Health Challenges in the Pacific: Infectious Diseases, Non-communicable Diseases and the Health Workforce

Nancy Davis Lewis, PhD
East-West Center, Honolulu
lewisn@eastwestcenter.org

and

Rémy Tessou
Malardé Institute
rtessou@ilm.pf

ABSTRACT

“Health Challenges in the Pacific: Infectious Diseases; Non-communicable Diseases and the Health Workforce” was one of the five symposia organized for the 11th Pacific Science Congress held in Tahiti, French Polynesia March 2-6, 2009. Organized by Nancy D. Lewis, East-West Center, Honolulu and Rémy Tessou, Malardé Institute, it addressed many of the health challenges facing the Pacific Island region. The islands states are at different stages of the health transition. The report below employs the concept of the “triple burden of disease” to organize the research results presented. A series of presentations also addressed ICT, e-health and telemedicine. A final session dealt with virology and health challenges in China.

KEYWORDS


INTRODUCTION

The Asia Pacific Region is faced with the health challenges facing the rest of the globe: persistent, if lower rates of infectious disease and the emergence and reemergence of infectious diseases; increasing rates of chronic diseases associated in part with dietary and life-style changes as well as aging populations; and an increasing proportion of death and disability due to accidents. They are also faced with the often daunting challenge of providing an adequate health infrastructure including assuring that a well-trained health workforce is in place. In the island context, this is compounded by isolation, fragile economies and often widely dispersed populations. The sessions on health at the PSI2009 were designed to address these challenges with a special focus on the Pacific Islands.

1. THE PACIFIC ISLAND CHALLENGE

The nations and territories of the Pacific span a vast region of the Pacific Ocean. It is 13,000 km from Papua New Guinea to Easter Island and 8,500 km from New Zealand to Hawaii. They are generally characterized by small land areas, fragmentation and distance from continental land masses, attenuated but often unique and endangered biota, largely tropical maritime climatic regimes and most often small populations. Referring only to those island nations that belong to the Secretariat for the Pacific Community (SPC) and not including Hawaii, New Zealand or Easter Island, in 2008 the population was 9.1 million with 71% of that in the large Melanesian nation of Papua New Guinea.

While there are communalities, the peoples of the Pacific exhibit complex genetic, linguistic, cultural and social variations and their experience with explorers, missionaries, colonial administrations, decolonization and most recently globalization has also varied. There endowment of natural resources is different and they have achieved different levels of ‘development’ [1] and Table 1. GDP per capita in the mid-2000s was above $10,000 USD only in Guam, Commonwealth of the Northern Marianas Islands, New Caledonia and French Polynesia all of which have a close affiliation with a metropolitan power. New Caledonia also has significant nickel deposits. In terms of political status, nine are independent states, twelve are represented at the UN General Assembly, nine are politically integrated into larger countries and five are self-governing in free association with larger countries.

The peoples of the Pacific also find themselves at different places on the spectrum of the health transition. With the adoption of more Western diets and more sedentary lifestyles, dietary change and concomitant obesity have emerged as causal factors [2, 3] and noncommunicable diseases are the leading cause of death in the more modernized parts of the Pacific. However, communicable and infectious diseases, including TB, dengue, filariasis, leptospirosis, malaria (in PNG and the Solomons), STIs including HIV/AIDS (especially in PNG), as well as drug and alcohol abuse and accidents, remain problems in much of the Pacific. Suicide is elevated among the youth in some Pacific populations.

2. KEYNOTE ADDRESSES

The keynote addresses were chosen to highlight some of the key health threats as well as to underscore the challenges of health care provision in the region. Eric Dewailly, of the Unité de Recherche en Santé Publique du CR-CHUL, delivered on behalf of his colleagues Edouard Suhas, Emilie Counil, Rémy Tessou and Yolande Mou, the keynote on health challenges. He synthesized recent and ongoing studies of the health transition in French Polynesia. While these were specific to French Polynesia, the trends they represented were more widely representative of much the Pacific as a whole.
### Table 1. Pacific Island political, social, economic, and health indicators

