



Fiji Climate Change and Health Adaptation

Proceedings of the Symposium

9 February 2015 in Suva, Fiji

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Presenters



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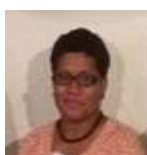
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Symposium group photo (by Division of Pacific Technical Support, WHO)



Audience and presenters at the symposium (by Division of Pacific Technical Support, WHO)

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1. Introduction

It has been observed that the impacts of climate change on ecological systems will potentially favour disease transmission. Global climate change is a significant health hazard faced by humankind. The World Health Organization (WHO) alerted that the changing climate would inevitably affect the basic requirements for maintaining health which includes clean air and water, sufficient food, and adequate shelter. WHO indicated that weather, climate variability and climate change are the three meteorological-based threats to health. It is evident that all the regions of the world will be affected by climate change, although the extent and intensity of health risks vary depending on where and how people live.

The Piloting Climate Change Adaptation to Protect Human Health (PCCAPHH) Project is a global initiative facilitated by WHO. The project piloted in 7 countries seeks to identify and share solutions that address health risks caused and exacerbated by climate variability and change. In Fiji, PCCAPHH Project was jointly implemented by the WHO Division of Pacific Technical Support and the Ministry of Health and Medical Services (MOHMS). The project identified four climate sensitive diseases in Fiji; namely dengue, leptospirosis, typhoid fever and diarrheal diseases that are major public health concerns in Fiji.

The project is nearing its completion and as such the MOHMS convened this symposium on Climate Change and Health Adaptation in Suva on the 9th February 2015.

The symposium aimed at informing partners of the achievements and lessons of the PCCAPHH project in strengthening internal cooperation and capacity for climate change and health within the Ministry.

Seventeen experienced professionals shared findings from their projects and their knowledge with the audience, consisting of various stakeholders and partners.

The Deputy Secretary for Public Health, Dr Eric Rafai, welcomed everyone to the one day symposium on Climate Change and Health. He thanked the keynote speakers Dr. Metuisela Tuicakau, Acting permanent Secretary, Ministry of Health and Medical Services, Acting Permanent Secretary Foreign Affairs, Mr. Esala Nayasi, Ms. Professor Elisabeth Holland, Director PaCE SD from the University of the South Pacific and all the other speakers and participants of the symposium.



2. Keynote Speeches

Importance of health adaptation to climate change in Fiji

Dr Metuisela Tuicakau (Acting Permanent Secretary, Ministry of Health & Medical Services)

It is indeed a privilege to be here this morning to address this important forum on the importance of Climate change and its effects on Health. It's been 22 years since the Rio Declaration on Environment and Development was adopted with two legally binding instruments: the UN Framework Convention on Climate Change and the Convention on Biological Diversity with opening the negotiation on the Convention to Combat Desertification, and 17 years since the Kyoto Protocol was adopted. I therefore acknowledge the UN organisations for the momentum and the progress of this vital aspect of human development. I also do note that WHO has been working on climate change and health over 20 years building on its long experience in supporting countries to build resilience of their health system to facilitate modifications of current system to reduce the health risk posed by climate variability and change. Climate change impacts society in a broad of variety of ways e.g., increase or decrease in rainfall influence agriculture, health, forests or ecosystem or even impact our energy supply. It is

no doubt that we are all witnessing these climate change effects in our societies and the world we live in. It is therefore only right that we prepare ourselves for these impacts through what we

“We must convince ourselves that YES there are signs of global warming through greenhouse effects and a warming climate will bring changes that can affect our water supplies, agriculture, power and the natural environment but most importantly OUR HEALTH and SAFETY”

called Adaptation Programmes/projects - basically meaning planning for the changes that are expected to occur. In health there are three important points to remember: 1) A warmer climate is expected to both increase the risk of heat-related illnesses and death, and worsen conditions for air quality, 2) Climate change will likely increase the frequency and strength of extreme events such as droughts, floods and storms that threaten human safety and health and 3) Climate change may allow some diseases to spread more easily.

“Effects of climate change on health are predominantly negative and impact most heavily on low income countries where capacity to adapt is weakest.”

Adaptation is the adjustments that society or ecosystems make to limit negative effects of climate change. It can also include taking advantage of opportunities that a changing

climate provides, which means to be protective (guarding against negative impact of climate change) or opportunistic (taking advantage of any beneficial effects of climate change).

Examples of adaptation in Health are 1) Implement early warning systems and emergency response plans, 2) Plant trees and expand green spaces in urban settings to moderate heat increase, and 3) Improve water use efficiency and build additional water storage capacity.

There is a need to assess vulnerabilities and identify cost effective intervention/adaptation options in the health sector and other sectors that have direct links to human health. Changes in climatic conditions and increases in weather variability affect human wellbeing, safety, health and survival in many ways. Some effects are directed to act and immediate such as heat waves, impaired food yields and storm surges. Other health effects are less immediate and typically occur via complex casual pathways that involve a range of underlying social conditions and sectors such as water and sanitation, agriculture and urban planning. It is important to develop adaptation activities on a sound understanding of baseline community needs and vulnerabilities and how these may alter with change in climate.

The question at hand is; what is Fiji's status and plan on adaptation strategies?

WHO and UNDP should be acknowledged for the project on "Climate Change Adaptation to Protect Human Health" that was launched in 2010 whereby Fiji is one of the participants in addition to the other six countries namely Barbados, Bhutan, China, Jordan, Kenya and Uzbekistan.

The project objective is to increase adaptive capacity of the health sector to respond to climate sensitive risk. The project is intended to increase MOHMS capacity to monitor, assess and respond to Hydro-Meteorological Disasters (HMDs) and Climate Sensitive Diseases (CSDs) thus reducing health risks. The expected benefit will be Fiji MOHMS having a functional Health Information System (HIS) that is capable of generating Early Warning Systems for Climate Sensitive Diseases, creating awareness to communities so as to increase resilience to climate change, strengthening inter-sectorial collaboration at all levels with other key government agencies such as Fiji Meteorological Services (FMS) and National Disaster Management Office (NDMO). In addition climate change adaptation has also been clearly captured in our Annual Corporate Plan (ACP) 2015 to enhance Ministry's resilience to health emergency and disaster response, preparedness and recovery. Our emphasis areas include development of disaster risk management and climate change for health adaptation strategic plan (2015-2018) and strengthening community collaboration on these issues.

Fiji's response to climate change impacts

Mr Esala Nayasi (Acting Permanent Secretary, Ministry of Foreign Affairs)

Let me start by thanking the Ministry of Health and Medical Services with the support of the WHO Division of Pacific Technical Support for organizing this very important symposium. In doing so, I also wish to congratulate these two agencies for effectively implementing the Fiji Protecting Human Health from Climate Change Project, which had been a great success for us. I wish to begin my keynote address this morning with this message by the UN Secretary General, Mr. Ban Ki-moon at the Climate Summit held in New York last year:

“Climate change is the defining issue of our age. It is defining our present. Our response will define our future. To ride this storm, we need all hands on deck.”

“Climate change is the defining challenge of our era”

Climate change impacts all sectors of our economy and is a threat to sustainable development. The recent Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report tells us that “Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen”. In Fiji, we have experienced this first-hand. We have noticed that as the sea levels continue to rise, more and more people are forced to leave their homes to move to higher grounds. These people that are on the verge of losing their land implement and improve basic public health measures such as provision of clean water and sanitation, secure essential health care including vaccination and child health services, increase capacity for disaster preparedness and response and alleviate poverty. The human, environmental and financial cost of climate change is fast becoming much more difficult to adapt to. For these, the Ministry of Foreign Affairs continues to vigorously engage in the international and regional negotiations for a meaningful, universal climate agreement in Paris in December. At the same time, we are working closely with our partners, including WHO to mobilize the much needed resources and markets so we can urgently and adequately address climate change effectively here in Fiji.

“Our response will define the future”

At a country level, in 2012, we launched the National Climate Change Policy. The policy provides a platform for coordination among sectors, and direction on national positions and priorities regarding climate change mitigation and adaptation. It is clear in this policy that we all have a part to play in our efforts to combat the impacts of climate change. For this reason, I hope that this symposium will provide you the opportunity to exchange views on this and identify solutions that will improve public health intervention to reduce and mitigate climate change and its health effects. We are working very closely with communities to assess impacts of climate change and to advise on possible adaptation solutions. We are doing our best to increase awareness on the issue, which we believe to be crucial at all levels. It is critical for us to engage and share resources to create a well-informed society. This will reduce our vulnerability and increase our resilience. And I believe that symposiums such as this could be an effective tool for this purpose.

“To ride this storm we need all hands on deck”

Today, I voice a humble plea requesting the collaboration and cooperation of all climate change stakeholders and development partners. We must work together to create resilient communities. Perhaps we could begin by sharing knowledge, resources and further commit to continually build the capacity of our people to better respond to the changes in our physical environment they call home. Losing their critical basic necessities and infrastructure, culture, identity and traditional knowledge, this is no longer a news story. It is real, and it is happening now. Ladies and gentlemen, we often ask that question – what does the future hold for our children? Will they have land to live on? Will they have land to plant on for their sustenance? Will they have safe and clean drinking water? To project the future, we need to understand and address what we are currently facing now. In Fiji, we already have three community relocation projects in the last 3 years; at Vunidogoloa in Vanua Levu, Narikoso in Kadavu and Denimanu village on Yadua Island in Bua that are supported by the Fijian government. The next state sponsored project will be Waciwaci District School in Lakeba, Lau. Having conducted extensive vulnerability and adaptation assessments at community level, statistics collected from both the Ministry of Itaukei Affairs and the Climate Change Division revealed that around 800 communities in Fiji have been impacted by climate change. Of these, a projected 45 communities will have to be relocated in the next 5 to 10 years. These are coastal communities from the maritime islands and those who inhabit our major river banks.

