Local Health System Responses to Climate Change: Lessons From Coastal Municipalities in the Philippines

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Local Health System Responses to Climate Change:
Lessons from Coastal Municipalities in the Philippines

Ramon Lorenzo Luis Rosa Guinto

A DELTA Doctoral Thesis Submitted to the Faculty of
The Harvard T.H. Chan School of Public Health
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Public Health

Harvard University
Boston, Massachusetts

November 2019
Local Health System Responses to Climate Change:
Lessons from Coastal Municipalities in the Philippines

Abstract

Climate change has now become humanity’s defining challenge, and its initial health effects are beginning to manifest in different parts of the world. International discourse and scholarship on the climate and health nexus have so far focused on quantifying risks and projecting future outcomes. Meanwhile, the global health community is still yet to incorporate the climate lens in the research and practice of health systems development. More specifically, little is known about how local health systems and frontline communities are addressing the early health consequences of climate change and preparing for future ones. This DELTA Project aims to generate lessons and insights on the challenges and opportunities that local health systems especially in developing countries face with regard to responding to climate change and its health impacts.

Two coastal municipalities in the Philippines, one of the most climate-vulnerable countries in the world, were examined using a multiple case study approach. Through a mix of interviews, document review, and field observations, the individual case studies explored present and future climate and health risks and vulnerabilities, challenges and barriers confronted in addressing them, and enablers and opportunities that can be tapped for future implementation. In cross analyzing these cases, key concepts in climate science such as adaptation and resilience were engaged, while existing frameworks traditionally used in health systems research and practice were interrogated.
Now that climate change is already part of the health system equation, new system goals may need to be considered, key determinants for enhancing health systems’ adaptive capacity and intelligence are identified, and new forms of engagement with other ‘systems for health’ become critical now more than ever. The insights drawn from this project will hopefully inform future global health practice in the pursuit of building local health systems that ensure universal healthcare, provide health protection from shocks and stresses, and achieve sustainable development in the era of climate change and planetary health.
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<tr>
<td>ADRA</td>
<td>Adventist Development and Relief Agency</td>
</tr>
<tr>
<td>BAU</td>
<td>Business-As-Usual</td>
</tr>
<tr>
<td>BHS</td>
<td>Barangay Health Station</td>
</tr>
<tr>
<td>BHW</td>
<td>Barangay Health Worker</td>
</tr>
<tr>
<td>CCA</td>
<td>Climate Change Adaptation</td>
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<tr>
<td>COP</td>
<td>Conference of Parties</td>
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<tr>
<td>DELTA</td>
<td>Doctoral Engagement in Leadership and Translation for Action</td>
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<tr>
<td>DOH</td>
<td>Department of Health</td>
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<tr>
<td>DRR</td>
<td>Disaster Risk Reduction</td>
</tr>
<tr>
<td>EPI</td>
<td>Expanded Program on Immunization</td>
</tr>
<tr>
<td>PIC</td>
<td>Fully Immunized Children</td>
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<tr>
<td>GCF</td>
<td>Green Climate Fund</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GCM</td>
<td>General Circulation Models</td>
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<tr>
<td>GEF</td>
<td>Global Environmental Facility</td>
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<tr>
<td>GGHH</td>
<td>Global Green and Healthy Hospitals</td>
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<td>GHG</td>
<td>Greenhouse Gases</td>
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<tr>
<td>GHS</td>
<td>Global Health Security</td>
</tr>
<tr>
<td>GIDA</td>
<td>Geographically Isolated and Disadvantaged Areas</td>
</tr>
<tr>
<td>HAPPINESS</td>
<td>Harmonization and Actualization of People’s Plans through Inclusive, Nurturing, and Effective Systems and Services</td>
</tr>
<tr>
<td>HCWH</td>
<td>Health Care Without Harm</td>
</tr>
<tr>
<td>HPSR</td>
<td>Health Policy and Systems Research</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<td>--------------</td>
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<tr>
<td>IHR</td>
<td>International Health Regulations</td>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<tr>
<td>IRA</td>
<td>Internal Revenue Allotment</td>
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<tr>
<td>LCCAP</td>
<td>Local Climate Change Action Plan</td>
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<tr>
<td>LDRRMC</td>
<td>Local Disaster Risk Reduction and Management Council</td>
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<tr>
<td>LDRRMF</td>
<td>Local Disaster Risk Reduction and Management Fund</td>
</tr>
<tr>
<td>LDRRMO</td>
<td>Local Disaster Risk Reduction and Management Office</td>
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<td>LDRRMP</td>
<td>Local Disaster Risk Reduction and Management Plans</td>
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<tr>
<td>LGU</td>
<td>Local Government Unit</td>
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<td>LHB</td>
<td>Local Health Board</td>
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<tr>
<td>MDG</td>
<td>Millennium Development Goals</td>
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<tr>
<td>MOOE</td>
<td>Maintenance and Operational Expenses</td>
</tr>
<tr>
<td>MRF</td>
<td>Materials Recovery Facility</td>
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<tr>
<td>NAP</td>
<td>National Adaptation Plan</td>
</tr>
<tr>
<td>NCCAP</td>
<td>National Climate Change Action Plan</td>
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<tr>
<td>NDC</td>
<td>Nationally Determined Contribution</td>
</tr>
<tr>
<td>NCD</td>
<td>Non-Communicable Disease</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
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<tr>
<td>NHIP</td>
<td>National Health Insurance Program</td>
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<tr>
<td>NTD</td>
<td>Neglected Tropical Disease</td>
</tr>
<tr>
<td>OISCA</td>
<td>Organization for Industrial, Spiritual and Cultural Advancement</td>
</tr>
<tr>
<td>PHC</td>
<td>Primary Health Care</td>
</tr>
<tr>
<td>PhilHealth</td>
<td>Philippine Health Insurance Corporation</td>
</tr>
<tr>
<td>PhP</td>
<td>Philippine Pesos</td>
</tr>
<tr>
<td>PSF</td>
<td>People’s Survival Fund</td>
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RCM    Regional Circulation Models
RHU    Rural Health Unit
SARAI  Smarter Approaches to Reinvigorate Agriculture as an Industry in the
       Philippines
SDG    Sustainable Development Goals
SES    Social-Ecological Systems
SIKAT  *Sentro para sa Ikauunlad ng Katutubong Agham at Teknolohiya, Inc.*
UHC    Universal Health Coverage/Care
UN     United Nations
UNDP   United Nations Development Program
UNEP   United Nations Environment Program
UNFCCC United Nations Framework Convention on Climate Change
US     United States (of America)
USD    United States Dollars
WHO    World Health Organization
Acknowledgments

The journey of this DELTA Project is one of ambition and adventure; it is also a lesson on hard work and humility. The original dream was to build a ‘Climate and Health Leadership Academy’ within eight months, yet the time allotted was not even enough to fully understand what is happening on the ‘ground.’ The plan that was crafted at the start was never set in stone; challenges and surprises came along the way. This is similar to how human societies are shaken when uncertainties arise from the backdrop of constant change. In the end, I did not just feel a sigh of relief but also a profound sense of fulfillment, now that I did not just finish a DELTA Project and a Harvard DrPH degree, but also created something that is meaningful and potentially transformational.

I remember when I first set foot in Harvard, I was told that one of the goals of the Harvard DrPH Program is to cultivate both analytical thinking – looking at the details, beneath the surface – and synthetic thinking – seeing the connections, the big picture – to make a positive difference in public health. My hope is that through my DrPH experience, especially this DELTA Project, I was able to nurture both. Specifically, I hope that through this project I was able to further sharpen my public health and health systems knowledge and skills, understanding of climate change science and policy, appreciation of public management and international development, social science and qualitative research abilities, and the DrPH pillars of leadership, management, communication, and innovation.

Journeys as amazing as this one happen because there are many people who guided our path – and they deserve to be thanked, remembered and honored. Therefore, I express my deepest gratitude first to my DELTA Project committee: my chair Peter Berman of the Harvard T.H. Chan School of Public Health (and also former faculty director of the Harvard DrPH Program), who has been a
constant source of encouragement and whose astute thinking around health systems I hugely admire (additional thanks for keeping me under your tutelage despite your exciting transition to the University of British Columbia); Jesse Keenan of the Harvard Graduate School of Design, who introduced and exposed me to the ‘whole new world’ of climate change resilience and adaptation and whose commitment to helping climate-affected communities I desire to emulate; and Michael Woolcock of the Harvard Kennedy School of Government, who constantly reminded me, sometimes in a subtle fashion, about incorporating PDIA principles into my execution of this DELTA Project and whose awesome sense of practicality I certainly will adopt for my future career. I cannot imagine a better committee for this kind of DELTA Project, which enabled me to enjoy the best of three worlds – three schools, three disciplines, and three brilliant teachers.

I also would like to extend my special thanks to Winnie Yip, who served as my academic advisor during my first two years in Harvard DrPH. As someone who has an eclectic range of interests, it was hard for me to settle on a DELTA Project topic at the start. I will never forget her advice: for this degree, just choose one topic, and use this opportunity to develop and demonstrate the ‘Renzo approach’ to problem-solving. I hope that this DELTA Project demonstrated my own way of thinking and doing, which I can apply to other public health problems later on.

During my two years in residence at Harvard, I also sought the ideas and inputs of myriad professors, researchers, and visiting fellows as I incubated my DELTA Project and deepened my knowledge of the subject matter. I am thankful to the following from Harvard Chan and beyond for the time they shared with me through thoughtful conversations and consultations: Gary Adamkiewicz, Rifat Atun, William Bean, Aaron Bernstein, Jesse Bump, Jonathan Buonocore, Wafaie Fawzi, Ashish Jha, Margaret Kruk, Stephen Marks, Gina McCarthy, Eileen McNeely, Sam Myers, John Spengler, Stephane Verguet, Walter Willett (Harvard Chan School); David Angelson, Joia Mukherjee
The humbling realization while being in Harvard is that Harvard does not possess monopoly of great ideas. That is why I also shared my DELTA Project ideas to experts from other institutions and sought their input, advice, and inspiration: Nicola Banwell (Griffith University); Josh Karliner (Health Care Without Harm); David Nabarro (Imperial College London/4SD); Andy Haines, Susannah Mayhew (London School of Hygiene and Tropical Medicine); Jason Jay, Elizabeth Sawin, John Sterman (Massachusetts Institute of Technology); Gabrielle Fitzgerald (Panorama); Linda Rudolph (Public Health Institute); Michael Myers (Rockefeller Foundation); Natalia Linou (United Nations Development Program); Michael Marmot (University College London); Kate Raworth (University of Oxford); Anthony Capon (University of Sydney); Kris Ebi (University of Washington); Diarmid Campbell-Lendrum, Nasir Hassan, Rokho Kim, Marina Maiero, Elena Villalobos Prats (World Health Organization); and Timothy Bouley (World Bank).

I also would like to mention special thanks to the amazing and hardworking team of the Harvard DrPH Program, its past and current members – our faculty director Rick Siegrist, Kimberlyn Leary, Shaloo Puri, Jennifer Betancourt, Gary Williams, Aria Xuemei Jin, and Alexander Hendren – for their guidance and support throughout my three years at Harvard.

Across the Pacific at home, I greatly benefited from the guidance, advice, and support from the following colleagues and friends in the Philippines – they helped me navigate the ‘field’ and turn the idea of this DELTA Project into reality: Beverly Ho, Ronald Law (Department of Health); Secretary Emmanuel de Guzman, Arnold Belver, Jerome Ilagan (Climate Change Commission); Ramon San...
Pascual (Health Care Without Harm-Asia); Mahar Lagmay (University of the Philippines Resilience Institute); Carmelita Canila (University of the Philippines College of Public Health); Marites Solomon (Development Academy of the Philippines); Eduardo Banzon (Asian Development Bank); Anthony Faraon (Zuellig Family Foundation); Marilyn Lorenzo (HRH 2030/Chemonics); Merci Ferrer (formerly Health Care Without Harm-Asia); and Rhodora and Jojo Fresnedi (Leadership Journey).

I would like to especially thank Elmer Soriano of the Civika Asian Development Academy for providing me with a platform for the conduct of this independent project, and for the outstanding mentorship and genuine friendship.

At the heart of this DELTA Project are two vibrant, brave, and loving communities – the municipalities of Del Carmen, Surigao del Norte and Ajuy, Iloilo. I hope that this DELTA Project was able to tell their stories with justice, in a way that depicts their struggles but also inspires hope. I want to express my endless thanks to their leaders – honorable mayors Alfredo Coro, Jr. and Jett Rojas as well as their hardworking staff, especially their municipal health offices; Joy Vizconde, Archie Rojas, and Glenn Ticzon who helped me navigate their respective municipalities; and of course, the hundreds of people who welcomed me with open arms to their homes, their barangays, their islands, and allowed me to take a ‘sneak peek’ of their daily life. By them I am deeply humbled, and to them forever grateful.

A project like this – a case study both in print and in film – will also not be possible without the superb research assistance of Nico Valdez and Anna Sasil, and the talent and industry of my video production team – Owen Atendido and Cheska delos Reyes. To the four of you – thank you! I hope
that through this process, you also learned a great deal not just about climate and health but also about yourselves, and you are assured of my continued mentorship and friendship beyond DELTA.

This DELTA Project and my entire DrPH education will not be possible without the financial support coming from the Eugenio Lopez Scholarship Fund at Harvard University. What makes this DELTA Project extra special is that Gina Lopez, one of the members of the Lopez family and one of the Philippines’ bravest environmental advocates, passed away when I was nearing the end of writing this thesis. I was privileged to encounter her once when we were co-panelists in a press conference calling for the phase-out of coal-fired power plants in the Philippines in 2015. The future work that will come out of this DELTA Project will certainly build on Gina’s lasting legacy. This project is also funded by a generous grant from Harvard Medical School’s Center for Global Health Delivery–Dubai. I also thank the Harvard Asia Center (special thanks to Jorge Espada), Walker Study Group (a collaboration of the Harvard Chan School and Harvard Kennedy School), and the S.E.A.L. Award (Sustainability, Environmental Achievement and Leadership), whose financial support helped me in various stages of the Harvard DrPH and DELTA Project process.

A special ‘Thank You’ also goes to the different professional networks that contributed a lot to my thought process, skills building, and character formation – chief among them are the Aspen New Voices Fellowship of the Aspen Institute and the Emerging Voices for Global Health Program headquarterd in the Institute of Tropical Medicine in Antwerp, Belgium, which I will be joining as a visiting fellow after finishing my DrPH.

My entire DrPH experience is way richer and more memorable, thanks to my amazing Cohort 3 classmates who were my comrades in this learning journey. Special thanks to my ‘peer coach’ Asinath Rusibamayla, who served as my listening ear, asked me reflective questions, witnessed my
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Special thanks to my friends at Harvard – they are too many to list down, but I want to mention Jose Gonzales and Dorit Stein for their intellectual and emotional company during my DELTA year. My gratitude also goes to my fellow students and friends in my numerous extra-curricular activities, most notably the two organizations that I founded – the Harvard Chan ASEAN Student Organization (HCASO) and the Sustainability and Health Student Forum at the Harvard Chan School.

There are also so many Filipino friends to thank – my Filipino friends at Harvard and Boston, most especially my fellow “Boston Bokchoys” Tytana Karamitis, Roselyn Mateo-Collado, Patrick Ching, and Erin Tababa, as well as Marga Castro-Zarraga and Myrish Antonio, as well as my Filipino friends in the Philippines who were a source of encouragement at a distance, especially Joseph Paguio, Carl Acasili, Jayson Co, Annabelle Sinlao, Erica Tania Davillo, Tea Anne Padre, and Angeli Comia.

My heartfelt thanks to Tita Jenny Aying and Tito Dodi Ramos, for providing me a home in Dedham. The bulk of this thesis was baked in their dining room, accompanied by ice cream, Gosling, and your infectious laughter. Special thanks too to Tita Nelia Francisco for our bonding over Netflix and Amazon Prime. I will never forget our gang's five months of bonding in Sumner Street.

From the bottom of my heart, I would like to express my eternal gratitude and love to my family – my mom and dad Ritz and Louie, my siblings Lara and Raemon, my brother-in-law Melvin and my
niece Clara Bunita. Not only were you a source of comfort and encouragement during my DELTA Project year – you have always been there since Day One. Others may come and go, but you remain as my constants. Thanks also to our many relatives in the Philippines and around the world – after all, a Filipino family is a global barangay, a community – for all your well wishes and support. Special thanks to my grandma Mama Fely, who I know have been praying for me in Houston and Calamba in each day of my Harvard DrPH journey, and to my grandpa Lolo Dad, my fellow ‘Ramon,’ who I am sure is now looking after me from the heavens above.

And of course, my highest thanks, honor and praise is to God Almighty, who makes all things possible, even for a small-town Filipino boy who in grade school once said, “I will be studying at Harvard someday.” As said in Philippians 4:13: "I can do all this through Him who gives me strength." This Harvard doctorate is part of His plan for me, and I pray that He will continue to use me as a manifestation of His greatness and an instrument of His love. To God be the glory!

This acknowledgment section might appear too long for a doctoral dissertation, but why not allocate a few more pages for delightful words of thanksgiving? My heart is just so filled with gratitude and awe, realizing that there are so many people that made my Harvard DrPH experience so unique and wonderful a chapter in my life book. I also want this simple gesture to memorialize the names of these beautiful people, especially my family and friends, in the library of Harvard University forever.

Although this doctoral thesis was written with the guidance and support of so many people, especially my committee, any errors or misrepresentations are entirely my own.
Towards the end of thesis writing, I had the opportunity to watch the acclaimed Broadway musical “Hamilton,” which is about Alexander Hamilton, one of the less known yet consequential Founding Fathers of the United States. The final song, performed by Hamilton’s wife Eliza, goes: “Who lives, who dies, who tells your story?” More than anything, this doctoral thesis is a telling of a story – not just of how two coastal municipalities are fighting against climate change’s initial symptoms, but also how we as humanity at large are currently mobilizing (or not) to prepare and survive for the impending crisis. This thesis is situated in a particular moment – it is my prayer that I was able to capture the zeitgeist of our generation, the spirit of our times, and that the reader, whether now or fifty years from now, will have the opportunity to experience it.

In a future world of unstable climate, many will surely be able to cope with the ‘new normal.’ They will survive and live on – such is the tenacity and longevity of the human spirit. Unfortunately, some too will get sick and eventually die, and others a bit earlier and faster. May the telling of this story inspire us to act with celerity and fervor, so that half a century from now, the stories that will be told are not merely of disease, death, and despair, but of healing, heroism, and hope.
For my parents
Luisito and Rita

For the Philippines
my beloved home

For the climate generation –
today’s children
and those to come
Whoever wishes to pursue properly the science of medicine must proceed thus. First he ought to consider what effects each season of the year can produce; for the seasons are not at all alike, but differ widely both in themselves and at their changes. The next point is the hot winds and the cold, especially those that are universal, but also those that are peculiar to each particular region. He must also consider the properties of the waters; for as these differ in taste and in weight, so the property of each is far different from that of any other.

Hippocrates, Airs, Waters, and Places (400 B.C.)
Father of Western Medicine

I do not write for this generation. I am writing for other ages. If this [generation] could read me, they would burn my books, the work of my whole life. On the other hand, the generation which interprets these writings will be an educated generation; they will understand me and say: 'Not all were asleep in the nighttime of our grandparents.'

Dr. Jose Rizal, Noli Me Tangere (1887)
National Hero of the Philippines

The health sector must lift its gaze to bigger, ecological horizons. This will require a radical extension of the public health agenda, new forms of professional training in environmental health, a preparedness to base policy advice upon predictions and best guesses (as opposed to empirical data), and an ability to collaborate with unfamiliar disciplines (e.g. climatology and ecology).

Anthony McMichael (1991)
Climate and Health Pioneer
Del Carmen, Surigao del Norte

Ajuy, Iloilo

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Chapter 1
Introduction

2018: An Early Warning Signal for Climate and Health

Climate change – particularly anthropogenic climate change\(^1\) – has been called the “biggest global health threat of the 21st century” (Costello, et al., 2009, 1693). The effects of climate change on human health are wide-ranging (Figure 1) – from direct impacts of extreme weather such as hurricanes, drought, and heatwaves, to indirect effects mediated through natural systems such as the rise and re-emergence of vector- and water-borne diseases, to tertiary effects mediated by human systems such as undernutrition due to crop failure and mental stress resulting from conflict and climate-induced displacement (Smith, et al., 2014; McMichael, 2013). The World Health Organization (WHO) (2014b) conservatively estimated that due to climate change alone, there will be 250,000 additional deaths annually between 2030 to 2050 due to climate-sensitive diseases such as undernutrition, infectious diseases, and heat-related illness.

With the increasing recognition of the impacts of climate change on population health, this defining challenge of our time has evolved from merely being an environmental issue into a pressing public health concern worldwide. Addressing both climate change and its effects on health is central to achieving the Sustainable Development Goals (SDGs) (United Nations, 2015a) (Figure 2)\(^2\), which

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\(^1\) Article 1 of the United Nations Framework Convention on Climate Change (UNFCCC) defines ‘climate change’ as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (United Nations, 1992, 7). While historically, some ‘climate change’ was induced by natural processes, the UNFCCC uses the term to pertain to anthropogenic climate change.

\(^2\) Adopted by all United Nations Member States in 2015, the 2030 Agenda for Sustainable Development provides a shared blueprint for “people, planet and prosperity.” There are 17 Sustainable Development Goals (SDGs), and for this DELTA Project, two are most relevant: Goal 3 – Ensure healthy lives and promote well-being for all at all ages; and Goal 13 – Take urgent action to combat climate change and its impacts. For more information, visit https://www.un.org/sustainabledevelopment/sustainable-development-goals/.
Figure 1. How climate change affects human health

Source: Smith, et al., 2014

Figure 2. United Nations Sustainable Development Goals

Source: United Nations, 2015c
identified separate goals for improving global health (Goal 3) and taking urgent climate action (Goal 13).

2018 was a particularly important year for climate change and human health, in some ways a loud signal in our global early warning system. In an unprecedented move, the United Nations Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2018) released a special report calling for “deep emissions reductions” if the 1.5 degrees Celsius target of the 2015 Paris Agreement³ is to be achieved by 2030. This was echoed by the UN Secretary-General Antonio Guterres (2018) who warned countries that they only have 12 years remaining to prevent serious catastrophe on human and natural systems. Meanwhile, the annual Emissions Gap Report of the United Nations Environmental Program (UNEP, 2018b) revealed that even if countries fulfill their current commitments to curb greenhouse gas (GHG) emissions, emissions will not peak by 2030 and keeping the average global temperature increase below 2 degrees Celsius is extremely unlikely. Steffen et al. (2018) also warned about the likelihood of reaching a ‘Hothouse Earth’ – an uncontrollable, irreversible, and uninhabitable state of extreme warming resulting from triggering of other Earth system feedbacks – if the transition to an emission-free world economy is not accelerated.

³ The successor to the Kyoto Protocol, the Paris Agreement is a legally-binding treaty under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC). The Agreement’s central aim is to “strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by: (a) holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; (b) increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and (c) making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development” (United Nations, 2015b, 3). One of its major differences from the Kyoto Protocol is that in the Paris Agreement, all countries, both developed and developing, are now tasked to make commitments (called Nationally Determined Contributions or NDCs) for both climate mitigation and adaptation. More information can be accessed here: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement. I was privileged to be part of both global health and Philippine delegations during the adoption of the Paris Agreement in 2015.
In addition to these major climate reports, the health dimensions of climate change also received spotlight. The 2018 edition of the Lancet Climate and Health Countdown noted that the initial effects of climate change on heat waves, labor capacity, vector-borne disease, and food security provide early warning of the growing burden on public health systems that is yet to come (Watts, et al., 2018). A special report published by the WHO (2018) for the 24th Conference of Parties (COP 24) of the UN Framework Convention on Climate Change (UNFCCC) did not just highlight the health effects of climate change but also the public health ‘co-benefits’ of reducing GHG emissions, such as the reduction in air pollution-related deaths. Even high-income countries such as the United States (US) are already experiencing some of the initial health impacts of climate change such as increase in heat-related illness and resurgence of vector-borne diseases, as reported by the Fourth National Climate Assessment (Ebi, et al., 2018a) and the US Lancet Countdown (Salas, Knappenberger, & Hess, 2018).

Beyond these formal reports, newspaper headlines and social media were also filled with real stories announcing that climate change is already here, and the health of human populations is slowly being impacted. Scientists confirmed that 2018 is the fourth hottest year on record, with the years prior to that being slightly hotter, making this five-year period the hottest in human history (Milman, 2019). Extreme weather events that happened in this year alone – from storms in the Philippines and US (Borenstein, 2018) to massive flooding in India (Taylor, 2018) to wildfires in Australia (Victor, 2018) – have destroyed property, disrupted healthcare systems, inflicted illnesses, and even claimed human lives. While attributing individual events to global climate change is difficult since a host of natural and anthropogenic factors are at play, there is robust evidence and strong consensus regarding the influence of changes in the climate system to changes
in the frequency, intensity, and duration of extreme weather events (National Academies of Sciences, Engineering, and Medicine, 2016).4

While progress in both climate mitigation – reduction of carbon emissions – and adaptation – adjustment in preparation and/or in response to climate change’s effects – is still generally slow, several initiatives launched in 2018 do offer some hope. COP 24, which was held in Poland, saw the creation of the Paris ‘rulebook’ which lays down the implementing guidelines of the 2015 treaty.6 While mitigation remains an important priority for preventing long-term climate catastrophe, the inevitability of climate change is becoming more recognized and the need for stronger adaptation measures more pressing. Hence, world leaders established the Global Commission on Adaptation in order to catalyze the global momentum for climate adaptation. The global health community also did its share. On September 12, 2018 in San Francisco, health organizations from around the world gathered at the Global Climate and Health Forum and through a ‘Call to Action’ made a pledge for more ‘climate action for health’ and ‘health action for climate.’8 The WHO also convened a high-level conference9 to build political momentum around the health impacts of air pollution, which is driven by the same sources that emit greenhouse gases such as energy and transport.

4 This 2016 NASEM report examined the science of event attribution, which aims to “estimate how much climate change has affected an individual event’s magnitude or probability of occurrence” (NASEM, 2016, 2). Based on this review of evidence and methods, confidence in attribution to climate change is highest for extreme heat and cold events, followed by hydrological drought and heavy precipitation.
5 The terms ‘mitigation’ and ‘adaptation’ are discussed in greater detail in the next chapter (Analytical Platform).
6 More information about COP24 can be found here: https://cop24.gov.pl/.
7 More information about the Global Commission can be found here: https://gca.org/global-commission-on-adaptation.
8 I was privileged to speak in this Forum, where I shared about the Philippine experience in addressing climate and health. The forum’s Call to Action can be accessed here: https://www.globalclimateandhealthforum.org/call-to-action.
9 More information about the Global Conference on Air Pollution and Health can be found here: https://www.who.int/airpollution/events/conference/en/.
Health Systems in the Era of Climate Change

Given this new climate reality, health systems – traditionally defined as the set of organizations, people and actions whose primary intent is to promote, restore or maintain health (WHO, 2007) – around the world must act to both contribute to reducing greenhouse gas emissions and to prepare to respond to climate change’s myriad health effects. Health systems, like other systems, also emit carbon dioxide and other GHSs through their many inputs, activities, and products. Meanwhile, the current and projected health impacts of climate change are anticipated to put additional stress on health systems, especially in low- and middle-income countries, many of which are already overwhelmed by a double burden of disease and under-resourced due to unsustainable funding, health workforce shortage, and governance deficits.

To provide guidance to countries, WHO (2015b) developed an operational framework on ‘climate-resilient’ health systems, which incorporates climate-resilient features to the six health system ‘building blocks.’ Meanwhile, the World Bank introduced the concept of ‘climate-smart’ healthcare, which emphasizes the dual role of healthcare facilities and systems not just in adapting to the effects of climate change but also mitigating climate change itself through low-carbon measures (Bouley, et al., 2017). The mitigation aspect of ‘climate-smart’ healthcare echoes the 10-point agenda of the Global Green and Healthy Hospitals (GGHH) initiative advanced by international nongovernmental organization (NGO) Health Care Without Harm (HCWH) (2011). These proposed frameworks are discussed in greater detail later in this thesis.

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10 More information about GGHH can be found here: https://www.greenhospitals.net/.
11 From 2014-2016 before coming to Harvard, I worked for HCWH’s Asia regional office as inaugural campaigner of its Healthy Energy Initiative, which focuses on the intersection of climate, energy, and health. More information about HCWH can be found here: https://noharm.org/.
Despite these proposed frameworks and previous initiatives, there has been little progress, at least in documented peer-reviewed literature, in the mainstreaming of climate change into health systems development especially in developing countries. A recent review of previous multi-country health adaptation projects (2008-2013) supported by the WHO, United Nations Development Program (UNDP), Global Environmental Facility (GEF), and Millennium Development Goals (MDG) Achievement Fund found out that while vulnerability and adaptation assessments and planning exercises were accomplished at the level of the health ministry in several countries, eventual dissemination and scale-up to subnational units were impeded by several factors including lack of political will, limited in-country expertise, human resource shortage, and unsustainable financing (Ebi & del Barrio, 2017).

Another indication of the slow incorporation of climate change into the health system equation is manifested in the health systems research community. Banwell, et al. (2018) noted that research on climate change and health is still dominated by the environmental health community, concentrated in risk quantification, vulnerability assessment, and projection of future health risks. Meanwhile, there is little research examining either the impact of climate change on health systems, or the effectiveness and appropriateness of existing and theoretical health system responses to climate change and its health impacts. Health systems researchers and practitioners are yet to embrace climate change – the biggest global health threat – as part of their business. Mayhew, Van Belle, and Hammer (2014, 1) noticed that “despite the urgency [of climate change], the health care systems development community appears insular in its interests and actions…”

Much of the attention of the health systems community is focused on universal health coverage (UHC), generally defined as all individuals and communities having access to quality services without financial hardship (WHO, 2017). UHC has emerged as today’s central global health agenda,
a key goal under the SDGs, and a priority topic in health systems research. Unfortunately, it is not very much discussed in the light of climate change or even framed as a climate adaptation measure (Guinto, 2015). Past health system conferences failed to consider climate-related issues (Mayhew & Hanefield, 2014), and the most recent Fifth Global Symposium on Health Systems Research held in Liverpool in 2018 only had one abstract that mentioned the phrase ‘climate change’ (Guinto, 2018b).

In addition to this gap in knowledge and scholarship on climate change and health systems, there is also generally low investment in activities for mainstreaming climate change into health systems worldwide. In 2018, the Adaptation Gap Report, which is annually published by the UN, focused on health, and it concluded that there is a significant global health adaptation gap today (UNEP, 2018a). This gap is reflected in negligible funding for climate adaptation in health both domestically and internationally. Moreover, only 54 percent of the Nationally Determined Contributions (NDCs) of countries included health as a priority sector.

Meanwhile, the Green Climate Fund (GCF), established within the UNFCCC to support developing countries shift towards low-emission and climate-resilient development, has not yet funded any health system-focused climate mitigation or adaptation project since its creation in 2010. Other

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12 As of the time of submission of this thesis, Health Systems Global, the professional society responsible for organizing the biennial Global Symposium on Health Systems Research, announced that the Sixth Symposium, which will be held in Dubai, United Arab Emirates in 2020, will revolve around the theme “Re-imagining health systems for better health and social justice.” One of the sub-themes is “Engaging social, economic and environmental forces,” which includes the nexus of health systems and climate change. More information can be found here: https://www.healthsystemsglobal.org/blog/343/HSR2020-Re-imagining-health-systems-for-better-health-and-social-justice.html.

13 While none of the GCF funded projects are focused on health systems in the traditional sense, some address health-related concerns such as food and water security. The projects can be viewed here: https://www.greenclimate.fund/what-we-do/projects-programmes.

14 While countries agreed to establish the GCF in 2010, it only became operational in 2015 when it made its first investment decisions. More about the GCF can be read here: https://www.greenclimate.fund/who-we-are/about-the-fund.
earlier funding mechanisms under the auspices of the UNFCCC such as the Adaptation Fund and the Least Developed Countries Fund allocate negligible amounts for health protection (Bowen & Friel, 2012). To help fill some of these gaps especially in the world’s most climate-vulnerable countries, WHO Director-General Tedros Adhanom Ghebreyesus, in his first year of office, launched a special initiative to enhance the capacity of national health systems in Small Island Developing States (SIDS) to address the health effects of climate change.\footnote{More information about the SIDS Initiative can be found here: \url{https://www.who.int/globalchange/sids-initiative/en/}.}

**Climate and Health at the Local Level**

With the increasing urgency of the climate crisis and the imminent threat it imposes to health systems worldwide, there is a dire need to rethink the way health systems especially in developing countries are designed and operate in the era of climate change. This is especially true at the local or subnational level, where the effects of climate change on human health will manifest and from where the initial response of communities must emanate. Outside of the health sector, despite the prominence of climate change in the international arena (e.g., United Nations), there is already a growing recognition that the societal response to climate change – especially adaptation to its impacts – needs to be facilitated, promoted and achieved at the local context – where vulnerability to climate change is perceived and experienced (Jerneck & Olsson, 2008). Local adaptation initiatives are now happening around the world. However, most of the activities and resources are being allotted to the initial phase of adaptation initiatives, particularly the conduct of vulnerability assessments and creation of local adaptation plans, while limited attention is given to implementation, monitoring, and evaluation (Nordgren, Stults, & Meerow, 2016).
Nevertheless, compared to other sectors, much of the discourse around climate change and health systems is still happening at the international level, and existing guiding frameworks are designed particularly for consumption of national health ministries. In the United States, a guide on climate change, health, and equity was developed for local health departments (Rudolph, et al., 2018); on the other hand, there is currently no known toolkit for localizing climate and health plans that is created for developing country settings. While the number of national vulnerability and adaptation assessments has grown steadily over the past two decades, local or subnational assessments are generally lacking especially in developing countries (Berry, et al., 2018). Although many countries have already incorporated health into their National Adaptation Plans (NAPs; Ebi & Prats, 2015), there is poor documentation as to how these plans are trickled down to local governments and frontline communities.

While several pilot projects on climate and health have been pursued in several developing countries, most of them failed in what can be referred to as the 3S of climate and health projects – *streamlining* across health system components, *sustaining* efforts across time, and *scaling up* across geographies. Because of this, little is known about what is happening on the ground especially in developing countries. If strategies and interventions are to be designed to assist local health systems in addressing climate change and its health effects, it is important to first know what kinds of responses are already taking place at the local level.

**The DELTA Project: Research Questions, Specific Objectives, and Expected Results**

Therefore, in partial fulfillment of the requirements of the Doctor of Public Health (DrPH) Program of the Harvard T.H. Chan School of Public Health, this Doctoral Engagement in Leadership and Translation for Action (DELTA) Project aims to generate lessons and insights on the challenges as well as opportunities that local health systems especially in developing countries face when it
comes to responding to climate change and its health effects. This project is set in the Philippines – one of the most climate-vulnerable countries in the world – and focuses on the municipal health system as unit of analysis. In devolved national health systems such as the Philippines, the municipal health system is the main vehicle for local health planning, financing and service delivery. Unfortunately, given the limited attention accorded to local health sector adaptation to climate change, the workings of a municipal health system are yet to be examined through a climate lens. In addition to literature review, this DELTA Project adopts a multiple case study research design featuring two coastal rural municipalities – Del Carmen, Surigao del Norte and Ajuy, Iloilo.

The overall goal of this DELTA Project led to the formulation of the following research questions:

- What are the present and future climate and health problems being confronted by municipal health systems?
- What are the barriers, gaps and challenges faced by municipal health systems when it comes to mounting responses to climate change and its health effects?
- What are the enablers, opportunities and potential strategies that can be harnessed to strengthen the response of municipal health systems to climate change and its health effects?

To answer these questions, this DELTA Project seeks to accomplish the following specific objectives:

- Review the current state of knowledge around climate change and health systems, both at the level of international discourse and as applied specifically to local health systems;

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16 The original proposal for this DELTA Project was to design and prototype a “Climate and Health Leadership Academy” for local governments in the Philippines. It was then realized that even before designing such a capacity building and training program, it is important to first conduct preliminary diagnostic work and generate insights that can inform the design of such a health system intervention, hence this current project. This thesis contains useful ideas that can aid the development of the future academy.
• Examine the experiences of two municipal health systems in the Philippines when it comes to responding to climate change and its health effects, and;

• Identify lessons and strategies for future application in other parts of the Philippines and other developing countries.

By the end of this DELTA Project, the following key results would have been delivered and extensively presented in the next chapter, Results Statement:

• Insights on the challenges and opportunities faced by municipal health systems in confronting climate change and its health effects;

• Recommendations on strategies and measures for potential implementation, dissemination, and scale-up to strengthen local health system responses to climate change in other developing country settings, and;

• Specific proposals for action for the Philippine municipal health systems being investigated in this project.

Structure of this Thesis

The succeeding pages will discuss the process and outcomes of this DELTA Project. The next chapter, Analytical Platform, will cover the following: brief overview of the project setting; survey of basic climate change concepts; review of main climate change and health system frameworks; the project’s research design and methodology; and an overview of the structure and function of the project’s unit of analysis – the municipality and the municipal health system in the Philippines.

The subsequent chapter, Results Statement, will present the two individual local case studies as well as their cross-case synthesis. The findings will then be discussed in light of the project’s main research questions and with respect to climate and health concepts and frameworks. The chapter
will end with a discussion about implications of this research to future health systems development and propose concrete steps for the way forward. A concluding chapter will summarize key findings and synthesize lessons learned from this DELTA Project.
Chapter 2
Analytical Platform

An Overview of the Philippines – A Climate and Health Hotspot

Before diving into the DELTA Project’s conceptual foundations and methodological approach, it is vital to provide an overview of the Philippines and its current state in relation to the issue of climate change and public health. Located in Southeast Asia, the Philippines, an archipelago of more than 7,000 islands, is one of the countries in the world that are most vulnerable to the effects of climate change. The think tank German Watch ranks the Philippines as number 5 in terms of losses in human lives and gross domestic product (GDP) resulting from climate-related extreme weather events (Eckstein, Hutfils, & Winges, 2018). The most recent national climate assessment projected that annual mean temperature and intensity and frequency of extreme rainfall events are expected to rise in most parts of the country by 2050 (Villarin, et al., 2016). When it comes to sea level rise, it was observed that the rate in certain parts of the Philippines is even faster than the global average rate (Kahana, et al., 2016).

