

# The Use of Selective Agar Medium to Increase the Awareness of Handwashing of Students at SD Negeri 57 Banda Aceh, Indonesia

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Handwashing  
Microbes  
Student  
primary school  
Selective agar  
media

## Abstract

Hand is a part of the body that contains lots of microbes. Handwashing is kind of a clean and healthy lifestyle that is aimed to reduce the number of microbes in the hand. The proper handwashing behavior should be begun to be accustomed since in elementary school, but students' awareness is relatively low. This is alleged because they assumed that their hands look clean. In this community engagement activity on how to wash hands properly, hundred students in national primary school SD Negeri 57 Banda Aceh, Indonesia were involved from March until June 2019 and then ten students were chosen as ambassador of handwashing (*ducuta*). Two selective media agars were used to grow microbes from the hands of the students before and after hand washing. Several programs (*secuta*, *mocuta*, *bacuta*, and *kacuta*) were also conducted to measure the success of this activity. There was an increase in understanding the proper way of handwashing from 78% before socialization to 96% after the socialization. The results based on the handwashing activity book (*bacuta*) showed that 50% of the *ducuta* have begun to get used to washing their hands properly before eating, after going to the toilet, and after playing recommended by WHO.

## 1. INTRODUCTION

Hands are parts of the body that are used most in contact with the environment. The spreading of diseases such as diarrhea, gastrointestinal infections, as well as respiratory system infections can easily happen if the hands are not properly washed (Pratami *et al.*, 2013; Lipinwati *et al.*, 2017). Diarrhea has become the mortality cause of 1.8 million toddlers in developing nations (Sumampouw, 2017). According to the data by the World Health Organization (WHO) and the

Department of Health of Indonesia in 2009, each year on average 100,000 children in Indonesia are dead due to diarrhea (Kartika & Rahmawati, 2017). In Aceh, the prevalence of diarrhea has increased from 7.5% in 2013 to 8% in 2018 (Kemenkes RI, 2018). One of the causal factors is the lack of practice of a clean and healthy lifestyle, especially handwashing, in children between the age of 7 to 12 years old.

The fundamental problem that often occurs is the lack of understanding in elementary students on the importance of handwashing, proper methods of

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handwashing, and time of handwashing (after any activity, after going to the bathroom, and before eating). Based on the research conducted in SD Negeri 001 Karimun, it is known that most of the students do not practice Clean and Healthy Lifestyle (PHBS) due to their lack of understanding of PHBS as well as the inadequate facility to wash their hands (Diana *et al.*, 2014). The assumption that hands should only look clean also becomes a major factor in the lack of practice in handwashing in children (Rachmawati & Triyana, 2008).

The effort to increase the awareness to properly wash hands on elementary students is important considering the significant impact of a hand that is contaminated with pathogenic bacteria. One of the efforts is to conduct socialization as an actualization of Tri Darma Perguruan Tinggi. This activity was conducted in SD Negeri 57 Banda Aceh on Maret until June of 2019. The school was chosen due to the short distance from Universitas Syiah Kuala, Banda Aceh to the location ( $\pm 150$  m).

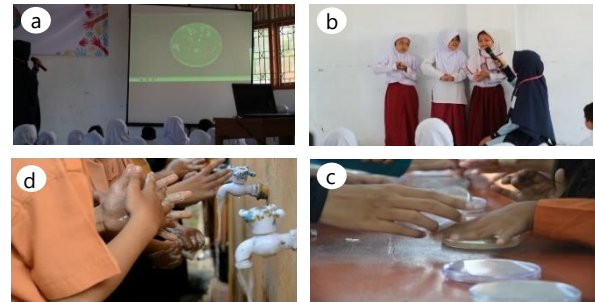
The research by Angga *et al.* (2015) shows that four main bacterial contaminants could potentially cause diseases if the hands are not properly washed, including *Staphylococcus aureus* (53.85%), *Staphylococcus epidermidis* (34.62%), *Eschericia coli* (7.69%), and *Basillus sp.* (3.84%). Therefore, in this activity, the agar used is (a) *Baird-Parker Agar* (BPA) which specifically targets the bacterium *Staphylococcus aureus* with a clear black view of the colony with a clear zone, and (b) *Mac Conkey Agar* (MCA) which specifically targets *Enterococcus faecalis* with red colony view as well as *Staphylococcus aureus* with a pale pink colony view (Bridson, 2006).

