



PERSONAL DEEPENING

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Introduction

In 2010, a new human right was set: the right to access safe and clean water for sanitation and drinking purposes (P. Hall, Van Koppen, Van Houweling, 2014). On paper, this would mean people all over the world can access clean water, but unfortunately this is not the reality. According to Unicef, over 2 billion people drink water which is contaminated by feces (Drinking-Water, 2019). Out of the 209.5 million inhabitants of Brazil in 2018 (Brazil | Data, n.d.), over 34 million Brazilians lacked access to clean drinking water and over a 100 million lacked access to proper sanitation (More than 34 Million Brazilians Lack Access to Water, 2018).

A possible solution to this problem could be water filtration. The definition of water filtration is as follows: “Water filtration is the process of removing or reducing the concentration of particulate matter, including suspended particles, parasites, bacteria, algae, viruses, and fungi, as well as other undesirable chemical and biological contaminants from contaminated water to produce safe and clean water for a specific purpose, such as drinking, medical, and pharmaceutical applications.” (Mao, 2016).

Therefore, when people have access to dirty water and a proper water filtering system, they can filter it in order to make it suitable for drinking and sanitation, especially for washing hands. The latter one is vital to reduce the spread of CoViD-19, because the diseases are often spread without noticing. The virus can stick to one’s hands, and when touching eyes, mouth or nose the virus can enter the body. Washing hands with clean water would lessen the chance of the virus accidentally sticking to your hands, and therefore lower the chance of getting infected by the CoViD-19 virus (Hygiene and COVID-19, 2020).

In order to inform the people in favelas facts like these, an appropriate way of communication should be set up. Since the amount of illiterate people in Brazil in 2018 were approximately 11 million (5,33%) and getting less (Trading Economics, n.d.), the way of communication should contain clear pictures for the people who cannot read the information. To get the information

to as many people as possible, the poster should be very clear about hygiene during the CoViD-19 as well as explaining about the water filter. The emphasize of hygiene during the pandemic will be on the benefits of washing hands.

The water filter design will also be included and explained on the poster. This way our stakeholders will know how the design works, why it works, why it is very important for them and how it can be made.

Existing technology

The design is a water filtering system, which contains five layers filled with different materials which can filter dirty water effectively, to ensure that it is safe to drink and usable for sanitation purposes. A prototype sketch of the design can be seen in figure 1. The design is partially based on the Biosand filter (figure 1), which also uses a sand layer in order to filter water. The Biosand filter has been tested, and it has been proven that the chance of getting contaminated by bacteria is reduced with 90-99%, the chance of getting contaminated by a virus is reduced by 90% and almost a 100% reduces risk of getting contaminated by protozoan parasites (Stauber et al., 2009). By using the

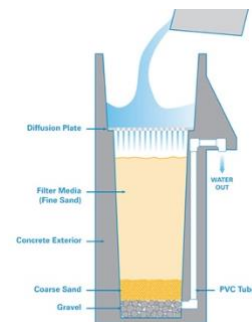


Figure 1 Biosand filter

idea of the sand layer, we expect to achieve these same results.

One of the things that will differ from the Biosand Filter, is the top layer. The Biosand Filter uses a biolayer, on which bacteria and micro-organisms grow, in order to remove pathogens in the water. Since our design should be easily manufacturable in favelas, this is something that will not be included in the design. Instead, our top layer is consisting of stones.

As can be seen in the sketch (figure 2), an activated charcoal layer is also added to the design, because of its natural and effective filtering abilities (McNamara, 2017). Activated charcoal can be made from heating a variety of materials which contain a lot of carbon, such as wood, peat or coconut shells. When these materials are heated at very high temperatures, the activated charcoal gets the capacity of binding to ions and other atoms, such as viruses and chemicals in water (Huizen, 2020). This ability can be compared to a magnet

At the bottom part of the design, a material such as cloth will be added, to make sure that the content of the design does not fall out, whilst the water can flow through.