When it comes to the social and health effects of climate change, abrupt, sporadic, and oftentimes large-scale natural disasters such as typhoons and storm surges first come to mind. The Philippines has a long experience of responding to natural calamities, the biggest of which is the 2013 Typhoon Haiyan (also called Super Typhoon Yolanda in the Philippines), the strongest ever to hit land in recorded history. The typhoon claimed more than 6,000 lives and affected nearly 16 million people (Philippine National Disaster Risk Reduction and Management Council, 2015). Hydrometeorological events such as Typhoon Haiyan generate health effects in two major pathways – either as a direct exposure to the hazard (e.g., drowning from storm surge, injury due to landslide) or indirectly through disruption of basic services and limited access to necessities during...
the aftermath (e.g., malnutrition due to food scarcity, cholera outbreak due to lack of clean water, sexually-transmitted diseases due to lack of sexual hygiene in overcrowded temporary shelters).

On the other hand, it is also important to note the slow-onset effects of climate change on human health. In this aspect, the main challenges are the general paucity of rigorously conducted local studies (Chua et al., 2019) and lack of guidelines for reporting climate-related health impacts and climate adaptation measures. Nonetheless, the overall health situation in the Philippines suggests that climate change is more likely to exacerbate existing health conditions rather than introduce new ones (Cruz, et al., 2017). For instance, as a tropical developing country, the Philippines is home to many climate-sensitive infectious diseases such as dengue, malaria, cholera, typhoid fever, and leptospirosis. Initial qualitative studies and modelling exercises have demonstrated the potential of these infectious diseases to rise as mean temperature, humidity and rainfall increase (Lorenzo, et al., 2017). These potential health impacts will also be modulated by other factors such as chronic poverty, poor sanitation and hygiene, and weak health system infrastructure. Other climate-related disease conditions that are noncommunicable in nature such as respiratory diseases resulting from air pollution (Ortega & Klauth, 2017) and heat-related illness driven by direct exposure to intense heat (Guadalupe, Ozaki, & Tanimoto, 2018) are also beginning to be recognized.

Given the country’s vulnerability to climate change overall and to its health impacts in particular, the Philippines instituted several national policies that put health in the climate agenda and climate change in the health agenda. Health is identified as a priority sector in the Climate Change Act of 2009 (Congress of the Philippines, 2009a) – once lauded by the United Nations as one of the best climate laws in the world (Ubac, 2012), the Philippine Disaster Risk Reduction and Management Act of 2010 (Congress of the Philippines, 2009b), and the National Climate Change Adaptation Plan
With support from the WHO, the Philippine Department of Health (DOH) also developed its own national policies and strategies on climate and health, with the creation of a Climate and Health Unit as one of the strategies (DOH Philippines & WHO, 2012).

In recent years and especially in the aftermath of Typhoon Haiyan, the DOH also strengthened its efforts in the management of health emergencies, including but not exclusive to disasters related to extreme weather events (Banwell, et al., 2016). Calamities also occasionally trigger reactionary responses from the national health system at large. For instance, following Typhoon Haiyan, PhilHealth, the country’s national health insurance agency, implemented automatic enrolment at the point of care for disaster victims who were not previously insured (PhilHealth, 2013). These emergency measures reflect the general recognition among various sectors of the importance of disaster response, and increasingly in the context of climate change. There is some concern that the emphasis on more abrupt and catastrophic extreme weather events may lead to neglect of the slower and more subtle effects of climate change on health. More effort is needed to mount joint-up approaches that combine disaster risk reduction and climate change adaptation (DRR-CCA) especially for health, which may be challenging but not impossible given the two’s conceptual, technical, and operational synergies (Banwell, 2018; Banwell, et al., 2018).

Despite these gains in policy development and discourse around climate change, natural disasters, and health, progress has been slow when it comes to implementation, especially in terms of building local health system capacity particularly for addressing the slow-onset health effects of

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17 The relevance of these policy-legal instruments to municipal governments are discussed towards the end of this chapter, in the section entitled “The Municipality and the Municipal Health System.”
18 More information about PhilHealth are also provided in the same section about municipal governments and the municipal health system.
climate change. In 2018, the Philippine Climate Change Commission noted that of all sectors, the health sector is seen as a laggard in climate mainstreaming.\textsuperscript{19} This is alarming because the health sector – the very sector responsible for the protection and promotion of human health – will be the one to bear the brunt of climate change in both the short and long term.

To date, the DOH Climate and Health Unit has been largely nonfunctional, and vertical public health programs have failed to incorporate climate change into their programming.\textsuperscript{20} The public health community at large is also disconnected from other sectors that also work on climate change such as the environment, agriculture, water, and weather monitoring sectors. Local governments receive little guidance on climate mainstreaming in local health planning and operations. Nonetheless, in recent years, some actions have been undertaken by some medical professional societies and civil society organizations, such as the campaign to include climate change in the medical curriculum.

Despite the heavy emphasis on adaptation, the Philippines also expressed commitment to contribute to climate mitigation to set an example to other countries. During the 2015 Paris treaty negotiations, the Philippines made a conditional pledge (contingent on the availability of financial resources and facilitation of technology transfer) to cut emissions by 70\% below business-as-usual (BAU) by 2030 (Ranada, 2015). This is in spite of the country being a minor emitter (contributing only 0.3\% of the total greenhouse gas emissions annually from 1990 to 2010) compared to the rest of the world (Buendia, et al., 2018). At present, the Philippines is in the process of revising its Nationally Determined Contributions (NDC), and whether it will stick to its 2015 commitment or not remains uncertain (Chen, 2018). Meanwhile, in terms of health sector contribution to climate

\textsuperscript{19} Personal communication with the Vice Chairperson of the Climate Change Commission, December 2017.
\textsuperscript{20} In 2013-2014, I worked as a consultant on migrant health for the International Organization for Migration. My role was to support the establishment of the Migrant Health Program at the Philippine Department of Health (DOH). Because of my interactions with the DOH, I have been made aware of the situation of the climate change and health portfolio within the agency.
mitigation, campaigns around lowering the carbon footprint of hospitals and health facilities are currently being conducted by NGOs such as Health Care Without Harm-Asia (Oliva, 2019).

Finally, it is important to also note the current situation of the Philippine health system outside of the climate change issue. Like many developing countries, the Philippines is undertaking reform initiatives to achieve universal health care (or coverage; UHC). During the implementation period of this DELTA Project, the Philippines passed a revitalized UHC Act (Congress of the Philippines, 2018) to address gaps not just in financing but also in other health system ‘building blocks’ such as health workforce (e.g., mandatory service for graduates of government medical schools) and pharmaceutical products (e.g., institutionalization of health technology assessment) (WHO, 2019).

To address the fragmentation of healthcare delivery resulting from health system devolution, municipal and provincial health facilities, both public and private, will be organized into ‘health care provider networks,’ offering core packages of health care services in an integrated and coordinated manner. While this DELTA Project focuses on singular municipal health systems, the newly formed networks – which will be comprised of several municipalities – might become the new platform not just for ensuring continuity of care for patients but also for mounting collective responses to climate change’s public health impacts. However, since the law was just recently passed, these networks are yet to be created, a process which may take years in a highly decentralized system. Hence, the potential role of these networks in health sector response to climate change can only be imagined for now. The design and function of local health systems in Philippine municipalities is described towards the end of this chapter.

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21 While the global health community uses the term “universal health coverage,” in the Philippines, UHC means “universal health care.” Although not documented in literature, there is a general sentiment among Filipino health policy leaders and advocates that “care” is a more comprehensive term than “coverage,” which tends to connote mere financial coverage for healthcare.
Review of Basic Climate Change Concepts

Since this DELTA Project examines the intersection between climate change and health systems, it is appropriate to provide a short review of basic climate change concepts, which can be useful in interpreting the empirical findings of this project. First, what do we mean by responses to climate change? In general terms, societal responses to climate change are categorized into two, and these have already been alluded to in earlier sections of this thesis. The first category is mitigation, which pertains to "human intervention to reduce the sources or enhance the sinks of greenhouse gases" (IPCC, 2014b, 4) – the main culprit of climate change. Examples of mitigation measures include, among others: shifting from fossil fuels to renewable energy for electricity generation; improving building insulation to reduce the need for energy; and expanding forests and other sinks to sequester greater amounts of carbon dioxide from the atmosphere.

The second category is adaptation, which generally refers to "the process of adjustment to actual or expected climate and its effects" (IPCC, 2014a, 5). The aim of adaptation is to "either moderate harm or exploit beneficial opportunities." Climate adaptation measures vary depending on the context and across sectors – from building physical barriers to protect against sea-level rise in

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22 For the purpose of this DELTA Project, the definitions of the terms ‘mitigation,’ ‘adaptation,’ ‘resilience,’ and ‘adaptive capacity’ are obtained from the Fifth Assessment Report of the UN Intergovernmental Panel on Climate Change. It is important to note that there are other definitions proposed in the broader social-ecological systems literature, most of which are variations of the IPCC definitions, but the core meaning of these terms remains the same.

23 Here, greenhouse gases primarily refer to carbon dioxide, but the IPCC also covers “other substances which may contribute directly or indirectly to limiting climate change, including, for example, the reduction of particulate matter (PM) emissions that can directly alter the radiation balance (e.g., black carbon) or measures that control emissions of carbon monoxide, nitrogen oxides (NOx), Volatile Organic Compounds (VOCs) and other pollutants that can alter the concentration of tropospheric ozone (O₃) which has an indirect effect on the climate” (https://www.ipcc-data.org/guidelines/pages/glossary/glossary_lm.html).

24 While the dominant discourse around climate change is all about the harms that it will bring, it is important to remember that there are also some benefits or opportunities associated with it, depending on the location or sector. For example, when it comes to health, milder winters in temperate zones may lead to fewer wintertime deaths from myocardial infarction and stroke, and in some low-latitude regions, hotter and drier conditions make it less conducive for virus-carrying mosquitoes to survive (McMichael, 2013). Nonetheless, the global consensus is that overall, the negative effects of climate change far outweigh these expected minimal benefits.
coastal areas to introduction of new crop varieties resistant to flooding and intense heat. Beyond climate change, the growing body of adaptation literature has developed a typology that classifies adaptation actions based on several categories such as intent (autonomous/spontaneous or planned), timing (reactive, concurrent, or anticipatory), temporal scope (short- or long-term), and spatial extent (localized or widespread), among others (Smit, et al., 2000; Pelling, 2011). Adaptation is also viewed in literature as either a process or an outcome. A ‘process’ view implies open-endedness, with no reference to any particular time or subject, while adaptation as an ‘outcome’ generates higher expectation (because of the connotation of finality) (Levina & Tirpak, 2006).

Broader sustainability literature has questioned the dichotomy between mitigation and adaptation, noting that mitigation is merely a function of adaptation or an ‘adaptive act’ (Pelling, 2011). Pursuing mitigation efforts ameliorate or even reverse climate change through reduction of greenhouse gas emissions, which eventually reduces the need for further adaptation. Nevertheless, for operational purposes, international climate policy has evolved to distinguish between the two, which in practice have different targets, interventions, temporal and spatial scales, costs and benefits, and actors involved (Klein, Schipper, & Dessai, 2005). Moreover, given the slow pace of action in the area of mitigation and the fear that current mitigation efforts may even fail, the prospect of more serious impacts of climate change unfolding becomes inevitable. Hence, a strong emphasis on adaptation separate from mitigation therefore becomes necessary. For this DELTA Project, like the IPCC’s approach, mitigation and adaptation are treated separately.

When it comes to climate adaptation in particular and adaptation science in general, another related term is resilience. The IPCC (2014a, 5) defines resilience as “the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also
maintaining the capacity for adaptation, learning, and transformation.” A term first used in diverse fields such as psychology, ecology, and social-ecological systems (SES), resilience has gained widespread popularity especially over the past decade (Holling, 1973; Alexander, 2013). At the turn of the 21st century, it began to creep from ecology and SES into social systems, with its widespread use in the area of disaster risk reduction, and then later extending to cover other forms of acute shocks and chronic stresses, culminating with climate change. In a review, Davidson, et al. (2016) constructed a typology of resilience with five major domains – engineering resilience, social-ecological resilience, urban resilience, disaster resilience, and community resilience. More recently, the concept has enjoyed global attention, thanks to the Rockefeller Foundation’s 100 Resilient Cities Challenge and its promotion of the concept of ‘resilience dividend’ – the dual benefits of bouncing back from disruption and new opportunities that are opened through resilience building (Rodin, 2014).

Triggered by recent events such as conflict situations (Martineau, et al., 2017), refugee influx (Ammar, et al., 2016), natural disasters (Fukuma, et al., 2017), financial crisis (Thomas, et al., 2013), and most significantly the West African Ebola outbreak (Kruk, et al., 2015), the global health field has recently seen an explosion of papers exploring the concept of ‘health system resilience.’ The definition of a ‘resilient health system’ proposed by Kruk, et al. (2015, 1) is by far the most popularly referenced: “the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons

25 For more information about the 100 Resilient Cities Challenge, visit https://www.100resilientcities.org/.
26 Unlike the concept of resilience, there is little discourse happening around the concept of adaptation as applied to health systems. One probable reason is that it is seen as only applicable to the issue of climate change (unlike resilience which has been applied to a wide array of external shocks and stresses. In a viewpoint by Blashki, et al. (2011), three key principles of health system adaptation to climate change were posited: flexibility (in terms of service location, scale of response, and type of service and service provider); strategic allocation of resources (by building on existing services, prioritizing vulnerable populations, and ensuring equitable and just access to services); and robustness (through resilient infrastructure, consistent services, and sustainable workforce).
learned during the crisis, reorganize if conditions require it.” Their framework identified five characteristics of a resilient health system – aware, diverse, self-regulating, integrated, and adaptive – which are being proposed to constitute a ‘resilience index’ for health systems (Kruk, et al., 2017).

Nevertheless, as manifested in numerous proposed definitions and frameworks, there seems to be little consensus within the health system community on what resilience really means (Turenne, et al., 2019). Moreover, the global health field must observe caution with borrowing concepts such as resilience from other disciplines, as it may lead to ‘paradigm creep’ – “the use of buzzwords far beyond their original sphere of application, which in turn can dilute their meaning and utility” (Park, 2011, 337) – which may limit its utility as a ‘boundary object’ and ‘mobilizing metaphor’ between disciplines (Brand and Jax, 2007; Tanner, Bahadur, & Moench, 2017).

Adaptation and resilience are two closely related concepts with myriad definitions and sometimes even used interchangeably. However, these two terms are not synonymous at all. In the wider sustainability science literature, resilience is commonly conceptualized as the system’s property to absorb shocks and stresses, return to a state of equilibrium (‘bouncing back’), and ensure functional persistence amid disturbances (Davidson, et al., 2016; Manyena, 2016). On the other hand, adaptation generally pertains to the incremental adjustments or, if necessary, dramatic transformations undertaken by a system in response to changing external conditions (Pelling, 2011).

Until today, debates continue whether one is subsumed under the other. Some conceptualize adaptation as part of resilience as a system property (Folke, et al., 2010; Béné, et al., 2012), and adaptations are needed to preserve system resilience (Nelson, 2011). On the other hand, others view resilience (system-maintaining) as an initial phase of adaptation, with transformation
(system-altering) being the other end of the spectrum (Pelling, 2011; Fisichelli, Schuurman, & Hoffman, 2016). Irrespective of these debates, there is a growing recognition that both constructs are useful especially when informing policy and practice. For instance, resilience is considered a useful frame to understand adaptation and fill its limitations and gaps (Nelson, Adger, & Brown, 2007). The ‘actor-centered’ view of adaptation, focused on reducing vulnerabilities, is strengthened by the ‘systems-orientated’ approach of resilience building.

Without a concern for adaptation and transformation, resilience alone is also deemed inadequate. The resilience frame implies status quo preservation, which may be detrimental to systems in the light of massive external changes (Van de Pas, et al., 2017). It also creates a ‘depoliticizing effect’ – that populations affected by shocks and stresses should be responsible for securing themselves and not depend on external (political) forces (Brown, 2012). The resilience concept is viewed to be unable to address complex social processes such as power relations and human agency, and is perceived to reinforce a “neoliberal hegemony,” passing responsibility from “accountable collective bodies onto the marginalized and vulnerable” (Gillard, 2016, 4). Hence, because of the limitations of either concept, for the purpose of this DELTA Project, both adaptation and resilience are studied and treated separately while acknowledging their close connection as well as potential tensions.

Finally, when discussing about system-wide responses – especially adaptation – to climate change, another concept that is often cited is adaptive capacity. Like adaptation and resilience, numerous definitions of adaptive capacity have been proposed. For the purpose of this project, a good starting point is the one proposed by the IPCC (2014b, 1251): “the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.” In short, they are the preconditions that enable adaptive behavior.
Another term, *sources of resilience*, also pertains to this similar concept (Folke, 2006).

Adaptive capacity is a term that is often discussed in relation to other concepts. For instance, adaptive capacity is also viewed as a concept shared by both adaptation and resilience – i.e., a system that has high level of adaptive capacity can both ensure functional persistence (resilience) or create incremental adjustments or transformations (adaptation), depending on which pathway is required by the situation (Engle, 2011). Adaptations are also described as manifestations of adaptive capacity (Smit & Wandel, 2005), while adaptive capacity is conceived as the resources and abilities for influencing, managing, and maintaining resilience (Engle, 2011; Nelson, 2011). Meanwhile, adaptive capacity is also linked to another concept – *vulnerability*, which is broadly defined as the degree to which a system is susceptible to harm, such as the adverse effects of climate change (IPCC, 2014a). Vulnerability is generally conceptualized as a function of the hazard to which the system is exposed to, the system’s sensitivity to it, and the system’s adaptive capacity. Simply put, controlling for exposure and sensitivity, increased adaptive capacity reduces vulnerability (Smit & Wandel, 2006).

Currently, there is no agreement as to what constitutes adaptive capacity, and as a result, there is also no consensus on how to measure it (Engle, 2011). What is certain is that the execution of successful adaptation, for instance to climate change, is a manifestation of some degree of adaptive capacity (Smit & Wandel, 2006). In terms of its determinants, the IPCC (2001) identifies economic resources, technology, information and skills, infrastructure, institutions, and equity. Meanwhile, since this DELTA Project focuses on local health systems, a potentially useful framework is the one developed by Jones, et al. (2010) for analyzing local-level adaptive capacity, which is comprised of
five characteristics – asset base, institutions and entitlements, knowledge and information, innovation, and flexible and forward-looking decision-making and governance (Figure 3).

![Diagram](image-url)

**Figure 3. Framework for analyzing adaptive capacity at the local level**

*Source: Jones, et al., 2010*

When it comes to the adaptive capacity of institutions, Gupta, et al. (2010) developed an ‘Adaptive Capacity Wheel’ comprised of six dimensions (variety, learning capacity, room for autonomous change, leadership, availability of resources, and fair governance) with 22 criteria underneath them. Synthesizing previous literature, Keenan (2015) simplifies the determinants of adaptive capacity into a trifecta of factors – awareness (beliefs and perceptions, learning capacity, and processes for signal detection), strategy (the ‘what’ and ‘how’ for acting on the changes detected through awareness), and space of decisions (technical, commercial, financial, and informational
spaces where the adaptation strategies chosen are to be executed). These existing frameworks would be useful for examining the local case studies in the later chapter.

**Survey of Climate Change and Health System Frameworks**

In addition to the basic climate change concepts discussed above, several proposed frameworks related to climate change and health systems will be useful for examining the case studies in the next chapter. As mentioned in the Introduction, there are a few frameworks that were put forward by international organizations to guide the consideration of climate change in health system development. This section covers only three that are most widely used and are potentially helpful for this DELTA Project.

The first one, developed by the WHO (2015b), is an operational framework for building ‘climate-resilient’ health systems (Figure 4). WHO (2015b, 8) defines a ‘climate-resilient’ health system as “one that is capable to anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stress, so as to bring sustained improvements in population health, despite an unstable climate.” It is important to note that the framework chose the term ‘resilience’ as opposed to ‘adaptation’ (as in ‘climate-adaptive’ health system); the WHO report admits that while health system adaptation to climate change is important, “the preservation of a certain level of quality and sustainable performance of the system itself is not ensured” (if the focus is on adaptation alone) (2015b, 7).

The operational framework builds on the WHO’s health system framework (WHO, 2007), which is comprised of six ‘building blocks’ – leadership and governance, financing, service delivery, health workforce, health information systems, and essential medical products and technologies. For sure, the ‘building blocks’ framework has its limitations: 1) given its supply side focus, it ignores the
demand side of health systems, particularly patients and communities (Van Olmen, et al., 2012; Sacks, et al., 2019) and; 2) it does not reflect the dynamic nature of the health system as a complex adaptive system, characterized by nonlinearity, feedback loops, and surprises (De Savigny & Adam, 2009). Nonetheless, being simple and intuitive, this health systems framework is widely used by health ministries in developing countries, hence making it a good starting point for introducing ‘climate resilience’ to the health sector.

Figure 4. WHO's operational framework for climate-resilient health systems

Source: WHO, 2015b

The ‘climate-resilient’ health system framework incorporated climate change into the six building blocks and turned them into ten components. These components are identified for mainstreaming
climate change into the different sector-wide or vertical programs of a health ministry and guide the development of National Adaptation Plans (NAPs). It can be noted though that much of the elaboration in relation to climate change were made in only two building blocks – service delivery and health information systems. To date, there exists no documentation as to how this operational framework has supported national health planning that considers the climate, although elements of this framework are reflected in WHO Climate and Health Country Profiles (WHO, 2015a).

Apart from the operational framework that is based on the health system’s building blocks, the WHO report also includes a conceptual framework that describes how health systems respond to chronic stresses and acute shocks such as the ones brought about by climate change (Figure 5). The diagram brings together the different climate change concepts discussed earlier and illustrates how they are all connected when applied to health systems. For instance, resilience is conceptualized a system property characterized by reduced vulnerability and increased adaptive capacity. While the word ‘adaptation’ is not explicitly mentioned, the diagram includes recovering better than before or even transforming to another state as potential outcomes of health system-wide responses to climate change. This conceptual framework is an initial attempt to apply concepts used in climate science and social-ecological systems to health systems thinking, and more empirical work through research and practice is needed to demonstrate how these concepts operate.

Despite its several advantages, the WHO climate-resilient health system framework also has its limitations, especially when it comes to its applicability in local health systems. First, the framework was originally designed as a guiding tool for national governments, and some components are applicable only at the level of the health ministry (such as national climate and health research and national climate and health financing). For sure, local health systems are anchored on nationally determined structures, norms, and processes, but the framework does not
explicitly act like a ‘how-to’ guide for local governments. The WHO document assumes that the task of 'localizing' this operational framework lies on health ministries.

Another limitation is that the framework puts greater emphasis on health sector adaptation (and resilience) to climate change with little emphasis on the health system's role in mitigation, although there are references to several climate mitigation measures such as adoption of green practices in hospitals and air quality monitoring. This observation is somehow not surprising as the health sector is traditionally seen as an adaptation sector, primarily focused on addressing climate change's health impacts. Such notion is reflected even in the reports of the IPCC, which included health only in the section on adaptation.
To complement the emphasis on health sector adaptation, parallel efforts have been undertaken to highlight the roles of the health sector in climate change mitigation. The first role pertains to health sector advocacy and research on the public health ‘co-benefits’ of climate mitigation measures in other policy areas such as energy, transport, and agriculture (Haines, et al., 2009). For instance, over the past five years, heightened attention was given to the issue of outdoor and indoor air pollution, which causes nearly 7 million deaths globally each year; air pollution and climate change both share similar sources that emit both carbon dioxide and particulate matter (Landrigan, et al., 2017). Another area in which the health sector has been very involved is agriculture. Calls have been made for transitioning from a meat-based to a plant-based diet to both reduce greenhouse gases emitted by the meat industry and prevent chronic diseases coming from overconsumption of meat (Willett, et al., 2019).

The second mitigation role of the health sector is directed towards the sector itself. Over the past decade, there has been an increasing recognition that hospitals and health facilities, while providing healthcare, do emit carbon too, and therefore health systems must do their part to reduce their environmental footprint as contribution to society-wide climate mitigation. National economic input-output life cycle assessments estimated the share of national health systems’ carbon footprint in relation to their countries’ overall emissions, from 7% in Australia (Malik, et al., 2018) to 10% in the US (Eckelman & Sherman, 2016). Several toolkits have also been developed for assessing not just the resilience of health facilities to natural disasters but also their adoption of green sustainable practices (Balbus, J., et al., 2016). Most notably, the environment and health advocacy organization Health Care Without Harm (HCWH) launched the Global Green and Healthy Hospitals (GGHH) program, which is guided by a 10-point agenda covering different areas of hospital operations such as the management of chemicals, wastes, and water, procurement of medicines and other commodities, and energy use, among others (2011) (Figure 6).
To combine the two parallel streams of climate adaptation and mitigation in the health sector, the World Bank (2018) recently introduced a new framework called ‘climate-smart’ healthcare (Figure 7). Already used in other sectors such as agriculture (Lipper, et al., 2014) and urban development (i.e., ‘climate-smart’ cities – World Bank, 2019), the term ‘climate-smart’ generally pertains to the convergence of climate mitigation and adaptation. In some ways, it combines WHO's ‘climate-resilient’ health systems framework with HCWH's GGHH agenda (among others). However, unlike that of the WHO's, this framework was developed not as a guidance document for national governments but to memorialize the Bank's strategy for incorporating climate change into its health investments, with the hope that it will later be adopted by the broader global health and international development community. The report synthesizes the wide array of mitigation (e.g., installing solar panels in health facilities) and adaptation (e.g., setting up early warning systems) options for the health sector, as well as the various tools that can be used for conducting vulnerability and adaptation assessments, carbon footprint calculation, and designing health and nutrition programs that consider the climate.
While the World Bank report presents examples of specific hospitals and health systems that implement one or more of the ‘climate-smart’ interventions recommended, a concrete example of a fully ‘climate-smart’ health system, whether at the national or subnational level, is still yet to be identified and studied. Such a determination is not possible anyway, as the World Bank document, apart from enumerating specific technology options that are available, does not explicitly describe the different characteristics or dimensions of a ‘climate-smart’ health system, let alone lay down specific criteria or indicators for measuring a health system’s ‘climate-smartness.’ Currently, there is also no known exercise or project happening that promotes the climate-smart healthcare concept, at least in publicly available literature (online and in print).

**Research Design and Methodology**

The narrative review of climate change concepts and proposed climate and health system frameworks in the previous section provides an adequate background for the next step of this DELTA Project, which is the generation of real-world insights through empirical research. To
accomplish this goal, this DELTA Project adopted an exploratory, holistic, multiple case study design and observed widely accepted case study research principles and methodology as articulated by Yin (2018). A case study is “an empirical method that investigates a contemporary phenomenon (the ‘case’) in depth and within its real-world context” (Yin, 2018, 15). In short, unlike an experiment, the researcher has no control over the behavior of the system being analyzed.

Case studies attempt to answer not just ‘what’ but also ‘why’ and ‘how’ questions. In general, there are three types of case studies – descriptive, exploratory, and explanatory. As earlier mentioned, this DELTA Project is exploratory in purpose as it attempts to investigate questions and themes that are understudied (such as the role of municipal health systems in responding to climate change), with the hope of generating new insights, novel research questions, or even a working hypothesis. Hence, it does more than describing but does not attempt to provide partial or full explanation to observed phenomena.

Meanwhile, this case study project is holistic in nature because the entire case – in this occasion the municipality – was examined. This contrasts with an embedded case study, wherein two or more sub-units of a case (for instance, villages in a municipality) are studied. The definition of a ‘case’ in this research is described later (See ’Case definition and selection’).

In addition, this case study research adopted a multiple case design because there is more than one ‘case’ that was being investigated. However, while there are certainly many more cases that could have been included in this project, only two Philippine municipalities – Del Carmen in the province of Surigao del Norte and Ajuy in the province of Iloilo – were selected for the purpose of this exploratory research (Figure 8). While additional number of cases can further strengthen the study’s cross-case findings, Yin reminds that a multiple case study design does not observe a
'sampling logic' – there is no ‘right’ sample size of cases for research findings to be considered generalizable. Instead, case studies adopt what is called a ‘replication logic’ – individual cases either predict similar results ('literal replication') or contrasting results but for anticipatable reasons ('theoretical replication'). In simple terms, the second case can either exhibit the same findings as the first because of similar contextual characteristics, or present different findings as expected because the context is significantly different.

Figure 8. Map of the Philippines showing the two cases – Del Carmen and Ajuy

Source: Author

Corollary to the concept of replication logic, adopting a multiple case study design is also one measure to ensure the research's external validity (Yin, 2018). Findings from multiple case studies are generalizable in a sense that they apply to other cases with similar contexts (analytic generalization) and not because they extrapolate probabilities (statistical generalization). In short, they are generalizable only to “theoretical propositions and not to populations or universes” (Yin, 2018, 20). This is how findings from this DELTA Project should be treated – the insights that will be
drawn are likely more applicable to other cases with similar contexts (e.g., low-income, rural, coastal municipalities in a developing tropical country), and their application in other settings will need to be further tested, perhaps through another multiple case study with different sociodemographic, economic, and geographical characteristics.

This multiple case study research followed a two-step analytical process (Figure 9). The first step is individual analysis of each case, which would hopefully generate insights specific to the case that can be used for developing recommendations for action. The second step is the cross-case synthesis, wherein the two cases were jointly investigated in order to draw common themes and shared lessons. The details of each analytical step are discussed later (See 'Data analysis').

Figure 9. Two-step analytical approach for the multiple case study research

Source: Author's elaboration
Case definition and selection

Since this project focuses on the local health system, the case being referred to in this multiple case study research is the municipality. The Local Government Code of 1991 (Congress of the Philippines, 1991) describes the municipality (also called a town) as a type of local government unit (LGU) with a population of at least 25,000 people. The other types of LGU are the province, the city, and the barangay – the smallest political unit in the Philippines. A province is comprised of several municipalities, and a municipality is composed of numerous barangays.

The Local Government Code enabled the process of devolution which transferred some of the power and authority from the national government to LGUs such as regions, provinces, and municipalities. As a result, Philippine municipalities enjoy corporate status and powers of self-government or jurisdiction (i.e., local autonomy). Hence, they are not only responsible for delivering a wide range of services covering health, agriculture, environment, social welfare, and

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27 However, some smaller jurisdictions, such as Del Carmen, have been declared municipalities prior to this definition in Section 442 of the Local Government Code. See Table 1 for Del Carmen’s population size. Apart from population size, other requisites for the creation of municipalities are: an average annual income of at least PhP 2.5 million (USD 48,000) for the last two consecutive years based on 1991 constant prices; and a contiguous territory of at least 50 km².

28 Section 461 of the Local Government Code defines the criteria for the creation of provinces: a population of not less than 250,000 inhabitants; average annual income of at least PhP 20 million (USD 384,000); and a contiguous territory of at least 2,000 km².

29 The city can be thought of as an urbanized municipality. However, Section 450 of the Local Government Code set a criteria for cityhood, such as a population of at least 150,000; income of at least PhP 20 million (USD 384,000); and land area of at least 100 km². They can be part of a province or independent (i.e., reporting directly to national government).

30 Section 384 of the Local Government Code describes the function of the barangay: “the primary planning and implementing unit of government policies, plans, programs, projects, and activities in the community, and as a forum wherein the collective views of the people may be expressed, crystallized and considered, and where disputes may be amicably settled.” Each barangay has a council composed of a chairman, seven regular council members and the chair of the youth council.

31 Based on the public administration approach, devolution is the “creation or strengthening of subnational levels of government (often termed local government or local authorities) that are substantially independent of the national level with respect to a defined set of functions” (Mills, et al, 1990, 19). It is one of the four types of decentralization, the others being: deconcentration (shifting power from the central offices to peripheral offices of the same administrative structure); delegation (shifting responsibility and authority to semi-autonomous agencies); and privatization (transferring operational responsibilities and in some cases ownership to private providers).
other sectors, but they also play important regulatory, corporate, and fiscal functions, including the right to collect taxes and create local budgets. A more in-depth description of the municipality, including its government and health system, is provided towards the end of this chapter.

The Philippines is a vast archipelagic country with 1,489 municipalities representing a diverse range of social, demographic, economic, political, cultural, and ecological profiles (Philippine Statistics Authority, 2019). Given this immense pool of potential cases for this project, several criteria were identified not for the purpose of finding two identical cases (which is impossible in the first place), but to select two cases that share several important similar baseline characteristics that would allow for rigorous comparison and for generating common themes.

One set of criteria used to select the two cases is related to their general characteristics. Del Carmen and Ajuy are both rural municipalities with a population of approximately less than 50,000 people. While both are predominantly coastal and having a tropical climate, they are also marked by other common geographical features such as islands, mountains, and plains. Such geographic mix is reflected in the predominant source of livelihood for both municipalities – farming and fishing. Both municipalities also have a growing tourism industry, although Del Carmen is slightly more advanced than Ajuy in developing the tourism sector.\(^{32}\) Table 1 compares some of the general characteristics of the two municipality cases.

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\(^{32}\) Del Carmen is one of the nine municipalities in the island of Siargao. Over the past decade, the island has grown into a popular surfing destination due to its high sea waves. The island also hosts the largest mangrove forest reserves in the country’s Mindanao region, which has turned into an ecotourism spot. The mangrove forest is deemed an important climate adaptation measure and is featured in the Results Statement.
Table 1. General characteristics of Del Carmen and Ajuy

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Del Carmen</th>
<th>Ajuy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Rural</td>
<td>Rural</td>
</tr>
<tr>
<td>Land Area</td>
<td>151.68 km²</td>
<td>175.57 km²</td>
</tr>
<tr>
<td>Number of Barangays</td>
<td>20</td>
<td>34</td>
</tr>
<tr>
<td>Revenue (in PhP³⁴)</td>
<td>69.3 million (2016)</td>
<td>114.6 million (2016)</td>
</tr>
<tr>
<td>Income Class³⁵</td>
<td>5th Class</td>
<td>2nd Class</td>
</tr>
<tr>
<td>Livelihood</td>
<td>Farming, fishing, tourism</td>
<td>Farming, fishing, tourism</td>
</tr>
<tr>
<td>Geography</td>
<td>Coastal, island, mountain, plain</td>
<td>Coastal, island, mountain, plain</td>
</tr>
</tbody>
</table>

Meanwhile, another set of criteria used to select the two municipalities are related to different aspects of climate change. When it comes to types of vulnerability to climate change, the two are confronted with the same hydrometeorological hazards – typhoons, storm surges, slow-onset sea level rise, landslides, flooding, and drought. Specifically, both municipalities are located along the trajectory of Typhoon Haiyan. However, the two municipalities were not as tragically hit by Haiyan as other towns and cities, especially Tacloban in Leyte province.³⁶ Nonetheless, Typhoon Haiyan served as an important wake-up call for the two municipalities to ramp up their local disaster risk reduction and management efforts.

³³ Philippine Statistics Authority, 2015
³⁵ Executive Order No. 249 classifies Philippine municipalities according to “the average annual income that they actually realized during the last four calendar years immediately preceding the general classification” (President of the Philippines, 1987, np). Here are the cut-offs: 1st class – PhP 15 million or more; 2nd class – PhP 10 million or more but less than PhP 15 million; 3rd class – PhP 5 million or more but less than PhP 10 million; 4th class – PhP 3 million or more but less than PhP 5 million; 5th class – PhP 1 million or more but less than PhP 3 million; 6th class – less than PhP 1 million.
³⁶ Much of the coastal city of Tacloban is very low-lying. “Official figures from the Global Disaster Alert and Coordination System suggest the storm surge reached 2.3 meters in Tacloban, but anecdotal evidence from people on the ground suggests it was much higher” (BBC, 2013).
In addition to enhancing disaster preparedness and response, both Del Carmen and Ajuy have already commenced initiatives that address the impacts of climate change on other sectors, particularly agriculture and tourism. These initiatives are described with greater depth in the Results Statement section of this thesis and discussed vis-à-vis efforts from the health sector. Finally, and in relation to these climate-related activities, both municipalities are also led by municipal mayors who demonstrated some knowledge of climate change and its impacts and therefore expressed commitment to addressing it locally.\(^{37}\) Hence, there is also strong political support from the two municipalities’ respective local governments for the conduct of this case study research. Each municipality made it logistically feasible for the field data collection to be conducted within a tight one-week period, and each also expressed willingness to utilize research findings and collaborate on concrete implementation projects post-DELTA.

Despite the presence of these positive attributes such as the existence of climate-related initiatives and strong buy-in from the top, this case study research does not make an assumption \emph{ex ante} that these two municipalities are concrete examples of communities with good, adequate, or successful response (i.e., adaptation) to climate change. Such an evaluation or even comparison (between the two municipalities, or between them and other municipalities that were not selected for this research) is beyond the scope of this thesis. Furthermore, as earlier discussed, conducting such assessment is difficult due to lack of consensus on adaptation evaluation and measurement within the research and practice community.

\(^{37}\) While a set of criteria was defined for selecting municipalities for this case study research, a major reason for the selection of Del Carmen and Ajuy is the willingness of the two towns’ municipal mayors to be included in this DELTA Project. I have been in contact with the mayor of Del Carmen since 2016, when I first visited the municipality as part of a leadership program. On the other hand, the mayor of Ajuy was introduced to me in October 2019 when I was attending a conference hosted by the Philippine Climate Change Commission in observance of the National Climate Change Consciousness Week.
Finally, while both municipalities share numerous general and climate-related characteristics, they also possess slight differences as well as distinctive features. Some of these detailed differences may offer invaluable insights and lead to unique recommendations for a specific case, but others may not be significant enough to alter higher-level insights generated through the cross-case synthesis. Important points of distinction between the two municipalities are discussed in the Results Statement as needed.

