

Could We Predict Caries Risk In Children before They Were Born? The Sensitivity and Specificity Test of Mother Belief Early Childhood Caries Risk Predictor Software

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ABSTRACT

There were approximately 7 until 9 of 10 children suffering dental caries. Prevention of dental caries should be started since early childhood and needs comprehensive strategies. Mother's belief on dental health determines mother's behaviour on protecting and maintaining children's dental health. Aim: The aim of this study is to analyze sensitivity and specificity test of mother belief early childhood caries risk predictor software. Method: A cross-sectional study was conducted on Surabaya and involved 126 mothers paired with their children. The mother answered the question on early childhood caries risk predictor and the children were examined regarding their dental caries. Result: The sensitivity of predictor software to predict high risk of dental caries was 93% and the specificity to predict low risk of dental caries was 82%. Conclusion: Mother belief early childhood caries risk predictor software had high sensitivity and specificity to predict early childhood dental caries risk.

INTRODUCTION

There were approximately 7 until 9 of 10 children suffering dental caries. Prevention of dental caries should be started since early childhood and needs comprehensive strategies. The movement of dental caries prevention and treatment has been shown positive and dynamic development, but dental caries problems still showing high prevalence rates, particularly in developing countries (Peterson, 2008). Review of several studies on dental caries in some countries in the world, specifically developing countries shows that dental caries still regarded as frequent or common dental health problem in early childhood and preschool between ages one to six years old (Peterson, 2008; Bagramian et al, 2009). Dental caries still as a major health problem and has the potential to grow in various parts of the world. According to Petersen, the high incidence of dental caries, not only in developing countries, but also in developed countries, there are some spreads in several countries in Asia and Latin America. In some studies referred by Bagramian et al, dental caries still be called a common dental health problem and mostly found in early childhood and preschool between the ages one to six years old (Bagramian et al, 2009). The problem of dental caries in children requires particular and more attention because not only has the potential to develop, but also has significant impact on the quality life of children which related to disruption of the mastication system and the daily activities (Ismail, 2003; Fisher-Owens, 2007).

The problems of dental caries in children, especially dental caries in early childhood has multilevel and multifactorial causes,

thus requiring dental caries prevention efforts with comprehensive strategy and perspective. The consideration of prevention efforts along with activities which related to the process of nutrition intake, healthcare and controlling children's growth and development process (Tinanoff and Reisine, 2009; Mouradian, 2001; Slabšinskienė, 2010). Home environment with parents, siblings, or caregivers as a primary involvement, has an important role in the process of establishing health behavior. Parents attitude and behavior, particularly mother, have a role in early childhood development with age range when the child has sensitive life cycles to the various influence (Slabšinskienė, 2010; Wigen and Wang, 2011; Wigen and Wang, 2012; Okada et al, 2002).

Mother's belief regarding dental health determine mother's behaviour on protecting and maintaining children's dental health. Mothers have an important role related to condition of children health, particularly in early childhood. These can be support of child health behavior and the provision of health facilities and access to health services for children. The presence of mother in the family can be used as an early social environment which considered to have a significant impact in improving welfare of mental and physic. This required to the prevention of disease and the influence on child health behaviour (Pusponagoro, 2010). Mother belief early childhood caries risk predictor software as an outcome of the mother belief study related to children dental health status has been developed to answer that challenge. The caries predictor software is an implementation of the mother dental health belief relationship analysis model of early childhood caries risk, consisting of 4 factors, namely Susceptibility, Severity, Benefit, and Barrier. The aim of this study was to analyze sensitivity and

spesifity test of mother belief early childhood caries risk predictor software.

MATERIALS AND METHOD

A cross-sectional study was conducted on Surabaya and involved 126 mothers paired with their children. The mother answered a questionnaire on early childhood caries risk predictor and the children were examined regarding their dental caries. A sample of 126 pairs of mothers and children was taken by purposive sampling, ie children of mothers with children after getting ethical clearance and informed consent. Each mother measured the risk of caries in children using caries predictor software. Each child received a measure of caries severity with DMF-T index, with high and low caries classification. High caries with a DMF-T index is more than 6, whereas low caries with a DMF-T index is less than or equal to 6.

The caries risk factor measured in caries predictor software consists of 4 factors, namely Susceptibility, Severity, Benefit, and Barrier from the mother. Sensitivity is the result of a true positive comparison to true + false negative. The specificity of the comparison between true negative to true + negative is true. PPV is the ratio between true positive to true positives + pseudo positivity and NPV is a comparison between true negative to true negative + false negative (Petrie, 2010; Tsai et al, 2006).

RESULTS AND DISCUSSION

Demographic distribution shows that 61.11% respondents of mothers are aged less than 30 years. Most of the respondents 80.95% have education level above bachelor degree.63.49% respondents are non-working mother (Table 2).

