-2020. We included all patients who willingly came to the anti-smoking consultation of the Sahloul University hospital Sousse Tunisia. Data were collected during the consultation of all patients. We proceeded to a univariate and then multivariable analysis to identify the predictive factors of smoking cessation. **Results:** Over 5 years, we included 450 patients, mainly males (91.3%). The average age of the consultants was  $46 \pm 15.58$  years. The average age of the first cigarette among our patients was  $16.83 \pm 4.34$  years. The likelihood of smoking cessation was higher among males ( $p=0.004$ ,  $OR=9.708$ ), patients attending minimum 3 anti-smoking consultations ( $p<10^{-3}$ ,  $OR=5.714$ ), patients benefiting from nicotine replacement therapy ( $p=0.034$ ,  $OR=2.123$ ), with high motivation score for smoking cessation ( $p=0.001$ ,  $OR=1.980$ ) and with an advanced age of the first cigarette ( $p<10^{-3}$ ,  $OR=1.096$ ). However, the likelihood of smoking cessation was lower among coffee and alcohol consumers ( $p=0.002$ ,  $OR=0.252$ ) and smokers with less than 5 years smoking habit ( $p=0.011$ ,  $OR=0.069$ ). **Conclusion:** Although the decision to stop smoking is a personal one, it requires medical and psychological support as highlighted by our findings. Our study showed that assiduity and medical assistance for tobacco cessation increase smokers' chances of quitting.

**Keywords:** Smoking, tobacco- addiction- socioeconomic factors- preventive medicine

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### Introduction

Tobacco is a global public health concern and a sustainable development issue. It is considered by the World Health Organization (WHO) as the epidemic of modern times [1]. It is the leading cause of preventable death in the world with an average of 7 million deaths per year [1]. It is also considered a major risk factor strongly associated with the deterioration of the smoker's quality of life [2–4].

Consequently, active or passive tobacco consumption remains a major concern for public health organizations worldwide and in particular in low-income countries such as Tunisia. In Tunisia, tobacco use affects both men and women and is a concern for all age groups [4]. We observe an increase in tobacco consumption among women and adolescents in our country [5]. The use of tobacco in Tunisia is not only responsible for significant morbidity and mortality but also a significant financial cost and contribution to the exhaustion of health institutions [4].

Given the dangers of tobacco and its impact on the

population's health and well-being, a national tobacco control program was established in Tunisia in 2009. This initiative was indeed one of the priorities of the country's public health strategies [4]. Moreover, the year 2009 was declared in Tunisia, as the national year of tobacco control. In fact, to facilitate access to specialized anti-smoking consultations, Tunisia created in 2009 several cessation centers accessible free of charge including the consultation on smoking cessation at the Sahloul University Hospital.

In this context, this present work aimed to describe the population of smokers consulting voluntarily the smoking-cessation unit in Sahloul Hospital – Sousse in Tunisia and to determine the factors associated with tobacco cessation during the last five years.

### Materials and Methods

#### Study design

We conducted a descriptive prospective study over five-years-period between January 2015 and December 2020 concerning smoking patients consulting the smoking

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cessation unit at Sahloul University Hospital in Sousse - Tunisia. The consultation and treatments suggested were provided free of charge. The work of this consultation is based on the recommendations of the Tunisian national tobacco control program which was developed in 2009.

### *Study population*

We included in our study, patients who willingly came to the anti-smoking consultation of the Sahloul- Sousse hospital, were referred by different departments of health facilities, and private doctors, or came after national or regional public anti-smoking campaigns. We included in this study the exhaustive list of patients who attended at least two consultations during the study period. All ages were included (adolescents under 18 years of age were accompanied by their parent to the medical visit). We did not include in our study patients who attended the consultation only once (having no follow-up). Study population size was determined by the exhaustive number of eligible patients during the 5 years' study period.

