

The Impact of Health Risk Communication: A Study on the Dengue, Chikungunya, and Zika Epidemics in Curaçao, Analyzed by the Social Amplification of Risk Framework (SARF)

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Abstract

Epidemics of dengue, chikungunya, and Zika have been threatening the Caribbean. Since risk communication (RC) plays a fundamental role in preventing and controlling diseases understanding how RC works is essential for enabling risk-reducing behavior. This multimethod qualitative study compares news reports with local's and health professional's perspectives, currently lacking in RC research. It was found that RC strategies were obstructed by a lack of governmental structure, organization, and communication. The content analysis showed that the majority of newspaper articles contained negative reporting on the government. Furthermore, this study shows how trust and heuristics attenuate or amplify people's risk perceptions and possibly positively and negatively influence people's risk-reducing behavior. A transcending approach (e.g., *structural*, *cooperative*, and *multidisciplinary*) of the prevention and control of vector-borne diseases and the corresponding RC is recommended.

Keywords

risk communication; social amplification of risk; risk perception; vector-borne diseases; trust; qualitative research methods; the Caribbean

Introduction

Vector-borne diseases (VBDs) such as dengue, chikungunya, and Zika present a threat to human health in many regions of the world and cause international concern (Reynolds et al., 2017). The spread of VBDs is driven by global travel and trade and complex demographic, social, and environmental factors (Semenza, 2016). Dengue virus, chikungunya virus, and Zika virus infection cause various clinical manifestations that range from mild to life-threatening symptoms (Mayer et al., 2017). A dengue virus infection causes a flu-like illness and occasionally progresses to severe dengue forms such as dengue hemorrhagic fever and dengue shock syndrome (World Health Organization [WHO], 2020). Chikungunya virus infection generally causes high fever, skin rash, and debilitating polyarthralgia. The mentioned symptoms typically resolve within 10 days. However, a proportion of cases progresses to the chronic stage of chikungunya virus infection, in which some symptoms (e.g., *arthralgia*) last

for years (Elsinga, et al., 2017). In most cases, Zika virus infection causes no or mild symptoms, but complications such as microcephaly and Guillain-Barré syndrome have been linked with the disease (Kazmi et al., 2020).

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In Curaçao, a Caribbean island, the chikungunya and Zika virus caused significant outbreaks in 2014–2015 and 2016–2017, respectively. Moreover, dengue virus infection epidemics occur cyclically. These diseases also threaten other islands in the Caribbean (Rico-Mendoza et al., 2019). In the Caribbean, the primary vector of dengue, chikungunya, and Zika virus is *Aedes Aegypti* (Kotsakiozi et al., 2017). The lack of a (ready and suitable) vaccine causes the reduction of the transmission of these VBDs to rely on preventing mosquito bites, preventing sexual transmission in case of Zika virus, and controlling the vector and its breeding sites (Beltrán-Silva et al., 2018; Clapham & Wills, 2018; Goyal et al., 2018; Paixao et al., 2018; Petersen et al., 2016; Singh et al., 2018). Hence health communication in terms of risks of the diseases, prevention, and control programs are of primary importance.

Risk communication (RC) is defined as: “(. . .) an interactive process of exchange of information and opinion among individuals, groups, and institutions about the nature of risk, concerns, (. . .) or reactions to risk messages or to legal and institutional arrangements for risk management” (Covello et al., 2001). RC is an essential tool for preventing and controlling diseases as it influences risk perception, increases awareness, and might lead to change in behaviors and/or stimulate risk-reducing behavior (Infanti et al., 2013). It is therefore essential to understand the impact of RC on the community. Kasperson et al. (1988) developed the Social Amplification of Risk Framework (SARF), which has been used widely to research and explain RC, where and how information is amplified or attenuated in the communication chain, and how risk perception influences behavior and situations. The SARF is based on the thesis that hazardous events interact with social, psychological, cultural, and institutional processes that can intensify or attenuate individual and social perceptions of risk and shape risk behavior (Kasperson et al., 1988).