## 2. METHOD

This activity was conducted in three stages, which are pre-socialization, socialization, and post-socialization. The pre-socialization stage includes all preparations such as scheduling, making the agar media, procurement of equipment, as well as preparation of socialization materials. SD Negeri 57 Banda Aceh has been facilitated with water faucets and a soap dispenser installed near the faucets, enabling the students to immediately wash their hands.

The activities during socialization were conducted by explaining six steps of handwashing as recommended by the World Health Organization, which are (a) spreading the soap on both palms in a rotating manner; (b) rubbing the back of the left hand with the right palm through the dorsum; (c) rubbing the dorsum with the palms touching each other; (d) rubbing the knuckles with the tip of the fingers; (e) rotational rubbing with the left thumb clasped in the right palm and vice versa; and (f) rubbing the right nails and

fingertips on the left palm, and vice versa (WHO, 2020). Those materials were delivered to the students through presentation (Figure 1.a) and demonstration (Figure 1.b). The next step is to practice the handwashing technique and stick the surface of the palms to agar media, which are *Baird-Parker Agar* (BPA) and *Mac Conkey Agar* (MCA) before and after the students wash their hands. The handwashing activity can be seen in Figure 1.c and the sticking of the palms into agar can be seen in Figure 1.d.



**Figure 1.** Activities during the socialization: a) Watching the handwashing video; b) Practicing handwashing dance; c) Washing hands with soap; and d) Sticking hands on agar media.

This activities during the socialization involves 100 students. The handwashing module or *modul cuci tangan* (*mocuta*; Appendix 1), handwashing activity book or *buku aktivitas cuci tangan* (*bacuta*; Appendix 2), and handwashing card or *kartu cuci tangan* (*kacuta*; Appendix 3) were designed to enable the elementary students to easily understand and practice the proper way of handwashing. Ten students were then chosen using quota sampling as *duta cuci tangan* (*ducuta*; Figure 2), ambassador of handwashing, which acts as promoters and motivators of handwashing for the other students in the school. The criteria include: (a) students from Grade 4 and 5 of SD Negeri 57 Banda Aceh, (b) recommended by the homeroom teacher, (c) willing to follow every step of the activity, and (d) achieved 100 marks on the pre-test. *Ducuta* teaches the handwashing dance or *senam cuci tangan* (*secuta*) every Monday morning (after the morning ceremony) in the schoolyard (Figure 3). The success rate of this socialization was measured through questionnaires (Appendix 4) provided to all the participants before and after they are given the materials.



**Figure 2.** Duta Cuci Tangan in SD N 57 Banda Aceh



**Figure 3.** Handwashing dance after Monday morning ceremony

During the post-socialization stage, further evaluation on the continuity of the handwashing activity by the students of SD Negeri 57 Banda Aceh involved their parents and were done through direct supervision in their homes within one month. At this level, the ten *ducutas* were involved in filling *bacuta* and their father/mother were involved in answering a questionnaire (Appendix 5).

The validity and reliability of all questionnaire data from the parents were analyzed using the software IBM SPSS Statistics 22. The validity of the questions was known by correlating the question score from the total score using Pearson correlation test. The statements were considered valid if the equated  $r$  is equal or more to table  $r$  with the significance rate of 5%. A reliability test was done to test the consistency of the measuring instruments, whether it shows a consistent result if the measuring process is repeated. Reliability test was done using Cronbach's alpha method with the limit of 0.60 to determine whether or not a variable is reliable. If the Cronbach's alpha value is bigger than 0.60, the variable is reliable. However, if the value is less than 0.60, the variable is not reliable.

### 3. RESULT AND DISCUSSION

#### 3.1 Description of Respondents' Characteristics

Hundred students involved at socialization are students

Of Grade 4 and 5 in SD N 57 Banda Aceh. The characteristics of respondents based on their genders showed that the majority of the respondents are female (80%). In addition, based on age, 50% of the respondents are eleven-year-olds, 40% are ten-year-olds, and 10% are 12-year-olds.