<table>
<thead>
<tr>
<th>Island Group</th>
<th>Political Status</th>
<th>GDP/cap (US$)</th>
<th>Land Area (km²)</th>
<th>Population (est. 2008)</th>
<th>Pop Density (km²)</th>
<th>% Urb.</th>
<th>TFR</th>
<th>IMR</th>
<th>LE Male</th>
<th>LE Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Samoa</td>
<td>Dependent (US)</td>
<td>6,995</td>
<td>199</td>
<td>66,107</td>
<td>322</td>
<td>50</td>
<td>4.0</td>
<td>11.9</td>
<td>69.3</td>
<td>75.9</td>
</tr>
<tr>
<td>Cook Islands</td>
<td>Associated (NZ)</td>
<td>8,553</td>
<td>237</td>
<td>15,537</td>
<td>66</td>
<td>72</td>
<td>2.8</td>
<td>14.5</td>
<td>68.0</td>
<td>74.3</td>
</tr>
<tr>
<td>Fed States of Micronesia</td>
<td>Associated (US)</td>
<td>2,183</td>
<td>701</td>
<td>110,443</td>
<td>158</td>
<td>22</td>
<td>4.0</td>
<td>37.5</td>
<td>67.4</td>
<td>68.0</td>
</tr>
<tr>
<td>Fiji</td>
<td>Independent</td>
<td>3,175</td>
<td>18,272</td>
<td>839,324</td>
<td>46</td>
<td>51</td>
<td>2.6</td>
<td>18.8</td>
<td>63.8</td>
<td>67.6</td>
</tr>
<tr>
<td>French Polynesia</td>
<td>Dependent (Fr)</td>
<td>22,472</td>
<td>3,521</td>
<td>263,267</td>
<td>75</td>
<td>53</td>
<td>2.2</td>
<td>6.5</td>
<td>72.2</td>
<td>76.7</td>
</tr>
<tr>
<td>Guam</td>
<td>Dependent (US)</td>
<td>22,661</td>
<td>541</td>
<td>178,980</td>
<td>331</td>
<td>93</td>
<td>2.7</td>
<td>9.8</td>
<td>71.1</td>
<td>76.1</td>
</tr>
<tr>
<td>Kiribati</td>
<td>Independent</td>
<td>653</td>
<td>811</td>
<td>97,231</td>
<td>120</td>
<td>44</td>
<td>3.4</td>
<td>52.0</td>
<td>58.9</td>
<td>63.1</td>
</tr>
<tr>
<td>Marshall Islands</td>
<td>Associated (US)</td>
<td>2,851</td>
<td>181</td>
<td>53,236</td>
<td>294</td>
<td>68</td>
<td>4.4</td>
<td>37.0</td>
<td>63.7</td>
<td>67.4</td>
</tr>
<tr>
<td>Nauru</td>
<td>Independent</td>
<td>2,807</td>
<td>21</td>
<td>10,163</td>
<td>484</td>
<td>100</td>
<td>4.0</td>
<td>42.3</td>
<td>52.5</td>
<td>58.2</td>
</tr>
<tr>
<td>New Caledonia</td>
<td>Dependent (Fr)</td>
<td>29,898</td>
<td>18,576</td>
<td>246,614</td>
<td>13</td>
<td>63</td>
<td>2.2</td>
<td>6.2</td>
<td>71.9</td>
<td>78.6</td>
</tr>
<tr>
<td>Niue</td>
<td>Associated (NZ)</td>
<td>5,828</td>
<td>259</td>
<td>1,549</td>
<td>6</td>
<td>36</td>
<td>2.6</td>
<td>7.8</td>
<td>67.0</td>
<td>76.0</td>
</tr>
<tr>
<td>Northern Marianas</td>
<td>Associated (US)</td>
<td>12,638</td>
<td>457</td>
<td>62,969</td>
<td>138</td>
<td>90</td>
<td>1.6</td>
<td>6.5</td>
<td>73.5</td>
<td>77.1</td>
</tr>
<tr>
<td>Palau</td>
<td>Associated (US)</td>
<td>8,423</td>
<td>444</td>
<td>20,279</td>
<td>46</td>
<td>64</td>
<td>2.0</td>
<td>20.0</td>
<td>66.3</td>
<td>72.1</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>Independent</td>
<td>991</td>
<td>462,840</td>
<td>6,473,910</td>
<td>14</td>
<td>13</td>
<td>4.6</td>
<td>64.0</td>
<td>53.7</td>
<td>54.8</td>
</tr>
<tr>
<td>Samoa</td>
<td>Independent</td>
<td>2,872</td>
<td>2,935</td>
<td>179,645</td>
<td>61</td>
<td>21</td>
<td>4.6</td>
<td>19.8</td>
<td>70.1</td>
<td>75.5</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>Independent</td>
<td>753</td>
<td>28,370</td>
<td>517,455</td>
<td>18</td>
<td>16</td>
<td>4.8</td>
<td>66.0</td>
<td>60.6</td>
<td>61.6</td>
</tr>
<tr>
<td>Tonga</td>
<td>Dependent (NZ)</td>
<td>NA</td>
<td>12</td>
<td>1,170</td>
<td>98</td>
<td>0</td>
<td>4.5</td>
<td>38.0</td>
<td>67.8</td>
<td>70.4</td>
</tr>
<tr>
<td>Tuvalu</td>
<td>Independent</td>
<td>2,319</td>
<td>650</td>
<td>102,724</td>
<td>158</td>
<td>23</td>
<td>4.2</td>
<td>19.0</td>
<td>67.3</td>
<td>73.0</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>Independent</td>
<td>1,831</td>
<td>26</td>
<td>9,729</td>
<td>374</td>
<td>47</td>
<td>3.7</td>
<td>35.0</td>
<td>61.7</td>
<td>65.1</td>
</tr>
<tr>
<td>Wallis and Futuna</td>
<td>Dependent (Fr)</td>
<td>2,127</td>
<td>12,190</td>
<td>233,026</td>
<td>19</td>
<td>21</td>
<td>4.4</td>
<td>25.0</td>
<td>65.6</td>
<td>69.0</td>
</tr>
</tbody>
</table>

Source: Secretariat of the Pacific Community

#### 3.1 “Global Challenges and Health in French Polynesia”

Dewailly noted that French Polynesians as other island peoples are intimately connected to their environment. The past decades have brought significant changes to both their society and their environment. Changes in diet and associated risk factors have resulted in an increase in noncommunicable disease. He discussed three separate studies that have taken place over the past four years. The first study took place on Tahiti and neighboring Moorea and included 195 adults, 18 years and older. The second study’s goal was to evaluate exposure to toxicants and nutrients from fish during pregnancy and the third included 306 participants from Papeete, the urban center on Tahiti, and the much more isolated Tubuai in the Austral archipelago.

The findings of these related studies found that (1) fish consumption still supplies extremely high levels of key nutrients such as selenium; (2) a shift from reef fish to pelagic fish consumption, perhaps due to fear of ciguatera, as well as modernization (and perhaps depletion of the reef) is responsible for a high exposure to toxic mercury in adults and pregnant women; (3) high intakes of natural omega-3 fatty acids found in fatty fish are offset by the intake of harmful industrial fatty acids, especially among the youth; (4) there was a definite increase in cardiovascular risk factors among the youngest generation compared to their elders; and (5) the youth from isolated Rapa are healthier than teenagers from other islands. It was noted that Polynesian children show increased signs of atherosclerosis but that this increase was not linked to the traditional risks for cardiovascular disease (obesity, hypertension, diabetes) and that while both are rampant, obesity seems not to be related to hypertension in French Polynesian adolescents. Nonetheless, Polynesians are well along a health transition that is accelerating with increasing rates of chronic disease, especially among the younger generations. This is reason for serious health concern and both further research and effective policy intervention are needed.