### *Data collection*

The data sources were mainly the medical file and the anti-tobacco prescription form. At the first appointment, the tobacco physician conducted a structured interview lasting 30 to 45 minutes. Data were collected during the consultation: sociodemographic variables, smoking history (duration, length of time smoking, age of first cigarette, previous attempts and reasons for quitting, daily consumption of cigarettes/narcotics, nicotine dependence measured by the Fagerstrom test [6]), psychological elements such as the degree of self-confidence to quit smoking evaluated by a visual analog scale from 0 to 10, the importance to quit smoking (question measured by the patient by a score between 0 and 10), the motivation to quit evaluated by the Lagrue and Legeron test [7]. The anxiety-depression pattern was measured by the Hospital Anxiety and Depression (HAD) Scale [8]. A basic clinical inspection and check-up are done during the visit and before the interview.

Smoking cessation was defined as complete abstinence from smoking at 6 months. Smokers' assiduity was measured by the number of consultations ( $\leq 3$  consultations: irregular, indifferent patient. Patients were considered diligent and consistent if consulting more than 3 times).

Smoking-cessation method was a medical assistance using cognitive and behavioral therapy to act on the psychological dependence and nicotine substitution, if necessary, in the form of a transdermal patch, to act on the pharmacological dependence. The transdermal patches and pills are delivered free of charge while available.

All patients were contacted and interviewed by telephone by the nurse in charge of the consultation, which allowed us to retrieve information from patients who discontinued the follow-up. Non-responders at the time of the survey were considered persistent smokers in the analysis of the results.

### *Statistical analysis*

Data entry and analysis were performed using SPSS version 25 software. The results were presented in

two parts: A descriptive part where we described the study population and an analytical part showing the analysis of successful smoking cessation factors. We performed a univariate comparative statistical analysis. The significance level was set at 5%. We then performed a multivariable analysis to seek factors independently associated with smoking cessation. This analysis was performed using binary logistic regression. All variables associated with the dependent variable "successful or unsuccessful cessation" in the univariate analyses with significance levels  $<0.20$  were included in the initial multivariable analysis models. In the final models, the strength of association between the factors studied and the dependent variable was estimated using the calculation of adjusted Odds Ratios (OR) and their 95% Confidence Intervals (CI).

### *Ethical considerations*

The present study included adults consenting to participate in this research study. Adolescents (aged  $< 18$  years) were accompanied by their parent to the medical visit. Anonymity and confidentiality were ensured from data entry to the publication of the results. This study was approved by the Institutional Review Board of the Department of Prevention and Security of Care, Sahloul University Hospital.

## **Results**

### *Characteristics of the population study*

We collected 450 patients who consulted the smoking-cessation unit at Sahloul University Hospital over five years from January 2015 to December 2020. The study population was mainly males ( $n= 411, 91.3\%$  vs  $n=39, 8.7\%$ ) with a sex ratio of 10.53. The average age of the consultants was  $46 \pm 15.58$  years with extremes ranging from 15 to 84 years. The most represented age group (21.6%) was [50-60 years] followed by [40-50y] 18.4%, [60-70y] 18.2% and then [30-40y] 17.8%. Two-thirds were professionally active and more than 65% of our population did not reach the university level during their studies. The majority (75.4%) of our smoking patients used to smoke freely inside their homes. Half of our patients had a daily physical activity of 30 minutes to one hour per day and 12.7% had no daily physical activity. Coffee consumption among our patients ranged from 0 to 10 cups per day with a median consumption of 2 cups of coffee per day and an Interquartile range (IQR) [1-3]. Alcohol consumption was found among 97 patients (17.6%).

The average age of the first cigarette among our patients was  $16.83 \pm 4.34$  years. Indeed, the majority of our patients smoked their first cigarette before the age of 20. In addition, the average age of daily smoking in our patients was  $18.97 \pm 4.55$  years. Almost the totality of our patients (437/450 patients; 97.1%) smoked every day. The median daily consumption was 20 cigarettes per day with an interquartile range [20-30]. The maximum consumption in our study was 80 cigarettes per day. Indeed, the majority of our consultants (81.9%) consumed more than 20 cigarettes per day.

The median smoking duration was 26 years (IQR

[13–40]) with a maximum of 70 years. The majority of our patients (81.7%) smoked daily for more than 10 years.