The roots of social amplification of risk lie in direct personal experience with the risk and secondary information received about the risk (Kasperson et al., 1988). It has been stated that personal experience and trust in the messenger have the most substantial impact on risk perception (Wachinger et al., 2013). Thus when a person considers the potential personal harm, the believability of information provided depends much on the trust and confidence a person has in the messenger (Kasperson, 1986). The belief in the accuracy of the information tends to be greater if a factual statement is repeated multiple times by different sources (Kasperson et al., 1988). Also, heuristics or cognitive shortcuts act as an amplifier or attenuator of risk perception (Kasperson et al., 1988). Heuristics are mental processes that help individuals solve problems and learn new concepts when there are limited time and

resources to make a judgment (Bailey & Hutter, 2006; Institute of Medicine, 1997). People can automatically process information using heuristics rather than through systematic analysis (slow thinking system) when confronted with a (new) threat.

Past research has applied the SARF to understand RC in public health emergencies (Barnett & Breakwell, 2003; Busby & Duckett, 2012; Chong & Choy, 2018; Kasperson et al., 1988; Kasperson & Kasperson, 1996; Petts & Niemeyer, 2004; Raupp, 2014; Rickard et al., 2013; Rossmann et al., 2018; Strekalova, 2017; Wirz et al., 2018), but literature concerning RC in small developing countries and countries in the Caribbean region is lacking (Wirz et al., 2018). In 2019, the SARF was used to understand RC regarding VBDs in Curaçao, determine the association between socio-demographic variables and channels of information, and the influence of cultural schemas on perceptions (Mulderij-Jansen et al., 2020). The mentioned study gives useful insights, but it does not take the impact of the content of the provided health information and heuristics into account. Therefore, this study goes a step further by analyzing the newspaper's content, comparing people's perceptions with perceptions of experts/government officials and the information provided by the newspapers, and understanding the newspaper's influence on people's perceptions. To our knowledge, the comparison of newspaper content with perceptions of locals and experts/government officials lacks in RC research. The role of trust, previous experience with VBDs, and heuristics on risk perception regarding VBDs will also be studied in combination with the SARF to understand the amplification and attenuation of risk more profound. The findings and recommendations of this research can be used to strengthen RC strategies in Curaçao. Undoubtedly, other islands in the Caribbean (e.g., *Dutch Caribbean islands*) can use this study's findings to improve their RC approaches. Besides that, amid a current COVID-19 pandemic, this research can make a useful contribution in examining and shaping RC policies worldwide.

Methods

Study Design

In 2018, a qualitative study using in-depth interviews with local people and experts/government officials and a content analysis of newspapers and other visual materials (e.g., *folders, poster, etc.*) was performed to examine the experiences and processes related to the risk of VBDs on people living in Curaçao. The study was designed based on an integrated theoretical framework of the SARF, heuristics theory, previous experience with VBDs, and trust. The time-frame that the research focused on was the



Figure 1. Simplistic time-frame overview of the VBD epidemics in Curaçao.

Note. VBD = vector-borne disease.

beginning of 2010 until the end of 2017. Within the mentioned time-frame, the last big dengue virus infection epidemic occurred in 2010/2011, while the chikungunya and Zika virus infection epidemics occurred in 2014/2015 and 2016/2017, respectively (Figure 1). Articles for the document analysis were used within the time-frame mentioned above. The participants recruited met the following criteria: they currently live and have lived in Curaçao between 2010 until the end of 2017.

