FIVE KEYS TO SAFER FOOD MANUAL
Adaptation of the WHO manual to school children
prepared by the National Institute of Public Health, Japan,
to teach Food Safety to school children of elementary schools
The WHO Five Keys to Safer Food manual available at

http://www.who.int/foodsafety/consumer/5keysmanual/en/index.html

Cover of the Japanese manual

was adapted by the National Institute of Public Health, Japan to teach Food Safety to school children in elementary schools aged from 10 to 12 old years.

The English version of this adaptation is a translation from the Japanese manual.
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5 keys to safer food to prevent foodborne disease

5 Keys to Safer Food

- Keep clean
- Separate raw and cooked foods
- Cook thoroughly
- Keep food at safe temperature
- Use safe water and raw materials
Key No. 1: Keep clean

Microorganisms that can cause food poisoning can often be found on hands or cooking utensils such as cutting boards. Clean hands and cooking utensils thoroughly before preparing food to prevent contamination of food with microorganisms!

Why wash your hands?

Even if your hands look clean, they carried dangerous microorganisms. There are a lot of microorganisms that can cause food poisoning in the dirt on our hands. If it gets into your mouths it could cause serious problems.

You cannot completely eliminate microorganisms even by washing your hands, however, the fewer bacteria you exposed, the less we have to worry about getting food poisoning if they get into our mouths.
When should you wash your hands?

★ When do you wash your hands 🧼? Let's think about it.

- Before preparing food
  - Before eating food

- After going to the toilet

- When coming back to home from outside

- After touching/playing with animals/pets

There are lots of bacteria in feces. After wiping yourself, your hands can become dirty from leftover bits of toilet paper and such.

Let's teach everybody in our home!

There are lots of bacteria on your hands!
Let's wash our hands!

If you just wash your hands quickly with only water, the water will be absorbed by the bacteria in folds in our skin and under our nails which will then come to the surface of our hands. As a result, instead of making your hands clean you will see increased number of bacteria on them! Use soap and wash your hands really well!

1. Wet hands with water and apply soap
2. Rub the palms of your hands together while creating a lather of soap
3. Wash the backs of your hands
4. Wash really well between your fingers
5. Wash really well under your nails
6. Wash your wrists
7. Thoroughly wash off all the soap with running water
8. Finished!

If you only wash a little or use only water then you won't remove bacteria on your hands!

Make sure to clean cooking utensils thoroughly as well!
Key No. 2: Separate raw and cooked foods

Raw meat and fish can contain dangerous microorganisms, which may cause food poisoning. Separate cooked and raw foods so that the bacteria is not transferred onto other food during food preparation and storage.

- Keep raw meat and fish separate from other foods.

  
  ![Good example](image1)

  ![Bad example](image2)

- Thoroughly clean knives and cutting boards which were used to cut raw meat and fish.

  ![Designated cutting boards](image3)

  It's best to have a designated cutting board each for meat, fish, and vegetables.

- Put cooked and raw foods into containers with lids for storage to make sure they don't come into contact with each other.

- Prepare food on clean dishes.
Key No. 3: Cook Thoroughly

Proper cooking can kill almost all dangerous microorganisms. Cook foods so that they are heated all the way to their center.

- Meat, eggs, fish and shellfish especially should be thoroughly cooked.
  Cook until the color of the center of the hamburgers is getting brown and the juices from the meat are clear.

- When re-heating curry or stew, heat it until it boils.
- When using a microwave to cook or heat food, mix the food occasionally to make sure the heat is evenly distributed throughout the entire dish.
Key No. 4: To minimize the growth of Bacteria

There is a dangerous temperatures zone in which bacteria multiply very quickly and a safety temperatures zone in which the growth of bacteria is slow or stopped. If left in a warm place, the bacteria will multiply quickly. The growth of bacteria is slow or stopped at temperature below 10°C or above 60°C. Make a good use of refrigerators to prevent bacteria in food from multiplying. If there are only small numbers of bacteria, the risk of getting food poisoning is low, even if the bacteria get into your mouth.