“Allow me to speak on key health concerns and vulnerability to climate change”

Fiji's climate is expected to become warmer, dry seasons to become drier, wet seasons wetter and the intensity of tropical cyclones to increase. Together, these will cause health impacts to increase and threaten the wellness of Fiji's population. Climate change and the associated temperature rise are expected to impact dengue-fever by increasing the frequency of epidemics. Diarrhoeal disease may become more common if Fiji becomes warmer and wetter, and if droughts and tropical cyclones occur more frequently, disrupting water supplies and sanitation systems. Nutrition-related illnesses are most likely to be affected by increases in frequency and/or magnitude of tropical cyclone and drought events. Climate change affects food security thus affecting livelihoods. This has an impact on Non-Communicable-Diseases. I must emphasise that the health of our population is sensitive to shifts in weather patterns and other aspects of climate change. And the most effective measures to reduce vulnerability in the near term are programmes in reiterating the words of the UN Secretary General Ban Ki Moon, *“Climate Change might be defining the present, however it is in our visible hands-on deck commitment toward riding this storm out, that defines us all as people who share a common humanity”*. The Fijian Government remains committed to helping its people ride the storm, and is grateful to you for your ongoing support in helping chart the way to a better future. I wish you well in your symposium and I trust that it will be successful. And I thank you for providing you for providing me this opportunity to speak to you this morning.

Global and regional climate change

Dr Elisabeth Holland (Director PaCE SD, University of the South Pacific)

The UN Framework Convention on Climate Change (UNFCCC) entered into force in 1992 and soon later the Kyoto Protocol was formed to establish an enabling environment to reach the global goal of reducing CO₂ emission. However, we still launched ourselves onto trajectory now to increase CO₂ emissions which is the underlying cause of climate variability and change: reported that CO₂ emission rose by 2.5%. If it continues to rise by this much each year, there will be at least 5 degrees warming. Given climate variability and change is unequivocal, understanding the backdrop of the current structure seems to be emphasized.

As a number of data and quantitative information come out from IPCC support, there is no doubt that climate variability and change has a close correlation with increase in global temperature. Series of unprecedented climate events and natural disasters threatening many people in vulnerable areas have been observed since 1950; it has become warmer than any preceding decade since 1980. Sea level rise is a huge concern as well, given that 20cm-rise in global sea level since 1700s, no wonder that we will have another meter of sea level rise by the end of 2100.

Taking advantage from this symposium as a venue to build partnership between the Fiji government and WHO to address the health issues in Fiji under climate change, the role of leadership has to be paid more attention as a choice we have: the leadership of the Pacific Island Countries and Territories as well as

that of the Fiji government. With this leadership we could choose which of trajectories of temperature rise we wish to have. If we want to keep temperature rise

“This is why Fiji’s leadership is so important, and coming together is so important.”

below 2 degrees, the globally agreed upon amount, we have to have 50% reduction in emission by 2030 and by the end of this century, our emissions have to be negative. We have to be taking more CO₂ out of the atmosphere than today.

It is all about water and fresh water availability. It is also about how much water we are able to drink. So as the South Pacific Convergence Zone changes location or we establish ENSO (El Niño Southern Oscillation), like we are moving into right now, we are talking about changing our water availability. Our wet seasons will become wetter; our dry seasons will be drier. Fiji sits right on the edge, which means any movement in South Pacific Convergence Zone has an impact. In this context, as a service provider of the global climate framework for Fiji and other Pacific regions, Fiji Meteorological Service (FMS) needs to play a role based upon partnership and coordination with health and foreign affairs.

The WHO project implemented with the Fiji government is an excellent example of the one that we need to be seeing as we move forward in the execution of the global framework of climate services. What matters are how we develop, distribute and use scientific information in an appropriate manner to assist planning of projects or programmes.

State of emergency was declared two years ago where some islands had to deal with 18 months drought. There is no fundamental solution, but it is clear that we need to consider not only adaption; also mitigation – shifting to renewable energy or sustainable transportation to reduce emission during the whole development processes. Pacific leadership is critical in setting an enabling environment for a better tomorrow.

Commitment to 50% decrease in imported fuel is a good example of the leadership. Papua New Guinea has committed to decrease CO₂ emissions by 50% by 2020, Solomon Islands by 100% by 2020, Federated States of Micronesia committed to a 50% decrease of imported petroleum fuel, and Tuvalu will use 100% renewable energies by 2020. But in contrast, Australia has committed to a 5% reduction. Canada withdrew from the Kyoto Protocol in 2011 because their emissions were far beyond initial commitment. The EU will possibly reduce emissions by 20-30% and New Zealand by 5%. It shows a clear contrast between Pacific leaders' commitments and the key governments of the region. In addition to focusing on finding solutions, we are looking at

building capacity and training Pacific climate leaders. Leaders should help communities build community driven climate change resilient model

“Solution requires unprecedented collaboration from communities to world leaders.”

considering diversity of their culture and convention. With long-term relationship with villages, we believe that there are already right approaches here in Pacific.

In total, we are working with 130 communities in 15 countries. This means communication is one of the key components to share challenges along with lessons learned from failures or successes. In Fiji alone, we've done three different water projects and carried out training projects for ambassadors in the region. Assuming that these efforts would be a great asset to pave the way, we need to keep in mind that the three hulls: culture, science and wisdom will provide sail for the future.



3. Piloting Climate Change to Protect Human Health (PCCAPHH)

Piloting Climate Change Adaptation to Protect Human Health (PCCAPHH) in Fiji

Dr Rokho Kim (Environmental Health Specialist, WHO)

Since 1989, WHO has been working with partners to identify and estimate potential health impacts of climate change. According to the comparative risk analysis report of 2004, an estimated annual 140,000 deaths occur around the world due to malaria, diarrhoea, malnutrition and extreme weather events aggravated by climate change.

In 2008, the ministers of health and their delegates of WHO members states adopted a resolution on Climate Change and Health at the World Health Assembly (WHA). The WHO Western Pacific Regional Committee in Manila endorsed the *Regional Framework for Action to Protect Human Health to the Effects of Climate Change in the Asia Pacific Region*. These resolutions emphasized raising awareness, assessing vulnerability and develop national strategies and plans to manage climate-related risks. The health ministers of all Pacific Island Countries met in Papua New Guinea in Madang in 2009 and agreed to work with WHO to assess vulnerabilities, plan regional response of adaptation measures and ensure coordinated, regionally relevant responses (called “Madang Commitment”).

“Health is sensitive to climate. Climate and weather have been known to affect human health since ancient time of Hippocrates. Tropical diseases distribution and transmission are affected by climate and weather, particularly vector-borne diseases.”

Following up Madang Commitment, WHO implemented the Vulnerability Assessment and Adaptation Capacity (V&A) project with PICs since 2010. The project identified health issues that can be influenced by climate change, and developed national action plan in 11 PICs (Federated States of Micronesia,

Republic of Marshall Islands, Palau, Kiribati, Tonga, Tuvalu, Cook Islands, Niue, Solomon Islands, Vanuatu, Nauru). WHO will present the outcomes of the project in a synthesis report titled *Human Health and Climate Change in the Pacific Island Countries* that will be published in 2015. WHO has also collaborated with Fiji Ministry of Health and Medical Services in the *Piloting Climate Change Adaptation to Protect Human Health (PCCAPHH)* Project together with partner countries (Barbados, Bhutan, China, Jordan, Kenya and Uzbekistan). The achievement and lessons learnt from this five year project are presented in this presentation. WHO and UNDP are currently preparing a new project *Building resilience of health systems to climate change* project with the support of the Least Developed

Countries Fund (LDCF) of the Global Environment Facility (GEF). This five-year project will benefit the governments of Kiribati, Solomon Islands, Tuvalu, and Vanuatu.

Weather also affects the risk of food-borne and water-borne diseases and emerging infectious diseases. There is a well-established association between weather and mortality from cardiovascular, respiratory disease & other non-communicable disease (NCDs). An example is the heatwave that hit Europe in 2003 causing 70,000 extra deaths.

Each year 3.5 million people die because of under-nutrition, diarrhoea is the cause of 2.2 million deaths and malaria kills 900,000 people yearly. These are climate-sensitive diseases. Extreme weather events are the reason for 60,000 deaths and dengue fever for over 50 million infections and around 15,000 deaths per year. Regarding dengue fever, climate change will reduce the incubation period of the dengue virus from 12 days to 7 days. PICs are seeing more frequent and severe outbreaks of dengue fever, chickungunya, zika virus, and other vector-borne diseases in recent years. All of these burdens of disease are aggravated by climate change. WHO estimated that the climate change that has occurred since the 1970s and already kills over 140,000 annually.

The WHO-UNDP-GEF Project on Piloting Climate Change Adaptation to Protect Human Health (PCCAPHH) in Fiji Islands aims to enhance the capacity of health practitioners in Fiji to respond to CSDs with the following 3 outcomes.