Data Collection and Study Population

In-depth interviews. Interviews with experts/government officials were held to obtain information on the government policy, RC strategies, and the health system's performance during the dengue, chikungunya, and Zika virus infection epidemics. The term experts/government officials regard policymakers or health professionals working for the government. Moreover, to further research the newspapers, an interview was conducted with a media expert who writes articles regarding public health in the media. In total, four experts/government officials were interviewed. In-depth interviews with local people were performed to investigate risk perception, trust, heuristics, and previous experience with VBDs. The interviews were held in two socioeconomically different neighborhoods (low and middle socioeconomic status [SES] and high SES) to aim for heterogeneity within the study population ($n = 18$) (Supplemental file 1: Table 1). Low-/middle- and high-SES neighborhoods were selected based on neighborhood classifications made by the Central Bureau of Statistics (2001), Curaçao. Gatekeepers and the snowball technique were used to recruit study participants. The number of interviews needed in this study was determined after data saturation was reached, meaning that when the information was repeated during new interviews, it was decided to stop recruiting participants. Both interview guides (for locals and experts) contained similar questions that offered the opportunity to compare the responses (Supplemental file 2). The interviews were conducted and recorded in Papiamentu or Dutch, translated if necessary to Dutch, transcribed, and analyzed. Interviews with experts and locals were conducted in April and May 2018.

Content analysis. Written messages in the form of information materials are and have been fundamental in RC. For the visual materials sampling strategy, readily available information on the island (e.g., in community centers, medical centers, etc.) and information materials from the Ministry of Health, Environment, and Nature of Curaçao (MoH) storage were sought and photographed for the content analysis. A total of six flyers, posters, and booklets developed by the MoH were collected. This number can be explained by different factors, for example, lack of documentation, loss of documents throughout the years, and limited developed information materials.

Articles of two local newspapers (Dutch "Amigoe" and Papiamentu "Extra") were sought for the content analysis. From the Dutch newspaper, 23 articles were gathered on dengue, 62 on chikungunya, and 100 on Zika within the time-frame 09-23-2010 until 11-02-2017 (mm-dd-yyyy). The other newspaper (Papiamentu) has an online database that goes back to 07-15-2016, which resulted in 49 more articles on Zika. No articles on dengue and chikungunya at the time of their epidemic were found in their database. To ensure the inclusion of timely relevant articles in the content analysis, an overview of the Pan American Health Organization (PAHO) and the WHO epidemiological reports was created and used to select articles (Supplemental file 3: Table 2) (PAHO, 2019a, 2019b, 2019c). After correcting for irrelevant or repetitive articles, a total of 14 articles on dengue, 32 on chikungunya, and 108 on Zika were included in the content analysis (Supplemental file 4: Table 3).

Data analysis. Conventional (inductive) and directed (deductive) content analysis methodologies were used to analyze the data. The conventional content analysis went as followed: (a) data were read word by word to derive codes, (b) notes about the data were made, and (c) codes were sorted into categories based on observed links. The directed content analysis went as followed: (a) key concepts of the SARF, the theory of heuristics, trust, and previous experience with the disease were identified and used as categories and codes, and (b) any data that could not be coded from the existing coding scheme were coded inductively. The research team critically monitored and evaluated the phases mentioned above to increase coding

accuracy and trustworthiness (Hsieh & Shannon, 2005). The data were translated and analyzed by two persons simultaneously. By coding the same data set at the same time, initial difficulties could be discussed. A disagreement between coders meant that a definition had to be expanded or revised, which is how the coding list was made (Elliott, 2018). After that, the coded data were reviewed by another author, where a qualitative comparison of the codes was conducted. The analysis was conducted by coding the articles, expert interviews, and visual materials with the same coding list using NVivo for Mac (11.4.3). A word cloud for the code “government” was created to analyze the frequency and meaning of words used regarding the government in newspaper articles. For the in-depth interviews with locals, a different coding list was used to focus more on analyzing participant’s perceptions, experiences, and opinions. The coding list for newspapers, expert interviews, and visual materials contained category codes such as; information, prevention methods, government, trust, responsibility, approach, and cooperation institutions (Supplemental file 5: Table 4). Category codes used to analyze in-depth interviews with locals were: information source, knowledge, responsibility, trust, perception dengue/chikungunya/Zika, heuristics, perception media, perception government, false/unclear information, risk-reducing behavior, and improvement (Supplemental file 6: Table 5). Narrative analysis methodology was also used to analyze the coded data, including notes about this study’s data. Narrative analysis was used to examine individual experiences regarding VBDs and how risk and risk information concerning these diseases was processed. All quotes in the current research were transliterated to keep the context intact. The study used multiple methods and data sources to study the same phenomenon to produce findings that breed credibility (Renz et al., 2018).

