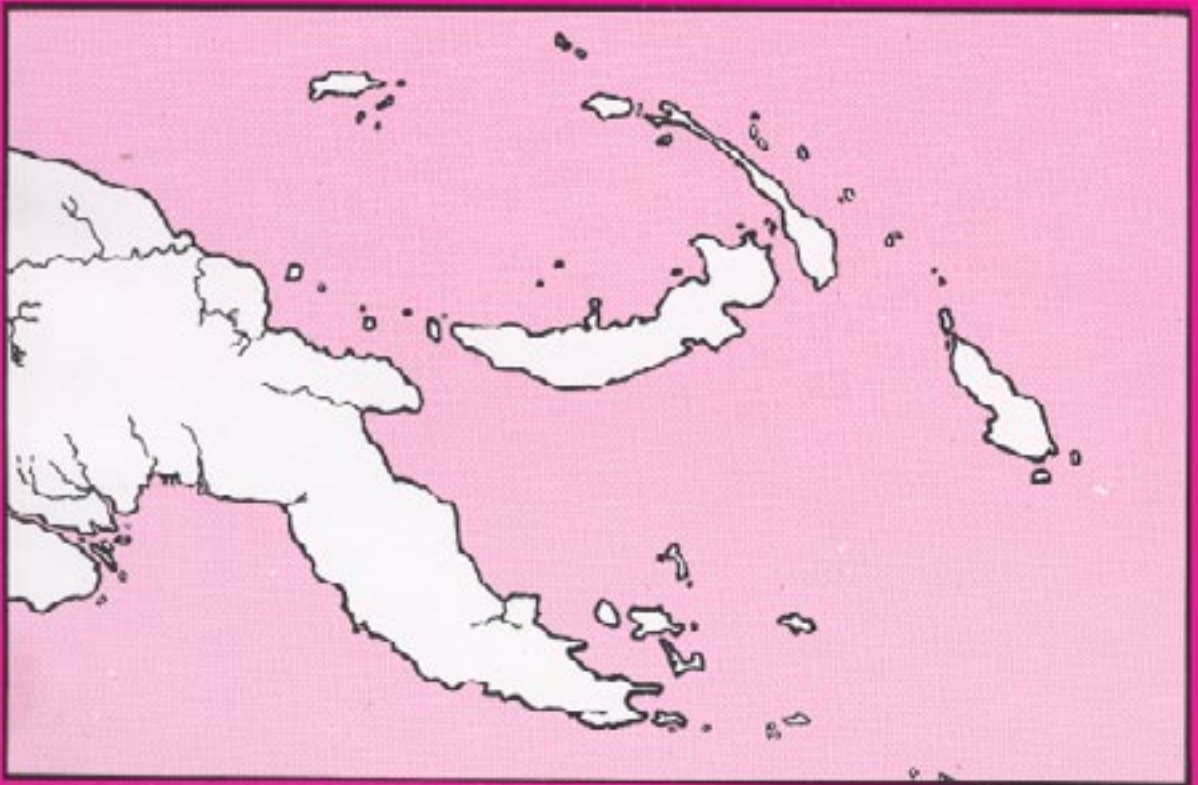


ISSN 0031-1480

PAPUA NEW GUINEA MEDICAL JOURNAL



VOL. 56, NO 1-2, MARCH-JUNE 2013

Medical Society of Papua New Guinea

Executive 2013

President:	Nakapi Tefuarani
Vice-President:	Nicholas Mann
Secretary:	Sylvester Lahe
Treasurer:	Glen Mola
Executive Member:	Evelyn Lavu

ACKNOWLEDGEMENT

We are grateful to the Government of Australia through AusAID for providing funding for the publication of this issue of the Journal.

The Editors



Papua New Guinea Medical Journal

ISSN 0031-1480

March-June 2013, Volume 56, Number 1-2

EDITORS: PETER M. SIBA, NAKAPI TEFUARANI, FRANCIS HOMBHANJE
GUEST EDITORS: ANNEMARIE LAUMAEA AND CERIDWEN SPARK

Editorial Committee

B. Amoa	J. Millan
G. Mola	J. Vince

Assistant Editor: Cynthea Leahy

Emeritus Editor: Michael Alpers

Email: pngmedj@pngimr.org.pg
Web page: <http://www.pngimr.org.pg>

- * Registered at GPO, Port Moresby for transmission by Post as a Qualified Publication.
- * Printed by Moore Printing for the Medical Society of Papua New Guinea.
- * Authors preparing manuscripts for publication in the Journal should consult 'Information for Authors' inside back cover.

CONTENTS

EDITORIAL

- Health services for all in 2050 – getting the balance right *J.D. Vince* 1

ORIGINAL ARTICLES

- Perceptions and use of maternal health services by women in rural coastal Madang Province *S. King, M. Passey and R. Dickson* 5
- A comparative study of intestinal helminths in pre-school-age urban and rural children in Morobe Province, Papua New Guinea *J.M. Shield and F. Kow* 14

Women in Health and Medicine in Papua New Guinea**EDITORIAL**

- Papua New Guinean women in health and medicine: celebrating women's achievements *A. Laumaea and C. Spark* 32

ORIGINAL ARTICLES

- Run to Win – the dedication, commitment and service of Judy Yaiyon *P. Aupae, R. Aupae and S. Aupae* 34
- The story of Francisca Trimas *T. Meki* 38
- Mother's love for bacterial babies: the commitment of Audrey Michael, Miton Yoannes and Tilda Orami to medical research *T. Gibbs and G. Vilakiva* 43
- Papua New Guinea's next generation of medical researchers: Celestine Aho, Patricia Rarau and Pamela Toliman *G. Vilakiva and T. Gibbs* 50
- Julie Kamblijambi-Kep – PhD candidate at RMIT University, Australia *M. Masta* 55
- The founder of the Friends Association – Tessie Soi *O. Topurua* 59
- Susan Setae and the Papua Hahine Social Action Forum *A. Laumaea* 64
- Turning negatives into positives: the life and work of Naomi Yupae *C. Spark* 67
- Humble beginnings: from Lalaura to the board rooms of Papua New Guinea – the story of Dr Evelyn Lavu *C. Spark* 74

MEDLARS BIBLIOGRAPHY

79

EDITORIAL

Health services for all in 2050 – getting the balance right

Vision 2050, the blueprint for the development of Papua New Guinea (PNG) over the next three and a half decades, envisages that by 2050 “we will be a Smart, Wise, Fair, Healthy and Happy society” (1). It may be pertinent to consider what role we as members of the medical and health professions should play in achieving this vision.

It is important to appreciate that health is not the prerogative solely of the medical profession. A healthy society results when its people are educated and understand that health is not just the absence of disease, know how to prevent ill-health and have access to an acceptable level of care when sickness occurs. This means that education, road and other transport systems and infrastructure, town planners, public health engineers and others all have major roles to play. But the medical and health professions are vital and have an important role in ensuring health and equity in health for the people of Papua New Guinea.

Readers of this editorial will not need to be reminded that Papua New Guinea has an under five mortality rate (U5MR) of around 60/1000 live births and infant mortality rate (IMR) of around 50/1000 live births, almost half of which is accounted for by neonatal deaths, has the highest maternal mortality rate (MMR) in the region and has a life expectancy of 62 years (2,3). Female literacy is estimated as less than 60% and approximately 50% of PNG's women deliver their babies unsupervised at home. Approximately 1 in 100 women will die as a result of pregnancy or childbirth (4). In comparison the corresponding figures for Fiji are U5MR 17/1000, IMR 15/1000, an MMR less than one-tenth that of PNG and life expectancy 69 years (3,4). Infectious disease is still by far the commonest cause of death in children and in adults, but there is a rapidly escalating epidemic of noncommunicable diseases fuelled by underlying genetic propensity and changes in diet and lifestyle (5). Tuberculosis (TB) is out of control and the emergence of multidrug-resistant organisms and of extremely-drug-resistant

organisms is of very major concern (6). The population growth rate is 2.7% – a doubling time of around 25 years, with the urban sector growing much faster, accompanied by unplanned settlements with overcrowding, poor hygiene and social tensions. The ratio of health worker to population in 2000 was 0.58/1000 (5) – one-fifth that in Fiji and Samoa. A substantial proportion of the work force will have reached retirement age within the next 10-15 years. It is against this background that the Government, the National and Provincial Departments of Health and the medical and health professions should think about the way forward. The National Health Plan is visionary and ambitious, with a ‘Back to Basics’ approach aiming at “strengthened primary health care for all and improved service delivery for the rural majority and the urban disadvantaged”. The plan also envisions specialist services at all provincial hospitals and the establishment of at least four regional specialist hospitals. Specialist services are expensive and important questions need to be asked and answered in relation to the type and scope of such services.

Inevitably there are tensions between clinicians, particularly specialists, and policy-makers as to the levels of subspecialization and technical requirements which are achievable, affordable and practical. Clinicians wish to do the best for their patients. Specialists and subspecialists are highly trained, usually with exposure to overseas practice involving highly technical diagnostic and treatment modalities. The desire to see such diagnostic and treatment facilities in Papua New Guinea is therefore not surprising. The hard reality, though, is that the PNG government is currently spending about 120 kina per person per year (5). This does not cover the cost of a single day in a hospital bed. Costs of hospital care in the public sector are not readily available, but a recent estimate of average cost per inpatient day in Palestinian hospitals of 90 \$US and in a tertiary burns unit in India of 125 \$US give some idea of the likely costs in PNG (7,8). The government has a responsibility to spend its money in a way which provides the best outcomes for the majority of the population.

We have to ask ourselves difficult questions and we may have to admit that whilst highly trained clinicians should have their say they are not necessarily the appropriate people to make decisions on how the health budget is spent. Do we want to see a country with state of the art dialysis units, coronary artery bypass surgery and highly sophisticated medical imaging for relatively few patients whilst tuberculosis is out of control with multidrug-resistant organisms, infectious diseases top the mortality charts, the noncommunicable disease epidemic marches on unchecked with people dying from untreated or inadequately treated diabetes and hypertensive disease, and people in rural areas are denied access to basic high-quality medical, surgical and other services?

Technology plays an important part in health services, but there is a need for careful and objective assessment of the place of sophisticated high technology in countries such as Papua New Guinea. The introduction of ultrasound into PNG in the early 1980s was greeted by some with a degree of scepticism, but within a relatively short time ultrasonography became widely available and has doubtless improved obstetric care and the non-invasive diagnosis of conditions such as pericardial effusion and renal and biliary calculi (9,10). Portable ultrasound machines can now be carried on rural health patrols. The recent introduction of oxygen concentrators linked with pulse oximetry and tied to training of staff has been demonstrated to reduce the mortality of children by as much as 35% (11). These are examples of relatively recent and relatively inexpensive technology which benefit large numbers of people. At the same time long-established diagnostic investigations – the simple X-ray and basic laboratory tests – whilst usually available in Port Moresby and the bigger hospitals are often non-functional or non-existent at smaller hospitals.

We live in exciting times. The prospect of almost unimaginable wealth from the extraction industries is tantalizing but how that wealth will be used to plan for and ensure the health of the population and to address the major problems of illness affecting the people of PNG is by no means clear.

In deciding how the country progresses in terms of health service provision government agencies and the people in them have a difficult

task and have to make difficult choices. They are bombarded by interest groups pushing their own agendas, by politicians who may not have a broad understanding of the issues involved, and, yes, by doctors with special interests. At one extreme, the government could stop further development of hospital services and facilities and concentrate instead on the TB control program (which admittedly might include the construction and staffing of infectious disease units!), the HIV/AIDS (human immunodeficiency virus/acquired immune deficiency syndrome) and sexually transmitted infection (STI) programs, family planning, maternal and child care and vaccination. At the other extreme it might choose to put the vast majority of its money into the building and furnishing of highly sophisticated superspecialty hospitals. Both extremes are untenable. In between these extremes it might opt for ensuring that all district health facilities, as well as the larger hospitals, are adequately staffed for their curative and preventive activities and have functional and well-maintained basic equipment. Decisions should be informed and objective, and it is crucial that the decision-makers get the balance right between improving curative services in the major centres, improving the less sophisticated services at the district hospitals and health centres, and providing sensible, practical and effective public health preventive interventions. The National Health Plan – whilst perhaps not to everyone's taste – is a good attempt at getting the balance right.

The plan outlines 8 key result areas (KRAs) to be achieved by 2020:

- Improve service delivery
- Strengthen partnerships and coordination with stakeholders
- Strengthen health systems and governance
- Improve child survival
- Improve maternal health
- Reduce the burden of communicable disease
- Promote healthy lifestyles, and
- Improve preparedness for disease outbreaks and emerging health issues.

Objectives and strategies for their achievement are outlined for each of the KRAs. Under improved service delivery the plan is to reinvigorate community-based services with the introduction of the Community Health Post, staffed by a minimum of three health workers with combined expertise in maternal and child health and community health in addition to general health service provision, the establishment of a district hospital in every district with medical officers on staff, the provision of specialist services in all provincial hospitals and the rehabilitation of at least four major provincial hospitals as regional specialist hospitals by 2030. All health institutions are expected to meet the appropriate Minimal National Standards.

These objectives are certainly laudable, but they require adequate numbers of appropriately trained health workers and they beg the question of where these health workers will be trained. The Papua New Guinea Development Strategic Plan 2010-2030 postulates an output of 200 new graduate doctors by 2021, 400 by 2022 and 700 by 2025. The strategic plan provides even more startling figures for nurses and community health workers (CHWs), projecting an annual output of 3000 nurses by 2025 and 2100 CHWs by 2024 (12). The recent World Bank report on Human Health Resources indicates that these figures are unachievable, and provides a "Recommended Preservice Training Scenario to Meet Key Health Human Resource Needs" (13). This scenario indicates a more realistic output of 100 medical graduates by 2019, 150 by 2023 and 200 by 2028. Comparable figures for both nurses and community health workers are 500 by 2019, 700 by 2023 and 800 by 2028. Given that the School of Medicine and Health Sciences is currently graduating between 45 and 50 doctors per year, nursing schools around 160, and CHW schools around 210, there is much to do if these relatively modest targets are to be met. The recommended scenario "leaves space for recurrent health resources to be allocated to a significant expansion of training – both preservice and inservice. It also leaves space for increased allocation of both support staff and quality-enhancing nonsalary budgets so necessary for improved health outcomes". Many health training institutions are currently understaffed and all are inadequately resourced. The training of adequate numbers of doctors, nurses, community health workers and other

health professionals in appropriately staffed and resourced training institutions and the provision of career structures and incentives to keep them in the workforce present major challenges.

The allocation of government funding to the various service departments is itself a major balancing act. If the government is serious about achieving Vision 2050 it must make hard decisions to get the balance right and it must make a major investment not only in health service facilities but also in health training institutions.

As medical officers in our various disciplines and as health professionals, we all have our particular interests. But we should also be prepared to take a wide and balanced view of the development of health services in the future and do all that we can to persuade those making the important decisions to make them in the best interests of the majority of Papua New Guineans. It is vital that they get the balance right.

John D. Vince

School of Medicine and Health Sciences
University of Papua New Guinea
PO Box 5623
Boroko
National Capital District 111
Papua New Guinea
johndvince@gmail.com

REFERENCES

- 1 **Papua New Guinea Department of Treasury.** Papua New Guinea Vision 2050. Port Moresby: Department of Treasury, 2011:xii. www.treasury.gov.pg/html/publications/files/pub_files/2011/2011.png.vision.2050.pdf
- 2 **National Statistical Office of Papua New Guinea.** Demographic and Health Survey 2006. Chapter 7, Infant, Child and Maternal Mortality. Port Moresby: National Statistical Office, 2009:99-111.
- 3 **United Nations Children's Fund.** State of the World's Children 2012: Children in an Urban World. Statistical Tables: Table 1. Basic indicators. New York: UNICEF, 2012:88-91. www.unicef.org/sowc2012
- 4 **United Nations Children's Fund.** State of the World's Children 2012: Children in an Urban World. Statistical Tables: Table 8. Women. New York: UNICEF, 2012:116-119. www.unicef.org/sowc2012
- 5 **Government of Papua New Guinea.** National Health Plan 2011-2020. Back to Basics: Strengthened primary health care for all and improved service delivery for the rural majority and urban disadvantaged. Volume 1. Policies and Strategies. Port Moresby: Government of Papua New Guinea, Jun 2010. www.wpro.who.int/health_services/papua_new_guinea_nationalhealthplan.pdf
- 6 **Amini J, Poka H, Kumbu J, Pomat N, Ripa P,**

- Tefuarani N, Vince JD, Duke T.** The crisis of tuberculosis in Papua New Guinea – the role of older strategies for public health disease control. *PNG Med J* 2012;55:1-4.
- 7 **Younis MZ, Jaber S, Mawson AR, Hartmann M.** Estimating the unit costs of public hospitals and primary healthcare centres. *Int J Health Plann Manage* 2012;Nov 5. doi:10.1002/hpm.2147
 - 8 **Ahuja RB, Goswami P.** Cost of providing inpatient burn care in a tertiary teaching hospital of North India. *Burns* 2013;39:556-564.
 - 9 **Amoa AB, Wapi J, Klufio CA.** Longitudinal fetal biometry of normal pregnant Melanesian Papua New Guineans to construct standards of reference for Papua New Guinea. *PNG Med J* 1993;36:219-227.
 - 10 **Richens J.** Experience with ultrasound on a medical ward in Papua New Guinea. *Trop Doct* 1987;17:99-103.
 - 11 **Duke T, Wandt F, Jonathan M, Matai S, Kaupa M, Saavu M, Subhi R, Peel D.** Improved oxygen systems for childhood pneumonia: a multihospital effectiveness study in Papua New Guinea. *Lancet* 2008;372:1328-1333.
 - 12 **Department of National Planning and Monitoring.** Papua New Guinea Development Strategic Plan 2010-2030. Part 4. Land, services, transport and utilities development strategies, 4.3 Health. Port Moresby: Department of National Planning and Monitoring, Mar 2010:47-53. http://www.treasury.gov.pg/html/publications/files/pub_files/2011/png-development-strategic-plan.2010-2030.pdf
 - 13 **World Bank.** Papua New Guinea (PNG) Health Workforce Crisis: A Call to Action. Scenario 5, A Recommended Preservice Training Scenario to Meet Key Health Resource Needs. Washington, DC: World Bank, 2011:125-133.

Perceptions and use of maternal health services by women in rural coastal Madang Province

SUE KING^{1,2}, MEGAN PASSEY^{1,3} AND RUMONA DICKSON^{1,4}

Papua New Guinea Institute of Medical Research, Goroka

SUMMARY

Maternal mortality remains exceptionally high in Papua New Guinea (PNG) at 733 per 100,000 live births. There has been little, if any, improvement in maternal mortality or maternity services since the 1980s. In 1992-1993 a survey of 550 women in rural coastal areas of Madang Province was undertaken to investigate the prevalence of maternal risk factors and parous women's utilization of and attitudes towards the existing health services. Women were classified as at risk on the basis of previous obstetric complications, parity, stillbirths and neonatal deaths. On this basis 67% of women were classified as being at risk in a future pregnancy. High rates of obstetric complications were reported, with only 42% of women delivering their most recent child in a health facility. There was no statistical difference between those not at risk and those at risk in terms of their use of antenatal care or having been referred for a health centre delivery. The most common reason given for not utilizing the existing health services was lack of access. Most commonly expressed positive perceptions of a health centre delivery were the availability of medical help (59%) and the physical comfort of the health centre (48%). Most common negative views expressed were lack of physical comfort (29%) and the attitudes of staff (11%). Women's opinion on village births was divided. Many (47%) thought that there was nothing good about a village birth and the same percentage cited lack of medical care if problems arose. On the other hand 36% of women thought there was nothing wrong with a village delivery, and 30% cited the care and respect received from relatives as a positive aspect. When asked for suggestions on how services could be improved only a minority of respondents expressed an opinion. Those who did wanted better access, more information on family planning and improved care and respect from staff.

Background

The health of women in Papua New Guinea (PNG) has been of significant concern for many years, with multiple reports of the dire state of women's health, particularly in regard to high birth rates, high maternal mortality rates and high neonatal death rates (1-8). Maternal care for rural women is delivered through maternal and child health (MCH) clinics, but the focus of these clinics has historically been on child health with neglect of maternal health (7,8). Utilization of these

clinics by women is also less than ideal. In 1987 it was estimated that nationally 68% of pregnant women attended an antenatal clinic and 43% of births were supervised (4). For Madang Province, 49% of women received antenatal care and 31% delivered in a health facility in 1989 (9). Unfortunately there has been little improvement in the intervening years (10).

In the late 1980s the Papua New Guinea Institute of Medical Research (PNGIMR), in conjunction with United Nations Children's

1 Papua New Guinea Institute of Medical Research, PO Box 60, Goroka, Eastern Highlands Province 441, Papua New Guinea

2 Present address: 115 Wilson St, Brunswick, Victoria 3056, Australia

3 Corresponding author: University Centre for Rural Health – North Coast, School of Public Health, University of Sydney, PO Box 3074, Lismore, New South Wales 2480, Australia
megan.passey@ucr.edu.au

4 Present address: Liverpool Reviews and Implementation Group, Whelan Building, University of Liverpool, Liverpool L69 3GB, United Kingdom

Fund (UNICEF), commissioned a review of the literature in relation to the health of women in PNG. This was published as a PNGIMR monograph (4) and provided a comprehensive overview of the issues relating to the state of women's health and the delivery of health services. Over 10,000 copies of the monograph were distributed to health centres and aid posts throughout the country.

Following the publication of the monograph, a modified Delphi technique was used to gain insight from government and non-government sectors involved in the delivery of health care for women in the country (11). The culmination of the process was a one-day strategic planning meeting involving almost 100 delegates to identify factors that enhanced the health of women and strategies to improve their access to health care. The results of the day included specific project ideas to move these strategies forward. It is interesting to compare the report of this strategy meeting to the recent (2009) PNG Ministerial Taskforce on Maternal Health in Papua New Guinea (10). The issues raised have not changed. Nor has the maternal mortality rate improved. For the period 1984-1986, the maternal mortality ratio was estimated to be 700 per 100,000 live births (2). For the period 1994-2006 it is estimated to be 733 per 100,000 live births (10).

Here we report on a study undertaken in 1992 and 1993 to gather information on the prevalence of maternal risk factors and women's perception and utilization of maternal health services. Although the information is now dated, we are reporting it due to our concern at the lack of progress in reducing maternal morbidity and mortality in PNG. The article is based on a previous report to the World Health Organization (WHO) and the PNG Department of Health. We present this information in the hope that it may still be of benefit in improving maternal health services.

Methods

This cross-sectional, community-based survey was undertaken in rural coastal areas of Madang Province, between September 1992 and September 1993. Women aged 15 to 45 years living more than 10 km from the centre of Madang town, within 25 km of the coast and below 800 metres above sea level, who had given birth in the past 5 years, or who were currently pregnant, were eligible to

participate in the survey. Ethical approval for the study was provided by the PNG Medical Research Advisory Committee.

Selection and recruitment

A stratified cluster sampling method was used. Village population estimates, based on the 1990 census, were used to estimate the eligible female population aged 15 to 45 years. This data set was used to stratify villages by census division, from which villages were then randomly selected. Within villages women were selected on the basis of their availability on the day of the village interviews with a maximum of 25 interviews per cluster. In cases where there were fewer than 25 eligible women available in the selected village an attempt was made to interview women in the closest neighbouring village. A total of 26 clusters were chosen giving a maximum of 650 women to be interviewed.

The villages were contacted in advance, informed about the purpose of the study and what was involved, and their cooperation requested. No village refused to participate. The study team, consisting of a supervisor (SK) and four experienced interviewers, visited the villages and conducted the interviews on pre-arranged days. Individual women were informed about the purpose of the study and all gave their oral informed consent.

Data collection

The interviewers, some of whom had done similar work previously with the Institute of Medical Research, were trained in the use of the questionnaire. The questionnaire was pilot tested in several non-selected villages and modified accordingly. The questionnaire took 20 to 30 minutes to administer and collected information on the woman's obstetric history, use of maternal health services, perceptions of the services, barriers to their use and suggestions for improvements, as well as basic demographic data.

For each pregnancy they were asked whether the child was still alive or not. If the child was dead, they were then asked when it died in relation to the birth. The outcome was recorded as alive, stillbirth, early neonatal death (within one week of birth), a subsequent death (after one week of birth), a miscarriage or currently pregnant. For each pregnancy and delivery, mothers were questioned about

the occurrence of the following complications: premature rupture of membranes (defined here as rupture of the membranes more than 24 hours before the onset of labour), prolonged labour (labour lasting more than 24 hours), assisted delivery (forceps, vacuum extraction or caesarean section), breech presentation, eclampsia, postpartum haemorrhage, ruptured uterus, retained placenta or postpartum infection. In addition, for the most recent pregnancy, women were asked about bleeding during the pregnancy and abnormal swelling of hands and feet. In addition, women were asked about their use of antenatal and delivery services for each pregnancy.

Validation from health centre records

All health centres and hospitals in PNG are required to maintain a birth register in the labour ward, which records the details for all women admitted. An attempt was made to validate the data from the interviews by reviewing the birth books at the health centres for those births which the mother had reported as occurring in a health facility. After entering the interview data on the study database, a report was obtained for all births reported to occur in a health facility, as well as the details of that birth as reported by the mother. This was then used to try to identify mothers in the birth books and determine the correlation between the records.

Data analysis

All data were double-entered and checked using the FoxPro data management system. Analysis was performed using FoxPro and Epi Info 5.01. The perinatal mortality rate was calculated as the number of stillbirths plus neonatal deaths within the first 7 days of life, divided by the total number of stillbirths and live births, multiplied by 1000.

Women were considered to be at risk in their most recent pregnancy if they were parity 0 or ≥ 4 at the time; developed bleeding or abnormal swelling during the pregnancy; had a breech presentation or twins during the last pregnancy; or had a history of one of: long labour, surgical delivery, postpartum haemorrhage, ruptured uterus, retained placenta, stillbirth or early neonatal death. Women were considered to be at risk in future pregnancies if they are now para 4 or more or had a history of one of these risk factors.

Results

A total of 550 women were interviewed, giving details of 2356 pregnancies. Many of the villages had fewer than 25 eligible women, and for some clusters there were difficulties obtaining 25 interviews, despite going to one or more extra villages. In total the survey team visited 47 villages, with a minimum of 16 and a maximum of 25 completed interviews per cluster.

The women ranged in age from 17 to 49 years, with a mean age of 29 (standard deviation [s.d.] 6.6). Their parity ranged from 0 to 13 with a mean of 4.1 (s.d. 2.5). 40% of women ($n = 218$) had not attended school at all, and only 40 (7.3%) had any post-primary schooling.

Pregnancies, risk factors and outcomes

Of the 2356 pregnancies experienced by the women (mean = 4.3), 61 were current and 2295 completed pregnancies; 2236 were reported as being full term. There were high levels of mortality, with 59 miscarriages (2.5% of all pregnancies), 67 stillbirths (3%), 55 early neonatal deaths (2%) and 162 deaths after day 7 (7%). The perinatal mortality rate was calculated as 55 deaths per 1000 births.

A total of 261 of the women had experienced at least one obstetric complication (48% of those who had had a full-term pregnancy) (Table 1). Of the 2236 full-term pregnancies, 517 (23%) had been complicated by at least one of these problems. Additionally, 14 women reported bleeding during their last pregnancy (3%), and 33 women reported abnormal swelling of hands or feet during their last pregnancy (6%).

The information on complications, parity, stillbirths and neonatal deaths was used to determine the number of women at risk in their last pregnancy and the number who would be at risk should they become pregnant again. The results are shown in Table 2.