- Put food in the refrigerator soon after returning from shopping
- Eat hot foods while they are hot and cold foods while they are cold
- Don't leave leftovers at room temperature; cool them in the refrigerator immediately. And eat them as soon as possible.
Key No. 5: Use safe food and raw materials
It is important to select safe and wholesome ingredients in order to make safe food! Also wash foods thoroughly since there may be dirt or germs that you cannot see.

- Use safe and clean water.
- Make sure to wash fruits and vegetables thoroughly, especially if eaten raw.
- Select fresh and wholesome foods. Do not use foods beyond their expiration date.

Where are food expirations written?

Pay attention to the ingredients in food.

The expiration date is here!

Name
Main Ingredient △△、××、・・・
Quantity ○○g
Expiration Date XX/XX/XXXX
Storage Method: Store at 10° C or lower
Manufacturer ○○ Co., Ltd.
XXX City, XXXXX Prefecture
Let's Practice Cooking Using the 5 Keys

Before cooking

There are a lot of bacteria on unwashed hands, food and utensils. What should we be careful of? (Check the appropriate items)

- **Body and Clothing**
  - □ Are your nails cut short?
  - □ Have you thoroughly washed your hands?
  - □ Are your apron, hair net or indoor shoes clean?

- **Cooking Utensils and Equipment**
  - □ Are the cutting boards, knives, towels and other utensils to be used thoroughly cleaned?
  - □ Is the counter or table top clean?

- **Ingredients**
  - □ Are the ingredients fresh?
  - □ Were they stored properly in the refrigerator?
  - □ Were the ingredients thoroughly washed?
  - □ Are the ingredients past their expiration date?

Vegetables can also be sterilized by boiling them in hot water for one minute or more.
**During Preparation**

- Did you wash your hands after handling meat or fish?
- Did you wash knives and cutting boards after cutting meat or fish?
  
  *It's best to use designated specific cutting boards for meat, fish, and vegetables.*
- Did you cook the food thoroughly (75°C, 1 minute or more)?
- Are the dishes the prepared food is to be served on clean?

**After Preparing**

- Did you eat hot foods while they are hot and cold foods while they are cold?
- Did you store leftover ingredients and food in the refrigerator?
- Did you thoroughly clean the cooking utensils you used?
★What should I do if I get food poisoning?

Be careful, because it can be mistaken as catching a cold or other sickness!
Although the symptoms may seem mild at first, they can quickly become severe, so you should immediately consult a doctor.

● Give the doctor the following information.
  □ When did you start feeling sick?
  □ How do you feel, what are your symptoms?
  □ What did you eat?

● Emergency Measures
  □ Drink lots of fluids to prevent dehydration.
  □ Drink only warm tea and such in order to avoid upsetting your stomach and digestive tract further.
  □ Keep quiet
  □ Eat only food easy to digest.
What is Food Poisoning?

★What is Food Poisoning?

Stomach pains (stomach ache), diarrhea, fever, and other sick feelings which are caused by food are called food poisoning.

There are different types of food poisoning, caused by bacteria and viruses, by natural toxins in poison mushrooms or puffer fish, and caused by chemicals. The most common type is that caused by bacteria and viruses.

Numerous bacteria and viruses can be found on dirty hands, unwashed foods, and cooking equipment (like knives and cutting boards) that isn't washed after use. Symptoms of most food poisonings begin 1 to 2 days after the bacteria, virus or poison were swallowed, however, depend on the type of bacteria, symptoms may begin as short as 30 minutes, or after a week or longer!
There are many types of bacteria that can cause food poisoning.

Bacteria Multiplication Methods

Bacteria multiply by a method called "binary fission" where 1 bacterium becomes 2 and 2 bacteria become 4. For example, Vibrio parahemolytica carries out fission very quickly, and in conditions which are good for the bacteria can undergo fission once every eight minutes. If this is calculated out, a single bacterium will have multiplied into 4,200,000 bacteria after 3 hours and 68,919,470,000 bacteria after 5 hours! (Figure 1)
Figure 1 Bacteria Multiplication. If each bacteria splits in two every eight minutes, after 3 hours there will be 4,200,000 bacteria and 68,919,470,000 bacteria after 5 hours.