#### 3.2 “What about the Workers? Where are the Health Workers Going, Why and With What Impact?”

John Connell, Professor of Human Geography at the University of Sydney presented the keynote address on the healthcare workforce. It was based on his recently published book, The Global Health Care Chain: From the Pacific to the World [4]. The out-migration of skilled health workers from the less-developed countries in the past decade has reached crisis proportions. It is said to epitomize the brain drain, but despite the significance of this migration, in numbers, impacts (medical, economic, social and political) and its continuing growth, the phenomenon is poorly understood. The migration of Pacific Island health workers is part of a more general “culture of migration,” especially in Polynesia. There is a tradeoff, however. While there is a loss of superior skills, there is a gain in remittances. Do the remittances compensate for the brain drain or does this result in a new inverse care law? Globally, restructuring and privatization are changing the architecture of...
Connell touched on many of these topics in his talk. He posited that there have been four stages of medical migration globally, an early phase of medical missionaries from the more developed regions to the less, a phase in the 1960s and 1970s characterized by Indian, Iranian, Filipino and other doctors going to the North, a quiescent period in the 1980s, and a massive flow of nurses and paraprofessionals (mostly women) in the 1990s based on very active recruitment. One of the major push factors in the Pacific as elsewhere is the lack of opportunities for further training and job advancement at home. Poor working conditions and a chronic lack of supplies contribute to job dissatisfaction. Reasons given for choosing a health care career include altruism (and/or a call from God), the fact that it is challenging, and that it provides both a regular stream of income and also migration opportunities, a “passport to the world.” Pacific health workers also tend to send back larger remittances for longer than other immigrants.

What can the Pacific do to secure its health care workforce? This presents a significant challenge and current programs are primarily tinkering at the margins. They can provide better facilities and more regular supplies. They can implement programs to recruit, train and retain workers. They can increase the age of retirement, recruit individuals closer to middle age who have established families, provide professional training, child care and jobs for spouses in rural areas. The Asia Pacific Technical College (APTC) is an example of a training opportunity. I would add that the Pacific Open Learning Health Network (POLHN) described later in this review is another. Connell’s talk gave a sense of the more detailed analysis available in his recently published volume.

4. THE TRIPLE BURDEN OF DISEASE

As suggested by the introduction and the two keynote addresses, the Pacific Islands are in the midst of a health transition where, as in most parts of the world, the chronic and noncommunicable diseases are becoming an increasingly important component of morbidity and mortality. However, infectious diseases, especially in the lesser developed and most isolated parts of the Pacific remain a serious problem. Infant mortality rates, common measures of levels of health, range from 66/1000 in the Solomon Islands and 64/1000 in Papua New Guinea to 6.2/1000 in New Caledonia and 6.5/1000 in both French Polynesia and Commonwealth of the Northern Marianas Islands. That is a 10 fold difference. Life expectancy, another common comparative measure ranges, from 54 years in Papua New Guinea and 55 years in Nauru to 75 years in both the Commonwealth of the Northern Marianas Islands and New Caledonia (Table 1). As noted, accident rates are also elevated in many Pacific locations. Together these three causes of morbidity and mortality are often referred to as the “triple burden of disease.” Islands in the Pacific are at different locations on the spectrum of the health transition. The rest of this report briefly reviews the individual paper contributions to the health sessions at the PSI2009 using this triple burden of disease framework. It also presents special sections on the contributions of ICT, e-health and telemedicine, and a panel on virology and health challenges in China. Appendix 1 is the session program for the health sessions which includes the titles of the papers and a full listing of all the authors. The abstract volume includes their affiliations.1

5. INFECTION DISEASE

The Institut Louis Malardé in French Polynésia and the Institut Pasteur in New Caledonia are associated with the wide network of the Institut Pasteur in Paris which has been conducting research on infectious disease in the tropical world for over a century. It is not surprising that many of the papers presented were on infectious diseases important in the tropical Pacific: dengue, filariasis, leptospirosis, and TB (and ciguatera, discussed below). Allison Imrie and colleagues compared dengue-specific T-cell responses in Hawaii and French Polynesia. Dengue is a mosquito-borne illness caused by any of four RNA viruses of the family Flaviviridae. Most patients recover in five to six days but about 5-30% of the cases develop the more severe dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS), often during secondary infection with one of the four viruses. This typically occurs when the viral load drops and the fever remits, suggesting that the vascular leakage leading to shock is due to immunopathology. This study of dengue specific T-cell cross-reactivity is the first study of dengue specific cellular immunity in Pacific Islanders. It has important implications for dengue vaccine design and it may improve safety by avoiding potential cross-reactivity in T-cell responses.

Van-Mai Cao Lorameau and colleagues gave a presentation on the history and epidemiology of dengue in French Polynesia. Since the middle of the last century, there have been twelve dengue epidemics caused by all four dengue virus serotypes. Nine of these occurred after the introduction of a new viral strain from outside of the region DEN-1 (1944, 1975, 1988, 2001), DEN-2 (1971, 1996), DEN-3 (1964, 1989), and DEN-4 (1979). The three others were caused by strains endemic in the region (DEN-3- 1969; DEN-4 1985; DEN-1- 2006). When a new strain causes an outbreak, the endemic strain is completely replaced within a few months; co-circulation of multiple strains has never been reported. The authors explored geographical, eco-biological and sociological correlates of dengue epidemics. Claudine Roche and colleagues reviewed the role of the Institut Louis Malardé in Papeete in the detection and control of dengue in French Polynesia. They have been employing more and more effective tools, particularly the classical semi-nested RT-PCR. Because of globalization, French Polynesia is also at risk of the introduction of other emerging arboviruses. They have used both classical RT-PCR and real-time RT-PCR to detect the Flavivirus, Alphavirus and Phlebovirus genera.

Edouard Bourgaut and colleagues addressed vector surveillance and control of Aedes aegypti in New Caledonia. There has been a network for surveillance and control of dengue at the Institut Pasteur since 1998. A sample of houses is visited every month and breeding sites destroyed. Entomological indices are calculated monthly and published in the local newspaper. TV

1 I apologize in advance to any authors whose presentation was not fully captured. My responsibilities as vice president of the Pacific Science Association precluded my attending the entirety of every health session. The following was compiled from notes from the sessions I attended, notes from my colleague Rémy Tessou and the abstracts.
and radio are used to broadcast warnings during the hot, rainy season from January to March and meteorological indicators are correlated with entomological indices. Anavaj Sakuntabhai and Richard Paul noted that dengue fever is most severe in Southeast Asia, milder in South America and the Pacific and rarely reported in Africa where both vector and virus are present. The authors investigated population genetic differences in polymorphisms associated with protection against severe dengue including the DC-SIGN-336 allele. They found that African populations had a higher frequency of resistance alleles, Caucasian populations a lower frequency and that they were least frequent in Southeast Asians. While viral genotypes, epidemic vs. endemic transmission, and other genetic differences in populations could be involved in the higher frequency of resistance, gene variants could be one of the reasons that severe dengue is rarely reported in Africa.