Table 2: Mother characteristic statistical description

Characteristic	Criteria	Frequency	
		n	(%)
Age	> 30 years	49	38.89
	< 30 years	77	61.11
Education	> Bachelor Degree (S1)	102	80.95
	< Bachelor Degree (S1)	24	19.05
Occupation	Working	46	36.51
	Non working	80	63.49

Results of caries risk measurements with caries prediction software show that 22 children has low caries risk and 104 has high caries risk (Table 4). On the other hand, the result of the caries measurement in children with DMF-T

Table 3: Risk factor distribution of mother caries risk with caries predictor software

Risk factor	Mean	Standard deviation	Standard error of the mean	Lower bound on mean (95%)	Upper bound on mean (95%)
Susceptibility	2.679	0.699	0.063	2.555	2.802
Severity	2.879	0.560	0.050	2.780	2.978
Benefit	3.250	0.466	0.042	3.167	3.333
Barrier	2.563	0.646	0.058	2.449	2.678

Table 4:Result of caries predictor software and child caries cross-tabulation

Result	Prediction Result	Child Caries		Total
		High Caries	Low Caries	
Caries Predictor Software	High Risk	101	3	104
	Low Risk	8	14	22
	Total	109	17	126

Table 5: Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV)

index showed 109 children has high caries, and 17 children has low caries (Table 4).

The sensitivity of children's caries predictor software is $101/109 \times 100\% = 92.66\%$, whereas the specificity is $14/17 \times 100\% = 82.35\%$. The result of PPV measurement is $101/104 \times 100\% = 97.12\%$, and NPV obtained $14/22 \times 100\% = 63.64\%$ (Table 5).

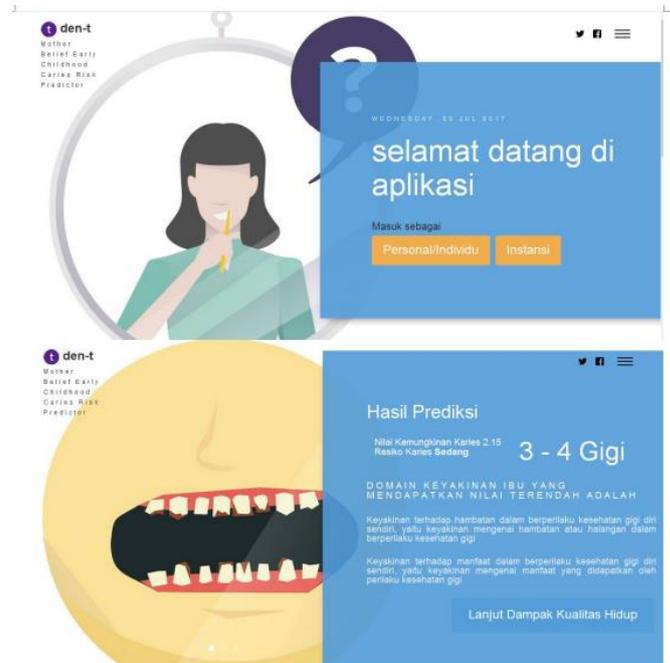


Fig1. Layout of mother belief early childhood caries risk predictor software

Knowledge-behavior interaction in dental hygiene activities of children and their parents, and delayed children first dental visit have association with early childhood caries incidence (Vanagas, 2009; Chu et al, 2012; Naidu et al, 2011; Naidu, 2013). Mother's influence on early childhood dental health status is related to mother's behavior in promoting children's dental hygiene and their dental hygiene as well. Mother's health behavior on themselves has a significant association with early childhood caries experience.

Moreover, mother's behavior in toothbrushing have association with their children (Wigen and Wang, 2012; Okada et al, 2002; Bozorgmehr, 2013; Locker, 2007; Piovesan et al, 2010; Goettems, 2011).

Sensitivity (%)	Specificity (%)	Positive Predictive Value (PPV) (%)	Negative Predictive Value (NPV) (%)
92.66	82.35	97.12	63.64

Measurements of caries in 126 children, and measurement of caries risk for 126 mothers, obtained high caries in 109 children and high risk of childhood caries in 101 mothers, so that it can be said the sensitivity of child caries predictor is 92.66%. The specificity of child caries predictors was 82.35%, significant in 17 children with low caries, there were 14 mothers with low caries risk. These results suggest that children's caries predictor software can measure 92.66% of children with high caries and 82.35% of children with low caries. From 104 mothers who were predicted to have children with high caries risk, there were 101 children with high caries, resulting in PPV 97.12%. These results indicate that if this examination gives a positive result, then 97.12% of these tests will show high caries results, while 2.88% have low caries. From 22 mothers who were predicted to have children with low caries risk, there were 14 children with low caries, resulting in NPV 63.64%. These results indicate that if this examination gives negative results, then 63.64% of these tests will show low caries results, while 36.36% have high caries. The prediction model of caries generally has sensitivity between 29-70% and specificity 65-80% (Aleksėjuniene, 2009). The caries prediction tool that has sensitivity, specificity, PPV and NPV 70-100% is included in the good category until very good, so it can be said to have high validity (Ditmyer, 2011).

CONCLUSION

From the results of the above research, it can be concluded that caries predictor software has a high sensitivity, specificity, PPV and NPV and can be used as an instrument to predict the occurrence of caries risk in children.