Use of services and referrals by the antenatal clinic

100 women (18%) reported having no antenatal care during their last full-term pregnancy and 13% reported never having had antenatal care. In total, women did not receive any antenatal care for 531 (23%) of

TABLE 1

PREGNANCY COMPLICATIONS REPORTED BY WOMEN

Complication	Cases		Women	
	N	% of full-term pregnancies	N	% of women*
Premature rupture of membranes	71	3.2	53	9.7
Prolonged labour	139	6.2	92	16.9
Forceps delivery	33	1.5	21	3.9
Vacuum extraction	24	1.1	18	3.3
Caesarean section	16	0.7	15	2.8
Breech presentation	34	1.5	29	5.3
Eclampsia	64	2.9	44	8.1
Postpartum haemorrhage	205	9.2	141	25.9
Ruptured uterus	3	0.1	3	0.6
Retained placenta	82	3.7	49	9.0
Postpartum infection	175	7.8	90	16.5

*Percentage of women who had had a full-term pregnancy

TABLE 2

WOMEN AT RISK

Risk	N	% of women
Parity ≥ 4	216	39.3
Previous stillbirth or neonatal death	97	17.6
At least one previous complication or one other risk factor	395	71.8
Women at risk in future pregnancies	369	67.1
Women at risk in last pregnancy	414	75.3

the reported pregnancies. The majority of births took place in the village including 1374 (61%) of all full-term births, with 843 (38%) in a health facility and 19 (1%) in other locations. 42% of the women delivered their last child in a health facility.

Use of antenatal services and referral for

a health facility delivery were similar among women at risk and those not classified as at risk. While 335 of 414 women (81%) classified as high risk in their last pregnancy received antenatal care, 115 (88%) of those not classified as high risk received antenatal care. Of those who received antenatal care, 68% at high risk and 57% of those not at risk

were referred for a health facility delivery. There were no significant differences between the proportions of women receiving antenatal care in the two risk categories, nor between the proportions referred in each category.

If they had been advised to have a health facility delivery, the women were asked what reason they had been given. The vast majority of the women did not recall being told of any specific risk they may have been facing in that pregnancy, but just that it was generally better to deliver in a health facility in case they developed a complication.

While only 38% of all deliveries took place in a health facility (42% for the most recent delivery), 64% of women had had at least one health facility delivery. Only 24% of women had delivered all their children in a health facility, 21% had delivered at least half but not all of their children in a health facility, and 19% had delivered less than half their children in a health facility but had used a health facility for at least one delivery. 60% of women either always use the delivery services or never use them. There was a strong association between education level and use of delivery services, with women with higher levels of education using the services more ($X^2 = 57.14$, $p < 10^{-8}$).

Women's attitudes toward the health services

Women who had been to the antenatal clinic in their last pregnancy were asked to give their opinion on the positive and negative aspects of attending the antenatal clinic. Those women who had not attended an antenatal clinic in their last pregnancy were asked why they had not done so. Those who had ever delivered in the village were asked to give their opinion on the positive and negative aspects of delivering their baby in the village and those who had ever delivered in a health facility were asked similar questions regarding delivering in a health facility. All women were asked what they would like to change about the health services for women. For each of these questions, an open-ended format was used, and the responses subsequently categorized. More than one response was allowed. The data are presented in Table 3.

Antenatal clinics

A total of 477 women responded to this

aspect of the interview. 70% of the women indicated that there was nothing negative about the clinics. The most common positive responses related to obtaining medical care, specifically medicines for the mother or the infant (82%). The second most common positive aspect was receiving information or advice (39%). On the negative aspects a small minority of women (9%) commented on a lack of care or respect accorded to them by the clinic staff, who they reported as being 'cross or hard'.

Among the 101 women who did not go to the clinic, the most common reason given was a problem with access (81%). There were also a number of women who reported that they could not be bothered or did not think they needed to go (19%).

Village births

A total of 409 responded to questions related to aspects of having their babies in the village. 47% of women said there was nothing good about having their baby in the village, while 36% indicated there was nothing bad about it. In a similar comparison 18% indicated that physically it was better to deliver in the village where their family can help and they have a bed and food, while 17% thought this was lacking and a problem if they delivered in the village. One positive aspect identified by 30% of the women was the care and respect that they received in the village during the delivery of their babies. A negative aspect identified by 47% of women was that there was no medical support if something went wrong.

Health facility births

A total of 350 women responded to these questions. The majority (59%) of women indicated that the medical support available at the health facilities was very important, while 55% of women indicated that there was nothing negative about delivering at the health facility. Interestingly 48% of women indicated that the positive aspect of delivering at the health facility was the physical comfort (good water, toilets and beds), while 29% indicated that this was a problem in the health facility, where there were not enough beds, the facility was dirty and it was difficult to get food. 9% of women identified problems with medical issues, including lack of medicines, and 11% of women indicated that there was at times a lack of care and respect from staff in the

TABLE 3**WOMEN'S VIEWS OF ANTENATAL CARE AND PLACE OF BIRTH**

	Number (%)
Antenatal clinic (N = 477)	
Satisfied with clinic – no need to change	336 (70%)
Medical issues	389 (82%)
Receive medicine for mother or baby	
Receive treatment	
Receive information and advice	187 (39%)
Reasons for not attending antenatal clinic (N = 101)	
Access issues (too far, does not come to the village)	82 (81%)
Don't know, don't think I need to	19 (19%)
Village births (N = 409)	
Lack of medical care if there is a problem	192 (47%)
Nothing is good about village births	193 (47%)
Nothing is bad about village births	146 (36%)
Physically more comfortable	72 (18%)
Physically less comfortable	70 (17%)
You receive care and respect from family and relatives	123 (30%)
Health facility births (N = 350)	
Medical support if you need it	205 (59%)
Physically more comfortable	167 (48%)
Physically less comfortable	102 (29%)
Changes to health services (N = 550)	
No comment	295 (54%)
Improved access	146 (27%)

health facility.

When asked about suggestions for changing the health services for women, 54% had no suggestions. However, 27% of the women mentioned issues related to improving the access of the services. 10% requested more help with family planning, 9% mentioned improving physical comfort of the health centres and 6% thought the staff should treat

the women with more respect and do their jobs more conscientiously.

Validation from health facility records

The women interviewed were served by seven health centres and the Madang Provincial Hospital. The birth books from these health facilities were searched for records of all the births which the women reported

having occurred in a health facility. Of the 843 reported, only 144 were identified in the birth records. The reasons for this very low return rate are likely to include: the mother using a different name (people in PNG usually have several names and also frequently change names, so it is common to find someone using one name at a health facility and another in the village); poorly kept records (some of the birth books were missing or had large gaps in the dates); occasionally a woman may have claimed to have had a health centre delivery when in fact she delivered in the village. The relative contribution of these factors is not possible to assess.

Of the 144 births identified, 85 (59%) were in complete agreement, and a further 14 differed only on sex, date of birth or parity, and these differences were small. Thus a total of 99 (69%) were either in complete agreement or differed on a point not related to the level of complications and/or in which we consider our data more likely to be correct.

The remaining differences were related primarily to details of delivery (use of forceps) or complications reported by the women and not by the health facility or vice versa. Complications that had been noted by the women that did not appear in the health facility record included: postpartum haemorrhage (10 cases), prolonged labour (16 cases), eclampsia (4 cases), retained placenta (1 case) and 1 case where the mother reported twins (currently still alive) of whom the birth book made no mention. Details in the health facility record that were not noted by the mother included breech presentation in 7 cases.

In general we found the birth books to be poorly kept, with little information, which was inconsistently recorded. It is unfortunate that we were not able to use the actual labour notes for the validation as historically these have provided a more complete and reliable record of the details of a given birth.

Discussion

This study identified a number of issues in relation to obstetric history and the provision of antenatal and birthing services for women in rural Madang Province. The women reported high rates of parity and complications in pregnancy meaning that the majority of women would be classified as high risk in

their last and future pregnancies. While the majority of women received antenatal care, a sizeable proportion did not. Of even greater concern is that the majority of deliveries had taken place in the village, and there was no difference in the rate of health facility delivery by risk status.

The women's responses to the questions about their perceptions of antenatal services are generally fairly positive, with women identifying the clinic as a place to get medicines and advice. However, none of the women mentioned the role of screening and identification of high-risk women, which suggests that they were not aware that this should be a part of that service. The major single dissatisfaction expressed by women who attended for antenatal care (9%) was with the attitude of the nurses (cross or hard). A similar problem was identified in a more recent study in Goroka, where ill-mannered treatment by staff was one of the most significant concerns raised by the women (12). The most common reason given for not receiving antenatal care was related to access (too far away, no transport, clinic does not come any more), with 81% of non-users identifying access as a problem. A smaller but more worrying group were those that could not be bothered or did not see a need to attend (19%). Overall, this suggests that where antenatal services are available to them, all but a few women would use them.

The picture was not so good regarding the place of delivery. 42% of the women in the study had delivered their last baby in a health facility. Despite the official strategy of referral of high-risk women for a supervised delivery, those women defined as high-risk in their previous full-term pregnancy were no more likely to report being referred for a health centre delivery than those not at risk. This research was not able to identify the influence of antenatal clinic advice on a woman's decision as to where to deliver. When the women were asked why they did not deliver in the health centre, almost all replied that it was too hard to get there.

Difficulty of access is a given for village women, but there may be other factors at play. For example, in 2002, 89% of Huli women, some of whom may face similar access difficulties, were reported to deliver in a health centre (13). However, a traditional delivery for a Huli woman is a solitary one; this is not true

for the Madang women who were interviewed.

While 47% of women who had delivered in the village identified nothing good about it, a further 36% indicated that there was nothing bad about it. The care and respect provided by the community and family members was important to 30% of women. Opinions related to physical comfort were varied, with almost as many saying the village was best as those saying it was a negative aspect. These issues were also important as criticisms of the health services, with 29% of women complaining about difficulties with cooking, washing, dirty toilets and bad beds in the health facilities. In contrast to this 48% of women delivering in a health facility praised the physical surroundings. It may be that some health centres are more pleasant than others and this may explain the apparent discrepancy. Such differences were identified in the study by Beracochea et al. (14).

Availability of medical help was identified as an important issue by the majority of women who had delivered in a health facility. It is therefore important that this positive perception be maintained by meeting medical needs adequately. This involves maintaining supplies and equipment as well as ensuring staff are adequately trained. It also involves ensuring rapid and appropriate referral when needed. In this respect it is salient that 9% of women identified problems with medical issues, including lack of medicines, staff absences and frightening procedures, and felt that the experience was just as bad as in the village.

The low response rate when asked about improvements to the services is disappointing, but probably to be expected in a population which is rarely consulted about services. The most important issues identified by the women were improving access, providing family planning, improving the physical comfort of health facilities and changing negative staff attitudes to the mothers and to their jobs.

Limitations

This study involved the retrospective collection of data by interviewing women about their reproductive lives and attitudes. It is inevitable that there will be problems related to this methodology, particularly related to the women's recall. Where the birth occurred some considerable time in the past, it is likely

that the recollection of the event will be less accurate than if it occurred more recently. There is also the possibility of error due to differing perceptions of what is normal and what is abnormal. While an attempt was made to minimize this by providing case definitions for some of the complications (eg, a long labour was one which lasted more than 24 hours), there will inevitably be different interpretations of when labour started, and there may be an altered perception of the events with the lapse of time. Doubt exists about the authenticity of the reports of eclampsia. The Tok Pisin expression 'ai raun, bun guria', which is the nearest equivalent which can be found to describe a convulsion, can also mean merely 'dizzy, fainting, shaking'. It was decided to include the 'yes' responses, because this condition appears to be widely recognized and is considered to indicate a difficult and dangerous labour. Some other complications could not be assessed at all. These include problems such as anaemia and preeclampsia which require assessment at the time of occurrence. Additionally, the study did not capture any information on maternal mortality, or data related to women who had died during or as a result of pregnancy or childbirth.

Conclusions

This study provides an overview of pregnancy and childbirth histories, and use and perceptions of maternity services, as reported by a large group of women from Madang Province in the early 1990s. It supports previous reports of high fertility rates as well as high rates of complications from pregnancy (4,10). A mixed picture emerges of women's views regarding the benefits and disadvantages of antenatal care and delivery services. There is no correlation between the use of delivery services and women's risk status. Given the high proportion of women classified as high risk this should perhaps not be surprising. It may be that health care service providers simply tell all women to take advantage of the services and do not discriminate between women at different risk levels, or, if they did, they did not communicate these thoughts to the women.

An important finding is that the women provided very few recommendations for health care delivery improvements. It is not possible to tell if this lack of opinion is related to a sense that it does not really matter what they think or that they really do not have a

perception of what these services should/could be providing. However, it is reasonable to assume that women have fairly limited expectations and are not aware of the type of services they should be able to expect.

Although the data reported could be considered dated, the sad truth is that it is likely that little has changed in relation to the provision and acceptance of health care for women, especially in relation to pregnancy and childbirth, over the past 20 years. Recent data indicate that 44% of women still deliver at home and over 44% of women experience complications during or immediately following delivery (15). The PNG Ministerial Taskforce also reports an increase in maternal mortality rates between 1996 and 2006 and the recommendations in the Ministerial Taskforce Report (10) mirror many of those made during the 1993 consensus conference (11).

In this article we have provided the data from our previous report to make it more accessible in the public domain. As researchers who lived and worked in Papua New Guinea we developed a love for the country, its people and its women. We hope that the provision of these findings will assist other researchers, policy-makers and service providers to move forward in their endeavours to improve the delivery of health services for the women of Papua New Guinea.

REFERENCES

- 1 **Mola G.** Maternal health services and maternal mortality in Papua New Guinea. *PNG Med J* 1985;28:241-245.
- 2 **Mola G.** Maternal death in Papua New Guinea, 1984-1986. *PNG Med J* 1989;32:27-31.
- 3 **Sanga K, de Costa C, Mola G.** A review of maternal deaths at Goroka General Hospital, Papua New Guinea 2005-2008. *Aust NZ J Obstet Gynaecol* 2010;50:21-24.
- 4 **Gillett J.** The Health of Women in Papua New Guinea. Papua New Guinea Institute of Medical Research Monograph No 9. Goroka: Papua New Guinea Institute of Medical Research, 1990.
- 5 **Alto WA, Albu RE, Irabo G.** An alternative to unattended delivery – a training programme for village midwives in Papua New Guinea. *Soc Sci Med* 1991;32:613-618.
- 6 **Biddulph J.** Maternal mortality – a continuing tragedy. *PNG Med J* 1993;36:1-3.
- 7 **Everett VJ.** The M of MCH. *PNG Med J* 1987;30:121-125.
- 8 **Reid J.** The role of maternal and child health clinics in education and prevention: a case study from Papua New Guinea. *Soc Sci Med* 1984;19:291-303.
- 9 **Papua New Guinea Department of Health.** Papua New Guinea National Health Plan 1991-1995. Port Moresby: Department of Health, 1991.
- 10 **Ministerial Taskforce on Maternal Health in Papua New Guinea.** Ministerial Taskforce on Maternal Health in Papua New Guinea Report. Port Moresby: Papua New Guinea National Department of Health, 2009.
- 11 **Dickson R.** Proceedings of the National Strategy Meeting on the Health of Women in Papua New Guinea. In: Taufa T, Bass C, eds. Population, Family Health and Development. Proceedings of the Nineteenth Waigani Seminar, Port Moresby, 16-22 Jun 1991, Volume 2. Port Moresby: University of Papua New Guinea Press, 1993:111-135.
- 12 **Larsen GL, Lupiwa S, Kave HP, Gillieatt S, Alpers MP.** Antenatal care in Goroka: issues and perceptions. *PNG Med J* 2004;47:202-214.
- 13 **Vail J.** Antenatal utilization, family planning and fertility preferences in Tari. *PNG Med J* 2002;45:134-141.
- 14 **Beracochea E, Dickson R, Freeman P, Thomason J.** Case management quality assessment in rural areas of Papua New Guinea. *Trop Doct* 1995;25:69-74.
- 15 **World Health Organization Department of Making Pregnancy Safer.** Papua New Guinea Country Profile. Geneva: World Health Organization, 2010.

A comparative study of intestinal helminths in pre-school-age urban and rural children in Morobe Province, Papua New Guinea

JENNIFER M. SHIELD^{1,2} AND FELICIA KOW^{3,4}

Papua New Guinea Institute of Medical Research, Goroka and Papua New Guinea University of Technology, Lae

SUMMARY

Children aged between 1 month and 10 years from one rural coastal locality, two rural upland localities and two urban localities in Morobe Province, Papua New Guinea were examined between September 1980 and September 1982. Hookworm (predominantly *Necator americanus*), *Ascaris lumbricoides* and *Trichuris trichiura* increased in prevalence with age. The prevalence of *Strongyloides fuelleborni* subspecies *kellyi*, where present, was either highest in the <1 year age group or similar in all age groups. *N. americanus* prevalence was between 59% and 83% in the 3 year age group except at the coastal locality, where it was 15%. *A. lumbricoides* prevalence in the 3 year age group was very low in one upland locality and between 7% and 41% for the other localities. *T. trichiura* prevalence in the 3 year age group was between 33% and 55% at the coastal and two urban localities, and very low at the two upland localities. *S. f. kellyi* prevalence in the <1 year age group was 48% and 20% respectively at the two upland localities, 2% at one of the urban localities and not detected at the other localities. *Strongyloides stercoralis* was detected at both urban localities, but not at the coastal locality or at the upland locality where testing was done. Many children had infections of more than one species, and there was a significant association of *A. lumbricoides* with *T. trichiura* at the coastal and two urban localities. The presence of *S. f. kellyi* at one of the urban localities raises the possibility that this once isolated species may now be spreading as infected people visit and settle in the towns. Between 68% and 93% of children in the 3 year age group and between 65% and 100% in the 5 year age group were infected with at least one helminth species.

Introduction

Intestinal helminths, predominantly *Necator americanus*, *Ascaris lumbricoides* and *Trichuris trichiura* are endemic throughout Papua New Guinea (1,2). In addition, *Strongyloides fuelleborni* subspecies *kellyi* is prevalent but with a restricted distribution (3). In recent years, there has been a growing awareness throughout the world of the public health significance of these parasitic diseases, particularly their detrimental effect on child development.

There is increasing evidence that chronic infection with helminth parasites, including *N. americanus*, *A. lumbricoides* and *T. trichiura*, at levels that do not cause acute disease, are a major factor in malnutrition, decreased fitness and decreased cognitive ability. Stephenson (4) has summarized the mechanisms involved. These parasites cause blood loss or malabsorption of nutrients, leading to iron deficiency anaemia, which is associated with decreased appetite, growth rate, activity, fitness, work capacity, cognitive ability, school performance and productivity. Even when

-
- 1 Papua New Guinea Institute of Medical Research, PO Box 60, Goroka, Eastern Highlands Province 441, Papua New Guinea
 - 2 Present address: Department of Pharmacy and Applied Science, La Trobe University Bendigo, PO Box 199, Bendigo, Victoria 3552, Australia
j.shield@latrobe.edu.au
 - 3 Papua New Guinea University of Technology, Free Mail Bag, Lae, Morobe Province 411, Papua New Guinea
 - 4 Present address: Australian Maritime College, University of Tasmania, Locked Bag 1370, Launceston, Tasmania 7250, Australia

anaemia is not present, intestinal helminths, particularly *Trichuris trichiura* infections, lead to an increase in the inflammatory cytokine tumor necrosis factor- α (TNF- α) in children, causing decreased appetite and consequently decreased food intake (5,6). Intestinal helminths have also been implicated in reduced efficacy of BCG vaccination (7) and *Salmonella* and influenza vaccination (8).

Heavy burdens of helminth parasites cause acute disease. It has long been known that hookworms are a major cause of iron deficiency anaemia (9,10), and this is life threatening when the hookworm load is high and the person is iron deficient. *Ascaris lumbricoides* causes blockage of the gut in young children when infected with more than 60 worms (11) and this is also life threatening. *Trichuris* dysentery syndrome (TDS), comprising chronic dysentery, anaemia, rectal prolapse and clubbing of the fingers, is associated with egg counts of more than 30,000 per g of stool (6,12). *Strongyloides fuelleborni kellyi* in high numbers causes swollen belly syndrome in babies, particularly in damp climates, and this is fatal if not treated with appropriate anthelmintic drugs (3,13). *Strongyloides stercoralis* is a life-long disease if not eradicated from the body, because the parasites multiply in the host through a process of autoinfection (14,15). Immune impairment and other unknown factors allow the worms to multiply out of control (hyperinfective or severe complicated strongyloidiasis) and overwhelm the host if the underlying cause is not treated effectively (16,17).

In this study, the abundance and distribution of intestinal parasites in pre-school-age children was investigated as part of a series of nutrition surveys in Morobe Province, Papua New Guinea (PNG) which took place between September 1980 and September 1982 (18-23). Although these data were collected in the 1980s, they provide important baseline information with which to compare the present epidemiology of intestinal helminths in young children, given that the current standard treatment for children in PNG includes the anthelmintic drug albendazole (24).

Methods

The parasitological survey was carried out in conjunction with a comparative study of nutritional status of pre-school-age children in Morobe Province. At Aseki, the nutrition study

was part of a road impact study. Subjects were children aged between 1 month and 10 years who were brought to the survey point by a parent or guardian. This was considered to be a representative sampling method without bias, because at the time the mothers used to bring their children, both well and unwell, to the Maternal and Child Health (MCH) clinic regularly on the appointed day for check-ups. The surveys in this study were carried out as part of that MCH process. Most of the children were 5 years old or younger. The children surveyed were from three areas, Wasu (rural coastal), Aseki (rural uplands) and Lae (urban) (Figure 1).

Survey locations and date of study

Wasu – on the north coast of Morobe Province, November 1980 (rural coastal): the children were surveyed at Lambutina Health Centre and were from 5 villages along the coastline and 2 villages about 10 km from the coast (Figure 2). The sea was frequently used for disposal of waste in the coastal villages. Some villages were near Sio Lagoon, and had some coastal swampy land nearby. Fresh water was 20 minutes' to 1 hour's walk away, or from wells near Sio Lagoon for the villages adjoining the lagoon. The MCH clinic and health centre was about 20 km away from the furthest village, accessible by foot or canoe.

Aseki 1 – June to September 1981 (rural uplands): villages surveyed were from 1200 to 1800 m above sea level. About one-third of the villages were connected by road (Figure 3), the rest by walking track only. Survey work was carried out at Angewanga village (June), Hoganeywa and Kamiagaga villages (July) and Aseki Rural Health Centre (September) and included children from 15 villages within walking distance of the survey points. Water was obtained from springs, or from rainwater tanks at Aseki station.

Aseki 2 (Langemar) – May 1981 (rural uplands): Langemar airstrip and the adjoining Otete aid post are about 1500 m above sea level (Figure 3) and are not accessible by road. The children surveyed came to the aid post from 4 villages that were within walking distance. Fresh water was obtained from a spring, a few minutes' walk away, in the wet season, and from the river, one hour's walk away, in the dry season.

Buimo Road Settlement, Lae – September



Figure 1. Morobe Province showing the study areas: Wasu (coastal), Lae (urban: Buimo Road Settlement and Taraka) and Aseki (upland – Aseki villages surveyed were accessible by road or from Langemar airstrip).



Figure 2. Wasu coastal study area, showing the location of the coastal and inland villages surveyed.



Figure 3. Aseki study area showing Aseki villages accessible by road and the Langemar villages accessible from the airstrip.

1980 (urban): the settlement is situated on the southern bank of the Bumbu River about 5 km from the coast (Figure 4). This settlement included people who had migrated from both coastal and inland areas. The survey took place at the MCH centre. Housing was of the privately owned 'self-help' type, and about two-thirds were considered by the Town Planner to be deteriorating or dilapidated. Sanitation was by pit latrine. Water was obtained from rainwater tanks or the Bumbu River. The hospital and MCH centre were 4 km away.

Taraka, Lae – June 1981 (urban): Taraka is a suburb located on both sides of the Bumbu River about 4 km upstream from Buimo Road Settlement (Figure 4). The survey took place at the MCH clinic located within the suburb. Housing was a mixture of government low-covenant rental housing (37%) and privately owned 'self-help' type (25). 32% of houses were deteriorating or dilapidated, according to the Town Planner. Each house was provided with a pit latrine, and each plot was provided

with reticulated water to an outside tap (25).

Parasitology

The mother or guardian of each child was given a sterile, labelled plastic jar with identifying marks if there was more than one child in the family, and instructed about how to collect the stool and how much to collect. The stools were returned as soon as possible after collection (usually the next day) and refrigerated as soon as possible. All stools were examined in the laboratory by the Macmaster counting chamber technique (26), except for 5 stools from Taraka and 2 from Aseki that were too small for a Macmaster count and were examined by weighed direct smear only. Harada and Mori filter paper cultures (27) of stools from Langemar and Taraka samples were set up in the laboratory if the sample was adequate, and samples from Hoganeiva (Aseki) were set up in the field on receipt of the specimens. This enabled identification of hookworm to species



Figure 4. Lae and surrounds, showing the location of the urban study areas – Buimo Road Settlement and Taraka.

by identification of infective larvae (27) and the detection of *Strongyloides* spp infection by the morphology of the infective larvae. Direct smears of all Buimo Road samples and 39 Wasu samples were also examined. Identification of *Strongyloides* spp to species was done according to the morphology of the free-living females (28). Although this identification method is based on the morphology of *S. f. fuelleborni*, the free-living females of *S. f. kellyi* are indistinguishable from *S. f. fuelleborni* (29) and we relied on the geographical distribution to conclude that they were *S. f. kellyi* (29). Where there were no free-living females, identification of *S. f. kellyi* depended on observation of eggs in McMaster counting chambers or direct smears, and *S. stercoralis* was identified by observation of larvae in direct smears (28).

Statistics

The results were categorized by age groups as follows: 0 years = less than 12 months, 1 year = 12 to 23 months, 2 years = 24 to 35 months, 3 years = 36 to 47 months, 4 years = 48 to 59 months, etc. Differences in prevalences were tested by chi-squared or Fisher's exact test. The significance of double infections was tested by chi-squared. Geometric means were calculated using ln-transformed values and the differences were tested by Student's t test. A result was considered to be significant if p was <0.05 .

Results

Necator americanus, *Ascaris lumbricoides*, *Trichuris trichiura* and *Strongyloides fuelleborni*

kellyi were the major species detected, and the prevalences (% infected) at most survey locations were very high. *Ancylostoma duodenale*, *Strongyloides stercoralis*, *Enterobius vermicularis*, *Rodentolepis (Hymenolepis) nana* and an unidentified cestode were also detected. *E. vermicularis* is an incidental finding, as the methods used do not usually detect this species.

Results from the Harada and Mori cultures indicated that *N. americanus* was the predominant hookworm species. It was the only hookworm species in cultures from Aseki 1 and Aseki 2 (Langemar), but in 12% of the Taraka cultures yielding hookworm larvae the species was *A. duodenale*. Only Taraka cultures yielded free-living adult *Strongyloides* females: in 70% the species was *S. f. kellyi* and in 30% *S. stercoralis*.