Case study themes and topics

Given that this is an exploratory case study research looking at the nexus between climate change and health systems, there is a broad range of potential themes and topics that can be potentially investigated. In a way, this case study provides a 'snapshot' of the two municipalities and a rapid assessment of the present situation. The different topics that are deemed relevant are divided into four main themes, as depicted in Figure 10. It should be noted that these themes and topics serve as guidance for the data collection phase, which will provide the empirical findings that are later subjected to data analysis and interpretation.

The first theme pertains to the overall context surrounding the case, which includes geographic, environmental, political, social, cultural, and economic factors. This case study does not attempt to provide a comprehensive and in-depth discussion and analysis of the municipality's context. However, demonstrating familiarity about the surrounding context helps in situating the findings of this case study and extrapolating their potential application in similar settings (e.g., similar socio-economic status or physical geography).
The next theme is characterizing the municipality's vulnerability to climate change and its health effects. As earlier discussed, vulnerability is a function of exposure, sensitivity, and adaptive capacity. However, for the purpose of simplicity, this theme covers mainly exposure (i.e., the types of climate-related hazards the municipality is exposed to) and sensitivity (mainly in terms of population health status). Meanwhile, the adaptive capacity of the municipal health system and the municipality at large are reflected in later themes.

When characterizing climate and health vulnerability, it is important to note that in general, the complex phenomenon of climate change manifests in three ways: change in long-term trends (average); change in variability over finite periods; and occurrence of extreme weather events such as typhoon, flood, and drought (Smit, et al, 2000). This research attempted to briefly cover these three in each of the case studies given the best available information. Key elements under the theme of climate and health vulnerability include both historical and projected effects (identified through
either stakeholder perception obtained through interviews or systematic assessment based on available documents) as well as baseline health profile (e.g., vital health statistics, common causes of morbidity and mortality, etc.), which is deemed an important determinant of population health vulnerability to future climate change (Yohe & Ebi, 2005; Ebi, et al., 2018c).

As mentioned, the next two themes will provide some indication of the adaptive capacity of the municipal health system and the larger municipality and help generate insights on the challenges and opportunities encountered in local level responses to climate change. The third theme pertains to the municipal health system itself. Instead of merely using the ‘building blocks’ framework in examining the health system, a broader view was adopted to cover both its ‘hardware’ and ‘software’ elements (Sheikh, et al., 2011). The hardware elements include both the health system's building blocks (i.e., inputs like workforce and medicines) and functions (such as governance and financing, which turn the inputs into intermediate outputs, such as the efficient delivery of a specific clinical intervention, and eventually into ultimate outcomes, such as improved aggregate health) (Murray & Frenk, 2000). A special emphasis is made about the distinction between healthcare and public health, as most health system analyses tend to focus on individual clinical services and ignore population-based interventions such as community vaccination, health education, vector control, and sanitation, among others.

On the other hand, software pertains to the “ideas and interests, values and norms, and affinities and power that guide actions and underpin the relationships among system actors and elements” (Sheikh, et al., 2011, 2). Barasa, Cloete, & Gilson (2017, iii92) also dissected health system software into the “tangible software of management knowledge and skills, and organizational systems and procedures as well as the intangible software of values and norms, relationships, and power.” It can be argued that even intangible dimensions such as power are not necessarily invisible at all – for
example, power can be ‘seen’ in physical objects, mission statements, workplace design, routines and rituals, and interactions between staff, among others (Erasmus & Gilson, 2008). While these elements are sometimes missed in the traditional programmatic approach that is usually oriented around building blocks and functions, they are undoubtedly crucial in shaping the hardware dynamics of the health system (e.g., actual service delivery), especially in the context of continuous change.

The hardware and software elements of a health system are, by themselves, still broad categories. Therefore, for the purpose of this assessment, specific indicators and pointers were pre-identified as guide (Table 2). When it comes to hardware building blocks and functions, there is a long list of indicators already being tracked and measured by the WHO, national governments, and donor agencies (WHO, 2010; Health Finance & Governance Project, 2017); however, most of these measures are applicable only for monitoring of global progress as well as national level assessments. Meanwhile, due to the limited attention given by health systems policy and research to subnational/local level, there is a lack of consensus or guidance on local health system performance assessment and monitoring. For this case study, and considering the Philippine context, indicators that can be described and assessed at the local level were extrapolated and identified.

Some of these hardware indicators are hard to quantify, while others may have numerous components underneath them. For example, under infrastructure, general service readiness – which is included in WHO’s Service Availability and Readiness Assessment or SARA survey (WHO, 2015c) – is in itself a domain composed of many tracer indicators. In this case study research, multiple sources of data were exploited to describe, qualitatively or quantitatively, these different health system elements and lead closer to the real picture (See ‘Data collection methods’).
Table 2. Indicators and pointers for describing health system ‘hardware’ and ‘software’ elements

<table>
<thead>
<tr>
<th>Building Blocks</th>
<th>Hardware</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governance</td>
<td>Degree of priority given to health in municipal governance; development of local health policies (i.e., ordinances) and projects; level of oversight and enforcement of regulations; community participation in planning and decision-making; intersectoral action for health</td>
<td>Ability (of an actor or the system) to create a clear and shared vision and to motivate actors to act towards achieving a common goal</td>
</tr>
<tr>
<td>Resource Mobilization</td>
<td>Sources of municipal health funding (in addition to PhilHealth); budgeting process; availability of funds for emergencies</td>
<td>Healthy and opportunistic workplace environment that encourages learning, creativity, and innovation</td>
</tr>
<tr>
<td>Financing</td>
<td>Health insurance (PhilHealth) population coverage; likelihood of out-of-pocket payments, catastrophic spending and impoverishment; availability of funding for population-based public health interventions</td>
<td>Degree of control of actors towards each other; Ability to exercise individual agency (e.g., take initiative, make decisions) to positively influence the system</td>
</tr>
<tr>
<td>Service Delivery</td>
<td>Range of public health and healthcare services available; care coordination (i.e., referral and back-referral system); indication of healthcare service quality and safety (i.e., cleanliness, respect towards patients, observance of safety precautions)</td>
<td>Articulation of positive values and aspirations (as reflected in physical objects, documents, and organizational practices); Written and unwritten rules that define actor behavior</td>
</tr>
<tr>
<td>Workforce</td>
<td>Types, number, and distribution of local health staff; clinical and managerial competence especially when it comes to climate-sensitive diseases and disaster response</td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Number and physical accessibility of hospitals and primary care facilities; general service readiness (i.e., presence of basic amenities and equipment); vulnerability of physical buildings to natural disasters</td>
<td></td>
</tr>
<tr>
<td>Medicines and Devices</td>
<td>Types, amount, and sustainability of available medical supply; types and number of medical devices available</td>
<td></td>
</tr>
<tr>
<td>Information System</td>
<td>Data collection and storage (e.g., paper-based or electronic); Capacity for analysis, synthesis, and translation of health information</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s elaboration

As earlier mentioned, most health system hardware indicators widely used today apply to global and national assessments. These indicators, many of which were drawn from WHO (2010) and Health Finance & Governance Project (2017) were tailored to the local/municipal level and with consideration of the unique Philippine context. Meanwhile, the pointers for describing software elements were mainly based on Barasa, Mbau and Gilson (2018) and Erasmus and Gilson (2008).
On the other hand, health system software elements, while can be observed and described, are much harder to measure, especially in quantitative terms (Gore & Parker, 2019; Erasmus & Gilson, 2008). Investigating such aspects usually requires full-blown research studies utilizing a variety of social science methods (i.e., ethnography, social network analysis, etc.) (Storeng & Mishra, 2014; De Brún & McAuliffe, 2018). Nevertheless, as earlier said, these software elements can be ‘seen,’ and the use of multiple data collection methods can surface their tangible manifestations. Hence, for this case study research, some pointers were developed for describing these software elements. It must also be noted that these pre-identified software elements are deeply interrelated and can even be overlapping (e.g., power dynamics can be manifested in values statement or workplace culture).

Finally, special emphasis is given to a fourth theme, which in the diagram above is described as ‘systems for health.’ These systems pertain to the other sectors outside of the traditional health system that relate to climate change or human health or both. Sectors such as disaster risk reduction, environment, and agriculture are vital both in pursuing direct climate adaptation measures as well as in addressing the social and environmental determinants of health, many of which are also indirectly affected by climate change (Galvão, et al., 2009). Aspects that were investigated include: current and projected challenges faced by each sector, especially linked to climate change, environment and/or health; ongoing and planned sector-specific activities to address them; and interactions with health and other sectors for responding to cross-cutting issues.

It is important to note that some of the aforementioned themes and topics are traditionally captured in more conventional assessment tools in climate change and health systems practice. For instance, characterization of climate-related hazards is covered in climate vulnerability and adaptation assessments (WHO, 2013) which are conducted to not just describe baseline vulnerability but also project future impacts and identify, prioritize, implement, and evaluate
adaptation interventions. Meanwhile, description of health system building blocks and functions is a main feature of comprehensive health systems analyses (Berman & Bitran, 2011) that seek to diagnose gaps and bottlenecks and measure different intermediate outcomes (e.g., efficiency, quality, access) and/or the attainment of health system goals (e.g., improved health, reduction of health inequality, enhanced financial risk protection).

While this case study research has numerous overlaps with these assessment tools, this project does not in any way replace these tools. For instance, unlike a full-blown and comprehensive vulnerability and adaptation assessment, this project did not attempt to evaluate the range of adaptation options through a participatory exercise and/or the use of decision support tools such as multi-criteria decision analysis (Haque, 2016). It also does not resemble a comprehensive health system performance assessment, which would likely aim to measure the effectiveness of specific health interventions or make a judgement about the success (or failure) of health sector reform in achieving desired health system goals.

**Case study protocol and interview guide**

Prior to collecting data about the two cases from the field, a case study protocol was developed, informed by themes and topics described above as well as the concepts and frameworks discussed in the literature review. The protocol is a vital guide for the whole data collection process and an important measure for ensuring the reliability of a case study (Yin, 2018). The case study protocol (See Appendix 1) contains the following: overview of the case study research; main research questions; logistical considerations for the field visit; description of data collection procedures; key topics and themes especially for the key informant interviews; and tentative template of the written individual case study. Based on the case study protocol, a semi-structured interview guide was also
developed (See Appendix 2). The specific questions in the interview guide elaborated on the themes and topics earlier identified in the protocol.

**Data collection methods**

The two municipalities were consecutively visited during a two-week period in February 2019, one week for each municipality. Prior to the field visits, communication over email and phone was established with the local governments of the two case municipalities. In collecting data from each case, three methods were employed – key informant interviews, document reviews, and field observations. A brief background document about the case study research, as well as a list of target key informants and requested documents were provided to the municipality in advance.

**Key informant interviews.** For the semi-structured interviews, participants were pre-identified based on their roles in the municipality (Table 3). Prior to the field visit, key informants were sent with invitation letters requesting for interview date, time, and specific location. While the sequence of the interviews depended on the availability of the key informants, the municipal mayor and the municipal health officer were prioritized on the first day of the field visit, as it was expected that they would provide a broad overview of the situation of the municipality and the local health system. They also provided leads to other potential issues that may merit investigation or other key informants that should be considered for interview. Informed consent was sought from each participant.

During the interviews, several themes were explored which were listed in the interview guide, such as the current context of the municipality, present situation of the local health system, and local issues around climate change and disaster vulnerability, among others. Each interview lasted for approximately 30 minutes to one hour. In the Philippines, English is the medium of communication
in government and business; however, in situations where the key informant is not comfortable speaking in English, the topics and questions in the interview guide were translated into Filipino during the conduct of the interview. All interviews were recorded both in audio and video formats (See later section on ‘Production of short films’) and then transcribed for later use in the case study writing proper. Quotes in Filipino were then translated to English.

Table 3. List of participants for the key informant interviews

<table>
<thead>
<tr>
<th>Key informants</th>
<th>Del Carmen</th>
<th>Ajuy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Municipal office staff</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Municipal mayor</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Disaster risk reduction and management officer</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Environmental management officer</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Social welfare officer</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Agricultural officer</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Budget officer/Accountant</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Planning officer</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Health system personnel</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Municipal health officer</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Public health nurse</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Midwife</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Barangay health worker</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Hospital physician</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Chairman of a barangay</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• NGO leader (if applicable)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Leader of an educational institution (if applicable)</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>• Executive assistant to the mayor</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

**Document review.** The second data collection method employed is document review. A limited number of documents, such as local plans, ordinances, and reports, were carefully selected as they are expected to contain information related to the overall workings of the municipality and its local context, local health system situation, and climate change and other environmental problems as well as the measures undertaken to address them. The documents are hoped to validate data gathered from the interviews and fill information gaps, including specific names and pertinent
quantitative details. Moreover, these documents are anticipated to also contain new information about the aforementioned themes and topics that did not emerge from the key informant interviews. Important data found in reviewed documents were recorded in a notebook and were weaved into the individual case studies. Table 4 shows the list of documents requested from the two municipal governments in this case study.

Table 4. List of documents reviewed for the case study

<table>
<thead>
<tr>
<th>Documents reviewed</th>
<th>Del Carmen</th>
<th>Ajuy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Municipal plan (short- or long-term)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Most recent annual municipal report(^{39})</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Most recent annual health report(^{40})</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Disaster risk reduction and management plan(^{41})</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Local climate change action plan(^{42})</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Hazard maps(^{43})</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Other documents that describe specific initiatives or reports of previous studies/assessments(^{44})</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Field observations.** The last data collection method used is field observations. Careful observation of everyday phenomena using a researcher’s different senses (especially sight) during a field visit is essential for corroborating findings from interviews and review of documents. It can also help

\(^{39}\) There is no nationally determined standard format for the annual municipal report. Hence, the content of such reports varies from basic summaries to comprehensive description of the municipal situation.

\(^{40}\) Similar to the annual municipal report, there is also no standard format for annual health reports. Some reports can be comprehensive, and others can provide basic information, depending on municipal health staff capacity for data collection and analysis, completeness of information being collected and stored, etc.

\(^{41}\) The Philippine Disaster Risk Reduction and Management Act of 2010 requires all LGUs (provinces, cities, and municipalities) to develop and implement a Local Disaster Risk Reduction and Management Plan (LDRRMP). This is discussed further in the later section about municipal governments.

\(^{42}\) The Climate Change Act of 2009 requires all LGUs to develop and implement a Local Climate Change Action Plan (LCCAP). This is discussed further in the later section about municipal governments.

\(^{43}\) Today, most Philippine municipalities do have hazard maps for flooding, storm surge, landslide, and other types of natural disasters. These maps were produced with support from the Mines and Geosciences Bureau (MGB) of the Philippine Department of Environment and Natural Resources (DENR).

\(^{44}\) During the actual visit, other documents not pre-identified were made available by the interview respondents – for Del Carmen, a copy of the municipality’s Eco-town Assessment; for Ajuy, a brief description of their municipal-wide initiative “Project Happiness.” These initiatives are further discussed in the Results Statement.
generate other insights that were not revealed by interviews and documents (e.g., visual phenomenon that cannot be explained in words by key informants or not documented in reports). It gives the researcher a ‘feel’ of the local situation. Ordinary people and other stakeholders who were not included in the interview were also observed as they function in a real-world setting. Since this DELTA Project is interested in the health effects of climate change, environmental changes that are already manifesting were also witnessed first-hand with the naked eye and as reported by everyday people during the field walk-through. Significant observations were recorded in a notebook. Table 5 lists down some of the different places observed during the field visits.

Table 5. List of places visited for field observations

<table>
<thead>
<tr>
<th>Locations observed</th>
<th>Del Carmen</th>
<th>Ajuy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Municipal hall</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Rural health unit (RHU)\hspace{.5em}\textsuperscript{45}</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Nearest hospital</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Barangays, especially those already affected by climate change-related effects</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Other locations unique to the case (e.g., farmlands, fishing communities, etc.)</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

\hspace{.5em}\textsuperscript{45} Each municipality has a rural health unit (RHU) which is administered by the municipal health office, which in turn is under the municipal government/LGU. The RHU is described later in this chapter in the concluding section on municipal health systems.

Data analysis

Individual case analysis. After data were collected and processed, the two-step analytical approach earlier introduced was conducted. In the first step, data from each case was internally analyzed ('within-case' analysis) to identify lessons that are unique to the case and generate specific recommendations for action applicable to the case. These case studies serve as concise assessment of the situation in the municipality in terms of their risks and vulnerabilities to climate change and its health effects as well as the challenges and opportunities they face with regard to
mounting local responses to climate and health. Hence, a more comprehensive and in-depth assessment, such as a vulnerability and adaptation assessment, is beyond the scope of this DELTA Project.

All interview transcripts, document review notes, and field observation notes were first reviewed individually then collectively. Relevant details were then inputted in a case study database in the form of a Microsoft Excel Sheet, with each row pertaining to specific questions in the case study protocol and interview guide. The development of such database is not only good practice for ensuring a case study research’s reliability (Yin, 2018). It also maintains a chain of evidence, linking case study questions and protocol topics with case study findings later derived. Presenting granular data in an Excel Sheet database also allows the easy triangulation of data between various sources (e.g., key informants) and between data collection methods (e.g., interview versus documents).

Once the case study database was filled, its contents were reviewed again, and pertinent information were then weaved into a coherent narrative using the pre-designed case study template described in the case study protocol. The template’s outline, which was based on the main themes covered in the case study protocol and interview guide, includes the following: brief overview of the municipality (socio-demographic, economic, geographic, political, cultural); general current and future issues related to climate change; current and anticipated health effects of climate change; other health and environment problems; health system challenges and opportunities; challenges and opportunities for climate action outside the health sector; and proposed recommendations for future action.

**Cross-case synthesis.** After each case was individually analyzed, the two cases were then subjected to the second step in the project’s analytical approach – cross-case synthesis, which is an analytical
method only applicable for multiple case study research (Yin, 2018). This method entails a rigorous comparing and contrasting of the two cases in order to identify patterns and themes common to both cases as well as features unique to each case (for anticipating potential rival explanations). Such juxtaposition is hoped to generate new higher-level insights or sharpen, challenge, or revise predefined theoretical propositions. Yin (2018, 197) describes this as “[thinking] upward conceptually, rather than downward into the domain of individual variables.”

In this regard, the comparison between the two cases must adopt a ‘case-based’ rather than a ‘variable-based’ approach. This means that important data from each case should be compared with the other with the whole context of the case in mind, as opposed to simple tallying of individual (numeric) variables which will unlikely generate useful hypothesis about the phenomenon being examined (even when the number of cases is increased to more than two). The goal of cross-case synthesis is to retain the integrity of the entire case rather than nitpick on specific minute details from each case. The success of cross-case synthesis relies on argumentative interpretation and not on a reductionist data table.

For the cross-case synthesis, an iterative exercise was undertaken to compare and contrast the empirical findings of the two individual case studies, with consideration of the project's main research questions as well as the climate and health concepts and frameworks discussed earlier in this chapter. As a way of “thinking upward conceptually,” key themes that are common to both cases were identified and discussed. In addition, findings that are unique to each case were also emphasized. The cross-case synthesis was wrapped up with a narrative discussion of the key issues that emerged as well as recommendations generated by this multiple case study research.
In analyzing data from different sources in a case study especially from key informant interviews, one of the challenges is delineating between what is perceived (e.g., perception of the nature, gravity, or even mere existence of a problem; normative expressions of “what should be”) and what is factual (e.g., description of an actual phenomenon – a problem, mechanism, or solution). In both the individual case studies and cross-case synthesis, data elicited from the interviews were carefully examined in the light of other interviews, reviewed documents, and personal observations in the field. In the case study narrative in the succeeding chapter (Results Platform), these nuances were explicitly acknowledged when clarification is needed.

Production of short films

Apart from the written thesis, which includes both the individual case studies and the cross-case synthesis, a short film, five to six minutes long, was also produced for each case study. The short films were developed for two main purposes: first, for presentation during the Oral Final Examination towards the end of the DELTA Project implementation, and second, as an advocacy and educational material for later dissemination through social media and public viewing events. The process of creating these short films is quite different from the traditional method applied by mainstream filmmakers, wherein researchers visit the location in advance and a script is written prior to shooting. For this DELTA Project, the field research and the recording occurred at the same time, and the script was written only after the recording.

With the help of a videographer, all interviews were recorded in video form. As earlier mentioned, all interviews were transcribed and analyzed for inclusion in the individual case studies. Meanwhile, important quotes from interview respondents were identified, and a script was then developed, which served as the basis for video editing. Short clips capturing those selected quotes were then weaved into a coherent narrative. Interviews were interspersed with clips of various
scenes in the municipality that were also recorded by the videographer during the trip. The final version of the short films was presented during the OFE held at the Harvard T.H. Chan School of Public Health on April 2, 2019. The short films can be accessed on YouTube and copies were submitted to the Harvard DrPH Program.

**Ethical considerations**

This case study research was deemed exempt from full ethical review of human subject research by the Office of Human Research Administration of the Harvard T.H. Chan School of Public Health (IRB19-0058).

Overall, generally accepted principles and methods for protecting the privacy of interview respondents and data confidentiality were observed (Streib, 1973; Kaiser, 2009; Tracy, 2010), with slight modifications due to the production of short films. Prior to the interview, informed consent was obtained from all key informants. Privacy of key informants was observed in different aspects of the research process: in email and phone correspondences prior to the interview; during the conduct of the interview in the informant’s office or preferred location without the presence of other individuals apart from the researcher and videographer; and by asking of interview questions that pertain to the case (i.e., municipality) and not to the individual.

Meanwhile, confidentiality of data collected from key informants was observed through the following: discussion of confidentiality risks and measures to address such risks during the procedure of obtaining an informed consent; removal of names in interview transcripts, case study database, and actual case study narrative; limiting access to audio and video recordings, transcripts,

46 The short films can be found in the following links: Del Carmen, Surigao del Norte - https://www.youtube.com/watch?v=PZrslj-FmEw&t=6s; Ajuy, Iloilo - https://www.youtube.com/watch?v=q29WlkxeVjc&t=6s.
and database only to the researcher (and in the case of video recordings, to the videographer); and commitment to destroy all research materials obtained up to three years after the submission of the thesis.

In both the individual case studies and cross-case synthesis, names of key informants were not mentioned, especially when direct quotes were cited. Only the position or role of the key informant and the name of the municipality were mentioned. However, for key informants whose direct quotes were chosen for the short film, their names and positions were included. All key informants were informed of this possibility when the informed consent was obtained.

Finally, as already demonstrated both in this written thesis and in the short films, the names of the two municipalities were not anonymized and their characteristics not disguised for several reasons. First, the topic of this multiple case study is not controversial enough to merit anonymity. Second, the research topic is certainly important for public health policy and practice. Policymakers and practitioners alike will benefit from learning about the experience of each of the two municipalities in their pursuit to apply the research’s findings to their own work. Lastly, this project received enormous backing from the local governments of the two municipalities, and both have committed to later utilize the new knowledge generated and translate them into concrete projects. These are indications that the local governments support the dissemination of their lessons and experiences to other audiences in the Philippines and around the world.

**The Municipality and the Municipal Health System**

Before presenting the two individual case studies and the cross-case synthesis, it is important to gain a general understanding of the workings of a municipality, particularly the municipal government and the municipal health system in the Philippines. As earlier described, the
municipality is the main platform for “coordination and delivery of basic, regular and direct services and effective governance of the inhabitants within its territorial jurisdiction” (Local Government Code, Section 440). While the municipality as a basic political unit has been existing in the Philippines for centuries, the 1991 Local Government Code has institutionalized a system that gives municipal governments “more powers, authority, responsibilities, and resources” so that they can “attain their fullest development as self-reliant communities and make them more effective partners in the attainment of national goals” (Local Government Code, Section 2).

**Municipal governments: functions, finance, and form**

Through the process of devolution, many of the functions of national government were transferred to local governments. In general, municipal governments are expected to implement nationally mandated programs such as agricultural and fishery activities, environmental conservation, management of public spaces, promotion of local livelihood and tourism, preservation of peace and order, and provision of social and health services (Local Government Code, Section 17). When municipal governments fall short of expectations, the next higher level of local government unit (such as the province) or the national government may provide or augment the basic services and facilities that are not made or are inadequately available to meet the needs of constituents.

In order to deliver the aforementioned services, municipalities and other levels of local government receive an Internal Revenue Allotment (IRA) from the national government, generated from income tax, value added tax, excise tax, and custom duties, among others. Section 284 of the Local Government provides the formula for calculating local government IRA based on LGU type (i.e., province, municipality, **barangay**), land area, and population size. Meanwhile, in addition to IRA, municipalities can also generate additional revenue by imposing community and property taxes, fees from administrative services such as granting of business permits and fishery privileges, and
from the use of tourism facilities and other public utilities, among others. Such additional income can be used to create ‘trust funds’ for financing other special purposes (Local Government Code, Section 309). The Local Government Code also details the process for developing local government budgets (Sections 314-354).

Municipal governments are governed by both elected and appointed officials. Elected officials include the municipal mayor, a municipal vice-mayor, and eight elected regular members of the municipal council, which is the municipality’s legislative body responsible for enacting ordinances, approving resolutions and appropriating funds for municipal services and projects. The council also has ex-officio members such as the president of the league of barangays, president of the youth federation, and other sectoral representatives (ex. women, indigenous people) (Local Government Code, Sections 444-447). For this DELTA Project, among these political personalities, only the mayor was interviewed in both municipalities.

Meanwhile, the Local Government Code also provides a list of appointed officials who are responsible for executing the different functions of a municipality. Some of the vital positions include: treasurer; accountant; budget officer; planning and development coordinator; engineer; civil registrar; and health officer. Depending on local need, other municipalities may also hire other staff such as: legal officer; agriculturist; social welfare and development officer; environment and natural resources officer; information officer; cooperatives officer; population officer; and veterinarian (Local Government Code, Sections 469-490). Both Del Carmen and Ajuy possess the majority of these appointed officials, especially the most essential and relevant ones who were all included in the key informant interviews (See Table 3 in the Analytical Platform). Figure 11 presents a basic organizational chart of a municipal government in the Philippines.
Finally, while local government units are given local autonomy over their jurisdiction, the Local Government Code provides that higher level units shall exercise general supervision over lower level units (e.g., provinces over component municipalities, municipalities over component barangays). Acknowledging these loose relationships between levels is critical for ensuring smooth coordination across different levels of the health system (especially now that, as a result of the new UHC Act, primary healthcare facilities and district hospitals will be reorganized into health care provider networks, as earlier described), which are in turn administered by different local government units (e.g., primary care under municipalities, district hospital under provinces).
Hence, a barangay chairperson from each municipality was included in the interviews, and several barangays, especially remote island barangays, were visited during the field walk-through.

**Climate change- and disaster-related mandates**

Nearly two decades after the passing of the Local Government Code, new mandates were given to local governments, particularly municipalities, to enhance their capacity for disaster risk reduction and climate change adaptation. As earlier mentioned, the Philippines instituted two significant legislations – the Climate Change Act of 2009 and the Philippine Disaster Risk Reduction and Management Act of 2010 (Disaster Act hereafter) – both of which have relevant provisions regarding the obligations of local governments when it comes to climate change and natural disasters.

To strengthen local disaster efforts, the Disaster Act requires municipalities to establish a Local Disaster Risk Reduction and Management Office (LDRRMO; disaster office hereafter), which shall be responsible for the development, implementation and coordination of local disaster risk management programs, including the conduct of risk assessments, setting up of a multi-hazard early warning system, training of first responders, and coordination of response and recovery efforts, among others (Disaster Act, Section 12). The disaster risk reduction officers of each municipality were interviewed for this case study.

In addition to the disaster office, municipalities also must convene a Local Disaster Risk Reduction and Management Council (LDRRMC; disaster council hereafter), which is composed of the municipal mayor; all relevant appointed officials (including the municipal health officer); chiefs of police, fire protection, and military; and sectoral representatives from civil society and the private sector (Disaster Act, Section 11). Bestowed with decision-making and supervisory functions, this
council is tasked to, among others, approve, monitor and evaluate the implementation of the Local Disaster Risk Reduction and Management Plans (LDRRMPs; disaster plan hereafter) and recommend the implementation of forced or preemptive evacuation of residents, if necessary.

In terms of financing disaster risk reduction and response efforts, the law also requires municipalities to allocate at least five percent (5%) of their annual revenue for a Local Disaster Risk Reduction and Management Fund (LDRRMF; disaster fund hereafter) (Disaster Act, Section 21). Thirty percent (30%) of this fund must be allocated as ‘Quick Response Fund’ that can be immediately mobilized when a calamity strikes. The rest of the fund (70%) is used for preparedness and risk reduction activities such as awareness raising, purchasing of rescue equipment, and payment of premiums for calamity insurance.

It is important to note that while the Philippines, being a developing tropical country highly vulnerable to climate change, is frequently beset with typhoons, flooding, and storm surges, there are other types of natural and human-made hazards that are considered by these local disaster laws and mechanisms. For instance, being in the Pacific Ring of Fire, the Philippines faces the perennial threat of earthquakes, landslides, and volcanic eruptions. The same disaster infrastructure is mobilized when human-made emergencies such as armed conflict or stampede do occur.

Beyond disaster preparedness and response, the Climate Change Act recognizes the role of government in both stabilizing greenhouse gas concentrations in the atmosphere (i.e., mitigation) and reducing the adverse impacts and maximizing the benefits of climate change (i.e., adaptation). With support from provincial governments, municipalities are tasked to formulate and implement
Local Climate Change Action Plans (LCCAPs; climate plan hereafter)\(^\text{47}\) that prioritize local climate-related issues and are consistent with the provisions of the National Climate Change Action Plan (NCCAP) (Climate Change Act, Section 14). While the law requires municipal mayors to appoint one municipal staff to lead the design and implementation of the climate plan, both Del Carmen and Ajuy created task forces comprised of various relevant appointed officials (e.g., disaster officer, agriculturist, environment and natural resource officer, planning officer, health officer) to develop the climate plans.

In terms of financing local climate change programs, municipal governments are expected to allocate financial resources to effectively implement the plan. However, unlike the Disaster Act, the Climate Change Act does not specify how much exactly as a share of their IRA should municipalities appropriate for climate change-related activities (Climate Change Act, Section 18). Meanwhile, local governments are now required to implement climate change expenditure tagging,\(^\text{48}\) wherein local climate change programs, projects and activities, during the preparation of the municipality’s annual investment program, are assigned codes prescribed by national government. This practice does not only help local governments prioritize climate change interventions but also allows national government to take stock of climate-related efforts and expenditures from across the country.

\(^{47}\) To guide local governments on how to design an LCCAP, the Department of Interior and Local Government (DILG), through its Local Government Academy, developed the “LGU Guidebook on the Formulation of Local Climate Change Action Plan (LCCAP).” The guidebook can be accessed here: https://lga.gov.ph/media/uploads/2/Publications%20PDF/Book/BOOK%201-LGU%20Guidebook%20in%20LCCAP%20Formulation%20%20Process.pdf.

\(^{48}\) The Department of Interior and Local Government, in cooperation with the Department of Budget and Management and the Climate Change Commission, developed a guide entitled “Climate Change Expenditure Tagging for Local Government.” The guidance document can be accessed here: https://www.dilg.gov.ph/PDF_File/reports_resources/dilg-reports-resources-2016418_4e6ff64e9b.pdf.
Despite the existence of national mandates such as the crafting of climate plans and climate change expenditure tagging, local governments across the country need technical and financial assistance to be able to execute these new responsibilities. Unfortunately, the Climate Change Commission has limited capacity to extend such support to all municipalities in the country. For instance, the Commission previously implemented a project that demonstrated the application of an ‘Eco-town’ framework which aimed to build climate-resilient, ecologically sustainable, and economically thriving local communities (Climate Change Commission & Global Green Growth Institute, 2014). Ten municipalities – including Del Carmen – were initially selected and later benefited from the assessments (such as hazard assessments and vulnerability and adaptation assessments) that were conducted as part of the project. The findings of these assessments informed the development of climate plans. However, this program was not sustained and scaled up to include other municipalities in the country.

Finally, to provide further financial support to local governments for their climate adaptation initiatives, a 2011 amendment to the Climate Change Act (Congress of the Philippines, 2011) led to the creation of the People’s Survival Fund (PSF), which amounts to PhP 1 billion (approximately USD 19.3 million) annually. Through the PSF, LGUs are invited to submit project proposals, which are assessed based on certain criteria such as the municipality’s level of climate risk, the project’s poverty reduction potential, presence of potential spillover benefits beyond its jurisdiction, among others. To date, only six LGUs – including Del Carmen – have received grants from the PSF.

The Philippines’ national disaster and climate policies explicitly recognize the connection between disaster risk reduction and climate change adaptation and promote their integration at all levels, including the municipality. However, even though the effects of climate change are wide-ranging, natural disasters such as typhoons and flooding, being more visible, tangible, and immediate,
remain top of mind among leaders and citizens alike when climate change is discussed. This challenge is especially palpable in the local health system, where disaster management has been earlier introduced while climate change adaptation remains a novel and less understood concept.

**General configuration of municipal health systems**

While the Local Government Code laid out the general structure and function of a municipal government, there is no written legally binding guidance on what constitutes a local or municipal health system other than the appointment of a health officer and the establishment of a local health board (see below for details). Such lack of clarity is perhaps a consequence of devolution’s intent to widen the ‘decision space’ and relegate decisions and choices traditionally made by national governments to local governments (Bossert & Beauvais, 2002). As a consequence, when the devolution of the national health system pushed through, inequalities in healthcare access and health outcomes persisted (if not widened) between geographical regions, reflecting the huge variability across municipalities in terms of managerial capability and resources (i.e., staff, finances, infrastructure) (Cuenca, 2018). Decisions regarding municipal health matters were left to the mayors who, as politicians, demonstrate varying degrees of appreciation and concern for local health issues.

Especially those in ‘Geographically Isolated and Disadvantaged Areas’ (GIDA), local government investment in local health systems is highly constrained by limited municipal budgets, primarily coming from IRA, which had to be appropriated across diverse priorities. When devolution began, some LGUs were beset with myriad challenges such as high disease burden, inadequate municipal

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49 The Philippine Department of Health defines ‘Geographically Isolated and Disadvantaged Areas’ (GIDA) as “communities with marginalized population physically and socio-economically separated from mainstream society” ([https://www.doh.gov.ph/node/1154](https://www.doh.gov.ph/node/1154)). Of the two municipalities in this case study research, only Del Carmen is considered as GIDA.
budgets, vulnerability to natural disasters and armed conflict, and inability to recruit health professionals due to distant location, among others. Hence, these LGUs barely coped with the new responsibilities transferred to them through devolution, leaving local health facilities – both the ones inherited from the central government and new ones constructed – badly equipped and poorly staffed (Dayrit, et al., 2018).

To address health service delivery gaps brought about by devolution and fragmentation and to help achieve nationally defined health objectives (such as elimination of specific infectious diseases), the DOH, through its regional offices, provides operational support to local governments for the delivery of vertical programs (i.e., expanded program of immunization, diagnosis and treatment of tuberculosis, etc.), mostly through training of municipal health officers and provision of supply of essential medicines and vaccines. However, because of the local autonomy of municipalities, the DOH and the national government as a whole cannot hold local governments accountable for weak program implementation and poor health outcomes on the ground.

When it comes to local health system personnel, as earlier mentioned, the Local Government Code provides that each municipality must have a municipal health officer, who will take charge of the office on health services (commonly called ‘municipal health office’ or ‘rural health unit’/RHU in rural areas). Always a licensed physician, the health officer is responsible for supervising the municipality’s health workforce, formulating health measures for the consideration of the municipal council, and developing plans and strategies for approval by the mayor, among others (Local Government Code, Section 478).

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50 For more detailed up-to-date information about the Philippine health system, Dayrit, et al. (2018) is a great resource. It is part of the Health in Transition (HiTs) series, regularly published by the Asia Pacific Observatory on Health Systems and Policies, which is housed in the WHO Regional Office for South East Asia.
Meanwhile, the recruitment of other types of health personnel, such as nurses, midwives, dentists, pharmacists, and sanitary inspectors, is under the discretion of the municipal mayor, who is the local health system's ultimate decision-maker. These staff of the municipal health office are considered employees of the local government. Similar to service delivery, the DOH issues guidance documents recommending (not requiring) what kinds of personnel need to be present in the municipality's primary healthcare system. However, low priority for health and limited budgets also prevent municipalities from hiring adequate health workforce that can meet population health needs. Meanwhile, municipal health systems are supported by a cadre of volunteer barangay health workers (BHWs) who are mostly overworked, always underpaid, and often politicized, as their appointments and allowances can be revoked when they fail to give allegiance and support to mayors and other local politicians especially during election season. These various health personnel were also included in the key informant interviews (See Table 3).

In terms of local health governance, while the mayor and the municipal health officer play important administrative roles in the planning and management of the local health system, policy- and decision-making for health are shared with the members of the local health board (LHB). The LHB, headed by the municipal mayor as chairman and the municipal health officer as vice-chairman, addresses health personnel issues, conducts operations reviews, develops project proposals, and recommends municipal heath budgets to the municipal council, among others (Local Government Code, Section 102).

In terms of infrastructure, local health systems are commonly comprised of a physical municipal health office or rural health unit (RHU) (Figure 12), where all administrative and clinical functions are conducted. As a consequence of health sector devolution, the RHU is administered and financed by the municipal government. Open five days a week, these health facilities typically have limited
space, equipment, and supplies for basic non-emergency primary care services such as prenatal care, family planning counseling, and outpatient pediatric consultations. Meanwhile, each barangay has a barangay health station (BHS) which contains basic medical supply and equipment (such as a sphygmomanometer and weighing scale). This is also where the municipal health officer (or in most cases, nurse or midwife) conducts health education sessions, administers immunizations, or sees patients who could not make it to the RHU, usually once in a month (or less frequent especially in remote barangays in islands or mountainous regions). In both Del Carmen and Ajuy, the RHU as well as one barangay health station were visited as part of field observation (Figure 13).

