

# Cariogram – An Expedient Tool for the Clinician to Assess Caries Risk

Ms. Krishnan Padminee<sup>1</sup>, Dr. Saravanan Poorni<sup>2</sup>, Dr. Cruz Nishanthine<sup>3</sup>, Dr. Ravi Devi<sup>4</sup>,  
Dr. Manali Ramakrishnan Srinivasan<sup>5</sup>

<sup>1</sup> CRRRI

<sup>2</sup> Reader

<sup>3</sup> Sr. Lecturers

<sup>4</sup> Lecturer

<sup>5</sup> Professor & Head

Dept of Conservative Dentistry  
and Endodontic,  
Sri Venkateswara Dental College  
and Hospital, Chennai

## Abstract

Caries risk assessment is an integral part of comprehensive management of the disease. A software enabled approach called cariogram has been designed to assess the caries risk of an individual two decades ago by Dr. Douglas Bratthal. The model takes into consideration the multifactorial nature of the disease and acts as both a risk model and a prediction model. Caries risk profile generated by the cariogram is depicted as a pie chart with five sectors each representing a domain embracing different risk factors. This paper attempts to provide all necessary details a clinician needs to know about cariogram so as to exploit its benefits in the clinical decision making process.

**Key Words:** Cariogram, Dental Caries, Risk Assessment Tool..

## Introduction

Caries risk assessment is crucial for the management of the disease and should be considered as the standard of care. If caries were pandemic then there wouldn't have been a necessity for assessing the risk for the disease. Many individuals simply do not suffer from dental caries while some are severely affected and the rest fall somewhere in between <sup>1</sup>. This suggests the presence of stratification among the people in a community based on their exposure to caries risk or protective factors. As clinicians, recognizing the presence of risk factor and modifying the treatment protocol accordingly is more prudent than providing identical treatments to all patients independent of their risk <sup>2</sup>.

The risk assessment tools available for dental caries are based on either manual or software enabled approaches. A software enabled approach is preferred to manual for the greater precision with which the algorithm embedded in the software works <sup>3</sup>. Electronic risk assessment tools for caries include the cariogram which depicts the caries risk profile of an individual as a pie chart with five sectors. The concept and formula for the cariogram model was discovered by Douglas Bratthal in 1976 after an extensive research and the PC version was developed in alliance with Dr. L. Allander and K-O Lybegard. Cariogram was first considered to be an edifying model illustrating the multifactorial nature of dental caries <sup>4</sup>. Apart from using cariogram as a patient education model it has also been used to assess the caries risk level of large number of individuals in a community <sup>5-9</sup>. However in the last two decades the cariogram has progressively evolved to become a clinical reality.

## What is a Cariogram?

Cariogram is a model that represents the patients risk profile as a pie chart with five sectors. It is a didactic tool with a graphical picture depicting the caries risk profile in an interactive way and also represents an individual's susceptibility to dental caries. The model also expresses the magnitude with which different risk factors can influence the caries activity for an individual. The model does not propose the occurrence of caries with mathematical exactness but professes the likeliness of the individual to actually suffer from the disease based on the risk scenario <sup>10</sup>.

## Objectives of the Cariogram Model

- To illustrate the interaction of caries related factors.
- To represent in percentage the 'actual chance to avoid new cavities'.
- To help one identify which all factors and to what extent do they influence this 'chance'.
- To be used as a tool for patient education and motivation.
- To express caries risk graphically

Furthermore the model also classifies the patients into the high, medium or low risk categories and provides suggestions on how to proceed with the preventive management based on the risk level. This program cannot surpass the judgment of the clinician or examiner but rather would serve to provide as a valuable tool in the clinical decision making process <sup>10</sup>.

## The Pie of the Cariogram

Each slice of the cariogram pie chart is given a color and represents a particular domain as shown in Figure 1. Each domain embraces certain risk factors with weights allocated on a differential basis. The five domains include.