#### 3.2 Questionnaire as A Benchmark for Student's Knowledge and Awareness

The students' understanding before and after given the socialization was measured with three questionnaires. The first questionnaire (Appendix 4) consisted of six questions that had to be filled by the students. The six questions included the definition of handwashing, the materials used to wash hands, the time of handwashing, as well as the procedure of handwashing in six steps. Their results can be seen in Table 1. The validity and reliability test showed that all students' knowledge and awareness variables are valid and reliable.

From Table 1, the number of correct answers rose from 78% before the students were given the material, to 96% after they were given the materials. This shows that there was an increase in students' knowledge of the proper way of handwashing. This increase hopes to encourage the students to apply the proper way of handwashing in their daily lives.

The second and third questionnaires were given to the parents. The second questionnaire consists of four questions related to their knowledge on handwashing as well as their view towards their children's knowledge on handwashing. The third questionnaire consists of three questions related to the parents' observation of their children's handwashing habit. The results of both questionnaires can be seen in Table 2 and Table 3, respectively. The validity and reliability test shows that all the variables of the parents' responses are valid and reliable.

**Table 1.** Percentage of students' questionnaire answers (n=100)

Question	Before Socialization		After Socialization		$t_{\text{calculated}}$	$t_{\text{table}}$	Cronbach $\alpha$	Interpretation
	Right	Wrong	Right	Wrong				
1	100%	0%	100%	0%	0.430	0.196	0.675	Valid and Reliable
2	100%	0%	90%	10%	0.485	0.196	0.675	Valid and Reliable
3	90%	10%	100%	0%	0.409	0.196	0.675	Valid and Reliable
4	100%	0%	100%	0%	0.406	0.196	0.675	Valid and Reliable
5	40%	60%	90%	10%	0.320	0.196	0.675	Valid and Reliable
6	40%	60%	100%	0%	0.381	0.196	0.675	Valid and Reliable
<b>Average</b>	<b>78%</b>	<b>22%</b>	<b>96%</b>	<b>4%</b>				

The data in Table 2 explains that all parents know that handwashing is a habit that must be implemented in daily activities for it can reduce the disease prevalence rate. All the parents have observed and concluded that their children know how to properly wash their hands and when they should do so. This shows that the parents support the activity to increase the children's awareness to wash their hands. The result presents the average of 70% of children who have got used to washing their hands before eating, 80% have got used to washing their hands after going to the

bathroom, and 60% have got used to washing their hands after playing (Table 3). There are 40% who have not got used to washing their hands after playing due to the activity, presumably due to such activity is often neglected. Elfiadi (2016) stated that playing can be an exciting and intoxicating activity for the children, thus the act of washing their hands afterward is often overlooked. Most children spent their time watching television and 64% of them spent their time playing with gadgets daily (Vitariusova *et al.*, 2010).

**Table 2.** Percentage of parents' response on knowledge on handwashing (n=10)

Parents' Knowledge	Parents' Responses		r <sub>calculated</sub>	r <sub>table</sub>	Cronbach $\alpha$	Interpretation
	Knowing	Not Knowing				
Parents knowing that properly washing one's hand is a form of a clean and healthy lifestyle that should be applied in daily lifes.	100%	0%	0.600	0.196	0.778	Valid and Reliable
Parents knowing that properly handwashing can reduce the disease prevalence rate in children.	100%	0%	0.594	0.196	0.778	Valid and Reliable
Children knowing how to properly wash their hands.	100%	0%	0.502	0.196	0.778	Valid and Reliable
Children know certain times to wash their hands.	100%	0%	0.637	0.196	0.778	Valid and Reliable