Hervé Bossin and his colleagues noted that while the diversity of mosquito species in French Polynesia and much of the Pacific is low, those that do exist like Aedes aegypti and Aedes polynesiensis are often disease vectors, of, e.g. dengue and lymphatic filariasis. Despite seven years of anti-filarial drug distribution through the Pacific Elimination of Lymphatic Filariasis (PaELF) programme (a regional program), filariasis remains a serious public health concern especially in the Society Islands and the Marquesas. Supplemental control strategies must be employed, e.g., biological and insecticidal approaches to control A. polynesiensis. They have experimented with crab bait with insecticides and biological modification of the vector, rendering the male sterile. Ngoc Lam Nguyen and colleagues also addressed the challenge of filariasis control in French Polynesia. From 1993-2007 mass drug administration was re-implemented in French Polynesia. The team recommended the extension of the mass drug administration. Cyrille Gounant and colleagues argued for a multidisciplinary approach to leptospirosis detection and control in New Caledonia. The Institut Pasteur is the local reference lab for leptospirosis and it has developed efficient molecular diagnostic tools. However this complex disease demands multidisciplinary tools focused on the relationships between humans, animal reservoirs, environmental sources of infection and other animal hosts. The researchers are also developing a rapid, simple diagnostic test and a program to identify the cytokine response to Leptospira infection in a hamster model.

TB remains a public health threat in the Pacific. Alex Wiegandt, Janet O’Connor and Kerri Viney noted that multidrug-resistant (MDR-TB) tuberculosis is becoming a substantial threat to TB control in the Pacific due to complex diagnostic and treatment challenges. While the overall rates are low in the Pacific they are alarmingly high in some places, especially Micronesia. The prevalence rate among new cases in the Commonwealth of the Mariana Islands is as high as 11.1%. Chuuk State, Federated States of Micronesia recently experienced an outbreak with six laboratory confirmed cases and four deaths. Four cases were identified on Ebeye, Republic of the Marshall Islands in 2005. There is serious need to link the three critical aspects of case management of drug resistant TB in the Pacific, notably laboratory services, technical/clinical support for case management, and the timely provision of second-line drugs. The same authors discussed the critical importance of TB contact tracing in the Pacific. TB rates (excluding PNG) increased from 49 to 53/100,000 between 2000 and 2006. The rates range from less than 10/100,000 in the Cook Islands to 400/100,000 in Kiribati (Micronesia). More than 30% of the cases are found in the age group 0-24 suggesting ongoing active transmission. Despite the implementation of DOTS strategy in the Pacific in 2000, active transmission of the disease continues. A pilot course in contact investigation was taught in 2007 for participants of 10 Pacific Island countries. This effort should be expanded.

Edward Moola of the Samoa AIDS Foundation submitted two abstracts, one on legislative challenges for HIV/AIDS intervention programs targeted at Pacific men who have sex with men (MSM) and the second on the impacts of sexual behaviors on HIV infections in MSM in the Pacific but he was unable to attend the Inter-Congress. His abstracts discuss the establishment of the Pacific Sexual Diversity Network, a group whose purpose is regional advocacy for policy and legislative change and the protection of human rights, prohibiting MSM and HIV/AIDS status as bases for discrimination. The second abstract reviews a Family Health International (FHI) study of MSM populations in Port Moresby, Papua New Guinea where HIV prevalence is 1.8%, highest in the Pacific. The respondents demonstrated a lack of knowledge of HIV/AIDS/STI transmission and the proper use of condoms. A quarter of the MSM sample is married to female partners. There is a critical need for culturally sensitive education strategies targeting MSM in the region. Sophaganine Ty Ali and Alex Wiegandt presented the Consensus Document on the HIV testing and STI case definition for the Pacific. Recently conducted second generation surveillance studies show there is a high prevalence of STIs in the Pacific. There is a need to strengthen the process of HIV testing and STI case reporting. The Secretariat of the Pacific Community (SPC) convened a meeting in American Samoa in 2008 with multiple stakeholders. The goal was to harmonize a regional approach to HIV testing. They drafted a document that provides clear direction on HIV testing, addresses reducing turnaround time for results, and provides direction for scaling-up HIV testing. This should also result in a reduction in future costs for HIV testing. They also developed a case definition and minimum data set for STIs. The results of the meeting are aligned with the goals of the Pacific Regional Strategy on HIV Implementation Plan.

6. NONCOMMUNICABLE DISEASES AND ACCIDENTS

As noted in the introduction and Eric Dewailly’s keynote address, the islands of the Pacific are undergoing a health transition and for most of the region, noncommunicable diseases present the greatest health challenges. Viliami Puloka and colleagues proposed a multisectoral, trans-disciplinary approach to the prevention and control of NCD in the Pacific. NCDs are the leading cause of death in the Pacific, accounting for approximately 75% of deaths each year compared to 70% worldwide. Risk factors include poor diet, physical inactivity, tobacco use, and alcohol abuse. SPC has joined forces with WHO to develop the Pacific NCD Programme which seeks to coordinate efforts of implementing partners and donors sharing resources under the concept of “One Team, Two Organizations for 22 Countries and Territories.” Emilie Counil and colleagues explored the dietary transition in French Polynesia attempting to capture both geographical and generational differences. The goal
of their work was to develop simple scores to measure the dietary transition. They developed two measures, a “dietary transition score” (DTS) based on the sum of food frequency scores (local foods are positive) and a “dietary fat transition score” (DFTS) which measured the ratio of trans-fatty acids in red blood cells. They measured the scores in three age groups (12-17, 18-49 and 50+) in urban Papeete and rural Tubuai. There was a positive linear trend from teenagers in Papeete to elders in Tubuai, in the Austral Islands. DTS was correlated with DFTS. DFTS correlated positively with iodine and selenium, markers of marine food consumption.