★What are ideal conditions for bacteria?

(1) Temperature – bacteria multiply in warmer temperatures. They multiply the best at temperatures of between 30°C and 40°C.

(2) Water – is necessary for bacteria to survive.

(3) Nourishment – If the bacteria have nourishment (food), they will continue to multiply.

If the temperature, water, and nourishment conditions are all right, the bacteria will multiply in great numbers over time. On the other hand, if these conditions are not correct, the bacteria will not be able to multiply and will gradually die. For example, food poisoning can be prevented by raising or lowering the temperature, or removing water (drying or dehydrating).
★How big are bacteria and viruses?

Bacteria and viruses are tiny creatures that cannot be seen by the naked, but need a microscope to be viewed. The size of bacteria is different for different types of bacteria, however they are approximately 1 micrometer (1µm=1/1000 of 1mm). Viruses are even smaller, at approximately 0.03 micrometers, or 1/30 the size of a bacteria.

If the size of virus is assumed as 1 cm, then the size of bacteria is roughly 30 cm, and by applying this scale, the size of human is almost equivalent as the height of Mt. Fuji (3000 m).
★Statistics of Food Poisoning

What are the most common causes of food poisoning?
The most common causes for food poisoning are bacteria and viruses. In 2005 there were 1,545 incident of food poisonings reported in Japan, and 86% of those were caused by bacteria or viruses (Figure 2).

![Food Poisoning Causes](2005 Food Poisoning Cases From Nationwide Preliminary Figures)

Figure 2  Food Poisoning Causes. The most common causes of food poisoning are bacteria and viruses. Although rare, there are also food poisonings caused by natural toxins and chemicals. (2005 Food Poisoning Incidents, Preliminary Figures, Ministry of Health, Labour and Welfare of Japan)

★What types of food poisoning-causing bacteria and viruses are there?
In 2005, among 1,340 incidents of food poisoning occurred across Japan, the major bacteria and virus types involved are shown in figure 3.
Campylobacter

**Characteristics:** Bacteria commonly found in animal intestines. It cannot live for long in high oxygen environments. A small amount of these bacteria in the body will not cause food poisoning.

**Cause:** Eating raw or insufficiently cooked meat (especially chicken). Eating salads or other foods made using utensils (knives or cutting boards) which weren't washed thoroughly after preparing raw meat (called secondary contamination or cross contamination).

**Symptoms:** diarrhea, stomach ache, fever

**Prevention:** Thoroughly cook all meat. When preparing raw meat, use a cutting board and knife that will be used exclusively for the meat, and wash them thoroughly after use.
Salmonella

**Characteristics:** Bacteria commonly found in animal digestive tracts.

**Cause:** Meats such as beef, pork or chicken as well as eggs or food containing eggs. Or secondary contamination. It can also be transmitted from pets.

**Symptoms:** diarrhea, stomach ache, fever

**Prevention:** Thoroughly cook all meat and eggs. Cook eggs immediately after breaking. Wash hands after touching pets or other animals.

Vibrio parahemolyticus

**Characteristics:** A bacteria found in the ocean, it tends to prefer water environments which contain approximately the same saline content as seawater (approximately 3%). Food poisoning caused by *Vibrio parahemolyticus* tends to be concentrated in the summer when ocean water temperatures rise.

**Cause:** Cause by consumption of seafood such as raw fish and shellfish. Or secondary contamination.

**Symptoms:** diarrhea, stomach ache, fever, nausea, vomiting

**Prevention:** Thoroughly cook all fish and shellfish before eating when possible. This bacteria is
susceptible to pure water, so wash fish and shellfish thoroughly with tap water during preparation. When eating sashimi or other raw foods, refrigerate at low temperatures and eat them as soon as possible.