Figure 2 Sketch of the filter

Functionality of the different layers

The top layer, the rocks, work as a filter for coarse materials, such as twigs and leaves. The following layer which consists of coarse sand will filter out smaller contaminants, but more importantly, filter out pathogen (Calvo-Bado, 2003). Pathogens are very small organisms which can cause diseases, for example viruses, bacteria and parasitic worms (Bell, 2020). Since the first sand layer is coarse sand and the second sand layer fine sand, pathogens of all sizes will be filtered from the water. The third layer is made from activated charcoal. Activated charcoal filters water through adsorption. This means that the chemicals in the water will stick to the

charcoal, like a magnet, which causes the water to be cleaner when it flows out (National Research Council (US) Safe Drinking Water Committee, 1980). The final layer is made from cloth. The cloth prevents any of the other layers from falling out of the bottle. It does let the clean, filtered water through.

The benefits of washing hands

Washing hands have always been of great importance. When someone does not wash their hands often enough or properly, the risk of getting infections such as diarrhea and the adenovirus is high.

Approximately 3200 bacteria live on the human skin (Coffey, 2017).

The small organisms living on people's body are called microbes. Microbes are tiny creatures, also called microorganisms, which live all over the body. They are so tiny that they can't be seen with the human eye. There are multiple kind of microbes, most commonly known are viruses, bacteria and fungi. In some cases, these might cause diseases. In others, they are harmless (What Are Microbes?, 2019). When people do have harmful microbes on their hands and then touch their eyes, nose or mouth, chances are high that they can get infected with a serious disease, such as COVID-19 (Hygiene and COVID-19, 2020b).



Figure 3 Pathogens and viruses are living on the skin.

Making people aware of the serious risks of not keeping your hands clean is vital, as it helps to prevent a lot of unnecessary spread of diseases. Take for example respiratory sickness. By properly educating people about the consequences of not washing hands, the amount of people with respiratory diseases will decrease with 16%-21%. The amount of people who suffer from diarrhea will lower with 23%-40% (Why Wash Your Hands? Read the Science Behind the Recommendations, 2020).

According to the Dutch National Institute for Public Health and the Environment, “*Washing your hands regularly ensures that your hands are clean and removes pathogens. This prevents you from spreading pathogens that can make you sick via hand contact*” (Hygiene and COVID-19, 2020b). However, properly washing hands is a challenge for many people around the world due to a lack of knowledge and clean water. The CDC (US Centers for Disease Control and Prevention) has written down five clear steps which lead to properly clean hands:

1. **Wet** your hands with clean, running water (warm or cold), turn off the tap, and apply soap.
2. **Lather** your hands by rubbing them together with the soap. Lather the backs of your hands, between your fingers, and under your nails.
3. **Scrub** your hands for at least 20 seconds. Need a timer? Hum the “Happy Birthday” song from beginning to end twice.
4. **Rinse** your hands well under clean, running water.
5. **Dry** your hands using a clean towel or air dry them.”

(When and How to Wash Your Hands, 2020)

Teaching people this effective way of washing hands in combination with providing a design which can ensure clean water, will be extremely beneficial to people's health. It will help to remove different microorganisms from the hands (WHO Guidelines on Hand Hygiene in Health Care, 2009). However, water alone is not enough to remove the harmful pathogens like the COVID-19 virus, also soap is needed. Soap contains surfactants, which are molecules consisting of two sides, a hydrophobic part and a hydrophilic part (see figure 4) (Laurén, 2018). The hydrophilic side can easily attach to water, whilst the hydrophobic side attaches to oil and grease. Pathogens stick to this grease and oil, and due to the hydrophilic part of the soap surfactants, it sticks to the water you rinse your hands with. This ensures that the pathogens are removed from the hands (Hickok, 2020).

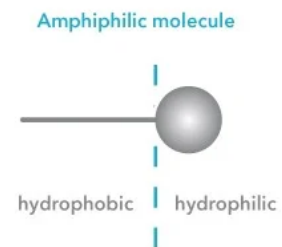


Figure 4 A surfactant

A culturally appropriate poster

In order to grasp the stakeholder's attention to read the poster, and keep their interest, the poster should be well thought through. It must clearly communicate our design and the additional CoViD-19 guidelines. A requirement should be that the poster is readable from a distance, to make sure people do not have to stand within 1,5 meters from each other while reading it. The poster should also look trustworthy, by using sources, graphs etc. Furthermore, a small version of the poster could also be included by the poster, so that people can take these home and make the design themselves (Gundogana et al., 2016).

When making the poster, being culturally aware of the surroundings in which our poster will hang, is of great importance. Cultural awareness involves among others language, norms and traditions (Mercer, 2018). Take for example the stakeholders language. When translating the poster to Portuguese, it should be translated to Brazil's Portuguese, which differs from Portugal's Portuguese in both grammar and spelling (Key Differences Between Brazilian and European Portuguese, 2020).