Beyond primary care, emergency care and inpatient hospitalization are provided in a higher-level facility, which is usually an infirmary (i.e., an expanded RHU), a district hospital (shared by several municipalities and administered and funded by the provincial government) or a privately-owned hospital.\(^{51}\) Both Del Carmen and Ajuy do not have a functioning hospital; patients requiring advanced care have to be referred to a district hospital which is located in another town approximately 30 minutes away by road. Usually, the RHU and the nearby hospital have an agreement regarding patient referrals. However, in many places, tensions arise between the two as a result of incorrect diagnosis (and therefore incorrect referrals) and insufficient medical supply and equipment, among others, eventually jeopardizing continuity of care. The proposed concept of health care provider network articulated in the new UHC Act hopes to address these coordination issues.

\(^{51}\) In the Philippines, hospitals are categorized in terms of service capability. “Level 1 hospitals are district hospitals and municipal hospitals. They have an operating room with equipment as specified by DOH standards, including provision for their sterilization. Level 2 hospitals are core district hospitals and provincial hospitals, and have the minimum Level 1 capacities as well as provisions for general intensive care, neonatal intensive care, and high-risk pregnancy units. Level 3 hospitals are medical centers that have the minimum Level 2 capabilities as well as provisions for dialysis and blood bank facilities, ambulatory surgical clinic, and a physical medicine and rehabilitation unit. Level 3 hospitals are teaching/training hospitals with accredited residency training programs in the four specialties – Medicine, Pediatrics, Obstetrics/Gynecology and Surgery.” (Dayrit, et al., 2018, 134)
Figure 12. Rural health unit in Ajuy
Source: Author, February 12, 2019

Figure 13. A barangay health station in Ajuy
Source: Author, February 12, 2019
As a result of recent reforms in the National Health Insurance Program (NHIP; popularly known as PhilHealth\textsuperscript{52}), RHUs and hospitals can only be reimbursed for clinical services if they are a PhilHealth-accredited facility. Hence, municipalities and other LGUs are now incentivized to enhance their infrastructure and meet certain quality of care standards. The PhilHealth reimbursements have become an additional source of funding, mainly for capital outlay (e.g., extension of an RHU), procurement of additional medicines and supplies, and personnel bonuses. Meanwhile, the annual health budget of the LGU still comes mainly from the IRA, which is allocated for personnel salaries, maintenance and operational expenses (M00E; e.g., electricity in the RHU), and in some cases, subsidy for PhilHealth premiums for near-poor inhabitants who were disqualified from PhilHealth's sponsored program\textsuperscript{53}, as well as additional financial assistance for paying for hospital balance\textsuperscript{54} and indirect costs (e.g., transportation).

\textsuperscript{52} PhilHealth – short for Philippine Health Insurance Corporation – is actually the name of the government agency in-charge of NHIP. The National Health Insurance Act of 1995 created PhilHealth/NHIP with the hope of “providing all citizens of the Philippines with the mechanism to gain financial access to health services” (Congress of the Philippines, 1995, 1). However, it took nearly two decades for PhilHealth to expand population coverage beyond the employed and voluntarily paying sectors. In 2013, the 1995 law was amended to declare mandatory coverage of all Filipino citizens (Congress of the Philippines, 2012). Since then, major reforms in membership recruitment, benefit packages, facility accreditation, etc. have been instituted. The new UHC Law signed in 2019 is expected to introduce additional reforms to fix the remaining gaps in the country’s health financing and delivery system.

\textsuperscript{53} One of the reforms made by PhilHealth in 2013 was the establishment of a sponsored program, which includes the recipients of the Pantawid Pamilyang Pilipino Program (4Ps), the country’s conditional cash transfer program for the poor (https://pantawid.dswd.gov.ph/). The premiums of indigent members under the program are paid for by the national government, specifically obtained from the excise tax collected from tobacco and alcohol (popularly known as “sin tax”) (Kaiser, Bredenkamp, & Iglesias, 2016).

\textsuperscript{54} PhilHealth has a “no-balance billing” policy for indigent members under the sponsored program (Cristostomo, 2012). Hence, no other fees shall be charged to sponsored members above and beyond PhilHealth’s published case rates. Meanwhile, those who are not part of the program but are incapable of paying the remaining hospital balance may seek for financial assistance from their municipality. However, not all municipalities have special funds for this purpose.
Chapter 3

Results Statement

Individual Case Studies

This next section presents the two individual case studies featuring the municipalities of Del Carmen and Ajuy. As earlier described in the Analytical Platform, these individual case studies serve to assess of the municipality's climate and health vulnerabilities, as well as challenges and opportunities in the responses to climate change both by the municipal health system and other sectors (i.e., ‘systems for health’). In developing these case studies, some challenges were encountered. While the interviews provided rich insights regarding both actual phenomena as well as stakeholder perspectives, the documents reviewed were admittedly not as comprehensive, as some of them are executive summaries and others do not have standard format. Hence, one municipality may have information on one item and the other may not.

In addition, both the interviews and the documents provided limited quantitative information, especially for some health system indicators (e.g., health financing), reflecting deficiencies in the municipality's health information system and the limited technical capacity of local government staff to report, analyze, and synthesize numerical data. As a result, the rough assessments below are mainly qualitative in nature, with some information based on stakeholder perception (e.g., funding is inadequate) and others being mere descriptions of the process (e.g., describing the provision of premium subsidy without including information on how much is allocated). Liberty was also taken to interpret and synthesize diverse granular insights pertaining to more general phenomena (e.g., detailed descriptions of governance mechanisms, leadership practices, and organizational culture in the section describing the local health system).
**Del Carmen, Surigao Del Norte**

*Brief overview of the municipality.* Located in the island of Siargao, Del Carmen is a fifth-class rural municipality in the Province of Surigao del Norte with a total land area of 151.68 km² and a population of 18,392 (as of 2015). It has 20 barangays, two of which are island barangays separate from the rest of the municipality. The municipality’s poverty incidence is 67.24% and each family earns an average of PhP 3,500 (USD 66) each month. The main sources of income are farming, fishing, and more recently, tourism (among domestic and foreign tourists alike), thanks to its beaches, lagoons, and the mangrove forest, which is considered the largest contiguous mangrove forest ecosystem in the country. Its population is predominantly Catholic. (These information are summarized in Table 1 in the Analytical Platform.)

*General current and future issues related to climate change.* The municipality of Del Carmen has benefited greatly from its inclusion in the now-defunct Eco-town Program of the Philippine Climate Change Commission. As earlier described, this program selected several municipalities in the Philippines for the piloting of climate vulnerability and adaptation assessments, information drives, and other climate-related activities. Hence, the municipality was able to systematically study the expected future local climate trends and their potential effects, which informed the development of its climate plan.

Del Carmen’s climate plan describes some of these anticipated changes. When it comes to changes in the mean of climate variables, Del Carmen is expected to face an increase in average temperature under climate change. Meanwhile, increasing variability in seasonal rainfall (i.e., erratic yet heavy rain) is also anticipated; in fact, according to several key informants, this is already beginning to be observed. In turn, this rainfall pattern leads to less predictable yet more intense flooding events.
The municipality already identified barangays that are most susceptible to flooding, and evacuation centers were built in areas that are least susceptible (Figure 14).

![Flood Susceptibility Map](image)

**Figure 14. Flood susceptibility map of Del Carmen**

*Source: Municipality of Del Carmen, obtained February 5, 2019*

When it comes to extreme weather events, Del Carmen is also projected to experience more typhoons and storm surges and more intense (longer and hotter) periods of drought. While Del Carmen is not directly facing the Pacific Ocean, the island of Siargao is located on the eastern side of the country, which is always first to be hit by typhoons emanating from the Pacific. Hence, Del Carmen and the whole Siargao island will need to enhance preparedness and response capacity for future typhoons, since as earlier mentioned in the Analytical Platform, the number and intensity of
Typhoons in the Philippines in general are expected to increase under climate change. This also means that the municipality is at high risk for storm surges, although there is a general perception that the surrounding mangrove forest ecosystem\textsuperscript{55} will provide some level of protection (Figure 15).

![Del Carmen's mangrove forest reserve](image)

**Figure 15. Del Carmen's mangrove forest reserve**

*Source: Author, February 5, 2019*

\textsuperscript{55} As earlier described in the Analytical Platform, Del Carmen has become a popular eco-tourism site because of its extensive mangrove forest reserve. Mangrove forests are “coastal wetlands made up of a dense jumble of trees and shrubs capable of living in salt or brackish water” (Dunn, 2018). Mangrove forests are considered an important climate adaptation measure in coastal areas. Because of their density, waves from storm surges and tsunamis lose their power as they approach the coastline, offering protection to coastal communities (Othman, 1994). However, there is also growing recognition that mangroves themselves are vulnerable to climate change, particularly to sea level rise (Gilman, et al., 2008). When it comes to climate mitigation, the semi-decomposed plant matter underneath the water is believed to be an effective carbon sink (Doughty, et al., 2016).
As an example of Del Carmen’s vulnerability to typhoons and storm surges, initial forecasts revealed that Del Carmen would be one of the areas to be first hit by Typhoon Haiyan in 2013. However, the municipality was then spared when the trajectory of the typhoon later changed, according to the mayor:

“We were supposedly the first to be hit [by Typhoon Haiyan]. We knew the mangroves will protect us. If the [typhoon] hit us, I was told that based on simulation, 60% of us would have been gone.” (Mayor, Del Carmen)

Outside of meteorological events, there are also other changes already beginning to be observed particularly in the surrounding sea as noted in the interviews and observed during the field visit. First is the rise in sea level, which results in receding of the coastline and seawater intrusion of groundwater which is a vital source of drinking water. This was particularly observed in Halian, one of the island barangays visited for this case study. Residents have reported that the groundwater has become salinized, and therefore filtered water for drinking must now be purchased from the mainland at a cost. The other change reported by the municipal agriculture and fisheries officer is the increasing sea surface temperature, which can lead to coral bleaching and eventually result in destabilization of the marine ecosystems – a main source of livelihood for Del Carmen. Unfortunately, a systematic investigation of sea level rise and sea temperature increase in Del Carmen, including obtaining of more precise measurements, is still yet been conducted.

**Current and anticipated health effects of climate change.** Del Carmen is still affected by many climate-sensitive diseases that are endemic in rural areas of tropical countries such as the Philippines. Their annual health report as well as the interviews with RHU staff revealed some of these longstanding health concerns; however, only malnutrition and immunization rates (along
with number of maternal and child deaths) are the outcome measures that were reported numerically. Despite efforts to combat malnutrition, still 5% of Del Carmen’s children under five years old suffer from undernutrition, which can be worsened by food insecurity under climate change. Meanwhile, the percentage of fully immunized children (FIC) in Del Carmen declined from 88% in 2012 to 62% in 2018, which may be generally attributed to weak health care system performance but may also be related to the growing hesitancy towards immunization as a result of vaccine-related scandals that hit the Philippines in recent years. While these vaccines under the DOH’s Expanded Program on Immunization (EPI) do not necessarily target established climate-sensitive diseases, immunization rates can be indicative of levels of health literacy and health-seeking behavior, which are in turn reflective of baseline community health.

While 90% of Del Carmen’s rural population already have access to sanitary toilets, water-borne diarrheal diseases remain a consistent health problem due to poor availability of clean water for drinking and cooking. This problem can be further exacerbated by the threat of increasing frequency of flooding. Meanwhile, vector-borne diseases such as dengue are also a recurrent health problem especially during the rainy season, aggravated by poor implementation of vector control practices (such as covering of containers carrying stagnant water). The municipality is also home to several neglected tropical diseases (NTDs) such as schistosomiasis and lymphatic filariasis, which are also known to be sensitive to climate change (Blum & Hotez, 2018). Occasional injuries and

56 Under the Philippine Department of Health’s Expanded Program on Immunization (EPI), a fully immunized child (FIC) is an infant who “received one dose of BCG [for tuberculosis], three doses each of OPV [polio], DPT [diphtheria, pertussis, tetanus], and Hepatitis B vaccines, and one dose of measles vaccine before reaching one year of age” (https://psa.gov.ph/content/fully-immunized-children).

57 While there may be a multitude of factors leading to declining immunization rates in the Philippines for the past five years, one major reason for the sharp decline recently is the 2017 scandal around a new dengue vaccine that was injected to nearly 830,000 Filipino children (Yasmin & Mukerjee, 2019). Vaccine-related deaths have been claimed after the manufacturer, Sanofi-Pasteur, announced that the vaccine is more dangerous to children who never had dengue, and Department of Health officials were accused of railroading the introduction of a novel vaccine. The controversy remains unsolved until today, resulting in low morale within the health sector, decreasing vaccine confidence among the public, and declining immunization rates (for all types of vaccines) overall.

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deaths may also result from the occurrence of natural disasters such as typhoons and storm surges if preparedness measures (e.g., pre-emptive evacuation) are not implemented on a timely manner. Unfortunately, while these disease conditions were mentioned in the interviews, quantitative data for these disease groups were not available in the documents reviewed.

Meanwhile, one phenomenon whose potential health effects need further investigation is sea level rise, which results in the seawater intrusion of groundwater that is used for drinking and bathing. The residents of the remote island barangay of Halian reported that their deep wells, which are their only source of drinking water, are already slowly being intruded by saltwater. This should be a cause for alarm, as some initial evidence from Bangladesh revealed that the consumption of salinized water was shown to lead to increase in hypertension (Talukder, et al., 2017; Das, et al., 2019) and pre-eclampsia (hypertension among pregnant women) (Khan, et al., 2014; Scheelbeek, et al., 2016; ) in coastal communities.

**Other health and environment problems.** Apart from the health problems that are directly or indirectly related to climate change, there are also other environmental problems raised by key informants that are deemed important, sometimes even confused during the interviews to be related to climate change. One is improper waste management, which despite the existence of national laws continues to be a major problem in Del Carmen but also in almost every part of the country. Unfortunately, there is no quantitative data estimating the gravity of the local waste problem. Unlike in most Philippine municipalities, this problem is not just perpetuated by local inhabitants in Del Carmen, but also aggravated by the influx of tourists that come to the

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58 Lauded as one of the best waste management laws in the world, the "Ecological Solid Waste Management Act of 2000" requires local governments to implement proper segregation, collection, and recycling of waste starting at the household and barangay level. Like many laws in the Philippines, this law continues to be weakly implemented in many municipalities across the country. The text of the law can be accessed here: [https://www.doh.gov.ph/sites/default/files/policies_and_laws/RA09003.pdf](https://www.doh.gov.ph/sites/default/files/policies_and_laws/RA09003.pdf).
municipality and carry with them trash from other locales. Thankfully, key informants, especially the environmental management officer, mentioned that efforts are currently under way to educate households, set up segregated garbage bins, and establish a materials recovery facility (MRF) to encourage reuse and recycling of plastic, metals, and other materials.

Meanwhile, illegal fishing by unauthorized fisherfolk and the use of illegal practices such as cyanide and dynamite fishing were also cited by interview respondents as pressing problems confronting Del Carmen’s seas. There is a growing concern that the decline in fish catch resulting from such practices may threaten future food security in Del Carmen’s coastal communities, although this needs to be further studied systematically.

In addition, Del Carmen’s tropical rainforest is also threatened by illegal logging activities. Forests are not only carbon sinks that help sequester carbon dioxide from the atmosphere and help mitigate climate change. They also serve as important habitat for flora and fauna that provide food and natural medicines, and destruction of forests may also create new breeding grounds for vector-borne diseases (Burkett-Cadena & Vittor, 2017). Apart from the tropical rainforest, Del Carmen’s mangrove forest, a vital climate adaptation measure, is also actively conserved through reforestation and prohibition of mangrove cutting for fuelwood. The municipal government was not able to provide quantitative information estimating the rate of deforestation happening in Del Carmen as a result of these unscrupulous activities.

Health system challenges and opportunities. Table 6 shows the current state of the different ‘hardware’ and ‘software’ elements of the local health system in the municipality of Del Carmen. Majority of the descriptions below are of qualitative nature, based on interviewee accounts, written
documents, and personal observations during the field visit. Meanwhile, due to poor
documentation, useable quantitative information is very limited and not easily accessible.

Table 6. Assessment of Del Carmen’s local health system

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governance</td>
<td>Municipal health funding is sourced mainly from annual revenue allotments. Local government has set a target of 15% of the local budget to be earmarked for health. The budget has increased by 91% from 2016 to 2018, yet still deemed limited especially for medical supplies. No PhilHealth reimbursements are earned due to unaccredited health facilities. The mayor is able to mobilize additional funds for health emergencies from other discretionary and contingency sources within the municipal budget. External partners (i.e., NGOs) have occasionally provided in-kind support (i.e., equipment, facilities).</td>
</tr>
<tr>
<td>Resource Mobilization</td>
<td>The rural health unit (RHU) provides basic primary care services that span promotion (i.e., family planning), prevention (i.e., immunization), basic emergency care, and outpatient treatment for common symptoms and illnesses. Del Carmen also has a district hospital located beside the RHU, which has limited functionality due to lack of beds, equipment, and personnel. Plans to improve this facility is underway so that it can receive PhilHealth benefits are not maximized by members because local health facilities are not yet accredited. The burden of out-of-pocket payments is unknown but likely to be happening for secondary and tertiary care services sought outside the municipality/island. Limited funding allocated for population-based public health interventions such as educational campaigns and clean-up drives.</td>
</tr>
<tr>
<td>Financing</td>
<td>The municipal government has set a target of 100% PhilHealth coverage but exact population coverage remains unknown. Majority of the poor inhabitants are automatic PhilHealth members (as part of the sponsored program). The local government provides support for non-sponsored PhilHealth members who cannot pay their voluntary contributions.</td>
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</tbody>
</table>

| Service Delivery | Health is identified as one of the top priorities of the municipal government (especially at the level of the mayor). Several health-focused ordinances (i.e., essential medicine supply, waste management, tobacco control) were passed by the municipal council. The municipal mayor is very hands-on with regard to oversight of overall local health system operations. The municipal health officer facilitates health planning and day-to-day facility management, but the mayor makes the major decisions. Both local and barangay health boards meet regularly to discuss issues and solutions. The health sector is represented in several cross-sectoral committees but not in a leadership or convening role. |

<table>
<thead>
<tr>
<th>Functions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing</td>
<td>The municipal government has set a target of 100% PhilHealth coverage but exact population coverage remains unknown. Majority of the poor inhabitants are automatic PhilHealth members (as part of the sponsored program). The local government provides support for non-sponsored PhilHealth members who cannot pay their voluntary contributions. PhilHealth benefits are not maximized by members because local health facilities are not yet accredited. The burden of out-of-pocket payments is unknown but likely to be happening for secondary and tertiary care services sought outside the municipality/island. Limited funding allocated for population-based public health interventions such as educational campaigns and clean-up drives.</td>
</tr>
<tr>
<td>Service Delivery</td>
<td>The rural health unit (RHU) provides basic primary care services that span promotion (i.e., family planning), prevention (i.e., immunization), basic emergency care, and outpatient treatment for common symptoms and illnesses. Del Carmen also has a district hospital located beside the RHU, which has limited functionality due to lack of beds, equipment, and personnel. Plans to improve this facility is underway so that it can receive PhilHealth benefits are not maximized by members because local health facilities are not yet accredited. The burden of out-of-pocket payments is unknown but likely to be happening for secondary and tertiary care services sought outside the municipality/island. Limited funding allocated for population-based public health interventions such as educational campaigns and clean-up drives.</td>
</tr>
</tbody>
</table>
### Table 6 (Continued)

<table>
<thead>
<tr>
<th>Functions</th>
<th>Service Delivery</th>
<th>to improve this facility is underway so that it can receive PhilHealth accreditation. Referral arrangements for advanced care (i.e., inpatient care, surgery, etc.) exist between the district hospital and another public hospital in the nearby town of Dapa, which is approximately 30 minutes away by land – however, the referral center, despite being PhilHealth accredited, is also ill-equipped and has limited bed capacity. Patients also get lost along the referral and back-referral process due to poor coordination between facilities. There are no private sector providers in the municipality. Basic quality and safety standards downloaded by the DOH are observed by RHU staff. Awareness raising town hall activities (e.g., on physical activity, nutrition, etc.) occasionally conducted in various barangays.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Blocks</td>
<td>Workforce</td>
<td>There is one primary care physician for a population of nearly 20,000, who also fulfills administrative responsibilities, as well as one public health nurse, nine midwives and 149 barangay health workers scattered across the municipality. The skilled health worker to population ratio is 0.6 per 1,000, which is way below the 2006 WHO recommendation of 2.3 per 1,000. Overall, health staff were trained to perform basic care services and procedures, including first aid, but are generally overworked and unable to routinely reach different barangays (e.g., island barangays are visited by health staff only once every quarter).</td>
</tr>
<tr>
<td></td>
<td>Infrastructure</td>
<td>There is a single RHU building located in the central part of the municipality, which is less accessible to people living farther from the center (due to unpaved roads and limited public transportation) and those living in isolated island barangays. The RHU has very basic equipment (i.e., refrigerator for vaccines, sphygmomanometer, etc.). Not all barangays have a barangay health station (BHS) which contains very basic equipment (i.e., weighing scale) – five barangays still need a BHS, while six do have that need to be rehabilitated. There is also an old and small hospital building which is only used for outpatient and brief inpatient services due to lack of beds and equipment. Health facilities are built with basic construction materials which renders them vulnerable to natural disasters.</td>
</tr>
<tr>
<td></td>
<td>Medicines and Devices</td>
<td>A local ordinance was passed by the municipal council to ensure steady supply of 20 essential medicines as recommended by the DOH; however, medicine stockouts still occur in the RHU and barangay health stations. Basic medicines for common symptoms (e.g., fever, headache) can be purchased from kiosks/mom-and-</td>
</tr>
</tbody>
</table>

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59 The 2006 World Health Report identified a minimum health worker density of 2.3 skilled health workers (physicians and nurses/midwives) per 1,000 population, which was considered generally necessary to attain high coverage (80%) of skilled birth attendance. Over the years, this ratio has been updated to 3.4 then to 4.1 in separate reports in 2010 and is even raised to 5.9 by the Ending Preventable Maternal Deaths initiative (WHO, 2016). The two municipalities failed to meet the minimum density required, no matter which recommended ratio is used.
<table>
<thead>
<tr>
<th>Building Blocks</th>
<th>Medicines and Devices</th>
<th>The RHU only has a recently donated ultrasound machine used for prenatal check-ups; no other imaging device is available in the municipality.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information System</td>
<td>The RHU’s information system is mainly paper based, with a few parameters electronically encoded to comply with DOH reporting requirements. Automation plans are stalled by limited equipment, weak wireless connectivity, and limited technical and implementation capacity of health workforce. The local government takes advantage of limited information available for planning and decision-making.</td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td>Leadership Practices</td>
<td>Overall, the municipal mayor has created an aura of openness and optimism within the municipality, which generally motivates staff and stakeholders to actively participate in achieving collective goals. The mayor is highly regarded as a someone who ‘walks the talk.’ Both the municipal mayor and the municipal health officer are also seen as very action- and solution-oriented leaders.</td>
</tr>
<tr>
<td></td>
<td>Organizational Culture</td>
<td>Despite the chronic lacks in the local health system, health staff are repeatedly reminded by their leaders to be resourceful and innovative. However, concrete incentives need to be placed to ensure that health staff are able to demonstrate ingenuity and initiative without fear of being reprimanded for overstepping authority.</td>
</tr>
<tr>
<td></td>
<td>Power Relations and Agency</td>
<td>While there seems to be no rigid lines of communication linking leaders and staff, the health staff demonstrated high regard for, if not fear of, authority, especially towards the mayor and the municipal health officer. The municipal health officer herself feels limited control over major local health system decisions, as the mayor is perceived as the ultimate boss and decision-maker.</td>
</tr>
<tr>
<td></td>
<td>Values and Norms</td>
<td>Strong desire to sustain health gains is explicitly articulated in local health system roadmaps and physical objects (e.g., posters in the local health facility). Such aspiration is repeatedly reminded to staff and stakeholders during local health board meetings and town hall activities.</td>
</tr>
</tbody>
</table>

Source: Author’s elaboration

Overall, the municipal health system of Del Carmen continues to face several chronic problems such as limited human resources; occasional stockouts of essential medicines; lack of essential diagnostic devices such as an X-ray machine; and gaps in the referral system linking the primary care facility...
and hospitals providing inpatient care. The two island barangays are especially at a great disadvantage, as not only they lack adequate health workforce and medical supplies, but patients also need to travel to the mainland by boat for 30 minutes to an hour just to receive essential care from the mainland.

Nevertheless, in recent years, the municipal government has made strengthening the local health system as top priority. Incremental investments have been made through the years to upgrade primary care facilities and implement basic disease prevention and control programs. Such surge in attention for health is reflected in increasing municipal health budgets and additional health facilities that are currently under construction or rehabilitation. The municipality has a health roadmap containing its ‘wish list’ of additional inputs (e.g., personnel, facilities, equipment) but there is no cost estimate accompanying it. Plans for automating the health information system as well as to upgrade local hospital facilities are also underway, although technical challenges delay implementation progress.

To improve municipal health governance, the local government also launched a program called ‘Seal of Good Health Governance’ which provides incentives to local barangays in addressing priority health, environmental, and social problems and achieving specific target indicators. Winning barangays receive a combination of monetary rewards and non-monetary recognition. The local health system has also greatly benefited from the technical and in-kind support given by external partners, particularly the Zuellig Family Foundation which implements a nationwide capacity-building program for local health governance.

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60 For the past decade, the Zuellig Family Foundation has been implementing a health leadership and governance program for local governments (municipalities, cities, provinces) to address the challenges brought about by health system devolution and to improve health outcomes especially in disadvantaged areas. More information can be found in their website: https://zuelligfoundation.org/.
In relation to governance, the ‘software’ elements of Del Carmen’s local health system are also worth noting. Generally, there is no indication that the different staff and stakeholders of the local health system are experiencing ‘toxic’ power relations and work dynamics, which is good for driving initiative, innovation, and adaptation. Despite the many challenges being confronted in the municipality, people are generally aware of community-wide aspirations for better health, inclusive economic growth, and sustainable development. Municipal leaders are well-regarded by subordinates and constituents, not merely as a result of established norms of authority but also because of positive leadership behaviors manifested in the workplace. The interactions between stakeholders are also generally collaborative, if not ‘family-like,’ which perhaps is attributable to the small size and closely-knit nature of their isolated municipality.

**Challenges and opportunities for climate action outside the health sector.** As mandated by the Disaster Act and the Climate Change Act, the municipality of Del Carmen developed a disaster plan and climate plan, both of which were crafted by a committee composed of the heads of different local agencies, including the municipal health office. These plans lay out the priority areas that the municipality needs to address when it comes to disaster risk reduction and climate change adaptation, respectively, as well as the specific measures that need to be undertaken by each agency involved.

For instance, the disaster plan details various activities and investment priorities such:

- Conduct of disaster preparedness and response training for community volunteers;
- Disaster-proofing of multi-purpose facilities;
- Building of evacuation centers in safe zones;
- Cementing of roads to prevent landslides;
• Forging of memorandum of agreement with owners of grocery stores as sources of alternative food supply;
• Forging of memorandum of agreement with households with big houses for providing temporary shelter, and;
• Establishment of community radio for rapid dissemination of disaster warnings, among others.

Meanwhile, the climate plan enumerates several adaptation measures such as:
• Preserving of mangrove forest as protection from storm surges and sea level rise;
• Construction of irrigation facilities for farmlands in preparation for longer periods of drought;
• Installation of rainwater collectors in households in preparation for water shortage;
• Building of sea walls especially in coastal areas facing rapid sea level rise, and;
• Pre-emptive relocation of households living in coastal areas prone to storm surges and sea level rise, among others.

Some of these disaster preparedness and climate adaptation projects have already been implemented while others are works-in-progress. For some of these initiatives, the municipality of Del Carmen is working closely with several NGO partners such Sentro para sa Ikauunlad ng Katutubong Agham at Teknolohiya, Inc. (SIKAT) and RARE (an international environmental organization).

61 In English: Center for the Advancement of Indigenous Science and Technology, Inc.
62 More information about RARE can be found here: http://www.rare.org/.
One of the major climate-related initiatives of Del Carmen is the establishment of a climate field school for farmers and fisherfolks. Supported by a PhP 80 million (USD 1.5 million) grant from the People’s Survival Fund of the Philippine government, this facility will provide training on climate-smart agricultural and fishing practices and engage in future research on developing climate-resilient crops and testing novel technological interventions. The Surigao State College of Technology, which is the only institution of higher learning in Del Carmen, serves as the climate field school’s host. As of the time of the field visit, the physical building of the new school was still under construction. Meanwhile, the initial program offerings are still being developed with the help of external partners such as Project SARAI (Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines), and some interviewees expressed interest in introducing other potential training and research programs such as those relating to public health.

**Proposed recommendations for future action.** Based on this assessment of Del Carmen in terms of climate and health challenges, health system situation, and challenges and opportunities outside the health sector, below are some initial recommendations for future action:

- Enhance the baseline capacity and performance of the local health system through measures such as: hiring more midwives that can cater to island barangays; procuring essential diagnostic devices; ensuring adequate supply of essential medicines in both the RHU and the barangay health stations; improving the local health information system; and closing gaps in access to clean water, sanitation, and hygiene, among others;

- In relation to the previous recommendation, work towards the accreditation of the rural health unit and the district hospital by PhilHealth to generate additional revenue for health;

- Through training programs, increase the awareness of health workers when it comes to climate-sensitive diseases and their prevention and management;

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63 More information about SARAI can be found here: [http://sarai.ph/](http://sarai.ph/).
• Strengthen the capacity of the barangay health station located in the two remote island barangays and enhance patient transfer capability from island to mainland through acquisition of sea ambulance;

• Through collaborative, interdisciplinary research with external academic partners, investigate the potential nutritional impacts of food insecurity resulting from the long-term effects of climate change on agriculture and fisheries;

• Investigate the possible unseen health impacts of saltwater intrusion of drinking water sources and consider the procurement of water desalinization technology;

• Review and update the municipal-wide disaster plan and climate plan and explore ways to increase investments in and strengthen the role of the health sector, and;

• Assess the possibility of including health-related curriculum and research in the program offerings of the climate field school.

Ajuy, Iloilo

Brief overview of the municipality. Located in the island of Panay, Ajuy is a second-class rural municipality in the Province of Iloilo with a total land area of 175.57 km² and a population of 52,268 (as of 2015). It has 34 barangays, three of which are island barangays separate from the rest of the municipality. The main sources of income are farming and fishing, thanks to its long coastline. Ajuy’s tourism industry is less advanced than that of Del Carmen, although efforts are now being undertaken to promote its island beaches to domestic (rather than foreign) tourists. Its population is predominantly Catholic. (These information are summarized in Table 1 in the Analytical Platform.)

General current and future issues related to climate change. Unlike Del Carmen, the municipality of Ajuy was not a beneficiary of the now-defunct Eco-town Program of the national government. As
a result, there was no rigorous assessment of future climate trends previously conducted for Ajuy. Hence, compared to the climate plan of Del Carmen, Ajuy's is less comprehensive and more qualitative and descriptive in content.

Nonetheless, a rough assessment, based on historical experience, current observations by stakeholders, and national-level projections documented in literature, provides some indication of future climate change trends in the municipality. For instance, like in Del Carmen, Ajuy is expecting to face an increase in average temperature under climate change. Meanwhile, increasing variability in seasonal rainfall (i.e., erratic rain patterns) is also anticipated and, according to the key informants, is already beginning to be observed, leading to less predictable yet more frequent flooding events. Like in Del Carmen, Ajuy also already identified its barangays that are most susceptible to flooding as reflected in hazard maps such as the one in Figure 16.

Meanwhile, similar to most places in the Philippines, Ajuy is also anticipating more typhoons and storm surges and more intense (longer and hotter) periods of drought. The island of Panay, where Ajuy is located, is not located in the Eastern Seaboard facing the Pacific Ocean. However, being located at the heart of the country, Ajuy always finds itself along the trajectory of typhoons coming from the Pacific. Hence, the municipality will need to enhance preparedness and response capacity for future typhoons, since national assessments reveal that the number and intensity of typhoons are expected to generally increase in the Philippines under future climate change.
This projection was tested when Typhoon Haiyan hit the Philippines in 2013. Unlike Del Carmen, Ajuy happened to be located directly along Typhoon Haiyan’s path. However, unlike the city of Tacloban, which was one of the first to be hit by Typhoon Haiyan before sunrise, Ajay was hit shortly before noon. People were not just wide awake, but also were receiving initial news about the havoc wreaked in Tacloban and surrounding areas. As a result, the citizens of Ajuy who live in fragile settlements were able to evacuate, and while there was enormous damage caused on property, there was only one human casualty that was reported. The mayor of Ajuy recalled the initial response of the municipality to the typhoon and its aftermath:
“Before Yolanda [Haiyan], we did not really prepare. Only after Yolanda did we realize that there is a possibility that a very strong typhoon will happen. We knew already 10 days before that a super typhoon is coming. But we did not bother to prepare. So we had more casualties in terms of properties, agriculture, and fisheries because we did not believe.” (Mayor, Ajuy)

In addition to the abovementioned phenomena, similar to Del Carmen, there are also changes beginning to be observed in Ajuy’s municipal waters as reported during the interviews and through the field observation. Admittedly, a more systematic investigation will be needed to quantitatively validate these observations. First is the rise in sea level, which results in receding of the coastline and seawater intrusion of groundwater which is usually a source of drinking water. In fact, in the island barangay of Nasidman, the seawater already reached some of the houses, displacing local inhabitants (Figure 17).

The barangay captain also narrated the changes that he had witnessed in his island village through the years:

“The island has become smaller. Before, the island was big and there were many people here. Now, we only have a small space. Several meters of land were already eaten by the sea... We no longer have space to build houses. Before, we still had space where we can build along the shore. Now, the sea level has risen. We are already at high-risk.” (Barangay chairman, Ajuy; Translated)
Apart from sea level rise, the other change that was mentioned by the municipal agricultural and fisheries officer is the increasing sea surface temperature, which can lead to coral bleaching and eventually result in destabilization of marine ecosystems. Like in Del Carmen, the potential effects of these emerging phenomena on the health of the people of Ajuy are yet to be investigated.

**Current and anticipated health effects of climate change.** Like Del Carmen, Ajuy is still affected by many climate-sensitive diseases that are endemic in rural areas of tropical countries such as the Philippines. Their annual health report as well as the interviews with RHU staff revealed some of
these longstanding health concerns. However, immunization rates are the only outcome measures reported in numbers that may be relevant to this assessment. While currently available vaccines do not necessarily target climate-sensitive diseases, local vaccination rates provide a glimpse of the baseline status of health literacy and health system performance in the municipality. Like in Del Carmen, Ajuy witnessed a sharp decline in immunization rates, from 87% in 2014 to 62% in 2018, likely a result of weak health care system performance and growing vaccine hesitancy due to recent vaccine-related scandals in the country.

On the other hand, while numbers are not available, malnutrition was identified as a chronic scourge facing children in Ajuy until today, which can be exacerbated by food insecurity due to future climate change. While 86% of Ajuy's rural population already have access to sanitary toilets and 96% to safe water, water-borne diarrheal diseases remain a consistent health problem especially among children. The perennial threat of flooding may reverse progress in the prevention and control of water-borne diseases. Vector-borne diseases such as dengue are also a recurrent health problem especially during the rainy season, aggravated by poor implementation of vector control practices (such as covering of containers carrying stagnant water).

The municipality is also home to filariasis, which as earlier mentioned is known to be sensitive to climate change. Efforts are now under way to eliminate this tropical disease of poverty, but without factoring in the influence of climate change on this disease, progress towards elimination might be slowed if not reversed. Meanwhile, while the links to climate change are not yet clear, local health staff noticed that the number of patients reporting to the health facility for non-communicable diseases (NCDs) such as hypertension and diabetes is rising. However, the actual burden of NCDs in Ajuy is still yet to be systematically studied.
Finally, occasional injuries and deaths may also result from the occurrence of natural disasters such as typhoons and storm surges if preparedness measures (e.g., pre-emptive evacuation) are not implemented on a timely manner. Fortunately, as earlier mentioned, when Ajuy was hit by Typhoon Haiyan in 2013, it only had one casualty. Most of the damage incurred was to private property and public infrastructure.

Meanwhile, similar to the situation in Del Carmen, one phenomenon in Ajuy that needs further investigation in terms of its potential health effects is sea level rise, which results in the seawater intrusion of groundwater which is used for drinking and bathing. As observed by the municipality's disaster risk reduction officer:

"Another problem that I would add is saltwater intrusion. The deep wells are now contaminated with saltwater so the groundwater is not anymore potable." (Disaster risk reduction and management officer, Ajuy; Translated)

Other health and environment problems. Like in Del Carmen, there are also other environmental problems not necessarily related to climate change that were deemed important by key informants in Ajuy. For example, improper waste management was identified as a persistent menace in the community, although the extent of the problem cannot be supported by any report or study. However, interviewees mentioned that the municipal government is doubling its efforts to solve this problem through household education, setting up of segregated garbage bins, and creation of a materials recovery facility (MRF) to encourage reuse and recycling.

Also like in Del Carmen, illegal fishing by unauthorized fisherfolk and the use of illegal practices such as cyanide and dynamite fishing were also cited as pressing problems affecting Ajuy's
municipal waters. Some key informants noted that fish catch has been steadily declining in recent years, and they conjecture that this may be due to these practices, in addition to increasing seawater temperature. In addition, Ajuy’s municipal forests are also threatened by illegal logging activities as well as indiscriminate land use change, for instance for agricultural purposes. The widespread use in agriculture of chemical fertilizers and pesticides that destroy soil viability was also raised as a persistent environmental issue in Ajuy. The extent of these environmental problems and their consequences on human and ecological health still need to be systematically researched.