Picture of *Vibrio parahaemolyticus*

- **Enterohemorrhagic* Escherichia coli 0157**

**Characteristics:** Bacteria originally lives in the intestines of animals, produces a powerful toxin (verotoxin), and can cause food poisoning if even small numbers of the bacteria enter the body.

**Cause:** Eating raw or under-cooled beef. Or secondary contamination.

**Symptoms:** diarrhea, stomach ache, bloody stool. It can cause death when symptoms are severe.

**Prevention:** Do not eat raw meat or liver. Thoroughly wash foods and heat at 75°C or above for 1 minute or more. EHEC can be found in well water, so when using well water, boil it first.

- **Staphylococcus aureus**

**Characteristics:** Bacteria found on human skin and human hair, especially prevalent in and
around cuts on the hands and fingers. Some strains are capable of producing a highly heat-stable protein toxin that causes illness in humans.

**Cause:** This bacteria is transmitted to food from human hands. Or secondary contamination.

**Symptoms:** Severe vomiting approximately 3 hours after ingestion. Also stomach ache and diarrhea.

**Prevention:** Thoroughly wash hands. Do not touch food when there are cuts or sores on your hands.

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- **Norovirus**

**Characteristics:** Viruses are organisms which are smaller than bacteria (approximately 1/30 the size of bacteria). Noroviruses multiply in human intestines, and viruses excreted from people were accumulated in shellfish (oysters, freshwater clams, little neck clams and other bivalves). Food poisoning can be caused not only by eating contaminated food, but infection can also be transmitted by coming into contact with the feces or vomit of infected persons.

**Cause:** Eating raw shellfish infected with the virus and contaminated ready to eat food, coming into contact with the feces or vomit of infected persons. Or secondary contamination.

**Symptoms:** diarrhea, stomach ache, fever, nausea, vomiting, etc.

**Prevention:** Thoroughly cook shellfish which accumulate the virus by heating at 85°C or above for 1 minute or more. The virus was often accumulated in the internal organs of infected shellfish, so do not eat these organs when eating the shellfish raw. The person preparing the food should wash hands thoroughly, and wear clean gloves and a mask. Do not
Example Educational Experiments based on "5 Keys to Safer Food manual"

Key No.1: Keep Clean
[Experiment 1.1] Hand washing luminescence experiment using a fluorescer and black light
[Experiment 1.2] Hand washing effect verification culture experiment using hand-shaped agar medium cultures

Key No. 2: Separate Raw and Cooked Foods
[Experiment 2] Cross contamination verification experiment using a fluorescer and black light

Key No. 3: Cook Thoroughly
[Experiment 3] Meat cooking experiment

Key No. 4: Keep Food at Safe Temperatures
[Experiment 4] Low temperature pasteurized milk TTC reduction experiment

Key No. 5: Use Safe Water and Raw Ingredients
[Experiment 5] Water chlorine residue measurement experiment
Key No.1: Keep Clean
[Experiment 1.1] Hand washing luminescence experiment using a fluorescer and black light

Purpose
- To make the participants understand that although the microbes (bacteria, viruses, etc.) which cause food poisoning cannot be seen with the human eye, there are a variety of microbes present on our hands and that these can contaminate food.
- To learn proper hand-washing methods by using a fluorescer to simulate the microbe-containing dirt which hands come into contact with in order to verify the removal of the "dirt" after hand-washing.

Materials to prepare
- Lotion with fluorescer
- Soap
- Paper towels
- Black light (UV lamp)
- Running water for washing hands

Procedure
1. Have the students put the fluorescer containing lotion on their hands. The fluorescer is a surrogate of microbes (bacteria).
2. The students should then wash their hands. It is also possible to assign different hand-washing methods to different groups in order to compare the differences.
3. Check how much "dirt" is left on the hands by examining them under the UV lamp and checking for glowing areas.
4. Pass out hand-shaped sheets of paper to the students and have them note on what areas the "dirt" (fluorescer) remains, comparing and contrasting the results for better emphasis.

