

An Indonesian Version of Caries Management by Risk Assessment (CAMBRA) for Children Aged 0–5 Years: Assessing Validity and Reliability

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Abstract

Caries is a serious public health problem and its control should be a priority. Proper caries management is urgently needed to handle caries based on specific individual conditions in Indonesia. CAMBRA methodology helps dentists identify the causes of caries by examining risk factors in each patient.

The aim of this study is to assess the validity of the CAMBRA Indonesia version that was developed according to guidelines for cross-cultural adaptation.

This was a validity and reliability test designated with Cohen's Kappa. This study was carried out by two groups of operators who performed an assessment using the CAMBRA Indonesia version and the original CAMBRA. Both groups examined 36 pairs of mothers and children aged 0–5 years.

The mothers had a minimum education of a bachelor's degree. The outcomes of caries risk from each group was tested using Cohen's Kappa.

The results of intra- and inter-examiner agreement was almost perfect with a k-value = 0.828 (range 0.81–1.00), with inter-examiner agreement at 94.4%. The Indonesian version of CAMBRA was developed successfully to be used as an instrument assessing caries risk in children 0–5 years old.

The inter- and intra-examiner agreement between the CAMBRA Indonesia version and the original CAMBRA were confirmed.

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Introduction

Caries is a serious public health problem and its control should be a priority. The presence of caries and extraction may lead to dental malocclusion and cause pronunciation problems and low self-esteem in children.¹ Previous research has suggested that the population of individuals that is susceptible to caries continues to increase along with age.²

In the United States, caries prevalence is estimated to be five time higher than allergic rhinitis.² In Indonesia dental caries analysis

results in Riset Kesehatan Dasar (Riskesdas) 2013, there was an increase in caries from 40.4% in 2007 to 53.2% in 2013.³ If converted to the total population in Indonesia, more than 90 million people suffer from caries. In other research, in Gunung Anyar, Surabaya found that 30.8% of children aged between 6 months and 3 years already have early childhood caries.⁴ Study in Jakarta, found that 37.5% of breastfed children and 70.8% of non-breastfed children between 6-24 months have early childhood caries.⁵ Based on these data, proper caries management is urgently needed to control caries based on specific individual conditions.

These specific conditions include pathological factors and protective factors that both determine individual caries risk.^{6,7} Caries risk assessment is important at childrens' first dental visit. Information that is obtained through a caries risk assessment can guide a caries treatment plan based on the age and risk of each individual to effectively manage their caries

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process.^{8,9} This, in turn, could raise parental awareness about the causes and consequences of caries, and help dentists to develop the most suitable treatment for each patient.⁸

There are several available caries risk assessment methods, including Caries Management by Risk Assessment (CAMBRA). CAMBRA methodology helps dentists identify the causes of caries by examining the risk factors in each patient. From the available evidence, the dentist will correct the etiology by managing the patient's own risk factors, using specific treatment recommendations, including behavioral modification, chemistry and non-invasive procedures.⁹

Currently CAMBRA has been validated and translated into several languages. In Asia, CAMBRA has been validated and used in South Korea¹⁰ and Thailand.¹¹ Based on this, it is necessary to have caries risk measurement tools such as CAMBRA, which can be used and understood in Indonesia. Therefore, this study examined a CAMBRA Indonesia version, which has been validated.

Materials and methods

The study was approved by Universitas Indonesia's ethics committee. We adopted the CAMBRA questionnaire forms for children 0–5 years old from the California Dental Association (CDA), University of California, San Francisco. The forms (see Figures 1 and 2) consist of an original CAMBRA form and a self-management goals form aligned with the CAMBRA protocols.

We were granted permission from Gayle Mathe, the Community Program Director of CDA, to do this research. The first step was to perform a translation in accordance with Guillemin et al.'s (1993) guidelines covering translation into the country's language, back-translation to instrument language, assessment by an expert committee and confirmation from the original instrument maker, in this case the original CAMBRA. Figures 3 and 4 are the CAMBRA Indonesia version and the translated self-management goals form, respectively.

The study population consisted of 36 pairs of mothers and children from newborn to 5 years of age who received a base-line examination. Both mother and child were new to CAMBRA and had not received any prior CAMBRA recommendations. The baseline

Caries Risk Assessment (CRA) was performed June 2017 by pediatric dentistry residency students in the Pediatric Clinic, RSGM Faculty of Dentistry, Universitas Indonesia.