**Table 3.** Percentage of parents' answer regarding the observation of handwashing activity (n=10)

Parents' Observation on Their Children	Parents' Response		r <sub>calculated</sub>	r <sub>table</sub>	Cronbach $\alpha$	Interpretation
	Used to	Not Used to				
Children wash their hands in six steps with soap before eating	70%	30%	0.500	0.196	0.674	Valid and Reliable
Children wash their hands in six steps with soap after going to the toilet	80%	20%	0.453	0.196	0.674	Valid and Reliable
Children wash their hands in six steps with soap after playing	60%	40%	0.505	0.196	0.674	Valid and Reliable

### 3.3 View on the Bacteria in Students' Hands-on Agar Media

Selective agar media were used to grow the colonies of bacteria as concrete proof for the students that a hand that may look clean can contain many bacteria. The use of agar also gives a view and a mean of comparison of

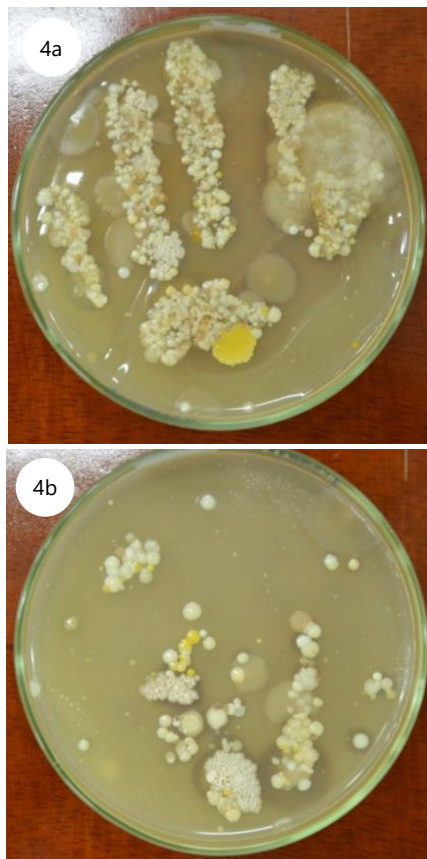
the number of bacteria before and after handwashing. Most of the results show a decrease in the number of the colony after the hands have been washed with soap according to the six steps provided by the WHO.

#### 3.3.1 Baird-Parker Agar (BPA)



*Baird-Parker Agar* is a medium used to isolate the bacterium *Staphylococcus aureus*. This medium is made from glycine, lithium, and tellurite whose composition has been modified to suppress the growth of other bacteria aside from *Staphylococcus aureus*. In this medium, the isolated *Staphylococcus aureus* with good growth may make a black colony with a clear zone that requires a coagulation test (Bridson, 2006). In this activity, *Staphylococcus aureus* with such characteristics was not found, but a colony with a clear zone but not black color was seen. This anomaly often occurs on the other agar media. This phenomenon was explained by Yunita and Dodd (2018) in their research, in which the media M17 which were supposed to be selective for *Lactococcus* did not show an isolated result of the bacteria accurately, *rogosa agar* which is selective for *Lactobacillus* shows not only the growth of lactobacillus, but also *Kochuria, sp.* Also, *Lactobacillus curvatus* only grows on *de Man Rogosa Sharpe (MRS) agar*.

The colony count in the *Baird-Parker Agar* (BPA) showed a decrease after washing the hands compared to before washing the hands. The average count of colonies before washing the hands was  $3.2 \times 10^1$  CFU/cm<sup>2</sup> which decreased as much as 65.6% to  $1.1 \times 10^1$  CFU/cm<sup>2</sup> after the hand has been washed. The bacterial growth in BPA medium can be seen in Figure 4.