- **Outcome 1:** A climate-based early warning system is providing timely and reliable information on likely outbreaks of CSDs at pilot sites.
- **Outcome 2:** Strengthen capacity of health sector to respond effectively to CSDs, based on early warnings provided.
- **Outcome 3:** Health adaptation activities are piloted in selected vulnerable sites in Ba and Suva.

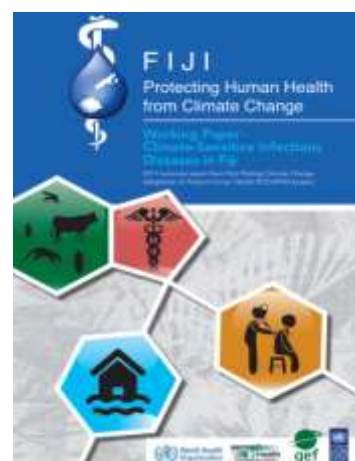


Figure 1. PCCAPHH working paper

The key achievements of PCCAPHH project in Fiji are: (1) climate change adaptation work introduced to the health sector, (2) awareness raised among the health ministry leaders on health impacts of climate change and adaptation options, (3) climate and health data inter-linked to develop prototype of early warning system, (4) health aspects included in the Fiji National Climate Change Policy and the 2nd National Communication, (5) the National Notifiable Disease Surveillance System (NNDSS) improved, (6) Fiji National University

Environmental Health curriculum reform supported to reflect climate change and health, and (7) community adaptation activities piloted through the Fiji Red Cross Society. The lessons learned are (1) the need to build the individual and institutional capacity to conduct statistical analysis and modelling of an early warning system, (2) lack of timely, accurate and reliable surveillance data delaying timely intervention for prevention, (3) uncertainties about the effectiveness of the community adaptation activities in preventing climate-sensitive diseases and (4) the importance of health sector leadership and coordination role in the centre of national climate change actions. Future directions are suggested (1) to generate an evidence base for policymakers, through a comprehensive surveillance system and health information system and health impacts assessment including non-communicable diseases and mental illnesses, (2) to build a “climate-resilient health system” based on systems approach which includes electronic medical records, telemedicine, and climate-proofing of hospitals, (3) to adopt a multi-sectoral approach to implementing post-2015 sustainable development agenda which includes water, food, energy, disaster, meteorological services, and (4) to prioritize vulnerable groups and remote communities for the health equity. In conclusion, PCCAPHH project was an important first step of the health sector response to the climate-related health risks, strengthening the adaptation capacity at the central and local governance in Fiji.



4. Studies of Climate Change and Health in Fiji

Review of and lessons from recent dengue outbreaks in Fiji


Dr Domyung Paek (Consultant, WHO)

Early warning system for climate change sensitive health outcomes should be an important tool for effective health adaptation. However, having and making early warning system effective requires far reaching feedback from climate monitoring to health effect identification and management. This presentation tries to contribute to the initiation of effective feed-back from weather to health in Fiji by reviewing the last dengue outbreak during 2013-14 period in terms of where it started, how it had spread, and ultimately what weather condition had contributed to it during 2013.

Laboratory test results compiled by National Laboratory of Fiji (Mataika House) during the outbreak of 2013 to 2014 was analysed together with national metrological data from 1990 to 2014. Based on laboratory test result log from 2013 September, sudden increase in dengue cases was noticed first in Central division, then in Western division. However, the spread of dengue from Suva to Nadi during the early period of outbreak in 2013 was unlikely to be explained by the spread from person to person via mosquito. When the age and sex composition of early dengue positive clusters during the outset of 2013 outbreak was examined, the excess representation of men, 30-40 years old, was noted, possibly representing the mobility of those cases in early cluster spread.

"When the spread of dengue in Suva was analyzed separately for its subdivision, more than a 10 fold difference in incidence was noted for different localities even though localities can be regarded as a same metrological place, possibly representing different vulnerabilities of the region."

The metrological data of maximum temperature, minimum temperature, monthly rainfall, and relative humidity was divided into two periods, those years without any epidemic, and the others with epidemic, and then the monthly average was compared. Three epidemic years were identified, July 1997 to June 1998, July 2002 to June 2003, and July 2008 to June 2009 based on historic dengue report. When data during epidemic years was compared with those without epidemics, only minimum temperature showed consistent differences before the outbreak in later half of years. For the data of 2013, minimum temperature showed a clear and wide difference from the average of non-epidemic years, while monthly rainfall and relative humidity showed no such differences. Based on this observation, no epidemic is expected for 2015 even though the exact underlying mechanism of epidemic from higher



minimum temperature is not known yet. Further research is needed to examine local are specific weather changes and link them to vector, immunity, behaviour, and disease occurrence for each region.

This whole exercise revealed that improvement in feedback is needed in every aspect of disease report, laboratory notification, vector monitoring, and weather forecast in Fiji. This will be accomplished by paying more attention to problem solving process and outcomes of climate sensitive health effects.

Dengue and Climate Change: Exploring the relationship and risks in Fiji

Ms Kelera Oli (PCCAPHH Project Coordinator, Ministry of Health & Medical Services and WHO)

Introduction

Climate variability and change in Fiji cause severe disasters as a result of droughts, floods or tropical cyclones. A major impact from these disasters is seen in the health sector where there is an observed increase in hospital admissions and treatments from injuries and infectious diseases such as diarrhoea, typhoid, dengue and leptospirosis. There is also an influx in malnutrition and stress related ailments. Dengue is identified as one of the four important climate-sensitive diseases in Fiji (Piloting Climate Change Adaptation to Protect Human Health, 2012). The other three important climate sensitive diseases are diarrhoea, typhoid and leptospirosis.

Dengue

Dengue is prevalent in urban settings but also observed in the rural areas of tropical and subtropical regions (Hales et al., 1999). The disease had increased thirtyfold in the last fifty years with an estimated 50 million cases occurring annually (WHO, 2009b). However, there is no effective vaccine or drug to treat dengue but proper case management and good clinical outcomes save lives (Hales et al., 2002; WHO, 2009b).

The 1997/98 epidemic which occurred during a severe drought period relating to the El Niño event recorded 24,000 cases, 17,000 hospital admissions and 13 deaths (de Wet & Hales, 2000). Local climate changes associated with ENSO affects dengue occurrence by causing changes in household water storage practices and surface water pooling (Hales et al., 2003). It is further confirmed that between 1970 and 1995, the annual number of dengue epidemics in the South Pacific was positively correlated with La Niña conditions (i.e. warmer and wetter) (WHO, 2003; Hales et al., 1999). The aim of this study therefore is to explore the links between dengue incidence and climate variability and change in three localities in Fiji. This study analyses existing data on dengue incidence and temperature, humidity and rainfall from 1996-2010 for the three selected subdivisions of Ba, Lautoka and Nadroga.

Study sites and methods

The districts of Ba, Lautoka and Nadroga were selected because of the consistent and high number of dengue cases reported particularly during epidemics. Data sources include; hospital data (confirmed -positive dengue cases); Climate data (temperature, rainfall and humidity - FMS); Questionnaires, interviews and observational surveys - case study

communities. The climate data for the study areas was provided by the Fiji Meteorology Services after following their approval protocols. Data, recorded in the months for the required period, was sent through electronically in Excel.

Relationship between climate and dengue

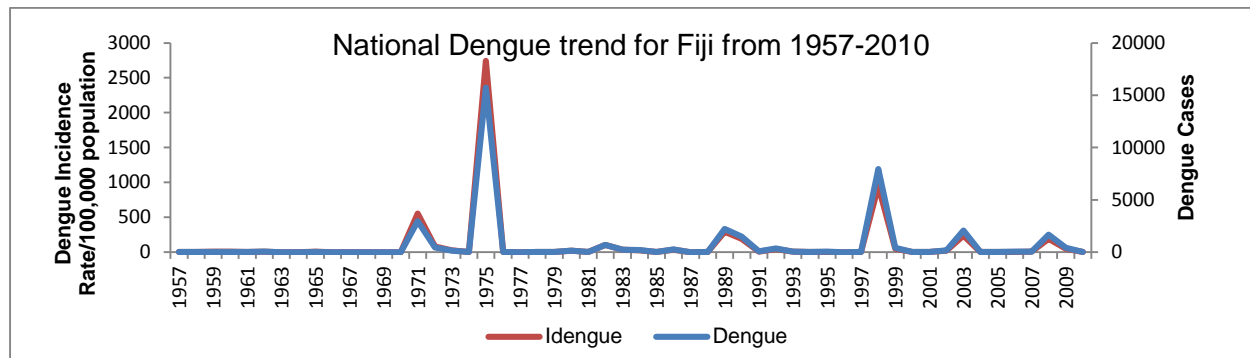


Figure 1. National Dengue trend for Fiji from 1957-2010

The national dengue trend from 1957-2010 shows a significant decline in the number of dengue cases for the progressive epidemic periods. The dengue incidence rate is proportional to the national dengue cases implying that the impact of the epidemic on the given population is the same. Figure 1 indicates that the episodes of the epidemics were occurring at an interval of four to nine years.