Tables 1 to 5 compare the prevalences (%)

infected), geometric means (eggs per gram [EPG] faeces) and In-transformed standard deviations (SDs), for each age group (for children with known ages) for each parasite species (detected by Macmaster technique or weighed direct smear) at each survey location, and Figure 5 shows the four major helminth species detected, comparing the prevalence in each age group at the different survey locations. *N. americanus*, *A. lumbricoides* and *T. trichiura* were found at all locations. *S. f. kellyi* was detected at Aseki 1, Aseki 2 and Taraka. In general, prevalences of *N. americanus*, *A. lumbricoides* and *T. trichiura* increased with age, but in *S. f. kellyi* the mean egg counts and/or prevalence were higher in children under 1 year. Although the figures for mean egg counts in the Tables show an increase with age for *N. americanus* and a decrease with age for *S. f. kellyi*, no significant differences between any geometric mean egg counts in any species could be established

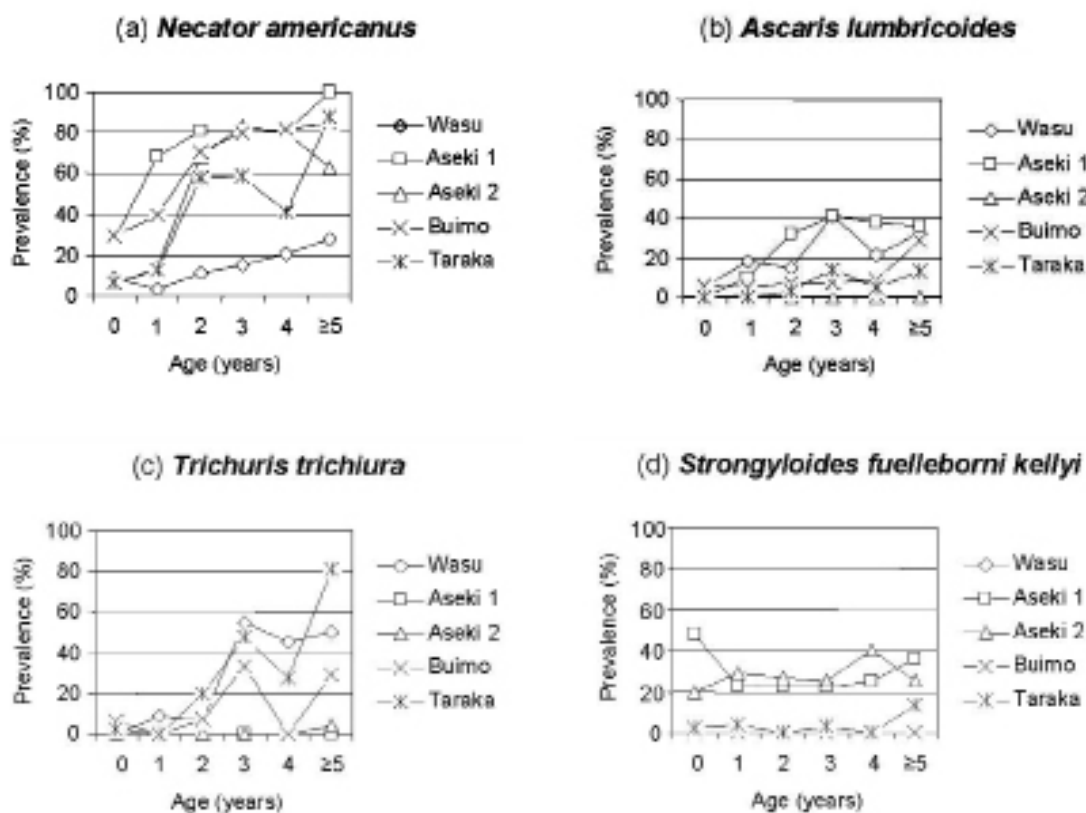


Figure 5. A comparison of the prevalence at each study location for each age group for – (a) *Necator americanus*; (b) *Ascaris lumbricoides*; (c) *Trichuris trichiura*; and (d) *Strongyloides fuelleborni kellyi*.

by the t test. This may be due to the small numbers in each group and the large SDs in the data.

Wasu (rural coastal) (Table 1, Figure 5)

N. americanus, *A. lumbricoides* and *T. trichiura* were detected in children at Wasu, and 14% of children <1 year old were already infected with one or more of these. Hookworm prevalences and mean egg counts were considerably lower than at all the other places surveyed. *A. lumbricoides* prevalence was 41% in 3 year old children. *T. trichiura* prevalence was 55% in 3 year old children, but the mean egg counts were not high. Wasu had the lowest rate of infection by any helminth species for 5-7 year olds of 65%. However, the 21 children aged from 0 to 7 years from the two inland villages (the ages of 9 were not known accurately and therefore not included in the Table) had a higher overall prevalence: 76% for hookworm, 29% for *A. lumbricoides* and 57% for *T. trichiura*. There were no *Strongyloides* eggs or larvae present in any of the 39 direct smears examined.

Aseki 1 (rural uplands) (Table 2, Figure 5)

At Aseki 1, the main helminth species were *N. americanus*, *A. lumbricoides* and *S. f. kellyi*. 61% of children <1 year old were infected with one or more species. *N. americanus* prevalence in 5-8 year olds was 100%. *A. lumbricoides* prevalence was 41% in the 3 year old age group. Prevalence of *S. f. kellyi* was 48% in children <1 year, significantly higher than in the age groups from 1 to 5 years. The mean egg count was high in the <1 year age group, decreasing with increased age, except that it was very high in the 4 year age group. *E. vermicularis* and *T. trichiura* were present in a few stools, the latter in subjects whose ages were not documented. Direct smears of 133 stools of children of all ages revealed that *A. lumbricoides* eggs were present in 48, compared with 37 identified by the McMaster egg counting chamber. Thus use of the McMaster method alone underestimated *A. lumbricoides* prevalence by at least 8%. Of 55 stools cultured, 38 yielded infective hookworm larvae; 37 contained larvae of *N. americanus* only, and in the remaining one the larvae had died and could not be positively identified. 31 cultures (56%) yielded infective *Strongyloides* larvae, compared with 13 (24%) of the same specimens in which eggs were seen in McMaster counting chambers. Since all the

direct smears which contained *Strongyloides* larvae also contained *Strongyloides* eggs it is concluded that these were larvae of *S. f. kellyi*, though it is possible that some were *S. stercoralis*. The results from the cultures imply that the true prevalence of *S. f. kellyi* is more than double the figures given in Table 2.

Aseki 2 (Langemar) (rural uplands) (Table 3, Figure 5)

The major species present at Langemar were *N. americanus* and *S. f. kellyi*. 20% of children in the <1 year age group were infected with one or more species. *N. americanus* prevalence was 83% in the 3 year age group and 86% in the 6-8 year age group. The prevalence of *S. f. kellyi* at Langemar has already been briefly reported (30). It was between 20% and 40%, similar in most age groups, but the mean egg count was highest in the <1 year age group and declined with age. These results were similar to Aseki 1, except that, at Aseki 1, the prevalence in the <1 year age group was significantly higher than in the other age groups. *Enterobius vermicularis*, *A. lumbricoides* and *T. trichiura* were detected in a few stools. Of the 96 cultures, 11 yielded hookworm larvae, of which 8 had infective *N. americanus* larvae only, and 3 contained first and second stage larvae only, and these cannot be identified to species. 24 cultures out of 96 yielded infective *Strongyloides* larvae. Since the same number of stools had *S. f. kellyi* eggs in the McMaster egg counting chamber, it is concluded that these larvae were *S. f. kellyi* although the possibility that some were *S. stercoralis* remains.

Buimo Road Settlement (urban) (Table 4, Figure 5)

N. americanus, *A. lumbricoides* and *T. trichiura* were the major species at Buimo Road, though *S. stercoralis* was also present. 41% of children in the <1 year age group were infected with one or more species. *N. americanus* was the most frequent helminth present, increasing in prevalence from 29% at <1 year to 80% at 3 years and 85% at 5 to 7 years. *A. lumbricoides* and *T. trichiura* prevalences were low except in the 3 and 5-7 year age groups. Examination of 91 direct smears revealed that larvae of *Strongyloides* were present in 4 stools, indicating *S. stercoralis*, and that eggs of *A. lumbricoides* were present in 5 additional stools. Eggs of *S. f. kellyi* were not seen in any specimens from

TABLE 1

WASU, MOROBE NORTH COAST (RURAL COASTAL): PREVALENCE (% INFECTED), GEOMETRIC MEAN EGG COUNT (EGGS PER GRAM FAECES [EPG])[#] AND LN-TRANSFORMED STANDARD DEVIATION (SD) OF INTESTINAL HELMINTHS IN CHILDREN 7 YEARS AND UNDER, N = 178

Age (years)	No tested	<i>Necator americanus</i> *			<i>Ascaris lumbricoides</i>			<i>Trichuris trichiura</i>			All
		Prevalence %	Mean EPG	SD	Prevalence %	Mean EPG	SD	Prevalence %	Mean EPG	SD	
0	22	9	212	0.49	5	150	-	0	-	-	14
1	34	3	1500	-	18	1230	1.63	9	343	0.73	26
2	27	11	545	1.13	15	1037	1.07	7	260	0.78	22
3	22	15	479	1.70	41**	5853	1.49	55**	587	1.16	68
4	33	21	536	1.16	21	12352	1.22	45	468	1.21	61
5 to 7	40	28	403	1.20	33	4886	1.24	50	329	0.85	65

[#]by Macmaster method

*presumed *N. americanus*: no testing to determine whether *Ancylostoma duodenale* was present

** *A. lumbricoides* and *T. trichiura*: significant increase in prevalence from 2 year old to 3 year old children, p<0.05

TABLE 2

ASEKI 1 (RURAL UPLANDS): PREVALENCE (% INFECTED), GEOMETRIC MEAN EGG COUNT (EGGS PER GRAM FAECES [EPG])[#] AND LN-TRANSFORMED STANDARD DEVIATION (SD) OF INTESTINAL HELMINTHS IN CHILDREN 8 YEARS AND UNDER, N = 155

Age (years)	No tested	<i>Necator americanus</i> [†]			<i>Ascaris lumbricoides</i>			<i>Strongyloides fuelleborni</i> <i>kellyi</i>			Other	All
		Prevalence %	Mean EPG	SD	Prevalence %	Mean EPG	SD	Prevalence %	Mean EPG	SD	Infected %	Infected %
0	33	27	1195	1.35	0	0	-	48	2461	1.96	0	61
1	31	68*	515	1.24	10	1432	2.23	23***	1101	1.47	3 ^a	71
2	37	81	702	1.08	32**	2623	1.51	22	1070	0.99	5 ^{a,b}	89
3	27	81	906	1.20	41	427	1.76	22	492	1.40	4 ^c	85
4	16	81	1252	1.24	38	6361	1.07	25	6229	1.02	13 ^b	88
5 to 8	11	100	1028	1.27	36	1886	1.30	36	511	1.80	0	100

[#]by McMaster method except two stools by weighed direct smear

[†]confirmed by Harada and Mori cultures

**N. americanus*: significant increase in prevalence from 0 year old to 1 year old children, p <0.05

***A. lumbricoides*: significant increase in prevalence from 1 year old to 2 year old children, p <0.05

****Strongyloides f. kellyi*: significant **decrease** in prevalence from 0 year old to 1 year old children, p <0.05

^a*R. nana*

^b*E. vermicularis*

^cunidentified cestode

TABLE 3

ASEKI 2 (LANGEMAR) (RURAL UPLANDS): PREVALENCE (% INFECTED), GEOMETRIC MEAN EGG COUNT (EGGS PER GRAM FAECES [EPG])[#] AND LN-TRANSFORMED STANDARD DEVIATION (SD) OF INTESTINAL HELMINTHS IN CHILDREN 8 YEARS AND UNDER, N = 140

Age (years)	No tested	<i>Necator americanus</i> [†]			<i>Strongyloides fuelleborni kellyi</i>			Other	All
		Prevalence %	Mean EPG	SD	Prevalence %	Mean EPG	SD	Infected %	Infected %
0	20	5	1350	-	20	3340	2.19	0	20
1	21	14	300	0.69	29	1780	2.46	10 ^{a,b}	43
2	22	68*	529	1.04	27	841	1.62	0	73
3	12	83	872	0.81	25	833	1.07	33 ^b	92
4	20	80	611	1.17	40	510	1.50	20 ^b	90
5	24	63	1216	1.07	25	319	1.53	4 ^b	79
6 to 8	21	86	1101	1.07	24	215	0.51	24 ^{a,b,c}	90

[#] by Macmaster method

[†] confirmed by Harada and Mori cultures

**N. americanus*: significant increase in prevalence from 1 year old to 2 year old children, p<0.05

^a*A. lumbricoides*

^b*E. vermicularis*

^c*T. trichiura*

TABLE 4

BUIMO ROAD SETTLEMENT, LAE (URBAN): PREVALENCE (% INFECTED), GEOMETRIC MEAN EGG COUNT (EGGS PER GRAM FAECES [EPG])[#] AND LN-TRANSFORMED STANDARD DEVIATION (SD) OF INTESTINAL HELMINTHS IN CHILDREN 7 YEARS AND UNDER, N = 91

Age (years)	No tested	<i>Necator americanus</i> [†]			<i>Ascaris lumbricoides</i>			<i>Trichuris trichiura</i>			All
		Prevalence %	Mean EPG	SD	Prevalence %	Mean EPG	SD	Prevalence %	Mean EPG	SD	Infected %
0	17	29	492	1.34	6	600	-	6	2100	-	41
1	20	40	2878	1.26	5	1000	-	0	-	-	40
2	14	71*	1966	1.60	7	150	-	7	300	-	71
3	15	80	1724	1.45	7	600	-	33	369	0.86	93
4	11	82	2446	1.66	9	5700	-	0	-	-	82
5 to 7	14	85	2080	1.98	29	1110	1.51	29	770	0.39	93

[#]by Macmaster method

[†]presumed *N. americanus*: no testing to determine whether *Ancylostoma duodenale* was present

**N. americanus*: significant increase in prevalence from 1 year old to 2 year old children, p <0.05

Buimo Road. As no cultures were prepared from Buimo Road, it was not known whether *A. duodenale* was present.

Taraka (urban) (Table 5, Figure 5)

The major species at Taraka were *N. americanus*, *A. lumbricoides*, *T. trichiura* and *S. f. kellyi*. *Ancylostoma duodenale* and *S. stercoralis* were also present. 8% of children in the <1 year age group were infected with one or more species, considerably lower than at Buimo Road. Hookworm prevalence at Taraka increased from 6% in the <1 year age group to 59% in 3 year old children and 88% in 5 year olds. *A. lumbricoides* prevalence was low, but some children had extremely high egg counts. *T. trichiura* prevalence varied between 20% and 81% in the age groups ≥ 2 years. *S. f. kellyi* was present in most age groups at a low prevalence. Of the 41 cultures that yielded infective hookworm larvae, 36 contained larvae of *N. americanus* only, and 5 contained larvae of *Ancylostoma duodenale*. Of 24 cultures that yielded infective *Strongyloides* larvae (which cannot be identified to species), 8 contained *S. f. kellyi* free-living adults and 3 contained *S. stercoralis* free-living adults.

Comparison of prevalences for each species (Figure 5)

N. americanus (Figure 5a): at all survey locations the prevalence increased with age, and at all except Wasu (predominantly coastal residents) the prevalences were very high by age 5 years. At Buimo Road and Aseki 1, the prevalence was >20% even in children less than 1 year old. The prevalence in 2 year olds was high except at Wasu.

A. lumbricoides (Figure 5b): the prevalence of *A. lumbricoides* at Wasu and Aseki 1 where it was present in appreciable numbers, increased with age. At these locations and at Buimo Road, the prevalence was similar in the ≥ 5 year age group.

T. trichiura (Figure 5c): the prevalence of *T. trichiura* was very low at the two upland localities. At the coastal and urban localities, the prevalence increased with age and in ≥ 5 year olds varied from 29% to 81%.

S. f. kellyi (Figure 5d): the prevalence was 48% at Aseki 1 in the <1 year age group, then similar in the other age groups. At Aseki 2

(Langemar), the prevalence was similar in all age groups, and similar to that at Aseki 1 in the age groups ≥ 1 year. At Taraka it was low in all age groups except the ≥ 5 year age group, where it was 13%.

S. stercoralis: the prevalence of *S. stercoralis* was low at Buimo Road and Taraka and not detected at Wasu, Aseki 1 or Aseki 2 (Langemar).

Infections with two or more species in children ≥ 2 years old (Table 6)

The prevalence of double infections was compared with single infections using chi-squared contingency tables in the four surveys where there was an appreciable prevalence of both species, or Fisher's exact test where the numbers were too small for chi-squared. *A. lumbricoides* infection was significantly associated with *T. trichiura* infection at all three locations where there was an appreciable *T. trichiura* prevalence. There was no significant association of hookworm infection with *A. lumbricoides* infection or with *S. f. kellyi* infection. Hookworm infection was associated significantly with *T. trichiura* infection at Taraka, but not at Buimo Road or Wasu. *A. lumbricoides* was significantly associated with *S. f. kellyi* at Aseki 1.

Discussion

The results of this study are in accordance with the earlier high infection rate with intestinal helminths throughout Papua New Guinea (1,2). A hookworm prevalence rate of 90% by the Macmaster method probably indicates universal infection in the community, and at 4 of the 5 localities surveyed the prevalence approached 90% at 5 years of age.

These results also confirm the finding that hookworm is the most common form of intestinal helminth infection, except at coastal localities (1,2), and support the view that most hookworm infections in Papua New Guinea are due to *Necator americanus* (1). Infection with *A. duodenale* is associated with a greater burden of iron deficiency anaemia than *N. americanus* (31). The prevalence of hookworm in <2 year olds in this study (apart from the coastal locality) is similar to earlier surveys in Morobe Province, where 20% of children aged under 2 years and about 80% of those between 2 and 6 years had hookworm (32). Ewers and Jeffrey (1) concluded that

TABLE 5

TARAKA (URBAN): PREVALENCE (% INFECTED), GEOMETRIC MEAN EGG COUNT (EGGS PER GRAM FAECES [EPG])[#] AND LN-TRANSFORMED STANDARD DEVIATION (SD) OF INTESTINAL HELMINTHS IN CHILDREN 10 YEARS AND UNDER, N = 203

Age (years)	No tested	<i>Necator americanus</i> [†]				<i>Ascaris lumbricoides</i>				<i>Trichuris trichiura</i>				<i>Strongyloides fuelleborni kellyi</i>				All
		N	Prevalence %	Mean EPG	SD	Prevalence %	Mean EPG	SD	Prevalence %	Mean EPG	SD	Prevalence %	Mean EPG	Prevalence %	Mean EPG	SD	Infected %	
0	49		6	455	1.37	0	-	-	2	150	-	2	1650	2	1650	-	8	
1	23		13	407	0.87	0	-	-	0	-	-	4	150	4	150	-	14	
2	40		58	893	1.29	3	79400	-	20	985	1.50	0	0	0	0	-	57	
3	29		59	1388	1.53	14	35217	1.61	48	636	1.45	3	2400	3	2400	-	73	
4	22		41	2914	1.12	5	300	-	28	370	0.80	0	0	0	0	-	68	
5	16		88*	2466	1.34	13	2893	1.49	81	838	1.43	13	150	13	150	-	94	
6 to 10	24		83	922	1.18	4	111900	-	46	974	0.86	4	140	4	140	-	96	

[#]by Macmaster method except five stools by weighed direct smear

[†]includes *Ancylostoma duodenale*, present in 12% of infections

*N. americanus: significant increase in prevalence from 4 year old to 5 year old children, p <0.05

TABLE 6

PREVALENCE (%) OF DOUBLE INFECTIONS[†] IN CHILDREN 2 YEARS OLD AND OLDER

Survey point	Number tested	<i>N. americanus</i> and <i>A. lumbricoides</i>	<i>N. americanus</i> and <i>T. trichiura</i>	<i>N. americanus</i> and <i>S. f. kellyi</i>	<i>A. lumbricoides</i> and <i>T. trichiura</i>	<i>A. lumbricoides</i> and <i>S. f. kellyi</i>
Wasu	122	7	11	-	17*	-
Aseki 1	91	30	-	22	-	4*
Aseki 2 (Langemar)	99	-	-	23	-	-
Buimo	54	11	19	-	7*	-
Taraka	131	6	32*	-	5*	-

[†]ignores additional infection by a species other than the two being considered*p <0.05 by χ^2 or Fisher's exact test

one-third of children <1 year old in Papua New Guinea were infected with hookworm. In this study, this figure was approached at one upland and one urban locality but at the other localities the prevalence was <10%, similar to children at Tari (Southern Highlands) (33) and Karimui (on the southern fringe of the highlands north of Gulf Province) (34). The difference in hookworm prevalence in the lower age groups between the two urban areas surveyed could have been due to the generally better housing and provision of piped water at Taraka.

In contrast, the prevalence of *A. lumbricoides* and *T. trichiura* varied from place to place, as in earlier studies (1,2), and did not seem to conform to a pattern. However, the prevalence of these species was much lower than that of hookworm. The significant association of *A. lumbricoides* and *T. trichiura* with each other at the three localities where there was an appreciable prevalence of *T. trichiura* probably reflects their common mode of transmission, which is different from that of hookworm. This is consistent with the findings of Booth and Bundy in Malaysia (35) and Brooker et al. in Kenya (36). The generally low mean egg counts of *T. trichiura* encountered in this study agree with the results of earlier studies (1,2).

The two upland localities, where there is a high prevalence of *S. f. kellyi*, are both in the zone described by Ashford, Hall and Babona (37) where *S. f. kellyi* is endemic but swollen belly syndrome has not been reported. The absence of *S. f. kellyi* at Buimo Road Health Centre suggests that this species was not originally endemic at Lae. A previous study indicated that the prevalence of *Strongyloides* spp in the Markham Valley (which includes Lae) is very low (38). People from endemic areas have settled in Lae and brought *S. f. kellyi* with them (38,39). The presence of *S. f. kellyi* at Taraka suggests that it is now being transmitted there.

The finding of relatively high mean egg counts and/or high prevalence of *S. f. kellyi* in the younger age groups at Aseki 1 and Aseki 2 (Langemar) is similar to that at a number of other places in PNG (13,37,40). At Taraka, the prevalence of *S. f. kellyi* was low, but the higher egg counts were in children <4 years of age. A lack of association between *S. f. kellyi* and *N. americanus* infection was also found in a highlands fringe people of all ages (34),

but contrasts with the results of a study in a different area of Lae, where hookworm was significantly associated with *Strongyloides* spp and also with *T. trichiura* (39).

Strongyloides stercoralis was detected at both urban areas surveyed, but not at the upland and coastal localities where direct smears were examined. Although the majority of severe complicated strongyloidiasis (due to *S. stercoralis*) occurs in infected people with immunosuppression, in a significant number of cases of the severe disease the person has no evidence of immunosuppression. The latter is more frequently observed in toddlers, and persons living in developing countries (16). In addition, malnutrition is frequently associated with severe strongyloidiasis (16).

It is difficult to assess morbidity and mortality due to helminth infections apart from the presentation of acutely ill patients to health centres and hospitals, such as children presenting with severe anaemia (38) or with *S. f. kellyi* swollen belly syndrome (13). The numbers encountered in this way probably underestimate the degree of morbidity. Cooper et al. (41) calculated from field surveys that the morbidity rate from trichuriasis in St Lucia approached 100 per 1000 infected children, yet the morbidity rate as assessed by self-presentation to medical services was only approximately 10 per 1000.

In this study, the number of infections detected by egg counts would have underestimated the true situation. The Macmaster technique is sensitive for hookworm, but comparison with smears showed that it considerably underestimated the prevalence of *A. lumbricoides* at Aseki 1 and Buimo Road, and comparison with cultures showed that the Macmaster technique detected only approximately half the *S. f. kellyi* infections.

Today, much more sensitive tests are available. Serology using the ELISA test for detecting anti-parasite IgG is considerably more sensitive for detecting *S. stercoralis* infection than stool testing (42).

Recently even more sensitive tests have been developed to detect parasite DNA in faecal specimens by the polymerase chain reaction (PCR). In a survey of 77 samples, conducted by Basuni et al. (43), simultaneous PCR testing for *N. americanus*, *A. duodenale*,

A. lumbricoides and *S. stercoralis* detected infections in 68% of samples, whereas microscopic examination in the field detected infections in only 8%. Moreover, the tests were conducted on samples that were not refrigerated until arriving at the laboratory. The addition of PCR tests for *T. trichiura*, *S. f. kellyi* and *R. nana* would enable accurate testing for all the intestinal helminths known to be endemic in Papua New Guinea.

The high intensity of infection with *A. lumbricoides* in children can be partly explained by changes in the immune response to helminths in childhood from a non-protective Th1 response to a protective Th2 response by adulthood. Both *A. lumbricoides* and *T. trichiura* have a bell-shaped curve of prevalence and/or infection intensity with age in all age samples. In a study in Cameroon, the intensity in *T. trichiura* increased to age 7 years, and decreased to age 12, then remained constant in the older age groups (44). Non-protective inflammatory cytokines of the Th1 immune response (including TNF- α and IFN- γ) dominated in the young children. In older children the decrease in infection intensity correlated with an increase in protective non-inflammatory Th2 cytokines (44). There was a similar cytokine picture for *A. lumbricoides*, except that in this species the peak of infection intensity occurred at about age 11 years (45).

A study by Barnish and Ashford (40) of prevalence and infection intensity of *S. f. kellyi* with age, using one-month intervals, showed that infection intensity peaked at 12 months and prevalence peaked at 4 years. Our results are in general agreement with this finding. A change in immune response may also account for these observed changes in prevalence and intensity for *S. f. kellyi*.

Hookworm, however, shows an increase in prevalence with age to about 15 years (34), remaining constant during adulthood. In Barnish and Ashford's study (40), hookworm prevalence plateaued at about 9 years of age and infection intensity rose until about 10 years of age, then remained stable.

Although albendazole is now part of standard treatment for children in PNG, and swollen belly syndrome and hookworm anaemia have largely disappeared, it cannot be assumed that the intestinal parasites have disappeared from the population, with the possible exception

of *A. lumbricoides*, which is very susceptible to elimination, not only by albendazole but also by pyrantel and piperazine. Places where there is access to medical services, no overcrowding of accommodation, safe water, effective sanitation, and adequate hygiene and sanitary practices, may also be free of intestinal parasites.

Albendazole treatment is very useful clinically by achieving a high egg reduction rate, but the cure rate for *N. americanus* for adults and all age groups at approximately 78% (46) is less than for *Ancylostoma duodenale* at approximately 90% (46). Moreover, the cure rate for children is less still, for example 48% (47) or 64% (48). Similarly, the measured cure rate for *T. trichiura* in adults or all age groups is not high, with reports varying between 43% (49) and 76% (50), but in children it varied between 8% (51) and 41% (47). The story for *S. f. kellyi* is probably similar. ELISA serology has revealed that single-dose albendazole is ineffective at eliminating *S. stercoralis* (52). Consequently, there is an appreciable prevalence of these parasites after treatment, and residual parasites are a source of ongoing transmission. In the case of *S. stercoralis*, the residual parasites re-establish the original patent infection by autoinfection (52).

There is evidence that where there is incomplete elimination of intestinal helminths in a community, the parasites re-establish themselves. In a study in Madang Province (53) *N. americanus* prevalence had returned to preinfection levels two years after treatment and worm burden to 58% of the pretreatment value. In Zanzibar, after a decade of control programs, the prevalence and intensity of hookworm (species unspecified) and *A. lumbricoides* was reduced but still appreciable at 20% and 9% respectively, and the prevalence of *T. trichiura* remained high at 63% (54).

The presence of intestinal helminths in the community increases the risk of individuals succumbing to nutritional deficiency diseases, especially in circumstances when parasite load is heavy and nutritional intake marginal. Young children are particularly at risk because marginal food intakes are common in early childhood, and because their immunological response to the parasites is largely non-protective.

As the result of data showing improvements

in child health after deworming, the worldwide community is awakening to the importance of intestinal helminths (55) and the need to control them.

ACKNOWLEDGEMENTS

We thank the National Analysis Laboratory in Lae for the use of their facilities for the laboratory component of this study and an anonymous reviewer for his or her comments.