Annie Ferland and colleagues examined the relationship between the dietary glycemic index (GI) and nutrient intake, anthropometric variables and metabolic risk factors in Papeete and rural Tubuai. Dietary GI is correlated with an unfavorable risk profile in Papeete, but not in Tubuai. Traditional diet and other favorable lifestyle factors such as physical activity may be protective with respect to cardiovascular and other metabolic risk factors. Annick Fontbonne and colleagues explored the paradoxical relationships between anthropometric variables and phenotypic expression of the metabolic syndrome in non-diabetic Polynesians in New Caledonia. Despite their much higher mean body mass index and waist circumference, Polynesians had lower plasma insulin levels and indices of moderate insulin resistance compared to Melanesians and Europeans. The Polynesians had a much higher rate of glycemic abnormalities but their mean triglycerides and blood pressure were lower compared to Melanesians and their total cholesterol was lower when compared to Europeans. In this ethnic group, triglycerides were not associated and total cholesterol was inversely associated with abdominal obesity. This illustrates the diversity of phenotypic expressions of the metabolic syndrome across populations and this has implications for health promotion in Polynesia.

Marie-Ludvine Château-Degat and colleagues looked at obesity and hypertension in French Polynesian adolescents. One hundred and seventeen adolescents aged 12-17 from four islands (Papeete, Tubuai, Raivave and Rapa) in French Polynesia were involved in the study. 27.6% of the participants were identified with a significant likelihood of persistence of obesity into adulthood and among them, 15% had BMI greater than 30Kg/m2. No gender or regional difference was detected. There was no relationship between hypertension and anthropometric measures. Obesity and hypertension were both prevalent but independent in Polynesian adolescents. Martin Noel and colleagues addressed atherosclerosis disease in children in the four islands mentioned above. An ultrasound image of the carotid intimal to medial thickness (CIMT) was used as a marker of atherosclerosis. Risk factors known to induce CIMT were obesity, hypertension and diabetes. CIMT measurements were higher than what has been reported as healthy. There was no difference between islands. The increase is not related to traditional risk factors related to CVD. These last four papers suggest that additional research should be focused on the dietary transition in the Pacific, its expression and implications for health and health interventions in the region.

Christophe Serra Mallol explored the cultural aspects of food habits from a historical perspective taking into account colonization, Christianization, changes in the mode of production and the implications of the nuclear testing program. He places obesity in French Polynesia in a historic, ecosystematic and political economic context to help to understand and de-stigmatize obesity.

Pauline Brindel and colleagues studied the anthropometric risk factors associated with thyroid cancer in French Polynesia which has one of the world’s highest rates of that disease. A case control methodology was used to study 225 cases of differentiated thyroid cancer (201 women and 24 men) diagnosed between 1979 and 2004. Women in the highest quartile BMI had a 2.3 fold higher risk of thyroid cancer than women in the lowest quartile. Overall, for both men and women, taller stature, elevated weight and BMI at all ages were associated with elevated risk of thyroid cancer. Enora Clero and colleagues note that the risk of thyroid cancer in French Polynesian women is 20/100,000. Only in New Caledonia is the risk higher. The focus of their study was the role of diet in thyroid cancer. On average, men consumed 3975 kcal/day and women 3000 kcal/day. For active individuals, the recommendations are 3400 kcal for men and 2400 kcal for women. The average consumption of fish was 64 g/day. The study suggests that diet interacts with genetics in determining thyroid cancer risk. Beatriz Valera and colleagues explored the relationship between mercury exposure and cardiovascular risk factors among adults in French Polynesia. While seafood is rich in nutrients beneficial for cardiovascular health, it may also contain contaminants such as mercury. The study was designed to assess the influence of mercury on heart rate variability (HRV) and blood pressure (BP) on rural Tubuai and in Papeete. Mercury concentrations were higher in Papeete than Tubuai. Papeete participants had lower HRV compared to those from Tubuai. No differences were observed in heart rate or BP.

Two papers (and several posters) addressed ciguatera fish poisoning (CFP). Ciguatera, which is among the most frequently reported marine food intoxications globally, is the clinical syndrome associated with the consumption of fish from tropical and subtropical waters that have bioaccumulated the neurotoxins associated with the dinoflagellate Gambierdiscus toxicus and possibly related species. Mireille Chinain and colleagues noted that it causes major health and economic problems for communities who rely heavily on seafood resources. The mean annual incidence in French Polynesia is 2-4 cases per 1000 making it a “hot spot” of ciguatera poisoning. Significant research on ciguatera has been carried out at the Institut Louis Malardé in Papeete since the 1960s under the leadership of Dr. Raymond Bagnis (parenthetically the author explored the public health and marine resource development implications of ciguatera in French Polynesia as part of her dissertation research in the 1970s).

Two large scale risk assessments have been carried out in two CFP-endemic islands, Raivave (Australs) and Fakarava (Tuamotus). These assessments looked at the etiology of the poisoning incidents, the abundance and distribution of Gambierdiscus, assessed the toxicity of sea food in various fishing areas, and collected local information. The study has reactivated ciguatera reporting and it provided evidence of a new source of CFP-related toxins, marine benthic cyanobacteria and their subsequent transfer to invertebrates (giant clams). It
also explored the relationship between reef damage-anthropogenic or natural-and increases in ciguatera, and the increased local awareness of seafood risks. Anne-Sophie Kerbrat and colleagues explored the relationship between marine Oscillatoriales (cyanobacteria) blooms and ciguatera, mentioned above. Studies in Lifou (New Caledonia) and Faivavae (French Polynesia) show that marine benthic cyanobacteria of the Oscillatoria group can produce CTX-like compounds in association with paralytic toxins. Following cyanobacterial blooms, giant clams can accumulate these toxins. The syndrome is provisionally named “Ciguatera Shellfish Poisoning.”

7. ADDITIONAL PAPERS

There were several papers that do not neatly fit into ‘triple burden of disease’ framework. Janis Paterson reported on the Pacific Islands Families study. It is a large scientifically and culturally robust longitudinal study that is following a birth cohort of over 1000 Pacific children and their families in New Zealand. Assessments have been carried out at 6 weeks, 12 months, 24 months, 4 years, and 6 years of age. The aim of the study is to discover pathways leading to successful adaptation as the cohort and their families negotiate critical developmental transitions.