Twenty-four residency students were divided equally into two groups. The first group did the examination with the CAMBRA Indonesia version and the other group used the original CAMBRA version. The students in this study had the same level of TOEFL ITP with a minimum score of 450, and were also new to CAMBRA without any prior CAMBRA training. Both groups were trained separately regarding CAMBRA. This training was limited only to how to fill out the forms and how to determine the patient's caries risk status, without any language interventions.

The 36 pairs of mothers and children were examined two times, with operators using original CAMBRA and the CAMBRA Indonesia version. After the CAMBRA form was filled out by an operator, mothers were asked to choose two pictures from the self-management goals form after the operator interpreted the pictures, in accordance with their child's caries risk. This form was then collected and the patient's caries risk was compared between both groups using Cohen's Kappa. The expected *k*-value was 1.

The duration of the examination and completion by the operators of the CAMBRA forms were being recorded by a time keeper, and the two groups were compared. Unpaired comparison between the groups was tested using the Mann-Whitney test. The level of significance for the test was $p = 0.05$. The study protocols were approved by the University Ethical clearance board, and patients signed an informed consent form to participate in the study.

Results

Results of this research on the validity and reliability test of the CAMBRA Indonesia version were conducted at the Pediatric Dentistry Clinic, RSGM Faculty of Dentistry, Universitas Indonesia using a total sample of 24 operators who participated in the Pediatric Dentistry Residency Program following the calibration of CAMBRA. This study was also attended by 36 pairs of mothers and children aged 0–5 years, in which the mother had a minimum of a bachelor's degree, and who were willing to take part in this research. Data collection was conducted in June 2017. Table 1a presents the distribution of

research subjects: operators, patients and gender of the children.

Based on Table 1, it can be seen that there are a total of 72 examination forms that were used in the study and were divided into two groups: 36 forms for CAMBRA Indonesia and 36 forms for the original CAMBRA. A total of 24 operators were divided into two groups consisting of 12 operators using the CAMBRA Indonesia version and 12 operators using the original CAMBRA. Table 1b also shows that there were 55.6% girls and 44.4% boys, with total of 36 pairs of respondents.

To obtain compatibility between the CAMBRA Indonesia version and the original CAMBRA, a validity and reliability test of the two versions was conducted. Based on the caries risk results that were determined from use of the CAMBRA Indonesia version and original CAMBRA, a statistical test was performed to learn whether there were matching results and agreement between operators. This intra- and inter-examiner agreement was calculated using Cohen's Kappa, as presented in Table 2.

It is shown in Table 2 that the k value (kappa value) is $k = 0.828$ with the inter-examiner agreement is 94.4%. This indicates there is a perfect agreement between operators using the CAMBRA Indonesia version and the original CAMBRA in interpreting the forms and assessing the children's caries risk to the same subjects.

We also compared the duration of examination in seconds between operators using each CAMBRA version. The unpaired comparison was calculated and determined with the Mann-Whitney test, described in Table 3. The test showed that the mean duration of examination using the original CAMBRA is longer than with the CAMBRA Indonesia version, yet there is no statistically significant difference between both groups.

In Table 4, the image distribution self-management goals were chosen by the mother after being interpreted by the operator in accordance with the conclusion of caries risk in children. In the table, we divided mothers into three categories: category 1 if the mother did not choose a similar goal picture, category 2 if the mother choose one similar picture, and category 3 if the mother choose two similar pictures. The table shows that category 2 had 18 mothers (50%) and category 3 had 14 mothers (38.89%); both are higher than category 1, which had only

four mothers in it (11.11%). This indicates that the operator's interpretation and perception of the patient's caries risk are the same, whether the operator was using the Indonesian version of CAMBRA or the original CAMBRA version.

Discussion

In the cross-cultural adaptation of CAMBRA, it is necessary to show that the instrument is relevant and valid culturally in the country where the instrument is adapted. The first step is to perform a translation in accordance with Guillemin et al.'s guidelines covering translation into the country's language, back-translation to instrument language, assessment by an expert committee and confirmation from the original instrument maker, in this case, the original CAMBRA.¹²

Translations were performed after we received permission to conduct the validity and reliability research of the CAMBRA Indonesia version from the copyright owner, California Dental Association (CDA), University of California, San Fransisco, in this case represented by Gayle Mathe, CDA community programs director.