REFERENCES

- Aleksejuniene J, Holst D, Brukiene V. Dental caries risk studies revisited: causal approaches needed for future inquiries. *Int J Environ Res Public Health* 2009; 6(12): 2992-3009
- Bagramian, RA., Garcia-godoy, F., Volpe, AF. The global increase in dental caries. A pending public health crisis. *Am J Dent* 2009, 21(1):3-8.
- Bozorgmehr E, Hajizamani A, Malek Mohammadi T. Oral health behavior of parents as a predictor of oral health status of their children. *ISRN Dent* 2013;2013:741783. doi:10.1155/2013/741783.
- Chu C-H, Ho P-L, Lo ECM. Oral health status and behaviours of preschool children in Hong Kong. *BMC Public Health* 2012;12:767. doi:10.1186/1471-2458-12-767.
- Ditmyer MM, Dounis G, Howard KM, Mobley C, Cappelli D. Validation of multifactorial risk factor model used for predicting future caries risk with nevada adolescents. *BMC Oral Health* 2011; 11(18): 1-8.
- Fisher-Owens SA, Gansky SA, Platt LJ, Weintraub JA, Soobader M-J, Bramlett MD, et al. Influences on children's oral health: A conceptual model. *Pediatrics* 2007;120:e510-20. doi:10.1542/peds.2006-3084.
- Goettems ML, Ardenghi TM, Romano AR, Demarco FF, Torriani DD. Influence of maternal dental anxiety on oral health-related quality of life of preschool children. *Qual Life Res* 2011;20:951-959. doi:10.1007/s11136-010-9816-0.
- Ismail AI. Determinants of Health in Children and the Problem of Early Childhood Caries. *Pediatr Dent* 2003;25:328-33.
- Locker, D. Disparities in oral health-related quality of life in a population of Canadian children. *Community Dent Oral Epidemiol* 2007, 35:348-56
- Mouradian WE. The face of a child: children's oral health and dental education. *J Dent Educ* 2001;65:821-31. doi:10.1177/001789690106000411.
- Naidu R, Nunn J, Kelly A. Factors and early childhood caries: a cross-sectional study of preschool children in central Trinidad. *BMC Oral Health* 2013;13:30. doi:10.1186/1472-6831-13-30.
- Naidu R, Nunn J, Kelly A, Socio-behavioural Abanto, J., Carvalho, TS., Fausto, MM., Marcia, TW., Marcelo, B., and Daniela, PR. Impact of oral diseases and disorders on oral health-related quality of life of preschool children. *Community Dent Oral Epidemiol* 2011, 39: 105-114.
- Okada M, Kawamura M, Kaihara Y, Matsuzaki Y, Kuwahara S, Ishidori H, et al. Influence of parents' oral health behaviour on oral health status of their school children: An exploratory study employing a causal modelling technique. *Int J Paediatr Dent* 2002;12:101-8. doi:10.1046/j.1365-263X.2002.00338.x.
- Petersen PE. World Health Organization global policy for improvement of oral health--World Health Assembly 2007. *Int Dent J* 2008;58:115-21. doi:10.1922/IDJ.
- Petrie A, Sabin C. Medical statistic and a glance. 3 rd ed. Singapore: Ho Printing Singapore; 2010. p. 115-6.
- Piovesan C, Antunes JLF, Guedes RS, Ardenghi TM. Impact of socioeconomic and clinical factors on child oral health-related quality of life (COHRQoL). *Qual Life Res* 2010;19:1359-1366. doi:10.1007/s11136-010-9692-7.
- Pusponagoro, Sastroasmoro S, Ismail S. Dasar-dasar metodologis penelitian klinis. Edisi ke 3. Jakarta: Sagung Seto; 2010.h.193-216.
- Slabšinskienė, E., Milčiuvienė, S., Narbutaitė, J., Vasiliauskienė, I., Andruškevičienė, V., Bendoraitienė, E., and Saldūnaitė, K. Severe early childhood caries and behavioral risk factors among 3-year-old children in Lithuania. *Medicina (Kaunas)* 2010. 46(2):135-141.
- Tinanoff N, Reisine S. Update on early childhood caries since the Surgeon General's Report. *Acad Pediatr* 2009;9:396-403. doi:10.1016/j.acap.2009.08.006.
- Tsai AI, Chen C-Y, Li L-A, Hsiang C-L, Hsu K-H. Risk indicators for early childhood caries in Taiwan. *Community Dent Oral Epidemiol* 2006;34:437-45. doi:10.1111/j.1600-0528.2006.00293.x.
- Vanagas G, Milasauskiene Z, Grabauskas V, Mickeviciene A. Associations between parental skills and their attitudes toward importance to develop good oral hygiene skills in their children. *Medicina (Kaunas)* 2009;45:718-23.
- Wigen I, Wang J. Maternal health and lifestyle, and caries experience in preschool children. A longitudinal study from pregnancy to age 5 yr. *Eur J Oral Sci* 2011;119:463.
- Wigen TI, Wang NJ. Parental influences on dental caries development in preschool children. An overview with emphasis on recent Norwegian research. *Nor Epidemiol* 2012;22:13-9. doi:10.5324/nje.v22i1.1515.