Sumiko Ogawa, Tadashi Nakasone and Eugene Boostrom discussed the Health Okinawa 2010 Program. Okinawa has been internationally recognized for its longevity. Dietary and lifestyle factors have been important components in achieving this longevity. Diet and lifestyle have been changing. Recently life expectancy, particularly for men, has decreased somewhat. The program is aimed at increasing awareness of the importance of diet, exercise and cognitive shifts as well as preventive health care in Okinawa.

8. THE HEALTH WORKFORCE AND THE ROLE OF ICT, E-HEALTH AND TELEMEDICINE

Information technologies have revolutionized health research and the delivery of health care in a myriad of ways. Papers were presented on a wide range of topics from ICT in health surveillance to bioinformatics. The interest of immediate past President of the PSA, Dr. Kiyoshi Kurokowa, a physician, science advisor to former Prime Minister Abe and one of Asia’s leading proponents of innovation in science, fostered a focus on ICT and telemedicine at this Inter-Congress.

Axel Wiegandt on behalf of his two co-authors, Tom Kiedrzynski and Christelle Lepers, described PacNet which is an early warning system designed to prevent and control outbreaks of infectious disease in the Pacific Islands. PacNet was created in 1997 as a service of Secretariat of the Pacific Community (SPC) Pacific Public Health Surveillance Network to facilitate the timely exchange of information on outbreak-prone infectious diseases in or threatening the Pacific Island countries and territories and to ultimately develop into an early warning system. Self-moderated, the discussion list is open only to health professionals. In many instances the system has proved its usefulness in raising awareness and preparedness, examples include the SARS outbreak in 2003, endemic and epidemic dengue (and I suspect some months after the Inter-Congress, swine flu). The system is robust, accessible and easy to use.

There is also a restricted list available only to Pacific Island Departments or Ministries of Health.

Harry McConnell and colleagues described the Pacific Open Learning Health Network (POLHN), a continuing professional education network for health professionals in Pacific Island countries. Continuing education for health workers is a challenge in this widely distributed island region. In 1999-2001 Pacific Island Health Ministers asked the WHO for help in developing continuing professional education (CPE) for health workers in the region. Located in hospitals and nursing schools for easy access, POLHN learning centers were established in 10 countries in 2003. Since then, 7 more centers have been established. In addition to traditional learning materials and computer and individual on-line learning, they provide access to highly relevant instructor-led courses developed and offered for health workers in the Pacific. Over 100 such courses have been offered to date. Camille Boostrom, representing her colleagues, gave a presentation that explored how social network analysis (SNA) will be used in the 2009 evaluation of POLHN. It will assess the information flows and networks surrounding access to continuing education, upgrading educational qualifications, access to health related information, and inter-country consultations and learning opportunities.

Nicolas Goffard submitted an abstract that stressed the importance of bioinformatics in deciphering and organizing the vast amount of data generated from traditional biology in the quest to control infectious disease. Bioinformatics has become an integral part of the investigation of the biological complexity of host-pathogen interactions and it allows the study of their dynamic co-evolution. Yasumitsu Tomioka, Hiroshi Juzoji and Isao Nakajima explained the DAI (Digital Access Index) which combines a selection of indicators to evaluate communication accessibility. The DAI is built around four main factors that impact a country’s accessibility: infrastructure, affordability, knowledge and quality and actual usage of ICTs. The DAI allows comparison across countries. The DAI was applied to the Pacific Islands.

Nakajima and colleagues made a case for the use of ICT in the control of avian influenza. The system would track wild birds and monitor their movements. Because of the lack of a vaccine and the high case fatality rate, prevention of avian influenza is critical. During an ITU-D meeting in Japan the Tokyo Declaration on An Integrated Information and Communications Network for Avian Influenza was approved. Noritaka Ichida demonstrated the feasibility of satellite tracking of bird migration. Using the example of several species of crane he illustrated how modern satellite tracking can tell us not only the site where the transmitter is attached and where the bird is recovered but its route and the exact period during which the animals are migrating. This could be very useful in understanding the geographical distribution of wild fowl implicated in avian influenza. Ichida is a superb avian photographer and his photos enlivened the presentation.

Tadamasa Takemura and colleagues submitted a paper on the development of low cost telemedicine environment using a broadband network but they were unable to attend the meeting. They argued in their abstract that more attention needs to be paid to the development of low cost telemedicine environment using a broadband network but they were unable to attend the meeting.
The central component is the Mobile Telemedicine Laboratory (MTL) situating combining mobility and telemedicine technologies. Addressed the delivery of medical services in emergency based social services to remote locations. The second paper Complex, “CyberTwin” that delivers a complete set of ICT including HIV. There is also a Multi-Functional Mobile Social Network) which can be adapted to fight a variety of diseases. These services and it is equipped with the necessary diagnostic health services to individuals who live in mountainous areas and on isolated islands. Currently this is paid for largely by subsidies from the central government. The authors suggested a reimbursement system from medical insurance. With respect to the Pacific they suggested a “Universal Service Fund of e-Health” to which developed countries would contribute.

Yuji Akematsu and Masatsugu Tsuji analyzed the how and the degree to which e-health systems reduce actual medical expenditures using Nishiaizu Town as a case study. They compared users and non-users of the e-health system. They found that users of the system have lower medical expenditures for lifestyle related diseases than non-users; this phenomenon increased with the time an individual had been using the system and there was a greater effect for those who were ill than those that were not. Asif Zafar from Pakistan was not able to attend the Inter-Congress. His abstract presented lessons learned from Pakistan’s Ministry of IT Health NET’s Telemedicine Rural Support Program in remote and rural Pakistan. Telemedicine Centers are set up in rural hospitals and connected to a telemedicine hub by PAKSAT-1. In addition to telediagnosis and consultation, there are continuing medical education (CME) programs and Grand Rounds are held. He argued that this could be replicated in the Pacific.

Mikhail Natenzon gave two presentations on complex telemedicine projects developed in Russia. The Mobile Telemedicine Laboratory (MTL) is central to the provision of these services and it is equipped with the necessary diagnostic and telecommunication equipment. One project is the SCAESNet (Satellite Communication AntiEpidemic Screening Network) which can be adapted to fight a variety of diseases including HIV. There is also a Multi-Functional Mobile Social Complex, “CyberTwin” that delivers a complete set of ICT based social services to remote locations. The second paper addressed the delivery of medical services in emergency situations combining mobility and telemedicine technologies. The central component is the Mobile Telemedicine Laboratory (MTL).