Two-thirds of the patients (60.9%; 263/432 responders) had made one or more attempts to quit smoking. Moreover, 72.2% (n=190) of previous attempts to quit smoking were successful at least once. Of these, 12.5% were assisted by a smoking doctor. The longest previous quit was a median of 60 days [IQR 8-180 days]. The maximum quit period in our series was 13 years. Patients who had previously succeeded in quitting smoking started smoking again for many reasons explained during the consultation. Conviviality with the smoking environment was the most frequent reason (40.44%) followed by stress (27.21%), the urge to smoke (5.88%), and weight gain (3.68%). The Fagerström Test for Nicotine Dependence revealed that 46.2% (n=196) were highly dependent, 34% were moderately dependent, and 20% were weakly dependent. The mean nicotine dependence score was  $6.16 \pm 2.29/10$ . It was not associated with gender. It was, however, significantly associated with a level of education and age with a weak positive correlation ( $r=0.182$ ,  $p<10^{-3}$ ) between age and Fagerström score. The level of physical dependence was significantly associated with the average number of cigarettes smoked ( $p<10^{-3}$ ), and the average anxiety and depression score ( $p<10^{-3}$ ).

In the present study population, 81.3% were considered motivated to quit [7]. The median motivation score was 18/22 IQR [16- 18]. On a scale of 0 to 10, the importance of quitting smoking had a mean of  $9.43 \pm 1.31$  in our patients. “Seeking better health” was the main reason for quitting smoking in 73.1% of our consultants. The median level of self-confidence for smoking cessation, estimated by a 0-10 scale, was 8 IQR [5- 9]. A score greater than or equal to 5/10 (good self-confidence in quitting) was observed in 87.0% of smokers. Among our series, 238 patients (52.8%) benefited from 3 or more medical visits in our unit. All of our patients received motivational speech for smoking cessation and behavioral therapy at the first consultation. Half of the population (48%; n=216) received nicotine replacement therapy at the first visit, including 210 with a transdermal device. Among our 450 patients, 55.6% successfully quit smoking (n=250) and they were considered non-smokers 6 months after the first visit.

#### *Factors influencing smoking cessation*

In the present study, factors associated with smoking cessation were: advanced age ( $p=0.004$ ), male gender ( $p=0.010$ ), active occupational status ( $p=0.024$ ), participation in sports activities ( $p=0.019$ ), absence of coffee ( $p=0.008$ ) and alcohol consumption ( $p=0.003$ ), the advanced age of daily smoking ( $p=0.038$ ), the presence of previous quit attempts ( $p=0.002$ ), period of tobacco use ( $p=0, 012$ ), low physical dependence ( $p=0.045$ ), low Anxiety and depression scale ( $p=0.034$ ) and high Legrue and Legeron motivation score ( $p<10^{-3}$ ), the importance of quitting smoking ( $p=0.005$ ), confidence levels ( $p<10^{-3}$ ), a high number of cessation visits ( $p<10^{-3}$ ) and introduction of nicotine therapy ( $p=0.001$ ) during the first visit (Table 1).

After multivariable analysis, the likelihood of smoking

cessation was higher among males, patients attending minimum 3 anti-smoking consultations, benefiting from nicotine replacement therapy, with high motivation score for smoking cessation, and with an advanced age of the first cigarette. However, the likelihood of smoking cessation was lower among coffee and alcohol consumers and smokers with less than 5 years smoking habit (Table 2).

## **Discussion**

Tobacco prevention remains a global health priority [1]. Smoking cessation consultations are one of the important components of the efforts to control tobacco use. The present study focused on showing to decision makers the predictive factors for successful smoking cessation among Tunisian Smokers during the last five years. It showed that providing free and accessible anti-smoking medical consultations to smokers helps 83% of the successful quitting and that the effectiveness of the introduction of Nicotine replacement therapy helps successful cessation by 53%. These factors being modifiable-factors: informing and motivation smoker to consult medical tobacco-cessation units.

Our study spread between 2015 and 2020, represented the continuation of a study that took place from 2009 to 2014 in the same smoking cessation unit [9]. The two consecutive cohorts were very similar. This shows that during the last decade, the profile of the Tunisian smoker has remained the same in terms of socio-demographic components. Access to information was a sort of limitation during the data collection, some patients were not included because they consulted only once the smoking-cessation unit. The decision of not including them was taken since we cannot evaluate smoking-cessation or failure factors from a single visit. Moreover, even if our research showed good results to the policy makers, it had influence of a strong regional focus (Sousse being a main big city and may not represent the whole Tunisian population).