Some cultures might also have symbols which might be of importance. The national flag is probably the most commonly known symbol (figure 5). It consists of three main colors, each with its own meaning. The green symbolizes the vegetation in Brazil, and its beautiful fields. The yellow stands for gold, meaning the wealth of Brazil. The last color is the blue circle filled with stars. This represents the sky above Brazil at night and every star stands for one of the states of Brazil (Meyer, 2010). Knowing that these colors represent these things, implementing them in a poster design could be useful. Other colors should be avoided, such as brown and black, which are associated with being sad colors. Using these colors might therefore convey a message or feeling which will not be beneficial to the product (Singh, 2006).



Figure 5 Brazil's flag

Different countries have different rules about advertisement, which should be taken into consideration. Take for example a Brazilian law saying that advertisement must “*not be made so as to suggest the healing or prevention of any disease that requires medically supervised treatment*” (Werneck & Garcia, 2020). Statements made in advertisement also have to be correctly substantiated with proper resources. The use of words and visuals used should be identical to the dictionary definition and should not be understood with another meaning by the public (Werneck & Garcia, 2020). These and other advertisement laws should be closely looked at and incorporated in the advertisement.

The poster

Draft 1 is the first planning of the poster. I made the background green (like the color of the Brazilian flag) with yellow cubes (also from the flag). The cubes can contain a lot of information, but due to the separate blocks will keep it clear and structured. Next up, I added some pictograms and played around with different title styles (draft 2). At the bottom, I added “For more information, take a handout of visit our site: <https://portfolio.id.utwente.nl/student/group4/>” and a QR-code to our website. This ensures that people will have access to the information both on paper and online.

For the third draft, I added the text for the column “how to wash hands” and started on the “why wash your hands” section. The “possible consequences” will be added to the section about why to wash hands, and instead, a “what can you do” section is added. I think it is nice that people not only know what is important, but also know how they can help of change their behavior.

For draft 4, 5 and 6, the main changes were the addition of text to the introduction, “why wash your hands” and “about the filter”. I also added the logo my team used in the website, to create unity.

The final poster design can be seen in figure 6 (appendix 1). The version which will be hung in favelas can be seen in appendix 3, figure 7. This is the same poster, but translated into Brazilian Portuguese. I decided to cut out some of the text, so that it is faster to read when walking past it. Accompanying the poster is a handout. This double-sided paper will show how to design the design, portrayed the trough the same clear manual as can be found on the site (appendix 3, figure 8). The manual of the soap (appendix 3, figure 10) should also be added on the handout. Similar to the manual on the website, these manuals can also be translated to Portuguese. I designed the manuals in such a way that they are easy to understand, even when people don't have a high level of education. The combination between clear pictures and easy to follow steps ensure this. The other side of the manual is a miniature similar to the poster, but with a slightly more elaborate text (appendix 2, figure 9). The poster meets the Brazilian laws for advertisement.



Draft 1



Draft 2



Draft 3



Draft 4



Draft 5



Draft 6

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WASHING HANDS



Especially during times of COVID-19 washing hands is of great importance. Why? And how? That information can be found on this poster?

Want to know more? Then you can visit the site at the bottom of the page.



HOW TO WASH HANDS

1. **Wet your hands** with clean, running water and apply soap.
2. **Rub your hands together.** Pay extra attention to the backs of your hands, between your fingers, and under your nails.
3. **Scrub** your hands for at least 20 seconds.
4. **Rinse** your hands well under clean, running water. Dry your hands using a clean towel or air dry them.”

When and How to Wash Your Hands, 2020 (CDC)



WHAT CAN YOU DO?

Everyone can start by paying attention to washing hands, using soap and clean water.

The filter will be distributed to community leaders, contact them if you want to learn how to make a filter or if you want to help spread information to others.



WHY WASH YOUR HANDS

Around 3.200 bacteria live on a human hand from which some of them might be harmful. Therefore, washing hands is very important in order to stay healthy. When you touch eyes, mouth or nose with unwashed hands, the chance of getting a serious disease like COVID-19 is high.

Washing hands properly entails using soap and clean water, and knowing how to wash them (read "How to wash hands"). This causes harmful bacteria and viruses to be washed off and getting ill might be prevented.