REFERENCES

- 1 **Ewers WH, Jeffrey WT.** Parasites of Man in Niugini. Brisbane: Jacaranda Press, 1971.
- 2 **Kelly A.** Alimentary Parasites of Man in Papua New Guinea. Goroka: Papua New Guinea Institute of Medical Research, 1974.
- 3 **Ashford RW, Barnish G, Viney ME.** *Strongyloides fuelleborni kellyi*: infection and disease in Papua New Guinea. *Parasitol Today* 1992;8:314-318.
- 4 **Stephenson LS.** Helminth parasites, a major factor in malnutrition. *World Health Forum* 1994;15:169-172.
- 5 **O'Lorcain P, Holland CV.** The public health importance of *Ascaris lumbricoides*. *Parasitology* 2000;121(Suppl):S51-S71.
- 6 **Stephenson LS, Holland CV, Cooper ES.** The public health significance of *Trichuris trichiura*. *Parasitology* 2000;121(Suppl):S73-S95.
- 7 **Elias D, Britton S, Aseffa A, Engers H, Akuffo H.** Poor immunogenicity of BCG in helminth infected population is associated with increased in vitro TGF- β production. *Vaccine* 2008;26:3897-3902.
- 8 **Maizels RM, Pearce EJ, Artis D, Yazbanbakhsh M, Wynn TA.** Regulation of pathogenesis and immunity in helminth infections. *J Exp Med* 2009;206:2059-2066.
- 9 **Foy H, Kondi A.** Hookworms in the aetiology of tropical iron deficiency anaemia. *Trans R Soc Trop Med Hyg* 1960;54:419-433.
- 10 **Layrisse M, Roche M.** The relationship between anaemia and hookworm infection. Results of surveys of rural Venezuelan population. *Am J Hyg* 1964;79:279-301.
- 11 **de Silva NR, Guyatt HL, Bundy DAP.** Worm burden in intestinal obstruction caused by *Ascaris lumbricoides*. *Trop Med Int Health* 1997;2:189-190.
- 12 **Cooper ES, Bundy DAP.** *Trichuris* is not trivial. *Parasitol Today* 1988;4:301-306.
- 13 **Ashford RW, Vince JD, Gratten MJ, Miles WE.** *Strongyloides* infection associated with acute infantile disease in Papua New Guinea. *Trans R Soc Trop Med Hyg* 1978;72:554.
- 14 **Speare R.** *Strongyloides stercoralis*: the parasite. Second National Strongyloidiasis Workshop, Brisbane, 25-26 Jul 2003. www.jcu.edu.au/school/phtm/PHTM/ss/acrrm-cd/CD-Index.pdf
- 15 **Shield JM, Page W.** Effective diagnostic tests and anthelmintic treatment for *Strongyloides stercoralis* make community control feasible. *PNG Med J* 2008;51:105-119.
- 16 **Genta RM.** Immunology. In: Grove DI, ed. Strongyloidiasis: A Major Roundworm Infection of Man. London: Taylor & Francis, 1989:133-153.
- 17 **Genta RM.** Dysregulation of strongyloidiasis: a new hypothesis. *Clin Microbiol Rev* 1992;5:345-355.
- 18 **Kow F.** Interim report on child nutrition survey, 1980. Aseki Road Impact Study Report No 2. Lae: Papua New Guinea University of Technology, 1980.
- 19 **Kow F.** Report on nutrition survey – Buimo Road Settlement, Lae 1980: comparative nutritional status study. Lae: Papua New Guinea University of Technology, 1981.
- 20 **Kow F.** Supplementary report on child nutrition survey, 1980. Aseki Road Impact Study Report No 6. Lae: Papua New Guinea University of Technology, 1982.
- 21 **Kow F.** Report on nutrition survey – Wasu 1980: comparative nutritional status study. Lae: Papua New Guinea University of Technology, 1982.
- 22 **Kow F.** Patterns of nutrition and related health factors among pre-school aged children in Papua New Guinea. Abstract in Proceedings of the Fifteenth Pacific Science Congress, Dunedin, 1-11 Feb 1983, Volume 1:133.
- 23 **Kow F.** Assessment of the nutritional status of pre-school aged children in Papua New Guinea with reference to the appropriateness of the international standards. PhD Thesis, London University, London, 1987.
- 24 **Papua New Guinea Department of Health.** Standard Treatment for Common Illnesses of Children in Papua New Guinea. Eighth edition. Port Moresby: Department of Health, 2005.
- 25 **Blowers H.** Taraka – a community in evolution. Social Science Dissertation, Western Australian Institute of Technology, Perth, Nov 1981.
- 26 **Gordon HM, Whitlock HV.** A new technique for counting nematode eggs in sheep faeces. *J Council Sci Industry Res* 1939;12:50-52.
- 27 **Hayashi S, Tanaka H, Shirasaka R.** Application of test-tube cultivation method on the survey of hookworm and related human nematodes infection. *Jpn J Exp Med* 1958;28:129-137.
- 28 **Little MD.** Comparative morphology of six species of *Strongyloides* (Nematoda) and redefinition of the genus. *J Parasitol* 1966;52:69-84.
- 29 **Viney ME, Ashford RW, Barnish G.** A taxonomic study of *Strongyloides* Grassi, 1879 (Nematoda) with special reference to *Strongyloides fuelleborni* von Linstow, 1905 in man in Papua New Guinea and the description of a new subspecies. *Systematic Parasitology* 1991;18:95-109.
- 30 **Crouch PR, Shield JM.** *Strongyloides fuelleborni*-like infections in Anga children. *PNG Med J* 1982;25:164-165.
- 31 **Albonico M, Stoltzfus RJ, Savioli L, Tielsch JM, Chwaya HM, Ercole R, Cancrini G.** Epidemiological evidence for a differential effect of hookworm species, *Ancylostoma duodenale* or *Necator americanus*, on iron status of children. *Int J Epidemiol* 1998;27:530-537.
- 32 **Bearup AJ, Lawrence JJ.** A parasitological survey of five New Guinean villages. *Med J Aust* 1950;1:724-732.
- 33 **Shield JM, Smith D, Heywood P.** The prevalence of alimentary helminthiasis and its association with nutritional status in children under five years old in the highlands of Papua New Guinea. *PNG Med J* 1981;24:40-44.
- 34 **Shield JM, Hide RL, Harvey PWJ, Vrbova H, Tulloch J.** Hookworm (*Necator americanus*) and *Strongyloides fuelleborni*-like prevalence and egg count with age in highlands fringe people of Papua New Guinea. *PNG Med J* 1987;30:21-26.
- 35 **Booth M, Bundy DAP.** Estimating the number of multiple-species geohelminth infections in human

- communities. *Parasitology* 1995;111:645-653.
- 36 **Brooker S, Miguel EA, Moulin S, Luoba AI, Bundy DAP, Kremer M.** Epidemiology of single and multiple species of helminth infections among school children in Busia District, Kenya. *East Afr Med J* 2000;77:157-161.
 - 37 **Ashford RW, Hall AJ, Babona D.** Distribution and abundance of intestinal helminths in man in western Papua New Guinea with special reference to *Strongyloides*. *Ann Trop Med Parasitol* 1981;75:269-270.
 - 38 **Shield JM.** Hookworm, *Strongyloides* and other intestinal helminths in children admitted to hospital in Lae, Papua New Guinea. *PNG Med J* 1986;29:225-231.
 - 39 **Shield J, Karr M, Kimber R, Casey G, Dreosti I.** Intestinal helminthiasis and nutritional status including iron, zinc and copper in Papua New Guinea urban children aged 1 to 5 years and effect of anthelmintic intervention. *PNG Med J* 1986;29:317-331.
 - 40 **Barnish G, Ashford RW.** *Strongyloides* cf *fuelleborni* and hookworm in Papua New Guinea: patterns of infection within the community. *Trans R Soc Trop Med Hyg* 1989;83:684-688.
 - 41 **Cooper ES, Bundy DAP, Henry FJ.** Chronic dysentery, stunting and whipworm infestation. *Lancet* 1986;2:280-281.
 - 42 **Grove DI.** Diagnosis. In: Grove DI, ed. *Strongyloidiasis: A Major Roundworm Infection of Man*. London: Taylor & Francis, 1989:175-197.
 - 43 **Basuni M, Muhi J, Othman N, Verweij JJ, Ahmad M, Miswan N, Rahumatullah A, Aziz FA, Zainudin NS, Noordin R.** A pentaplex real-time polymerase chain reaction assay for detection of four species of soil-transmitted helminths. *Am J Trop Med Hyg* 2011;84:338-343.
 - 44 **Faulkner H, Turner J, Kamgno J, Pion SD, Boussinesq M, Bradley JE.** Age- and infection intensity-dependent cytokine and antibody production in human trichuriasis: the importance of IgE. *J Infect Dis* 2002;185:665-672.
 - 45 **Turner JD, Faulkner H, Kamgno J, Cormont F, Van Snick J, Else KJ, Grecis RK, Behnke JM, Boussinesq M, Bradley JE.** Th2 cytokines are associated with reduced worm burdens in a human intestinal helminth infection. *J Infect Dis* 2003;188:1768-1775.
 - 46 **Horton J.** Albendazole: a review of anthelmintic efficacy and safety in humans. *Parasitology* 2000;121(Suppl):S113-S132.
 - 47 **Rossignol JF, Maisonneuve H.** Albendazole: placebo-controlled study in 870 patients with intestinal helminthiasis. *Trans R Soc Trop Med Hyg* 1983;77:707-711.
 - 48 **Nontasut P, Singhasivanon V, Prarinyanuparp V, Chiamratana B, Sanguankiat S, Dekumyoy P, Setasuban P.** Effect of single-dose albendazole and single-dose mebendazole on *Necator americanus*. *Southeast Asian J Trop Med Public Health* 1989;20:237-242.
 - 49 **Keiser J, Utzinger J.** Efficacy of current drugs against soil-transmitted helminth infections: systematic review and meta-analysis. *JAMA* 2008;299:1937-1948.
 - 50 **Pene P, Mojon M, Garin JP, Couland JP, Rossignol JF.** Albendazole: a new broad spectrum anthelmintic. Double-blind multicenter clinical trial. *Am J Trop Med Hyg* 1982;31:263-266.
 - 51 **Olsen A, Namwanje H, Nejsun P, Roepstorff A, Thamsborg SM.** Albendazole and mebendazole have low efficacy against *Trichuris trichiura* in school-age children in Kabale District, Uganda. *Trans R Soc Trop Med Hyg* 2009;103:443-466.
 - 52 **Page WA, Dempsey K, McCarthy JS.** Utility of serological follow-up of chronic strongyloidiasis after anthelmintic chemotherapy. *Trans R Soc Trop Med Hyg* 2006;100:1056-1062.
 - 53 **Quinnell RJ, Slater AFG, Tighe P, Walsh EA, Keymer AE, Pritchard DI.** Reinfection with hookworm after chemotherapy in Papua New Guinea. *Parasitology* 1993;106:379-385.
 - 54 **Knopp S, Mohammed KA, Speich B, Hattendorf J, Khamis IS, Khamis AN, Stothard JR, Rollinson D, Marti H, Utzinger J.** Albendazole and mebendazole administered alone or in combination with ivermectin against *Trichuris trichiura*: a randomized controlled trial. *Clin Infect Dis* 2010;51:1420-1428.
 - 55 **Bethony J, Brooker S, Albonico M, Geiger SM, Loukas A, Diemert D, Hotez PJ.** Soil-transmitted helminth infections: ascariasis, trichuriasis, and hookworm. *Lancet* 2006;367:1521-1532.

EDITORIAL

Papua New Guinean women in health and medicine: celebrating women's achievements

Inspiring stories

As a young Papua New Guinean woman, I embarked on this exciting project, following the invitation from Ceridwen, with very few expectations: not because I thought there were few Papua New Guinean women who had made contributions, but mostly because I was curious as to how many submissions we would receive.

Having conversations with friends and fellow young Papua New Guinean women, it became more and more apparent to me that indeed this would be a wonderful project as there were countless women out there who have made immense contributions to their communities. One story of a woman in the rural highlands particularly stood out for me. This woman used her vehicle to assist in transporting people from her community to the hospital when there were emergencies. Like so many other women in Papua New Guinea (PNG), she does not demand attention for her acts. As such, she goes on being a hero in her community with very little recognition from authorities.

Hearing stories of these women was very inspiring and I thought that other young Papua New Guinean women would feel the same if they were to read these, and so I was very excited at the prospect of receiving a multitude of submissions. Unfortunately, the submissions we received were relatively few. There were various difficulties but the logistics of organizing and conducting interviews proved a particular challenge.

While this proved to limit submissions, those we received were nothing short of inspirational. Importantly there was a good spread of stories, including some about 'well-known' women who work in health as well as those who have not been exposed in the media. Personally this was important as all these stories helped me see each person from a different perspective. In a sense it placed all the women on an even playing field. It became apparent that they shared so many similarities: how they were brought up,

their relationships and what propelled them into their careers, and, most strikingly, their aspirations for young educated Papua New Guinean women such as myself.

I was in awe of their achievements and soon realized that this was merely the beginning of an era in which more and more women in PNG would be willing to have their stories told, knowing that it would inspire women such as myself to work in and assist the community.

It was an honour taking part in this project and I am grateful for the opportunity to be part of it.

Annemarie Laumaea

Viral Fusion Laboratory
Burnet Institute
85 Commercial Road
Melbourne
Victoria 3004
Australia
alaumaea@burnet.edu.au

Embodying the best of humanity

As someone who has conducted research on gender in PNG, I have worked predominantly with women. Consequently, I have experienced the kindness, patience and dependability of many who have gone out of their way to make my life and work easier or more joyful. Thus, like Annemarie, I am delighted to be able to honour the Papua New Guinean women that we celebrate here. While they represent a particular group, namely women who have made a contribution to the area of health and medicine in PNG, the women whose stories are told here embody the humility and commitment of Papua New Guinean women I have met.

Despite their admirable qualities and achievements, these women tend to go about their business with little recognition, as Annemarie has remarked. Among other things, this means that those living outside the immediate areas in which women are making their contribution do not get to learn about

them.

In interviews I have conducted with Papua New Guinean women, many report a desire to learn about women whom they perceive to be 'role models'. Rapid change in PNG as a result of modernization has meant that young women today live different lives from those led by their mothers and grandmothers. This is especially so for women living in PNG's towns and urban centres. As such, they are keen to discover how other women are managing the simultaneous demands of paid work, child-raising and domestic labour. Reading about western women is of little relevance for most Papua New Guinean women, most of whom are also grappling with these competing demands while trying to respect Melanesian values such as caring for extended family and confronting changing ideas about women's roles.

Thankfully, there are shifts taking place. For example, *Stella*, a new magazine for women in PNG and the Pacific, contains many articles about inspirational Papua New Guinean women. I have also met young people who are interviewing their mothers, aunts and grandmothers for the purpose of writing their life stories. These accounts will form an important record, becoming an integral part of PNG's history.

It is to this history – or perhaps 'herstory' – that we wish to add. And while offering us as readers the chance to see the world through the eyes and experiences of individuals, as a collection these biographies simultaneously allow us to observe broader patterns. As Annemarie has noted, the similarities between these women are most interesting. For example, the importance of parental support for girls' participation in education would appear to be a key ingredient for success. As Morobe politician, Luther Wenge, remarked when Dr Lenga Yuyutine Dopenu, one of the first Papua New Guinean women to become a doctor, died: "Her good parents saw the potential in her and made sure she went to school." <http://www.pinanius.org>

While education is important, it is by no means a guarantor that those whom it benefits will use what they have learned to benefit others. Another factor uniting the women

represented in this collection is that they have all drawn on the resources and positive input from which they have benefited to alleviate suffering in the lives of others. Whether working to understand deadly viruses in a laboratory at the Institute of Medical Research or establishing an organization to support families experiencing violence, these women display a profound commitment to improving the lives of their fellow Papua New Guineans. Despite differences in personality, training and experience, they embody the best of humanity, demonstrating in their everyday lives the intuitive understanding of the following line in the Hippocratic oath:

I will remember that there is art to medicine as well as science, and that warmth, sympathy and understanding may outweigh the surgeon's knife or the chemist's drug.

In PNG, where surgeons and drugs are not always within reach, the grasp these women have on the art of warmth and sympathy is of immense importance. In what follows, we celebrate this gift and the intelligent, dedicated and brave Papua New Guinean women who share it.

Annemarie and I have been encouraged by the response of the *Papua New Guinea Medical Journal* to the series of articles that we have edited. We are pleased to note that the Journal is willing to accept additional contributions to this topic and we encourage others to write up their stories and those of their colleagues for submission to the Journal as individual articles. They should be submitted as contributions to the ongoing series on 'Women in health and medicine in Papua New Guinea'.

Ceridwen Spark

Research Fellow, State, Society and Governance in Melanesia
School of International, Political and Strategic Studies
Australian National University College of Asia and the Pacific
Canberra
Australian Capital Territory 0200
Australia
ceridwen.spark@anu.edu.au

Run to Win – the dedication, commitment and service of Judy Yaiyon

PAMELA AUPAE¹, RUTH AUPAE¹ AND SARAH AUPAE¹

Madang, Madang Province, Papua New Guinea

SUMMARY

This article documents the life and achievements of Judy Yaiyon Aupae from the perspectives of her three daughters. Judy was born in Enga Province and raised by her mother, who was the second wife of a chief. The article explores the origins of Judy's interest in health care as a child. It further explores her commitment to helping others through training as a nurse and, later, through working in physiotherapy. The article also documents Judy's recent gaining of further qualifications in physiotherapy through her completion of a degree at Divine Word University in Madang.

Family background and the early years

Judy Yaiyon Aupae (née Reme) was born and raised in Mamale village, Laiagam District, Enga Province – then part of Western Highlands District in the Territory of Papua and New Guinea. She was the second child of Reme Sangai Lakani, chief of the Laei tribe of the Pyain clan, and Parame Reme (née Aen) of the Tumbipyain tribe. Judy's birth occurred around two or three years after the arrival of Christian Apostolic missionaries in Mamale village in 1954, which family oral history indicates as the year Judy's father had given some of his land for the establishment of a Christian mission station at Mamale.

Judy was born into a large family. As polygamy was culturally acceptable in her society at that time, her father had four wives. The first wife had five children. Judy's mother was the second wife and had only two children, her older brother (who passed away in 1991) and herself. The third wife had one child and the fourth wife had three. Because her father had more than one wife, Judy and her brother were effectively rejected and neglected by their father. They were, however, loved, cared for and single-handedly raised by their mother, a strong principled woman of Christian faith who did not give up or discard her children. With the support of her cousin-brothers, Judy's mother was determined to give her children a good life and worked hard by planting vegetable

gardens and raising pigs, which she then sold in order to raise a bit of money to put Judy and her brother through school. Judy believes that she was also fortunate and privileged to have grown up in a village hamlet which was nestled beside the missionary station, as this close proximity enabled her to interact with the missionary families, which influenced her early development and also placed her in good stead for her future.

Education

In 1964 at the age of seven, Judy commenced her primary education at the Mamale Apostolic Primary School. As a young girl Judy was hard-working, both at home and academically. She excelled at school and scored very high marks in assessments. While in primary school, Judy was employed by some of the teachers at the school, as well as the missionaries, to help on a part-time basis with home chores such as babysitting, cooking and cleaning, in order to earn a bit of pocket money to pay for her school fees. On a number of occasions, Judy was taken as an English interpreter to accompany missionary nurses on medical (health and hygiene) patrols to the surrounding villages, because of her language ability and her confidence in interacting with people. It was during these medical patrols that Judy developed an interest in medicine and health care. Judy says that the early missionaries and teachers in her village were great role models for

1 PO Box 96, Madang, Madang Province 511, Papua New Guinea

her. She witnessed first-hand important and valuable traits such as love, care, dedication, commitment, self-denial and concern for other people. Judy was also often called on by the church pastors to interpret during church sermons.

In 1969 Judy completed her primary education and the following year enrolled at the Pausa Lutheran High School in Wapenamanda, Wabag District. In mid-1971 a team of health workers from Yagaum Hospital in Madang came to the school and conducted a health outreach; they informed the students about the Lutheran School of Nursing in Madang and encouraged them to apply after finishing high school. It was around that time that Judy was faced with a significant decision in her life. Although Judy wanted to continue her higher education, she was also realistic about her financial situation. After considering the financial struggle her mother sustained to put her through school, Judy decided that the best option for her was to get a job quickly to look after her mother. Given her early exposure to and interest in the field of health care, Judy applied and was subsequently selected to undertake her studies at the Lutheran School of Nursing as an enrolled hospital nurse (nursing officer). In 1975 Judy successfully completed her training and graduated with high distinction, attaining a Dux of Nursing Council Exam Award, and became an enrolled hospital nurse.

First posting and a family

In 1976, Judy's first posting as a nurse was at the Yagaum Lutheran Hospital, which was the main hospital in Madang Province at that time. Because of her commitment and work ethic it was not long before Judy was given the responsibility of being nurse in charge of the children's ward.

In 1977 Judy married John Aupae, a health inspector from Manam Island, Bogia District in Madang Province. A young family was soon on the way and Judy left her job at the hospital to become the homemaker. In 1978 she applied for a nursing role at the Modilon General Hospital – which had recently become the main referral hospital in Madang – but did not receive a positive response. In 1982 Judy gave birth to her second child and continued in her role as homemaker. In 1984 Judy was engaged by the College of Allied Health Sciences in Madang and worked as the mess

supervisor for a short period.

Return to nursing – Modilon General Hospital

In April 1984 the Director of Nursing at the Modilon General Hospital, Matron Mary Kamang, recruited Judy and on 9 April she started working in the children's outpatient department. In September the same year Matron Kamang was approached by Marianne Klus, a Canadian volunteer with CUSO International in the physiotherapy department, with a request for staff to be placed in the physiotherapy department to work with her and learn on the job because her term was soon ending.

Matron Kamang invited Judy to take on the role on a one-month trial basis and told her that she could report back whether she liked it or not. Although Judy had no practical experience in the discipline of physiotherapy, she quickly found the role very interesting, encouraging and inspiring – especially the sight of the crippled and the lame, both young and old, beginning to walk again. On expiration of the trial period she reported to the matron that she would remain in that role. The main interest for Judy was the innovation that physiotherapy represented, in terms of the treatment of various mobility conditions that, in disabled persons, medicinal drugs had little success in improving. Through physiotherapy, people could improve their condition, their health and even their personal livelihood – that was the importance and value of physiotherapy.

In August 1988 Ms Klus departed and Judy was left with the responsibility of overseeing the physiotherapy department as the unit manager. In 1990, Australian volunteer physiotherapist Debbie Lewin joined the department for a two-year period. Ms Lewin continued to provide a mentoring role for Judy and helped her to acquire new knowledge in treatment and patient care. After Ms Lewin left the department, Judy continued to manage the unit until 1995 when Hugh Saweni, one of the first national physiotherapists, was appointed to head the department. Unfortunately, Mr Saweni could stay with the department for only one year because of inadequate staff accommodation. Again, Judy was left to manage the department up until 2000, when South African physiotherapist Nina Venestra was placed with the department through VSO

(Voluntary Service Overseas). Ms Venestra was instrumental in putting together plans for the establishment of the physiotherapy school at the Divine Word University. It was during this period that much of Judy's practical experience and knowledge was drawn upon in collating and preparing the teaching and training materials. When Ms Venestra left the department to start the physiotherapy school at the Divine Word University in 2002, Mr Saweni returned. During this period Judy realized the importance of having the appropriate and necessary qualification for the role she was performing.

Back to school

In 2004 Judy approached the hospital management and sought approval for her bid to undergo formal training at the Divine Word University's School of Physiotherapy. With Mr Saweni's endorsement, her application was approved and Judy enrolled in the diploma of physiotherapy from 2005 to 2007. In March 2008 Judy graduated. She

was a qualified, registered physiotherapist and subsequently undertook her two-year residency at the Modilon General Hospital. In 2012 the physiotherapy school at Divine Word University started a degree program, which Judy enrolled in. On 3 March 2013, after years of faithful dedication and commitment to her vocation, Judy was rewarded when she graduated with a bachelor's degree in physiotherapy from the Divine Word University – it was a proud moment for the family as much as a momentous personal achievement. Judy was inspired and motivated to persevere by the motto of Divine Word University, 'Run to Win', which we have used as the title of this article on her life of dedication, commitment and service (Figure 1).

Vocation in health care – encouragement and motivation

Based on her experiences, Judy believes that pursuing a vocation in health care is an important discipline which requires something more than empathy for others. It requires



Figure 1. Judy Yaiyon Aupae at her graduation.

a deep desire to help fellow human beings, whether they are rich or poor, young or old, and from whatever cultural background or upbringing they may come from. Other important health care traits are kindness and compassion. Judy explains that she finds it rewarding when bedridden patients begin walking and moving freely again, as a result of her treatment. As part of her personal and professional work ethos Judy believes that being faithful in whatever you do, by having confidence in your own abilities, is critical. She says that being able to apply yourself and have patience and, most importantly, persevere in the face of challenges and times of difficulty are integral qualities for health care workers.

Nurses are vital and play an important role in the development of health care in Papua New Guinea (PNG). From an economic perspective, a healthy population translates to a healthy work force. At the moment the national government is looking at developing

a national health standard. In this regard, Judy is of the firm view that before a national standard can be developed and approved by government bureaucrats, those working in health care need to set the health standards.

There are tremendous challenges faced by health care workers, especially in the context of PNG, and professionals from all health care disciplines require the best support if they are to perform their duties at the highest levels of quality.

Judy attributes all her achievements in life, and her life itself, to her faith in God and His providence. Judy pays tribute to her dear mother, who not only brought her into the world, but also raised and cared for her and was her role model by imparting important principles and values. Finally, Judy acknowledges the vital role churches played by providing vital services in health and education wherein she is a beneficiary.

The story of Francisca Trimas

THERESA MEKI¹

Pawa Meri Project, Centre for Social and Creative Media, University of Goroka, Papua New Guinea

SUMMARY

Francisca Trimas is a 57-year-old nurse from the Madang Province of Papua New Guinea. This article documents her life as a rural health worker in Papua New Guinea. Since graduating from the Angau School of Nursing in 1976, Francisca has spent more than 30 years of her life working in the most remote parts of Papua New Guinea, from Kimbe to Hagen, Tari and the outskirts of the Eastern Highlands. In a country characterized by difficult terrain that makes access to basic health care very difficult, Francisca recalls the memorable moments in her life as a nurse dealing with life-threatening situations. From breech births to the occasional wild pig bite, Francisca reminisces on the joys and triumphs as well as the frustrations of working in the bush.

This narrative is a brief account of the life of Francisca Trimas, a nurse who has spent more than 30 years of her life serving in the remotest parts of Papua New Guinea (PNG) and still continues to work in health care.

Early life

Francisca Trimas was born in Maumbuan village in Bogia District in Madang Province on 1 November 1956. Her biological father had two wives. The first wife, Francisca's mother, had a total of fourteen children, nine boys and five girls. The second wife had two boys and a girl, so there was a total of seventeen children in the family. Life was tough in the village and it was difficult to raise so many children. Fortunately, an uncle named Petrus from Francisca's father's side of the family decided to adopt her. Petrus Ambale and his wife Anna adopted Francisca when she was only two months old.

Growing up, Francisca did not feel as if she was adopted; she was well taken care of and loved. When she was fifteen years old, Mrs Ambale revealed to Francisca that she was in fact adopted, but that fact made little difference in her life. She remembers her mother, Anna, as a very subservient wife, always obedient and hard-working. While her

father was at work, her mother earned income for the family by raising and selling pigeons. Francisca remembers a childhood spent swimming in the ocean and playing games – hopscotch and cops and robbers. Her parents were Catholic and very disciplined. As a child, she was taught never to steal. As she recalls, "My parents told me if I put my fingers into my mother or father's 'bilum' (bag) and take just 10 or 20 toea then I can do that to other people as well." Telling lies was also forbidden, and even the smallest fib was discouraged. As devout Catholics, Francisca's parents taught her that if she ever encountered anything difficult in life, she was to go down on her knees and seek the Lord in prayer. If she ever faced any problems, only God alone could help her.

Francisca's father was an aid post orderly. For much of her childhood, she and her family moved around the country accompanying their father to whichever aid post he was stationed. She described her father as timid and quite reserved. But as someone who loved people, he opened his home to strangers and treated everyone he met with kindness. Francisca recalls:

"He would carry me on his shoulders wherever he went and I would sit nearby

1 Pawa Meri Project, Centre for Social and Creative Media, University of Goroka, PO Box 1078, Goroka, Eastern Highlands Province 441, Papua New Guinea
theresamek3@gmail.com

and watch him work. I loved watching him talk to patients and the way they would respond to him. I was fascinated by the way he would draw injections and prepare medicine.”

Francisca decided that when she grew up she would be just like her father.

Education

Francisca started elementary school in 1962 at Kavieng Tee Primary School when her father, Petrus, was working at Kavieng Hospital in New Ireland Province. Their family home was conveniently located between the highway and the ocean so she and her siblings would spend afternoons swimming and playing by the beach. After three years in Kavieng, Petrus was assigned to go to work at a hospital in Rabaul, East New Britain Province. In Rabaul, Francisca continued her primary education. She had three brothers and three sisters but none of them wanted to go to school. They would leave home in the morning then escape during class time to the bushes or beach and later come home pretending they had been to school. Eventually their parents discovered what they were doing, but it was difficult to force them to go to school and so they just let them stay home. Francisca, however, was a smart girl and continued with her schooling. By 1969, she was back home in Bogia District, Madang, doing grade six at a local primary school. At this time Petrus was working in neighbouring Morobe Province.

In 1970 Francisca was accepted and enrolled at Divine Word High School – now Divine Word University in Madang – a high school developed and run by the missionaries of the Catholic faith. Most of those on the teaching staff were missionaries, laymen or priests, and all were professional and caring. Francisca believes she was blessed to have received a quality education at Divine Word, where she completed her high school education, finishing up to grade 10. In high school Francisca enjoyed mathematics, science, playing basketball and riding her bicycle around the mission grounds. She got along well with others but was quite timid, shying away from organized events such as school dances and other social gatherings.