Other limitations of this present study were that our population was mainly masculine and that it did not include representatively subjects with a good level of education. The prototype of a Tunisian Smoker consulting a smoking-cessation unit was a working male, strongly addicted (dependent) to tobacco, with a low education level and high coffee consumption. These characteristics of our eligible population could undergo some biases (not evitable at data collection since we collected the exhaustive list). These biases were avoided via the created model for multivariate analysis. Indeed, the low frequency of female smokers could be due to under-reporting. In fact, smoking is still a taboo subject in our country and women smokers prefer to hide rather than seek help to stop smoking. The male sex has been, since the marketing of tobacco, considered an identified risk factor for smoking. In the Arab-Muslim world, including Tunisia, the male trend of active smoking and the use of cessation therapy is still a major trend [3, 9, 10].

People with a low level of education were the most represented in smoking populations [3, 10, 11]. Having only a basic education stage is a risk factor for smoking

Table 1. Factors Associated with Successful Smoking Cessation

Factors	1 year of successful smoking-cessation		OR [CI95%]	p
	Yes n (%)	No n (%)		
Social demographic characteristics				
Age (M ± SD)	47.3 ± 14.4	44.3 ± 16.8	1.02 [1.01-1.04]	0.040
Sex (N=450)				
Males	236 (57.4)	175 (42.6)	2.43 [1.22-4.76]	0.010
Females*	14 (35.9)	25 (64.1)		
Professional status (N=450)				
Active*	168 (57.9)	122 (42.1)	-	0.024
Student	15 (35.7)	27 (64.3)	2.48 [1.2-4.8]	
No activity	67 (56.8)	51 (43.2)		
Level of education (N=415)				
Primary or illiterate	87 (59.2)	60 (40.8)	-	0.325
Secondary	66 (49.6)	67 (50.4)		
University	36 (61.0)	23 (39.0)		
University degree/ Doctorant	41 (53.9)	35 (46.1)		
Lifestyle habits:				
Smoking inside the home (N=256)				
Yes	108 (56.0)	85 (44.0)	-	0.112
No	28 (44.4)	35 (55.6)		
Physical activity (N=411)				
No physical activity *	21(40.4)	31(59.5)	2.00 [1.11-3.70]	0.019
At least 30 minutes of physical activity	207(57.7)	152(42.3)		
Coffee consumption (N=401) (median [IQR])	2 IIQ[1-3]	2 IIQ[1-3.75]	1.23	0.008
Alcohol consumption (N=329)				
Yes	33 (41.8)	46 (58.2)	2.16 [1.30-3.62]	0.003
No	152 (60.8)	98 (39.2)		
History of Tobacco Use:				
Age de first cigarette (N=432) (M ± SD)	17.1 ± 4.1	16.3 ± 4.3	-	0.109
Age of daily smoking (N=432) (M ± SD)	19.4 ± 4.3	18.5 ± 4.9	0.96 [0.92-0.99]	0.038
Previous quitting attempts (N=432)				
Yes	162 (61.6)	101 (38.4)	1.85	0.002
No*	78 (46.2)	91 (53.8)	[1.27-2.78]	
Clinical examination and follow-up:				
Number of cigarettes per day (median [IQR])	20 IIQ [20-30]	21 IIQ [20-30]	1.04 [1.00-1.13]	0.226
Length of time smoking:				
<5 years*	9 (29.0)	22 (71.0)	-	0.012
5-20 years	71 (55.5)	57 (44.5)	0.33 [0.14-0.77]	
>= 20 years	156 (57.1)	117 (42.9)	0.31 [0.14-0.69]	
Fagerstöm dependence scale(N=424)(M ± SD)	6.0 ± 2.0	6.4 ± 2.2	1.09 [1.00-1.19]	0.045
Hospital Anxiety and Depression scale (N=434) (median [IQR])	18 IIQ [13 -23]	19.5 IIQ [14-24]	1.06 [1.02-1.15]	0.034
Motivation scale (N=450) (median [IQR])	18 IIQ [15-18]	16 IIQ [12-18]	0.87 [0.83-0.98]	<0.001
Self-Importance of quitting (N=380) (M ± SD)	9.6 ± 0.8	9.0 ± 1.8	0.71 [0.58-0.87]	0.005
Self-confidence scale (N=392) (median [IQR])	8 IIQ [7-9]	7 IIQ [5-9]	0.47 [0.58-0.86]	<0.001
Number of visits (N=450) (median [IQR])				
≤ 3 visits*	102(42.9)	136(57.1)	3.08 [2.08-4.55]	<0.001
>3 visits	148(69.8)	64(30.2)		
Treatment used:				
Use of Nicotine replacement therapy since the first medical visit(N=450)				
Yes	137 (63.4)	79 (36.6)	1.85	0.001
No*	113(48.3)	121(51.7)	[1.28-2.70]	