There was one statement that we changed to be more suitable for use in Indonesia: "*Caregiver has low health literacy, is a WIC participant and/or child participates in Free Lunch Program and/or Early Head Start,*" because those three programs are United States government programs for low socioeconomic status that is stated by government law.¹³ Indonesia does not have these programs, but does have a similar program, so we replaced them with BPJS Penerima Bantuan Iuran (BPJS PBI), a program where the eligible participant is a family with low socioeconomic status that is assigned by the government and set by government law.¹⁴ Where it was reported in other study that socioeconomic status also determine the caries risk status of patient.¹⁵ Furthermore, BPJS PBI also provides dental protection to its members.

The number of operators that participated in this research was 12 operators using the original CAMBRA and 12 operators using the CAMBRA Indonesia version. The inclusion criteria to be an operator for this study was to have a TOEFL ITP® score of at least 450. It was intended that the operator have a homogeneous English language ability. TOEFL 450 is included

in category B1 in The Common European Framework of Reference for Language (CEFR).¹⁶ Category B1 is described as the ability to read including understanding the process of description and narrative that is relatively simple in academic texts.¹⁷

In this study, we invited 36 pairs of mothers and children aged 0–5 years. Participating mothers had to be college graduates, with a minimum of a bachelor's degree. We aimed to have a homogeneous knowledge and perception by the mothers at the time of interviewing the operator in examining their children's caries risk using CAMBRA. As stated in the literature, knowledge can be obtained and influenced by the education process. A person's level of education can describe her knowledge, which may also affect perception from within.¹⁸ Other studies have reported that maternal knowledge and perception of oral hygiene are associated with caries risk in children.¹⁹

In this study of CAMBRA, caries activity status of mother also has an important role in determining child's caries risk. This is in accordance with other study, that also using child-mother pairs with dental caries. It shows a significant relationship in caries between mother and child. The study found that child caries scores increased as mother caries score rose.²⁰

There are several methods in determining caries risk from patients in recent years. CAMBRA is a system developed by the California Dental Association, and has been validated and proven as a system in determining caries risk.²¹ Hence validation of the CAMBRA Indonesia version is required in determining caries risk in Indonesian children. This research is the first research conducted in Indonesia. The validity and reliability test of the CAMBRA Indonesia version was conducted with the Cohen's Kappa reliability test (intra-examiner agreement) between dentists using the CAMBRA Indonesia version against dentists using the CAMBRA original version.

The Cohen's Kappa test aimed to learn whether the Indonesian version of CAMBRA could result in a similar interpretation as the original CAMBRA as a way to determine caries risk in children. Intra- and inter-rater reliability is a concern in many studies, as many operators may generate different perceptions and interpretations when collecting data. The importance of an

operator producing consistent interpretation in evaluating a sample is an important factor in the reliability of the quality of the instrument that is under research.²²

There are satisfying results in the validity and reliability test of the CAMBRA Indonesia version. Cohen's Kappa test had an intra-examiner agreement that shows k value = 0.828 with inter-examiner agreement at 94.4% in determining caries risk. Thus, the CAMBRA Indonesia version is proven to produce similar interpretation as the original CAMBRA in determining caries risk in children aged 0–5 years. Furthermore, the CAMBRA Indonesia version can also produce the same results for a child's caries risk, with almost perfect agreement 94.4% with original CAMBRA.

This is consistent with the literature. When the k value minimal 0.80 is performed in the medical field, it means that the instrument being tested is valid. The same author (Mary L, 2012) also suggests 80% as the minimum inter-examiner agreement that is acceptable for clinical research.²² In this research, the k value of 0.828 was followed by 94.4% inter-examiner agreement, showing that the CAMBRA Indonesia version is valid and reliable.