Ethics Statement

Ethical approval was obtained from Utrecht University, and the minister of the MoH of Curaçao was informed on the research. All participants signed an informed consent prior to the interview. The raw data will not be publicly available because the participants did not consent to have their full transcript available for the public. The data are archived at Utrecht University. Request to access the data can be sent to the corresponding author: e-mail address: v.i.c.jansen@umcg.nl.

Results

The following key themes will be presented in the results: channels of information, the content of newspapers, the perceptions of locals compared to experts/government officials’ perceptions and information provided by the

newspapers, and finally, influences on risk perception such as trust and heuristics. The characteristics of the participants ($n = 18$) are presented in Supplemental file 1, Table 1. It was decided not to include the participant’s names and the neighborhood they inhabit to guarantee their anonymity.

Channels of Information

The locals reported having received information regarding dengue, chikungunya, and Zika via newspapers, radio, television, family, friends, doctors, social- and international media. The locals did not mention the government directly as a channel of information. However, health professionals working for the MoH create and publish flyers, posters, and statements to be spread. Therefore, the mentioned flyers, posters, and information published by the newspapers, television, and radio stations could be from the government.

Even though the government published information regarding VBDs, during the in-depth interviews with locals, it became apparent that a pamphlet with information about chikungunya produced by the MoH did not reach the participants. Only one participant recalled that she had seen the pamphlet. According to an RC expert of the MoH, a pamphlet about chikungunya was made in four languages: Papiamentu, Dutch, English, and Spanish (these languages are widely spoken on the island), and a postal company was paid to distribute those to the community. However, during the communication campaign evaluation, it became clear that the pamphlets were not distributed as agreed. Another government official also mentioned the above-reported issue:

So at a certain moment, one can deliver all the perfect content, but there must be someone or a structure that knows how to sell it to people. And there are more issues; for example, if you have done all your work that you are supposed to do (e.g., make a pamphlet or poster), it does not mean that it will end up where you want it to end up. (Government official)

Moreover, it was mentioned by a few participants that they received information in a language they did not understand, as portrayed by the quote below.

Well, we did get a lot of pamphlets in the mailbox, and I suppose those came from the MoH. I don’t know. The only thing I find stupid is that the pamphlets are only in Papiamentu. And then I think, okay; 52 different nationalities are living on the island, not everyone speaks Papiamentu or can read it. Female, (living in high-SES area)

The public and the government could be missing out on vital risk information by a lack of structure and communication between institutions, as shown in the quote

below. Moreover, the problem of insufficient funding for prevention and control arises during in-depth interviews with government officials:

You have to make sure you don't get into a pressured situation. And for that, you need enough workforce/employees, resources, and planning. You need high-speed communication. When one of these three is lacking, you will face the chance that things get out of hand. We saw that with chikungunya. (Government official close to policy)

Just like it always has been, people are more inclined (and certainly politicians) to put money into something where you see immediate results. (. . .) But prevention isn't something you see. You avoid problems, so you do not see the problems. But the importance of that often does not come across. (Government official [public health worker])

Moreover, participants showed little knowledge concerning the transmission of the diseases in this research. Most answers contained the simplistic answer "if mosquito bites you," but other forms of transmission (e.g., *sexual transmission of Zika*) or the full transmission cycle (human–mosquito–human) were not mentioned. The vector's description was mostly incorrect. People referred to the vector of dengue, chikungunya, and Zika virus as the "mosquito with the white paws." Knowledge with regards to health risk-related information was missing. This shows that the impact of health RC has not reached its full extent, it might be that RC is not reaching locals as mentioned before, or the RC is not increasing knowledge as it should be.