When it was time to fill out her school leaver's form, Francisca applied for entry

into nursing at Angau School of Nursing in Lae (now the Lae School of Nursing). She remembered the example of her father. She admired the manner in which he talked with patients and she loved the joy that came with making other people happy. Nursing is what she had always wanted to do and she felt it was God's calling for her life. Nonetheless, Francisca realized her vocation would not be without difficulties. Her mother had told her nursing would involve leaving home and travelling away, up in the mountains or in a valley, depending on where she got posted.

On 21 January 1976, four months after PNG gained independence, 20-year-old Francisca Trimas graduated from Angau School of Nursing with a diploma in maternal child health (MCH).

Early career

Francisca's first post was at Kimbe General Hospital in West New Britain Province, where she worked in the child and maternal care unit. Although Francisca worked at Kimbe for only six months, she felt satisfied there because at last she was doing what her father had always done. As a first-time nurse she felt a sense of pride every time she wore her white dress, and an overwhelming urge to call out, “Look at me, I'm a nurse!”

After Kimbe, Francisca was sent to Simbu General Hospital in Simbu Province, where she worked for six months attending to maternal and child care needs. Thereafter, the Health Department sent Francisca to Mt Hagen General Hospital, Western Highlands Province, where she worked for three years. Later she was sent to Mendi Hospital in the Southern Highlands Province. However, Buyeabi Prison in Mendi made a request for a nurse and Francisca was called there to work instead.

For the following 9 years, Francisca worked for various government hospitals all around the highlands region before deciding it was time for a break. She went back home to Madang and stayed in her village for a number of months.

Fayantina

After residing in the village for several months, Francisca became restless, so she did what she knew best – she prayed for a job.

One night she had a dream. In her dream, it was graduation day all over again and she had been given a posting. The next morning, when Francisca told her friends about the dream, they predicted that perhaps there would be good news for her. A couple of days later, a white man, a Foursquare Church missionary, came to Francisca's village looking for her. "We have been looking for you", he said. "We've heard that you are a nurse and we want to send you to our mission station in Goroka, Eastern Highlands Province."

"I'll go where you want me to go", Francisca responded.

In 1985 Francisca moved to Fayantina in the Henganofi District of the Eastern Highlands Province. She spent 14 years in this rural area. For 6 of these years she was officer in charge (OIC) of the Fayantina Health Clinic. As OIC, she ensured that her staff of four people – two nursing officers and two community health workers – were properly housed, that all equipment was in working order and that all supplies were in stock.

During her time as OIC, Francisca also carried out village birth attendant (VBA) training. These training sessions involved Francisca and two nursing officers entering a village and training mothers in health education. Francisca and her staff taught pregnant mothers about the importance of a proper diet, regular exercise and antenatal care. Francisca and her team conducted VBA training four times a year at the request of the village communities. While this training focused exclusively on antenatal care, in reality the information was used more widely. In rural PNG, older mothers, with the help of other women, often deliver babies without the assistance of skilled midwives.

From her time in Fayantina, the case of the wild pig is one particular incident that Francisca recalls clearly. One day, a nine-year-old boy was rushed to the clinic with his intestines spilling out. Early that morning, he had gone into the bush to pass stools. While he was squatting, a wild pig charged, ripping flesh from the boy's stomach. When the villagers brought the boy to Francisca, she swiftly administered two injections: tetanus toxoid to stop the poison of the pig bite and crystalline penicillin, an antibiotic to prevent infection. There was nothing she could do but use gauze and clean gloves to keep the contents

of the boy's stomach in his body. Francisca rang the health office in Goroka. Staff there arranged for a helicopter and Francisca and the boy were flown to Goroka. The boy was transferred straight to the operating theatre at Goroka Base Hospital. All the while the brave little boy did not so much as cry. Francisca asked him, "Yu pilim pen?" (Do you feel pain?), to which the boy replied, "Ye, tasol miles lo krai" (Yes, but I don't want to cry).

It was in Fayantina that Francisca met her husband, Bernard, a local pastor of the Foursquare Mission. They got married on 3 January 1987. They have two daughters, Bethany and Bosnia. Their second-born was named after the European region that experienced civil war during the early 1990s. The name Bosnia was all over the news and Francisca liked the sound of it so she decided to name her daughter Bosnia.

Gouno

In 2000 Francisca left Fayantina and moved to Gouno in the Lufa District, another remote area of the Eastern Highlands Province. In Gouno she worked with a Faith Mission clinic. The Faith Mission, which has numerous clinics in rural PNG, is a Christian organization not affiliated with any church. Reflecting on her years working in Gouno, Francisca recalls one particular incident that she believes was an act of God. A mother had come in for delivery and it was a breech birth. Francisca did her very best and managed to get the baby out. However, to her surprise there was another baby still inside – one leg was poking out – it was another breech. By this time the mother was physically torn up and exhausted. As there was no assistance or hospital nearby, Francisca did the only thing she could. She got down on her knees and prayed. Immediately, a thought came to mind: "Let nature take its course." She promptly put on her gloves and stood ready to catch the baby. Right before her very eyes, Francisca saw the baby rotate inside the mother. The baby's head then came into view and the baby popped out unassisted. Francisca was overjoyed as she cleaned the babies and dressed the mother. Although not a trained midwife, Francisca had delivered two breech babies and saved their mother. It is miracles such as this that motivate Francisca to continue working in rural locations.

Francisca remembers another difficult

birth from her time in Gouno. More than five minutes had passed following delivery of the baby, but the placenta had not come out. Even after the lengthening of the umbilical cord and tightening of the stomach, there was still no sign of the placenta. Francisca tried to get the mother to empty her bladder by turning on a water tap, but this did not work. She catheterized the patient and attempted to induce the placenta manually, but there was still no placenta. Soon after, the placenta began to break and the mother started to lose a lot of blood. Her eyes were turning white. Francisca put the mother on a drip and called a doctor at Goroka Base Hospital. The doctor recommended the patient be brought immediately into town, so Francisca called Faith Mission headquarters and requested a medical evacuation. The mother and the baby were transported into Goroka, where they received life-saving treatment.

While working with the Faith Mission in Gouno, Francisca occasionally travelled to even more remote locations to deliver vaccinations and VBA training. She reached these areas aboard Mission Aviation Fellowship single-engine piston aircraft. Although the mission clinics in Gouno and other remote locations were well stocked with supplies, there was limited help for Francisca and she usually worked alone. But she knew that God was always with her.

Francisca was raised a Catholic but later she became a Seventh-Day Adventist. Her decision to leave the Catholic faith was a gradual one. It started years ago when she and other nurses would go into Seventh-Day Adventist communities to deliver VBA training. Along with the Adventist principles of observing Saturday as a day of rest and practising vegetarianism, Francisca was captivated by the hymns and choruses of the church. One particular song that prompted Francisca's decision to move was a song called 'Carry your candle'. Francisca says that the very first time she heard that song, she felt it was calling her home to the Adventist faith. In 2009, Francisca became a member of the Seventh-Day Adventist church. When Francisca told her husband about her move he responded, "Go ahead, I'll come later."

Francisca regards God as the great physician capable of healing all ailments. She whispers prayers while administering medication as she believes that drugs and

injections are avenues through which God heals the sick.

Eastern Highlands Simbu Mission

In 2005 Francisca decided it was time for a break and so she resigned and went to live in Bernard's village in Henganofi District. While in the village Francisca did not stop working. She continued to help women and children with their minor ailments such as headaches and fevers. Even without modern medicine, she utilized medicinal plants and prepared healthy nutritious meals for her village patients. When the medical OIC of Henganofi District Clinic learnt that Francisca was residing in the area, he instructed Francisca to get supplies from the clinic and administer these to sick people in her village when necessary. In her free time, Francisca would walk from village to village checking on the health of mothers, children and the elderly.

In 2009 Francisca received a telephone call from Nina Giheno, health director of the Eastern Highlands Simbu Mission (EHSM) of the Seventh-Day Adventist Church. Nina asked Francisca to travel to Goroka and give VBA training. While in Goroka, Francisca saw that EHSM wished to employ a nurse at its headquarters. She applied for the job and was successful. Francisca has been working with EHSM since 2009. She flies throughout the Eastern Highlands and Simbu Provinces on Adventist Aviation Services, giving immunizations and VBA training wherever there are Adventist churches and clinics (Figure 1).

Life as a rural health worker

In addition to helping mothers and their babies, during her time in the bush Francisca has treated patients suffering from asthma, burns, typhoid, malaria, pneumonia, diarrhoea and fever. She has even attended to patients who have been attacked by animals. Francisca loves working in the bush where she has to be independent and self-reliant. Being away from civilization and the luxuries of the modern world has also shaped her faith. In her words:

"You really get to see the hand of God when you are out in the middle of nowhere ... every day you will see miracles because there is no distraction, just you and God."



Figure 1. Francisca Trimas.

When asked about her proudest achievements, Francisca replies, “I’m proud when I deliver babies because I help bring out a new life.” Francisca starts talking to babies when they are inside the stomach, and when they are born she always welcomes them with the popular Adventist hymn ‘Because He Lives’. Francisca derives an indescribable joy from holding newborn babies. She regards these moments as among the most special in life. Francisca has more than twenty namesakes scattered across the rural Eastern Highlands, baby girls who were named after her in appreciation of her work. In this way Francisca’s legacy lives on – the kind nurse who lived and worked among the people of the Eastern Highlands.

Now 57, Francisca intends to continue

working for EHSM, serving God and His people, for at least 10 more years. If given the opportunity she would love to work in the bush in one of the coastal regions of PNG. She knows working in the bush is hard but she reminisces:

“Sometimes when I’m attending to sick patients, I can see my father Petrus doing the very same thing and it gives me great joy to know that out of all his children I am the one who made him proud, who followed his footsteps.”

Despite the shortage of skilled workers and basic drugs, Francisca loves what she does by helping people in need. God willing, she intends to keep working as long as she is able.

Mother's love for bacterial babies: the commitment of Audrey Michael, Mitton Yoannes and Tilda Orami to medical research

TAMMY GIBBS¹ AND GERALDINE VILAKIVA²

**Telethon Institute for Child Health Research, Centre for Child Health Research,
University of Western Australia, Perth and Papua New Guinea Institute of Medical
Research, Goroka**

SUMMARY

Audrey Michael, Mitton Yoannes and Tilda Orami are long-term health researchers at the Papua New Guinea Institute of Medical Research (PNGIMR). Face-to-face interviews were conducted with all three women for the purpose of profiling women who are leaders in health and medicine in Papua New Guinea. They were asked questions about their early life and childhood, education, work life and training, and mentors who have supported their career path and leadership role. Audrey, Mitton and Tilda have all made significant contributions to the PNGIMR and to the health of the people of PNG. In particular, all three have been part of pneumococcal conjugate vaccine (PCV) studies – looking at the safety, immunogenicity and priming for immunological memory of a 7-valent PCV and investigating the safety and immune responses to two different, recently licensed types of PCV, a 13-valent and a 10-valent vaccine.

Working away in the bacteriology and immunology laboratories at the Papua New Guinea Institute of Medical Research (PNGIMR) are three dedicated, strong women. Between them, they have spent more than six decades at the Institute working on a range of infectious diseases from pneumonia to typhoid fever to HIV infection. They have all made significant contributions to recent pneumococcal conjugate vaccine (PCV) studies.

Audrey Michael, or Mama Audrey as she is affectionately known, is the matriarch of the laboratory (Figure 1). Other researchers consider her a mentor, having been trained by Audrey in the basics of bacteriology and laboratory techniques. Mitton Yoannes and Tilda Orami (previously Tilda Wal) are two of those researchers.

But Audrey says she only became a medical researcher by accident. As a child, she wanted to be a doctor but physics wasn't a strong point so she decided to study pathology

and later medical laboratory techniques.

Audrey hails from Wamira village in the Milne Bay area of PNG, at the south-eastern tip of the island known as the Bird's Tail Peninsula. She completed her training in Port Moresby as a medical laboratory technologist, then spent six months working in Lae, before heading into the highlands in 1985 to work at the PNGIMR in Goroka.

It is a similar tale for Mitton and Tilda. Both completed their laboratory technician training at the College of Allied Health Sciences in Port Moresby about a decade after Audrey.

Mitton (Figure 2) is from Wabag, Enga Province, and says she never thought she would be a researcher. She had dreams of becoming a typist after watching a woman typing in the school office and noticing she had 'good hands'. She ended up in Goroka after seeing PNGIMR mentioned on the noticeboard at the Port Moresby General Hospital pathology department. She wrote

1 Telethon Institute for Child Health Research, Centre for Child Health Research, University of Western Australia, PO Box 855, West Perth, Western Australia 6872, Australia
tammyg@icmr.uwa.edu.au

2 Papua New Guinea Institute of Medical Research, PO Box 60, Goroka, Eastern Highlands Province 441, Papua New Guinea



Figure 1. Audrey Michael in the bacteriology laboratory at the Papua New Guinea Institute of Medical Research.



Figure 2. Mitton Yoannes in the bacteriology laboratory at the Papua New Guinea Institute of Medical Research.

a letter which ended up in the hands of PNGIMR Director Professor Michael Alpers, who offered her a job in microbiology.

Tilda (Figure 3) had even fewer aspirations for her working career. She says she had no

interests and after finishing college was just hanging around in her home village of Aiyura near Kainantu in Eastern Highlands Province. But she did know Mitton from school and thought her work looked interesting and exciting so she followed in her footsteps.



Figure 3. Tilda Orami in the immunology laboratory at the Papua New Guinea Institute of Medical Research.

Tilda's training took longer than expected with a two-year wait due to a lack of lecturers. In that time, she had a baby and found it difficult to go back to school. Her career got back on track when she moved to Goroka to take up a position in the bacteriology laboratory at PNGIMR. Tilda says it gave her the opportunity to learn many new things and travel. She attended a three-week course in the Philippines on HIV/AIDS (human immunodeficiency virus/acquired immune deficiency syndrome) and co-infections in Asian and Pacific countries.

Audrey and Miton have also gained new skills and techniques overseas. Both have been to the Philippines – Miton learned about culturing and identification of bacteria and viruses during a training course while Audrey spent a month at the Research Institute for Tropical Medicine in Manila as a lab technician. Audrey says it was 'such a long time ago' but that it was an exciting time with lots of doctors and professors to learn from. She is grateful for the opportunity to gain training – she says in the early days of her career training was difficult to access and it was very expensive to go overseas.

All three have visited Australia. Audrey spent eight weeks at the Queensland Institute

of Medical Research learning how to serotype pneumococci and test for antibiotic resistance. She enjoyed the course. It was taught by the same teacher as in the certificate course she completed in Port Moresby.

Miton has been 'down under' several times – a visit to the Menzies School of Health Research in Darwin to learn quantitative polymerase chain reaction (PCR) techniques, and to Perth's Telethon Institute for Child Health Research and PathWest for training on a machine used to identify bacteria. Miton has also been to Melbourne to learn PCR and other molecular and microbiological techniques.

It is Tilda who has spent the most time in Australia. After completing a bachelor's degree in laboratory science in 2009, Tilda embarked on an honours degree and at the end of 2012 she travelled to the Telethon Institute to spend three months measuring salivary antibodies in the lab for her honours, and brought her 420 samples to Perth after waiting 12 months for reagents that never arrived in Goroka. Tilda worked in the Institute's labs and brought her results and newly acquired Bioplex techniques back to PNG. She says she did lots of work while in Western Australia, with very little time for sightseeing, but she did enjoy heading

to the south-west town of Denmark with its beautiful trees and beaches.

The trio have been part of the two PCV studies that have been running from the PNGIMR clinics since 2005. Both studies are collaborative projects between PNGIMR, the Telethon Institute for Child Health Research and the School of Paediatrics and Child Health in the University of Western Australia. The first study ran for four years looking at the safety, immunogenicity and priming for immunological memory of a 7-valent pneumococcal conjugate vaccine to find out whether neonatal immunization in the first week of life would provide earlier protective antibody responses than immunization starting a month later, which is the standard schedule in PNG.

Important results came from this study of 318 children, including that the vaccine had no negative effects and was immunogenic in neonates and young babies. The data showed that 60% of infants were colonized with *Streptococcus pneumoniae* by one month of age, with 51 different pneumococcal serotypes identified in the upper respiratory tract. The vaccine had limited overall impact on upper respiratory tract carriage in this population. However, the level of protective antibodies achieved by the vaccine was high and giving the 23-valent pneumococcal polysaccharide vaccine at nine months of age should provide even better and broader protection against diseases caused by the pneumococcus than PCV alone.

It was these children that provided the saliva samples analysed by Tilda for her honours project, allowing her to optimize and measure mucosal immunoglobulin (Ig) A and IgG antibodies. She hopes to submit her thesis within the coming year.

The current PCV study is looking at the safety of and immune responses to two different types of pneumococcal conjugate vaccine – the 13-valent Prevenar 13 and the 10-valent Synflorix. In the near future, the government of PNG will roll out a nationwide vaccination program of Prevenar 13 in children. Results from this current study will inform the government that if and when supplies of Prevenar 13 run out, due to world demand, it can be interchanged with Synflorix and still provide strong protection against pneumococcal disease.

In this study, 200 children have already been enrolled, with half receiving Synflorix and half Prevenar 13. Nasal swabs and blood samples are collected from each child and sent to the lab for analysis. Audrey's role in the study is to culture the bacteria from the samples and identify which bacteria are present – especially *Streptococcus pneumoniae* and *Haemophilus influenzae*. Once cultured and coded, the data are passed to Mitton, who enters all the information into the database. Mitton calls the bacteria their 'bacto babies' and they work hard to keep them alive all the time, putting them to sleep in -80°Celsius freezers so that research studies can continue.

This research is of vital importance to PNG as pneumonia (commonly caused by the pneumococcus) is the main reason children are admitted to hospital or die. Audrey says seeing vaccines work is one of the most rewarding parts of her job. Mitton agrees and says she is proud to have contributed to improving the health of the people of PNG by being part of research that provides important information to government and policy-makers. All can feel proud to have worked on the PCV studies and look forward to seeing a vaccine introduced to protect the children of PNG.

It is not just pneumococcal studies that these women have been involved in. Among other studies, Audrey has been part of research into osteomyelitis, a bone disease common in the highlands of PNG. She was looking at blood, bone and pus to identify the bacteria responsible for causing the disease.

Mitton has worked on a meningitis surveillance study, with daily processing of cerebrospinal fluid to culture and identify bacteria, as well as an HIV surveillance study. She has also looked at antibiotic resistance in *Neisseria gonorrhoeae* in a gonorrhoea study, a typhoid study to determine the age- and sex-specific incidence of typhoid fever in the Eastern Highlands, and a postpartum sepsis study which showed high rates of genital mycoplasma infection in women giving birth at Goroka General Hospital.

Both Tilda and Mitton were involved with the sexually transmitted infection (STI) and HIV surveillance project, travelled with the team to the study sites and collected, processed and transported samples back to the lab. They then tested the serum samples for HIV and syphilis. Audrey, Tilda and Mitton

all have a strong work ethic, which often sees them starting work early, working back in the evenings or coming into the lab on weekends. But they all love their jobs and they all agree that the PNGIMR is a great place to work, with a good family atmosphere and colleagues who help each other.

For a woman working in research, it can be tough at times. Juggling a full workload, caring for children, running a household and contributing to the community means there is little time left for themselves. Nevertheless, with lots of fellow women researchers at PNGIMR, Tilda says they can support each other both in the lab and outside of work as friends. They all credit their families with being supportive and understanding of the demands of their jobs. Audrey says her parents encouraged her to pursue her career in Goroka despite them being afraid of 'highlands people'. She has since brought them to Goroka on a visit.

Audrey, Tilda and Miton all have children; Audrey has a grandson too. Tilda cares full-time for three children, aged 10, 12 and 13. She says none of them have aspirations to follow in her footsteps and work in health research, but her youngest does help pack pipette tips into boxes for use in the lab. Along with their supportive families, there have been many mentors in their careers. Miton and Tilda both name Audrey as a significant personal and professional mentor, someone who willingly teaches others and passes on her knowledge. She's also a 'wonderful person'. Miton says microbiologists Alison Clegg and Tony Lupiwa taught her valuable laboratory skills at a time when she did not have much knowledge and understanding about the day-to-day procedures of a research laboratory. Tilda also credits Tony as an understanding and helpful mentor and her current boss Dr William Pomat, head of the PNGIMR infection and immunity section, for encouraging her to go back to school and complete her degrees. For Audrey, New Zealander Mike Gratten has been a strong influence since she met him at Port Moresby General Hospital early in her career; he subsequently came to work at PNGIMR. She says Mike had a lot of patience for her, insisting there were no silly questions, and sharing those experiences which cannot be found in a textbook.

While Audrey, Tilda and Miton are still found working at the bench, they are also

training the next generation of researchers, teaching them the basics of bacteriology, media making and how to freeze-dry bacterial isolates for long-term preservation. Audrey is at the end of her career at the PNGIMR but hopes to continue working in health as a consultant in bacteriology, especially in training and the establishment of laboratories. She is also keen to set up a program to get women together to teach them how to look after their own health. On a personal level, she hopes to travel to see all the people she has met over the years. But her big dream is to be a florist – she has already completed a floristry course – to grow flowers in her garden to sell, and have a park full of blooms where people can rest and enjoy a barbeque.

Tilda's future plans include going back to school. She would like to start a master's degree soon and says that a PhD could be a possibility further down the track. Miton also has studies on her mind, hoping to start a bachelor's degree before long. She also wants to do something to stop her fellow countrywomen dying of cervical cancer. According to Associate Professor Andrew Vallely, deputy director of science at PNGIMR, cervical cancer kills 1500 Papua New Guinean women a year, more than any other cancer, and PNG has one of the highest rates in the world. Miton sometimes talks to women in church gatherings to inform them about tests and facilities now available in PNG to detect cervical cancer. She says she would not hesitate to learn how to read Pap smears for the diagnosis of cervical cancer if given the opportunity. Currently, Pap smears are sent overseas and it takes a while for the results to come back to PNG.

Audrey, Tilda and Miton have helped shape the PNGIMR into the bustling and productive research facility that it is today. Through hard work, passion and a determination to make a difference to the health of their people, this trio are shining examples of women making valuable contributions to health and medical research in the challenging environment that is Papua New Guinea.

Bibliography of papers by Audrey, Miton and Tilda

- 1 **Montgomery J, West B, Michael A, Kadivaion B.** Bacterial resistance in the Eastern Highlands Province. *PNG Med J* 1987;30:11-19.

- 2 **Jenkins C, Montgomery J, Michael A.** Penicillin-resistant *Streptococcus pneumoniae* and other nasal bacteria among children in remote areas of the fringe highlands of Papua New Guinea. *PNG Med J* 1989;32:185-188.
- 3 **Brian MJ, Michael A.** Community-acquired infection with methicillin-resistant *Staphylococcus aureus* in Papua New Guinea. *Pediatr Infect Dis J* 1989;8:807-808.
- 4 **Montgomery JM, Lehmann D, Smith T, Michael A, Joseph B, Lupiwa T, Coakley C, Spooner V, Best B, Riley ID, Alpers MP.** Bacterial colonization of the upper respiratory tract and its association with acute lower respiratory tract infections in highland children of Papua New Guinea. *Rev Infect Dis* 1990;12 Suppl 8:S1006-S1016.
- 5 **Lehmann D, Coakley KJ, Coakley CA, Spooner V, Montgomery JM, Michael A, Riley ID, Smith T, Clancy RL, Cripps AW, Alpers MP.** Reduction in the incidence of acute bronchitis by an oral *Haemophilus influenzae* vaccine in patients with chronic bronchitis in the highlands of Papua New Guinea. *Am Rev Respir Dis* 1991;14:324-330.
- 6 **Manary MJ, Lehmann D, Michael A, Coakley K, Taime J, Montgomery J, Granoff DM.** Antigenuria in healthy Papua New Guinean children with nasal *Haemophilus influenzae* type b carriage. *Ann Trop Paediatr* 1993;13:385-389.
- 7 **Clegg A, Passey M, Yoannes M, Michael A.** High rates of genital mycoplasma infection in the highlands of Papua New Guinea determined both by culture and by a commercial detection kit. *J Clin Microbiol* 1997;35:197-200.
- 8 **Lehmann D, Yeka W, Rongap T, Javati A, Saleu G, Clegg A, Michael A, Lupiwa T, Omena M, Alpers MP.** Aetiology and clinical signs of bacterial meningitis in children admitted to Goroka Base Hospital, Papua New Guinea, 1989-1992. *Ann Trop Paediatr* 1999;19:21-32.
- 9 **Duke T, Michael A.** Increase in sepsis due to multi-resistant enteric gram-negative bacilli in Papua New Guinea. *Lancet* 1999;353:2210-2211.
- 10 **Lehmann D, Michael A, Omena M, Clegg A, Lupiwa T, Sanders RC, Marjen B, Wai'in P, Rongap A, Saleu G, Namuigi P, Kakazo M, Lupiwa S, Lewis DJ, Alpers MP.** Bacterial and viral etiology of severe infection in children less than three months old in the highlands of Papua New Guinea. *Pediatr Infect Dis J* 1999;18:S42-S49.
- 11 **Duke T, Poka H, Frank D, Michael A, Mgone J, Wal T.** Chloramphenicol versus benzylpenicillin and gentamicin for the treatment of severe pneumonia in children in Papua New Guinea: a randomised trial. *Lancet* 2002;359:474-480.
- 12 **Duke T, Mokela D, Frank D, Michael A, Paulo T, Mgone J, Kurubi J.** Management of meningitis in children with oral fluid restriction or intravenous fluid at maintenance volumes: a randomised trial. *Ann Trop Paediatr* 2002;22:145-157.
- 13 **Duke T, Michael A, Mgone J, Frank D, Wal T, Sehuko R.** Etiology of child mortality in Goroka, Papua New Guinea: a prospective two-year study. *Bull World Health Organ* 2002;80:16-25.
- 14 **Thong KL, Goh YL, Yasin RM, Lau MG, Passey M, Winston G, Yoannes M, Pang T, Reeder JC.** Increasing genetic diversity of *Salmonella enterica* serovar Typhi isolates from Papua New Guinea over the period from 1992 to 1999. *J Clin Microbiol* 2002;40:4156-4160.
- 15 **Duke T, Michael A, Mokela D, Wal T, Reeder J.** Chloramphenicol or ceftriaxone, or both, as treatment for meningitis in developing countries? *Arch Dis Child* 2003;88:536-539.
- 16 **Rochfort SJ, Towerzey L, Carroll A, King G, Michael A, Pierens G, Rali**

- T, Redburn J, Whitmore J, Quinn RJ.** Latifolians A and B, novel JNK3 kinase inhibitors from the Papua New Guinean plant *Gnetum latifolium*. *J Nat Prod* 2005;68:1080-1082.
- 17 **Combs BG, Passey M, Michael A, Pang T, Lightfoot D, Alpers MP.** Ribotyping of *Salmonella enterica* serovar Typhi isolates from Papua New Guinea over the period 1977 to 1996. *PNG Med J* 2005;48:158-167.
 - 18 **Francis JP, Richmond PC, Pomat WS, Michael A, Keno H, Phuanukoonnon S, Nelson JB, Whinnen M, Heinrich T, Smith WA, Prescott SL, Holt PG, Siba PM, Lehmann D, van den Biggelaar AH.** Maternal antibodies to pneumolysin but not to pneumococcal surface protein A delay early pneumococcal carriage in high-risk Papua New Guinean infants. *Clin Vaccine Immunol* 2009;16:1633-1638.
 - 19 **Phuanukoonnon S, Reeder JC, Pomat WS, van den Biggelaar AH, Holt PG, Saleu G, Opa C, Michael A, Aho C, Yoannes M, Francis J, Orami T, Namuigi P, Siba PM, Richmond PC, Lehmann D.** A neonatal pneumococcal conjugate vaccine trial in Papua New Guinea: study population, methods and operational challenges. *PNG Med J* 2010;53:191-206.
 - 20 **Dunne EM, Montgomery J, Lupiwa T, Michael A, Lehmann D.** *Streptococcus pneumoniae* serogroups and colony morphology: a look back. *PNG Med J* 2010;53:166-168.
 - 21 **Manning L, Laman M, Greenhill AR, Michael A, Siba P, Mueller I, Davis TM.** Increasing chloramphenicol resistance in *Streptococcus pneumoniae* isolates from Papua New Guinean children with acute bacterial meningitis. *Antimicrob Agents Chemother* 2011;55:4454-4456.
 - 22 **Laman M, Manning L, Greenhill AR, Mare T, Michael A, Shem S, Vince J, Lagani W, Hwaiwhanje I, Siba PM, Mueller I, Davis TM.** Predictors of acute bacterial meningitis in children from a malaria-endemic area of Papua New Guinea. *Am J Trop Med Hyg* 2012;86:240-245.
 - 23 **van den Biggelaar AH, Pomat WS, Phuanukoonnon S, Michael A, Aho C, Nadal-Sims MA, Devitt CJ, Jacoby PA, Hales BJ, Smith WA, Mitchell T, Wiertsema S, Richmond P, Siba P, Holt PG, Lehmann D.** Effect of early carriage of *Streptococcus pneumoniae* on the development of pneumococcal protein-specific cellular immune responses in infancy. *Pediatr Infect Dis J* 2012;31:243-248.