ABOUT THE FILTER

The water filter contains 5 layers, each having a specific purpose. The five layers are:

1. **The rocks**, to filter out bigger impurities such as leaves, twigs and bugs.
2. **Coarse sand**, to filter out small organisms which might cause diseases
3. **Activated charcoal.** This works through adsorption, as chemicals in the water will stick to the material. This can be compared to how a magnet works.
4. **Fine sand.** This layer filters out further impurities and even smaller organisms in the water.
5. **Cloth.** It lets water flow through and stops the sand from falling out.

With proper care, the water filter can be used up to 5 months.



For more information, take a handout or visit our site: <https://portfolio.id.utwente.nl/student/group4/>



Figure 6

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LAVAR AS MÃOS



Especialmente durante os tempos de COVID-19, lavar as mãos é de grande importância. Por quê? E como? Essas informações podem ser encontradas neste pôster!

Quer saber mais? Então você pode visitar o site na parte inferior da página.



POR QUE LAVE SUAS MÃOS

Cerca de 3.200 bactérias vivem nas mãos humanas, das quais algumas delas podem ser prejudiciais. Portanto, lavar as mãos é muito importante para se manter saudável. Quando você toca os olhos, boca ou nariz com as mãos sujas, a chance de pegar uma doença grave como a COVID-19 é alta. Lavar bem as mãos implica usar sabão e água limpa e saber como lavá-las (leia “Como lavar as mãos”). Isso causa danos bactérias e vírus a serem eliminados e ficar doente pode ser evitado.



COMO LAVAR AS MÃOS

1. Molhe as mãos com água limpa e corrente e aplique sabão.
2. Esfregue as mãos. Preste atenção extra nas costas das mãos, entre os dedos e sob as unhas.
3. Esfregue as mãos por pelo menos 20 segundos.
4. Enxágue bem as mãos em
5. água corrente limpa. Seque as
6. mãos com uma toalha
7. limpa ou seque-as com ar.

When and How to Wash Your Hands, 2020 (CDC)



O QUE VOCÊ PODE FAZER?

Todos podem começar prestando atenção à lavagem das mãos, com sabão e água limpa.

O filtro será distribuído aos líderes da comunidade, entre em contato com eles se quiser aprender como fazer um filtro ou se quiser ajudar a espalhar informações para outras pessoas.



SOBRE O FILTRO

O filtro de água contém 5 camadas, cada uma com uma finalidade específica. As cinco camadas são:

1. **As rochas**, para filtrar as impurezas maiores, como folhas, galhos e insetos.
2. **Areia grossa**, para filtrar pequenos organismos que podem causar doenças
3. **Carvão ativado**. Isso funciona por meio da adsorção, pois os produtos químicos na água grudam no material. Isso pode ser comparado ao funcionamento de um ímã.
4. **Areia fina**. Essa camada filtra outras impurezas e organismos ainda menores na água.
5. **Pano**. Ele deixa a água fluir pela calha e impede que a forma de areia caia.

Com os devidos cuidados, o filtro de água pode ser usado por até 5 meses.



Para mais informações, visite nosso site: <https://portfolio.id.utwente.nl/student/group4/>



Figure 7

Appendix 3





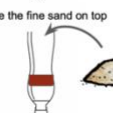
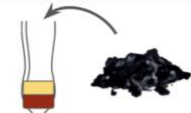

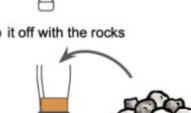
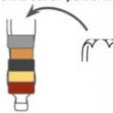
- Cut the bottom of the plastic bottle, not the part with the cap

- Clean the products such as the rocks and plastic bottle

- Hold the plastic bottle upside down, with the cut open part on top and the cap at the bottom

- Place the piece of cloth at the bottom, over the cap opening

- Place the fine sand on top

- Place the charcoal above the fine sand

- Put in the coarse sand

- Top it off with the rocks

- Place the bottle on top of the water storage container, this can be done by
 - Cutting a hole which is a bit smaller than the diameter of the plastic bottle, so that the bottle can be placed in the hole
 - Using a connection piece to screw the plastic bottle in the container

Figure 8 The filter manual

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WASHING HANDS

During times of COVID-19, certain guidelines were set to ensure that people could stay safe. One of these guidelines is washing hands. Questions such as "how to properly wash hand" were often left unanswered. On this poster, information can be found on how to wash your hands, why it is important and information on a tool to ensure clean water. There is also a hand out with more information on the filter.