It also indicated that the CAMBRA Indonesia version can produce the same accurate degree of interpreting a child's caries risk as the original CAMBRA. Literature also says that it is important to assess the degree of inter-examiner agreement to draw the conclusion that the instrument in the research is valid and useable.²²

At the beginning of this research, each group of operators received training that was limited to how to use CAMBRA and how to fill out the forms. This is in accordance with the literature that states that research designed with the Cohen Kappa test usually includes training for the operator or the examiner, and is followed by assessing whether the two groups of operators can produce similar results to the same phenomenon.²²

Training and calibration for these two groups was carried out so that operators could implement the results of the training to reduce the variability in how they interpreted CAMBRA and concluded the child's caries risk, where this variability could be a potential bias in the data retrieval. In accordance with the literature, the examiner was expected to attend the training and

could be assessed on effectiveness of the training and generate a degree of agreement (inter-rater reliability) between operators.²²

The duration of examination from both groups (with CAMBRA Indonesia version and original CAMBRA) was recorded by a time keeper. This duration was compared using the Mann-Whitney test. Table 3 shows that the examination duration with the CAMBRA Indonesia version was shorter than with original CAMBRA, but it was not statistically significantly different (p value > 0.05). This may be because, although Bahasa Indonesia is more understandable as the operator's native language, English has become the international language that is used in daily life.

The pictures of the self-management goals that were chosen by the mothers, after being interpreted by two operators using each CAMBRA version, were expected to produce a homogeneous selection of pictures between the two operators. Where most of the mothers belonged to category 2 and 3, which consisted of at least one similar picture, this indicates that operator interpretation and perception to caries risk is the same. Thus, both operators can suggest the same pictures in self-management goals for the mothers to choose.

This process in CAMBRA is mentioned as motivational interviewing. CAMBRA literature states that a brief version of motivational interviewing with a patient-centered counseling technique has been found to be effective in reducing caries in young children. Encouraging mothers to engage in self-care behaviors will reduce child caries risk.²³

This reasearch, where mothers were asked to choose by themselves their self-

management goals, is consistent with CAMBRA protocols. It states in CAMBRA philosophy that there is a collaboative relationship in which the patient's autonomy and choice are respected. Trust is establishing such a connection and is invaluable in influencing the patient to act or to change their behavior. Parents that are well motivated can effectively control their child's caries risk.²³

Conclusions

The CAMBRA Indonesia version has been proven to be valid and reliable. The Cohen's Kappa test has a k -value of 0.828, which means an almost perfect agreement. The CAMBRA Indonesia version also has a percentage inter-rater agreement of 94.4%, which means perfect agreement against the original CAMBRA version. Therefore, the CAMBRA Indonesia version can be used as a standard diagnostic tool to determine the risk of childhood caries in children aged 0–5 years in Indonesia.

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Declaration of Interest

The authors report no conflict of interest.

TABLE 1

CAMBRA — Caries Risk Assessment Form for Age 0 to 5 Years

Patient Name: _____ ID# _____ Age: _____ Date: _____

Assessment Date: _____ Please circle: BASELINE, three-month follow-up or six-month follow-up

	1	2	3	Comments:
NOTE: Any one Yes in Column 1 signifies likely "High Risk" and an indication for bacteria tests	Yes -CIRCLE	Yes -CIRCLE	Yes -CIRCLE	

1. Risk Factors (Biological Predisposing Factors)

(a) Mother or primary caregiver has had active dental decay in the past 12 months*	Yes			
(b) Bottle with fluid <u>other</u> than water, plain milk and/or plain formula		Yes		Type of fluid:
(c) Continual bottle use		Yes		
(d) Child sleeps with a bottle, or nurses on demand		Yes		
(e) Frequent (>3 times/day) between-meal snacks of sugars/cooked starchy/sugared beverages		Yes		#times/day:
(f) Saliva-reducing factors are present, including: 1. medications (e.g. some for asthma [albuterol] or hyperactivity) 2. medical (cancer treatment) or genetic factors		Yes		
(g) Child has developmental problems/CSHCN (child with special health care needs)		Yes		
(h) Caregiver has low health literacy, is a WIC participant and/or child participates in Free Lunch Program and/or Early Head Start		Yes		

2. Protective Factors

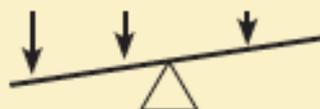
(a) Child lives in a fluoridated community or takes fluoride supplements by slowly dissolving or as chewable tablets (note resident ZIP code)			Yes	
(b) Child drinks fluoridated water (e.g. use of tap water)			Yes	
(c) Teeth brushed with fluoridated toothpaste (pea-size) at least once daily			Yes	
(d) Teeth brushed with fluoride toothpaste (pea-size) at least 2x daily			Yes	
(e) Fluoride varnish in last six months			Yes	
(f) Mother/caregiver chews/dissolves xylitol chewing gum/lozenges 2-4x daily			Yes	