Meanwhile, unlike Del Carmen, Ajuy does not have a mangrove forest, and therefore is not threatened by mangrove cutting for fuel use. However, recognizing mangrove’s important role in climate adaptation, the municipality of Ajuy, with the help of scientific NGOs such as the Zoological Society of London (ZSL)\(^64\), has recently conducted a feasibility study to select specific areas conducive for mangrove planting and identify the right mangrove species that can survive specific soil conditions.

Finally, some key informants from Ajuy have expressed concern about the potential threat of air pollution emanating from a coal-fired power plant located in the adjacent municipality of Concepcion. (The combustion of coal for electricity generation is also a major source of greenhouse gas emissions which drive climate change.) However, no rigorous investigation has been conducted yet on this matter.

**Health system challenges and opportunities.** Table 7 shows the current state of the different ‘hardware’ and ‘software’ elements of the local health system in the municipality of Ajuy. Like in Del Carmen, majority of the descriptions below are of qualitative nature, based on interviewee

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\(^64\) More information about the Zoological Society of London can be found here: [https://www.zsl.org/](https://www.zsl.org/).
accounts, written documents, and personal observations during the field visit. Meanwhile, useable quantitative information is also very limited and not easily accessible.

### Table 7. Assessment of Ajuy’s local health system

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Governance</strong></td>
<td>Despite the mayor being a physician himself, health is not necessarily identified as the topmost priority of the municipal government. Several health-focused ordinances were passed by the municipal council. The municipal mayor plays a limited role in the oversight of local health system operations. The municipal health officer facilitates health planning and day-to-day facility management and plays a very strong advisory role to the mayor, who is the final decision-maker. Local and barangay health boards meet regularly to discuss issues and solutions. The health sector is represented in several cross-sectoral committees but not in a leadership or convening role.</td>
</tr>
<tr>
<td><strong>Resource Mobilization</strong></td>
<td>Municipal health funding is sourced mainly from annual revenue allotments, with supplemental funding coming from PhilHealth reimbursements. The overall annual budget for health (from mixed sources) has slightly decreased by around 2% from 2017 to 2019. The mayor is able to mobilize additional funds for health emergencies from other discretionary and contingency sources within the municipal budget.</td>
</tr>
<tr>
<td><strong>Financing</strong></td>
<td>Majority of the poor inhabitants are automatic PhilHealth members (as part of the sponsored program) but exact population coverage remains unknown. The local government provides partial support for non-sponsored PhilHealth members who cannot pay their voluntary contributions. PhilHealth benefits are partially enjoyed by members depending on services provided by accredited facilities. The burden of out-of-pocket payments is unknown but likely to be happening for secondary and tertiary care services sought outside the municipality (e.g., from private hospitals). There is moderate funding allocated for population-based public health interventions such as educational campaigns.</td>
</tr>
<tr>
<td><strong>Service Delivery</strong></td>
<td>The rural health unit (RHU), which is accredited by PhilHealth, provides basic primary care services that span promotion (i.e., family planning), prevention (i.e., immunization), basic emergency care, and outpatient treatment for common symptoms and illnesses. Referral arrangements for advanced care (i.e., inpatient care, surgery, etc.) exist between the RHU and the district hospital located in the nearby town of Sara, which is approximately 30 minutes away by land. However, the referral center has limited capacity in terms of number of beds, medical supply, and health workforce, and therefore is constantly overwhelmed by patients from various municipalities. Patients</td>
</tr>
<tr>
<td>Building Blocks</td>
<td>Functions</td>
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<td>----------------</td>
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<tr>
<td>Workforce</td>
<td>Service Delivery</td>
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<td></td>
<td>also get lost along the referral and back-referral process due to poor coordination between facilities. There are very few physicians with private sector clinics that provide outpatient consultations. Basic quality and safety standards downloaded by the DOH are observed by RHU staff. Awareness raising town hall activities (e.g., on physical activity, nutrition, etc.) occasionally conducted in various barangays.</td>
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<td>There is one primary care physician for a population of more than 50,000, who also fulfills administrative responsibilities, as well as two public health nurse, 11 midwives, and 230 barangay health workers scattered across the municipality. The skilled health worker to population ratio is 0.27 per 1,000, which is way below the 2006 WHO recommendation of 2.3 per 1,000. Overall, health staff is trained to perform basic care services and procedures, including first aid, but generally overworked and unable to routinely reach different barangays (e.g., island barangays are visited by health staff only occasionally).</td>
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<td></td>
<td>Infrastructure</td>
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<td></td>
<td>There is a single RHU building located in the central part of the municipality, which was newly renovated after being destroyed by Typhoon Haiyan. The RHU is less accessible to people living farther from the center (due to unpaved roads and limited public transportation) and those living in isolated island barangays. The RHU has basic equipment for primary care (i.e., refrigerator for vaccines, sphygmomanometer, etc.). There are only 11 barangay health station (BHS) for 34 barangays; each BHS contains very basic equipment (i.e., weighing scale). Health facilities destroyed by Typhoon Haiyan are rebuilt with stronger construction materials.</td>
</tr>
<tr>
<td></td>
<td>Medicines and Devices</td>
</tr>
<tr>
<td></td>
<td>Generally, in the RHU, there is a steady supply of essential medicines for common illnesses, with several occasional incidents of stockouts throughout the year. Small privately-owned pharmacies sell basic medicines for common symptoms (e.g., fever, headache) as well as more specialized medicines not available in the RHU. Apart from basic equipment, the RHU also has a functioning laboratory that can perform basic blood chemistry and microscopic tests. Apart from ultrasound for prenatal check-ups, no other imaging devices are available.</td>
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<tr>
<td></td>
<td>Information System</td>
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<tr>
<td></td>
<td>The RHU’s information system is already transitioning to becoming fully electronic, with additional staff dedicated to encoding patient records. There is a palpable effort from local government to utilize available information for evidence-informed planning and decision-making.</td>
</tr>
<tr>
<td>Software</td>
<td>Leadership Practices</td>
</tr>
<tr>
<td></td>
<td>Overall, the municipal mayor has created an aura of openness and optimism within the municipality, which generally motivates staff and stakeholders to actively participate in achieving collective goals. The mayor is highly regarded as a someone who</td>
</tr>
</tbody>
</table>
### Table 7 (Continued)

<table>
<thead>
<tr>
<th>Leadership Practices</th>
<th>‘walks the talk’; the municipal health officer is perceived as a good implementer and manager.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Culture</td>
<td>The workplace culture is generally collaborative but not necessarily one that encourages individual initiative and creativity. Instead, the mood is geared more towards merely executing assigned tasks. Concrete incentives need to be placed to ensure that health staff and other stakeholders are able to demonstrate ingenuity without fear of being reprimanded for overstepping authority.</td>
</tr>
<tr>
<td>Power Relations and Agency</td>
<td>The hierarchy in the municipality is not very rigid but is also not very relaxed either. As top decision-maker, the mayor remains highly regarded and respected by subordinates and constituents; however, they do find the mayor accessible and amenable to suggestions and advice. Within the municipal health office, the same dynamic can be said between that of the municipal health officer and the rest of her health staff.</td>
</tr>
<tr>
<td>Values and Norms</td>
<td>Positive values such as happiness and sustainable development are manifested in key municipal documents, community programs, and physical objects (e.g., vision statement in the municipal hall). Such aspirations are repeatedly reminded to staff and stakeholders during cross-sectoral meetings and town hall assemblies.</td>
</tr>
</tbody>
</table>

Source: Author’s elaboration

Overall, like Del Carmen, Ajuy continues to face several chronic problems such as limited human resources; occasional stockouts of essential medicines; lack of essential diagnostic devices such as an X-ray machine; and gaps in the referral system linking the primary care facility and hospitals providing inpatient care. The three island barangays are especially at a great disadvantage, as not only they lack adequate health workforce and medical supplies, but patients also need to travel to the mainland by boat for 30 minutes to an hour just to receive essential care from the mainland.

However, unlike in Del Carmen, it can be argued that the local health system of Ajuy enjoys more resources or perhaps greater stability, as reflected in various indicators such as PhilHealth-accredited facilities (which generate additional income for the local health system), more sustained supply of medicines, and presence of diagnostic equipment. This is likely a result of Ajuy’s income
status (i.e., ‘richer’ than Del Carmen), Ajuy’s improved health system situation can also explain why compared with Del Carmen, aggressive efforts towards health system strengthening is not as strong a priority in Ajuy. Nonetheless, the various stakeholders interviewed expressed their desire to fill some of the health system gaps that they have identified such as recruitment of additional health personnel and enhancement in higher levels of care.

When it comes to the ‘software’ elements, the situation in Ajuy does not indicate any sign of difficult dynamics among various actors. Positive values such as good well-being and healthy environment are widely disseminated and reflected in stakeholder accounts and community processes. A culture of openness and collaboration exists to allow iterative problem-solving and innovation. Municipal leaders inspire government staff and other stakeholders to actively participate and take action. The community in Ajuy may be almost three times larger than Del Carmen, but a strong sense of community and kinship is also palpable.

*Challenges and opportunities for climate action outside the health sector.* Similar to Del Carmen, Ajuy was faithful to the requirements mandated by both the Disaster Act and the Climate Change Act. The municipality developed a disaster plan and climate plan, both of which were crafted by a committee composed of the heads of different local agencies, including the municipal health office. These plans lay out the priority areas that the municipality needs to address when it comes to disaster risk reduction and climate change adaptation, respectively, as well as the specific measures that need to be undertaken by each agency involved.

For instance, the disaster plan details various activities and investment priorities such as:

- Conduct of disaster preparedness and response training;
- Disaster-proofing of multi-purpose facilities;
• Building of evacuation centers in safe zones, and;
• Establishment of community radio for rapid dissemination of disaster warnings, among others.

Meanwhile, the climate plan enumerates several adaptation measures such as:
• Planting of mangroves along the coastline as protection from storm surges and sea level rise;
• Reforestation of mountain slopes for preventing rain-induced landslides and for carbon sequestration;
• Installation of rainwater collectors in various barangays, and;
• Planting of drought-resistant agricultural crops, among others.

Some of these initiatives were implemented with the support of several science-based NGOs that provide technical training and technology transfer such as the Adventist Development and Relief Agency (ADRA) and Japan-based Organization for Industrial, Spiritual and Cultural Advancement (OISCA).

Finally, one platform for intersectoral action that was launched in 2018 is an initiative called Project HAPPINESS, which stands for “Harmonization and Actualization of People’s Plans through Inclusive, Nurturing, and Effective Systems and Services.” The initiative aims to keep track of progress made by different villages on a wide range of health, environmental, and social indicators and to encourage innovation and initiative among community members in solving local problems. Villages who receive the top scores will receive generous monetary prizes, which can be used for funding innovative projects. During the time of the field visit, the municipal government was in the
process of rolling out the competition, providing orientation seminars to local leaders about the mechanics.

**Proposed recommendations for future action.** Based on this assessment of Ajuy in terms of climate and health challenges, health system situation, and challenges and opportunities outside the health sector, below are some initial recommendations for future action:

- Enhance the baseline capacity and performance of the local health system through measures such as: hiring more midwives that can cater to island barangays; procuring essential diagnostic devices; ensuring adequate supply of essential medicines in both the RHU and the barangay health stations; improving the local health information system; and closing gaps in access to clean water, sanitation, and hygiene, among others;
- Through training programs, increase the awareness of health workers when it comes to climate-sensitive diseases and their prevention and management;
- Strengthen the capacity of the barangay health station located in the three remote island barangays and enhance patient transfer capability from island to mainland through acquisition of sea ambulance;
- Through collaborative, interdisciplinary research with external academic partners, investigate the potential nutritional impacts of food insecurity resulting from the effects of long-term climate change on agriculture and fisheries;
- Investigate the possible unseen health impacts of saltwater intrusion of drinking water sources and consider the procurement of water desalinization technology;
- Review and update the municipal-wide disaster plan and climate plan and explore ways to increase investments in and strengthen the role of the health sector;
- Organize a joint learning activity with the municipality of Del Carmen so that Ajuy can learn from Del Carmen’s experience in planting and protecting a mangrove forest;
• Conduct research on the environment and health effects of air and water pollution emanating from the coal-fired power plant in the nearby municipality of Concepcion, and;
• Explore the feasibility of submitting a health-focused project proposal to the People’s Survival Fund while learning from the experience of Del Carmen in tapping the fund.

Cross-Case Synthesis

This next section of the Results Platform brings together the two individual case studies, identifies common lessons, and highlights unique differences. This section is divided into four major themes: awareness, understanding, and attitudes toward climate change; climate and health risks and vulnerabilities; current health system situation; and dimensions of municipal responses to climate change.

Awareness, understanding, and attitudes toward climate change

In general, various stakeholders who were interviewed from both Del Carmen and Ajuy did not only recognize the term ‘climate change’ but also demonstrated basic level of awareness about it. In both municipalities, climate change is seen as an inevitable reality, and therefore rather than trying to avoid or ignore it, one public official remarked:

“We do not have any choice but to confront it, and prepare ourselves, prepare our people, for them to be able to prepare their respective families and their respective communities to be resilient in the issues that are at hand.” (Executive assistant, Ajuy)

Most informants described climate change as deviation from anticipated weather patterns based on historical trends, as reflected in this statement:
“Your regular climate behavior that you are anticipating suddenly changes... The basic understanding of everybody is, whatever you project in the next few years, so you can plan whatever in your life in advance, will change.” (Mayor, Del Carmen)

For instance, as reflected in the individual case studies, some of the informants noted that compared to previous patterns, rainfall has become heavier and more frequent, while dry periods have become hotter and longer. They attributed these observed changes to climate change. These stakeholder perceptions are supported by national-level projections described in national climate assessments as well as Del Carmen’s previous Eco-town assessment.

The respondents also recognize the fact that climate change is a long-term challenge. Therefore, unlike the short-term problems that local governments are more familiar with, climate change on the other hand requires investments and planning for the long term. For example, the old reactive approach to isolated flooding incidents cannot hold anymore:

“It doesn’t necessarily mean that if we are flooded today we will create a new program for flooding just for next year. We look at five years from now, ten years from now, to 25 years from now.” (Disaster risk reduction and management officer, Ajuy; Translated)

Because of the long-term effects of climate change, the time horizon for building capacity for climate adaptation also has extended. One government official remarked on the importance of ensuring that preparedness and capacity-building efforts are sustained:
“It should not be a piece-meal approach. And it can never work if you are going to approach it in a one-month program or a two-day seminar or a three-day seminar. It has to be walked through for the whole year.” (Executive assistant, Ajuy)

Apart from the anticipated long-term deviation from historical experience that characterizes the climate challenge, there is also recognition among stakeholders of the increasing level of uncertainty when it comes to the occurrence of extreme weather events such as typhoons and storm surges, or the usual pattern of wet and dry seasons. Such knowledge is important for guiding activities and decision-making in farming and fishing. Hence, to confront the uncertainty that climate change presents, society must continuously adapt, as elaborated by the mayor of Del Carmen:

“The problem is, it changes all the time… So your design should be on how do they [the community] change themselves so that they are willing to adapt and innovate given that the climate will always change. We live in a world of uncertainty. The only [thing that is] certain is that you have the capacity to address the uncertainty.” (Mayor, Del Carmen)

When it comes to the causes of climate change, there is some level of awareness as to the anthropogenic nature of the climate crisis – that climate change resulted from the increasing concentration of greenhouse gases in the atmosphere through emissions from different forms of human activity such as fossil fuel-driven electricity generation, transport and agriculture. One health professional remarked:
“We are the ones who created the problem. We are also the ones who will harvest its impacts. At the end of the day, we really are the ones who create our diseases.” (Hospital physician, Del Carmen; Translated)

Meanwhile, another public official described the situation in both literary and spiritual way, reflecting the influence of indigenous and perhaps Catholic values and beliefs in Philippine rural municipalities:

“Climate change is nothing more but the effect of the abuse of our environment. Mother Earth is already asking for rent for the space that we are occupying.” (Executive assistant, Ajuy)

When it comes to the societal effects of climate change, natural disasters such as typhoons and storm surges come top of mind. The experience of both municipalities in 2013 when Typhoon Haiyan hit land was repeatedly raised by many informants (See later section on ‘Importance of past disaster events’). However, there is also a growing level of awareness of the slow-onset effects of climate change, as well as how climate change affects different sectors such as agriculture and environment. One municipal mayor remarked about the need to look at climate change from a broader perspective:

“Climate change has many repercussions. What people only focus on is the disaster side. You should look at the whole governance and developmental framework – how it affects everything.” (Mayor, Ajuy)

However, while from a general view, there is an acceptance that disaster risk reduction and climate change adaptation are closely connected, there is still confusion when it comes to operationalizing
this linkage and harnessing potential synergies, as reflected in this remark from one of the disaster risk reduction officers:

“\textit{I myself do not understand what climate change means because when I started my work in disaster risk reduction, climate change was not yet an issue. Last year, when the Local Climate Change Action Plan (LCCAP) was introduced, the two were merged. I’m not very well-versed about climate change yet but I’m studying it now.}” (Disaster risk reduction and management officer, Del Carmen; Translated)

Despite some level of awareness about climate change among key informants, who are mostly government officials, one NGO leader lamented that ordinary citizens in general may not be fully appreciating the gravity of the climate crisis and its potential impacts on the community in the future:

“\textit{Actually, I think people are aware of climate change. However, I think we need to deepen further their understanding of it. It is likely that they do not know what will happen in the future. Because these are coastal areas, do they know that the sea level will continue to rise? If it rains, the precipitation will become more intense. If it’s hot, there will be prolonged period of drought. These are some of the aspects that they need to understand better.}” (NGO leader, Del Carmen; Translated)

In relation to limited understanding about climate change among the general public, there is also a concern that given the sporadic nature of natural disasters and the subtlety and delayed timing of slow-onset climate effects, climate change is not yet becoming recognized as a felt and urgent need, which hampers immediate action. This is not unique to these two municipalities though, as globally,
this attitude towards the issue of climate change is also observed. One of the mayors asked the question:

“[People] have [wants] that might not be their actual need. Unfortunately, [preparing for] climate change is a real need that people still have to recognize. How do you translate the need to become the want?” (Mayor, Del Carmen)

Nonetheless, while climate change surely presents many potential problems including to human health, some key informants manifested not fear but optimism, as reflected in this statement:

“Climate change was never a threat to us. We saw it as an opportunity. Instead of fearing it, make it an ally.” (Mayor, Del Carmen)

Respondents from both municipalities identified positive visions and aspirations for their community despite the imminent threat of climate change. For Del Carmen, there is a strong belief that the first step is to ensure survival of people, which is a critical foundation for eventually improving quality of life. The mayor of Del Carmen put it in this manner:

“That’s [how you prepare] for the future. [How do we enhance our] climate adaptability? [We] start from understanding what our vulnerabilities are, to preparing for survival, to now having quality of life.” (Mayor, Del Carmen)

Meanwhile, in Ajuy, the disaster risk reduction officer also exhibited a similar degree of optimism, this time framing community members not as victims but as survivors of climate change:
“My vision for Ajuy is not only for the community to be seen as a victim... That’s what I saw when Yolanda happened. Initially, the community felt helpless. But on the other side, they did not notice, 25 hours after my assessment of the villages, around 80-90% of the households already restored the roofs of their houses. But people did not give importance to the innate capacity that they have to stand up to the moment of calamity. And I also saw how community members helped each other. I want to emphasize to the community that they are not victims. They are more than that. They are strong. They can prepare.” (Disaster risk reduction and management officer, Ajuy; Translated)

Climate and health risks and vulnerabilities

Apart from investigating people’s awareness, understanding, and attitudes toward climate change, it is also important to examine the actual climate- and health-related risks and vulnerabilities of both communities. Looking at the two individual case studies, many similarities can be observed, likely resulting from the many commonalities in geographical, sociodemographic, and economic contexts between the two municipalities.

Climate change and variability. The two municipalities are susceptible to long-term mean change and short-term variability of different climate and weather parameters, as well as increased likelihood of extreme weather events. These climate-induced hazards are in addition to other non-climate-related hazards present in both municipalities that they need to be prepared for such as earthquakes and volcanic eruptions (since the Philippines is located in the Pacific Ring of Fire).65

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65 While evidence showing how present-day anthropogenic climate change drives earthquakes and volcanic eruptions remains sparse, scientists such as McGuire (2012) suggest that it is theoretically possible, as demonstrated in the past with non-human-induced climate change.
In terms of climate change and variability, both Del Carmen and Ajuy are anticipated to face gradual increase in both mean temperature and rainfall variability over the coming decades. While downscaled projection was only made for Del Carmen as part of the previously concluded Eco-town assessment, national climate assessments earlier described indicate this possibility for both municipalities. Meanwhile, the extreme weather events to which both municipalities are susceptible can be summarized as follows: increase in number and severity of typhoons; increase in flooding and landslide; and longer periods of intense drought. Of specific interest is the increasing likelihood of storm surge, whose recognition became more prominent after Typhoon Haiyan. Before, a storm surge was always confused with a tsunami, which is caused by an earthquake in the sea floor. Today, both Del Carmen and Ajuy have developed storm surge hazard maps and have also installed billboards (Figure 18) in storm surge-prone areas to educate the public.

Figure 18. Billboard demarcating a storm surge prone zone in Del Carmen

Source: Author, February 5, 2019
Meanwhile, two climate-related ecosystem changes that are more subtle in manifestation were also identified in both municipalities: increasing seawater temperature and sea level rise. As already described, seawater temperature rise causes the bleaching of corals, which are vital habitats for small fish. The destruction of corals eventually leads to decline in fish catch. Meanwhile, sea level rise, which as earlier mentioned is happening faster in Philippine coastlines than in other regions of the world, leads to receding of coastline, displacement of local inhabitants, and saltwater intrusion of groundwater, which is a vital source of drinking water. Specifically, the potential and actual effect of salinized water on the health not only of the residents of Del Carmen and Ajuy but also of myriad municipalities along the Philippines’ coastlines merit urgent investigation.

**Climate-sensitive health risks.** When it comes to the linkages between climate change and human health, there is some awareness among key informants, especially health workers, about disease conditions that can be influenced by the climate. While there is a general appreciation of how health and disease are mediated by different environmental factors such as temperature and water quality, it is not evident that informants deeply understand the specific pathways through which climate change affect these discrete health outcomes. Climate-sensitive disease conditions that were enumerated in interviews and reflected in reports reviewed include: mosquito-borne diseases such as dengue; water-borne diseases such as typhoid fever and amoebiasis; childhood undernutrition; and heat-related illness especially among farmers and fisherfolks. Historical data for these disease conditions were not readily available during the time of field visit. Proper research can be done in the near future to fill data gaps in terms of present and potential future burden of these diseases under different climate change scenarios.

In addition to the climate variables and climate-sensitive disease outcomes that were identified in the interviews and documents, there is also some recognition of the importance of intermediate
factors that are influenced by climate change and also predispose communities to the above-mentioned diseases. Some of these factors enumerated by respondents include: limited community awareness about climate-sensitive diseases; poor heath seeking behavior; inconsistent execution of disease control measures (e.g., covering of water containers to prevent breeding of dengue-carrying mosquitoes); poor hygiene due to limited access to clean water; and poor sanitation and open defecation due to lack of sanitary toilets. Such factors result in a poor to moderate baseline health status, which may add to the existing vulnerability of communities to disease as a result of geography or poverty.

Given the many similarities between Del Carmen and Ajuy in terms of climate and health vulnerability and risk, a common diagram (Figure 19) is developed to illustrate how climate change, through its long-term trends and short-term variability and extreme events, is going to affect the health of both municipalities. Also depicted in this diagram are the different sources of vulnerability (e.g., environmental, social, health system) and the specific exposure pathways (direct, natural system-mediated, human system-mediated) through which climate change generates these anticipated health outcomes. Such diagrams for municipalities and local health systems can be an effective tool for educating health workers and other stakeholders about the causal chain or impact pathways linking climate change and human health. Similar assessment efforts in the future can employ participatory approaches that involve different stakeholders in the construction of these causal diagrams.

**Other environmental health issues.** In addition to the aforementioned climate-related health, social and environmental issues, there are other issues not directly linked to climate change that were raised by the respondents. Since both are coastal municipalities, one of the problems raised
Figure 19. How climate change affects the health of Del Carmen and Ajuy

Source: Author's elaboration

was illegal fishing by unauthorized fishermen (coming from other jurisdictions or controlled by big companies that were not given a license by the municipality) and/or through environmentally destructive means such as the use of cyanide and explosives. When it comes to terrestrial ecosystems, some of the present challenges identified include: deforestation especially by illegal loggers; land use change (for instance, cutting of trees for use in planting corn and other agricultural crops); and widespread use of chemical fertilizers and pesticides that destroy soil viability in the long run.
Improper management of waste and widespread use of plastic were also raised as serious environmental concerns. The preservation of mangrove ecosystems was also deemed an important environmental and climate-related issue, given the vital role mangroves play in protecting communities from sea level rise and storm surges. In Del Carmen, the environmental footprint of tourists that come to visit is also a growing concern. Meanwhile, the community of Ajuy is beginning to express concern about the potential threat of air pollution emanating from a coal-fired power plant located in the adjacent municipality of Concepcion. However, no rigorous investigation has been conducted yet to look into this matter.

For the additional environmental issues enumerated above, the environment and natural resources office of both municipalities lead in the enforcement of national environmental laws governing illegal fishing, deforestation, and improper waste management, as well as the conduct of awareness-raising campaigns to educate the public (and in the case of Del Carmen, tourists) on environmental protection. The office is usually supported by environmental NGOs and other village officials. A closer relationship between the municipal environmental office and health office can lead to more integrated approaches towards solving these environmental issues that have serious health consequences in the long run.

Current health system situation

The earlier section discussed the main climate- and health-related problems that the two municipalities are already witnessing now or anticipating for the future. This means that different stakeholders also acknowledge the important role of the local health system in responding to climate change, especially when it comes to adaptation. As one NGO leader stated:
“The health sector is the one that will complement other sectors to ensure that the community remains healthy when climate change comes.” (NGO leader, Del Carmen; Translated)

In several occasions, key informants were introduced to various constructs used to describe the health system’s response to climate change. Several stakeholders mentioned the term ‘resilient,’ while no one is aware of the term ‘climate-smart.’ Nonetheless, one health worker attempted to come up with her own definition of a ‘climate-smart’ health system:

“If a health system is climate-smart, all the things needed for healthcare provision should be complete and available.” (Midwife, Ajuy; Translated)

Apart from the presence of enough resources to sustain healthcare delivery in times of climate breakdown, another characteristic of a health system ready to address climate change is the ability to manage uncertainty, as reflected in this quote from one of the mayors:

“Your local health system has to be really climate-adaptive. It has to be because the changing climate will have new health challenges, and every new health challenge would require a new system, a new solution to resolve it, so it’s evolving.” (Mayor, Del Carmen)

A rough qualitative assessment of the local health system building blocks, functions, and software elements reveals a mix of positive and negative qualities, which can either enhance or hamper the health systems’ ability to respond to climate-related health impacts. Even without taking into account climate change, the two local health systems are visibly already facing chronic gaps and challenges that need to be addressed to meet existing population needs. Meanwhile, there are favorable features that, if harnessed well, can lead to local health systems that are ready and
prepared for climate change. Table 8 summarizes some of these positive and negative qualities shared by the local health systems of Del Carmen and Ajuy.

Table 8. Positive and negative qualities of the local health systems in Del Carmen and Ajuy

<table>
<thead>
<tr>
<th>Positive Qualities</th>
<th>Negative Qualities</th>
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</thead>
<tbody>
<tr>
<td>• Strong commitment to health</td>
<td>• Inadequate health workforce</td>
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<tr>
<td>• Expanding sources of additional funding (such as PhilHealth)</td>
<td>• Lack of diagnostic equipment</td>
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<tr>
<td>• Increasing sustainability of medicine supply</td>
<td>• Weak referral system</td>
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<tr>
<td>• Shift towards disaster-resilient infrastructure</td>
<td>• Overwhelmed hospitals at higher (e.g., secondary, tertiary) levels</td>
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<tr>
<td>• Growing attention to public health programs (not just personal healthcare)</td>
<td>• Weak and fragmented health information system</td>
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<tr>
<td>• Commitment to community participation</td>
<td>• Lack of alternative healthcare provider options (e.g., privately-owned clinics and pharmacies)</td>
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<tr>
<td>• Existing platforms for cross-sectoral collaboration</td>
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**Positive qualities.** What is striking about the two municipalities is that there is an expressed commitment to improving health and strengthening the local health system coming from the top leadership – i.e., at the level of the municipal mayor. As earlier discussed, this is not always the case in a devolved health system such as the Philippines, where health planning, financing, and decision-making lie at the mercy of politicians, some (if not many) of them may not be fully appreciating the value of health and therefore not making it a priority of local governance. Such high regard given to health is important, as it increases the likelihood of health being given special attention in the broader process of municipal-wide cross-sectoral climate adaptation planning, in which health continues to be neglected in most settings.

Such strong emphasis given to health at the highest level also translates to increasing financial investments to fund a wide array of health system activities. In recent years, old health facilities have been renovated and new ones constructed, incorporating features that enhance their ability to
withstand natural disasters. Increasing health budgets have also allowed local governments to ensure the steady supply of essential medicines, which before was a perennial problem in many municipalities. Today, the occurrence of medicine stockouts has reduced, and additional efforts are certainly needed to ensure that these situations do not anymore happen.

Meanwhile, additional allied health workers have been hired in recent years, although the total workforce remains inadequate to meet existing and emerging population health needs. Some of the additional funding have also been allocated not just to ensure the sustainability of personal healthcare delivery but also the implementation of population-based public health programs such as vector control and awareness raising campaigns. The two municipalities have now become capable of providing supplemental assistance to households who cannot fully pay their PhilHealth premiums or indirect hospitalization costs, among others.

Another positive feature that is palpable in the two municipalities is the commitment among health system leaders and stakeholders to community engagement. Interviewees from both municipalities have consistently expressed desire to involve ordinary members of the community in planning and decision-making at least in the barangay level, a scale that is more tangible and manageable for village leaders. Moreover, during the field visits, the local governments in both municipalities happened to be conducting disaster preparedness and response training for community volunteers; hence, some indication of active community engagement and participation were witnessed first-hand. Documents and interviewee accounts also mentioned about the conduct of regular meetings and town halls where community members are able to raise concerns and propose solutions. Finally, platforms for cross-sectoral collaboration are existing in both municipalities. Unlike in many municipalities in the Philippines, the local health board in Del Carmen and Ajuy are well-functioning, holding regular quarterly meetings which serve as a space for discussing pertinent
health issues and updating about ongoing and future initiatives. Moreover, the health sector is involved in other cross-sectoral committees such as the ones that are tasked to develop the municipal-wide disaster plan and climate plan. While at present, the two local health systems are not yet implementing specific projects or activities related to climate change (except for the disaster preparedness training provided to the local health staff), the inclusion of the health sector in these broad-based disaster and climate efforts provide a good foundation for the development and implementation of future climate-oriented public health projects.

**Negative qualities.** It can be noted that the negative qualities of local health systems tend to be material ‘hardware’ elements such as personnel, equipment, and information systems. Inadequate numbers of health workers have been repeatedly raised as an important concern, given the excess burden imposed on the existing workforce by the two municipalities’ complicated geography, continuously growing population, and increasing health needs. Meanwhile, health workers also need implements – including diagnostic devices – that will enable them to provide care effectively. When asked if her local health system is ready for future climate impacts, one hospital physician remarked:

“If the problem will occur today as of this moment, it seems like we are not ready because we are lacking in many things, especially manpower. We don’t have ECG. We don’t have CT scan. We even don’t have an X-ray.” (Hospital physician, Del Carmen; Translated)

Nonetheless, the existing health staff that were interviewed indicated that their awareness of climate change, natural disasters, and their health impacts and their ability to address them have grown in recent years, especially since the aftermath of Typhoon Haiyan. Apart from knowledge
and skills, what the health workers have gained is a higher level of confidence in confronting such changes. One of the nurses demonstrated this positive attitudinal change:

“We are ready. Before, our barangay health workers (BHWs) or volunteers were not trained with basic things such as first aid, what they are supposed to do when such a disaster occurs. Now, they are very trained on what to do when something like Typhoon Haiyan happens again.”

(Public health nurse, Ajuy; Translated)

Apart from limited health workforce and medical equipment, there are also gaps in health service delivery in both municipalities. Both Del Carmen and Ajuy do offer basic primary care services such as acute outpatient care, basic emergency care (first aid), pre- and post-natal care, and simple chronic disease management, as well as population-based services such as health education, nationally-mandated expanded program of immunization, and environmental approaches to disease prevention and control. However, beyond these outpatient services, the two local health systems do not have the skilled workforce, facilities and equipment for the provision of inpatient secondary level of care as well as advanced emergency care. Even the referral hospitals in neighboring hospitals have limited capacity to accommodate the influx of patients coming from surrounding municipalities, including Del Carmen and Ajuy. While a significant part of medical interventions that address climate-sensitive conditions is delivered at the primary care level (e.g., vector-borne disease prevention and control, supplemental nutrition, etc.), the broader referral system must also be ready for those patients who will transition to more advanced stages of disease that will require inpatient care. Good quality and available secondary and tertiary care that is within the reach of community inhabitants will also ensure that catastrophic spending and eventual impoverishment resulting from out-of-pocket spending are avoided.
Meanwhile, there are efforts to shift towards an automated health information system in both municipalities, but these plans are hampered by limited technical capacity of staff, lack of computers, and unreliable wireless connection. These challenges in the local health information system will need to be addressed first if more advanced features, such as the integration of health information with meteorological and other environmental data (i.e., climate services for health), will be introduced to develop early warning systems and enable forecasting and risk assessment, which will be useful for climate-oriented health planning and decision-making.  

Finally, apart from the immature referral system and inadequate health facilities for advanced care, there is also a lack of alternative sources of healthcare provision or medicine supply, particularly those that are privately-owned and/or -administered. While the Philippines health system in general has a pronounced public-private mix of providers and commodity suppliers, usually many isolated rural areas only have the public sector available, which is often underfunded, understaffed, and underequipped. Nonetheless, in both Del Carmen and Ajuy, the public health system administered by the municipal government is so far functional, yet the system’s ability to ensure functionality when disaster strikes is still yet to be tested. While the role of the private sector in healthcare delivery continues to be debated especially in the context of universal health coverage (McPake & Hanson, 2016), health systems may actually benefit from having multiple healthcare providers or pharmacies to increase actor redundancy and diversity – traits usually associated with

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66 An early warning system is “a set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss” (https://www.preparecenter.org/topics/early-warning-systems). Meanwhile, climate services are “mission-oriented processes driven by societal needs, which result in the production and delivery of relevant, authoritative, timely and usable information about climate change, climate variability, trends, and impacts to improve decision-making in climate sensitive sectors” (WHO/WMO, 2016, 15). Examples are early warning systems, integrated monitoring systems or risk forecasting systems.
the resilience of ecological systems – which can eventually help ensure the functional stability of the entire local health system when hit by an external shock or stress.

**Climate responses from outside the health system.** Despite the general absence of climate-related activities (apart from disaster preparedness and response training) within the health sector, both municipalities have already initiated climate-related projects in other sectors. This may not be coming as a surprise, as other sectors such as agriculture, environmental management and disaster risk reduction have been recognized early on as climate-relevant sectors. Meanwhile, as previously mentioned, the health sector is generally seen as a newcomer, if not a laggard, in climate mainstreaming.

For example, the agriculture and environment sectors in Del Carmen and Ajuy have begun implementing the following climate change adaptation projects: mangrove conservation and forestation; installation of rainwater collectors in households in preparation for water shortage; establishment of a climate field school for farmers and fisherfolks; introduction of drought-resistant crop varieties; and promotion of sustainable agricultural practices to reduce the use of chemical fertilizers and pesticides, among others.

Meanwhile, for disaster risk reduction and management, a diverse array of activities and projects is also being pursued in both municipalities, many of which were triggered after the occurrence of Typhoon Haiyan in 2013. Some of these activities include:

- Disaster preparedness and response training of health workers and other volunteers;
- Establishment of evacuation centers in safe zones;
- Adoption of zoning policies to prevent building of houses along coastal areas prone to storm surges;
• Disaster-proofing of multi-purpose government buildings, and;
• Establishment of community radio for rapid dissemination of disaster warnings, among others.

With these variety of projects happening in other sectors, there is a huge opportunity for the local health systems of Del Carmen and Ajuy to learn from these efforts and identify potential synergies. For example, traditional nutrition interventions implemented by the municipal health office can be tied to ongoing initiatives for ensuring food security in the agriculture sector. Health messages can be incorporated in the community radio that is mostly used for spreading disaster warnings. Existing disaster preparedness training efforts can be expanded to cover other non-disaster slow onset impacts of climate change on human health.

**Dimensions of municipal responses to climate change**

Earlier in this cross-case synthesis, municipal awareness and attitudes towards climate change as well as actual climate and health risks and vulnerabilities were described. An in-depth look at the health system situation then followed. In this next section, the overall municipal responses to climate change, both within and beyond the health system, are examined. Key dimensions were identified and explored.