WHY WASH YOUR HANDS

Around 3.200 bacteria live on a human hand from which some of them might be harmful. Therefore, washing hands is very important in order to stay healthy. When you touch eyes, mouth or nose with unwashed hands, the chance of getting a serious disease like COVID-19 is high. Washing hands properly entails using soap and clean water, and knowing how to wash them (read "How to wash hands"). This causes harmful bacteria and viruses to be washed off and getting ill might be prevented.

HOW TO WASH HANDS

- Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap.
- Lather your hands by rubbing them together with the soap. Lather the backs of your hands, between your fingers, and under your nails.
- Scrub your hands for at least 20 seconds. Need a timer? Hum the "Happy Birthday" song from beginning to end twice.
- Rinse your hands well under clean, running water. Dry your hands using a clean towel or air dry them.

ABOUT THE FILTER

The water filter contains 5 layers, each having a specific purpose. The top layer, the rocks, function to filter out bigger impurities such as leaves, twigs and bugs. The main function of the following coarse sand layer is to filter out small organisms which might cause diseases. Next up is activated charcoal. This works through adsorption, as chemicals in the water will stick to the material. This can be compared to how a magnet works. The following layer again contains sand. This time, it's fine sand. This layer filters out further impurities and even smaller organisms in the water. All the layers are compiled in a (recycled) plastic bottle. To ensure that the materials don't fall out of the bottle, the bottom layer is cloth. It lets water flow through and stops the sand. With proper care, the water filter can be used up to 5 months.

WHAT CAN YOU DO?

Everyone can start by paying attention to washing hands following the steps mentioned above. Furthermore, soap should be used to optimize the process of removing disease-causing bacteria and viruses. Using clean water is also beneficial. The filter will be distributed to community leaders, contact them if you want to learn how to make a filter or if you want to help spread information to others.

For more information, take a handout or visit our site: <https://portfolio.id.utwente.nl/student/group4/>

Figure 9

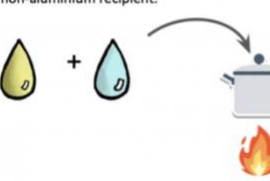
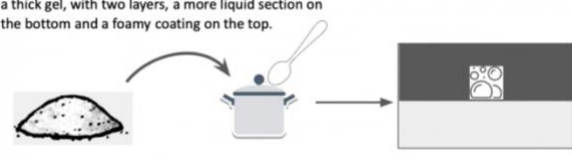

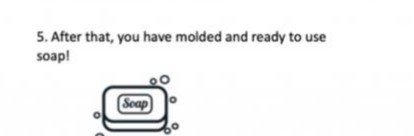

- Combine the oil and the water and set to boil in a non-aluminium recipient.

- Add the soda (NaOH) and water mix slowly, while mixing with a wooden spoon. The mixture will become a thick gel, with two layers, a more liquid section on the bottom and a foamy coating on the top.

- When reaching this stage, test the foamy part by trying to wash your hands with it. If there is a soapy, slippery feeling from it, you are done!

- Strain out the top mixture, and place it in separate recipients or molds, if wanted, and leave it to dry.

- After that, you have molded and ready to use soap!


Figure 10

References

- Bell, A. (2020, August 21). *What are pathogens?* Medical News Today.
<https://www.medicalnewstoday.com/articles/pathogens-definition#diseases>
- Brazil | Data.* (n.d.). Data Worldbank. <https://data.worldbank.org/country/brazil>
- Calvo-Bado, L. A. (2003, April 1). *Spatial and Temporal Analysis of the Microbial Community in Slow Sand Filters Used for Treating Horticultural Irrigation Water.* Applied and Environmental Microbiology. <https://aem.asm.org/content/69/4/2116#sec-14>
- Coffey, H. (2017, January 30). *SHOCKING: You won't BELIEVE how many GERMS are on your hands.* Express. <https://www.express.co.uk/life-style/health/760097/bacteria-germs-on-hands>
- Drinking-water.* (2019, June 15). World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/drinking-water>
- Gundogana, B., Koshya, K., Kurarb, L., & Whitehursta, K. (2016, November 1). *How to make an academic poster.* ScienceDirect.
<https://www.sciencedirect.com/science/article/pii/S2049080116301303>
- Hickok, K. (2020, March 5). *Why do we use soap?* Livescience.Com.
<https://www.livescience.com/57044-science-of-soap.html>
- Huizen, J. (2020, January 10). *What are the benefits of activated charcoal?* MedicalNewsToday.
<https://www.medicalnewstoday.com/articles/322609#possible-uses>
- Hygiene and COVID-19.* (2020, October 22). National Institute for Public Health and the Environment. <https://www.rivm.nl/en/novel-coronavirus-covid-19/hygiene-and-covid-19>
- Hygiene and COVID-19.* (2020b, December 22). RIVM. <https://www.rivm.nl/en/novel-coronavirus-covid-19/hygiene-and-covid-19v>