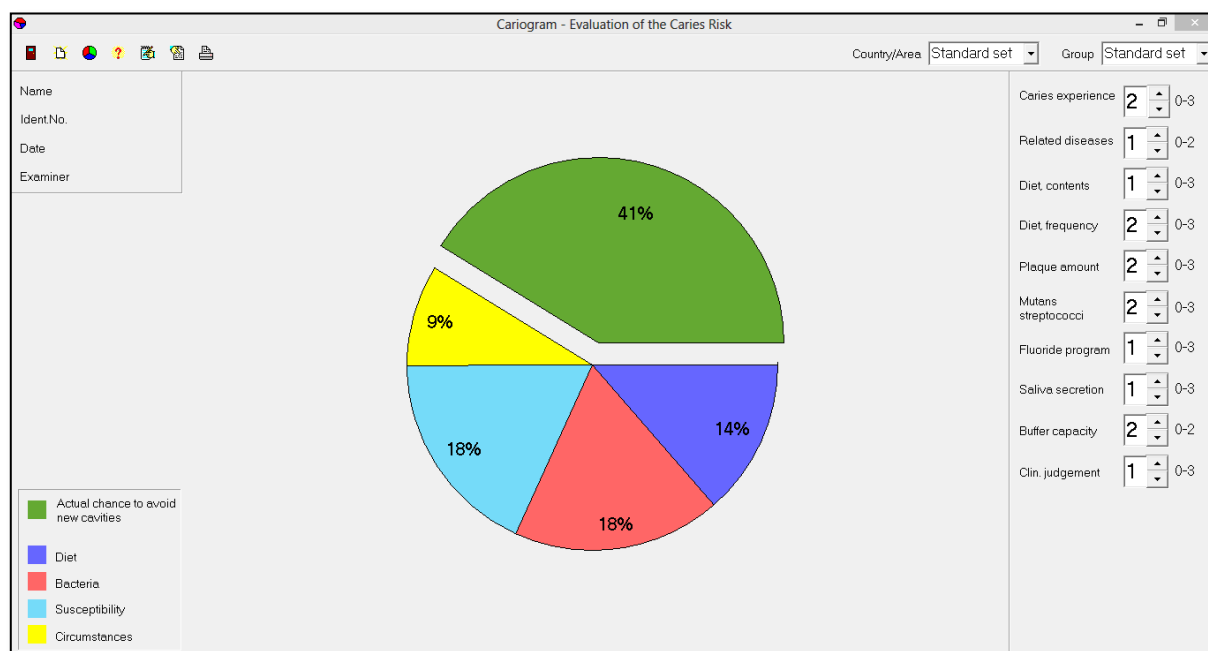


Figure 1: Cariogram Pie Chart

- Green sector - Actual chance to avoid new cavities
- Dark blue sector - 'Diet' which include diet content and frequency
- Red sector - 'Bacteria' which is based on a combination of Plaque amounts and Mutans streptococcus
- Light blue sector - 'Susceptibility' which comprises of salivary flow rate, buffering ability and fluoride program
- Yellow sector - 'Circumstances' which takes into account the past caries experience and related general diseases

Those factors which have relatively stronger impact on caries are given more weight when compared to the other factors. Ten factors that have direct influence on the carious process are taken into consideration. The algorithm constructs the pie chart based on the values entered for each of the criteria. The factors that influence dental caries can be divided into two groups; those which have direct influence on the disease process like salivary flow rate, cariogenic diet, etc. and the other group will be those factors like socioeconomic status which can indirectly affect the cariogenic process. The cariogram model includes only the biological factors that have immediate direct impact on dental caries<sup>11</sup>. Following are the ten criteria encompassed by the cariogram model and details on how each one is to be assessed are also highlighted.

1. Caries experience - can be objectified using DMFT or DMFS index
2. Related general disease - can be elucidated by taking a detailed medical history
3. Diet contents - can be obtained by tabulating a 3 day or 1 day diet chart or by taking Lactobacillus count
4. Diet frequency - Can be determined from the diet history
5. Plaque amount - Sillnes and Loe index or any other suitable index can be used to record this.
6. Mutans streptococci - Strip mutans test can be used or the bacteria can be cultured in a suitable media and counted.
7. Fluoride program - details can be obtained on fluoride exposure in the form of pastes, mouth wash, topical application, etc by interviewing the subject
8. Saliva secretion - can be determined by calculating the unstimulated/stimulated salivary flow in ml per minute.
9. Saliva buffer capacity - Dentobuff test can be used or traditional Erricson method or any other similar method can be used
10. Clinical Judgment - This factor is included in the cariogram model to take into consideration the examiners opinion. A pre-set score of 1 automatically is given by the cariogram implicating that the clinician's inference is same as that of the cariogram's representation. If there is a disparity in the opinion, then the examiner has all right to change the score and the pie chart will get modified accordingly. A score 0 can be given if the clinician feels that the patient has a better oral health than that shown by the cariogram. The score can be increased to 2 or 3 if the clinician suspects a higher risk presence than that judged by the cariogram. Thus a score of 1 show that the clinician's view is in harmony with that of the cariogram<sup>10</sup>.