As earlier mentioned in the Introduction of this thesis, the effects of climate change, which is a global phenomenon, manifest at both global and local levels. Hence, responses to climate change at the sub-national level, particularly at the municipal level, are of crucial importance. As earlier discussed, national laws such as the Disaster Act and the Climate Change Act have cemented the role of Philippine local governments in climate change adaptation and disaster risk reduction. Local
stakeholders who were interviewed also echoed the importance of municipalities as frontline responders. Here is a representative quote:

“The local government is at the forefront of climate change and its impacts. We are the ones who feel the effects. People come to us when they experience the problems. They rely on us. The national government is so far away. If the drought happens next season, they will not look for the regional director of agriculture, they simply go to the local government. That’s the structure of our society. The local government is very important because they are the ones who can identify what are the impacts and what are the possible solutions to these impacts.” (Mayor, Del Carmen)

**Role of leadership**, A common feature between the two local cases is the presence of some indication of good leadership in the community. This is particularly palpable at the top level, as demonstrated by municipal mayors who are visionary and forward-looking and adopt a system view of the many affairs dealt with by the community. Both mayors saw the importance of climate change as a cross-cutting issue and therefore made it a priority of local governance. One local government official described this kind of visionary leadership demonstrated by the mayor in his municipality:

“We are a little bit lucky because of a leadership that is attuned of the times and determined to give the best information that we could gather... In fact, 15 years ago, when our mayor was starting planting trees, I, myself, was asking him: ‘What are these trees for?’ And he said: ‘We are not planting trees for the present generation, but for the next generation.’ And I asked him: ‘For what?’ ‘In preparation for climate change, to balance the climate change issue here in our municipality.’” (Executive assistant, Ajuy)
Meanwhile, apart from top leadership, government officials and employees representing various agencies and sectors also demonstrated commitment to the climate challenge. However, the different agencies varied greatly in terms of level of involvement in cross-sectoral committees as well as implementation of sector-specific climate-related interventions. Compared to the health sector, the agricultural, environmental, and disaster management sectors seem to be more engaged with the climate issue. Nonetheless, both municipal mayors emphasized the importance of creating an enabling environment for sectoral leaders to take initiative in pursuing intra-sectoral and cross-sectoral activities related to climate change, which should provide a positive push to the health sector.

An important aspect of climate leadership is how the issue of climate change interplays with local politics. In both cases, there is a growing recognition that climate change is a political issue and addressing it is being demanded by municipality constituents. In addition, climate change, especially adapting to it, is not seen as a divisive issue, given its cross-sectoral nature as well as widespread potential consequences across the whole of society. As noted by one government official:

“Climate change is good politics. Because whenever you talk about climate change, you are talking about lives of people. You are talking about stomachs of people.” (Executive assistant, Ajuy)

**Role of science and evidence.** In both municipalities, science and research were deemed important for decision-making especially when faced with the uncertainty of a changing climate. In fact, these resources were considered by most stakeholders as even more important than financial assets. One mayor explained the importance of science in local governance and decision-making:
“How do you make the right decisions? You will go back to science. That’s why we’re advocating science-based governance. It’s like buying television – you need data to decide which to buy. Since you have the right data... you [can] come up with the right decision.” (Mayor, Del Carmen)

Del Carmen was particularly more advanced than Ajuy in this regard because, as earlier mentioned, it was one of the few municipalities previously selected by the Philippine Climate Change Commission for the now-defunct Eco-town program, which included the conduct of rapid vulnerability and adaptation assessments. Despite the program being discontinued, the municipality of Del Carmen continues to use the assessment’s results for their local planning and decision-making, as revealed by this remark from the mayor:

“We now have data to make better and more informed decisions of how to change and adapt to reach our targets and visions, because our original targets and visions were ‘bombed’ by climate change.” (Mayor, Del Carmen)

As described in the individual case studies, both municipalities have forged partnerships with local universities and local and international science-oriented NGOs. These partners have been conducting applied research on a few climate-related areas such as agriculture and environmental protection, including mangrove conservation and coastal resource management. However, the linkage between climate change and health is an area that has not yet been covered by these science-policy partnerships, and various stakeholders welcomed the idea of a health-focused organization partnering with their local governments for climate-oriented health research in the future.
While the roles of the local government related to disaster risk reduction and climate change adaptation and the standard operating procedures for executing them have already been laid out by the national government, an important concern raised by informants from both municipalities is that they possess limited technical capacity to ensure successful planning and implementation. Respondents expressed the need for technical support from national government as well as external partner organizations. One respondent even suggested that the national government must send ‘climate warriors’ to the different local governments across the country to provide direct and tailored training and technical support in the conduct of local vulnerability and adaptation assessments and the crafting of disaster risk reduction and local climate change action plans.

**Importance of past disaster events.** Past experiences with natural disasters play a key role in increasing the awareness and motivating action around climate vulnerability among different stakeholders. One common feature of both municipalities is their shared experience related to Typhoon Haiyan in 2013. As described in the individual case studies, both municipalities received advanced information about the impending calamity. The typhoon’s trajectory changed, hence sparing Del Carmen. Meanwhile, Ajuy was hit a few hours after the typhoon wreaked havoc in Tacloban, hence giving the town additional time to prepare and evacuate.

One health worker in Ajuy recalled her feeling of disbelief when Typhoon Haiyan began to pass through the municipality:

> “Even I at that time couldn’t comprehend that this would happen. I thought that it only happens in movies. I knew that because of climate change, things like this can happen, but I never realized it will happen here in our town.” (Public health nurse, Ajuy; Translated)
Nonetheless, Typhoon Haiyan was crucial in changing mindsets, mobilizing leadership, and encouraging the urgent development of disaster risk reduction plans in both municipalities. One public official admitted that the typhoon served as a wake-up call about the reality of climate change:

“I think we’re on the right track right now because of the Yolanda experience, but to be honest with you, before the Yolanda, nobody really takes climate change seriously.” (Executive assistant, Ajuy)

One of the disaster risk reduction officers also described the surge of support and initiatives that came in after Typhoon Haiyan occurred:

“Before Typhoon Yolanda, the municipal government was facing problems when it comes to allocating funds and implementing programs for disaster risk reduction. After Yolanda, NGOs such as Red Cross and ADRA came in to help us. With their help, we conducted vulnerability assessments and then we formulated the disaster risk reduction plan of the municipality.”

(Disaster risk reduction and management officer, Ajuy; Translated)

Finally, the Typhoon Haiyan experience made each municipality aware of the spatial inequalities that exist in their locale, which render some villages more vulnerable than the others. Remote island barangays that have limited access to healthcare, experience poor living conditions, and already begin to confront the initial effects of climate change such as sea level rise have been repeatedly cited by key informants as requiring additional and urgent help. Meanwhile, both municipalities also developed hazard maps that provide information as to which villages are prone to flooding, landslide, and storm surges – climate-related phenomena that in turn can provide a
breeding ground for infectious disease outbreaks, or cause injury and death due to direct exposure (for instance, due to landslides).

One main limitation of these maps however is that they were developed using a deterministic rather than a probabilistic risk assessment approach (OECD, 2012). A deterministic approach primarily considers the impact of a single risk scenario, usually historical experience, as basis for projecting future impacts such as which areas will be affected or how intense and frequent the event will be. Meanwhile, a probabilistic approach considers all possible scenarios; in addition to historical information, future climate projections (using various climate scenarios) which also take into account some degree of uncertainty are incorporated in the estimations. The importance of adopting a probabilistic approach was demonstrated in the case of Tacloban (Lapidez, et al., 2015). When Typhoon Haiyan hit the city in 2013, many areas farther from the shore, which were deemed safe in existing deterministic hazard maps, still ended up being hit by the storm surge, killing thousands who thought they were safe in evacuation centers. The massive loss of life could have been prevented if a probabilistic approach was adopted and people were relocated to areas way farther than where they were actually brought to.

**Funding climate change initiatives.** Apart from scientific evidence, financial resources were also identified as an essential input to effective climate change adaptation; however, most respondents deemed it only secondary in importance. One NGO leader noted that being ‘climate-smart’ does not depend merely on a municipality's financial resources:

"When we say climate-smart, it's not about how rich the municipality is. It's about how the community will cope with the impacts of climate change." (NGO leader, Del Carmen; Translated)
Nonetheless, financial resources remain a vital input to climate adaptation. While money is generally perceived to be scarce, the municipalities’ top leaders expressed some degree of optimism when it comes to the availability of funding outside of their regular budget and their ability to raise money for climate response at the municipal level. One of the mayors stated:

“The financials will come. They’re always there. Government has money. All other people are willing to help. People are willing to help other people. That’s the nature of humanity.” (Mayor, Del Carmen)

There is a general recognition that financial resources are most needed to enhance the level of preparedness of the municipality towards natural disasters and other climate-related impacts. Such proactive (as opposed to reactive) view is reflected in this quote:

“It’s better to expend millions, even billions of money for preparation, not for the response, because you cannot bring back anymore what is destroyed if we do not prepare.” (NGO leader, Del Carmen)

As described earlier, national climate and disaster laws already stipulated how municipalities should allocate resources for climate adaptation and disaster risk reduction initiatives (e.g., 5% of annual budget for disaster risk reduction, climate expenditure tagging). Both municipalities have been faithfully observing these requirements for the past few years, especially since the aftermath of Typhoon Haiyan in 2013. However, there were a few challenges identified. First is that the types of activities being funded under these mandates greatly depend on the quality of their vulnerability assessments and local planning. Many of these prerequisites, while executed, are of limited technical quality; therefore, most of the activities tend to be focused on the conduct of information
dissemination for the public and some skills training for volunteers, which are necessary but not sufficient for enhancing the community's readiness to disasters and other climate-related impacts.

The second challenge relates to the climate tagging exercise. While there is a guidance document provided by national government on how to conduct climate tagging, the lack of training leads to confusion and misclassification. Therefore, municipalities may not be maximizing the climate adaptation and mitigation potential of their many activities and investments across different sectors. In addition, the tagging exercise merely becomes a matter of compliance rather than an essential component of climate-considerate planning.

Since the focus of this case study research is climate and health, there is potential for financing coming from the health sector to be utilized for climate-sensitive health interventions. For instance, as shown in both municipalities, PhilHealth reimbursements are becoming an important additional source of revenue that help augment the limited annual health budget. Such payments from PhilHealth can be used for improving health facilities, hiring additional personnel, and securing medicines and equipment, which are prerequisites for enhanced capability of the local health system to address future climate impacts.

Finally, apart from the available funding obtained from annual revenue allotments and PhilHealth, potential non-traditional sources of climate funding were also identified. One example is the People’s Survival Fund which was described earlier. Del Carmen is one of the few municipalities in the country that has so far tapped this special fund. The municipality will be using this fund to establish a climate field school for farmers and fisherfolks. Respondents in Del Carmen mentioned that if municipalities are serious about innovating for climate change adaptation, there are resources beyond their disposal that can be harnessed. What is needed is commitment and
creativity in developing innovative project proposals and active lobbying of local governments to national government agencies responsible for these special funds.

**Community participation and cross-sectoral partnerships.** Because climate change is a highly scientific issue, there is a general tendency to highlight technical solutions and material assets especially at the levels of global and national discourse. What was notable in the interviews is that respondents have repeatedly emphasized the importance of positive values and other non-material aspects of local culture in the municipal response to climate change. One of the mayors further elaborated:

“Something we realized in the last 8 years, we thought it was all about infrastructures and systems. [We thought they] could resolve the sustainability issues given our political structure in a very politicized country. However, we realized it all boils down to basic values such as that of the family, the person, those towards the community... How do you translate values to become part of your systems and structures? How do you put it inside a building?” (Mayor, Del Carmen)

It was palpable that in both municipalities, community participation is highly valued by local leaders and other stakeholders. This was reflected in the key informant interviews, municipal plans and reports, and observations in the field. In fact, during the field visit in both Del Carmen and Ajuy, the municipal government conducted disaster training workshops for barangay leaders, community volunteers, and ordinary households (Figure 20).67

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67 In each municipality, I was able to attend a disaster training workshop for barangay officials and residents, conducted by the municipal government. It was such a coincidence that these activities happened during the time of my visit, and so I was able to witness the way by which municipal leaders interact with community members, especially in terms of preparing them for natural disasters and other climate-related impacts.
One public official passionately explained why community participation is critical in local governance and decision-making:

“They are the supreme authority of what they need, of what they plan for their future. Only if the people will be given the chance to find their voices and to be able to be given the chance to say something of the direction of their community.” (Executive assistant, Ajuy)

Another mayor emphasized the importance of listening to ordinary citizens and the role of local government as facilitator of local adaptation:
“Your communities know more than you do. Sometimes, you’re not giving them time to share their knowledge. You lose a lot of knowledge that’s supposed to help you. As the government, you are the facilitator. As a government, you simply facilitate... Allow them to develop a system that allows adaptation, innovation all the time because diseases change depending on the climate.”

(Mayor, Del Carmen)

To illustrate active community participation in disaster and climate preparedness activities, one disaster risk reduction officer described the hazard assessment exercise that was conducted at the village level, which was facilitated by staff from the municipal government:

“*The community members themselves conduct their own hazard assessment. They identify what hazards are faced in the community and they also identify the solutions.*” (Disaster risk reduction and management officer, Ajuy; Translated)

When dealing with communities, one must be sensitive to the diverse characteristics and needs of subgroups – for instance, in the context of a coastal municipality, the different barangays. Even within a municipality, barangays may vary in terms of geographic type (ex. coastal, island, mountainous) or sociodemographic profile (e.g., based on income, livelihood source, etc.). Hence, a ‘cookie-cutter’ approach especially to climate adaptation cannot be simply applied, as highlighted by one of the mayors:

“What we did is to accept that each barangay, our communities, they have different health needs, and because they have different health needs, you also need different approaches.”

(Mayor, Del Carmen)
Meanwhile, apart from meaningful engagement with community members, key informants also highlighted cross-sectoral collaboration as another positive value that underpins successful municipal response to climate change. For instance, one of the government officials emphasized the cross-sectoral nature of climate change, hence addressing it should go beyond the disaster risk reduction sector:

“If you talk about climate change, it cannot just be the work of the disaster risk reduction office. It should be the concern of all the agencies. It should be the concern of the whole community. It should be the highest priority of the LGU.” (Executive assistant, Ajuy)

One of the environment officers understood how her work in environmental protection contributes to other sectors such as health:

“If the environment is healthy, naturally, your people are healthy too. If you have good mangrove management, then if a typhoon or storm surge comes, the people will be in good hands too.” (Environment and natural resources officer, Del Carmen; Translated)

As earlier described, as part of national mandates, there are mechanisms already put in place for intersectoral planning for disaster risk reduction and climate change adaptation at the municipal level, such as the development of the disaster plan and climate plan. However, while the planning process is inclusive, execution still remains within the convening office, which is usually the disaster risk reduction office. Limited technical and implementation capacity are some of the reasons identified behind the inability of other sectoral offices to effectively fulfill their roles as set in the local plans.
Finally, as described in the individual case studies, both municipalities are partnering with universities and NGOs on applied research projects. However, these partnerships are limited by the project’s lifetime, which in turn is dependent on availability of external funding. Therefore, the challenge is not just on how to increase these external partnerships, but also on how to sustain these linkages in the long run.

Discussion

What this case study research achieved

As earlier mentioned, the aim of this multiple case study research is to produce insights on the challenges as well as opportunities that local health systems especially in developing countries encounter when it comes to responding to climate change and its health effects. By closely examining the experiences of two coastal municipalities in the Philippines – one of the world’s most climate-vulnerable countries – a wealth of insights and lessons were generated which can inform the diagnostic and implementation approach for climate-considerate local health system development in low- and middle-income countries.

Before proceeding to the main insights and lessons gathered from this project, it is important to first reflect on what this case study research achieved on a high level. First, by exploring the current and projected climate-related health impacts as well as the existing and evolving responses to them in these two municipalities, this case study research surfaced what could be the key elements, main principles, driving forces, vital processes, and actual tensions that shape the responses of a local health system – and perhaps a municipality at large – to climate change. Rather than conducting a theoretical tabletop exercise identifying what these elements could be, this exploratory research provided empirical data, which was then examined in the light of other existing concepts and frameworks coming from both fields of climate change science and health systems practice.
Proposed climate and health frameworks, such as the ones developed by WHO and World Bank, were useful starting frames for this research. They provided the raw material in terms of what initial elements to look at, such as essential health system building blocks and specific climate adaptation and mitigation measures. However, as already discussed in the Analytical Platform, these frameworks also have limited value with regards to diagnosing problems and guiding action at the local health system level, since these tools were developed primarily to aid international agencies and guide national-level assessments. Such limitations were further validated by the empirical material generated from these local case studies. For instance, governance for climate and health at the national level can be hugely different from governance at the local level; hence, a different set of interventions as well as process or outcome measures will apply to local health systems. The insights gathered from this interrogation of existing frameworks can be a useful input to the development of new frameworks that will be appropriate for the local level.

This case study research also demonstrated how an analysis of local health systems through a climate change lens can be conducted. As earlier mentioned, globally there is a dearth of health systems research that includes climate change in the equation. Hence, there is also limited guidance frameworks and tools for conducting such kind of research. This project had to draw and combine insights from multiple existing frameworks and tools that are used in the fields of climate change science, health systems, and environmental health. Some of the contributions of this climate-oriented health system analysis include: inclusion of information about environmental health determinants and vulnerabilities; examination of the ‘software’ elements that the traditional ‘building blocks’ approach tend to neglect; and expansion of the scope of analysis to cover other sectors that interface with the local health system – what is proposed to be called ‘systems for health’ in this thesis. Some of these new elements are further discussed below.
When new challenges such as climate change arise, there is always an urge, especially among global health practitioners, to ‘parachute’ right away into these kinds of settings and, guided by proposed frameworks and ‘best practices’ from other places, introduce or sell new innovations without examining first what is happening on the ground (Andrews, Pritchett, & Woolcock, 2012). The conduct of these case studies prior to framework development or intervention design demonstrates how essential preliminary, diagnostic groundwork is in providing vital information as to the preconditions for mounting local system responses to climate change. This contrasts with making blanket assumptions such as the perceived lack of local health system capacity for climate resilience and adaptation. Such attitude belittles the innate potential of individuals and communities to pursue adaptation actions on their own as they observe environmental change unfold – what sustainability science calls ‘autonomous’ adaptation (as opposed to ‘planned’ adaptation) (Smit, et al., 2000).

These local case studies also illustrate the claim that the health impacts of climate change are, in their very core, matters of equity and social justice (Walpole, Rasanathan, & Campbell-Lendrum, 2009). As a global phenomenon, climate change affects everybody, but more especially the poor and the marginalized especially in developing countries. This case study research did not have the benefit of looking into municipalities that may possess greater material and non-material resources (both the municipal government and inhabitants) – which may translate to greater adaptive capacity – to allow for inter-municipal comparison. However, this research instead examined the multiple forms of vulnerability already experienced by two municipalities – geographical isolation, chronic poverty, and poor baseline health outcomes, among others – and how these vulnerabilities interact with the initial manifestations of climate change that are already slowly emerging. Climate change puts additional stress to these already fragile and overburdened communities, which can lead them to become even much poorer, sicker, and more vulnerable – in short, exacerbating
existing health and social inequities. Therefore, enhancing the adaptive capacity of local health systems to respond to these additional impacts becomes an urgent global health imperative – compatible with the mission of health systems research and practice, which is to achieve health equity worldwide (Pratt, Allen, & Hyder, 2016).

Finally, it is important to remember that the purpose of this case study is not just descriptive but also exploratory in nature. However, it also did not seek to provide a comprehensive explanation for a particular phenomenon or to even evaluate success (or failure) of a system’s response, in this case a health system. This research did not attempt to definitively answer what exactly constitutes a successful local health system response (whether it is adaptation or mitigation) to climate change. This is despite the two cases, at first glance, having the appearance of success in their responses thus far, or at least pursuing some initial steps to address pre-identified issues at the climate and health nexus. (Earlier in the Analytical Platform, it was acknowledged that the two cases were selected because of the presence of top leaders giving priority to climate change and the existence of some climate-related activities in other sectors.) In fact, this case study research refined these first impressions – that despite the existence of initial efforts and optimistic attitude of stakeholders, the two municipalities are facing a variety of serious challenges that need to be addressed.

Evaluating the success of system responses to changing external conditions such as climate change has been deemed a difficult exercise to pursue. In fact, even outside the health systems field, there is little consensus as to the metrics for either adaptive capacity or successful adaptation of ecological or social-ecological systems, and this question continues to be a subject of academic inquiry and debate until today (Engle, 2011). Adger, Arnell, & Tomkins (2005) posited that overall, the success of adaptation action depends on the achievement of pre-identified adaptation
objectives, and suggested that criteria such as effectiveness, efficiency, equity, and legitimacy are important in judging success. This means that the metrics for such an approach will then vary between systems. For instance, from a health system standpoint, there is a range of indicators that are commonly measured to evaluate the achievement of traditional health system goals such as improved aggregate and distributional health, citizen satisfaction, and financial risk protection (Murray & Frenk, 2000). While this case study 'snapshot' captures just a portion of what is truly a continuous process of adaptation, it does not describe or even extrapolate the rest of the adaptation process and its outcomes in the long run. Hence, such investigation of adaptation success can be later pursued as a follow-up exercise. A future project may focus on evaluating the effectiveness of adaptation – such as the recommendations made for each municipality – in achieving traditional health system goals based on commonly used indicators (and even new ones that take into account climate change).

**Applying climate change concepts to health systems**

In the Analytical Platform, several key concepts in climate change science were briefly surveyed, as gaining a better understanding of these ideas is deemed helpful in analyzing the cases. Such background also ensures that the application of these borrowed concepts is done in a careful manner to avoid what was earlier described as the potential for 'paradigm creep' or meaning dilution, especially with regard to resilience. As earlier mentioned, these concepts were first used in the context of ecological and social-ecological systems. In this case study research, these concepts are empirically tested in a social system, specifically local health system. One major difference between past applications and this current research is that in social systems, human agency and power relations – which are aspects that are absent in purely ecological phenomena – become important considerations.
It is easier to begin with the concept of mitigation, which in mainstream climate change discourse is separate from adaptation (although earlier in the Analytical Platform, the synergies between the two were touched upon – i.e., mitigation is in itself an ‘adaptive act’). As earlier described, mitigation measures are those interventions that seek to lower the amount of greenhouse gases from the atmosphere – either through emission reduction from ‘sources’ (e.g., coal-fired power plants) or carbon sequestration into ‘sinks’ (e.g., forests). In the context of health systems, numerous points in the healthcare delivery chain have been identified for climate mitigation – from green purchasing of medical supply to adoption of renewable energy in health facilities. In both municipalities, there are no signs that climate mitigation measures are currently being pursued, and health staff have not expressed that this is a priority concern – which is anticipated in settings with serious resource constraints, high population demand for healthcare, and now, climate-related health risks beginning to unfold. It can be surmised that this is also the case in most local health systems in developing countries globally.

Nevertheless, this does not mean that climate mitigation within the health sector should not be advocated for, given the sector’s significant carbon footprint (although less compared to other sectors) and its ethical mission to protect health and not contribute to global pollution (following the Hippocratic tenet to “do no harm”). Health sector mitigation will contribute to maximizing mitigation’s public health co-benefits (e.g., reduced asthma attacks due to improved air quality) as well as reducing the need for future adaptation (i.e., by preventing further climate change). However, it is unrealistic to expect that local health systems will prioritize mitigation efforts given the background of persistent resource constraints and continuously unmet and slowly growing population demand. What this case study research suggests is that health sector mitigation efforts will need to be initiated and supported by upper-level governments (i.e., regional or national government) as well as the international community. Such momentum for mitigation can be
advanced through: additional funding (e.g., for replacing dilapidated health facilities with disaster-proof and solar-powered ones); provision of technical support; tying incentives into regulation (e.g., incorporation of sustainability standards in PhilHealth reimbursements to hospitals and primary care facilities); and market shaping (e.g., creating platforms where suppliers of green products and local health system purchasers interface).

When it comes to responding to current and projected health effects of climate change, there is no doubt that this is an area that local health systems especially in highly vulnerable settings will need to pay attention to, as demonstrated in the two case studies. From a mainstream climate change discourse perspective (e.g., in UN climate negotiations), such response is what is called adaptation. However, the related concept of resilience cannot be ignored, given its widespread use across many sectors and disciplines and its growing application in health systems development in relation to a diverse array of acute shocks and chronic stresses. As mentioned earlier in the Analytical Platform, academic debates about the relationship between the two concepts continue until today. Some even argue that in the real world, the dividing line between the two might be more arbitrary than actual, and one frame is needed to better understand the other (i.e., a resilience frame fills the gaps of adaptation theory, and vice versa). For the purpose of this DELTA Project, as earlier discussed, a simple distinction between the two – resilience as implying shock absorption and functional persistence and adaptation as incremental adjustments and transformational change – is adopted to serve as a starting point for investigation.

Considering the two local case studies in this research and adopting the proposed conceptual distinction, a simple resolution that can be made is that when responding to climate change, local health systems in theory must become both – resilient and adaptive. The local health systems in both Del Carmen and Ajuy continue to confront chronic challenges of constrained resources and...
weak implementation capacity, which impede their ability to perform their public health and healthcare functions in order to meet growing population demand. Such situation presents a resilience problem, especially when the abrupt impacts as well as the slow-burn effects of climate change on health, for instance more frequent dengue outbreaks due to increased flooding, begin to manifest and threaten long-term system functionality.

Meanwhile, climate change does not only threaten health system resilience through additional shocks and stresses, but also the unique nature of these new ecosystem alterations requires the health system to mount novel adaptive responses that have never been seen or implemented before. For example, there are new health threats that are unfamiliar to the community and have never been observed before that are slowly beginning to manifest, such as salinization of drinking water sources and reintroduction of neglected tropical diseases that have already been eliminated (or are close to elimination). These newly emerging health risks, which are anticipated but unfamiliar, will require new types of responses that the local health system may either have no prior technical knowledge about (e.g., desalination technology) and/or no extra resources available for (i.e., because historically, they are not part of the municipal health budget). Table 9 summarizes the distinction between adaptation and resilience and its posited implications for health systems practice.

While the mixed nature of challenges being confronted by the two municipalities indicate the importance of both resilience and adaptation as an aspiration, in reality much of what is happening especially in their local health systems is what would be described as ‘coping.’ Coping generally refers to actions aiming for short-term stability – reacting to occurrences of harm and avoiding their potential impacts without challenging prevailing rules and operating within a given policy context (Kelly & Adger, 2000; Gore, 1993; Yohe & Tol, 2002). Coping mechanisms may have the
Table 9. Distinction between resilience and adaptation with health system implications

<table>
<thead>
<tr>
<th></th>
<th>Resilience</th>
<th>Adaptation</th>
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<tbody>
<tr>
<td><strong>Definition</strong></td>
<td>Absorbing shocks and stresses, ensuring functional persistence, resisting collapse</td>
<td>Incremental adjustments or system-wide transformation to external stimuli</td>
</tr>
<tr>
<td><strong>What it means in practical terms?</strong></td>
<td>Enhancement of existing capabilities and implementing innovations to withstand changes</td>
<td>Introducing innovative interventions or restructuring the system to adapt to new normal</td>
</tr>
<tr>
<td><strong>Nature of problems addressed</strong></td>
<td>Old problems being exacerbated, usually with known solutions</td>
<td>New problems that are unknown or little understood, solutions need to be invented</td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
<td>More politically and operationally feasible; does not threaten status quo; outcomes more predictable</td>
<td>Opens up opportunity for reflection and change; addresses underlying root causes and structural problems</td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>May focus on one aspect or intervention; may ignore other issues and threats to system integrity; can be depoliticized; may be blind to existing injustices</td>
<td>Upfront cost may be high; those who benefit from status quo may be opposed to change; change may take time due to resistance and scale</td>
</tr>
<tr>
<td><strong>Health system example</strong></td>
<td>Disaster-proofing of hospitals to withstand typhoons and flooding; intensifying nutrient supplementation programs to improve community nutrition baseline</td>
<td>Introduction of floating healthcare facilities/hospital boats; promotion of backyard farming of fortified and climate-resistant vegetables to ensure food security</td>
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Source: Author’s elaboration based on Pelling, 2011

appearance of initial, if not desperate, measures to maintain system resilience. Meanwhile, unlike adaptation, coping is premature and inadequate, and does not seek to challenge the status quo. In the two municipalities, coping is reflected in the simple efforts – some routine, others spontaneous – that the local health systems undertake to ‘get by’ or ‘put off fires’ – from occasional information dissemination drives to relying on volunteers in times of small emergency. Such ‘coping inertia’ is happening despite the increasing awareness among health staff and other stakeholders of the looming threat of climate change to human health. The challenge in these municipalities is how to overcome this inertia and match the degree of response with the gravity of the problem being
recognized – i.e., transitioning from mere coping to thinking about more intentional adaptation and resilience building.

While in this thesis, a simple distinction between resilience and adaptation was adopted, it is important to remember that the two are neither totally unrelated nor even polar opposites. However, because the two concepts have different underlying values and assumptions, applying these concepts to health systems practice in the context of climate change (and other types of change) will require an acknowledgement not just of their conceptual synergies but also the potential tensions and trade-offs between the two (Figure 21). These desired synergies and unintended consequences are feature of health systems being complex adaptive systems, as earlier mentioned in the Analytical Platform.

For example, it may be intuitive that resilient health systems are also more capable to adapt to future uncertainty and surprises. However, an ‘obsession’ with resilience (i.e., retention of structural integrity and maintenance of functionality) may lead the health system to ‘get stuck,’ therefore rendering the system ineffective in mounting novel responses that deviate from the routine when an unexpected shock arrives. This phenomenon somehow relates to concepts such as ‘institutional inertia,’ ‘institutional stickiness,’ and ‘path dependency’ coming from the fields of political science and public administration (North, 1990; Boettke, Coyne & Leeson, 2008). What is worse is that due to the chronic lacks faced by local health systems or even societies as a whole today, such systems might end up being “locked into resilient but undesirable states of poverty and marginality” (Tanner, et al., 2015, 16) – in short, “poor, but resilient” (Neocleous, 2013).
One illustration of how local health systems may ‘get stuck’ in resilience is when command-and-control practices that foster hierarchy and rigidity are implemented in the name of efficiency. In the two municipalities, an examination of the health system ‘software’ elements provides some indication of a top-down approach in staff management and decision-making. When a climate-related natural calamity wreaks havoc and catches on-the-ground health staff by surprise, they may be incapable of making immediate decisions or even taking initiative to innovate, possibly because of lack of confidence and fear of overstepping authority.

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68 Maladaptation is “a result of an intentional adaptation policy or measure directly increasing vulnerability for the targeted and/or external actor(s), and/or eroding preconditions for sustainable development” (Juhola, et al., 2016, 135).
Conversely, while one may expect that adaptation measures (whether incremental changes or dramatic transformations) enhance system resilience or even bring a system to a new, stronger resilience state, maladaptations – whether due to wrong decisions or poor execution of decisions – may instead undermine future resilience (Nelson, 2011). In both Del Carmen and Ajuy, future investment decisions to address novel climate-related health threats, e.g., procurement of expensive water desalinization technology, may divert scare financial resources from more routine health system functions and activities, thereby potentially jeopardizing the sustainability of healthcare delivery to local citizens. Local health systems must therefore be ready to make these adaptive decisions while making sure functionality and resilience are retained.

Recognizing these positive synergies and potential tensions between resilience and adaptation, these issues must be explicitly considered in climate-oriented health system design, planning, and operations. The balance between being resilient and being adaptive is a negotiation that needs to be made among health system stakeholders. Since a comprehensive assessment may not be entirely feasible – possibly due to limited technical capacity, incomplete information, or even uncertainty – one practical approach is to choose interventions that build the core adaptive capacity of the local health system – for instance, investments in health workforce, robust information systems, and climate-proofing of physical infrastructure. As earlier mentioned in the Analytical Platform, adaptive capacity is a shared concept between resilience and adaptation – i.e., strong adaptive capacity facilitates both the sustaining of resilience and enables adaptation. The application of the concept of adaptive capacity to local health systems is further explored in a later section.

**Rethinking health system goals**

Examining the health system in light of climate-related goals also opens a re-examination of current health system goals. As earlier discussed, traditionally health systems are conceived to be striving
to achieve three main intrinsic goals – improved health and health equity; enhanced citizen satisfaction; and financial risk protection. These goals were formulated from an inward-looking view, with technical and allocative efficiency in mind, and without consideration of how the health system interfaces with other systems or how it is a part of a broader social-ecological system. Given the backdrop of an emerging planetary crisis, Mayhew, Van Belle, & Hammer (2014, 125) then urges the health systems community to begin thinking on how to “build adaptive health care systems that co-evolve with other social-ecological systems.”

For sure, as longstanding global health problems persist, improved health and health equity must remain essential health system goals. However, with climate change now a new part of the equation, new goals might also need to be considered. The lens of mitigation, adaptation, and resilience provide invaluable insights as to how these new goals may be constructed. As mentioned earlier, mitigation did not prominently feature as a priority in the local case studies. However, from a bigger, perhaps national or even global level, the health sector cannot be contributing to carbon and other forms of pollution, as doing so runs counter to the goal of health protection – i.e., the health system becomes an accomplice of disease causation as well. Hence, mitigation as a health system goal can be conceptualized as a component of the goal towards health improvement (as improvement occurs from the synergistic action of health-enhancing and disease-reducing measures).

Another possibility is for the reduction of climate risk (and other upstream ecological risks) through mitigation to be considered as a separate health system goal in itself. This is not necessarily a manifestation of ‘mission creep’ for the health system, since preventing the worsening of climate change supports the traditional goal of health improvement. Moreover, conversely, the health sector has been for some time advocating other systems (i.e., agriculture, energy, cities) to
incorporate the advancement of health and wellbeing to be part of their sectoral goals. The Lancet-University of Oslo Commission on Global Governance for Health puts it in this manner: “Health is a precondition, outcome, and indicator of a sustainable society, and should be adopted as a universal value and a shared social and political objective for all” (Ottersen, et al., 2014, 661). In the same vein, the health sector can be asked to embrace the goal of climate risk reduction through greenhouse gas emission reduction as well.

When it comes to adaptation and resilience to climate change, a question that can be asked is whether or not building and enhancing the adaptive capacity and reducing the vulnerability of a health system in light of external shocks and stresses is an end in itself and therefore merits a separate and explicit goal. Even without considering climate change, recent discussions around health system resilience – whether to pandemics or economic shocks – have been asking the same question on whether it is an end or a means to an end (i.e., an emergent property). Jerneck and Olsson (2008) suggests that with the evolving climate change regime, social systems in general must make the goal of adaptation explicit, because the preservation and survival of the system is certainly a desired system goal which also increases the likelihood that other goals are met. Should adaptive capacity strengthening and vulnerability reduction be eventually considered a legitimate health system goal, it should be remembered that health systems, like any other social system, respond to many different external stimuli, and climate change happens to be just one of the many (if not the most important or pressing at present). Therefore, the additional goals of enhanced system adaptive capacity and reduced vulnerability will have broad applications to different

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69 I was privileged to be a member of the Youth Commission of the Lancet-University of Oslo Commission. Our role was to shadow the main commission in their work, as well as to develop our own ideas around questions of global governance for health. Our youth report, entitled “Advancing health by enhancing capabilities: An agenda for equitable global governance,” can be found in Gopinathan, et al. (2014).
situations, not just in terms of climate impacts. (The concept of adaptive capacity as applied to health systems is discussed later in this chapter.)

Below is a potential schematic that depicts the proposed new health system goals in the climate era (Figure 22). In this diagram, added to the traditional health system goal of health improvement are the goals of climate risk reduction through mitigation, and adaptive capacity strengthening and vulnerability reduction for and through adaptation and resilience. The health system goals of citizen satisfaction and financial risk protection remain important but then become secondary and instrumental, hence not included in the diagram.

![Figure 22. New health system goals in the era of climate change](image)

Source: Author's elaboration

While new climate-oriented goals for the health system are being presented here, it is important to acknowledge that health systems, such as those in Del Carmen and Ajuy, are not able to meet even the old traditional goals that they are expected to meet. There already exists a distance between current performance and previously defined goals, and adding new goals such as the ones proposed...
here may even widen this distance. Therefore, the trade-offs that are entailed in this addition of or shift towards new goals need to be identified and addressed, and smart strategies that minimize the negative consequences of goal redefinition need to be employed.

Finally, the explicit acknowledgement of mitigation, adaptation, and resilience as core tasks for public health can be much better appreciated when the gaze is extended from ‘health systems’ to ‘systems for health,’ which is discussed in greater detail later in this chapter. As earlier acknowledged, responding to climate change has been a dominant part of discourse in other sectors even before public health began to pick it up. Meanwhile, as reflected in the case studies, other sectors and the whole municipality at large are also pursuing other legitimate goals such as poverty alleviation and economic growth, which are not necessarily mutually exclusive with health and climate goals. However, there can be potential tensions, for instance when economic development pathways being pursued by society adopt health- and climate-damaging policies, practices and technologies. In this regard, greater multisectoral collaboration and policy coherence are undoubtedly necessary.

**Adaptive capacity of local health systems**

After examining how the concepts of adaptation and resilience apply to local health systems in the context of climate change, it is then important to explore what might be the preconditions for adaptation and resilience to successfully manifest in a system. Here comes adaptive capacity (or as earlier mentioned, sometimes called sources of resilience), a term that both concepts do share.

Climate change adaptation is a two-fold process – building adaptive capacity and implementing adaptation decisions and actions (Adger, Arnell, & Tompkins, 2004; Huang, et al., 2011). The development and enhancement of adaptive capacity is in itself an adaptive act, necessary to allow
successful execution of specific adaptive measures and to ensure readiness for future change, even those that are yet to come in the distant future. This view somehow resembles resilience, hence it is not surprising that both concepts are viewed as deeply related, if not interchangeable.

As earlier discussed, there is no strict consensus on what the determinants of adaptive capacity are, and it is possible that the specific ingredients would vary across systems. However, the earlier survey of some of the proposed conceptual frameworks for adaptive capacity (i.e., Jones, et al., 2010; Gupta, et al., 2010; Keenan, 2015), as well as incorporating the empirical insights drawn from this multiple case study research reveal some degree of convergence as to what its key elements might be, whether pertaining to a health system or to any other social system. Figure 23 presents these putative adaptive capacity determinants. Top of mind are material assets such as financial resources, infrastructure, and workforce, which are undoubtedly vital in establishing good foundational adaptive capacity.