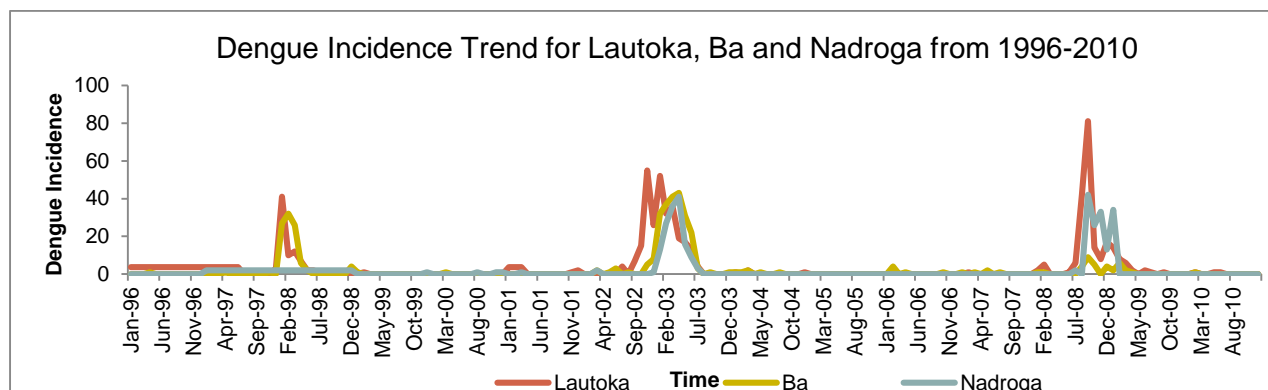


Figure 2. Dengue Incidence Trend for Lautoka, Ba and Nadroga from 1996-2010

Figure 2 shows that the three peaks of dengue epidemics are similar in 1998, 2002/03 and 2008/09 for the three study sites except for Nadroga, 1998 (missing data). The total number of confirmed dengue cases in this study from 1996 to 2010 is 1,279: 391 for Ba; 586 for Lautoka and 302 for Nadroga. The total number of dengue cases for the country for the same period is 12,867 indicating a 10% contribution of dengue from the three study sites.

Fifty-three percent of those who had dengue in the fifteen-year study period from the three study sites were Fijians of Indian descent; 41% were indigenous Fijians and 6% belonged to other Fijian or minority ethnicities. In comparison to the 1989 epidemic, the national surveillance data revealed that there were more indigenous Fijians (64%) than Fijians of Indian descent (31%) and the rest were from other minority ethnic groups (Andre et al., 1992). There were more males than females affected and the highest number of dengue patients was from the age of eleven to twenty closely followed by those aged twenty one to forty years. The trend shows that the very active and younger age-groups are more vulnerable than those in the older age demographics. Results of this study indicate that the population below the age of forty has a higher risk of contracting dengue particularly during an epidemic.

Dengue cases are being recorded in the months that display higher temperatures. Temperature (ambient) is one of the key climate components contributing to dengue epidemic risk in Fiji (de Wet and Hales, 2000). Dengue outbreaks are determined by the presence of a vulnerable individual, the dengue virus and its vector mosquito which are temperature dependent (WHO, 2003; Patz et al., 2005). Ling Hii et al. (2009) explained that aedes mosquitoes have shortened reproduction rates at higher temperatures of 32°C and their feeding rate is doubled as compared to lower temperatures of 24°C. Focks and Barrera (2007) explained that the mosquitoes become infective earlier than usual and bite more frequently, increasing the rate of dengue virus transmission as the gonotrophic cycle (reproductive-feeding cycle) are shortened due to higher temperatures.

In Nadroga, the association was observed for dengue incidence and rainfall concluding that there were more cases of dengue during the period of high rainfall. This finding is similar to other studies including Chen et al. (2010) who concluded that warmer temperatures (with a three month lag) contribute to increased rates of dengue fever transmission in Southern Taiwan. Moreover, Chowell et al. (2011) confirmed that the highly persistent and large outbreaks in Peru occurred most frequently during the heavy rainy season, when favourable environmental conditions promoted vector development. Rainfall, by itself, is not a useful predictor of epidemic risk, but the abundance of breeding sites, which is important in terms of adaptation to climate change (de Wet and Hales, 2000).

This study found humidity to be showing very little variation and similarly for its impact on the studied dengue incidences. There was variability in humidity before and during the three epidemics in the study period.

Conclusion and recommendations

Climate projections for Fiji have shown that the country's climate will continue to change. The temperature in Fiji will continue to rise by at least an estimated range of 0.4-1.0°C by 2030 (ABM and CSIRO, 2011; GRF, 2012). There would be more very hot days and warm nights and a decline in cooler weather. It is predicted that extreme rainfall days are likely to occur more often in Fiji. This study has shown how climate influenced the dengue incidence in Ba, Lautoka and Nadroga citing literature of mosquitoes' dependence on climate in the crucial periods of reproduction, maturation and survival.

“Therefore, it is essential that public health infrastructure is strengthened to combat the threat of climate change and its impact on dengue incidence.”

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Pacific students' knowledge & research on climate change and health

Mr Inia Valemei (Lecturer and Environmental Health Programme Coordinator, Fiji National University)

The Environmental Health training was originally designed by the University of Western Sydney, Hawkesbury with financial support from the WHO in the late 1980s. Today, the Bachelor in Environmental Health programme being offered at the FNU College of Medicine, Nursing & Health Sciences has 22 courses. There are currently no specific courses on Climate change and health, but elements are covered in the other courses such as contributing factors, impacts, mitigation and international protocols. Students in their third year are given the freedom to write a research proposal on a topic of their choice. A few years back, they were also required to implement their research to test how they apply knowledge gained into a real world problem. In this they were given minimal supervision by members of the Faculty.

Studies conducted by three students give us some valuable lessons on effects of climate change and health. First is a research by Mr. Francis Hicking from the Marshalls on the impact of sea level rise on ground water. In 2008 a King Tide event took place on Majuro in the Marshall Islands with visible surface impacts. His general Objective was: to identify the impacts of sea level rise

on ground water in Laura area in Majuro. The student carried out his research on the Laura island from 7 different

“The student’s research question was:

“Does sea level rise affect the ground water quality in the Majuro, Marshall Islands?”

boreholes. Each borehole

has a depth that ranges from 15-18m. Results showed that salinity levels from 2000 to 2007 had below 0.5ppt whereas in 2008 the level was 2.4ppt. Like salinity, conductivity level in 2000 to 2007 was merely around 0.5 and 1.5, however it rose up to 4.5 in year 2008. The EPA Standards for Conductivity is 1000 $\mu\text{S}/\text{cm}$ (= 1 mS/cm). Total dissolved solids level was low in the year of 2000 at 0.3. Levels were below 0.5 g/l until 2008 when it rose up to 2.3. EPA standard for TDS is 500mg/L (= 0.5 g/L). Fresh water typically ranges between about 100 and 500 mg/L TDS. Total coliform was confirmed from all the seven different boreholes in Laura. From 2008 to 2010, the level of Total coliform fluctuated and borehole six indicated the highest count in year 2011. The study showed a significant increase in salinity, conductivity, and total dissolved solids during king tide events. Significant levels of *Total coliform* and *E.coli* were also found in the samples analysed from the seven different borehole sites located in Laura indicating infiltration. Parameters measured showed levels

beyond the EPA drinking water standards and therefore not safe for consumption purposes without treatment.

The second researcher was Josefa Tabua, a student from Fiji who explored the research question:

“Does the variation in weather patterns have any effect on the incidence of Dengue in Fiji?”

His general objective was to determine if there is an association between the incidence of dengue in Fiji and the variation in weather patterns, specifically, rainfall /precipitation, rel. humidity and temperature. His research showed a **moderate association** between precipitation and dengue cases from 2007 to 2009. It suggested that an **increase in rainfall may also increase the incidence of dengue cases**. Lessons learned were 1) Insufficient data (dengue) to establish a correlation between weather variables and dengue incidence from 2003-2006, 2) Recording of dengue cases did not include date of onset & EXACT residential address of known cases, 3) Thus it was difficult to pinpoint exact locations on GIS maps.

GIS Mapping – Dengue cases (count) by province

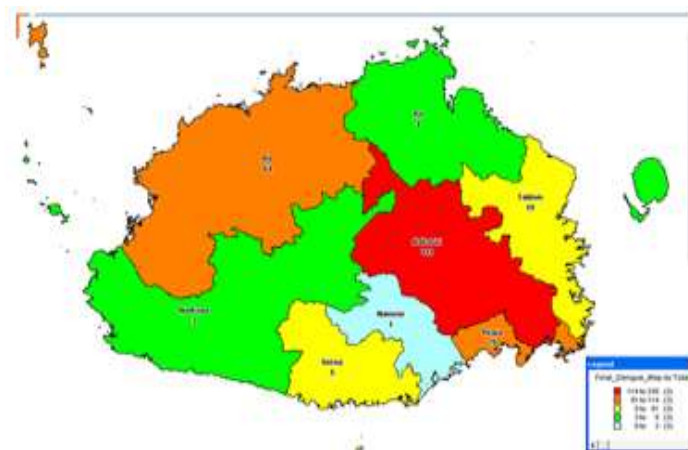



Figure 1. provinces in the central & western divisions exposed to dengue infections (2003-2010)

The third study was conducted by a student from Kiribati who carried out *an ecological and epidemiological survey in Kiribati*. Variables chosen were E.coli, residual chlorine and diarrhoea.

“He wanted to establish the relationship between the quality of drinking water and the incidence of diarrhea to children under 5 years old in South Tarawa, 2008 – 2010.”



His findings were 1) Weak association between incidence of diarrhoea and the water quality variables chosen, 2) Missing data – hospital records and water sampling data, and 3) Infantile diarrhoea could be due to other causes. These studies highlighted importance of proper surveillance data so that useful research can be done.