Papua New Guinea's next generation of medical researchers: Celestine Aho, Patricia Rarau and Pamela Toliman

GERALDINE VILAKIVA¹ AND TAMMY GIBBS²

Papua New Guinea Institute of Medical Research, Goroka and Telethon Institute for Child Health Research, Centre for Child Health Research, University of Western Australia, Perth

SUMMARY

Celestine Aho, Patricia Rarau and Pamela Toliman are amongst the next generation of health researchers at the Papua New Guinea Institute of Medical Research (PNGIMR). Face-to-face interviews were conducted with all three women for the purpose of profiling women who are leaders in health and medicine in Papua New Guinea (PNG). They were asked questions about their early life and childhood, education, work life and training, and mentors who have supported their career path and leadership role. All three see opportunities before them to tackle the health challenges facing PNG, find solutions and contribute to human development in their country. At PNGIMR, Pamela is a senior scientific officer in the HIV and STI laboratory; Celestine is a senior scientific officer in the bacteriology laboratory working on pneumococcal vaccines; and Patricia is the study clinician for the Partnership in Health Project, monitoring the impact of the PNG liquefied natural gas (LNG) project.

Celestine Aho, Pamela Toliman and Dr Patricia Rarau are three vibrant Papua New Guinean women who are making their mark in the world of medical research at the Papua New Guinea Institute of Medical Research (PNGIMR). They represent a new breed of young, highly educated, career-minded, ambitious yet culturally orientated PNG women. Although they come from different ethnic and cultural backgrounds, one thing draws them together – their love for research. For this trio, medical research has transformed from a profession to a passion – they all want to make a difference and improve health in PNG through research.

Medical research was not always on their minds. As a child, Celestine wanted to be a medical doctor. A science foundation year at university set her on the path to geology but in her third year she had a reality check and decided the 'fly-in fly-out' work roster that came with a career in geology was not for her. She transferred to microbiology and

has no regrets. The switch in science genres took her on a new path and she landed a job at the Wildlife Conservation Society in Goroka, where she worked on building a reference database, classed plant samples and fed birds. A phone call from Dr William Pomat with an offer to work at the PNGIMR saw another career change, setting her on the path to medical research.

Pamela says her choice in science was out of default as she was not sure what she wanted to do after finishing year 12. Her parents wanted her to do medicine so she started with a science degree first, with a view to doing postgraduate medicine down the track. Along with the science degree, she completed a bachelor of arts with a double major in sociology. This degree impressed upon her an approach to research that would be more holistic. For her, the arts degree filled the gaps in her science-based understanding of disease. Both her science and arts degrees were obtained abroad, at the University of

1 Papua New Guinea Institute of Medical Research, PO Box 60, Goroka, Eastern Highlands Province 441, Papua New Guinea
geraldine.vilakiva@pngimr.org.pg

2 Telethon Institute for Child Health Research, Centre for Child Health Research, University of Western Australia, PO Box 855, West Perth, Western Australia 6872, Australia

Queensland. Here, Pamela lived the full university experience: living on campus, participating in college sports, including hockey and softball, and even becoming college president.

Patricia's dream as a child was to follow in her father's footsteps and become a loans officer at a bank. She then entertained the thought of becoming a pilot or accountant. After completing her final high school years at a boarding school in Rockhampton in Queensland, Patricia enrolled in a bachelor of science degree course at the University of Papua New Guinea. Patricia streamed into genetics in the last semester of 2001, enabling her to enter the bachelor of medicine and bachelor of surgery course at the School of Medicine and Health Sciences. She then completed her medical residency at Port Moresby General Hospital in 2006 and 2007.

Unlike her medical colleagues who continued as practising doctors, Patricia took a different path, as she felt the hospital setting wasn't for her and she wanted to help prevent disease and make a difference to the whole population. In 2008, she became a research clinician for one of PNGIMR's major malaria research studies, the Intermittent Preventive Treatment of Malaria in Infants (IPTi) study. Having no idea about research, Patricia took up the challenge after being introduced to IMR by her university lecturer who was then the Dean of the School of Medicine and Health Sciences, Professor Sir Isi Kevau.

Pamela, Celestine and Patricia have all gone on to complete master's degrees. For Patricia, her work on the IPTi study formed the basis for her master's program. The IPTi study looked at antimalarial medications and how effective they are in preventing malaria in PNG infants when administered early in life. Results from the study were published in numerous international journals and also gave Patricia the opportunity to present the results of her thesis, which looked at respiratory viral pathogens in infants, at the 58th American Society of Tropical Medicine and Hygiene annual conference in Washington DC in 2009. She describes this experience as 'awesome'.

After joining IMR in 2006, Celestine completed an honours degree in 2009 before embarking on a master's degree. Her master's project took her to Switzerland for 18 months, where she worked and studied

at the Swiss Tropical and Public Health Institute. She looked at the diversity of *Streptococcus pneumoniae* isolated from the noses of young children, and also isolates from children who were diagnosed with pneumococcal meningitis. Living in Basel, in north-west Switzerland on the Rhine River, was a challenging experience for Celestine, a Goroka local. Everything was so different, including the lifestyle, weather and the way people interact, and she also had no family with her and did not know many people. But she discovered chocolate, cheese, bread and bobsledding, and was able to visit Paris, Barcelona and the Black Forest in Germany.

Since joining IMR in 2003, Pamela's research has been in the area of HIV (human immunodeficiency virus) and sexually transmitted infections (STIs) (Figure 1). These studies have contributed a wealth of information and broadened our understanding of HIV and STIs in PNG. Her honours project evaluated the standard treatment for gonorrhoea to determine its effectiveness in PNG. For her master's, Pamela looked at co-infections in those who are HIV positive. The study was significant as it provided an insight into the common diseases that affect those living with HIV, as well as the social and cultural issues that contribute to this in the PNG setting. Pamela's research also provided the first evidence to show that people are being diagnosed as HIV positive very late, which has a major impact on prognosis. Not only is that person's immune system already decimated, but they could unknowingly be transmitting the disease, further adding to the HIV problem.

Pamela is passionate about this area of health in PNG and is determined to make a difference. In particular, she is concerned about STIs in women as these can cause secondary infertility. For her PhD, she wants to do research into cervical cancer, the biggest cancer killer of women in PNG. Pap smear testing has not been logistically successful in PNG for a number of reasons. Pamela hopes that a rapid human papillomavirus (HPV) test will reduce cervical cancer rates by detecting strains of HPV and seeing women with high-risk strains referred for further treatment.

Leadership

Today, all three women have leadership roles at IMR. Pamela has risen through the



Figure 1. Pamela Toliman in the HIV (human immunodeficiency virus) and STI (sexually transmitted infection) laboratory at the Papua New Guinea Institute of Medical Research.

ranks in the HIV and STI laboratory from a graduate scientist to a senior scientific officer and the laboratory research coordinator. Celestine is a senior scientific officer in the bacteriology laboratory (Figure 2), where she is part of the acute respiratory infection research team conducting extensive research into pneumococcal conjugate vaccine for PNG children. These studies are done in collaboration with both national and international organizations and have provided vital information which has informed government policy. PNG will introduce a pneumococcal vaccine in 2014, and Celestine is proud to be part of the team that contributed to the research that will help many Papua New Guinean children.

Patricia is currently the study clinician for one of IMR's biggest projects – the Partnership in Health Project – looking after Hiri, one of the four study sites of the project (Figure 3). This project is monitoring the impact of the PNG liquefied natural gas (LNG) project on

the health of the population in the impacted areas Hiri and Hides and in non-impacted areas in the Asaro Valley and on Karkar. The LNG project is the largest resource project in the history of PNG and will have a significant impact economically, as well as on employment, lifestyle and health. This study will compare longitudinal demographic and health trends in these four communities using health and demographic surveillance systems. Patricia is particularly interested in non-communicable or lifestyle diseases such as diabetes, cardiovascular diseases and cancer. Patricia relishes in the opportunity to work on the project since, although it is research, it also gives her the opportunity to see patients in the clinic.

As young, up-and-coming researchers, Celestine, Pamela and Patricia rely on mentors to help teach them the tricks of research and to be good at what they do. These mentors are the special people who have made an impact in their careers and their lives.



Figure 2. Celestine Aho in the bacteriology laboratory at the Papua New Guinea Institute of Medical Research.

Mentors

For Patricia, Dr Ivo Mueller has been a big influence for her. Now at the prestigious Walter and Eliza Hall Institute in Melbourne, Dr Mueller has shown Patricia how to analyse data and was a big help with her thesis, as was Dr Nicolas Senn. Dr Senn was encouraging and insightful in how to manage a clinical trial study as big as the IPTi study in the PNG setting. Professor Sir Isi Kevau has been continually supportive of Patricia's medical training and now of her current research. And all would not have been possible without God, who she is always grateful to for bringing her to where she is today. Patricia is also very thankful for the great and never-ending support of her family in Rabaul.

For Celestine, it is IMR's Audrey Michael – or Mama Audrey as she is known – who has taught her the value of a good work ethic and professional laboratory conduct. Celestine calls her the 'walking text book',

as she often draws from Audrey's wealth of experience. Celestine also values her willingness to help train young researchers. Audrey always seems to have time for others and Celestine says she does not know where she would be without her. Professor Deborah Lehmann from Perth's Telethon Institute for Child Health Research has always been a good support for Celestine, who says she is not only passionate about her work, but understands the challenges, having lived in PNG for 17 years. Celestine also credits her former boss as the head of bacteriology, Dr Andrew Greenhill, who continues to be a collaborator, for motivating and supporting her during her training. Additionally, Celestine acknowledges Dr William Pomat, who has always been encouraging of her work.

Pamela says that while she has worked with many wonderful people, she has grown most from those who have said she could not do it. However, she does highlight Dr Claire Ryan and Dr Angela Kelly as being influential in her



Figure 3. Patricia Rarau working in the field for the Partnership in Health Project.

career. In particular, Pamela appreciates their honesty, friendship and candour. Pamela says they are the types of people she can go to and ask, "How can I get better at this?", and there will always be a constructive exchange. Dr Ryan has been a mentor in the lab, sharing her extensive knowledge and diagnosis of STIs. Dr Kelly has taught Pamela to be more critical of the world and her place as a woman in PNG, as well as helping her see how she can contribute to the world and stand up for what is right.

All of them credit their families for being supportive of their career choices.

Homeward bound

Pamela feels she has the best job in the world and feels privileged to work in this area. She had the opportunity to stay in Australia after completing university, and many of her friends did, but she felt the need to return to her home country and help her fellow Papua New Guineans. It is a sentiment shared

by Patricia and Celestine. All three see opportunities before them to tackle the health challenges facing PNG and find solutions.

But this work does not come without its trials, such as working long hours, dealing with difficult people, being women working in a culturally sensitive PNG society, the frustrations of procurement and logistics, and intermittent internet. Pamela adds to that the challenge of juggling work and family responsibilities, with two children to care for. She says being mum is the proudest thing in her life.

Pamela, Patricia and Celestine all want to make an impact in PNG. They want to continually ask questions and contribute to human development in their country. They have no regrets in choosing this career path. It is their way to make their mark as medical researchers and, more importantly, as Papua New Guinean women.

Julie Kamblijambi-Kep – PhD candidate at RMIT University, Australia

MERCY MASTA¹

Master's Student of Development Studies (Gender and Development), University of Melbourne, Australia

SUMMARY

Julie Kamblijambi-Kep has come a long way from her childhood in the village of Wingi in Papua New Guinea's East Sepik Province. This article explores the support Julie's family provided for her education, her subsequent training as a nurse and her work around the country, including as the coordinator of the maternal health program at the University of Goroka. The article's exploration of various challenges, including the death of Julie's husband and her need to work while raising five children, make it a useful reference point for women in Papua New Guinea, especially those who are committed to helping others by working in the field of maternal and child health.

Julie Kamblijambi-Kep currently resides in Melbourne, Australia, where she is undergoing her PhD studies at the Royal Melbourne Institute of Technology (RMIT). Julie's PhD examines the transference of knowledge from bachelor-level maternal and child health graduates to village child health volunteers in regard to how to identify mothers and children at risk. It also looks at the immediate and subsequent transportation to health centres for emergency care. Julie holds master's and bachelor's degrees in nursing, both attained through Monash University, Melbourne. In 2011 Julie was awarded an Australia Leadership Award through the AusAID scholarship program of the Australian government in partnership with the government of Papua New Guinea (PNG) to undertake her PhD studies (Figure 1).

Julie is originally from Wingi village in the Yangoru-Sausia District of East Sepik Province. She was born on 11 January 1960 to her father Kamblijambi and mother Glenjo. Both her parents were involved in supporting the work of Assemblies of God (AOG) missions in the district. Julie's father was a leader and his Christian values greatly informed her upbringing. Julie is the third born and she has three brothers and a sister. Julie remembers her mother as having a beautiful and loving personality. She was a softly spoken woman who diligently took care of all her children.

Her father was the first man to introduce the work of Christian missions in the village. Julie remembers that she and her siblings had a very close relationship with their parents. They would make gardens and do various household chores together. Both parents were subsistence farmers and had no formal education but took education very seriously and sent Julie and her siblings to school. Both of Julie's parents strived endlessly selling coffee and pigs to pay for school fees. At that time in PNG not many parents allowed their daughters to go to school, as they believed they would fall pregnant and get married too young. To this day, Julie is thankful to her parents for believing in education and for providing this support so she could make something of her life.

Julie spent her childhood growing up in the village – she remembers the cost of a tin of fish was 10 cents and 5 cents for a packet of biscuits. For the most part, however, Julie attended an AOG boarding school. This meant she left home at the age of nine. She recalls being very independent at an early age. Graduating from Hayfield Central School (now Waimba Primary School), Julie appreciates the influence that the expatriate missionary teachers had on her education. The strict discipline and high expectations with English vocabulary were important parts of shaping Julie's life.

1 Master's Student of Development Studies (Gender and Development), University of Melbourne, 2/339 Flemington Road, North Melbourne, Victoria 3051, Australia
mastamercy@yahoo.com



Figure 1. Julie Kamblijambi-Kep.

Julie initially aspired to become a journalist. She remembers being part of the radio broadcasting club for high school students. She recalls selecting journalism as her first choice for career development, and nursing as her second choice. Julie selected nursing because of a dream she had – she vividly remembers the dream which involved travelling up the Sepik River in an outboard motor working as a nurse in villages along the river.

Things changed for Julie when she was involved in a car accident in which one of her high school friends was killed. This was when Julie decided to be a nurse. She believes that God gave her and her friends a second chance in life through the caring hands of nurses at the hospital. Julie remembers with admiration how gentle and kind the nurses were – this was a life-changing experience. She was so inspired by the work the nurses did that after this time she would follow her mother to health centres to observe nurses providing infant clinic services and treatment. Julie has no regrets with her choice to become a nurse, as she believes this was God's calling for her life.

When asked about her career success, Julie emphasizes that she was always the kind of person who would never give up despite challenges. She also attributes her success to having supportive parents and siblings. Julie stresses that the only way to make it in life is not to give up and to be the best one can be when life's opportunities and challenges are presented. As a consequence of her determination, Julie has come a long way. She is the first woman from her village to finish secondary education and enter professional employment, and now she will be the first person from her village to achieve a PhD.

Once Julie attained her nursing certificate from the Port Moresby School of Nursing (now University of Papua New Guinea Medical School), her life took a different course. She began to travel and live in various provinces in PNG, including Western Province, Southern Highlands Province, Eastern Highlands Province, East New Britain Province, National Capital District and her home province. The majority of the work that Julie performed involved providing mothers and infants

antenatal care in remote locations. She recalls working overtime and travelling distances to deliver babies, attending to the emergency obstetrics concerns in remote villages in the odd hours of the night or morning. Although she adores her work, she recalls sometimes spending less time with her children and having little time for leisure activities. In the later years of her career, Julie started training and teaching midwives and nurses the art of maternal health care.

When Julie was in Port Moresby completing a diploma in nursing administration, she met her husband and father of her three biological and two adopted children – four sons and one daughter. She married John Kep in 1988 and they travelled and worked in various provinces in PNG, where John worked as a medical technician at the hospital laboratory while Julie worked as a midwife. Unfortunately, for Julie the journey of marriage was cut short when her husband died in 1998, leaving her to raise five young children on her own. Julie recalls this as the most challenging time of her life. However, she stresses that the unending support of her family and in-laws helped her through this phase of her life, as they were very supportive in helping raise her five young children. After the passing of her husband Julie believes that she acquired new-found strength, and this enabled her to obtain various degrees, including a bachelor's, a master's and now her PhD. Julie continuously reiterates the importance of every woman in PNG attaining some basic form of education and earning some money regardless of the presence or absence of a man in their lives. This is necessary not only for themselves but also for their children so that they are able to provide for themselves and the needs of their children in situations where there is no longer a supportive spouse.

When asked to describe the defining moments in her life, Julie talks about her visits to remote villages and communities with her trainee nurses or students. As the coordinator for the maternal health program at the University of Goroka, she has observed first-hand the realities and hardships that women and newborns face in accessing maternal health services. This led to her realization that providing health care systems alone does not equate to women attending these services. For Julie, it is crucial that these services be brought to and provided for mothers and children, especially in the

most remote areas of PNG. Julie's concern about the lack of provision of services in rural and remote parts of PNG has inspired her to commit to developing practicable maternal health care. This is the focus of her current PhD research.

Reflecting on some of the challenges of health care in PNG, Julie recalls with contempt that some people within her profession are prone to 'mishandling the women'. At times the actions and behaviours of health care professionals toward patients are disrespectful and cruel. As a result some women prefer giving birth in villages and not at health facilities. Julie says:

"I would rather stand up and support the woman and talk for her and I would ask myself all the time, 'How would I feel if I am put in that mother or child's situation?'... I would want to be taken care of properly."

Julie stresses the importance of not seeing nursing as an opportunity for making money but rather as a profession that should be driven by the desire to save lives and help others.

Julie's commitment to her profession has not been without its challenges. Balancing family life with work has always been very difficult as Julie's professional role consumes most of her time and has resulted in her spending very little time with her children. She recalls many occasions being woken up at midnight or being needed over the weekend to attend to a patient. She says she has always prioritized her profession because of her determination to make a difference in the lives of women and children in rural areas. This has been possible because of the support provided by her in-laws and family members, who have enabled Julie to make it through these challenges.

Despite her unquestioned success, Julie remains thankful and gracious about her accomplishments, and maintains that it is important to have the right perspective. She believes that she has encouraged her children to have these qualities and values and to strive to be their best in every area of their lives. Her encouragement of her children seems to have paid off. Julie's eldest son is an aircraft engineer, her second son is a mining engineer, her third son is a fourth year medical student, her fourth son is undertaking matriculation studies and her daughter is in

high school and lives with her in Melbourne.

Julie's hard work and desire to excel got her off to a great start in life. Today she says it is God who has allowed her to persevere and endure. The success of her children has inspired her to continue being a good mother and also a great friend to her children.

When asked what three changes she would like to make in maternal health care in PNG, Julie mentions that it is important that she provides the best care in her job as a health care worker, so that no woman should die during the clinical task that she is involved in. Secondly, she says she wants to be able to provide services to remote areas where women are not able to access conventional maternal health services. And thirdly, she would like men to see the value of the women in their lives and the contribution women

make to humanity. Indeed, she challenges men to value and respect the women in their lives by being involved in the things she is doing. She believes that it is important for men to be exposed to what midwives do in maternal health, so that they are able to take an active and informative role in caring for and supporting their women during childbirth and beyond.

In her spare time, Julie likes visiting her friends and family, cooking, spending time reading and meditating on God. Julie continues to provide mentoring skills to nurses and advice to the government of Papua New Guinea. She hopes that upon completion of her PhD studies, she will be able to bring positive and practical changes to maternal health care and services in Papua New Guinea.

The founder of the Friends Foundation – Tessie Soi

ORE TOPURUA¹

Master's Student in Epidemiology and Biostatistics, University of Melbourne, Australia

SUMMARY

Tessie Soi is well known in Papua New Guinea and beyond for her work with HIV/AIDS (human immunodeficiency virus/acquired immune deficiency syndrome) patients, including through the Friends Foundation, an organization that focuses on helping families affected by HIV and AIDS. This article explores Tessie's early life and childhood, providing insight into some of the values she learned from her parents. Providing details about the Friends Foundation and the Orphan Buddy Systems program, a program Tessie established to support AIDS orphans, the article offers insight into Tessie's beliefs and compassion, simultaneously highlighting the value she places on her family.

Introduction

Tessie Soi is the founder of the Friends Foundation, an organization that focuses on helping families affected by HIV (human immunodeficiency virus) in Papua New Guinea (PNG). Tessie has been involved in working with people with HIV and AIDS (acquired immune deficiency syndrome) since 1987, when the first HIV case was detected in PNG. As a social worker, she provides care and support to HIV patients and is a renowned advocate for those living with HIV in PNG. She currently manages the social work department at the Port Moresby General Hospital and also provides substantial support to the Friends Foundation (Figure 1).

Personal life and family

Tessie was born Tahiti Ranu on 27 December 1959 in Gabagaba village, in PNG's Central Province. She is the third of seven children to her father Win Ranu and her mother Hane Gari. She has two older brothers Pana and Gabutu, a younger sister Rogana and three younger brothers Asitau, Rei and Asi. She was named after her grandmother, Tahiti, who was named by Christian missionaries. In high school she was made fun of because of her name, and to prevent this Tahiti later changed her name to Tessie.

Tessie's father, Win Ranu, worked with

the government department stores in various provinces. Consequently, Tessie and her siblings grew up in Vanimo in Sandaun Province, Wewak in East Sepik Province and Lae in Morobe Province. The Ranu family atmosphere was warm and close and Tessie's parents encouraged their children to strive for the best in life. Win Ranu was a disciplined man who placed great value on time management and who had high aspirations for all his children. Tessie's mother, Hane Gari, was also very supportive of her children's education. Growing up, Tessie learnt to speak Tok Pisin and English before learning Motu, the main language spoken by the people of Gabagaba and most Motuan villagers in the Central Province. Family has always been an important aspect of the Ranus' lives and, despite the distance between them, Tessie and her siblings maintained strong ties with relatives from both their mother's and father's sides of the family. Tessie says:

"My parents just wanted us to do the right thing. Dad was like a philosopher who was working under Australian administration and he was always very time conscious and he doesn't lie. And those were the sort of values we learnt from him and I truly appreciate that. I am always very conscious about timing. My dad never keeps people waiting. He always says, 'If you tell people that you are going to be there then you have to be there because

1 Master's Student in Epidemiology and Biostatistics, University of Melbourne, 2/339 Flemington Road, North Melbourne, Victoria 3051, Australia
oretoporua@gmail.com



Figure 1. Tessie Soi.

you wouldn't like it if they did the same to you.' So those values have been part of my upbringing and I continue to uphold them within my own family and I hope that they [my family] will also learn from what my father and mother had taught and prepared me to be who I am, and the person I am today."

Education

Embracing the new values, Win Ranu wanted his daughters to be educated and so he enrolled Tessie and Rogana in international schools during their primary years of education. Tessie attended Vanimo International School from 1967 to 1970. Later, she transferred to The International School of Lae (TISOL) in 1971 when her family moved to Lae. After completing grades five and six at TISOL, Tessie transferred to Gordons High School in 1973, where she completed grades seven to ten when her family moved back to Port Moresby. Despite transferring from one school to another, Tessie excelled at school and consequently in 1977 she did grades 11 and 12 at the University of Papua New Guinea (UPNG). Tessie says:

"My sister and I were very fortunate because dad always supported the idea of educating girls....He put us into international

schools and that was one of the best things he did for us."

In 1978 Tessie began her foundation year in a bachelor of arts course at UPNG. At this point in her life, Tessie made a lot of important decisions. For example, she changed her name from Tahiti to Tessie. In addition, Tessie decided to take up social work after her foundation year instead of pursuing her dream of becoming a teacher. Growing up, Tessie had always wanted to be a teacher. As a senior student she had often provided tutorials to junior students when teachers were absent. However, this dream altered for Tessie before she streamed into her major course in the undergraduate program. In those days, the stream of education was considered the lowest stream and, influenced by her friends, Tessie decided to take up social work instead. Social work was not a random choice, however, as Tessie was influenced by her mother's brother who was a welfare officer. He inspired Tessie's interest in caring for people through his continuous display of enthusiasm and commitment. In 1982, Tessie graduated from UPNG with a bachelor of arts degree majoring in social work. She says:

"I haven't regretted my decision for not streaming into education. I still do a lot of teaching through my education programs

with students or colleagues or [when] I am doing HIV and AIDS awareness. So I am doing what I love.”

After graduating from UPNG, Tessie stayed home for two years while she raised her two young sons, Pana and Rori Sitapai. Sadly, her first husband passed away in 1987, just three years after Tessie joined Port Moresby General Hospital. In 1993, Tessie married her current husband, Sarea Soi, with whom she has two daughters Tara and Rogana, a son Xavier and a stepson Alfred whom she regards as her own. Tessie also has three grandchildren, whom she adores.

In 2002, Tessie was awarded an AusAID scholarship to do a master's in social work at James Cook University in Queensland, Australia. After graduating in 2004, Tessie returned to her job as a social worker at Port Moresby General Hospital.

Career as social worker at the Port Moresby General Hospital

Since 1984, Tessie has been working as a social worker at Port Moresby General Hospital, where she currently manages the department of medical social work. Decades of being a social worker in PNG have exposed Tessie to a wide range of social issues including domestic violence, child abuse and various terminal illnesses. However, it has been HIV and AIDS that have had the most impact on Tessie's career.

In 1987, the first known case of AIDS was reported as occurring at Port Moresby General Hospital. There was little information known about its causes and transmission route, and HIV infection and AIDS were associated with a high level of stigma and discrimination. As described by Tessie, some medical professionals were reluctant to come into close contact with the few AIDS patients that followed the first case at the hospital, because they were afraid of becoming infected. During that time, HIV patients did not respond to antibiotics and since no treatment was available for HIV infections, physicians at the hospital could only direct HIV patients to the social work department for counselling support as there was little hope of their living for very long. As described by Tessie, all that her department could do for the first HIV patient was to arrange for his repatriation back home. However, two years later, Tessie was

brought back into the wards of Port Moresby General Hospital to provide counselling to a female patient with AIDS who had just given birth. As Tessie started spending time with that patient as well as providing counselling to the patient's husband, she realized that, even though medical treatment was not available for HIV infection at that time, HIV patients needed more love and support from both medical professionals and their own family members. Indeed, Tessie witnessed the female HIV patient surviving beyond her predicted time of death without medical treatment because of the love and support she received from her husband.

In 1994, Tessie witnessed the slow death of a whole family due to HIV/AIDS. She describes this as a tragic loss within a family as well as a great loss to the PNG population as a whole. Moreover, this incident triggered her desire to provide support and more love to everyone infected and affected by HIV. This extended into her personal life because HIV patients were even visiting her at home for counselling during her leave days. As a result, Tessie developed a personal relationship with most patients and referred to them as friends.

“We [medical professionals] all knew that there was no treatment so what we had done or what we could only do was keep that person alive with positive thinking.”