Figure 23. Determinants of adaptive capacity of local health systems

Source: Author's elaboration
However, there are others that are deemed equally important, if not more, as reflected in existing frameworks as well as stakeholder perceptions and actual experiences in the two municipalities. System intelligence is deemed essential to be able to detect and understand problems, which is the first step in mounting an adaptive response. Intelligence is manifested in the presence of infrastructure that collects information, generates knowledge, and cultivates learning. The people of Del Carmen and Ajuy have repeatedly highlighted the importance of science and evidence as the first step towards becoming resilient and adaptive to climate change. A separate section on health system intelligence can be found later in this chapter.

Since adaptation entails making decisions and acting on them, another category of adaptive capacity determinant – leadership, good governance, and strong institutions – is also deemed crucial. The presence of committed municipal mayors and platforms for intersectoral collaboration gives both Del Carmen and Ajuy a good start for adaptive capacity strengthening, but much more needs to be done to fortify their existing systems of local governance, especially in the area of health sector leadership in climate adaptation. Meanwhile, because adaptation choices are made when significant change occurs, sometimes with an element of uncertainty or surprise, systems must also possess room for innovation and iteration to be able to generate novel solutions. While still in their inception phase, the inter-barangay competitions initiated by the two municipal governments are hoped to encourage creativity and inventiveness among community members in solving their local problems.

Nonetheless, while intelligence, governance, and innovativeness of formal structures are essential, they also seem to be insufficient. Social capital that rests on a community’s informal networks ensures that formal adaptation decisions have everyone’s buy-in and therefore are disseminated and executed across the whole of society. The importance of community may seem obvious and
intuitive, but nevertheless it needs to be reiterated. For instance, the predominantly top-down approach to the Ebola response has triggered calls for greater ‘people-centeredness’ in health system resilience-building (Martineau, 2016). While this case study research was not able to deeply evaluate the degree of social capital in both municipalities, efforts to enhance community participation and preparedness have been revealed not only through interviews and reports but also observations and interactions during the field visits. In turn, these adaptive capacity features must be underpinned by another determinant – positive values, which are ‘things’ that are judged to be important and worthwhile. For instance, values such as justice and sustainability are deeply espoused by the various stakeholders and embedded in different plans, processes, and symbolic objects in both municipalities.

Finally, since what is being pertained here is the adaptive capacity of health systems (or perhaps, health as a whole), it can be argued that baseline health status and health system performance at the local level is also one of its key determinants. This was already previously suggested in literature (Yohe & Ebi, 2005; Ebi, et al., 2018c). To elaborate, the sub-elements of baseline health profile include local burden of diseases and risk factors; level of health literacy and types of community behavior (both health-seeking and health-damaging); and the functioning and inclusivity of the local health system. All these sub-elements are already being routinely measured with traditionally used indicators.

These aforementioned factors illustrate how the adaptive capacity of health (or social) systems is, after all, a mixture of ‘hardware’ and ‘software’ elements that were examined in this thesis. It is important to remember that many of these determinants are related and not necessarily mutually exclusive with each other – for example, good leadership may inspire innovation, community participation, and health system responsiveness. It can also be argued that these adaptive capacity
features are not necessarily specific to adaptation and resilience to climate change – they are qualities that should be present in health systems anywhere, all the time. Other types of shocks or stresses – such as an infectious disease outbreak or an influx of refugees – will also require the existence of these adaptive capacity traits for local health systems to be able to retain functionality or reorganize if necessary.

As earlier mentioned, measuring the success of health system adaptation and resilience to climate change is beyond the scope of this thesis. In the same vein, this case study research did not attempt to measure the level of adaptive capacity of the two local health systems or even the municipalities at large. In fact, such measurement will be difficult to make, as several of the determinants that were identified are mainly software elements – perceived to be intangible but still observable, for instance in the governance mechanisms and decision-making processes adopted in the act of adaptation. Since deconstructing concepts such as adaptive capacity may end up being a hugely abstract exercise, what is important for now is to identify specific, tangible, and operational ‘entry points’ which system designers can pinpoint and address (Gogoi, Bahadur, & Del Rio, 2017). Table 10 summarizes these potential entry points and suggests some strategies and interventions to tackle them.

Table 10. Entry points and interventions for enhancing the adaptive capacity of health systems

<table>
<thead>
<tr>
<th>Determinants</th>
<th>Entry Points</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material assets</strong></td>
<td>Financial assets</td>
<td>Conduct climate lens analysis of local budgets; tap unconventional funding sources (both internal and external)</td>
</tr>
<tr>
<td></td>
<td>Infrastructure</td>
<td>Invest in disaster-proof health facilities; ensure steady supply of medicines and other commodities</td>
</tr>
<tr>
<td></td>
<td>Human resources/</td>
<td>Train existing health workers; fill health workforce gaps in secluded areas</td>
</tr>
<tr>
<td></td>
<td>workforce</td>
<td></td>
</tr>
<tr>
<td><strong>Intelligence</strong></td>
<td>Information system</td>
<td>Set up robust, integrated, and reliable information systems that collect, store, and analyze data; integrate health data with other</td>
</tr>
</tbody>
</table>
Table 10 (Continued)

<table>
<thead>
<tr>
<th>Intelligence</th>
<th>Information system</th>
<th>data types (e.g., climate/environmental data) to establish early warning systems/climate services for health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Technical capacity</td>
<td>Build technical capacity of workforce for data handling, analysis, and interpretation</td>
</tr>
<tr>
<td></td>
<td>Processes</td>
<td>Conduct vulnerability and adaptation assessment; embed routine monitoring and surveillance; arrange procedure for rapid evidence-to-practice translation</td>
</tr>
<tr>
<td>Leadership</td>
<td>Political leadership</td>
<td>Cement strong commitment to climate adaptation and health protection from the top leadership (i.e., mayor)</td>
</tr>
<tr>
<td></td>
<td>Health sector leadership</td>
<td>Develop systems thinking, management and diplomacy skills among local health system leaders</td>
</tr>
<tr>
<td></td>
<td>Cross-sectoral leadership</td>
<td>Establish routine platforms where sectoral leaders can discuss shared issues and develop solutions</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>Innovation platform</td>
<td>Create a workplace culture that encourages initiative and creativity; facilitate healthy competition among subgroups (i.e., barangays) to drive innovation</td>
</tr>
<tr>
<td>Social capital</td>
<td>Informal networks</td>
<td>Build coalitions among existing informal groups/organizations; motivate people to organize themselves into relevant support networks</td>
</tr>
<tr>
<td></td>
<td>Education and training</td>
<td>Design education and training programs that build capacity of households and volunteers (not just municipal government employees)</td>
</tr>
<tr>
<td>Positive values</td>
<td>Documents</td>
<td>Explicitly identify shared values in vision statements and local plans</td>
</tr>
<tr>
<td></td>
<td>Community rituals and symbols</td>
<td>Incorporate values in routine community activities and physical spaces (e.g., Sunday church, public parks)</td>
</tr>
<tr>
<td>Baseline health</td>
<td>Burden of disease and risk factors</td>
<td>Intensify disease-focused public health programs to reduce disease burden</td>
</tr>
<tr>
<td></td>
<td>Health literacy and behavior</td>
<td>Using diverse tactics (e.g., house visits, radio shows, town halls, incentives, etc.) to enhance public awareness and shape health seeking behavior</td>
</tr>
<tr>
<td></td>
<td>Health system performance</td>
<td>Address gaps and shortfalls in various health system building blocks (i.e., medicines) and core functions (i.e., financing)</td>
</tr>
</tbody>
</table>

Source: Author’s elaboration
Overcoming barriers to adaptation and resilience

In addition to developing adaptive capacity, local health systems must also overcome barriers to successful adaptation. Barriers are different from limits or constraints. Moser and Ekstrom (2010, 22026) describes limits as “obstacles that tend to be absolute in a real sense: they constitute thresholds beyond which existing activities, land uses, ecosystems, species, sustenance, or system states cannot be maintained, not even in a modified fashion.” Other terms that are related to this concept of limits include ‘vulnerability threshold,’ ‘tipping point,’ and ‘coping range’ – beyond such limits looms an inability to deal with change or even irreversible loss (Smit & Wandel, 2006). In the context of local health systems, a limit can take the form of unprecedented patient overload that can lead to collapse of health services, or capacities that are near-impossible to be developed, such as advanced technical capacity for conducting rigorous climate and health research. Either example will require some form of external help – either from a neighboring municipality, an external NGO, or upper-level governments.

Meanwhile, barriers make progress toward adaptation difficult as they increase the chance of failure and reduce the chance of successful outcomes, but through proper diagnosis and appropriate measures, they can be overcome (Huang, et al., 2011; Biesbroek, et al., 2012). Opportunities on the other hand are the converse of barriers – they “positively contribute to the [adaptation] process by increasing chance of success and reducing chances of failure” (Biesbroek, et al, 2012, 1126). If barriers have to be surmounted, then opportunities must be identified and

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70 The level of this limit or threshold is difficult to ascertain unless tested through experiencing a crisis with a magnitude way beyond the range of past experience. However, it can also be argued that human societies or social societies have innate ‘fighting spirit’ or ingenuity to persevere, find new solutions, and survive. This idea relates to a question that continues to be asked by many scholars until today – “Are there social limits to adaptation to climate change?” (Adger, et al., 2007, 335). There might be a difference between an actual, experienced limit and a perceived, subjective limit, and “limits to adaptation are endogenous to society and hence contingent on ethics, knowledge, attitudes to risk and culture” (335).

71 It can be argued though that these two examples are limits that cannot be overcome by the local health system itself, but are barriers that can be addressed in the context of the broader national health system.
maximized. These three concepts – limits, barriers, and opportunities – are presented in Table 11 with some illustrative local health system examples.

Table 11. Health system adaptation to climate change – limits, barriers, and opportunities

<table>
<thead>
<tr>
<th>Description</th>
<th>Examples from the case studies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Limits/Constraints</strong></td>
<td>Cannot be overcome; requires transformation or external help</td>
</tr>
<tr>
<td>Patient overload beyond surge capacity; technical capacity for advanced research</td>
<td></td>
</tr>
<tr>
<td><strong>Barriers</strong></td>
<td>Can be overcome within current norms and adaptive capacity</td>
</tr>
<tr>
<td>Limited funding and workforce knowledge for addressing climate-sensitive diseases</td>
<td></td>
</tr>
<tr>
<td><strong>Opportunities</strong></td>
<td>Increases the chance of success when harnessed</td>
</tr>
<tr>
<td>Climate-related initiatives happening in other sectors; existing disaster preparedness activities</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s elaboration

Adaptive capacity development and overcoming barriers are two related tasks – strong adaptive capacity makes surmounting adaptation barriers easier, and interventions that enhance adaptive capacity may also help overcome barriers. For example, installation of robust information systems for surveillance and forecasting both enhances health system intelligence and helps overcome the barriers of limited knowledge and high degree of ignorance and uncertainty. The key to successfully overcoming adaptation barriers is being able to diagnose them.

Moser and Ekstrom (2010) proposed a generic diagnostic approach that health system planners and decision-makers can adopt. This framework traces these barriers throughout the three main stages of the adaptation cycle: understanding (detecting the problem, gathering information, and redefining the problem), planning (developing, assessing, and selecting options), and managing (implementing, monitoring, and evaluation options). Using the earlier example, weak information systems reflect a barrier most especially in the understanding stage, resulting in lack of capability to properly detect a signal and collect data that can aid in characterizing the problem. Not
addressing this barrier can prevent the local health system from moving to the next stage, which is planning for adaptation. Figure 24 shows how the proposed adaptive capacity determinants may serve as a precursor to overcoming barriers and successful flow across the different stages of the adaptation cycle.

![Figure 24. Adaptive capacity determinants as precursor for the adaptation cycle](image)

Source: Author's elaboration based on Moser & Ekstrom, 2010

The barriers faced by the two local health systems in this case study research have been previously identified in literature. A review by Huang, et al. (2011) enumerated several of these barriers to public health adaptation to climate change – uncertainties of future climate and socioeconomic conditions, as well as financial, technologic, institutional, social capital, and individual cognitive limits. Among the stakeholders of both Del Carmen and Ajuy, there is general awareness of climate change as a pressing and present issue. However, it is also evident that the uncertainty associated
with climate change and the difficulty of ‘connecting the dots’ in this interplay of myriad causes and consequences present an ‘imagination challenge’ (Whitmee, et al., 2015) and therefore serve as a hindrance to tackling such problems and exploring the range of solutions. It can be argued that these problems that climate change presents are new and unfamiliar, compared to the usual, longstanding problems that they have been confronting for years, if not longer. Meanwhile, it must also be noted that some of these identified barriers, such as inadequate financing and institutional inertia, are not specific to responses to climate change and are encountered in almost every situation of shock and stress (Biesbroek, et al., 2013). Hence, addressing them will benefit local health systems to enhance their usual operations (without climate change being taken into account) and at the same time mount unusual responses to climate-related health effects.

**Tensions in health system response to climate change**

The previous sections explored the concepts of adaptive capacity and adaptation barriers as they apply to local health systems. As earlier mentioned, climate change adaptation entails both adaptive capacity building and implementation of adaptation choices. As if developing adaptive capacity is in itself not an uneasy task, the realm of implementation also presents additional yet related challenges.

As climate change becomes an inevitable new consideration in public health, health systems today are faced with several sets of tensions (Hess, McDowell, & Luber, et al., 2012) (Figure 25)– and the two local health systems of Del Carmen and Ajuy are not exempt from experiencing these dilemmas. One is between addressing significant current unmet needs (for instance, brought about by chronic poverty and endemic disease) and preparing for a somewhat unknown future set of needs, such as those associated with climate change, many of which are expected to worsen current unmet needs. Corollary to this, health systems are also confronted with a tension between enhancing existing
capabilities and activities (e.g., improving the primary healthcare facility) and introducing new strategies and innovations (e.g., installation of advanced early warning system). Another tension is between focusing on specific threats (e.g., mosquito-borne diseases) versus building broad-based capacity that can address a wide variety of threats. These tensions arise due to several reasons: accumulating list of problems both old and new; limited financial resources; overburdened health workforce; weak technical and implementation capacity; mismatch between annual budget cycles and the need for longer-term investments, among others.

Figure 25. Tensions faced by health systems in responding to climate change and health

Source: Author’s elaboration based on Hess, McDowell, & Luber, et al., 2012

These tensions that health systems grapple with are illustrations of the dilemmas that systems in general face on the road to resilience and adaptation. Resilience thinking offers a choice that need to be made between building ‘specified resilience’ – “resilience of what, to what?” – versus ‘general resilience’ – capacity to deal with unidentified shocks or a multiplicity of pressures (Nelson, 2010;
In the context of health systems, Gilson, et al. (2017, 1) made a distinction between developing ‘crisis resilience’ – the type of resilience for addressing large-scale shocks and stresses such as natural disasters and armed conflict – and ‘everyday resilience,’ which is needed to manage the instability and daily disruptions brought about by “patient complaints, unpredictable staff, compliance demands, organizational instability linked to decentralization processes and frequently changing, and sometimes unclear, policy imperatives.” Meanwhile, adaptation theory also talks about a similar dilemma between specific and general adaptive capacity (Nelson, 2010).

These tensions assume that health systems and societies in general must make a choice between either side of these dichotomies. However, if health systems are not able to fulfill their basic obligations and address current unmet needs, one begins to ask if there is indeed capacity for making such an allocative choice. A simple resolution to this dilemma is that both specific and general capacities are needed, as systems such as the local health system must be able to respond to new shocks and stresses while addressing many unfinished businesses and daily population needs at the same time. This relates to the concept of ‘resilience dividend,’ which are the dual benefits of resilience building that are accrued both in times of crisis and peace. The challenge is to find an accepted balance between both types of capacities, which requires information, resources, and mechanisms for problem detection and definition as well as solutions generation and evaluation. One approach is to identify what are called ‘no-regret’ options, which are projected to generate benefits (such as health protection) even if the climate-related effects (whether shock or stress) do not manifest in the future. For health systems, general health system strengthening is identified as a ‘no-regret’ option that meets population health needs while preparing for natural disasters and other climate-related impacts (Banwell, et al., 2018).
Building health system intelligence

Earlier, intelligence (also referred to as awareness, knowledge, and information in other frameworks) is identified as a key determinant of a health system's adaptive capacity. Intelligence is essential for all stages of the adaptation process, but most importantly for the 'understanding' phase, where the tasks of problem detection, information gathering and use, and problem definition happen.

This case study research illustrated how the lack or inadequacy of system intelligence can limit the ability of local health systems to mount timely and appropriate responses to emerging climate and health threats. Earlier, the imagination challenge posed by the cognitive limits of individual leaders and stakeholders can lead to misunderstanding or missing out of phenomena. While there is little understanding about the global and longer-term spatial and temporal dimensions of climate change, the municipal stakeholders are more familiar with the local, proximal, and shorter-term effects such as extreme events and monthly weather variability. Climate change was also implicated as the cause of some environmental health problems such as improper waste management. Some of the climate-related health effects already manifesting are ill-characterized (i.e., in a more precise quantitative fashion), while others, such as potential effects on mental health or heat-related cardiovascular disease, are not yet recognized and reported, despite growing evidence of their increasing incidence in other parts of the world.

To counter these cognitive limits, as well as the challenges brought about by uncertainty and surprise, problem detection and characterization can be enhanced through the following: robust information infrastructure; adequate technical capacity for analysis and decision-making among the health staff; continuous education and awareness-raising of the broader community; and conduct of diagnostic processes such as vulnerability and adaptation assessments. The two cases
document some previous experience when it comes to assessing disaster vulnerability, as indicated by the availability of hazard maps and identification of high-risk areas. This could open the door for the conduct of more comprehensive climate and health vulnerability and adaptation assessments, which also cover the subtle, slow-onset, and indirect effects of climate change on human health.

While the technical details of climate and health issues may be better understood by only select individuals in a particular community (such as sectoral officers in a municipal government), introducing climate adaptation and resilience thinking to the local health workforce should not be too difficult. Public health professionals are generally familiar with concepts such as vulnerability, risk, and uncertainty as they experience them in their day-to-day labor (albeit not in a deep technical sense) (Banwell, et al., 2018). Incorporating these concepts in the routine training of local health workers can build not just individual- but also system-level climate awareness and intelligence over time. With the use of evidence-based public health approach to climate change adaptation becoming increasingly advocated recently (Hess, et al., 2014), developing basic technical climate and health capacity, including the conduct of basic assessments and evidence appraisal, also becomes even more significant.

System intelligence is critical not just for detecting and defining problems, but also for identifying and assessing adaptation options. There are times when information will be limited, and there will be a high degree of uncertainty. Wardekker, et al. (2012) proposed an approach for classifying climate-related health risks to guide adaptation decisions. For instance, risks that are not identified at all, mainly due to ignorance, will benefit from adaptation policies that enhance the health system's overall capacity for dealing with future changes, uncertainties, and surprises – earlier referred to as general resilience or adaptive capacity. On the other end of the spectrum, risks that are already perceived by stakeholders and backed by strong evidence will benefit from the
adoption of precise adaptation measures, for instance those interventions targeting specific climate-sensitive diseases.

Finally, developing health system intelligence should not be equated to merely installing what can be called the three inputs (3 I’s) of information (i.e., data), infrastructure (e.g., electronic medical records), and insight (i.e., capacity to analysis and interpret information). Equally important is the less tangible concept of learning, which the aforementioned physical inputs merely support and/or complement. As stated by Sterman (2016, 513), “what prevents us from overcoming policy resistance is not a lack of resources, technical knowledge, or a genuine commitment to change. What thwarts us is our lack of a meaningful systems thinking capability.” Creating a culture of ‘life-long learning’ and ‘learning-by-doing’ within the local health system will increase not only the thirst of stakeholders to seek for more information and insight (i.e., inquiry skills), but also the capacity to turn collected information into appropriate adaptive actions.

Practical approaches to implementation
Earlier in this thesis, the importance of autonomous adaptation of societies, including within health systems, was highlighted. However, with today’s available resources, knowledge, and human capacity, there is an opportunity to be more intentional about the act of adaptation especially in the context of public health. Previously, specific adaptation and resilience measures that address identifiable climate and health risks were described. However, what is usually not discussed, for instance in reports of resilience building or climate adaptation projects, is the implementation tactics and strategies harnessed to stimulate adaptation and resilience (Tanner, et al., 2019) – for example, the use of policy entrepreneurs in taking advantage of ‘policy windows’ for reform and change (Kingdon, 1984). One major implementation challenge is how to incorporate the findings of
this case study research into established health policy, planning, budgeting, project management, and program implementation cycles, which tend to be siloed and short-term.

One traditional approach that is evident in the case studies is the downloading of mandates from national to local governments. Austin et al. (2018) highlighted the important role of upper-level governments (federal and regional) in building local-level adaptive capacity in Canadian and German municipalities. Some of the functions of national mandates include: building financial capital (through additional sources or earmarking for adaptation); developing and disseminating usable knowledge; collaborating and coordinating for shared knowledge; and claiming leadership by demonstrating prioritization from above and requiring adaptation in local public health planning. In both Del Carmen and Ajuy, the local governments are at least required to follow the instructions of both the Disaster Act and the Climate Change Act, hence the creation of multisectoral task forces and municipal-wide disaster and climate plans. However, much more needs to be done to enhance the support provided by national governments especially in the area of knowledge dissemination and enhancing collaboration across government levels.

Meanwhile, adaptive management is another approach that has been repeatedly suggested as a potential management practice for enhancing health system response to climate change (Ebi, 2011). Already applied in other sectors such as environmental and water management, adaptive management pertains to an “iterative framework [for decision-making] that embraces uncertainty, uses modeling, and integrates learning,” thereby allowing for adjustments in response to new information and changes in context (Hess, McDowell, & Luber, 2012, 171; USAID, 2019). There are numerous existing tools, frameworks, and approaches that adhere to general adaptive management principles, one of which is the Problem Driven Iterative Adaptation (PDIA) approach, which emphasizes, among others, the generation, testing and refinement of context-specific solutions in
response to locally nominated and prioritized problems, as well as the need for systems to tolerate (or even encourage) failure as the necessary price of success (Andrews, Pritchett, & Woolcock, 2012). The PDIA approach is becoming increasingly applied in climate adaptation as well (O’Brien & Samji, 2018).

Adaptive management requires the existence of several of the adaptive capacity determinants that were earlier identified, most especially system intelligence. Therefore, the success of adoption of adaptive management as a practice can only be guaranteed if those adaptive capacity preconditions have been first built. Thankfully, the initial signs of multisectoral collaboration in both Del Carmen and Ajuy can serve as good foundation for introducing adaptive management practices in their respective municipal governments and health systems.

Finally, to aid policymakers and implementers in choosing resilience building and adaptation options, another possible way of classifying interventions is to identify which aspect along the causal pathway is being targeted. In this case study research, not only are the climate variables and their concomitant disease outcomes presented; also examined are the mediating factors that lie in existing social and environmental vulnerabilities as well as limits and constraints that beset the local health system. Combining the elements in Figure 10 (Case study themes and topics) and Figure 22 (New health system goals), the different interventions that can be pursued by the local health system can be categorized into the following: actions that reduce greenhouse gas emissions (i.e., mitigation measures); actions that address the social determinants of climate vulnerability; actions that strengthen health system capacity and performance; and actions that improve the baseline health status. Figure 26 illustrates these different types of actions, while Table 12 provides some illustrative examples applicable at the local health system.
Health system ‘hardware’ and ‘software’

As earlier mentioned, this health system analysis is different because it paid some attention to what was described as the ‘software’ elements of a health system. Traditionally, health system performance assessments tend to emphasize the level of efficiency (both technical and allocative) by which health system goals are achieved. As a result, there is a strong bias towards characterizing and monitoring ‘hardware’ elements – building blocks that serve as inputs and the health system functions that turn these inputs into outputs and outcomes.
Table 12. Illustrative examples of different climate-oriented health system actions

<table>
<thead>
<tr>
<th>Actions that...</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce greenhouse gas emissions</td>
<td>Within the health sector: Installation of solar panels in health facilities; adoption of green purchasing practices</td>
</tr>
<tr>
<td></td>
<td>Beyond the health sector: Health sector advocacy to change energy policies and agricultural practices</td>
</tr>
<tr>
<td>Address the social determinants of vulnerability</td>
<td>Within the health sector: Monetary or in-kind assistance for patients' social needs/indirect healthcare costs (i.e., transportation, temporary shelter)</td>
</tr>
<tr>
<td></td>
<td>Beyond the health sector: Cash support and livelihood activities for poor families; Provision of clean water and toilets</td>
</tr>
<tr>
<td>Strengthen health system capacity and performance</td>
<td>Enhancing the capacity and competence of health workers in detecting and managing climate-sensitive diseases; Addressing referral system gaps to ensure smooth patient transfer from primary to higher care levels</td>
</tr>
<tr>
<td>Improve the baseline health status</td>
<td>Intensifying vector control and nutritional programs; Ensuring high immunization rates; Enhancing community awareness around noncommunicable disease prevention and control</td>
</tr>
</tbody>
</table>

Source: Author's elaboration

Barasa, Cloete, & Gilson (2017) suggested that when it comes to health system resilience, the software elements, such as leadership practices, power dynamics, workplace cultures, and values and norms, may actually matter more than the hardware. The adaptive capacity determinants describe earlier support this suggestion. While the actual manifestation of software elements is something that the local health systems of Del Carmen and Ajuy still need to improve on, several stakeholders affirmed that these ‘hidden’ elements such as positive values, good leadership, and social capital are vital for climate adaptation and resilience, even more important than financial or material resources. Bowen, et al. (2012) observed that there are vulnerable communities around the world with poorer economic resources that still survive. With a good mix of positive software traits, they can cope and adapt with the initial manifestations of climate change. As an illustration, when a major dengue outbreak driven by climate variability hits a community or a health system...
that is poorly resourced but has plenty of positive software qualities, they will certainly be overburdened – but are less likely to collapse and more likely to recover.

It is important to remember that this case study research did not attempt to measure the degree by which software (and even hardware) elements enhanced the adaptive capacity of local health systems (and the municipality at large) or even led to favorable health outcomes. Instead, the case studies of Del Carmen and Ajuy suggest that, with investments in health system software, there might be a higher chance for health systems to develop resilience and adapt successfully to climate change. Future health system strengthening or reform efforts that seek to incorporate climate change must therefore include interventions that strengthen these software elements. In fact, even without considering climate change, software improvements may be the missing link in current global efforts towards accomplishing the unfinished business of health system development and universal health coverage especially in developing countries.

**From ‘health systems’ to ‘systems for health’**

While the initial focus of this case study research is the local health system, a conscious decision was made from the get-go to cover other sectors at the municipal level that are relevant to either public health and/or climate change. It is widely acknowledged that health is shaped by a diverse range of social determinants (Marmot & Wilkinson, 2005) and therefore requires the participation and cooperation of different sectors, as espoused by public health concepts such as intersectoral action for health (IAH; Ndumbe-Eyoh & Moffatt, 2013) and Health in All Policies (HiAP) approach (Kickbusch & Buckett, 2010). The new challenge of climate change – which in itself is a cross-sectoral issue – adds a new argument to the case for cross-sectoral health work.
In this thesis, a new term was introduced – ‘systems for health.’ It may be considered as “old wine in a new bottle” – as earlier described, the idea of involving other sectors in public health has been around for some time. This term was proposed not only as a play of words to differentiate it from the traditional ‘health system.’ Unlike IAH or HiAP, ‘systems for health’ connotes that other sectors – and the broader social system where these sectors are situated – do not just indirectly/or and unknowingly influence health outcomes or merely consider the health implications of their actions. Instead, decisions and actions are deliberately and intentionally made within these sectors to positively contribute to health protection and improvement – especially when an emerging health threat such as climate change is a concern of all sectors. Such recognition of the interconnectedness of different sectors with health is vital especially when considering climate change. As espoused by the social-ecological system perspective, adaptation decisions in one sector are not isolated from those coming from other sectors (Adger, Arnell, & Tompkins, 2004). Local cross-sectoral mechanisms mandated by the Philippine government such as local health board, local disaster council and climate plan task force provide a good starting platform.

In protecting health from climate change at the local level, the other ‘systems for health’ cannot be ignored. Climate change will be affecting these systems for health, which will ultimately affect health outcomes (Hess, McDowell, & Luber, 2012). Evidence already indicates that the likelihood that climate change will alter basic ecosystem services that are important to health and survival – such as food and water systems – is very high, and this concern was already raised in both municipalities. Moreover, climate change is also expected to result in abrupt ecosystem shifts that can lead to exacerbation of existing climate-sensitive diseases, emergence of new diseases, or reintroduction of old ones. Mosquito-borne and other neglected tropical diseases (NTDs) that are climate-sensitive are endemic to both Del Carmen and Ajuy. It is imperative therefore that other sectors that govern these ecosystem factors that mediate disease transmission to be not only on
board in terms of health protection; health protection from climate change impacts must become part of their sectoral goal. Nudging other sectors to adopt this mindset will require a more proactive approach from the health sector. Unfortunately, competencies for cross-sector engagement such as diplomacy and negotiation are usually limited, if not lacking, among health professionals and health system leaders, as observed in the two municipalities. The health sector must build such capabilities if it were to succeed in engaging the different systems for health.

Finally, in decentralized health systems such as the Philippines, the municipal mayor is the top decision-maker in local health governance as well as in other areas such as disaster risk reduction and climate change adaptation. Hence, the mayor’s role in mobilizing the health system and systems for health especially in the context of climate change is vital. In both cases, there is some indication that both municipal mayors adopt a system view and are able to marshal different sectors to work together in addressing shared problems and towards common goals. Admittedly, at certain points in this thesis, it was hard to distinguish whether the observations made only apply to the health system or are reflections of the broader municipal systems for health, especially when describing ‘software’ dimensions. Perhaps the suggestion is that there should be a broader attention to municipal responses to climate change at large – i.e., climate-resilient and adaptive municipalities. While this thesis emphasized on barriers and challenges to climate responses from a public health/health system perspective, it can be surmised that the problems encountered – and perhaps the broad-stroke solutions as well – would be similar when referring to place-based municipal planning for climate change as a whole (Measham, et al., 2011).

**Climate-resilient, climate-smart, etc. – what’s in a name?**

In the Analytical Platform, the literature review presented several terms and frameworks that have been proposed to describe and conceptualize health systems in the context of climate change. These
terms were developed in order to provide a common language for health system practitioners as they attempt to incorporate climate considerations into their work. However, from a research standpoint, these terms need to be interrogated, not just in terms of their usefulness but also their hidden implications and unintended consequences. Hence, this case study research did not commit to any of these proposed concepts. Rather, some insights regarding terminology were gained while examining the two municipalities and interacting with different stakeholders.

Of the terms covered in the literature review, ‘climate-resilient’ seemed to resonate more with the local stakeholders of both Del Carmen and Ajuy. Not only the word ‘resilience’ was widely used in national policies and local plans; most key informants also verbally expressed the importance of being ‘resilient’ in the era of climate change. Another related term – ‘disaster-resilient’ – was repeatedly mentioned in the interviews, reflective of people’s past experiences and familiarity with natural disasters. While stakeholders have very limited understanding of what resilience technically means, there seemed to be a general understanding that it is a positive quality that their community must possess in order to address the anticipated impacts associated with climate change.

Meanwhile, ‘climate-smart’ – the convergence of mitigation and adaptation – was not only unfamiliar to the interviewees; it also may not be a useful construct since mitigation was not identified as a priority for local health systems. Even if climate-smart is more mainstreamed in sector such as agriculture and urban planning, the ‘non-health’ stakeholders in both Del Carmen and Ajuy are also not familiar with this concept. However, this lack of familiarity with climate-smart is not a justification to not advocate for mitigation measures whether in the health sector or in other ‘systems for health.’ Moreover, the term might later gain more traction when institutions that
introduced it such as the World Bank begin to make huge investments in ‘climate-smart’ healthcare in developing countries.

One observation made from this case study research is that there are other issues at the nexus of environment and health that were recognized and being addressed by both municipalities. Some of these problems are not necessarily directly linked to climate change but were labeled by local stakeholders as climate related, such as improper waste management and incessant use of artificial fertilizers and pesticides (however, it can be argued that everything is interconnected). Both the terms ‘climate-resilient’ and ‘climate-smart’ remain inadequate in capturing the breadth and complexity of these related issues. Hence, alternative terms may need to be considered.

One frame that can be used to conceptualize future health systems in the context of broader global environmental change (not just climate change) is ‘planetary health.’ Introduced by a 2015 report published by The Lancet and Rockefeller Foundation, planetary health is defined as “the health of human civilization and the state of the natural systems on which it depends” (Whitmee, et al., 2015, 1978). It acknowledges that human activity, especially during the past century, led to different forms of global environmental change (hence the proposed geological epoch called Anthropocene[72]), including climate change, land use change, biodiversity loss, altered biogeochemical cycles, and global air and water pollution. In return, these phenomena pose a grave threat to the health and survival of human populations now and in the decades to come. Because planetary health is a relatively new paradigm, the field of health system research and practice is yet to engage with it. This case study research hopes to open a new conversation around the role of

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[72] The Anthropocene is a newly proposed geological epoch first coined in the 1980s and later elucidated by Steffen, et al. (2011). In contrast to previous epochs in the geological time scale, Anthropocene emphasizes the significant role of human activities in altering the Earth’s geology and ecosystems, as best illustrated by challenge of climate change.
health systems in the era of planetary health, and perhaps the concept of a ‘planetary health-oriented health system’ is something worth exploring.

Another related frame that can be considered is the Sustainable Development Goals. The SDGs cover not just health but also a wide array of sectors – what could be considered as ‘systems for health.’ The concept of ‘SDG-oriented health systems’ can also be an alternative, especially since the SDGs is a global framework for international development that is already espoused by almost all countries. However, unlike planetary health, the SDGs are time-bound (the deadline is 2030, unless it becomes extended) and it covers a discrete set of sectors, challenges, and outcomes (17 goals and 169 targets).

Additional notes about gender

While not a pre-identified topic in this case study research, it will be remiss if this thesis does not comment on how climate change and health systems relate to the gender lens. This thesis is situated in the era of #MeToo (O’Neil, et al., 2018) and ‘Women in Global Health’ movements (Talib, States-Burke, & Barry, 2017). The role of women and gender in climate adaptation – not just as victims but also as change agents – has already been recognized for some time. In addition, it is anticipated that due to their unique vulnerabilities, women and other marginalized groups are going to be more impacted by climate change especially in the long run (WHO, 2014a).

In this case study research, it can be noted that all health worker interviewees are female, while the leaders of the municipality (including both municipal mayors) are mostly male – reflection of the still-ongoing feminization of frontline health workforce and the dominance of men in positions of authority at all levels. Such gender imbalance in local health systems have implications on planning and decision-making, for instance when it comes to giving priority and attention to public health
concerns that matter to women such as maternal health and sexual and reproductive health. For now, the interviews reveal that these public health issues are not recognized yet as closely linked with climate change. To ensure that these aspects are not forgotten in the coming years, future implementation projects on climate change and health systems must ensure that a gender-sensitive and intersectional approach is also incorporated.

**Methodological challenges**

When it comes to qualitative research studies such as a case study, one of the major challenges that a researcher constantly faces is exercising reflexivity – “analytic attention to the researcher’s role in qualitative research” (Dowling, 2006, 8). This process of constant reflection on one’s position and influence throughout the research process covers two major aspects – personal reflexivity, as it pertains to the researcher’s values, beliefs, experiences, identities, and political commitments; and epistemological reflexivity, which pertains to the framing of research question, research design, methods of data collection and analysis, among others (Willig, 2013).

Conducting this case study research by this particular researcher required consistent exercise of reflexive practice due to several reasons. For example, deep familiarity with the Philippine context may lead to either two ‘sins’: neglect of ‘givens’ which may be relevant to answering the research questions, or harsh criticism of system failures out of longstanding frustrations with the local situation. Meanwhile, personal activism around the cause of climate change and global health may cloud actual observations and result in normative declarations that reflect the personal aspirations and beliefs of the researcher-advocate rather than what was observed empirically through case study research. While full ‘objectivity’ – from question formulation to data interpretation – cannot be guaranteed (which may not even be possible in any research), dedicated effort was made to ensure that potential biases and limitations were explicitly acknowledged, if not avoided.
Earlier in the methodology section, it was also acknowledged that another of the anticipated challenges in this case study research, especially when it comes to interpreting key informant interview findings, is distinguishing which is positive/descriptive (i.e., the actual phenomenon – “what was, is, or will be”) from which is normative (i.e., either an interpretation of the phenomenon or an aspiration – “what should be”). Admittedly, distilling these different empirical inputs posed a real challenge especially in the development of the individual case studies as well as the conduct of cross-case synthesis. Certain individuals (for instance, mayors, doctors, disaster officers) may also have been more vocal (and perhaps, better informed) than the rest of the interviewees, which if not carefully examined could lead to bias towards more dominant voices. Extra care was therefore exercised in interpreting findings and making judgments by cross-checking understandings between interviewees and between interviews and other data sources (i.e., documents, field observations). A conscious attempt was made to ensure that both the positive and the normative were reflected in both the individual case studies and the cross-case synthesis.

The cross-case synthesis highlighted commonalities between the two municipalities in terms of the more tangible descriptive elements of both cases – actual climate and health vulnerability, hardware elements of health systems, challenges and opportunities outside of the health sector. However, it can also be noted in the cross-case synthesis that there was a strong and compelling convergence of normative views – on both the problems and the solutions – coming from the different stakeholders of both Del Carmen and Ajuy. Such convergence is perhaps indicative of shared perceptions and aspirations that are implicit in the two municipalities – possibly resulting from many contextual similarities but in spite of geographical distance and other idiosyncrasies – on what should be the municipal response to climate change and its health and societal effects.
**Study limitations**

The design and methods of this case study research presented several limitations. The first obvious limitation is the limited number of cases. While a multiple case study does not adhere to a ‘sampling logic’ as earlier stated, additional municipalities could have been included to allow for wider representation covering other relevant characteristics (e.g., urban setting, landlocked geography, mountainous landscape, higher income class, larger population or territory). Such diversity in case configurations would further reinforce the applicability of research findings to other settings within the Philippines and even in other countries. In addition, municipalities with no existing climate-related initiatives or weak political support for climate action, or those with more advanced climate adaptation and mitigation efforts would have acted as counterfactuals to both Del Carmen and Ajuy and would aid in refining research results.