Amount of time required (Approximate)
5 – 10 minutes per person.

Expected results
- The glowing should allow students to verify that some areas were not washed thoroughly enough although they seemed clean to the naked eye.
- It should be possible to compare and contrast the effectiveness of different washing methods by using different combinations, e.g. only cold water, hot water, and/or soap.

Notes
Glowing areas indicate insufficient washing
Commercially available fluorescer containing lotion is marked as "non-toxic" however appropriate caution should be taken to ensure that students do not drink or spread/splash the lotion more than necessary.

Other experiment methods

**Phenolphthalein reaction hand-washing experiment**

Materials to prepare: Phenolphthalein reagent (1%v/w), glycerin and potash solution, soap, paper towels

Procedure: (1) Cover the entire hand in the phenolphthalein reagent. (2) Wash with soap. (3) Drip the glycerin and potash solution on hands. (4) Insufficiently cleaned areas will turn red.

**Iodine reaction hand-washing experiment**

Materials to prepare: Iodine, starch liquid (a liquid that consists of 3% corn starch), soap, paper towels

Procedure: (1) Coat hands in starch liquid. (2) Dry hands. (3) Wash with soap. (4) Dip
Key No.1: Keep Clean

[Experiment 1.2] Hand washing effect verification culture experiment using hand-shaped agar medium cultures

Purpose
- To have the participants learn that although the microbes (bacteria, viruses, etc.) which cause food poisoning cannot be seen with the human eye, there are a variety of microbes present on our hands and that these can contaminate food.
- To cultivate the microbes on students' hands and make them understand that there are microbes on our hands by making them visible.
- To study hand-washing effects by comparing the results of cultures made before and after washing hands.

Materials to prepare
- Hand-shaped agar medium cultures
- Incubator
- Soap
- Paper towels
- Running water for washing hands

Procedure
1. Place hands palm down on the agar medium before washing.
2. Next, have the students wash their hands with soap.
3. Place hands palm down on a separate agar medium.
4. Cultivate the hand-shaped agar cultures in the incubator (set at 37°C) for 24 to 48 hours.
5. Verify that the number of microbes on the hands differs depending on the hand-washing method used (or not used).

Amount of time required (Approximate)
10 minutes per person. 24-48 hours for cultivation.

Expected results
- To allow students to see with the naked eye that there are microbes even on hands that look clean.
- It should be possible to compare and contrast the effectiveness of different washing methods by washing using different combinations only water, hot water and or soap.

Notes
- The microbes are multiplied on the culture medium in order to allow them to be seen with the eye. When disposing of the cultures, it is necessary to sterilize them in autoclave or similar first.
- Because the cultivation requires 24-48 hours, it will be necessary to gather the students and carry out the hand washing and cultivation beforehand if there is only to be one class.
- The effect of hand-washing can be seen really well before and after washing for hands where the cultures are taken after playing outside or with animals.
- Other pre-manufactured agar mediums can be used in place of the hand-shaped agar culture medium.
Key No. 2: Separate Raw and Cooked Foods

[Experiment 2] Cross contamination verification experiment using a fluorescer and black light

Purpose

- To understand that raw foods can contaminate other foods (called cross contamination or secondary contamination).
- To experience how cross contamination can occur via hands or cooking utensils and equipment.
- To learn effective methods for preventing cross contamination when handling food.

Materials to prepare

- Konjac 1 piece
- 1 Cucumber (or another vegetable or similar to be used in its place)
- Lotion with fluorescer
- Cutting board
- Knife
- Plate
- UV lamp (black light)
- Dish liquid, scrubbing brush, running water, etc.

Procedure

1. Instruct the students that the konjac represents raw meat, fish or similar.
2. Have the students coat the konjac with the fluorescer containing lotion. The lotion represents food poisoning causing bacteria which cannot be seen with the naked eye, such as salmonella bacteria and vibrio parahaemolyticus.
3. Place the konjac on the cutting board and cut into blocks.
4. Place the sliced konjac on a plate. Do not wash the cutting board, knife or hands.
5. Use the same knife and cutting board used to cut the konjac and cut the cucumber into slices or dice it.
6. Shine the UV lamp on the cutting board, knife and cucumber and observe what areas the fluorescer has adhered to.