What is the future for CMNHS with respect to climate change? 1) New programme and curriculum are being developed with courses on Climate & Health, 2) Development of GIS capability, 3) Use of climate specialists by visiting professors from all over the world, with WHO support and 4) There is plan also for Bachelor of Environmental Health Honours (4yrs), Mater of Environmental Health and eventually PhD in Environmental Health.

Fiji's current climate variability, climate change and future projections

Mr Ravind Kumar (Principal Scientific Officer, Fiji Meteorological Service) and Ms Arieta Daphne (Scientific Officer, Fiji Meteorological Service)

Fiji experiences generally a warm, humid oceanic tropical climate. Orographic effect influences the amount of rainfall being received on the windward and the leeward side of the major islands. There are two distinct seasons in Fiji, a warm and wet season from November to April and cool and dry season from May to October. The major climate drivers are the South Pacific Convergence Zone (SPCZ) and the sub-tropical high pressure ridge, and the persistent trade winds. The others are troughs and fronts which influence our weather and climate from time to time. El Niño Southern Oscillation (ENSO) is one of the most important drivers of inter-annual variability in Fiji's climate. The El Niño (warm phase) and La Nina (cold phase) are two opposite phases of ENSO. El Nino is usually associated with cooler and drier than usual climate while the La Nina is associated with warmer and wetter climate. These events usually lasts for 9-12 months, however, some of the events have lasted up to 2 years. Since Fiji lies in the transition zone, the impacts of ENSO are not always uniform and no two ENSO events are the same, however, most of the events have some typical characteristics. They typically recur every 2-7 years. The SPCZ normally lies to the north of Fiji and migrates south during the wet season and moves northeast of its normal position in the dry season.

The presence of an ENSO event influences its position and during El Nino events, it is displaced further northeast of Fiji and further southwest of its mean position during La Nina events, closer to Fiji. The tropical cyclones are one of the most severe extreme events to affect Fiji. The tropical cyclone season starts in November and ends in April, but has also occurred in October, May and June. On average, about 1 to 2 cyclones affect some part of Fiji every season with the highest risk during El Nino season. There have been seasons when Fiji had no cyclone while some season had as much as 4 to 5 cyclones. Fiji usually experiences below normal rainfall during El Nino events. In fact, over 80% of past droughts in Fiji have been associated with an El Nino event. On the other hand, above normal rainfall is usually experienced over Fiji during La Nina events, elevating incidences of flooding especially during the wet season. Sea flooding is usually associated with the passage of tropical cyclones close to the coast. Heavy swells generated by deep depressions and/or intense high pressure systems some distance away from Fiji have also caused flooding of low lying coastal areas. At times, heavy swells coincide with king tides and cause flooding and damage to coastal areas.

Rainfall Trends: Rainfall data from 1961 to 2013 show no significant decreasing or increasing trend. However, there has been substantial variation in annual rainfall. The observed annual and seasonal trends in rainfall are as follows:

- a weak positive linear trend in annual rainfall (about 3.61mm/year);
- a weak decreasing linear trend in wet season rainfall(about 1.09mm/season); and
- a weak increasing linear trend in dry season rainfall (about 1.59mm/season).

Maximum Temperature Trends: Consistent with the global pattern of warming, there is significant warming in mean trend in both the annual and seasonal maximum and minimum air temperatures over Fiji. The annual maximum temperature has increased by 1.24°C, the warm season by 1.22°C and the cool season by 1.20°C over the 1960 to 2013 period.

Minimum Temperature Trends: Similarly the minimum air temperature records over Fiji have also increased. The annual minimum temperature has increased by 0.62°C, warm season minimum temperature by 0.71°C, and the cool season by 0.62°C over the same period.

Sea Surface Temperature Trend: The sea surface temperature in Fiji is recorded at Lautoka tidal gauge. The trend at Lautoka tide gauge shows an annual increasing trend of around 0.05°C/year. However, this data set is too small to give a realistic long term trend.

Sea Level Trend: The mean sea level at Lautoka tide gauge is changing at a rate of about 5.7mm/year, however the tide gauge data are insufficient to deduce any reliable long term trend.

Climate Projections: The projections are for all emissions scenarios representing low, medium and high. We do not know for certain what our future greenhouse and aerosol emission will be like. IPCC has developed a set a plausible emission scenarios based on expected future demography, economics, technology, among others. The projections are for three 20 year average periods based on 2030, 2055 and 2090 relative to the 1981 to 2000 average.

By 2030: The most likely projected change for Fiji is for *warmer temperatures and little change* in rainfall, with annual mean temperature increases of 0.7°C and negligible (–1%) change in mean annual rainfall, which is predicted by 69% of the models. *Warmer and drier* change in projected climate is predicted by 6% of the models, with annual mean air temperature increases of 0.6°C and annual mean rainfall decreases of around 6%. *Warmer and wetter* conditions are represented by 13% of the models, with annual mean air temperature increases of 0.8°C and annual mean rainfall increases of 7%. There is high

confidence that the temperatures, that is both the ocean and air temperatures, will continue to rise during the 21st century.

By 2055: The majority of the models (69%) continue to project *warmer temperatures and little change* in rainfall, with annual mean air temperature increases of 1.0°C and annual mean rainfall decreases of 1%. Moreover, *warmer and wetter* conditions are predicted by 19% of the models, with annual mean air temperature increases of 1.2°C and annual mean rainfall increases of 10%.

By 2090: The majority of the models (56%.) project *hotter temperatures and little change* in rainfall, with annual mean air temperature increases of 1.9°C and annual mean rainfall decreases of 1%. The other likely high impact projected climate is for *hotter and much drier* conditions, which is predicted by 6% of the models, with annual mean air temperature increases of 1.8°C and annual mean rainfall decreases of 16%. *Hotter and much wetter* conditions are predicted by 13% of the models, with annual mean air temperature increases of 2.3°C and annual mean rainfall increases of 21%. There is no clear direction as how ENSO will change in future.

“Direct impacts can be due to increasing temperature, rainfall variability, storm activity, while indirect impacts can lead to increase in spread of diseases, compromised food and water sources, psycho-social impacts, displacement and income loss.”

Implications to health sector: These can further lead to increased incidence and severity of vector borne, zoonotic and infectious diseases (e.g. dengue fever), increased food and water-borne diseases (e.g. diarrheal illnesses), increased injuries and longer-term consequences of extreme weather events, mental health, food and water security and malnutrition, increased cardiovascular respiratory and renal diseases.

Use of GIS in vulnerability assessment and disaster risk mapping

Ms Siu I Fanga Pouvalu (Junior Research Fellow, University of the South Pacific) and Dr John Lowry (Senior Lecturer, University of the South Pacific)

A Geographic Approach to Assessing Vulnerability to Climate Sensitive Diseases in Fiji

There is considerable evidence that quality of human health is related to a variety of social and environmental factors that vary over geographic space. Diseases known to be sensitive to variations in climate and weather patterns are of special concern in Fiji. This talk presents an approach using GIS data to develop an index of vulnerability to climate sensitive diseases. The framework follows the IPCC definition of vulnerability as a function of exposure, sensitivity, and adaptive capacity. Using national GIS datasets obtained from a variety of government ministries and other sources, the investigation attempts to integrate diverse geospatial information with the goal of characterizing regions in the Republic of Fiji Islands at the Tikina level, based on their relative vulnerability to climate sensitive diseases. In addition to a preliminary geographic vulnerability index, maps of incidence rates for Dengue Fever from 2013 and 2014 are presented. The effort is a work-in-progress and input from professionals in the public health sector and, other interested parties, is most welcome. One of the goals of this presentation is to highlight the value of sharing data to address multi-disciplinary issues affecting Fiji.

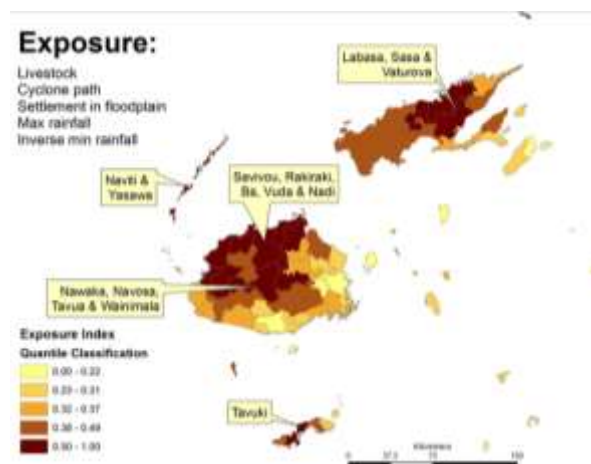


Figure 1. Map of incidence rates for Dengue Fever (2013-2014)

Community disaster risk mapping toolkit

It also has been structured to empower local people to identify alarming issues that may or may not be related to climate variation; better understand the causes of

“The main purpose of this Toolkit is to encourage direct community involvement in understanding and providing solutions to issues that threaten their livelihoods.”

these issues; their relationship to these issues; show areas, population and buildings that are at risk; highlight possible solutions and to better represent themselves to local governments and NGO's and/or seek further assistance.