- Laurén, S. (2018, June 26). *What are surfactants and how do they work?* Biolin Scientific.
<https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work>
- Mangus. (2020, July 1). *What does activated carbon filters remove from tap water? - TAPP Water*.
EN. <https://tappwater.co/en/what-activated-carbon-filters-remove/>
- Mao, N. (2016, January 1). *Nonwoven fabric filters*. ScienceDirect.
<https://www.sciencedirect.com/science/article/pii/B9780081005750000103>
- Mathur, P. (2011, November). *Hand hygiene: Back to the basics of infection control*. US National Library of Medicine National Institutes of Health.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3249958/>
- Mercer, A. (2018, October 11). *The Importance of Cultural Awareness in Teaching*. Ace.Edu.
<https://www.ace.edu/blog/post/2018/10/11/the-importance-of-cultural-awareness-in-teaching>
- Meyer, A. (2010). *Brazil National Symbols*. Brazil. <https://www.brazil.org.za/national-symbols.html>
- McNamara, P. (2017, July 17). *Five of the Many Benefits Charcoal Water Filters Provide*. Water Filters Fast. https://www.waterfiltersfast.com/5-Benefits-of-Using-Charcoal-Water-Filters_b_64.html
- More than 34 million Brazilians lack access to water*. (2018, March 21). Conectas Human Rights.
<https://www.conectas.org/en/news/34-million-brazilians-lack-access-water>
- National Research Council (US) Safe Drinking Water Committee. Drinking Water and Health: Volume 2. Washington (DC): National Academies Press (US); 1980. IV, An Evaluation of Activated Carbon for Drinking Water Treatment.* Available from:
<https://www.ncbi.nlm.nih.gov/books/NBK234593/>

P. Hall, Van Koppen, Van Houweling, R. B. E. (2014). *The Human Right to Water: The Importance of Domestic and Productive Water Rights*. PubMed Central (PMC).

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4237907/>

Stauber, C. E., Ortiz, G. M., Loomis, D. P., & Sobsey, M. D. (2009, February 1). *A randomized controlled trial of the concrete Biosand filter and its impact on diarrheal disease in Bonaó,...* ResearchGate.

https://www.researchgate.net/publication/23974502_A_randomized_controlled_trial_of_the_concrete_Biosand_filter_and_its_impact_on_diarrheal_disease_in_Bonaó_Dominican_Republic

Trading Economics. (n.d.). *Brazil - Adult Illiterate Population, 15+ Years, Both Sexes - 1980-2018 Data | 2020 Forecast*. <https://tradingeconomics.com/brazil/adult-illiterate-population-15-years-both-sexes-number-wb-data.html>

What are microbes? (2019, August 29). US National Library of Medicine National Institutes of Health. <https://www.ncbi.nlm.nih.gov/books/NBK279387/>

Werneck, L., & Garcia, T. S. (2020, March 31). *In brief: prohibited and controlled advertising in Brazil*. Lexology. <https://www.lexology.com/library/detail.aspx?g=98ca5f16-b544-43d7-91e3-d3efff8a730f>

When and How to Wash Your Hands. (2020, November 24). Handwashing | CDC.

https://www.cdc.gov/handwashing/when-how-handwashing.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Ffeatures%2Fhandwashing%2Findex.html

WHO guidelines on hand hygiene in health care. (2009). World Health Organization.

https://apps.who.int/iris/bitstream/handle/10665/44102/9789241597906_eng.pdf?sequence=1&isAllowed=y

Why Wash Your Hands? Read the Science Behind the Recommendations. (2020, September 10).

Centers for Disease Control and Prevention. <https://www.cdc.gov/handwashing/why-handwashing.html>