Content of Newspapers

To understand media report's influence on people's perceptions, the content of the newspapers analyzed in this study will be discussed. Most articles contained information on prevention methods, number of infections and deaths, mishandling of the epidemics by the government, lack of cooperation between institutions, the unpreparedness of the community, economic effects, global warnings, tourism, urging of locals to act, waste management, and general information on symptoms, transmission, and tests of VBDS. Information on the fact that dengue, chikungunya, and Zika virus share the same vector is lacking. Moreover, while analyzing the created word cloud, it became apparent that the number of articles with a negative undertone regarding the government outweighs the positive ones by far. Of the 155 articles included in this study, 92 (59.4%) articles mentioned the government negatively versus 12 (7.7%) articles that mentioned the government in a positive matter. Next to 33 articles containing general negative statements concerning the government, distinctions of negative reporting were made as follows: 15 articles contained government

officials questioning each other or being questioned by the newspaper, 18 on the unpreparedness for the epidemics, 10 on limited staff, and 16 articles on the delays in governmental actions and communication. Below, quotes from two newspapers show examples of negative comments on the government.

The MAN group has asked questions to Minister Ben Whiteman of Health, Environment, and Nature about the chikungunya virus. The political party thinks that the information about the disease got off to a late start and that the minister had assessed the situation poorly. (MAN Ask Questions on Chikungunya," 2014, November 11)

According to the general practitioners, the GGD [G&Gz] should have developed a policy for every general practitioner to follow from the start. They did report that there would be a general policy, but this never happened. The consequences of the lack of planning and not having a general policy caused that every doctor did what they want to do. ("Different General Practitioners Gave Their Opinion," 2016, October 31)

In an interview conducted with a media expert, it became clear that the newspapers strongly influenced the public in Curaçao. Generally, the MoH provides media sources with press releases. However, the media sources are free to publish these, make changes to them, or even decide not to publish them. The freedom that the media has gives the opening for possible attenuation by media sources because the RC could be presented but stopped at that station if the press releases are not published or adjusted.

Comparing Perceptions of Locals With Perceptions of Experts/Government Officials and Newspapers

The comparison of local's perceptions versus those of experts/government officials and information from newspapers will be discussed based on the chikungunya and Zika virus infection epidemics. The overall consensus of the participants regarding the RC about chikungunya was that it came too late. It was brought up during in-depth interviews with locals and government officials that information started to reach the public at the peak of the epidemic. Some participants already experienced the effects and impacts of chikungunya virus infection firsthand before receiving risk information.

With chikungunya, we were just too late. We were just way too late. It was already known that it was coming; there is a new virus in this region, other countries already had it. We are an island with continuous traffic from everywhere. So, you could bet everything that it would come here, but we just started too late. This happened because it is not clear who should do that. There is no central focal point within the Ministry to say what we have to do regarding the epidemics.

(. . .) We took a big hit with that chikungunya. With Zika, not, fortunately, but with chikungunya, we did. So many victims with long-term complaints. (Government official [public health officer])

According to the majority of health experts, the first cases of chikungunya virus infection were not timely reported, and a trained workforce to actively jump into action was lacking. A close analysis of the qualitative data suggests that the risk might not have been seen as important as it should have, leading to attenuated risk perception and response within the government and the media. The content analysis reveals that published articles with regard to chikungunya began to increase only after the peak of the epidemic. There were very few articles that warned the public that the chikungunya virus might arrive in Curaçao. Once the epidemic was in full swing, the number of articles in newspapers increased rapidly, and overall more attention was given to the chikungunya virus infection epidemic. The chikungunya virus infection epidemic was perceived as something threatening, and participants reported that they were scared of the infection.

Well, that chikungunya epidemic was a real wow for me. Unbelievable how fast that happened, what an impact it had on your personal life, but also the people around me. (. . .) I could have never imagined that it could have such an impact. While you know about certain malaria etcetera, what causes it, and what the consequences are, chikungunya was unknown here. (Female, [living in high-SES area])

In the Zika virus infection epidemic, perceptions of locals and experts/government officials and newspaper information differed. RC on Zika began before the epidemic hit the island. The newspapers picked up on the risk and published a large number of articles. Information on the symptoms, transmission, and health risks of Zika virus infection was written in the media, as was written on chikungunya at the time of the chikungunya virus infection epidemic. However, the difference was that Zika virus infection was portrayed more as a global threat in the newspapers (as shown by the quotes below).