The toolkit is designed to be used by anyone without a GIS background. This toolkit aims to enable local people to:

- Be able to identify and understand the risks and vulnerabilities that their communities are experiencing.
- Have the skills and knowledge to collect data of their own environment and create a database kept in their communities.
- Create hand drawn maps of all the assets and infrastructures, areas at risk, risks and vulnerabilities in their own communities.
- Transfer collected data onto a desktop and use QGIS software to highlight issues that their community is facing.
- Visually understand the risks they are facing and keep this knowledge within their communities and have a stronger position in representing themselves amongst government agencies, NGO's etc.

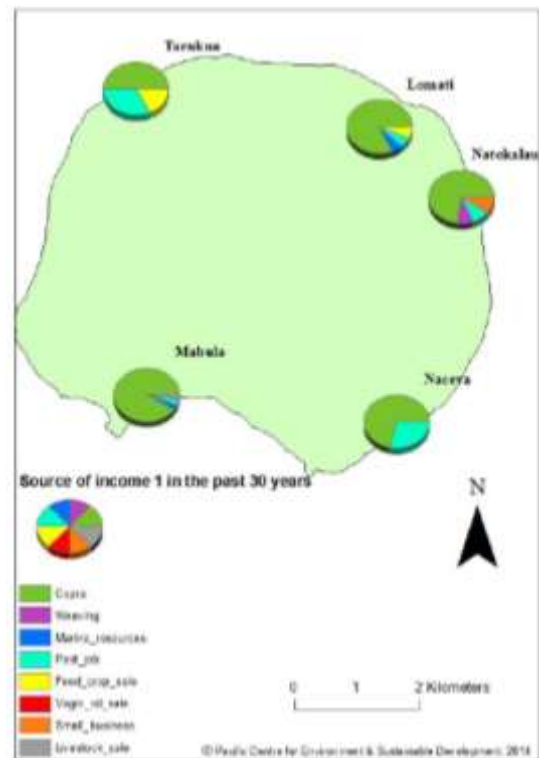


Figure 2. Example of community mapping

This toolkit consists of; the guide, video tutorials, QGIS 2.6.0 desktop software, Apache Open Office, VideoLAN media player, georeferenced google earth images of each community and shape files. The method and tools used in this toolkit is cheap, quick and effective. There are 20 chapters in this toolkit, Chapter 19 and 20 only apply to communities and people that have internet access. The first chapter introduces windows and basic operating a PC. The following chapters will then teach participants how to install and use the software and also through the basics of mapping.



5. Policy Options of Health Sector Adaptation

Evaluation of WASH kits during a hydrometeorological disaster

Mr Waqa Tikoisuva (National WASH Coordinator, Ministry of Health & Medical Services)

Introduction

The evaluation exercise was conducted conjointly between Ministry of Health and UNICEF Pacific. 189 WASH kits were distributed to 43 communities in the Nadi district that were affected by Tropical Cyclone Evans in December 2012-January 2013, as part of the water, sanitation and hygiene immediate support to the Fiji WASH cluster.

The UNICEF WASH Kits were distributed to the communities through the Environmental Health Unit (EHU) of the Ministry of Health (MOH), and in some cases it was distributed by district officers and public health nurses. At the same time, help kits that also included WASH items were distributed by Red Cross. The evaluation was planned between UNICEF and MOH from the beginning 2014. After months of planning and meetings, the evaluation actually started on 19 May 2014 and continued for 3 weeks until the 6 June 2014.



Figure 1. Content of the WASH kit

General objectives were to assess the efficiency and effectiveness of the UNICEF WASH Kits distributed to 43 communities in the Nadi District after Tropical Cyclone Evan in 2012.

Specific objectives were to (1) ensure better preparation and support after disasters in the future, (2) determine if the WASH kit materials were applicable to the affected communities, (3) identify gaps and make recommendations on ways for improvements, and (4) inform the necessary WASH partners on the results of the evaluation.

Methodology

Based on the records from the Ministry of Health, communities were identified prior to the evaluation. Given the vast distribution and inaccessibility of some of the communities, a convenience sampling method was used, where the most convenient communities were evaluated. A questionnaire was used to obtain information via mobile phones using a

software called Kobo Toolbox. Daily survey results were uploaded into a central filing system for the collation and analysis of data.

Outcomes

1. Reduction of timespan between disaster and distribution of WASH kits needs to be ensured, 2. To give clarification (esp. on Water Purification Tablets) during distribution is of vital importance, 3. In average two more water containers, three boxes of Water Purification Tablets, five pieces of soap, five packs of ORS, five sets of toothbrush and toothpaste and a first aid kits are requested to be included additionally in the kits, 4. IEC materials are helpful. Most people learned to boil water and to wash hands with soap, 5. For elderly people, access to health facilities is vital. Regarding disabled people in households, first aid and diapers were needed for babies. Overall, the recipients were appreciative of the assistance.

There were gaps identified in the evaluation relative to UNICEF's involvement in the WASH intervention in emergencies. Furthermore, no proper record was available with all WASH partners (UNICEF, MOH, District Officers, Commissioner's office, Red Cross) on the number of WASH kits and the receiving communities. Available records do not match with the record that MOH and UNICEF have. It was time consuming trying to consolidate the information. UNICEF's involvement in the distribution of its items (generally) is vital to take the lead role in monitoring the distribution plan, thus avoiding problem stated above. Additionally, the evaluation outcome reflects the level of coordination between the WASH Cluster and partners. Visual representation in emergency is also vital, to assist in the hygiene messaging and dissemination of correct information regarding the use of WASH kits. Adequate preparation is vital specifically when using mobile software tool for the activities. Another gap was that the evaluation was too long after the disaster occurred, so response may not be specific and be able to achieve the objective of the exercise.

Lessons Learnt

Important lesson learnt during the WASH Kit evaluation exercise were:

- One pre-test was not enough. Two or three pre-tests would be sufficient.
- Ensuring that the software is effective and working well during the evaluation.
- Phones needed to be charged on daily basis.
- Downloading of forms on daily basis. Supervisor needs to have a compatible laptop computer in order to do it.

- Improve record keeping and information management. Mapping is essential.
- Prior assessment needs to be done before an evaluation timeframe is allocated.
- Evaluation to be conducted at relevant time after the response period.
- Ensure proper training of the evaluators.

Conclusion

The exercise was the first ever conducted to assess effectiveness of UNICEF support to the Fiji WASH Cluster through the distribution of WASH Kits.

“The result shows positive responds from the communities relative to the assistance, with an indication that the assistance was vital and has positive implication on addressing WASH issues in emergency situations.”

Furthermore, it showed that the timespan between the disaster and the distribution of the kits needs to be decreased and that improvements of the content of the kits should be made. Also, clarification about the purpose of the intention of the WASH kits could be improved. The new technology made the evaluation and analysis easier, quicker and more reliable, although proper preparation and testing needs to be ensured prior to the assessment. The WASH Kit evaluation activity in Nadi provides the platform for similar activities to be carried out in other Pacific Island Countries (PICs) where similar assistance needs to be provided. Gaps and lesson learnt (as stated above) will greatly assist in future evaluations, and will help to improve UNICEF overall support in addressing water, sanitation and hygiene issues.

HEADMAP and the contingency plan for drought

Mr Kanito Lovobalavu (National Health Emergency Coordinator, Ministry of Health & Medical Services)

The objectives of the HEADMAP include the following:

- a. Minimize potential loss of lives and impact of disaster.
- b. Ensure prompt and appropriate disaster response.
- c. Achieve rapid and recovery and rehabilitation.
- d. Ensure provision of adequate resources.

The plan proposes to achieve the above - listed objectives by:

- a. Outlining the roles/responsibilities of specific bodies with disaster management.
- b. Indicating the roles of Ministry of Health division, other agencies, government departments in relation to natural and human generated disasters.
- c. Giving guidelines for operations and activities in relation to all stages of disaster management.
- d. Creating greater understanding of the disaster management arrangement that have been agreed upon with the Ministry of Health and with other national agencies.

Activities of the Health Emergency Unit:

- a. Capacity building: conduct of sub-divisional training on disaster management plans and awareness.
- b. Ensuring that health facilities and those who work there can manage disaster before national influence can be brought.
- c. Infrastructure: audit and up-standardizing of facilities and upgrading and equipping of Emergency Operation Centers.
- d. The developed SOPs for emergencies and disasters were distributed to stations and sub-divisions (SOP: Standard Operating Procedure).

The Health Emergency Unit requires support to be entirely effective in its services and the immediate needs include; the need for specialized training on disaster management; coordinated joint simulation exercise; better coordination among stakeholders with clear demarcation of responsibilities according to the SOPs. Fulfilling these activities paves way forward particularly with the provision of a separate budgetary allocation for unit upgrading with resources and manpower.

Knowledge, attitude and practices in relation to Dengue Prevention

Ms Alita Goneva (Climate Change Officer, Fiji Red Cross Society) and Ms Marica Kepa (Health & Care Coordinator, Fiji Red Cross Society)

The climate change and human health adaptation project is a unique initiative jointly implemented by the World Health Organisation (WHO) and United Nations Development Programme (UNDP). In Fiji the project is implemented by the Ministry of Health and Fiji Red Cross Society. The FRCS is the prime candidate for the implementation of Outcome 3 of the PCCAPHH project "*Disease prevention measures piloted in areas of heightened health risk due to climate change*". The three outputs to be implemented by FRCS are:

- a. Community members are well informed of the impacts of climate change in their communities.
- b. Community members practice Climate Sensitive Diseases (CSDs) prevention and seek early medical advice.
- c. Community is well prepared to counter adverse health effects due to climate change.