IQR, Interquartile range; M, Mean; SD, Standard deviation; OR, Odds Ratio; CI, Confidence interval; \*, reference modality

Table 2. Factors Independently Associated with Successful Smoking Cessation

	Adjusted Odds Ratio	Confidence interval 95%		p
		lower	Upper	
<b>Sex</b>				
Male	9.708	2.087	45.454	0.004
Female	Ref			
<b>Number of visits</b>				
>=3 visits	5.714	2.725	11.905	<0.001
<3 visits	Ref			
<b>Use of Nicotine replacement therapy</b>				
Yes	2.123	1.060	4.255	0.034
No	Ref			
<b>Self-Importance of quitting</b>				
Yes	1.980	1.338	2.924	0.001
No	Ref			
Age at first cigarette	1.096	1.008	1.191	<0.001
<b>Coffee consumption</b>				
Yes	0.799	0.630	0.916	0.005
No	Ref			
<b>Alcohol consumption</b>				
Yes	0.251	0.107	0.593	0.002
No	ref			
<b>Length of time smoking</b>				
<5 years	0.069	0.009	0.537	0.011
>=5 year	Ref			

and smoking exposure [11, 12]. while other studies showed that unemployment is a risk factor for exposure to addictive daily tobacco use [11–13], In Tunisia, the proportion of active smokers is higher than that of non-workers [3,9,10]. As for the lifestyle-quality, it has been shown that Tunisian smokers have a significantly lower quality of life in terms of health [4]. The practice of physical activity is an important pillar during smoking cessation interventions [3, 14]. Tunisian smokers do not practice more than 30 minutes per day of physical activity [9, 10].

In terms of coffee consumption, each additional cigarette per day consumed by current smokers was associated with higher coffee consumption [15, 16]. This could be explained by the conviviality of the coffee places with the collective habit of smoking simultaneously with coffee. Indeed, coffee places are always an incentive to smoke. Similarly, for alcohol, tobacco consumption is significantly higher among Tunisian alcohol drinkers [3,9,10]. Among other populations, the co-consumption of alcohol and tobacco was more and more frequent [14, 17].

Smoking is an addictive behavior for which nicotine is the main substance responsible. Smokers who seek smoking-cessation medical help and assistance generally have a high level of physical dependence on nicotine [9, 10, 18]. This dependence was strongly associated with the number of cigarettes consumed and the level of anxiety and depression among Tunisian smokers [10]. Highly addicted smokers were characterized by the existence of

a depressive or anxious profile [19].

All our patients received motivational smoking cessation talks and behavioral therapy. It has been proved that Behavioral therapies combined with pharmacological treatment increase the effectiveness of smoking cessation [20]. Outcomes are best when treatments are integrated with behavioral therapies and outreach interventions [9, 20].

#### *Factors influencing smoking cessation*

Quitting smoking is a difficult process because of the multiple dependencies (pharmacological, behavioral, and psychological). It is therefore useful to help motivated smokers to stop smoking.