The WHO convenes an emergency meeting on Monday to determine whether the spread of the Zika counts as a so-called global emergency. WHO Director Margaret Chan stated in Geneva today that the UN organization is extremely alert. (“First Local Zika Virus Infection Detected,” 2016, January 28)

It seems as though people are not taking Zika seriously enough. We cannot stress it enough that at least pregnant women have to deal with it seriously, in the sense that they have to do everything to ensure that mosquitos do not bite them. (“Mysterious Virus Possibly Different Zika Mutation,” 2016, October 28)

However, information regarding Zika did not seem to be received by the community since the participants were not very impressed by Zika virus infection, nor saw any real danger in the disease. According to the participants, it was only a discussion topic among young—or pregnant women. Participants showed that at a social and individual level, the risk perception was attenuated despite the newspaper’s coverage of the disease. Some participants even mentioned they did not notice the RC on Zika or did not pay much attention to the disease. Furthermore, the possible connection of the Guillain-Barre syndrome and microcephaly were not mentioned much in the interviews, and this could also account for attenuation in the risk perception with regards to Zika virus infection. However, it is interesting because the newspapers published news articles on Zika virus infection and its complications quite extensively.

Influence of Trust on Risk Perception

To explore how trust played a role in information people have received, it is necessary first to note the different sources that are trusted or not by the participants. The pamphlets and posters found in health care facilities are trusted and seen as reliable sources of information. Only low-SES participants acknowledged the television as a trustworthy source. General practitioners and people with previous experience with VBDs were frequently mentioned as trusted information sources.

I trust the experience of people. So, when someone tells me that they were having pain somewhere and they used a bit of Glacial [popular multipurpose menthol liquid in Curaçao], I am more likely to trust that than when the doctor tells me something. Female, (living in low-SES area)

Furthermore, the government was listed the most as a trustworthy information source, or more specifically, pamphlets, meetings, and home inspections organized by the government were mentioned. Participants often described information from the government as “official information” and therefore trusted by them. Social media and journalists were indicated as less trustworthy. Interestingly, the perceptions of locals on the trustworthiness of the government change throughout the SARF. As an information source, the government is perceived as trustworthy. Nevertheless, in the behavioral response stages of the SARF, this study found a lack of mutual trust, as portrayed in the quote below, where the reduction of mosquito breeding sites is discussed:

Responsibility lies with the government and the people themselves. If you use a bottle, wait until you get home and throw it in the garbage. It is impossible that the people of the government do not see this. The neighborhood is dirty and

needs to be cleaned. So, the government needs to encourage and control people to do their part, but the government also has to take care of their part. Male, (living in low-SES area)

It became apparent during this study that the locals did not trust the government to take their responsibility and execute the correct risk-reducing behavior, but the government neither trusted the locals to execute correct risk-reducing behavior. Although some locals reported the government as a trustworthy information source, some also reported that the government lacked information or knowledge on the diseases, therefore not trusting their provided information. The lack of trust in information from the government influenced the risk perception negatively, which was mostly the case with chikungunya and Zika:

Well, they [the government] do not know anything about Zika yet, so what kind of information could they give? There were mostly questions about whether or not it's true. What do we do with the information about the babies? Is it even a consequence of Zika? Cause no one proved that. So yeah, that caused some fuss. However, there were many people as well who just thought, well, I do not believe that for one second. Female, (living in high-SES area)

Heuristics and Its Influence on Risk Perception, Prevention, and Control of VBDs

Heuristics act as mental shortcuts that could cause or enhance amplification or attenuation of an individual's risk perception. These are often based on or derived from past experiences, perceptions, influences, or events. This research found that heuristics contributed to the attenuated risk perception, mostly concerning dengue. The participants perceived that mosquitos will always be around, or negligent neighbors make it impossible to eradicate all possible breeding sites.