The Ryukyu Islands (Okinawa Prefecture), like the state of Hawaii, share similarities with other Pacific Islands. Taking a historical perspective, Sumiko Ogawa, Tadashi Nakasone and Eugene Boostrom looked at infectious disease control in Post World War II Okinawa. The paper analyzes how health workforce policies, decisions, programs and leadership played key roles in controlling infectious disease and promoting health in the post war period. It considers technology transfer from that time through 1972 when Okinawa reverted to Japanese control. There is a focus on mid-level health workers and the accelerated epidemiological transition that took place in Okinawa.

9. VIROLOGY AND HEALTH

CHALLENGES IN CHINA

Dr. Toa Hung, long time chair of the PSA Health and Medical Sciences Committee, organized a session on virology and health challenges in China. Toa Hung and his colleagues highlighted the contributions of electron microscopy in the identification of new viruses. Ebola, HBV, Dane particles, HAV, infantile diarrhea (Group A), HFRS in mainland China, adult diarrhea (Group B) in mainland China, HFRS and SARS were first identified by electron microscopy. Bernard Roizman discussed the engineering of therapeutic viruses. The most promising candidates are the herpes simplex viruses. Albert Cheung Hoi Yu described a mobile diagnostic system that is being developed including technologies such as nucleic acid sequence-based amplification (NASBA) for RNA detection and enhanced real-time (ERT-PCR) that would be appropriate for use in the Pacific. He also discussed the development of a new Lab-on-a-chip (LOAC). Liang Guodong discussed arbovirus research in China with a focus on Japanese encephalitis (JE), dengue fever (DEN 1-4), Tick-borne encephalitis (TBE) and Crimea-Congo Hemorrhagic fever (XHFV). Shu Yuelong outlined human avian influenza surveillance in China. China employs two surveillance systems, one based on the reporting of hospitalized cases of pneumonia of unknown origin and the second is an enhanced, one-month surveillance for cases of influenza-like illness at all health care facilities within a three kilometer radius of a suspected or confirmed H5N1 poultry outbreak. Twenty-three H5N1 viruses were isolated from the confirmed human cases and the full genome of each isolate was sequenced and analyzed.

Luo Guangxiang and colleagues addressed the need to develop more effective and safer antiviral drugs for controlling Hepatitis C virus (HCV) infection. He discussed the recent developments in their lab including the development of transgenic mouse models of HCV infection and replication that will facilitate the development of more specific and safer antiviral drugs. Chen Zhi-Nan presented a number of developments related to the discovery and application of antibody based tumor markers useful for screening, diagnosis, monitoring and determining prognosis of cancer patients. Xu Qunyuan and colleagues presented the results of research on using tissue engineering in combination with stem cell transplants to treat stroke in a rat model using a three dimensional hyaluronic acid (HA). He Jin-Sheng and colleagues reported results of studies in mice that suggest that using Anti-A β1-42 monoclonal antibody may target cytotoxicity and improve learning and memory. Amyloid β-peptide (A β) plays a key role in the pathogenesis of Alzheimer’s disease. Fan Ming reported research on acclimatization and adaptation to acute mountain sickness (AMS) including the study of neuro-endocrine mechanisms. The International Society of High Altitude Medicine has adopted the QINGHAI score as diagnostic criteria for mountain sickness.

10. ABSTRACTS

Almost twice as many health/health care abstracts were received as could be accommodated in the oral paper sessions. The abstracts of the poster presentations are listed in the compilation of abstracts. Space precludes reviewing them all here but they presented a wide range of research results, many of which were companion studies to those presented in the oral sessions. They addressed topics as wide ranging as the 2008 leptospirosis epidemic in New Caledonia, an effective DOT model for
controlling TB in Kiribati, provider-initiated HIV testing and counseling in TB clinics in the Pacific, the diversity of Streptococcus pyogenes in invasive infectious in New Caledonia, effects of malaria control and the health transition in Vanuatu to an evaluation of the anti-inflammatory potential of extracts of plants traditionally used for the treatment of ciguatera in the South Pacific.

11. PSA AND THE WAY FORWARD

The 11th Pacific Science Inter-Congress (PSI2009) in Tahiti, March 2009, was highly successful with almost 900 participants from countries around the globe. It is the largest Pacific Science Inter-Congress ever held and more importantly the papers in all the symposia, including the health symposia, represented high quality, interdisciplinary, international scientific efforts. Some presented cutting edge science while others were more policy focused. Partnering with regional institutions and governments, holding meetings like this is an important goal of the Pacific Science Association. To quote from the Mission Statement of the PSA, “The Association’s focus is on key issues and problems in the region with the goals of engaging science in the service of human needs and improving both the environment and the quality of life of the region’s peoples. To achieve this mission the PSA serves as a catalyst for scientific and scholarly collaboration; develops scientific capacity within the region; fosters effective communication between scientists, policy makers, and the public; actively involves Pacific Island states in regional and scientific activities; and promotes the “Science of the Pacific” [5].

The Pacific Ocean is the defining geographic characteristic and the region includes countries or definitive geographic areas within or bordering the Pacific Ocean. Membership is also open to countries that have major scientific interests in the region. While the focus of this meeting which was held in conjunction with the 2nd symposium on French Research in the Pacific was logically on the Pacific Islands, especially French Polynesia and New Caledonia (and Wallis and Futuna), the activities of the PSA are far more extensive and the PSA footprint reaches from North, Central and South America across the island arcs to the all Asian nations bordering the Pacific, and Russia, Australia and New Zealand. The next Congress, the 22nd, will be held in Kuala Lumpur, Malaysia, in 2011 under the auspices of the Akademi Sains Malaysia and associated institutions. The PSA Executive Board welcomes your input and involvement in developing an exciting array of health sessions for that meeting.

11. ACKNOWLEDGEMENTS

The authors thank all the organizers of PSI2009, especially Pierre Merry and Priscille Frogier and the governments of France and French Polynesia for their generous support. The authors also acknowledge the many research organizations that supported the meeting. We also thank all the researchers who presented their results at the meeting.