Designing and implementing effective adaptation strategies to prevent diseases that are sensitive to climate is a pressing challenge in Fiji, and one which requires in-depth understanding of the ways in which Fijian communities are vulnerable to climate-sensitive disease. In 2012, the Fiji Red Cross Society (FRCS) conducted a Vulnerability and Capacity Assessment (VCA).

The Vulnerability and Capacity Assessment (VCA) survey sought information from 1,754 households in the ten project pilot sites in the west and central subdivisions in Fiji ('Ba sites' and 'Suva sites' respectively). Households were surveyed about vulnerabilities and risk factors in relation to water and sanitation, shelter, food hygiene, waste management and drainage that are relevant to climate variation and hydro-meteorological disasters (HMDs). The VCA also



Figure 1. Fiji Red Cross in action

sought information about conditions and practices that relate to the transmission and prevention of the four communicable, climate-sensitive diseases (CSDs) identified by the Fiji Ministry of Health as priority: dengue fever, diarrhoeal diseases, typhoid and leptospirosis.

The data collected was analysed through epi info software program and plan activity was recommended based on the analysed findings. Continuing on from the VCA findings FRCS has developed and conducted the following adaptation activities:


- a. Training Manual for FRCS Climate Change Champions
- b. Community Change Tool Kit
- c. Eight sets of Climate Change Posters on CSDs
- d. A Training of Trainers (Climate Change Champions) for the ten pilot communities on how to use the Manual and the Tool Kit
- e. Clean-up campaign in all sites
- f. Installation of Incinerator and Rubbish Separation
- g. Training of Climate Change Champions from all pilot communities on First Aid
- h. Provision of First Aid Kit to all ten communities
- i. Ongoing advocacy by the Climate Change Champions in their respective communities

Dengue as an identified CSD, Fiji Red Cross assists Ministry in the fight against dengue by conducting house to house advocacy, distributing IEC materials and assist in clean-up campaign during the 28th February, 2014 dengue outbreak.

Dengue campaign is a project funded by the Australian Red Cross Society and the New Zealand Red Cross Society with the aim of reducing incidence rate of dengue fever. The campaign was conducted by Red Cross Branch volunteers from around 13 Red Cross Branches, where it starts off with a training of trainers to capacity build volunteers in order to create awareness focusing on the three key messages. Red Cross also assists in strengthening vector control, assisting larvicide treatment and source reduction activities through the clean-up campaign.

“General findings of the Rapid assessment indicate a high level of basic specific knowledge on dengue which was clearly seen in interviewee correctly identifying the signs and symptoms of dengue.”

FRCS conducted a rapid assessment on Knowledge, Attitude and Practice (KAP) of communities that have been reached. It sought to examine the picture of current KAP status of community members, further allowing evidence based programme that will assist FRCS in the development of a Standard Operation Procedure for any future outbreak



of communicable diseases including dengue. The assessment was conducted amongst 180 household of the 10 Climate Change project sites across Suva and Ba by 20 Red Cross Branch volunteers.

On general practice community members acknowledge medical intervention is vital for the cure of dengue rather than other practices and that the IEC Materials and house to house advocacy were the common modalities reported to be helpful in ensuring community members' retained the information about dengue.

The rapid assessment reports a positive and successful outcome of the Climate Change project activities that was carried out by FRCS branch volunteers and trained community based climate change champions before and during the dengue outbreak and that consistent health promotion messaging through IEC materials and house to house advocacy by FRCS volunteers accompanied by on-going MOH health promotions on media were effective in the knowledge retention on dengue.

It is recommended that FRCS continues in the manner it has been delivering the dengue preventative measures through house to house advocacy that will contribute to the programme successes in the 10 Climate Change communities.

How vector control is planned and implemented in Fiji

Mr Elia Lawena (A/Senior Health Inspector, Vector Control and Quarantine, Ministry of Health & Medical Services)

The global effects of climate change on infectious diseases have been widely documented and inevitably, would contribute to the spatial distribution, the timing, the frequency and the intensity or severity of vector-borne diseases (VBD) in Fiji.

The increased threat of VBD is mainly due to the direct effect of climate change on the viremic development of pathogens in vectors (thereby increasing its infectivity), higher adaptability of vectors, the dynamics of the disease (contact rates) and the indirect effects of climate change on other disease drivers.

Currently, the south pacific region is experiencing a surge in a number of different types of vector-borne diseases that were never being heard of, in years past. These includes concurrent outbreaks of Dengue Fever in Fiji, which is spread primarily by *Aedes aegypti* and *Aedes albopictus*, outbreaks of Chikungunya and Zika virus in Kiribati, Samoa, and Tonga, which is also spread by *Aedes aegypti* and *Aedes albopictus*, continued incidences of Filariasis throughout the region (including Fiji), mainly by *Aedes polynesiensis* and the continued burden of Malaria in Vanuatu, Solomon Islands and Papua New Guinea, which is solely driven by the *Anopheles* mosquito.

“The combined effects of climate change and Fiji’s central position on trade to these affected countries, directly increases the chances of importing other viruses and its vectors to Fiji.”

Dengue fever, on the other hand, is a major public health burden in Fiji and one that continuously challenges our health system because of its huge cost for clinical management, public health control interventions, vector and disease surveillance, risk communication and for social mobilization. Outbreaks of dengue fever in Fiji have a seasonal presentation and mostly affect urban & peri-urban communities in the country. The last published outbreak was the one in 2009, even though we have had subsequent outbreaks in 2011, 2013 and 2014.

VBD preparedness & response

Fiji has chosen to approach these threats of vector-borne diseases, particularly dengue fever, through the implementation of 3 key strategic documents. These include the *Communicable*

Disease Surveillance and Outbreak Guidelines (2010), the *Dengue Fever Strategic Plan (2010-2015)* and the *Dengue Fever Vector Control – Standard Operating Procedures (2014)*.

The ‘operationalization’ of these documents allows Fiji to prepare and respond to the dengue situation at pre-outbreak, during the outbreak and at post-outbreak periods. The implementation of strategic activities are conducted by the *Subdivisional Outbreak Response Teams (SORT)* and the *Divisional Outbreak Response Teams (DORT)* at district and divisional levels, aligned to the Disaster and Management Plan of the respective district or division. Depending on the magnitude of the dengue situation, the response level may be elevated to trigger the activation of the Health Emergency and *Disaster Management Action Plan (HEADMAP)*, if the situation develops beyond levels that are not compatible with the resources and expertise in the divisions. It is, upon the declaration of a Public Health Emergency, under the HEADMAP, that the National Coordinator for Public Health Emergency, within the Ministry of Health, takes over. If the situation worsens, the command is then, elevated to the National Disaster Management Officer, upon the activation of a National Emergency, through the *National Disaster Management Plan*. Figure 1 shows how the responses link to each other at different levels within a dengue fever (or VBD) situation.

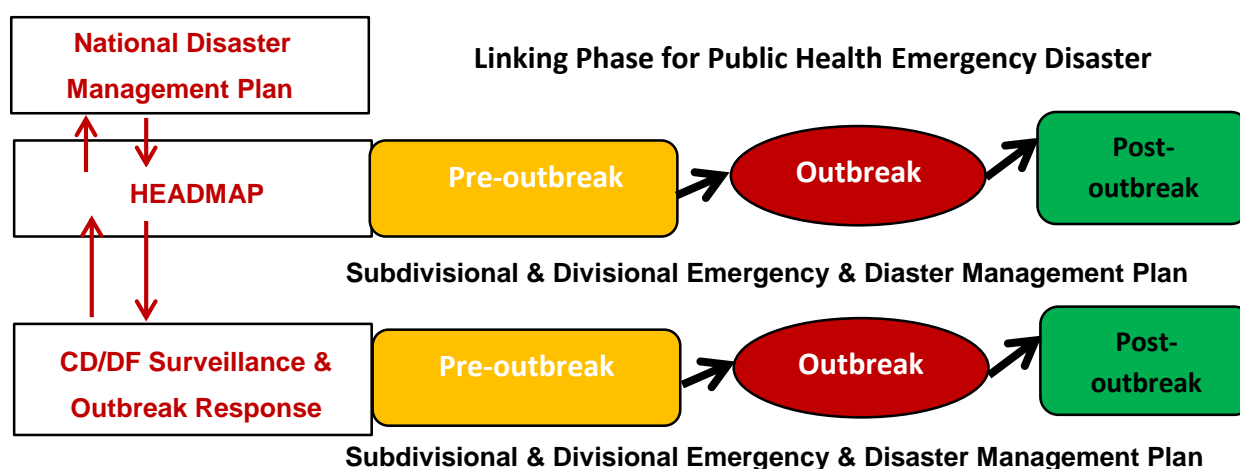



Figure 1. Linking Phase for Public Health Emergency Disaster

Surveillance systems & responses

Surveillance Systems have been put in place to allow the ministry of health to plan and strategize in accordance to the magnitude of the problem. These surveillance systems include Laboratory Surveillance (by hospital laboratories), Vector Surveillance (by the vector control unit), Syndromic Surveillance (by clinicians), Weather Surveillance (by NCPHE), Regional Disease Surveillance (by Fiji Center for Communicable Disease Control & Borders) and from Media or Reports. Information from these surveillance systems would



facilitate the ministry's decision to decide whether an outbreak is imminent, whether Fiji is just on heightened alert or if more information is needed.