You will always have the problem that if your neighbors keep 3 barrels of water and car tires lying around, you will still have a problem. So yes, it's about protecting against mosquitoes, but the funny thing is that you learn to deal with it as something that is just there. (. . .) I try to protect myself, and if it is very bad, I also spray myself, yes. For example, now all of a sudden, I have mosquitoes at home again, but then I think, well, what else can I do? (Female, [living in high-SES area])

Little can be done for complaints about stagnant water. ("Not Much to Do Against Complaints Stagnant Water," 2010, December 7)

The perceptions mentioned above regarding the vector of dengue virus (mosquitoes will always be around) and preventive/control measures (negligent neighbors and government make it impossible to eradicate all mosquito

breeding sites) were frequently mentioned when asking the participants for a solution for diseases transmitted by mosquitoes. Locals perceived the dengue virus infection as a normal phenomenon because dengue and its vector have been around for an extended period. Mentioned perceptions helped the participants cope promptly with their perceived risk and allowed them to make judgments quickly. These heuristics could have caused the attenuation of risk for other diseases transmitted by mosquitoes. The participants also reported that their input to reduce transmission is not significant to stop or prevent diseases transmitted by mosquitoes, making them pay less attention to these types of diseases and probably, attenuating their risk perception for other mosquito-transmitted diseases.

Another influence on risk perception is the mishandling of the risk by institutions in the past. Participants indicated that risk management with regards to dengue virus infection was minimal or nonexistent:

With dengue? No. The only thing they [the government] did with dengue is spraying that mess [insecticides]. However, real information on how to prevent and stuff, no. Look, we know that we live in the tropics, and we all know to look out for water and so. The standard we know, but more . . .? No, we did not get much extra information. (Female, [living in high-SES area])

The present government, do you think they can help us? The only thing they do is argue and argue. When something is wrong, they do not come to help the public. It is only when elections are coming up that they remind people [of the risks of VBD's]. (Female, [living in low-SES area])

Perceived mishandling of the dengue virus infection epidemic caused the credibility of the risk information regarding chikungunya to be perceived as less. The newspaper's content confirmed the government's mishandling during the dengue and the chikungunya epidemic, which in turn caused less risk information credibility. The observed reduction in risk information credibility could also explain some individual's minimal risk-reducing behavior regarding preventing and controlling mosquito bites during the dengue, chikungunya, and Zika epidemics.

Discussion

Qualitative methods were used to (a) understand how risk was communicated during the dengue, chikungunya, and Zika virus infection epidemics, (b) compare the content of newspapers with the perceptions of locals and experts/government officials, and (c) explore the influence of trust and heuristics on risk perception. This study's results concerning the channels of information are in concordance with the findings of a recent study conducted in

Curaçao (Mulderij-Jansen et al., 2020) and Jamaica (Shuaib et al., 2010). In Jamaica, investments have been made in media campaigns concerning dengue virus infection; however, an assessment to determine the impact of such interventions has not been conducted. In contrast, this study went a step further by analyzing the positive or negative influence of newspapers and governmental actions on people's risk perception regarding VBDs.

This study shows that the MoH of Curaçao faces challenges such as no funding for prevention and vector control interventions, no policy in place, no properly defined task division between governmental departments, and inadequate workforce and resources. These are common challenges of Small Island Developing States (Jenkins et al., 2011). Locals, experts/government officials, and the content analysis indicated that the MoH was late with RC concerning chikungunya. Furthermore, it was found that some information materials produced by the MoH were either not appropriately distributed, received in a language that participants were unable to understand, or not received at all. The reported lack of coordination and structure within the MoH might have obstructed RC strategies.