In 1998, Tessie took leave of six months after 15 years of service with the department of medical social work at the hospital. However, that did not stop her patient friends from visiting her at her home for counselling. Almost every day during her leave, Tessie would have people visiting her. They would sit under the mango tree next to her house as she offered them counselling. Tessie's husband and children supported her passion to help her friends. Nevertheless, the increasing number of HIV patients arriving at Tessie's home raised health concerns and Sarea was worried about their young children being exposed to TB, which many HIV patients have. Because Sarea wanted to support Tessie's work, he assisted Tessie to register the Friends Foundation as an organization, and secured her an office with space to operate away from their family home.

Friends Foundation

In 2001, Tessie and Sarea officially launched

the Friends Foundation in Port Moresby with the support of Lady Roslyn Morauta, their patron at that time. The organization was established with the main aim of providing care to people infected and affected by HIV and AIDS. Although Tessie is the face of the Friends Foundation, she describes the organization as a network of reliable and hard-working people whom she can always turn to for help. Since its establishment, the Friends Foundation has been managed and operated by volunteers who are dedicated to raising funds and bringing in resources to support the organization's program and aims. The Friends Foundation started off with Tessie's family as the leading volunteers with her son, Rori, as the manager. Through networking and after people saw the positive contribution that the Friends Foundation was making, the number of volunteers increased to about 250 people, most of whom lived in the National Capital District or Central Province. These volunteers assisted the Friends Foundation with its main program activity of burying the unclaimed dead bodies from the Port Moresby General Hospital's morgue. This burial program is partially funded by the National Capital District Commission with supplementary funds coming from fundraising activities conducted by the volunteers, as well as generous donations from individuals and other organizations.

As well as burying unclaimed bodies, the Friends Foundation established the Orphan Buddy Systems program in 2005. This program seeks sponsorship for each child who has been orphaned by HIV/AIDS due to the death of one or both parents. The program supports them financially while they remain under the care of their immediate relatives within their familiar home environment. This program was developed with reference to UNICEF's Global Parent program which supports vulnerable children on a monthly basis through sponsorships. In addition, the development of the Orphan Buddy Systems program integrated the concept of the Papua New Guinean 'wantok' tradition, where close-fitting relationships between family and relatives have always allowed for an extended hand of support to other relatives in their time of need. Thus the orphans in this program continue to live with their extended relatives while receiving fortnightly financial support from the Friends Foundation.

Sponsors for the Orphan Buddy Systems

program are mostly generous individuals and organizations. Despite irregular funding, Tessie maintained her support for these orphans every two weeks even when she needed to use her own money. Furthermore, the Friends Foundation also provides other opportunities for these orphans to go on excursions and watch movies at the cinema – activities that they would most probably not be able to afford. Tessie says:

"I have become attached to the children and seeing them at Christmas when there was a party ... it made me realize that they will never go to a Christmas party or get a Christmas present because most of them would never have someone give them a Christmas present. So I am very happy that I have done that and to give these children some hope."

The Friends Foundation has faced challenges with obtaining sponsors or donors for some of its activities. For example, the organization's program on parent-to-child group therapy was sadly stopped earlier this year due to a lack of financial support for the purchase of infant formula milk that supported babies born to mothers who are HIV positive. As much as the organization wanted to help infants born to HIV-positive parents, funding was the main limitation. However, Tessie's growing attachment towards orphans has shifted the focus of her work toward orphans. Therefore the Friends Foundation is now dedicated to assisting orphans due to the death of a parent or both parents from HIV/AIDS.

Since its establishment the Friends Foundation has maintained close collaboration with other stakeholders in the area of health and HIV in PNG. In addition, its current primary focus on orphans has extended the organization's network with other relevant authorities, such as the Operational Management for Child Health and Department of Community Development, Religion and Sports. With the country's rapid population growth and prevalence of HIV/AIDS, it is undeniable that the number of HIV-related orphans in PNG will also increase. As described by Tessie, there is a growing need for the expansion and sustainability of the Orphan Buddy System in other provinces of PNG, which can be achieved if the program is taken on board by the government. Relevant authorities are aware that the Friends

Foundation would like to see the program reach the national level; however, the organization has received minimal support so far. Tessie says:

"I think they [HIV orphans] are the ones that are forgotten in the planning [budget] of the government. I really feel that we need to get something into place. We have the highest number of orphans with HIV and AIDS ... so when you look at that, it is a sad thing. And I do not want them to be in an orphanage because my belief is that if they go into an orphanage they don't learn their own customs and cultures. They will be learning the carer's cultures and customs. And that is why I am against that and I am encouraging children to be with their family members so that they can grow up in their own setting."

Life beyond work

Tessie has been a strong advocate for people living with HIV and AIDS. In addition to her busy job as a social worker and her dedicated role within the Friends Foundation, Tessie also conducts awareness and education sessions for students from both the public and private education systems in PNG. And she finds these sessions most effective in terms of getting the HIV message across to the young and upcoming generation of PNG. Tessie says:

"Talking about HIV is what keeps me going. It's the positivity that I am able to offload

knowledge and information to the younger generation about being careful with their life and their future...I am doing it from my heart and even though I am working as a social worker, I am just thankful that God has chosen me to do this."

Tessie also speaks happily about her three grandchildren and the strength they give her to keep going, day by day. Tessie is a family-oriented person and loves spending time with her husband, children and grandchildren. She also enjoys the company of friends while winding down after a long day of work.

Discussing the things she would do to improve the lives of women in PNG, Tessie mentions education as the most important tool for empowering women to think for themselves and to have more self-value. Nevertheless, because in PNG men are seen as the dominant figure within family and society, Tessie also suggests the importance of educating men to appreciate the value of women as individuals. She also emphasizes the importance of giving women the opportunity to speak out in terms of addressing issues in PNG. Tessie further mentions the significance of forming networks among women as well as the need to establish a supportive body that stands together in addressing issues of women in PNG.

Finally, Tessie also states the importance of being positive in all situations, as well as instilling positive mindsets in the younger generations in order to bring about positive change in the lives of all people.

Susan Setae and the Papua Hahine Social Action Forum

ANNEMARIE LAUMAEA¹

Viral Fusion Laboratory, Burnet Institute, Melbourne, Australia

SUMMARY

This article explores the childhood, educational experiences and professional life of Susan Setae. As the founder and current president of Papua Hahine Social Action Forum – an organization involved in caring and providing support for victims of violence – Susan makes an important contribution to the lives of her fellow citizens in Papua New Guinea. The article documents Susan's early influences and her passion to see women in Papua New Guinea live lives free of violence.

Founder and president

Susan Setae is the founder and current president of Papua Hahine Social Action Forum, an organization involved in caring and providing support for victims of violence, notably women and children. Papua Hahine focuses on providing gender-based training programs, care and counselling and, to some extent, protection for victims of violence.

In a country like Papua New Guinea (PNG), not only are such services necessary, the need for them is almost as vital as health care. It is important to note that the need for these services is typically related to stigma associated with illnesses such as AIDS (acquired immune deficiency syndrome) and other debilitating conditions that are otherwise misunderstood by the perpetrators.

The role of Papua Hahine and other noteworthy non-government organizations (NGOs) and collaborators such as the Friends Foundation in alleviating the health burden in PNG cannot be underestimated, nor should it be overlooked. Social organizations are imperative in a functional health model where complex political and social issues are intertwined with serious health concerns.

The fundamental aim of Papua Hahine is to empower and educate marginalized women through gender-based training programs which focus on promoting positive conflict resolutions in the event of violent

altercations. Papua Hahine therefore works toward strengthening families, rather than the dissolution of ties, with the hope that educating women results in minimizing some of the misconceptions and struggles with the associated stigma of illnesses such as AIDS.

Personal life

Susan Setae was born to parents Laeka Hiovake and Marase Kavaro in Five Bay, Milne Bay Province, a long way from her home province in the Gulf of Papua. Susan was the youngest of four children, with two older brothers and a sister. Susan's parents were trainee pastors at the London Missionary Society (LMS) training college in Five Bay. When she was four months of age, her parents were posted to Goilala District in the Central Province and subsequently on to Sepoe in the Gulf Province, where the family remained while her parents took on the role of village pastors, and where her younger brother Sepoe was born. It was here in Iloke that Susan attended grades one and two at the LMS primary school, where classes were taught in Toaripi – her native tongue – and the only learning tools were an outdoor classroom with sand for books and one's index finger for writing.

At age 12 Susan progressed on to the LMS boarding school. It was this time at boarding school that Susan recalls as the most influential in her life. Susan and her fellow boarders learnt the skills of providing

1 Viral Fusion Laboratory, Burnet Institute, 85 Commercial Road, Melbourne, Victoria 3004, Australia
alauamaea@burnet.edu.au

for their own living. Parents paid a mere four shillings for an entire year's school fee, while all living expenses were paid for by the students through extracurricular employment programs, which involved cutting copra and selling to large businesses. Susan recalls this as forming the foundation to being a young, independent Papua New Guinean woman. This greatly influenced how Susan progressed into adulthood.

Susan recalls that the education system pre-Independence was very different to how it is in modern PNG. The system followed the Australian curriculum and teachers at Susan's school were mainly missionaries from England and often there were Samoan teachers as well. The young Susan was not only fascinated by a fellow islander speaking and teaching English but, most importantly, she was intrigued with how the pronunciation of words was 'exactly like the white teachers'. Susan was adamant that 'if they can do it, so can I'. This adage remained close to Susan's heart and it was from these early experiences that the young Susan decided to pursue a career in missionary education, the same vocation as her parents.

However, this was not to be. PNG was still in its infancy and gender bias dictated the roles of males and females. Susan's application to be a pastor consequently was rejected. This was Susan's first of a multitude of gender challenges. This, however, did not dampen her passion for the ministry; in fact it simply fuelled her interest to work in the ministry, with a focus on women and children, people whom she believed, through her own personal experiences, were often overlooked.

Susan's desire to be a teacher materialized, and so she began teaching primary school in Kikori District. In 1968, she moved to Rabaul to teach high school, merging her two passions, teaching and working with women and children in the ministry. It was following this, in 1969, that Susan was provided the opportunity to pursue a postgraduate diploma in community development at the South Pacific Community Education Training Centre in Fiji. This course enabled her to gain practical experience and training in sanitation and healthy living as the studies were centred largely around working in rural villages.

PNG was taking its initial steps toward independence with an impending development

boom, and Susan felt she could apply this knowledge and skill to her community. Seeing a fellow Melanesian country such as Fiji move ahead, Susan had faith that PNG could move just as swiftly, provided people like herself brought back skills and knowledge acquired through international education. Susan moved back to Rabaul upon completion of her studies, to the Raluana Leadership Training Centre of the United Church. She was given the role of training officer – one of the first PNG women to have been given this privilege. Here, Susan taught women in the mission until 1973.

Susan then began a life of travelling around PNG fostering partnerships with churches and communities to train women in community skills. She did this in Balimo in Western Province, Maprik in East Sepik, Bai River in Western Highlands, in Manus Province and in the Autonomous Region of Bougainville. Susan's working life, as an educator and trainer in church-funded programs, did not come without its challenges. Funding was, and continues to be, a common setback for development programs. Interestingly, Susan noted that the main challenge to maintain these programs was learning how to apply these new skills in everyday life. Susan says:

"To teach a person, in this case a woman, is relatively straightforward. To get her to practise this in her daily life and maintain this practice is the major obstacle."

Indeed, consistency continues to be one of the biggest challenges in PNG.

Susan's passion to work with families is reflected in her daily life. Her spare time is spent visiting and enjoying family time with her five children and nine grandchildren, which Susan states is a reflection of how she was raised. Her fondest recollection of her parents is their ability to relate to every person they encountered regardless of socioeconomic status, gender, culture or ethnicity. Her parents' genuine faith in God, she believes, was the foundation for their generosity and kindness – traits she concedes to aspire toward in her daily life and in her role as mother, grandmother, educator and friend.

While Papua Hahine at present does not have the capacity to provide shelter as part of its services, as Susan works purely on a voluntary basis, its collaboration with other

NGOs enables it to provide referrals. When asked what three changes she would like to see to improve the lives of women in PNG, Susan responded bluntly, saying her main desire was to see women enjoy life without violence. In addition, Susan would like to

see independent, well-educated women who are not reliant on their husbands. And, most importantly, Susan stresses she would like to see Papua New Guinean women educated overseas come back and be role models to the younger generation.

Turning negatives into positives: the life and work of Naomi Yupae

CERIDWEN SPARK¹

School of International, Political and Strategic Studies, Australian National University
College of Asia and the Pacific, Canberra, Australia

SUMMARY

This article explores the life story of Naomi Yupae, one of the founders and the first executive director of Eastern Highlands Family Voice (EHFV), an organization based in Goroka, Papua New Guinea (PNG). A proud Bena Bena woman, Naomi was one of only a handful of women in the pre-Independence era to gain a scholarship to pursue secondary schooling in Australia. The article discusses Naomi's experiences as a student and her determination to come back to PNG to maintain her cultural connections with her people and contribute to development in PNG. Naomi's professional contributions as a researcher and social worker are discussed and evaluated.

This article tells the story of Naomi Yupae, the inaugural executive director and one of the founders of Eastern Highlands Family Voice (EHFV), an organization that supports families experiencing violence and conflict. In documenting Naomi's story, the article provides a vital account of a woman who is a role model, and simultaneously helps to address the paucity of biographical material about Papua New Guinean women (Figure 1).

Between February and April 2012, I conducted four interviews with Naomi Yupae in Goroka, in the Eastern Highlands Province (EHP) of Papua New Guinea (PNG). The following account of Naomi's life is based on these interviews. The article also draws on personal correspondence with Naomi and correspondence with other friends and colleagues able to provide insight into Naomi's life and leadership.

Naomi's family and childhood

Naomi was born in 1957 in the hamlet of Sekeluga in Samogo village in the Bena Bena area of PNG's Eastern Highlands Province. She describes her childhood as a 'very happy' one characterized by love and discipline. Naomi is the oldest daughter of Kiyae and Yupae, who had seven children (five girls and two boys). Naomi says her parents had an arranged marriage and worked hard

and cooperatively to raise their children in a peaceful and productive environment.

Naomi's village was distinctive in that it was organized to reflect the values of cleanliness and discipline. Naomi recalls, for instance, that there was a bell for everything, including getting up, bathing in the river and commencing the Sabbath, celebrated on Saturdays because the family were committed Seventh-Day Adventists. Naomi grew up with her cousins as playmates and in a context in which her uncles and other relatives shared the task of raising the children according to their Christian values.

Alongside being great believers in discipline, which was woven through all aspects of their life, Naomi's family were strong advocates of education, including for girls. This was unusual, particularly at this time, not least because girls who went to school were seen as 'cheap', as a result of being exposed to inappropriate ideas and opportunities. Naomi's father, Yupae, was unconventional in that he did not discriminate on the basis of gender. Naomi is grateful for her family's belief in education, saying, "[I was] probably one of the few Bena women that got access to education... I salute them for that vision and dream that they had for us children." The forward-thinking nature of Naomi's family was also evident in other ways.

1 Research Fellow, State, Society and Governance in Melanesia, School of International, Political and Strategic Studies, Australian National University College of Asia and the Pacific, Canberra, ACT 0200, Australia
ceridwen.spark@anu.edu.au



Figure 1. Naomi Yupae.

For instance, Naomi says that during her childhood speaking Tok Pisin was associated with status and that her family were known for 'speaking pidgin a lot'.

Life was not entirely pleasant, however. Naomi topped her class at Magitu Primary School despite the fact that some of her classmates were much older. As a result, she experienced bullying at the hands of 16- and 17-year-old boys who were jealous of her achievements. Too afraid to report them for fear of further reprisals, she put up with this for some time. Eventually, however, she told the teacher, who threatened the boys that if it ever happened again they would be beaten themselves. From this time, Naomi was no longer bullied at school. Moreover, by standing up for herself, she had learned a lesson that would prove valuable in later life.

Leaving Papua New Guinea

When Naomi was in grade five, teachers by the name of Thelma and Rudi Peperkamp came to teach at Magitu Primary School, bringing with them the daughter they had adopted from Milne Bay. Recognizing their

young daughter's attachment to Naomi, the family incorporated Naomi into their lives. This led to her accompanying the family to Coogee, a southeastern beachside suburb of Sydney, Australia on a Christmas break in 1969. Here, the 11-year-old Naomi started to experience another life. The visit was also fortuitous in that it introduced Naomi to a place in which she would soon be spending her adolescent years.

On returning to PNG, Thelma and Rudi encouraged Naomi to sit the IQ test at the International School in Goroka. On the basis of her grade six results (96%) and high marks in this test, Naomi was awarded a scholarship to St Catherine's Church of England Girls' School, a prestigious private school for girls located in Sydney's eastern suburbs.

When Naomi left PNG in 1970 to attend St Catherine's, she was 12 years old. Having no idea of the world to which her daughter was going, Naomi's mother composed two mourning songs as an expression of her grief. Of this time, Naomi says:

"She cried a lot when I went to school in

Australia. In Bena culture they compose songs depending on what happens in the life of somebody, so she composed two songs that were like crying songs, very sad songs, and even till now the women sing that song when we cry for dead people; or if a sad situation happens we always sing these songs."

Naomi valued the rich and stimulating environment that St Catherine's afforded. In particular, she appreciated the school's focus on supporting young women to develop to their full potential, and the sense of discipline and Christian values that strongly echoed her family's values. While 'speaking out loud' was a challenge, she says the school taught her to analyse and assess knowledge independently. Because there were five other girls from PNG there, she was never entirely alone and together they shared a sense of representing their country, especially in sport. Demonstrating her leadership, Naomi was a prefect in year 12.

Despite these positives, Naomi's experiences in Australia opened what seemed an unbridgeable gap between herself and her people in Bena. When she first returned to PNG for the school holidays, for example, Naomi was unable to understand her own Bena language, saying it sounded to her now unaccustomed ear like 'gibberish'. She recalls trying to explain television and trains to her family and her feeling that such things were beyond their imagining. As a result of the gap between the two worlds, Naomi withdrew into herself, learning, at a young age, to cope with her bicultural experience on her own. She says that neatly folding her private school girl's uniform at the end of the school year was like 'shedding her skin' in preparation to become a 'village meri'. When she returned to the village for holidays, Naomi learned to fit in rather than spend energy longing for the things she missed about her life in Australia – or about PNG when she was at school in Sydney.

By the time she completed her secondary schooling, Naomi was determined to return to PNG and establish her roots as a Papua New Guinean. This was her response to the gulf between herself and her people. Valuing her identity as a Papua New Guinean above any opportunity Australia could offer, Naomi elected to study social work at the University of Papua New Guinea (UPNG) in Port Moresby.

She did so between 1976 and 1979.

Returning to Papua New Guinea: marriage and children

Describing her decision to study social work as her 'response to being Papua New Guinean', Naomi points toward her reason for returning to PNG – namely to reconnect with, but also to serve, her country and its people. While acknowledging the privileges of her education in Australia, Naomi considers that being away during her adolescence led to a gap in her education in terms of her knowledge of Bena customs and PNG history. She said this was evident when she returned to attend university in PNG. Discussing the small group of students who had been away at Australian schools and with whom she attended university, she says:

"When people were dressing up in their cultural things we weren't, we found it hard... We were pretty much like an isolated kind of people, 'cause when people were speaking their language and doing their traditional songs we found it a bit hard for us... I missed the opportunity to learn about the PNG history and culture ... I have never adorned myself in the traditional Bena 'bilas' and I think that's one thing I really missed."

As with her decision to study in PNG, rather than Australia, Naomi wanted to marry a man from her place of origin in order to reconnect with and uphold her Bena heritage. The following excerpt explains how she felt at the time:

"I want to find my roots. I want somebody who can culturally understand me and my extended family, and those choices I make are not only about me but it's about my father, my mother, my extended family who love me so much. And because I come from a very loving family, extended family, those decisions were very important to me. And I wanted somebody who could understand and identify with my culture, my people, the language."

Naomi and her husband were together for a total of thirteen years, during which time Naomi had two children, a son and a daughter, born four years apart. They had a traditional marriage in which her husband's family in Bena paid bride wealth in the form of cows

and pigs to Naomi's family. While Naomi says there were 'good times', the relationship did not last for various reasons despite Naomi's best efforts. Throughout the difficult times in her marriage, Naomi received support from her friends and colleagues and she remains grateful to those who provided this love and care.

Working life and the importance of institutional support for women

After graduating from university with a degree in social work, Naomi took a job as a project officer in the Office of Information. A year later, in 1980, she commenced a new role at the Papua New Guinea Institute of Medical Research (PNGIMR) in Madang. Here, she worked under Professor Peter Heywood, then Deputy Director of the PNGIMR, who managed the nutrition program. Prof. Heywood says of Naomi:

"It was exciting to find someone like Naomi – smart, conscientious, energetic, good English, social science background, pleasant, engaging personality, good sense of humour, willing to ask what we were doing and why, but still very much connected to her village in Bena Bena." (personal communication with the author)

Naomi's capacities as a social science researcher were also noted by Professor Michael Alpers, the Director of the PNGIMR between 1977 and 2000. Prof. Alpers worked with Naomi when she moved to the IMR in Goroka.

"Naomi stood out in [the field] ... context as intelligent, tough, sympathetic, meticulous and flexible, an unusual mix of good qualities that fitted her ideally for working in the community. ... She was highly regarded by everyone at IMR and would have had a great career as a social science research worker." (personal communication with the author)

For her part, Naomi recalls the high calibre of training she received at IMR, describing it as a workplace in which she learned a lot:

"They helped me to do some, pick up some research skills and work with a lot of people from other countries and ... it's there where I started to ground myself in a lot of the work ethics, work value, because a lot of them

were very professional, well-educated and well-renowned scientists like Dr Michael Alpers, who was the director of medical research, and Dr Peter Heywood and Mr [Ray] Spark, who was our lab manager. ... I looked up to them as ... leaders in their own field, but they did a lot even despite their status; they were also people who were willing to train a lot of Papua New Guineans in the field of research."

Naomi also values the emotional and at times material support that she received from staff at the IMR:

"They also provided a very supportive environment for me to feel free to say even personal things with them. And in the event of difficulties happening in the family environment I felt free to talk about it and know that support will be coming. I think for a lot of women ... in the workplace ... there's an element of fear that if I share this, what is happening in my home, they might terminate me from my work. So they don't tend to come up-front with the issues that are happening in the home, and definitely it affects the work output performance of employees."

This workplace support continued when Naomi left the IMR in 1986 to work as an officer in the probation and parole service (now known as community corrections). Despite the difficulties she was experiencing in her personal life, Naomi developed a positive reputation here also, making a mark because of her professionalism and intelligence. Beginning in the Eastern Highlands Province, Naomi went on to become the training coordinator for all offices across PNG. She says:

"I was one of the first officers that were recruited for the idea of having a community-based system for PNG based on the Canadian model. There I worked with a lot of Canadian CESO (Canadian Executive Service Organisation) volunteers to develop the system in PNG. And initially I was hired to look after the Goroka, Eastern Highlands provincial office and later on came to be the trainee coordinator. I did all the training, wrote the manuals, did a lot of training for probation and parole officers throughout the country."

Another significant way in which Naomi

demonstrated leadership at this time was in regard to housing. During the 1980s, houses were going on sale through a government scheme designed to assist employees to purchase their own home. The house Naomi was living in came up for sale but when Naomi expressed interest in buying it she met resistance from male employees who said it was her husband's role to provide a home and that she was therefore ineligible to purchase it. To their credit, Naomi's seniors, Mr Walter Nombe (then premier of EHP) and Mr Andrew Ataiya (then provincial secretary), resisted this pressure and, citing Naomi's status as an officer in charge of a government department, said she had every right to purchase the house. The story illustrates both Naomi's strength and persistence and the importance of gaining male support for women's advancement in PNG.

Naomi often says that her life has been one of building success then moving on to commence something new. This is certainly the case when it comes to the establishment of EHFV. In her role with probation and parole she had access to a car, a salary and a degree of power and prestige. When she left there in 2000 to start Family Voice, she had no idea where it would lead. Her decision was motivated by her strong desire to help those experiencing violence, as she herself had for so many years.

Establishing Eastern Highlands Family Voice

"Family Voice for me [is about] personally ... turning my story into positives to support other women and children which has been a passion for me. So I gave it all my best shot. I gave away my personal life, my social life, my church life, my family life to develop this organization to where it is now. And I feel proud that, you know, it's been a personal achievement for me as well as an achievement for women right across PNG."

As the above quotation makes clear, Naomi has put her heart and soul into EHFV. The idea to build the organization was born in 1997 when Naomi spoke about child abuse at a workshop on paralegal training for women. Her talk generated enthusiasm among the women present, who saw the need to establish an organization that would support women and children experiencing violence. Specifically, the women wanted to establish

a non-church organization because as Naomi puts it:

"In PNG, the church is the last place people go when they are having problems. In fact, people will often leave the church rather than mention the real difficulties of their lives."

Moreover, this was an opportune time in Naomi's life because she was not doing any 'real work' in her role at probation and parole. She became the secretary of the organization running monthly meetings with a small group of supporters.

In 1998, the non-government organization Save the Children sponsored Naomi to go to Fiji and attend regional training with the Fiji Women's Crisis Centre. This one-month workshop gave Naomi important training and contacts with other civil society and human rights organizations, thereby cementing the idea to establish a similar organization in the Eastern Highlands.

Around the same time, Save the Children New Zealand provided the first lot of funding; the amount of 37,000 kina enabled the fledgling organization to pay Naomi a basic salary and purchase a computer. Between 1998 and 2000, Naomi wrote the constitution for the organization, worked on getting it registered with the government, and clarified with the existing supporters what the goals of the organization would be. Together with other leaders in the Eastern Highlands, including Popsy Vira, Miriam Layton, Agnes Inape, Julie Soso (now Governor of the Eastern Highlands Province) and Ruth Palio, there was a decision to focus on women and children, but also include men. This was because domestic violence was being seen as a 'women's issue'. The women wanted to ensure that men were encouraged to take part in the prevention of violence, whether because they were involved as perpetrators or victims or because they could offer support – according to current estimates from staff at Family Voice, men make up approximately 20% of the clients who come to Family Voice as victims of violence. It was Naomi's good friend, Popsy Vira, who came up with the name 'Family Voice'.

Since its official establishment on 1 March 2000, EHFV has grown to become one of the most credible organizations in the country

working in the area of human rights, gender and child protection. It is one of the first local organizations in the country to promote the rights of children and has been instrumental in bringing discussion about children's rights to the fore across PNG. During its eleven years of operation, staff in the organization have trained over 600 volunteers in various skills including basic counselling, rape counselling, trauma counselling, child protection issues, peace mediation and conflict resolution. The organization also does awareness raising at both the village and provincial levels. Because of EHFV's strong, positive reputation it has attracted support from, and built partnerships with, various organizations operating internationally, including AusAID (Australian Agency for International Development), NZAID (New Zealand Agency for International Development), International Women's Development Agency and the German Development Service. In addition, local people from the Eastern Highlands, including respected men and women leaders, have supported the organization, whether as volunteers, board members or both. One such person is Mr Hona Javati, who has been a volunteer counsellor since 2001. He notes the way the organization has grown to support men as well as women:

"The counselling here that we conducted initially it was for women and children but increasingly men have been coming in. They have been either phoning or they've been coming in for counselling. So people have realized that she [Naomi] is delivering something that is lacking in the community."

The success of EHFV has led to Naomi being asked to start new branches of the organization in other provinces. While she is happy to share insights and experiences outside the Eastern Highlands, Naomi has declined because of her belief in the importance of integrating local knowledge into human rights promotion. Naomi explains:

"I strongly believe that each province, each ethnic grouping in PNG, have their own specific issues around gender human rights, and you need [to include] the local knowledge into ... developing programs and providing services. We are quite comfortable with providing the services across Eastern Highlands. That for me is all about learning about culture because a lot of the violence that happens is also

very much linked to the way people think and behave, their cultural norms and their values. Understanding that and linking it to gender issues and human rights is very critical to the way we run programs in PNG, especially for women and children."

Naomi's belief in the importance of knowing one's own people and culture underpins the success of EHFV. In addition, she provides empathy and support to all who come through the door at Family Voice. Jean Yano, the program manager at EHFV, says of Naomi:

"To me, I look to her as a role model. I see her character, she's got the strength. When she sees things that need to be done, she gets it done. And how she manages her time in order to help everybody that comes to her and she doesn't send anybody away... Even though she is a very busy lady she has time for everybody, even a little child. She [can] go down to anybody's level and be a friend to anybody who needs a friend. Even as co-worker she can be my employer but she can also be my friend, a mother and a counsellor also. So that's what I admire about her. Even though she has her difficulties she goes out of her way to those who need help."