## How to Use the Cariogram?

The cariogram software and the user manual can be downloaded for free of cost from the internet page - <http://www.db.od.mah.se/car/cariograminfo.html>.

The internet version software is a handy tool for the clinician and can be used with ease. With chair side examination kits for salivary tests, like the dentobuff and strip mutans test kit, constructing a cariogram will take no time. Figure 2 shows the PC version of the cariogram software with provision for scores to be entered in the boxes present on the right side column. All criteria are given separate scores after collecting the required details based on the ranking scale given for each criterion in the cariogram manual. The score values are to be entered in the respective boxes and a minimum of seven boxes are to be filled for the cariogram pie to be constructed. As the values are entered, the pie chart will be automatically displayed along with notes on risk stratification and suggestions on treatment approach<sup>10</sup>.

## Interpreting the Pie

Green sector is the 'to be watched' sector in the cariogram as it shows the vulnerability of the subject to dental caries. The greater the green sector, the better the oral health, the lesser is the risk<sup>10</sup>. This green sector is nothing but what is remaining on the pie after deducting the share taken by the other four sectors. Hence after constructing the pie the clinician should concentrate on identifying modifiable variables in the other sectors so as to bring about a fall in these sectors thereby resulting in an indirect increase in the percentage of the green sector. Patients can effortlessly appreciate this vivid model with varying colors and therefore can be easily motivated to improve their green sectors.

## Conclusion

Caries risk assessment forms the heart of the recently adopted philosophy of minimal intervention dentistry. Clinicians should recognize the importance of caries risk assessment and equip themselves with tools essential to identify the risk variables so as to provide clinically effective, economic and patient targeted therapy. Cariogram is a conceivably reliable and an undemanding tool that can be used in clinical practice as an endorsement to the clinician's expertise. Thus always remember to look at the cariogram only as an assistant or a helper but not as a master as stated by the maker of the cariogram, Dr. Douglas Bratthall.

## References

1. Jenson L, Alan WB, Featherstone DBJ, Francisco JR, Vladimir WS, Douglas AY. Clinical protocols for caries management by risk assessment. *CDA journal* 2007; 35(10):714-23.
2. Anusavice K. Clinical decision-making for coronal caries management in the permanent dentition. *J Dent Educ* 2001;65(10):1143-6.
3. American Dental Association. White paper NO 1074. Electronic oral health risk assessment tools. ADA SCDI 2013.
4. Nagaraj A, Vishnani P. Cariogram - A multi-factorial risk assessment software for risk prediction of dental caries. *Int J Sci Stud* 2014; 1(4): 58-62.
5. Celik EU, Gokay N, Ates M. Efficiency of caries risk assessment in young adults using Cariogram. *Eur J Dent* 2012; 6:270-9.
6. Kemparaj U, Chavan S, Nagesh, Shetty NL. Caries Risk Assessment Among School Children in Davangere City Using Cariogram. *Int J Prev Med* 2014; 5(5):664-71.
7. Petersson GH, Isberg P, Twetman S. Caries risk assessment in school children using a reduced cariogram model without saliva tests. *BMC Oral Health* 2010; 10(5):2-6.
8. Petersson GH, Twetman S. Caries risk assessment in young adults: a 3 year validation of the Cariogram model. *BMC Oral Health* 2015; 17:2-5.
9. Hebbal ML, Ankola A, Metgud S. Caries risk profile of 12 year old school children in an Indian city using cariogram. *Med Oral Patol Oral Cir Bucal* 2012; 17(6):1054-61.
10. Bratthall D, Hansel-Petersson G, Stjernsward J. Cariogram Internet Version 2.01. April 2; 2004.
11. Bratthall D, Petersson GH. Cariogram-a multifactorial risk assessment model for a multifactorial disease. *Community Dent Oral Epidemiol* 2005;33:256-64.