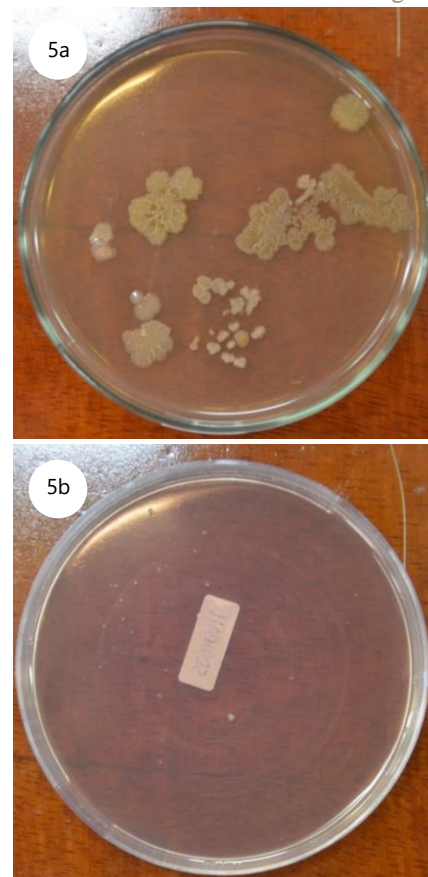


**Figure 4.** The bacterial growth: a) Before handwashing; and b) After handwashing as shown on BPA medium

### 3.3.2 Mac Conkey Agar (MCA)

*Mac Conkey Agar* is a medium recommended by WHO that is used to detect, isolate, and enumerate the pathogenic bacteria in the gastrointestinal system. The agar media is not only used for water testing, but also for testing the bacteria in urine, feces, and wounds. This media is specifically used for positive gram coccus bacteria, such as *Staphylococcus* and *Enterococcus* (Bridson, 2006). The use of this media is to detect the presence of *Eschericia coli* with a decent growth characteristic and forms a red colony.

In this activity, the presence of *E. coli* was not detected. The observation shows pink colonies on both hands of the students which were suspected to be *Staphylococcus*. After the hands have been properly washed, the colony did not show up anymore. The colony count shows a decrease after the hands have been washed compared to before. The average colony count before handwashing was  $4.6 \times 10^0$  CFU/cm<sup>2</sup> which decreased as much as 78.2% to  $1 \times 10^0$  CFU/cm<sup>2</sup> after the hands are properly washed. The growth of bacteria in MCA medium can be seen in Figure 5.



**Figure 5.** The bacterial growth: a) Before handwashing; and b) After handwashing as shown on MCA medium

### 3.4 Evaluation on Ducuta' Handwashing Activity through Handwashing Activity Book

An evaluation was conducted by asking the *ducuta* to fill out the Handwashing Activity Book (*bacuta*) in a month. The *bacuta* was filled by drawing a check if a

student has washed hands in the recommended time, such as before eating, after going to the toilet, or after playing. If the students did not wash their hands, they filled the provided column with an “X”. The grading of *bacuta* (Table 4) showed that 5 *ducuta* have gotten used to washing their hands before eating, after going to the toilet, and after playing.

**Table 4.** Percentage of *ducuta*'s handwashing activity for 30 days

<i>Ducuta</i>	Before Eating	After Going to The Toilet	After Playing
1	46%	35%	50%
2	25%	32%	39%
3	30%	20%	20%
4	100%	100%	100%
5	100%	89%	100%
6	100%	100%	50%
7	100%	100%	100%
8	100%	100%	100%
9	100%	100%	100%
10	57%	82%	57%

#### 4. CONCLUSION

Selective agar media has high effectiveness to increase students' awareness of the importance of handwashing in daily life. There was an increase in students' knowledge of the proper way of handwashing after socialization. The parents' questionnaire shows that 70% of the *ducuta* have gotten used to washing their hands before eating, 80% of them have been used to washing their hands after going to the toilet, and 60% of them have gotten used to washing their hands after playing. However, the grading of *bacuta* shows that only 50% of the *ducuta* have gotten used to washing their hands before eating, after going to the toilet, and after playing. Looking at the microbes under microscope can be conducted in the future socialization. Furthermore, the handwashing activity could reduce the number of microbes grown on BPA (65.6%) and MCA (78.2%). Unfortunately, only *Staph. aureus* and *E. coli* were identified by traditional culturing method. Further research is needed to identify all different colonies morphology grown on both medium by biomolecular method.