Another limitation is the limited availability of data in the two municipalities, especially quantitative data on health, environment, and other parameters, which would have been useful in producing a more in-depth characterization of climate-related health risks. As described in the case studies, the existing health information system in both municipalities are mainly paper based, fragmented and incomplete. Historical data on temperature, humidity, and precipitation were not readily available. Emerging environmental phenomena related to climate change that were already observed, such as sea level rise, are yet to be systematically studied. Access to downscaled climate models (General and Regional Circulation Models; GCM and RCM) is limited, and local capacity for using such data is nonexistent, hence making projections of future climate trends at the local level not feasible for now. The collection and analysis of this wide range of data types are beyond the scope of this thesis. However, these are the kinds of quantitative information that will be useful if the two municipalities eventually decide to conduct a full-blown comprehensive vulnerability and adaptation assessment in the future.
When it comes to qualitative data, the time period for data collection is also short and limited (one week for each municipality). This case study research would have benefited from a longer visit in the municipality to allow the conduct of additional interviews for gathering more citizen perspectives. A longer period for field observation would also have allowed the establishment of patterns, for instance in the way ‘software’ elements manifest in the local health system. A longer stay would also be beneficial in establishing closer rapport and deeper trust with the municipal government, other stakeholders, and the broader community – substrate for future longer-term collaboration. While one can merely speculate on how long is the ideal period for a case study research, it must also be acknowledged that ‘too long’ can also desensitize the researcher to the status quo (especially to chronic lacks and power dynamics) (Erasmus & Gilson, 2008), which may impede a more objective and impersonal assessment.

Finally, while this exploratory case study already covered a broad range of themes and topics, there are areas that were certainly still missed. For instance, there was little attention paid to other ‘spaces’ of health resilience and adaptation within the bounds of a municipality – informal community networks, households, and individuals – and how they interact with the other spaces (Figure 27). Understanding how these ‘non-formal’ spaces (as opposed to the ‘formal’ structures such as the health system and the municipal government) cope and adapt would provide a more complete picture of how societies as a whole respond to climate change.
**Ways forward post-DELTA**

**Research.** Smit and Wandel (2006) identified at least four types of adaptation research: evaluation of adaptation success; assessment of adaptation options; comparative analysis of adaptive capacity across systems (i.e., municipalities); and description and analysis of the adaptation process. It can be argued that this multiple case study research most resembles the fourth type, since it documented the elements and processes that shape the two municipalities’ responses to climate change and the challenges and opportunities encountered in their experience. Future climate and health research must therefore seek to cover the other adaptation research types. Additional case studies, especially those addressing the limitations earlier identified, can help further test, validate, and refine this project’s findings and insights.

As previously mentioned, there is paucity of research that examines the intersection between climate change and health systems –when it comes to either the burden added by climate change on already-constrained health systems or the effectiveness of both actual and hypothetical health
system responses to climate change. While this case study research did not fully and quantitatively investigate either aspect, it highlighted numerous themes and topics as well as generated new specific questions that can be elucidated through future research. Some of these new research questions are as follows:

- In quantifiable terms, how much burden of disease will be generated by the initial and long-term climate-related impacts observed and anticipated in the two municipalities?
- Given the identified gaps, how much financial resources would be needed to implement the recommended measures and further enhance the adaptive capacity of the local health systems?
- What will be the additional impact of other forms of environmental and social change, for instance land conversion and the influx of tourists, to the existing health burden as well as the projected health burden related to climate change?
- What adaptation behaviors to climate change and its health effects are demonstrated by local households and individuals?

**Dissemination and implementation.** While this project certainly opened more arenas for research, the findings generated from this multiple case study research can already be disseminated in policy and implementation circles as well as the general public. For instance, since their release right after thesis defense, the two short films produced as part of this thesis have already been collectively viewed nearly 10,000 times in social media. While climate change is a very serious challenge that can be quite depressing, the videos generally evoked a sense of hope among those who already watched them. The project findings can also be later presented to global health organizations interested in the nexus of climate change and health systems such as WHO and World Bank, as well as to the Philippine Department of Health and other local governments. In order to reach a much
broader audience including the health systems research and practice community, this thesis can
also be turned into shorter articles as well as presented in future conferences.\footnote{This thesis was accepted for presentation in the upcoming 2019 Planetary Health Annual Meeting on September 4-6, 2019 at Stanford University (https://planetaryhealthannualmeeting.org/).}

Furthermore, the project’s findings can support the development of future tools and activities such
as climate-oriented local health system assessments and capacity building programs for municipal
health officers. The proposed framework for enhancing local health system adaptive capacity can be
tested in other municipalities as a diagnostic tool and implementation guide. Such exercise can also
aid in the further validation and refinement of the framework.

**Co-production of project proposals.** Apart from general findings, this project also generated
specific recommendations for each of the two local cases as described in the individual case studies.
These recommendations can be turned into project proposals that can be submitted for external
funding, for example through the People’s Survival Fund of the Climate Change Commission. As
earlier mentioned, the municipal governments of the two local health systems demonstrated strong
support for this research project and expressed interest and commitment to utilize the findings for
local policy formulation and program implementation.

To further strengthen the rationale behind these future project proposals, comprehensive
vulnerability and adaptation assessments can be later conducted in both municipalities, with
support from other experts and organizations with technical expertise in diverse areas outside of
health (e.g., agriculture, water management, meteorology, etc.). Available health-focused
assessment tools such as the one developed by the WHO (2013) for national governments or by the
US Center for Disease Control and Prevention (CDC) for state health departments (Marinucci, et al.,
2014) can be tailored for use in the municipal level, incorporating insights generated from this research project. Another newly developed yet underutilized method, the climate and health stress test (Ebi, et al., 2018b), can also be piloted in these municipalities. The stress test enhances the traditional vulnerability and adaptation assessment by including table-top simulations of hypothetical scenarios beyond the range of past experience informed by climate projections.
Chapter 4

Conclusion

The DELTA Project: Summary

This DELTA Project aimed to generate lessons and insights on the challenges and opportunities that local health systems especially in developing countries face when it comes to responding to climate change and its health impacts. The initial effects of climate change on human health are already beginning to manifest in many parts of the world, yet international discourse and research have concentrated on reaching global consensus, quantifying current and future risks, and crafting national plans and policies. Little is known about what is happening at the local level, where the impacts of climate change are mostly felt. The boundaries of a ‘local’ health system may vary depending on the location; for the purpose of this doctoral thesis, ‘local’ pertains to the municipal health system (and municipality at large) in a devolved government system such as the Philippines, one of the most climate-vulnerable countries in the world.

Using a multiple case study research design, two coastal municipalities in the Philippines – Del Carmen in Surigao del Norte and Ajuy in Iloilo – were closely investigated. The combination of key informant interviews, document reviews, and field observations produced a wealth of empirical data which were subjected first to a ‘within-case’ analysis and then to a cross-case synthesis. The range of findings generated from this case study research is rich and wide. Some of the themes and topics that were explored include the following: present and anticipated climate and health vulnerabilities and risks; normative views expressed by different stakeholders as to how municipal health systems and municipalities in general should respond to climate change; and description of actual efforts mounted by communities to address climate change’s initial effects, and the challenges and opportunities encountered in the process. Different aspects of the health system's
‘hardware’ and ‘software,’ as well as problems and solutions emanating in the broader ‘systems for health’ were also examined. Based on the case study findings, specific recommendations for future implementation were also formulated for both Del Carmen and Ajuy.

The empirical findings of this case study research were then immersed in the contested space of climate change concepts such as mitigation, adaptation, resilience, and adaptive capacity. This is one of the rare occasions when such concepts are engaged within the space of health systems development, since climate change as a concern for health systems research and reform is still yet to be embraced and popularized. In addition, existing climate and health frameworks were interrogated in the light of newly obtained on-the-ground information from the two case municipalities. Insights as to how to approach the mainstreaming of climate change into local health systems development were generated, as well as initial plans for the way forward in terms of future research and implementation. Some additional realizations were also made regarding future visions of health system research and practice, and even the concept and goals of a health system itself.

Five Key Messages

What are the key messages that can be gleaned from this DELTA Project? Here are five important high-level findings:

**First, there is high level of awareness in local health systems and municipalities in the Philippines not just about climate change, but also its potential impacts especially on health.**

The local case studies provided a characterization of the long-term climate trends as well as proximal, short-term weather variability and extreme weather events that coastal municipalities in the Philippines are anticipating, with some of these phenomena already unfolding. Consequently,
these climate-related events are projected to result in a diverse array of health impacts – from old infectious diseases that are expected to re-emerge to health conditions that are novel and unfamiliar. At the local level, the pathways that link climate change to health outcomes are exacerbated by existing vulnerabilities in the environment, socioeconomic conditions, and the health system and mediated through direct exposure to the elements, ecosystem alterations, and problems in social systems. The mapping of these climate and health risks and vulnerabilities is based on a combination of initial vulnerability and adaptation assessments, community observations, and stakeholder perceptions. The next years and decades will then require constant monitoring and surveillance of the aforementioned variables constituting the local climate and health challenge, systematic investigation through research, and ultimately the development of robust intelligence within and beyond the health system. Initial climate-related activities are already happening in other sectors, which should motivate the health sector to pursue its own efforts.

Second, while recognizing the need to prepare for newly emerging health and other threats brought about by climate change, Philippine municipalities are still confronted with the longstanding problem of closing the gap between health system performance and current health needs. National mandates are already put in place to guide local governments develop cross-sectoral plans and allocate funds especially for climate change adaptation and disaster risk reduction. Some municipalities such as Del Carmen and Ajuy are fortunate to have leaders that appreciate the urgency and scale of climate change and have already made it a priority of local governance. However, institutional, financial, and technical barriers impede the resolution of chronic local problems, and also prevent robust diagnosis, improved planning, and successful implementation of intended responses to climate change and its associated effects. What is happening is coping – a process of ‘getting by’ to achieve short-term system stability. Because of
existing barriers and constraints, health systems and societies at large must then be supported to transition from coping to adaptation and resilience building.

**Third, in responding to climate change, both adaptation and resilience become imperative for local health systems in Philippine municipalities, although low baseline health system performance at present may be predictive of weak adaptive capacity in the future.** In principle, health systems, as vehicles for the protection and improvement of health of populations, must strive to contribute to reducing climate risk through decarbonization, strengthen its core capacities to sustain functionality through shocks and stresses, and develop the ability to mount novel responses, reorganize if necessary, and even challenge the status quo in the midst of constant change. In practice, mitigation is of low priority and limited benefit for local health systems, which must bear the consequences of slow progress in climate mitigation in higher levels or other jurisdictions. Meanwhile, although adaptation and resilience building need to be pursued, existing barriers and constraints that lead to poor health system performance raise questions about health system capability for addressing future (and potentially uncertain) risks. Proper diagnosis of the situation, adaptive capacity building, and external support from higher-level governments and technical experts may then be required. While adaptation and resilience are generally synergistic with each other, there can be potential tensions between the two that will need to be acknowledged to avoid institutional inertia and maladaptation. Although resilience has enjoyed some attention in health systems research and discourse in recent years, future scholarship can further investigate the usefulness of these constructs to health systems development in the context of climate change and other forms of external change.

**Fourth, building adaptive capacity is at the core of climate response of local health systems and municipalities at large – and it produces co-benefits that go beyond climate protection.**
The marriage of adaptive capacity literature and empirical case study findings generated several putative determinants that constitute local health system adaptive capacity. Stakeholder views and actual practice observed emphasized that when it comes to climate adaptation and resilience, ‘software’ elements do matter too. Intelligence is vital for problem detection; leadership for shaping positive visions; innovation for generating solutions; and social capital for widening the spread of action. Material assets are an undoubtedly important precursor, and so as the baseline health status of the municipality. All these must be underpinned by positive values shared and expressed by the whole community. Specific ‘entry points’ and interventions were identified to aid policy-makers, implementers, and system designers in the enterprise of adaptive capacity strengthening.

Traditional health system strengthening is a no-regrets option for public health, but it needs to be reoriented to take into account climate change, overall system adaptive capacity, and even the ‘systems for health’ where the mediators of the climate-to-health causal pathway operate. Adaptive management and its related approaches such as PDIA may offer new ways of doing things for health systems in the world of a changing climate.

Fifth and finally, applying the climate lens offers a unique and exciting opportunity to further enrich the field of health systems research and practice. The next generation of health policy and systems research (HPSR) must include climate change and other forms of external change in the equation, as these phenomena will surely complicate the road to universal health coverage and longer-term health system sustainability. This case study research showed what else can be discovered when the scientific and policy gaze is expanded beyond health system ‘building blocks.’ Health systems thinking will benefit greatly, both conceptually and operationally, from this act of ‘boundary spanning,’ interfacing with other disciplines that are not generally seen as conventional allies such as environmental health and sustainability science. The collision of concepts, frameworks, and paradigms epitomized in this case study research did not only produce important
findings but also generated new exciting questions. It is this DELTA Project’s implicit hope that this research helps usher the entry of health systems scholarship into the emerging new field of planetary health.

Local Health Systems and the International Policy Regime

Moving back from the local to the global, where is this DELTA Project situated in the current international regime on climate, health, and sustainable development? Since 2015, the United Nations have adopted several major global treaties and declarations addressing a variety of issues that intersect with the themes explored in this case study research (Figure 28). Chief among these instruments is the Sustainable Development Goals, earlier described as the shared blueprint for “people, planet and prosperity.” Ensuring healthy lives and stabilizing the climate are two of its 17 goals, but other goals pertaining to different sectors such as agriculture, energy, land and water management are also aligned with the other planetary health challenges documented in the case studies.

Meanwhile, since this investigation focused on health system responses particularly to climate change, another policy instrument of prime importance is the Paris Agreement, the global roadmap towards a low-carbon and climate-resilient future. While the document itself mentioned the word ‘health’ only once, the Paris Agreement is widely acknowledged by the global health community as the “strongest public health agreement of the century” (WHO, 2018, 12). Nonetheless, the health sector remains a critical part of the overall mitigation and adaptation strategy embraced by the Agreement, its subsequent policies, and translation into climate strategies and adaptation plans at the country level.
Since one of the significant impacts of climate change is the increasing intensity and frequency of natural disasters, the Sendai Framework for Disaster Risk Reduction\(^7\), which was adopted by UN member states also in 2015, is also a powerful complement to the agenda of climate-ready local health systems. Apart from the expressed goals of reducing mortality and economic losses emanating from all forms of disasters, the Framework also pushes for strengthening of not just national but also local disaster risk reduction strategies and establishment of multi-hazard early

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\(^7\) According to the United Nations Office for Disaster Risk Reduction, the Sendai Framework is a 15-year, voluntary, non-binding agreement with the aim of substantially reducing “disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.” The successor instrument to the Hyogo Framework for Action, the Sendai Framework identified seven global targets and four priorities for action – understanding disaster risk, strengthening disaster risk governance, investing in DRR, and enhancing disaster preparedness, recovery, rehabilitation and reconstruction. More information can be found here: [https://www.unisdr.org/we/coordinate/sendai-framework](https://www.unisdr.org/we/coordinate/sendai-framework).
warning systems, the importance of which have been repeatedly emphasized in this case study research.

The coherence between the SDGs, Paris Agreement, and Sendai Framework have already been articulated earlier in the context of urban development (Murray, et al., 2017). Applying this coherence to local health system development in the era of climate change and planetary health, other relevant international agendas related to health systems and public health also come to mind which have the potential to further boost these policy synergies and drive momentum on the ground. As earlier mentioned in the Introduction, universal health coverage (UHC) is currently the centerpiece agenda in global health, in recognition of gross inequalities in health (or specifically, healthcare access) still persisting within and between countries. While this DELTA Project was being implemented, negotiations among UN member states were underway to craft a high-level political declaration on UHC, slated to be adopted on September 23, 2019. The final draft acknowledges the “need to foster health in climate change adaptation efforts, underlining that resilient and people-centered health systems are necessary to protect the health of all people” (United Nations, 2019, 3). Interestingly, on the same day and in the exact venue of the UN High-Level Meeting on UHC75, the UN is also hosting the UN Climate Change Summit76 where world leaders are expected to update their commitments to accelerate the implementation of the Paris Agreement. Such opportune timing should be maximized in articulating the tight linkage between UHC and climate action (Figure 29) – that UHC is a climate adaptation measure (Clarke & Le Masson, 2017); climate mitigation alleviates the excess health burden on health systems (Haines,

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75 More information about the UN High-Level Meeting on UHC can be found here: https://www.who.int/news-room/events/detail/2019/09/23/default-calendar/un-high-level-meeting-on-universal-health-coverage.
money saved from climate-friendly policies can be reinvested in UHC (Gupta, Dhillon, & Yates, 2015); and UHC must be 'climate-proofed'\(^7\) to ensure that it continues to respond to people's needs even in times of climate instability (Guinto, 2018b).

Figure 29. Synergies between UHC and climate action

Source: Author's elaboration

Apart from the dominant UHC agenda, another recent development in the global health space is the Astana Declaration on Primary Health Care (PHC), which was adopted in October 2018 while this

\(^7\) While there is no authoritative definition of 'climate-proofing,' this term is used as a shorthand especially by the development sector "for identifying risks to a development project, or any other specified natural or human asset, as a consequence of climate variability and change, and ensuring that those risks are reduced to acceptable levels through long-lasting and environmentally sound, economically viable, and socially acceptable changes implemented at one or more of the following stages in the project cycle: planning, design, construction, operation, and decommissioning" (Asian Development Bank, 2005, xii).
DELTA Project was being implemented. An update to the influential 1978 Alma-Ata Declaration, the Astana Declaration revives the concept and philosophy of PHC in the age of UHC and SDGs. PHC emphasizes the rights-based approach to health, commitment to health equity, health promotion, people-centered healthcare delivery, community mobilization, and intersectoral action on the social determinants of health, among others. The new declaration also recognizes, among others, the health impacts of climate change as a new challenge for PHC in the 21st century. While it does not equate merely to primary level of care, much of PHC happens at the local health system. This case study research therefore signals how strengthening PHC and enhancing local health system response to climate change are deeply compatible missions for the global health community.

Finally, this case study research also touches on some aspects of the Global Health Security (GHS) Agenda, which is another emerging discourse in global health. While concern for international spread of infectious diseases has been existing for more than a century, major improvements in International Health Regulations (IHR) – the legally-binding treaty governing the global response

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78 I was privileged to participate in the Global Conference on Primary Health Care commemorating the 40th anniversary of the Alma-Ata Declaration, held on October 25-26, 2018 in Astana, Kazakhstan. I was invited to share my reflections during a pre-conference youth event, as I was a youth delegate myself to the 30th anniversary conference held in Almaty, Kazakhstan in 2008. The Astana Declaration can be accessed here: https://www.who.int/docs/default-source/primary-health/declaration/gcphc-declaration.pdf.

79 The Alma-Ata Declaration is considered a watershed moment in global health, as it re-emphasized health as a fundamental human right (first mentioned in the WHO Constitution and the Universal Declaration of Human Rights), first called attention to gross health inequalities worldwide, and set the vision of achieving “Health for All” by 2000, among others. It is already 2019 and clearly, there is still no health for all, and the message of Alma-Ata continues to ring true until today. I feel grateful that the first health text that I was taught in medical school is not an anatomy book, but the Alma-Ata Declaration. The Astana Declaration can be accessed here: https://www.who.int/publications/almaata_declaration_en.pdf.

80 While the term GHS is still yet to be defined, the GHS Agenda (https://www.ghsagenda.org/) is an international multisectoral and multi-stakeholder initiative committed to “attaining a world safe and secure from global health threats posed by infectious diseases.” Outside of the initiative, GHS is a growing subcommunity within the global health field comprised of multiple disciplines. On June 18-20, 2019 in Sydney, Australia, I was privileged to attend the inaugural Global Health Security conference (https://www.ghs2019.com/index.php) where I presented about the potential synergies between GHS and planetary health.

81 The original 1969 IHR was revised in 2005: https://www.who.int/ihr/publications/9789241596664/en/.
to epidemics – only occurred during the past two decades, triggered by the emergence of severe acute respiratory syndrome (SARS) in 2003.\textsuperscript{82} GHS especially gained prominence during the 2014-2016 Ebola outbreak in West Africa. The evidence linking climate change and infectious diseases is growing (Shuman, 2010), while the remit of GHS is beginning to further expand to cover other threats such as climate change, natural disasters, antimicrobial resistance, and bioterrorism. Many interventions at the nexus of climate change and health systems – such as traditional health system strengthening and creation of early warning systems – are also considered important investments in enhancing GHS (Guinto, 2018a; Aziz, 2019).

This concluding survey of recent policy developments in global health and sustainable development demonstrates the existence of a policy window (Kingdon, 1984) that can support a new climate-oriented approach to local health system development. For sure, these parallel policy developments, while converging to this agenda put forward by this thesis, may also have potential trade-offs that will need to be acknowledged and addressed. Nevertheless, the global health community must therefore take advantage of this new opportunity, armed with the lessons of this DELTA Project, in building local health systems that achieve UHC, ensure health security from all forms of risk, and protect and save lives in a world of climate breakdown.

**Finale: Opportunity, Emergency, and Systems Change**

In conclusion, beyond the technical lessons and key messages of this DELTA Project, the stories of Del Carmen and Ajuy convey three additional inspirational messages: opportunity, emergency, and systems change. When it comes to opportunity, the 2015 Lancet Commission on Climate and Health flipped its earlier 2009 statement (“Climate change is the biggest global health threat”) by stating:

\[\text{\textsuperscript{82} For more information about the historical evolution of GHS and IHR, see Davies, Kamradt-Scott, & Rushton (2015).}\]
“Tackling climate change could be the greatest global health opportunity of the 21st century” (Watts, et al., 2015, 1861). This investigation revealed that there are many things that can be done, even in a small, rural, isolated, simple, and humble community lying along the coast. The causal link of opportunity is also bidirectional: not only by addressing climate change that health is improved, but also enhancing local health systems’ adaptive capacity is in turn beneficial for climate readiness and stability, as well as overall sustainable development of the community.

But there is no room for complacency in the house of opportunity. The climate emergency is real, and the stories of Del Carmen and Ajuy have shown that as well. At the 72nd World Health Assembly in May 2019, Richard Horton, editor in chief of The Lancet, urged member states to declare a ‘planetary emergency’ because of climate change (Simpson, 2019).83 The work towards preparing local health systems for the ‘new normal’ of climate change must be dealt with a great sense of urgency, as human lives are at stake.

Finally, this DELTA Project is an evidence-based, theory-supported, and inspiration-driven call for systems change. In the Introduction, the year 2018 – when this DELTA Project was implemented – was described as an ‘early warning signal’ for climate and health. What was missed in that brief historical survey is that it also was the year when the next generation – the generation that will bear the brunt of climate change and its health impacts – spoke and was heard. On August 20, 2018, Greta Thunberg, a 16-year old girl from Sweden, skipped school to protest climate inaction outside parliament. A year later – as the writing of this thesis drew to a close – the school strikes that she inspired have already reached 3.6 million people across 169 countries.84 Today, Greta and the

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83 In preparation for his address, Richard Horton surveyed colleagues and friends via Twitter as to what he should tell health ministers during the 72nd World Health Assembly. I tweeted to him that WHO should declare a planetary emergency as a result of climate change. Days later, it became the key message of his speech and the main headline of global health news.
84 A brief timeline history of Greta Thunberg and the school strikes for climate can be found in Gould (2019).
millions of children – the climate generation – continue to urge everyone, including the health sector, for a global rethink and system overhaul. During the COP 24 on December 15, 2018 in Krakow, Poland, she addressed the world’s leaders with this powerful statement, something that the global health community must also ponder on:

"We cannot solve a crisis without treating it as a crisis... And if solutions within the system are so impossible to find then maybe we should change the system itself?"85

85 From Thunberg (2019)
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Appendix 1
Case Study Protocol

Section A: Overview of the Case Study

Goal and Objectives

The goal of this multiple case study research is to generate lessons and insights on the challenges as well as opportunities that local health systems – particularly municipal health systems in the Philippines – face when it comes to responding to climate change and its health effects. In order to achieve this goal, below are the following objectives:

- Examine the experiences of two municipal health systems in the Philippines when it comes to responding to climate change and its health effects, and;
- Identify lessons and strategies for future application in other parts of the Philippines and other developing countries.

Case study sites

There will be two sites for this case study project – Del Carmen, Surigao del Norte and Ajuy, Iloilo. These are two rural municipalities located in coastal areas that are already experiencing some of the initial effects of climate change such as intensifying typhoons and sea level rise. In addition, these two municipalities have some initial climate-related initiatives already happening, and they are both led by municipal mayors who understand climate change and have made addressing it as a political priority.
Main research questions

The following are the main interrelated questions to be asked in the case study:

- What are the present and future climate and health problems being confronted by municipal health systems?
- What are the barriers, gaps and challenges faced by municipal health systems when it comes to mounting responses to climate change and its health effects?
- What are the enablers, opportunities and potential strategies that can be harnessed to strengthen the response of municipal health systems to climate change and its health effects?

Key themes covered in the case study

The diagram above shows the four main themes that will be covered in this case study:

- Context, which includes geographic, environmental, political, social, cultural, and economic factors;
• Vulnerability to climate change and its health effects, including both historical and projected effects as well as baseline health profile;

• Health system ‘hardware’ (building blocks and functions) and ‘software’ (e.g. leadership capacity, values, etc.) elements, and;

• ‘Systems for health’ which pertain to the other sectors outside of the traditional health system that relate to climate change or human health or both.

Section B: Data Collection Procedures

Data collection plan

This case study project will adopt three qualitative research data collection methods: key informant interviews, document review, and field observation. Information from all three methods will be triangulated in order to develop a case study narrative that describes the current situation, explores issues and challenges, and proposes some recommendations for action.

For the key informant interviews, the following personalities will be interviewed using a semi-structured interview guide:

<table>
<thead>
<tr>
<th>Municipal office staff</th>
<th>Health system personnel</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Municipal mayor</td>
<td>• Municipal health</td>
<td>• Chairman of a</td>
</tr>
<tr>
<td>• Disaster risk reduction</td>
<td>officer</td>
<td>barangay</td>
</tr>
<tr>
<td>and management officer</td>
<td>Public health nurse</td>
<td>• NGO leader (if</td>
</tr>
<tr>
<td>• Environmental</td>
<td>Midwife</td>
<td>applicable)</td>
</tr>
<tr>
<td>management officer</td>
<td>Barangay health</td>
<td>• Leader of an</td>
</tr>
<tr>
<td>• Social welfare officer</td>
<td>worker</td>
<td>educational institution</td>
</tr>
<tr>
<td>• Agricultural officer</td>
<td></td>
<td>(if applicable)</td>
</tr>
<tr>
<td>• Budget officer/accountant</td>
<td></td>
<td>• Other relevant</td>
</tr>
<tr>
<td>• Planning officer</td>
<td></td>
<td>personalities</td>
</tr>
</tbody>
</table>

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The sequence of the interviews will depend on the availability of the key informants. However, the mayor and the municipal health officer will be prioritized on the first day of the field visit, as it is expected that they will provide a broad overview of the situation of the municipality and the local health system. They may also provide leads to other potential issues that may merit investigation or other key informants that should be considered for interview.

For the document review, the following documents will be requested from the applicable offices:

- Municipal plan (short- or long-term)
- Most recent municipal report
- Most recent annual health report
- Disaster risk reduction and management plan
- Local climate change action plan
- Hazard maps
- Other documents that describe specific initiatives or reports of previous studies/assessments

For the field observation, the researcher will visit the sites for one week each. The following settings were visited and observed:

- Municipal hall
- Rural health unit
- Nearest hospital
- Barangays, especially those affected by climate change-related effects
- Other locations unique to the case (e.g., farmlands, fishing communities, etc.)
**Expected preparation prior to fieldwork**

Prior to the field visit, the researcher will communicate with local authorities in advance and seek for their support in terms of informing interviewees and scheduling the visit. Documents in electronic form will also be requested in advance, which will be helpful in making interview questions more specific and detailed. An audio recorder will be used for the interviews, which will later be transcribed by research assistants. The researcher will also take down notes of his observations in the field.

**Section C: Protocol Questions**

The protocol below serves as a semi-structured interview guide for the key informant interviews. These are general themes that will be explored. However, the specific questions and way of asking can be tweaked, depending on the role of the interviewee. For instance, the mayor will be asked about his general impression of the health system, while the municipal health officer will be asked in detail about health system performance. Meanwhile, some specific questions might also not be applicable to certain respondents. For example, specific questions about the health system may not be asked to other municipal staff, while issues beyond the health sector may not be raised in detail to the health personnel.

1. **Current context of the municipality**
   1. Geography and environmental issues
   2. Political climate
   3. Socio-demographic profile
   4. Economic status
   5. Cultural practices and beliefs
2. **Health system situation**

   1. Present health status/outcomes (vital statistics, common diseases, causes of death)
   2. Access to the health system
   3. ‘Hardware’ elements: functions and building blocks
      a. Functions
         - Governance
         - Resource Mobilization
         - Financing
         - Service Delivery
      b. Building Blocks
         - Workforce
         - Infrastructure
         - Medicines and Devices
         - Information System
   4. ‘Software’ issues
      a. Leadership Practices
      b. Organizational Culture
      c. Power Relations and Agency
      d. Values and Norms
   5. Major health determinants

3. **Climate change and disaster vulnerability**

   1. Understanding of climate change
   2. Perceived effects of climate change (both health and non-health)
3. Historical experience with natural disasters (especially climate-related extreme weather events)
4. Perceived level of readiness to climate change and natural disasters
5. Current initiatives undertaken to address climate change
6. Gaps, barriers, and challenges encountered in relation to responding to climate change
7. Opportunities and aspirations for future climate action

**Section D: Tentative Outline for the Case Study Report**

While the tentative outline for the individual case study report resembles the abovementioned themes and questions, the case study is supposed to synthesize multiple information into a coherent narrative, highlight important details, and propose specific recommendations for action.

1. Brief overview of the municipality (socio-demographic, economic, geographic, cultural)
2. General current and future issues related to climate change
3. Current and anticipated health effects of climate change
4. Other environment and health problems
5. Health system challenges and opportunities
6. Challenges and opportunities for climate action outside the health sector
7. Proposed recommendations for future action

*The format of this case study protocol was based on: Yin, R. Case Study Research and Applications: Design and Methods. 6th Edition. USA: Sage Publications, 2018.*
Appendix 2

Interview Guide

Key Informant Information

1. Can you tell me about the roles and functions of your position and your office?
2. How many years have you been working in this position? How about working for this organization?
3. What are the main issues being addressed by your position and office today?
4. How does your office relate to the issue of climate change? What activities does your office implement in response to climate change?

Current context of the municipality

1. In general, how would you describe the current state of your municipality?
2. What is the current situation of your municipality in terms of the following?
   a. Socio-demographic profile: How many people are living in your municipality? What are their ethnic origins?
   b. Economic status: What is the overall economic status of your municipality? What are the main sources of income? What are people doing for work?
   c. Political climate: Can you describe the kinds of people and groups that govern the municipality? Is the municipality generally peaceful, or are there major political tensions that beset the municipality?
   d. Geography and environmental issues: What are the main geographical features of your municipality? What are the major environmental issues afflicting your locality?
e. Cultural practices and beliefs: How would you describe the overall culture of the municipality – in terms of religion, language, and ethnicity? What are the main practices, behaviors, and beliefs that characterize the people of the municipality?

3. What are the major challenges confronted by your municipality today?

**Health system situation**

1. Overall, how would you describe the state of health in your municipality?

2. What is the present health situation of your municipality in terms of health outcomes? What are the common causes of disease and death?

3. How is the state of healthcare access in your municipality? Are people finding it difficult to access healthcare? If yes, what are the reasons behind it?

4. *For municipal health personnel only:* Let me ask about specific functions and building blocks of your local health system.

   a. Governance

      i. Is health a priority of the municipal government? In what way is this manifested? How does health feature in municipal-wide governance, i.e. at the level of the mayor and the municipal council?

      ii. How does the local health system develop local health plans, policies (i.e., ordinances), projects, and projects?

      iii. Can you describe the level of oversight and enforcement of health regulations in the local health system?

      iv. Is community participation encouraged in local health planning and decision-making? In what manner?
v. How does intersectoral action for health manifest? How does the municipal health office coordinate and collaborate with other offices in the municipality?

b. Resource Mobilization
   i. What are the sources of municipal health funding?
   ii. How is the local health budget developed?
   iii. Are there alternative sources of funds that can be tapped in times of emergency?

c. Financing
   i. What is the state of health insurance (PhilHealth) population coverage in your municipality?
   ii. What is the likelihood of out-of-pocket payments, catastrophic spending and impoverishment in your municipality? What are the reasons behind this and how is this being addressed?
   iii. What financial assistance programs are available for those who are not covered or inadequately covered by insurance?
   iv. Does the local health system allocate funding for population-based public health interventions?

d. Service delivery
   i. What are the range of clinical services provided by your facility?
   ii. What are the range of public health services provided by your facility?
   iii. What are the challenges faced in the delivery of health services?
   iv. For conditions that cannot be addressed in your facility, is there an adequate and functioning referral system? If no, what are the reasons behind the delivery gap?
e. Workforce

i. What are the types of local health staff available in the local health system? How many are they and how are they distributed across the municipality?

ii. What are the clinical and managerial competencies available among the health personnel especially in relation to climate-sensitive diseases and disaster response?

iii. Do the health workers feel well-equipped? How are they trained? How are their capacity being enhanced?

iv. What are the challenges faced by the existing workforce in your municipal health office?

f. Infrastructure

i. How many hospitals and primary care facilities exist in the municipality? Are they geographically accessible to all residents of the municipality?

ii. How would you assess the general service readiness (i.e., presence of basic amenities and equipment) of the health facilities?

iii. How would you assess the vulnerability of the physical buildings to natural disasters? What measures are being done to ensure that infrastructure can withstand such stresses and shocks?

g. Medicines and Devices

i. What are the different types of medicines available in the rural health unit and/or consumed in the municipality?

ii. Is the amount of medicine supply adequate and sustained? Is the municipality experiencing occasional or chronic stockouts of essential medicines?
iii. What are the types and amount of diagnostic and therapeutic
devices/equipment available? For technologies that are not available, how
do people access them?

h. Information System

i. How is health data collected and stored? Is the system paper-based or
electronic/computerized?

ii. How capable are the local health staff for analysis, synthesis, and translation
of health information?

iii. How is health information being used for planning and decision-making?

5. For municipal health personnel only: This time, let me ask about some ‘software’ aspects of
the local health system.

a. Leadership Practices

i. How does leadership manifest in the local health system?

ii. Is this form of leadership enabling or disabling the health system from
adapting to change?

iii. Who are the ‘leaders’ of the local health system?

iv. How is a clear and shared vision created in your health system?

v. How are actors motivated to act towards achieving a common goal?

b. Organizational Culture

i. How would you describe the local health system’s organizational culture?

ii. Does your workplace environment encourage learning, creativity, and
innovation? In what way?

iii. Is the current organizational culture enabling or disabling the health system
from adapting to change?

c. Power Relations and Agency
i. How would you describe the power relations (i.e., degree of control) operating in the local health system:
   • Between the municipal health officer and the health personnel?
   • Between the health personnel and the patients/community?
   • Between the municipal health office and the broader municipal government?

ii. Are actors (especially health staff) able to exercise individual agency (e.g., take initiative, make decisions) to positively influence the system?

iii. Is the current state of power relations enabling or disabling the health system from adapting to change?

d. Values and Norms
   i. What are the values that underpin the local health system?
   ii. How are values selected and disseminated within the local health system?
   iii. Are these values enabling or disabling the health system from adapting to change?

6. What are the major social, cultural, and environmental determinants that drive health outcomes and health inequalities in your municipality? How are these being addressed?

**Climate change and disaster vulnerability**

1. Based on your knowledge and understanding, what is climate change?

2. Overall, what do you think are the effects of climate change on human society and the environment?

3. What effects of climate change are already manifesting in your municipality? How are these present effects of climate change being addressed by your municipality?
4. What are the anticipated future effects of climate change in your municipality? How does your municipality plan to address these anticipated effects?

5. One of the effects of climate change is the increase in severity and frequency of extreme weather events such as typhoons and flooding. Can you tell me about your municipality’s past experience with these effects? What was the impact? How did the municipality address these impacts?

6. Based on your current and planned efforts as well as historical experience, do you think your municipality is ready for the era of climate change? Why?

7. What systems are put in place to strengthen climate change adaptation in your municipality? How about for enhancing disaster risk reduction and management?

8. What are the challenges being faced by your municipality in terms of climate change adaptation? How do you think these challenges must be addressed?

9. What are the opportunities that exist in your municipality in terms of climate change adaptation? How do you think these opportunities can be maximized?

10. What is the aspiration of your municipality as climate change becomes real? What is your personal aspiration?

Climate change and human health

1. Why is climate change important for human health? How are they connected?

2. How do you think climate change affects human health?

3. Is climate change already affecting the health of your municipality? If yes, why and how?

4. What other health effects of climate change is your municipality anticipating in the future?

5. How is the local health system and the municipality at large addressing these present and future health effects of climate change?
6. How ready is the local health system in terms of addressing the health effects of climate change, both at present and in the future?

7. What are the challenges faced in strengthening climate change adaptation within the health sector? How do you think these challenges must be addressed?

8. What are the opportunities that exist in terms of strengthening climate change adaptation within the health sector? How do you think these opportunities can be harnessed?

9. Have you heard of the term ‘climate-resilient,’ ‘climate-adaptive,’ ‘climate-smart’? If yes/no, what do you think are they and how do they apply to health systems?

10. What is the aspiration of your local health system as climate change becomes real? What is your personal aspiration for the local health system?