3. Disease Indicators/Risk Factors – Clinical Examination of Child

(a) Obvious white spots, decalcifications enamel defects or obvious decay present on the child's teeth*	Yes			
(b) Restorations present (past caries experience for the child)*	Yes			
(c) Plaque is obvious on the teeth and/or gums bleed easily		Yes		
(d) Visually inadequate saliva flow		Yes		
(e) New remineralization since last exam (List teeth):				

Child's Overall Caries Risk* (circle): High Moderate Low
 Child: Bacteria/Saliva Test Results: MS: LB: Flow Rate: ml/min: Date:
 Caregiver: Bacteria/Saliva Test Results: MS: LB: Flow Rate: ml/min: Date:

Self-management goals:
 1) _____
 2) _____



**VISUALIZE
 CARIES BALANCE**

*Assessment based on provider's judgment of balance between risk factors/disease indicators and protective factors.

Doctor signature/#: _____ Date: _____

Figure 1. Original CDA Cambra for age 0–5 years.

Self-Management Goals for Parent/Caregiver

Patient Name _____

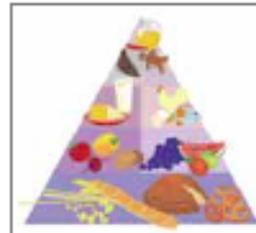
DOB _____



Regular dental visits for child



Family receives dental treatment



Healthy snacks



Brush with fluoride toothpaste at least 2 times daily



No soda



Less or no juice



Wean off bottle (no bottles for sleeping)



Only water or milk in sippy cups



Drink tap water



Less or no junk food and candy



Use xylitol spray, gel or dissolving tablets

IMPORTANT: The last thing that touches your child's teeth before bedtime is the toothbrush with fluoride toothpaste.

Self-management goals 1) _____

2) _____

On a scale of 1-10, how confident are you that you can accomplish the goals? 1 2 3 4 5 6 7 8 9 10

Signature _____ Date _____

Practitioner signature _____ Date _____

Figure 2. Original self-management goals CDA form.

INDO CAMBRA

TABEL 1

CAMBRA - Formulir Pemeriksaan Resiko Karies untuk Usia 0 sampai 5 Tahun

Nama pasien: _____ KTP# _____ Usia: _____ Tanggal: _____

Tgl Pemeriksaan: _____ Lingkari: DASAR, lanjutan tiga bulan atau enam bulan

	1	2	3	
CATATAN: Setiap pilihan Ya pada Kolom 1 menunjukkan kemungkinan "Resiko Tinggi" dan indikasi untuk uji bakteri	Ya = LINGKAR	Ya = LINGKAR	Ya = LINGKAR	Komentar:
1. Faktor Resiko (Faktor Predisposisi Biologis)				
(a) Ibu atau pengasuh utama mengalami karies gigi aktif dalam 12 bulan terakhir*	Ya			
(b) Botol dengan cairan selain air, susu biasa dan/atau susu formula biasa		Ya		Jenis cairan:
(c) Penggunaan botol terus-menerus		Ya		
(d) Anak tidur dengan botol, atau ASI atas permintaan*		Ya		
(e) Sering (> 3 kali/hari) antara makanan ringan gula/pati yang dimasak/minuman bergula		Ya		# Kali/hari:
(f) Faktor pengurang liur, termasuk: 1. Obat-obatan (misalnya, beberapa untuk asma [albuterol] atau hiperaktif) 2. Medis (pengobatan kanker) atau faktor genetik		Ya		
(g) Anak mengalami masalah perkembangan / anak dengan kebutuhan perawatan kesehatan khusus		Ya		
(h) Pengasuh memiliki literasi kesehatan yang rendah, peserta program BPJS PBI (Penerima Bantuan Iuran Jaminan Kesehatan)		Ya		
2. Faktor-faktor Pelindung				
(a) Anak tinggal dalam komunitas yang memiliki fluoride atau mengkonsumsi suplemen fluoride yang dengan perlahan melarutkan atau mengunyah tablet (catatan kode pos penduduk)			Ya	
(b) Anak meminum cairan ber-fluoride (misalnya susu formula yang mengandung fluoride)			Ya	
(c) Gigi disikat dengan pasta gigi ber-fluoride (seukuran kacang) minimal sekali sehari			Ya	
(d) Gigi disikat dengan pasta gigi ber-fluoride (seukuran kacang) minimal 2x sehari			Ya	
(e) Varnish fluoride dalam enam bulan terakhir			Ya	
(f) Ibu / pengasuh mengunyah / melarutkan permen xylitol/lozenges 2-4 x sehari			Ya	
3. Indikator Penyakit/Faktor Resiko – Pemeriksaan Klinis Anak				
(a) Bintik-bintik putih yang jelas, dekalsifikasi, kerusakan email atau lubang pada gigi anak*	Ya			
(b) Restorasi yang ada (pengalaman karies masa lalu untuk anak)*	Ya			
(c) Plak terlihat jelas pada gigi dan/atau gusi mudah berdarah		Ya		
(d) Aliran air liur secara visual tidak proporsional		Ya		
(e) Remineralisasi baru sejak pemeriksaan terakhir (Daftar gigi):				