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**Appendix 1** Cover and Table of Contents of Handwashing Module (*Mocuta*)





# Daftar Isi




Kata pengantar.....	3
Kenalan yuk !!.....	3
Daftar isi.....	4
Kenapa kita harus cuci tangan.....	5
Bentuk dan jenis kuman.....	7
Kapan saja kita harus mencuci tangan.....	8
6 langkah mencuci tangan.....	9
Kalau tangan bersih, kita pun sehat.....	10






Appendix 2 Handwashing Activity Book (*Bacuta*)



Ket: Apabila sudah mencuci tangan beri tanda contreng (√)

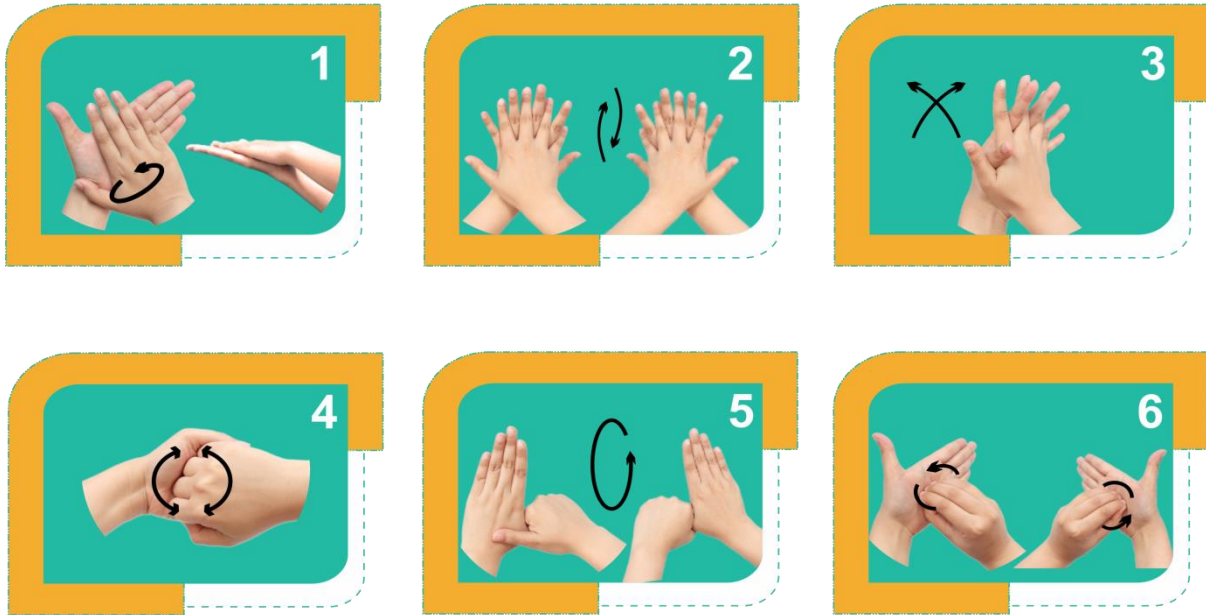
MEI		Cuci Tangan		
Minggu	Tanggal	Sebelum Makan	Setelah dari WC	Setelah bermain
I	01/05/2019			
	02/05/2019			
	03/05/2019			
	04/05/2019			
	05/05/2019			
	06/05/2019			
	07/05/2019			
II	08/05/2019			
	09/05/2019			
	10/05/2019			
	11/05/2019			
	12/05/2019			
	13/05/2019			
	14/05/2019			



MEI		Cuci Tangan		
Minggu	Tanggal	Sebelum Makan	Setelah dari WC	Setelah bermain
III	15/05/2019			
	16/05/2019			
	17/05/2019			
	18/05/2019			
	19/05/2019			
	20/05/2019			
	21/05/2019			
IV	22/05/2019			
	23/05/2019			
	24/05/2019			
	25/05/2019			
	26/05/2019			
	27/05/2019			
	28/05/2019			



**Appendix 3** Handwashing Card (Kacuta)





**Appendix 4** Questionnaire for Students

Nama :

Kelas :

**SEHAT DIMULAI DARI TANGAN****Berilah tanda centang (√) pada jawaban yang dianggap paling tepat.**

1. Supaya tidak mudah terserang penyakit kita harus membiasakan mencuci?










2. Tangan kita adalah bagian tubuh yang paling banyak digunakan sehari-hari. Oleh karena itu, tangan sering menjadi perantara penularan penyakit. Maka kita harus sering mencuci tangan menggunakan?