Amount of time required (Approximate)

30 minutes per experiment

Expected results

- To show how microbes which aren't visible to the human eye can be transferred to other foods via cutting boards, knives, plates and hands.
- To show areas which are susceptible to contamination when preparing food.
• To teach that it is important to appropriately clean tools and equipment as well as hands when preparing food in order to prevent cross contamination.

Notes
• Commercially available fluorescer containing lotion is marked as "non-toxic" however appropriate caution should be taken to ensure that students do not drink or spread/splash the lotion more than necessary.
Key No. 3: Cook Thoroughly

[Experiment 3] Meat cooking experiment

Purpose
- To learn that it is necessary to heat raw meat to 70°C or above in order to make it safe for consumption.
- To learn about the raising of temperature of meat through heating and changes in meat coloration depending on heating time.

Materials to prepare
- Chicken (white breast meat)
- Heater (Hot plate, etc.)
- Pan
- Core temperature thermometer
- Stopwatch or other timer

Procedure
1. Insert the core temperature gauge sensor into the center of the chicken (breast meat).
2. Place the chicken in boiled water and measure the temperature using the core temperature gauge.
   Record the temperature at specified intervals (e.g. every 30 seconds). Stop heating once the temperature reaches 70°C.
3. Place multiple pieces of chicken into the hot water and remove them at different heating times (e.g. one every minute).
4. Confirm how cooked the inside of the chicken is visually by cutting into cross sections.

Amount of time required (Approximate)
30 minutes per experiment

Expected results
- The amount of time required for the center of the chicken to reach 70°C can be confirmed.
- The differences between raw and cooked meat can be visually confirmed.

Notes
Take care to prevent students from burning themselves when using boiling water and heating equipment.
Experiment to check the heating of plant and animal materials using a catalase test

Materials to prepare: Hydrogen peroxide solution (of 2.5-3.5w/v% of hydrogen peroxide content)

Procedure: (1) Prepare plant and animal materials (chicken, etc) heated to different degrees. (2) Pour the hydrogen peroxide into a beaker. (3) Place the food into the hydrogen peroxide while visually observing the release of oxygen to verify the amount the food was heated. (Raw food will emit more oxygen
Key No. 4: Keep Food at Safe Temperatures

[Experiment 4] Low temperature pasteurized milk TTC reduction experiment

Purpose
- To learn that prepared food should be eaten as soon as possible.
- To learn that microbes multiply differently at different temperatures.
- To show that microbes have difficulty multiplying at 5°C or lower and multiply easily at 37°C.

Materials to prepare
- Low temperature pasteurized milk
- Clear container (flask, beaker, etc.)
- Indicator: TTC (2,3,5-triphenyl tetrazolium chloride)
- Saline solution
- Incubator
- Refrigerator

Procedure
1. Prepare 3 flasks sterilized using boiling water or other methods.
2. Just before the experiment, diffuse the TTC in the saline solution so that it is 0.1 w/v%, then cover and store it in the refrigerator.
3. Prepare the same amount of 0.1% TTC in the 3 flasks.
4. Add the same amount of low temperature pasteurized milk as the TTC reagent, then cover.
5. Cover with aluminum foil or other materials so that no light gets in then store the flasks 1 each in the refrigerator, at room temperature and in the incubator (37°C).
6. The next day, remove the 3 flasks and check the coloration (from pink to red).
7. The redder a flask, the more microbes have multiplied inside it.

Amount of time required (Approximate)
10 minutes. Approximately 24 hours for cultivation.

Expected results
- To learn that microbes multiply differently at different storage temperatures.
- To show that refrigerator storage slows microbe multiplication.