In the case of Zika, RC provided by the MoH started before the epidemic, and the media coverage was very high during the epidemic. However, it is remarkable that the participant's risk perception was attenuated during the peak of the epidemic because neither the MoH nor the media had changed their RC tone, namely: Zika virus infection is a serious threat to human health. A possible explanation for the observed attenuated risk perception could be that Zika virus infection's physical manifestations were milder than those of chikungunya virus infection (Elsinga et al., 2017). With regards to dengue, the participants had difficulties recalling RC strategies, low media coverage was observed, and the participants reported a lack of RC efforts. The study participants did not consider dengue virus infection to be a threat, perhaps because the last outbreak took place in 2010, and no severe case of dengue virus infection has ever been reported on the island. Another study in the Caribbean (Sint Eustatius) also indicated that the community often did not identify dengue as a severe concern (Leslie et al., 2017). Observed attenuated risk perception could also be ascribed to the previous experience with the relatively mild physical manifestation of dengue virus infection (heuristic) or habituation. An unchanging stimulus could produce habituation, and when the stimulus is presented to an individual repeatedly over time, less attention is given to that stimulus exposure (Wogalter & Mayhorn, 2005).

Furthermore, there might be a lack of mutual trust between the government and the public. Information materials produced by the government were perceived as

trustworthy sources in the current research. However, the trust in another to execute correct risk-reducing behavior was lacking on both the government's and local's sides. It has been stated that personal experience and trust in authorities have the most substantial impact on risk perception (Wachinger et al., 2013). The government officials indicated that they did not trust the locals to execute the correct risk-reducing behavior, and the locals indicated that they did not trust the government to perform their duties regarding risk-reducing behavior (e.g., *cleaning up breeding sites*). In the pursuance of trust, a source must have credibility. Credibility is gained from long-term evidence and commonly shared experience that a source is, among other things, competent, consistent in its performance, communication efforts, and fairness (Renn & Levine, 1991). On the other side of mutual trust, it is believed that the public's self-directed change is brought about by heightened awareness and knowledge of health risks (Bandura, 1990).

The locals indicated that the governmental actions concerning RC, prevention, and control measures for dengue virus infection were minimal or nonexistent and started late in the chikungunya virus infection epidemic. The community's expectations toward the government were not met, and the developed experience regarding the government's mishandling (heuristics) caused distrust. On top of that, the newspapers published many articles highlighting the failures of the government. The newspaper's content confirmed the local's negative perceptions with regards to the government and enforced distrust. When looking at the SARF, it is arguable that since both the locals and the government lack mutual trust in performing risk-reducing behavior, this has influenced both parties' behavioral response stages during the dengue, chikungunya, and Zika epidemics. The current research makes a useful contribution in showing how a lack of mutual trust between experts and locals can transpire into the behavioral stages of the SARF, which provides important research areas for future epidemics and the ongoing COVID-19 pandemic.

This study was limited by its retrospective design and is susceptible to recall bias. Another limitation is that solely the influence of the content of newspapers was researched. Other information sources such as general practitioners, schools, community centers, internet searching, social media, television, and radio were not further examined during this research. The information channels mentioned above could also impact RC, risk perception, and risk-reducing behavior in a way as described by the SARF. Moreover, the newspaper written in Papiamentu offered only access to articles on Zika; thus, the influence of media during the chikungunya and dengue epidemics presented in this study could be biased to the disadvantage of Papiamentu speaking participants.

Conclusions and Recommendations

This study found that negative reporting by newspapers influenced risk perception, (mutual) trust was lacking between experts/government officials and locals in the execution of prevention and control of VBDs, and local risk perceptions were influenced by heuristics positively and negatively. In this research, certain risk-reducing behavior topics were touched upon, but not in-depth worthy enough to study the behavioral responses and make valid comments in the responses stage of the SARF. Adding to that, the perceptions found in this study, particularly those of distrust, could disperse political and social impacts, or in other words, the ripple effects (Kasperson et al., 1988). The above provides interesting research areas to be further examined. We recommend studying the influence of other channels of information on the risk perception and behavior of people. Finally, a multidisciplinary team, with members of different (governmental) departments to tackle the prevention and control of VBDs on a timely basis, is recommended. Agreements and work procedures should be documented to enable transparency and communication. In a world that is currently facing a pandemic of COVID-19 virus infection, this research's findings could be used as a stepping stone to examine and shape current health RC policies around the world.

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