12. REFERENCES

Appendix I

PSI2009 Symposium on Health Challenges in the Pacific: Infectious Diseases, Non-communicable Diseases and the Health Workforce

Monday March 2nd, 2009 - Infectious and Vector-borne Diseases I
Chairperson(s): Rémy Tessou, Nicolas Goffard
14:00 Bioinformatics applied to infectious diseases, Nicolas Goffard
14:20 PacNet: An early warning system to prevent and control outbreaks of infectious diseases in the Pacific Islands, Tom Kiedrzynski, Christelle Lepers and Axel Wiegandt
14:40 Leptospirosis as a major public health concern in New Caledonia: The need for a multidisciplinary approach, Cyrille Goarant, Frédérique Vernel-Pauliac, Julie Perez, Fabrice Brescia, Mathieu Picardeau, Farida Nato and Suzanne Chanteau
15:00 Why contact tracing in TB is important for Pacific islands, Janet O’Connor, Kerri Viney and Axel Wiegandt
15:20 Multidrug-resistant tuberculosis in the Pacific, Axel Wiegandt, Janet O’Connor and Kerri Viney
15:40 Implementing molecular tools to quickly detect arbovirus introduction in French Polynesia, Claudine Roche, Marc Grandadam, Jérôme Viallon, Hervé Bossin, Stéphane Lastère, Jérome Marie, Stéphane Loncke and Van-Mai Cao-Lormeau
16:00 BREAK
16:30 Population genetic study of variants of genes conferring resistance to severe dengue disease, Anavaj Sakuntabhai and Richard Paul
16:50 History and particular features of dengue epidemiology in French Polynesia, Van-Mai Cao-Lormeau, Claudine Roche, Elodie Descloux, Jérôme Viallon, Stèphane Lastère and Axel Wiegandt
17:10 Targeting mosquito vector populations to curb disease transmission in the Pacific, Hervè Bossin, Ngoc Lam Nguyen, Anne-Marie Legrand, Catherine Plichart, Jérome Marie, David Mercer and Stephen Dobson

Tuesday March 3rd, 2009 - Keynote lecture on Health Challenges in the Pacific: Infectious Disease, Non-Communicable Disease and the Health Workforce
8:15 What About the Workers? Where are Health Workers Going, Why and With What Impact? John Connell

Tuesday March 3rd, 2009 - Infectious and Vector-borne Diseases II
Chairperson(s): Nancy Lewis, Isao Nakajima
9:00 Vector surveillance and control of Aedes aegypti in New Caledonia, Edouard Bourguet, Laurent Guillauumont, Anne Pfannstiel, Aurélie Guigon, Martine Noel, Jean-Paul Grangeon and Suzanne Chanteau
9:20 Dengue-specific T-cell responses in Hawaii and French Polynesia, Allison Imrie, Munkhzul Sukhbaatar, Janet Meeks, Claudine Roche and Van-Mai Cao-Lormeau
9:40 Predominance of ST306 serotype 1 among invasive Streptococcus pneumoniae in the South Pacific, Simon Le Hello, Marc Levy, Jean François Yvon, Françoise Charavay, Mitchell Brown, Severine Pageand Benoît Garin
10:00 BREAK
10:30 The challenge of filariasis control in French Polynesia, Ngoc Lam Nguyen, Anne-Marie Legrand, Hervé Bossin, Catherine Plichart, Jérome Marie, Sylviane Teurural, Marc Faaruia, V’eronicne Mou, Clemence Gatti and Ralph Pawlowiez
10:50 Statement of appeal on an integrated information and communications network for Avian Influenza, Isao Nakajima, Masatugu Taishi, Yasunitstu Tomioka and Leonid Androuchko
11:10 Satellite tracking of bird migration, Noritaka Ichida
11:30 Legislation poses a challenge for HIV/AIDS intervention programmes targeted at Pacific men who have sex with men (MSM), Edward Moala
11:50 The impacts of sexual behaviours on HIV infections in MSM in the Pacific Region, Edward Moala
12:10 Consensus document on HIV testing algorithm and STI case definition in the Pacific, Sophaganine Ty Ali and Axel Wiegandt
12:30 Lunch break

Tuesday March 3rd, 2009 - Non-Communicable Diseases II
Chairperson(s): Annick Fontbonne, Mireille Chinain
14:00 Multisectoral trans-disciplinary approach to prevention and control of NCD in the Pacific, Viliami Puloka, Jeanie McKenzie, Karen Fukofuka and Axel Wiegandt
14:20 Paradoxical relationships between anthropometric variables and phenotypic expression of the metabolic syndrome in non-diabetic Polynesians of New Caledonia, Annick Fontbonne, Amandine Cournil, Roselyne Defay, Annie Lacroux and Sylvie Laumond-Barnaud
14:40 Mercury exposure and cardiovascular risk factors among adults of French Polynesia, Beatriz Valera, Eric Dewailly, Paul Poirier, Edouard Suhas, Emilie Council and Rémy Tessou
15:00 The dietary transition in French Polynesia: What objective scores to measure its extent and components?, Emilie Council, Annie Ferland, Pierre Julien, Edouard Suhas, Rémy Tessou and Eric Dewailly
15:20 Glycemic index in relation to nutrient intake, body composition, and metabolic risk factors in French Polynesia, Annie Ferland, Emilie Council, Marie-Ludvine Chateau-Degat, Edouard Suhas, Rémy Tessou, and Eric Dewailly
11:40 Antibody based tumor markers: Discovery to practice, Zhi-Nan Chen
12:10 A study on experimental therapy of a rat model of stroke by tissue engineering with hyaluronic acid based scaffold, Xu Qunyuan, Wang Ying, Hou Shaoping, Tian Weiming and Cui Fuzhai
12:40 Mountain medicine in China, Ming Fan
13:10 Anti-Aβ1-42 monoclonal antibody mainly binding to oligomer and protofibrils may target the cytotoxicity and improve learning and memory in SAMP8 mice, Jin-Sheng He, Ying Zhang, Xin Wang, Fu-Xiang Bao, Yi-Qing Li, Xiao-Bo Wang and Tao Hong