3. Kita harus mencuci tangan **setelah keluar** dari?










4. Kita harus mencuci tangan **sebelum**?





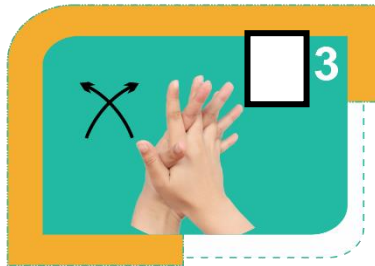




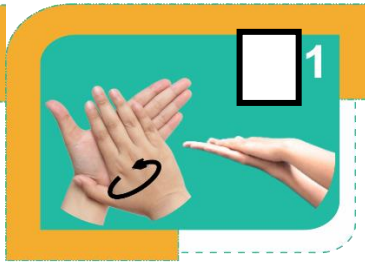

5. Kita harus mencuci tangan **setelah**?



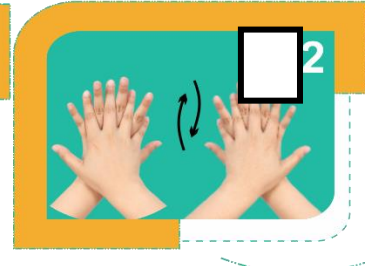
6. Ada 6 langkah mencuci tangan dengan benar. Berilah nomor pada setiap langkah mencuci tangan di bawah ini dengan benar dan tepat!



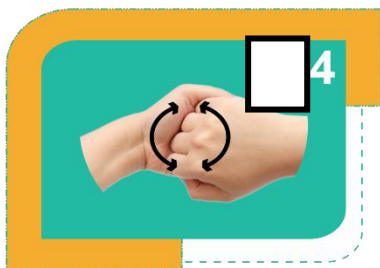
Gosok sela-sela jari dengan telapak tangan saling menempel



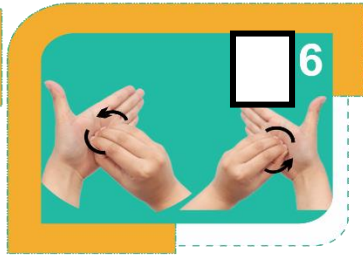
Ratakan sabun pada kedua telapak tangan dengan gerakan memutar



Gosok punggung tangan kiri dengan telapak tangan kanan, sampai sela-sela jari dan lakukan sebaliknya.



Gosok buku-buku jari dengan kunci ujung jari



Gosok kuku dan ujung jari kanan pada telapak tangan kiri, lakukan sebaliknya



Gosok jempol tangan kiri dalam gengaman dengan gerakan memutar dan keluar, lakukan sebaliknya

**Appendix 5** Questionnaire for Parents**Identitas responden**

Nama Orang Tua/Wali :  
 Nama Anak :  
 Kelas :  
 No. HP orang tua :  
 Alamat :

**A. Pengetahuan responden tentang kegiatan mencuci tangan**

Berilah tanda centang (√) pada kolom di bawah.

No.	Pernyataan	Tahu	Tidak Tahu
1.	Mencuci tangan dengan benar adalah bentuk perilaku hidup bersih dan sehat yang seharusnya diterapkan dalam kehidupan sehari-hari		
2.	Mencuci tangan dengan benar dapat menurunkan angka kejadian penyakit pada anak (contoh: diare)		
3.	Anak Bapak/Ibu mengetahui cara mencuci tangan yang benar		
4.	Anak Bapak/Ibu mengetahui waktu tertentu kapan harus mencuci tangan		

**B. Evaluasi kebiasaan mencuci tangan**

Berilah tanda centang (√) pada kolom di bawah berdasarkan kartu kontrol.

No.	Pernyataan	Biasa	Tidak Biasa
1.	Anak Bapak/Ibu mencuci tangan 6 langkah dengan sabun sebelum makan		
2.	Anak Bapak/Ibu mencuci tangan 6 langkah dengan sabun setelah dari toilet		
3.	Anak Bapak/Ibu mencuci tangan 6 langkah dengan sabun setelah bermain		