Notes
- Make sure the TTC reagent is not exposed to light.
- The principle behind the TTC reagent turning red is that the TTC is deoxidized by the succinic dehydration enzymes in the microbes, turning it into the red colored formazan.
• If there is not a clear difference in the results, comparison can also be carried out by adding a small amount of a non-pasteurized lactobacillary drink to the 3 flasks containing the milk and TTC reagent solution and storing at the three different temperatures.
Key No. 5: Use Safe Water and Raw Ingredients

[Experiment 5] Water chlorine residue measurement experiment

Purpose
- Tap water has chlorine added to it in order to sterilize it. To learn that the amount of chlorine residue is different for different types of water.

Materials to prepare
- Different types of water for testing (tap water, commercial bottled water, pump water, etc.)
- Free residual chlorine measurement kit

Procedure
1. Split the students into several groups.
2. Explain to the students how to use the free residual chlorine measurement kits.
3. Measure the different types of water by group (tap water, bottled water, pump water, etc.).
4. Have each group present their results.

Amount of time required (Approximate)
30 minutes per experiment

Expected results
- It should be possible to determine which types of water have residual chlorine and which don't.

Notes
- It is not uncommon for the tap water in some countries, especially developing countries, to not undergo chlorine purification. Such water often leads to diarrhea and other problems.
- In Japan, the amount of chlorine in tap water is limited to 0.1mg of free chlorine per liter by law.

Other experiment methods

Processed food expiration date indication experiment
Materials to prepare: Food indications from each household.
Procedure: Check the limit indications on each food indication. Talk about the different limits for different types of food and why they might be different.

Experiment equipment procurement and reagent creation
[Experiment 1.1] Hand washing luminescence experiment using a fluorescer and black light

<table>
<thead>
<tr>
<th>Lotion with fluorescer</th>
<th>Seaweed derived fluorescent dyes dissolved in water can also be used.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blacklight</td>
<td>Any UV lamp can be used. A set called the &quot;Hand washing checker&quot; which also contains the lotion with fluorescer is commercially available.</td>
</tr>
<tr>
<td>Phenolphthalein reagent (1 w/v%)</td>
<td>Dissolve 1g of the phenolphthalein in ethanol for a total quantity of about 1000ml.</td>
</tr>
<tr>
<td>Glycerin and potash solution</td>
<td>Dissolve 3g of potassium hydroxide gradually in water, then add 200ml of glycerin and 250ml of ethanol for a total quantity of 1000ml.</td>
</tr>
<tr>
<td>Iodine</td>
<td>Commercially available iodine gargle can also be used.</td>
</tr>
</tbody>
</table>

[Experiment 1.2] Hand washing effect verification culture experiment using hand-shaped agar medium cultures

| Hand-shaped agar medium cultures | There is a commercially available product called "Hand petan check". There is also a round product which can be used called "petan check". |

[Experiment 2] Cross contamination verification experiment using a fluorescer and black light

<table>
<thead>
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<td>Any UV lamp can be used.</td>
</tr>
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</table>

[Experiment 3] Meat cooking experiment

<table>
<thead>
<tr>
<th>Core temperature thermometer</th>
<th>Can be found at experiment equipment retailers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen peroxide solution (of 2.5-3.5 w/v% of hydrogen peroxide content)</td>
<td>Can be purchased at most pharmacies.</td>
</tr>
</tbody>
</table>

[Experiment 4] Low temperature pasteurized milk TTC reduction experiment

<table>
<thead>
<tr>
<th>TTC Reagent (0.1 w/v%)</th>
<th>Dissolve 1g of TTC 1 in 100ml of saline solution (0.8-1.0% saline content), keep out of the light and refrigerate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline solution</td>
<td>Can be purchased at most pharmacies.</td>
</tr>
</tbody>
</table>

[Experiment 5] Water chlorine residue measurement experiment

| Chlorine residue measurement kit | A commercially available product called "Simple Pack" (free chlorine residue) is available. |
Hand washing experiments
Game to match pathogens and their major sources
Cross contamination experiments