Strengthening of VBD control

Fiji, however, is cautious of the effects climate change and is challenged to strengthen the following areas to better prepare themselves. These areas for improvement include:

- a. Strengthening vector surveillance capacity & capability, through improved methods and modernized technology
- b. Implementation of integrated vector management for efficient control and preparedness against the other VBD looming over the horizon
- c. Establishing adequate stockpiles to effectively respond to surges in VBD
- d. Specialized training in the area of medical entomology and Geographical Information System (GIS) for vector-borne disease and vector surveillance

Conclusion

Climate variability and climate change affects our health in several ways and one of the most important impacts (in terms of mortality and morbidity) is clearly presence of vector-borne diseases. Vector control programmes and strategies need to evolve with the increasing challenge of climate change effects.

Vulnerability of health facilities to hydrometeorological disasters in Fiji

Ms Temo Kaukirewa Naidike (Senior Administrative Officer, Ministry of Health & Medical Services)

Over the years some of our health facilities have been affected by climatic factors either by way of flood, rising sea level or cyclones and etc. Undoubtedly, climate change is with us and impacting on our vulnerable facilities. There are direct and indirect impacts on the infrastructure which include; damages to the buildings (health facilities), roads or access to health facilities are damaged, intrusion of water into compounds of health facilities, water shortage forcing the health facilities to close operations.

Infrastructure

The Ministry of Health & Medical Services/ Government has spent a lot of funds for relocating some of the health facilities affected by the impact of climate change and one of those is Nacavanadi Nursing Station in Lomaiviti Group. Other Health Facilities that were affected include Loma Nursing Station along the Valley Road, Navua Hospital has been relocated to Namelimeli, Nausori Hospital (there are plans to relocate it to Vunivivi Hill), Nayau Nursing Station, Beqa Health Centre and Totoya Health Centre. The old Navua Hospital is always affected when there is a rise in the Navua River. The Government of Fiji has proceeded with the new hospital construction with the help of Chinese Government.



Figure 1. Ba Town during one of the flash flood in 2009 which affected the health facilities with water shortage

Nacavanadi Nursing Station is located in Nacavanadi Village in Gau (Lomaiviti). It was washed away during the 2007 cyclone whereupon the Ministry of Health & Medical Services made plans to relocate the same. It was relocated and rebuilt with the assistance of the New Zealand Government.

Loma Nursing Station was located along the Valley Road beside the Sigatoka River Bank. It has always been affected during floods. Plans for relocation were made after the 2009 flood. The Ministry of Health and Medical Services with the assistance of the Australian Government relocated the station to a new site, which is now located on a hill (see figure 2).



Figure 2. Loma Nursing Station that was relocated to higher

The hospital staff of **Nausori Hospital** are always on the alert when there is a down pour within the Nausori area. Due to the threat of rising flood water from the Rewa River. There are plans are underway to relocate the hospital to Vunivivi Hill and more consultations are being undertaken to finalise the plans. Other Health Facilities that are under threat from the impact of climate change are Nayau Nursing Station, Beqa Health Centre and Totoya Health Centre.

The process and procedures for a new health facility contain various steps. First, the land must be acquired to build the hospital on. Once the land is acquired and confirmed then an EIA (Environmental Impact Assessment) is conducted to ascertain the safety of the environment to be free from any risk, this is a new process that was never conducted before. Then, a survey of the site needs to be done to ascertain the boundary and topographical survey as well to ease up the drawings of plans for the hospital. Furthermore, the plans need to be lodged/ approved by all relevant stakeholders (National Fire Authority/ Occupational Health and Safety/ Town & Country Planning) to ensure compliance with the Building Code. It is then passed to Public Works Department to arrange for tender documents. Monitoring and evaluation in all stages of the construction until the project is completed and handed over. The new processes involved in planning of Ministry of Health and Medical Services infrastructure is also part of Disaster Risk Management and Adaptation to Climate Change impacts.



6. Symposium Outcome – Climate Change and Health Adaptation Plan

Future direction of climate change and health adaptation in Fiji

Dr Eric Rafai (Deputy Secretary for Public Health, Ministry of Health & Medical Services)

The future direction for climate change and health adaptation in Fiji is dependent on the following:

- Government Manifesto
- National Strategic Plan
- National Climate Change Policy and Government Strategies
- National Strategic Plan of the Ministry of Health and Medical Services
- Evaluation of the PCCAPHH and its findings
- Support from partners for development of a new project and program


So far, there have been parallel projects in different agencies. What we want now is to include the whole component of climate change and health in the strategic direction not only in the Ministry of Health and Medical Services, but across other sectors of the government.

Climate Change and Health Strategic Action Plan 2015-2020

Development of Climate Change and Health Strategic Action Plan (CCHSAP) 2015 – 2020 aims at building resilience to climate change impacts on human health in Fiji through appropriate adaptation strategies. The general goal of the CCHSAP is to plan climate change adaptation measures for the health system in order to prevent and overcome existing and future risks and to respond promptly to the risks and problems for the protection of people's health and well-being. The thematic areas of adaptation incorporated in different phases as the desired outcomes are to:

- Provide a coordinated approach and functional cooperation between the sectors and the relevant institutions in terms of effective and efficient use of the available resources
- Raise public awareness about climate change and its effect on health
- Protection from climate-change-related communicable diseases in order to reduce the incidence of climate-sensitive diseases (CSDs) in Fiji
- Climate-proof health infrastructure to maintain delivery of services at all times

Research and plans to improve the health system in its promotion, prevention and timely response to climate change risks is executable from the second year. Monitoring risks connected with climate change and their influence on people's health is included for food, water, waste disposal and disease vectors particularly mosquitoes and rodents.



What needs to be done?


- Incorporate a section of climate change and health in MoHMS Strategic Plan
- Evaluation of PCCAPH Project and other related projects to inform future directions
- Transition phase for ownership of project and transfer from project to program
- Wider multi-sector involvement
- Consultation for a program model with mobilization of resources

7. Conclusions

The Symposium on Climate Change and Health in Fiji served as a platform for the government officials, academia, and non-government stakeholders of climate change and health to exchange recent study results of health impacts of climate change and experiences in the health sector adaptation. Keynote speeches provided updated information and knowledge on the health impacts of climate change and the importance of health sector adaptation. The Piloting Climate Change Adaptations to Protect Human Health (PCCAPHH) project can be seen as an important first step of the health sector response to the climate-related health risks, strengthening the adaptation capacity at the central and also local governance in Fiji through a climate-based early warning system and further health adaptation activities. Lessons from previous dengue outbreaks provide valuable information for the future. New technologies, such as geographical information systems (GIS), have been introduced the vulnerability assessment and disaster risk mapping in Fiji. The practical examples of policy options for health sector adaptation were presented by the officers of the Ministry of Health and Medical Services. The future direction of climate change adaptation in health sector was discussed in lieu of draft Climate Change and Health Strategic Action Plan 2015-2020.

Participants appreciated that the presentations and discussions at the Symposium were informative, relevant and applicable to local situations. The event also served as networking and learning opportunities for participants, and raised the profile of climate change and health in Fiji among relevant stakeholders. It also set the platform for the subsequent workshop on climate change and health focusing on vector borne diseases on 10-12 February 2015.

Like other Pacific island countries, Fiji is among the countries very vulnerable to climate variability and change, having “triple burden of diseases” due to communicable diseases, non-communicable diseases, and health impacts of climate change. Therefore, it is important for the health sector to build the climate resilience of health systems by reducing vulnerability and improving the capacity of the health system. The resilience-building approach to health systems can improve the overall performance of the health system resulting in better protection and promotion of population health. Climate resilience should be built into all aspects of the health system – leadership and governance; human resources; information resources; essential medical products and technologies; financing; and service delivery – in order to be effective and sustainable. Fiji National Climate Change and Health Strategic Action Plan 2015-2020 will be developed through consultation with stakeholders.



Additional human and financial resources will be necessary for the Ministry of Health and Medical Services to implement Fiji National Climate Change and Health Strategic Action Plan 2015-2020. Massive investments and technical assistances are needed in health sector in the coming years. In this context, it should be noted that most developing countries like Fiji are not responsible for the massive emission of greenhouse gases (GHGs) during the past centuries, at present and in the coming decades. Countries responsible for the anthropogenic causes of global climate change should provide technical assistance and financial resources to support the Fiji Government for their adaptation to the impacts of climate change.





The Piloting Climate Change Adaptation to Protect Human Health (PCCAPHH) Project is a global initiative executed by the World Health Organization. The project piloted in 7 countries seeks to identify and share solutions that address health risks caused and exacerbated by climate variability and change. In Fiji, PCCAPHH Project was jointly implemented by the WHO Division of Pacific Technical Support and the Ministry of Health and Medical Services. It supports Fiji's health institutions and communities to deal four climate sensitive diseases in Fiji; namely dengue, leptospirosis, typhoid fever and diarrheal diseases. These diseases are major public health concerns in Fiji as well.

The symposium aimed at informing partners of the achievements and lessons of the PCCAPHH project in strengthening internal cooperation and capacity for climate change and health within the Ministry.

The symposium on Climate Change and Health in Fiji served as a platform for the government officials, academicians, and non-government stakeholders of climate change and health to exchange recent study results of health impacts of climate change and experiences in the health sector adaptation.

The symposium concluded that additional human and financial resources will be necessary for the Ministry of Health and Medical Services to implement Fiji National Climate Change and Health Strategic Action Plan 2015-2020.