Smoking cessation is strongly linked to the age of the patient. The older the patient, the higher the success rate of cessation [11, 13, 21–23]. This is related to a certain maturity level and self-concern about health status. Indeed, older patients have more health problems, consult more health professionals, and are consequently much more advised and encouraged to quit smoking [22]. Compared to males, smoking cessation in women is generally associated with negative elements that affect the success of the cessation process such as weight gain, depressed mood, decreased concentration, and loss of pleasure in life. As a result, it has been widely demonstrated that the success rates of smoking cessation in women are significantly lower than in men [11, 23]. The socio-professional and economic level influences the success of the cessation.

The higher the intellectual and socio-economic level, the better the result of smoking cessation [11, 13].

The relationship between smoking and caffeine consumption has long been discussed in various studies. Indeed, there is a real overlap between the symptoms of tobacco cessation and the symptoms of caffeine toxicity [15]. Apart from that, the consumption of coffee and/or alcohol is generally correlated with a personal and social urge to smoke. People with low coffee and alcohol consumption have better cessation success rates [12, 14]. In addition, it has been shown that the simultaneous control of caffeine consumption has a real, independent, and significant impact on the success of smoking cessation [16]. Physical activity has a health-enhancing capacity that can be a potential non-drug cessation aid [14]. Therefore, advice to engage in physical activity should be integrated into the smoking cessation program. [24]. Moreover, while studies have shown that the later the age of onset and the shorter the number of years, the more successful the cessation [13, 20], other studies have shown that the length of time a person has been smoking is a factor in success [20, 21]. In addition, previous quit attempts (even non-successful ones) are factors in successful smoking cessation [12, 13, 18, 20, 21]. Indeed, the feeling of past failure and past loss of motivation and confidence make quitting smoking a challenge to accomplish. Another effect that is bound to influence smoking cessation is the large number of cigarettes smoked per day [20]. A smaller number of cigarettes is more likely to encourage people to quit smoking. [13, 21, 25]. It is more difficult to stop smoking if you exceed 15 cigarettes per day [20]. In addition, it has been proven that the prolonged follow-up and the assiduity of the patients are strongly significant in the project of smoking cessation [21]. Nicotine replacement therapy is a necessary pillar of successful smoking cessation. It has been documented that nicotine replacement therapy significantly helps in smoking cessation, regardless of the degree of addiction [9, 18, 20, 23, 25, 26].

Moreover, the level of addiction, motivation of the smoker, and anxiety status play a role in the success of smoking cessation. Regarding cognitive factors, a person's belief and self-confidence in his or her ability to quit smoking are predictive of successful cessation [14, 20, 21, 25]. The success of tobacco cessation depends on factors related to the individual and the quality of his or her care. The main element that should be considered in the initial assessment is the patient's motivation to quit. Moreover, motivational interviewing helps to develop the smoker's ability to decide and implement cessation [14]. For psychological factors, depressed people are less likely to be successful in their attempts to quit smoking [19,20]. The absence of depression episodes and a history of depression remains a determinant of successful smoking cessation [14, 19].

In conclusion, smoking is a chronic disease. The real global pandemic is tobacco use [1]. Smokers should therefore be advised to stop smoking by initiating a smoking strategy. The evaluation of the predictive factors of cessation in our study, allowed us to identify the variables on which the physician toxicologist/tobacconist

must act during consultations. These modifiable factors are the number of consultations, the use of nicotinic substances, the consumption of coffee and alcohol, and the motivation of the patient. Therefore, ongoing maintenance of personal motivation with behavioral therapy is essential at every visit.

The results of the present study allow us to better orient the improvement of the management of the smokers' consultants and that of other tobacco-cessation help and medical assistance units in Tunisia and other countries. However, additional efforts must be made to reduce the number of people who come for a one-time consultation by reminding patients that the consultation is completely free of charge.

## Author Contribution Statement

The unit was created and has held up thanks to the efforts of HSL, SK and MBR. EM and HG are responsible for data cleaning and analysis. EM is responsible for the discussion of this manuscript. All the authors have contributed to the success of the hospital's anti-smoking consultation unit by managing the unit for many years and especially during the study period.

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### *approval*

This study was approved by the Institutional Review Board of the Department of Prevention and Security of Care, Sahloul University Hospital. No financial support was received for the work. The authors declare that there is no conflict of interest.

### *Data is availability*

Data is available on demand at the mail address of the first author.

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