Risiko Karies Anak secara Keseluruhan* (lingkari): Tinggi Sedang Rendah

Anak: Hasil Uji Bakteri/Liur: MS: LB: Tingkat Aliran: ml/mnt Tanggal:

Pengasuh: Hasil Uji Bakteri/Liur: MS: LB: Tingkat Aliran: ml/mnt Tanggal:

Tujuan perawatan mandiri:

1) _____

2) _____



GAMBAR KESEIMBANGAN KARIES

* Pemeriksaan berdasarkan penilaian penyedia jasa tentang keseimbangan antara faktor-faktor resiko/Indikator penyakit dan faktor pelindung.

Tandatangan dokter/#: _____ Tanggal: _____

Figure 3. CAMBRA Indonesia version for age 0–5 years.

INDO CAMBRA

PROTOKOL CAMBRA

Tujuan Perawatan Mandiri untuk Orangtua/Pengasuh

Nama Pasien _____



Kunjungan Gigi untuk anak



Keluarga menerima perawatan gigi



Kudapan sehat



Sikat dengan pasta gigi fluoride Minimal 2 kali sehari



Tidak untuk soda



Kurangi jus atau tidak sama sekali



Singkirkan botol (tidak ada botol saat tidur)



Hanya air atau susu dalam cangkir



Minumlah Air keran



Kurangi makanan manis



Gunakan xylitol semprot, jel atau tablet larut

PENTING: Hal terakhir yang menyentuh gigi anak anda sebelum tidur adalah sikat gigi dengan pasta gigi fluoride

Tujuan perawatan mandiri: 1) _____
2) _____

Dalam skala 1-10, seberapa yakin anda dapat mencapai sasaran? 1 2 3 4 5 6 7 8 9 10

Tandatangan _____ Tanggal _____

Tandatangan dokter _____ Tanggal _____

Figure 4. Self-management Indonesia version.

		n (quantity)	Percentage %
Questionnaire Form	Indonesian version	36	50
	Original	36	50
	TOTAL	72	100
Examiner (Operator)	Indonesian version	12	50
	Original	12	50
	TOTAL	24	100
Pair of mother and children	Boys	16	44,44
	Girls	20	55,56
	TOTAL	36	100

Table 1a. Sample distribution.

CAMBRA original	CAMBRA Indonesia version	CAMBRA Indonesia version			% Agreement	k	Kappa
		Low	Moderate	High			
Low		1	0	0	94.4	0.828	Almost perfect
Moderate		0	5	1			
High		0	1	28			

Table 1b. Intra- and inter-examiner agreement between CAMBRA Indonesia version and original CAMBRA. *k*= kappa value; Kappa = strength of agreement.

	Median (minimum-maximum)	<i>p</i> -value
CAMBRA Indonesia (n=36)	366 (184-764)	0.107*
CAMBRA original (n=36)	435 (241-745)	

Tabel 2. Mann-Whitney test result, unpaired comparison in duration of examination between CAMBRA Indonesia version and original CAMBRA.

CAMBRA Indonesia and CAMBRA original	Picture choose by Mother						Total	
	3		2		1		n	%
	N	%	N	%	N	%		
	14	38.89	18	50	4	11.11	36	100

Table 3. Self-management picture distribution that is chosen by mother, based on operator interpretation of child's caries risk. 3: Mother choose 2 similar pictures; 2: mother choose 1 similar picture; 1: mother did not choose any picture.

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