For Naomi, it is important that she has been able to turn the difficulties she has survived into a wellspring of experience on which she can draw to help others.

"It's how we turn negatives into positives. And whatever positives we have we build on those so we don't do it for ourselves; we also look around and see what everybody's lives are about. And we support them whether it be through awareness or through providing counselling or I think for me ... I walk down Goroka town and I want other women to see me and think that they hear this story – they will say she's done it, I will do it as well. And it's not based on education or based on anything else but it's about this personal conviction that we have personal values, we have personal dreams, and aspirations we have, and moving that forward. And if there are people who are trying to stop us from achieving those good things in our lives we don't have to live with it for life. There are opportunities, there are systems, there are services available where we can seek assistance and support to say, look, I do not want this aspect of my

life, I want to move forward.”

Through establishing, developing and leading EHFV over its first 11 years, Naomi has assisted countless others to move beyond lives characterized by violence to lives characterized by hope.

New horizons

At the end of 2011, Naomi resigned from her role as director of EHFV to undertake further study in Australia. Having won a prestigious Australian Leadership Award to complete a master's in international community development at Victoria University in Melbourne, she has recently commenced studies for the first time since completing her social work degree in 1979. It was challenging for Naomi to relinquish her role at EHFV as the organization has been her life and work since she began working towards its establishment in 1997. Nevertheless, in making her decision to resign, she continues her pattern of making a success of things then letting go to start again in a new direction.

“For me it was a personal dream to go and do further studies, and I suppose in a way that is a challenge to a lot of PNG women as well, because once we get married and we have children – and especially at my age when I’m eligible to be a grandmother – we

tend to live, we stop our lives there and we don’t think that [there’s] any more future for us in terms of personal achievements. So I am accepting to go on this scholarship. Firstly for me ’cause I’d like to continue to learn and still contribute to the development of PNG and gender issues in PNG, and also I hope that it’s a challenge to some of my friends and colleagues and women in general that learning doesn’t stop till we go six foot under.”

Reflecting her characteristic determination and leadership by challenging older women in PNG to extend themselves beyond their roles as mothers and grandmothers, Naomi’s decision to do a master’s will undoubtedly lead to her making further contributions of great value in PNG. As with her previous contributions, whatever she chooses to do when she returns to PNG will be distinguished by her intelligence, strength and empathy. Naomi’s embodiment of these characteristics, as much as her achievements, make her a respected leader and role model among both men and women in Papua New Guinea.

Acknowledgements

I thank Naomi Yupae, Michael Alpers, Peter Heywood, Hona Javati and Jean Yano for their contributions.

Humble beginnings: from Lalaura to the board rooms of Papua New Guinea – the story of Dr Evelyn Lavu

CERIDWEN SPARK¹

**School of International, Political and Strategic Studies, Australian National University
College of Asia and the Pacific, Canberra, Australia**

SUMMARY

This article explores the life and professional achievements of Dr Evelyn Lavu, the Director of the Central Public Health Laboratory at Port Moresby General Hospital in Papua New Guinea (PNG). The article documents Dr Lavu's journey from the happy village in which she grew up to her internationally recognized status as a leading pathologist of the Pacific region. Never limited by her gender, Dr Lavu has served as an executive committee member of the Medical Society of Papua New Guinea. She has also served as the President of the Women Doctors' Association of PNG. Exploring the factors that have enabled Dr Lavu's achievements, the article documents her quiet tenacity and confidence.

Dr Evelyn Lavu is a quiet and reserved person. Nevertheless, as the Director of the Central Public Health Laboratory (CPHL) at Port Moresby General Hospital, Evelyn is responsible for turning around its culture. Similarly, in her role as an executive committee member of the Medical Society of Papua New Guinea, Evelyn plays a key role in 'voicing the opinion of the medical fraternity' of Papua New Guinea (PNG). While she is a humble person, her efforts to lift standards at her workplace reflect another side of her – steely determination and outstanding professionalism. These strengths are also evident in her leadership of the Women Doctors' Association (WDA) of PNG. As the president of the WDA, a position she held for four years between 2008 and 2011, Evelyn worked tirelessly to inform women about the importance of having Pap smears. Cervical cancer was killing 80% of Papua New Guinean women who contracted the disease. Given that cervical cancer is preventable, Evelyn saw an opportunity to change things for the better. As a result of the media campaigns she instigated with the female doctors in PNG, an increasing number of Papua New Guinean women are having Pap smears, thus reducing the risk of their dying from cervical cancer.

To promote this cause, Evelyn met with

prime ministers, governors general and other dignitaries. According to this unassuming woman, "If you can achieve that you can achieve anything."

Childhood and family

Dr Evelyn Koruone Lavu began life in the rural village of Lalaura in PNG's Central Province. Her father, Lavu John Kaiulo, was a church pastor with a head for business. While his main role was working with the missionaries who came to live in the area, he earned extra money by meeting the visitors who arrived on the Talair planes, making copra and running the local cooperative shop. As the father of twelve children, Lavu's industrious approach to life was necessary and the Lavu children learnt this early. During their childhood, they were expected to contribute to the family's livelihood by working on the family's coconut plantations.

Evelyn was born in 1963, the ninth child in a family of five girls and seven boys. She says her mother, Wauta Gamini, was 'a typical village woman who cared for us all', but who was 'very strict as well'. Evelyn says girls and boys received the same treatment in their family. Some parents thought it unsafe for girls to go away to school because they would

¹ Research Fellow, State, Society and Governance in Melanesia, School of International, Political and Strategic Studies, Australian National University College of Asia and the Pacific, Canberra, ACT 0200, Australia
ceridwen.spark@anu.edu.au

get pregnant and not complete their studies. However, Evelyn's father was forward thinking in this respect. Evelyn says:

"My dad was a very strong person in encouraging us to go to school. He made sure we went to school as girls, and he said [we] could be just as good as any man."

Some of Evelyn's happiest memories are of going 'crabbing' with her mother and other women in the community. She says that while the men did the deep-sea fishing, it was the women who visited the reefs and rivers to gather local fish and crabs that would serve as an additional source of protein for families. Describing this as 'great fun', Evelyn says it formed part of what was a 'very happy' childhood. A key part of this was having lots of children around her. Evelyn says:

"We all grew up with cousins that were very close; even today we are very close. We laughed a lot as children and when we meet we just giggle a lot like those happy times we see each other. It's still there. I grew up in a very good community."

To this day, Evelyn maintains strong links with her people and place of origin. The industriousness and commitment to others she learned as a child are evident in her yearly visits to conduct health checks among her community. Every Christmas, she visits and checks everybody, taking with her to Moresby the 'complicated' patients who need further treatment.

Education

As a girl and young woman, Evelyn also benefited from a good education. During her primary years she was educated in the village but secondary school was 'an hour's drive if the road is good'. So, in order to complete the education that her family believed in, Evelyn attended boarding school at a nearby station. This involved mixing with people from various cultures who spoke different languages. It was thus a big leap for Evelyn and her siblings. Though the boarding school was made from bush materials, the standard of teaching was very good. The teachers were expatriates from England and Evelyn says they were strict in regard to both discipline and appearance. The girls had to make their own skirts for their school uniform. They learned this from Mrs Jordan, who was a very good mathematics

teacher, but who also taught many valuable skills in home economics. Evelyn says:

"I really admired her because she not only taught but she was the principal's wife and when it was a rainy cold evening she would make Milo and bring it to the whole girl's dormitory just to encourage us to keep going."

Despite possessing a quiet confidence in her own abilities, the young Evelyn had no idea what career to pursue. She says she 'just went with the flow'. The boarding school went to year 10; after that students had to apply to continue their education elsewhere. When it was time to do so, Evelyn followed her older sister, Esther Lavu, and applied to Sogeri, then the leading high school in PNG. Esther Lavu is now a senior research fellow at the National Research Institute in PNG.

After completing her secondary education at Sogeri, Evelyn was encouraged by one of the teachers to apply for medicine. Evelyn says she 'always underestimated' herself and she 'thought medicine was a bit too hard for a girl like me coming from a village'. For this reason, she applied for dentistry. However, when Evelyn learned that a friend was studying medicine, she switched in order to join her. Despite this rather haphazard beginning, Evelyn was committed to 'helping people' and this commitment underpinned her decision first to do dentistry and then medicine. She says:

"In the village we grew up helping each other ... you help your auntie or older women, it's always there, it's part of your life. It becomes part of you."

Evelyn enjoyed her time at the University of Papua New Guinea (UPNG), making good friends along the way. There were students from various countries in the Pacific such as Vanuatu, Solomon Islands, Tonga and Samoa, and Evelyn says they had wonderful 'cultural nights' together. Despite the opportunities for socializing, she remained focused on her studies. She was determined to complete the degree to please her parents 'who expected so much from us'. During this time, she also met her husband-to-be, Dr Mark Paul, a physician, whom she says is 'very good and not because he's my husband'. Together they have two children, the first of whom was born in 1988. Dr Paul is originally from Manus but

runs his own private practice in Port Moresby.

Graduating in 1987, Evelyn completed her residency at the Port Moresby General Hospital. She did her rural block in Kainantu in the Eastern Highlands Province.

A career in medicine

After completing her residency, Evelyn received encouragement from Professors Sirus Naraqi and Isi Kevau to focus on internal medicine. However, she was reluctant to do this because her husband was going to work in the same area. Evelyn says she did not 'want to get in the way or compete with him'. Also, Evelyn wanted to combine her career with being a mother, having had her daughter by this time.

For a combination of reasons, including because she wanted to study something that was linked to a lot of disciplines, Evelyn decided to focus on haematology under Dr John White in Port Moresby. To do this, she became a registrar at the Royal Prince Alfred Hospital (RPAH) in Sydney. Completing a one-year attachment, she joined the master's program in pathology and then 'streamed into haematology'. Perhaps unsurprisingly, given her evident capacities, Evelyn was singled out by one of her supervisors, Dr John Gibson. Dr Gibson says:

"RPAH has a long tradition in assisting in the training of developing haematologists from the Asia-Pacific region; only a minority, however, proceed to the RCPA fellowship. When Evelyn came to RPAH it was soon obvious that she possessed qualities that would, I believed, enable her to undertake advanced haematology training in Australia and sit for the fellowship. She adapted remarkably quickly to her new environment and was clearly dedicated to her ongoing education. Evelyn also possessed excellent people skills and interacted well with all members of our department. Not only notable is her success in the fellowship examination at the first attempt, but she also actively contributed to a research project on platelet antigens which was published in a peer-reviewed journal." (personal correspondence with the author)

For her part, Evelyn says she 'didn't know what she was getting herself into', but after four years she passed the exam. She is now

a Fellow of the Royal College of Pathologists of Australasia (RCPA), a distinguished achievement.

Evelyn's second child, a son, was born in 1997, once she had completed the fellowship program.

Since her time in Sydney, Evelyn has continued to maintain strong links with international organizations, including those that support her work through the provision of technical assistance and funding. Grateful to AusAID for supporting her postgraduate education, she also mentions the World Health Organization, the Clinton Health Access Initiative, the Burnet Institute and the Global Fund for HIV/AIDS, Tuberculosis and Malaria being among those who have supported her work, noting that in addition to direct support 'these organizations have enabled me to travel extensively to attend medical conferences representing PNG in countries within the Asia-Pacific region'.

After four years in Sydney, during which time her husband also completed further training and her daughter attended primary school, Evelyn returned to PNG and commenced work as a haematologist at the Port Moresby General Hospital. Though based in Moresby, she was consulting for the whole country. However, Evelyn left Port Moresby General because they reduced the salaries for laboratory staff and she 'didn't like discrimination'.

From Port Moresby General Hospital, Evelyn went to teach at the medical school at UPNG. During this time, Evelyn's family home was broken into and they lost many personal items, including their computers. This contributed to a sense of vulnerability, which Evelyn says also affected other academic staff. For instance, she says the poor working and security conditions meant that expatriate doctors were unlikely to work at UPNG, with few incentives to stay and almost no funds allocated to research. Moreover, during her time at UPNG, the curriculum changed and Evelyn did not agree with all the changes that were made.

As a consequence of these difficulties, Evelyn elected to leave UPNG to take up a role as the Director of the National Blood Service. She did this for two years before commencing her current role as the Director of the Central

Public Health Laboratory (CPHL). Evelyn has done a lot of different things during her career because, as she says, “I get bored doing one thing and if there’s no more challenge I move on.”

Challenges and achievements

Now well-established at CPHL, Evelyn (Figure 1) has great familiarity and insight into the enormity of the public health challenges in PNG. She says, “TB is a big problem, HIV is a problem, malaria too is a problem.” Despite these challenges she cites ‘human resources’ as the biggest difficulty she has encountered. Discussing this, she says:

“One of the issues is quality of work ... the culture is not there yet. So people do not do valid tests. That’s one thing I am pushing is quality. If you give a result is it true? Is it valid? Did you follow the steps? Those kind of things have to be really, really taught to the workers here in PNG. The commitment, it’s very difficult to get people committed. I’m a very committed person and I like people around me to show the same commitment.”

Evelyn mentions a culture of complacency

about work performance in which people who do not turn up for work suffer no consequences for absenteeism. She understands that such behaviour is influenced by the difficulty of people’s lives, including living conditions which see employees squatting in temporary homes with large numbers of other people and without access to tap water, for example. However, while recognizing the need for the PNG government to address the crucial matter of housing in Port Moresby, she wants to see the introduction of disciplinary committees so that employees are encouraged to pursue higher standards of commitment and professionalism.

Demonstrating her leadership in this area, Evelyn cites a turnaround in the workplace at CPHL as one of the highlights of her working life. She says:

“When I came to this organization, it wasn’t like this. Now people are working more than they used to. They are more organized and some staff are more committed, they’ve turned around. So that’s a highlight for me.”

Evelyn mentions she is proud to have participated in making improvements in the



Figure 1. Dr Evelyn Lavu.

diagnosis of HIV (human immunodeficiency virus). She says that the techniques of using rapid tests are as 'advanced as anywhere in the world' and enable clients to be informed immediately of their status. CPHL monitors the quality of this service, but because of the quality of the training provided by CPHL the process has been decentralized.

Such decentralization is important for Evelyn, who is passionate about improving the lives of people in rural PNG. She believes women are 'naturally caring' and that if more women doctors were involved in public health, it would help to create change for everyone in the community, including the majority of Papua New Guineans who live outside PNG's towns and cities.

"Many doctors in general look at working in the best hospital, or the big hospital or the city hospital. I think we have to move away from there and look at the rural population and how well we can do that. Female doctors ... we need them in every field, but we need more females in

public health, I think, to drive their health indicators forward. Public health will make a big difference."

Despite the many challenges entailed in changing the system, Evelyn has chosen to stay in public health and to contribute to the improvement of health indicators across the country. She says while she does not have enough money to buy her own home, she cannot contemplate leaving for greener pastures because she would wonder, "Who is going to do this? Who is going to fill this gap?" As she says, "Whatever you do affects other people, not just you."

Evelyn, a committed supervisor of six female registrars in pathology, would like to see more women involved in research and teaching. She says, "I'd like to see these young ladies take off." Once they do so, she would be happy to hand over the reins. If the young women training under Dr Evelyn Lavu have learned anything from this accomplished and inspiring woman, the future of Papua New Guinea looks brighter already.

MEDLARS BIBLIOGRAPHY

PUBLICATIONS OF RELEVANCE TO PAPUA NEW GUINEA AND MELANESIA

Bibliographic Citation List generated from MEDLARS

- 1 **Ambrose L, Riginos C, Cooper RD, Leow KS, Ong W, Beebe NW.**
Population structure, mitochondrial polyphyly and the repeated loss of human biting ability in anopheline mosquitoes from the southwest Pacific.
Mol Ecol 2012 Sep;21(17):4327-4343. Epub 2012 Jul 2.

Australia and New Guinea contain high levels of endemism and biodiversity, yet there have been few evaluations of population-level genetic diversity in fauna occurring throughout the Australo-Papuan region. Using extensive geographical sampling, we examined and compared the phylogenetic relationships, phylogeography and population structure of *Anopheles farauti*, *An. hinesorum* and *An. irenicus* throughout their ranges in the southwest Pacific using mitochondrial (mtDNA COI) and nuclear (ribosomal protein S9 and ribosomal DNA ITS2) loci. Phylogenetic analyses suggest that the ability to utilize humans as hosts has been lost repeatedly, coincident with independent colonizations of the Solomon Islands. As some of the species under investigation transmit malaria in the region, this is a medically important finding. Maximum likelihood and Bayesian phylogenetic analyses of nuclear loci also showed that the three species are monophyletic. However, putative introgression of *An. hinesorum* mtDNA onto a nuclear background of *An. farauti* was evident in populations from Queensland, Torres Strait and southern New Guinea. Haplotype networks and pairwise F_{ST} values show that there is significant genetic structure within New Guinea and Australia in both *An. farauti* and *An. hinesorum*, consistent with a long-term history of low gene flow among populations.
- 2 **Asa I, de Costa C, Mola G.**
A prospective survey of cases of complications of induced abortion presenting to Goroka Hospital, Papua New Guinea, 2011.
Aust NZ J Obstet Gynaecol 2012 Oct;52(5):491-493. Epub 2012 Jun 14.

Induced abortion on demand or for socio-economic indications is illegal in Papua New Guinea under the 1974 Criminal Code. Nevertheless, the procedure is known to be widely practised. This prospective study examines the demographic and medical features of women presenting with complications of induced abortion to Goroka Hospital in a 6-month period. It was noted that abortion was most commonly induced using the synthetic prostaglandin analogue misoprostol. Although illegal induced abortion cannot be condoned, it appears that misoprostol, much safer in this context than mechanical or traditional herbal methods, is now being widely used for the purpose of induced abortion in Papua New Guinea, as it is in other developing countries.
- 3 **Baddam R, Thong KL, Avasthi TS, Shaik S, Yap KP, Teh CS, Chai LC, Kumar N, Ahmed N.**
Whole-genome sequences and comparative genomics of *Salmonella enterica* serovar Typhi isolates from patients with fatal and nonfatal typhoid fever in Papua New Guinea.
J Bacteriol 2012 Sep;194(18):5122-5123.

Many of the developing countries of the Southeast Asian region are significantly affected by endemic typhoid fever, possibly as a result of marginal living standards. It is an important public health problem in countries such as Papua New Guinea, which is geographically close to some of the foci of endemicity in Asia. The severity of the disease varies in different regions, and this may be attributable to genetic diversity among the native strains. Genome sequence data on strains from different countries are needed to clearly understand their genetic makeup and virulence potential. We describe the genomes of two *Salmonella typhi* isolates from patients with fatal and nonfatal cases of typhoid fever in Papua New Guinea. We discuss in brief the underlying sequencing methodology, assembly, genome statistics, and important features of the two draft genomes, which form an essential step in our functional molecular infection epidemiology program centering on typhoid fever. The comparative genomics of these and other isolates would enable us to identify genetic rearrangements and mechanisms responsible for endemicity and the differential severity of pathogenic salmonellae in Papua New Guinea and elsewhere.
- 4 **Ballantyne KN, van Oven M, Ralf A, Stoneking M, Mitchell RJ, van Oorschot RA, Kayser M.**
MtDNA SNP multiplexes for efficient inference of matrilineal genetic ancestry within Oceania.
Forensic Sci Int Genet 2012 Jul;6(4):425-436. Epub 2011 Sep 22.

Human mitochondrial DNA (mtDNA) is a convenient marker for tracing matrilineal biogeographic ancestry and is widely applied in forensic, genealogical and anthropological studies. In forensic applications, DNA-based ancestry inference can be useful for finding unknown suspects by concentrating police investigations in cases where autosomal STR profiling was unable to provide a match, or can help provide clues in missing person identification. Although multiplexed mtDNA single nucleotide polymorphism (SNP) assays to infer matrilineal ancestry at a (near) continental level are already available, such tools are lacking for the Oceania region. Here, we have developed a hierarchical system of three SNaPshot multiplexes for genotyping 26 SNPs defining all major mtDNA haplogroups for Oceania (including Australia, Near Oceania and Remote Oceania). With this system, it was possible to conclusively assign 74% of Oceanian individuals to their Oceanian matrilineal ancestry in an established literature database (after correcting for obvious external admixture). Furthermore, in a set of 161 genotyped individuals collected in Australia, Papua New Guinea and Fiji, 87.6% were conclusively assigned an Oceanian matrilineal origin. For the remaining 12.4% of the genotyped samples either a Eurasian origin was detected indicating likely European admixture (1.9%),

the identified haplogroups are shared between Oceania and S/SE-Asia (5%), or the SNPs applied did not allow a geographic inference to be assigned (5.6%). Sub-regional assignment within Oceania was possible for 32.9% of the individuals genotyped: 49.5% of Australians were assigned an Australian origin and 13.7% of the Papua New Guineans were assigned a Near Oceanian origin, although none of the Fijians could be assigned a specific Remote Oceanian origin. The low assignment rates of Near and Remote Oceania are explained by recent migrations from Asia via Near Oceania into Remote Oceania. Combining the mtDNA multiplexes for Oceania introduced here with those we developed earlier for all other continental regions, global matrilineal bio-geographic ancestry assignment from DNA is now achievable in a highly efficient way that is also suitable for applications with limited material such as forensic case work.

- 5 **Ballif M, Harino P, Ley S, Coscolla M, Niemann S, Carter R, Coulter C, Borrell S, Siba P, Phuanukoonnon S, Gagneux S, Beck HP.**

Drug resistance-conferring mutations in *Mycobacterium tuberculosis* from Madang, Papua New Guinea.

BMC Microbiol 2012 Sep 4;12:191.

BACKGROUND: Monitoring drug resistance in *Mycobacterium tuberculosis* is essential to curb the spread of tuberculosis (TB). Unfortunately, drug susceptibility testing is currently not available in Papua New Guinea (PNG) and that impairs TB control in this country. We report for the first time *M. tuberculosis* mutations associated with resistance to first- and second-line anti-TB drugs in Madang, PNG. A molecular cluster analysis was performed to identify *M. tuberculosis* transmission in that region. **RESULTS:** Phenotypic drug susceptibility tests showed 15.7% resistance to at least one drug and 5.2% multidrug resistant (MDR) TB. Rifampicin resistant strains had the *rpoB* mutations D516F, D516Y or S531L; isoniazid resistant strains had the mutations *katG* S315T or *inhA* promoter C15T; streptomycin resistant strains had the mutations *rpsL* K43R, K88Q, K88R, *rrs* A514C or *gidB* V77G. The molecular cluster analysis indicated evidence for transmission of resistant strains. **CONCLUSIONS:** We observed a substantial rate of MDR-TB in the Madang area of PNG associated with mutations in specific genes. A close monitoring of drug resistance is therefore urgently required, particularly in the presence of drug-resistant *M. tuberculosis* transmission. In the absence of phenotypic drug susceptibility testing in PNG, molecular assays for drug resistance monitoring would be of advantage.

- 6 **Ballif M, Harino P, Ley S, Carter R, Coulter C, Niemann S, Borrell S, Fenner L, Siba P, Phuanukoonnon S, Gagneux S, Beck HP.**

Genetic diversity of *Mycobacterium tuberculosis* in Madang, Papua New Guinea.

Int J Tuberc Lung Dis 2012 Aug;16(8):1100-1107. Epub 2012 Jun 14.

SETTING: Madang and surroundings, Papua New Guinea (PNG). **OBJECTIVE:** To characterise the genetic diversity and drug susceptibility of *Mycobacterium tuberculosis* isolates collected in Madang and surroundings. **DESIGN:** *M. tuberculosis* was isolated from sputum samples from active pulmonary tuberculosis cases. Drug resistance profiles were obtained by drug susceptibility testing.

M. tuberculosis lineages were identified by single nucleotide polymorphisms and sub-typing was performed by spoligotyping. Spoligotyping and 24 locus mycobacterial interspersed repetitive units with variable number of tandem repeats were combined to identify clustered isolates. **RESULTS:** The 173 *M. tuberculosis* isolates collected belonged predominantly to the Euro-American lineage (Lineage 4) and the East-Asian lineage (Lineage 2). Multidrug-resistant *M. tuberculosis* was observed in 5.2% of isolates. Lineage 2 *M. tuberculosis*, which includes the 'Beijing' genotype, was significantly associated with any drug resistance (OR 5.2, 95%CI 1.8-15.1). Cluster analyses showed 44% molecularly clustered isolates, suggesting transmission of *M. tuberculosis* in the community, including transmission of primary drug-resistant *M. tuberculosis*. **CONCLUSION:** These data provide the first insight into the molecular characteristics of *M. tuberculosis* in the Madang area of PNG, and indicate substantial drug resistance with evidence of ongoing transmission.

- 7 **Betuela I, Rosanas-Urgell A, Kiniboro B, Stanicic DI, Samol L, de Lazzari E, Del Portillo HA, Siba P, Alonso PL, Bassat Q, Mueller I.**

Relapses contribute significantly to the risk of *Plasmodium vivax* infection and disease in Papua New Guinean children 1-5 years of age.

J Infect Dis 2012 Dec 1;206(11):1771-1780. Epub 2012 Sep 10.

BACKGROUND: *Plasmodium vivax* forms long-lasting hypnozoites in the liver. How much they contribute to the burden of *P. vivax* malaria in children living in highly endemic areas is unknown. **METHODS:** In this study, 433 Papua New Guinean children aged 1-5 years were randomized to receive artesunate (7 days) plus primaquine (14 days), artesunate alone or no treatment and followed up actively for recurrent *Plasmodium* infections and disease for 40 weeks. **RESULTS:** Treatment with artesunate-primaquine reduced the risk of *P. vivax* episodes by 28% ($p = 0.042$) and 33% ($p = 0.015$) compared with the artesunate and control arms, respectively. A significant reduction was observed only in the first 3 months of follow-up (artesunate-primaquine vs control, -58% [$p = 0.004$]; artesunate-primaquine vs artesunate, -49% [$p = 0.031$]) with little difference thereafter. Primaquine treatment also reduced the risk of quantitative real-time polymerase chain reaction- and light microscopy-positive *P. vivax* reinfections by 44% ($p < 0.001$) and 67% ($p < 0.001$), respectively. Whereas primaquine treatment did not change the risk of reinfection with *Plasmodium falciparum*, fewer *P. falciparum* clinical episodes were observed in the artesunate-primaquine arm. **CONCLUSIONS:** Hypnozoites are an important source of *P. vivax* infection and contribute substantially to the high burden of *P. vivax* disease observed in young Papua New Guinean children. Even in highly endemic areas with a high risk of reinfection, antihypnozoite treatment should be given to all cases with parasitologically confirmed *P. vivax* infections.

- 8 **Brown A, Gilbert B.**

The Vanuatu medical supply system - documenting opportunities and challenges to meet the Millennium Development Goals.

South Med Rev 2012 Jul;5(1):14-21. Epub 2012 Jul 23.

OBJECTIVES: Limited human resources are widely recognised as a barrier to achieve health-

related Millennium Development Goals. Availability of medical supplies and suitably trained health personnel are crucial to ensuring a well-functioning medical supply system. The objective of this paper is to identify the factors which influence the availability of medical supplies within the health facilities of Vanuatu. **METHODS:** A qualitative triangulated strategy using semi-structured interviews, observational workplace surveys and semi-structured focus groups was developed. This research was approved by the Human Ethics Committee of the University of Canberra and was funded through a direct grant from the United Nations Population Fund Suva, Pacific subregional office. **RESULTS:** During two weeks of data collection, 21 interviews were conducted, observational workplace surveys were completed in 19 facilities and 22 personnel participated in three focus groups across three provinces. The interviewees had a wide range of primary professional groupings and were representative of the Vanuatu health workforce. A complex array of medical supply issues are described from within the three tiered structure of the medical supply system. **CONCLUSION:** The results of this research have further informed our understanding of the competencies required by healthcare personnel to conduct medical supply management activities effectively in Pacific Island countries. As a result of this research, a platform is provided for the government of Vanuatu to engage development partners to work toward a sustainable medical supply system.

9 Camathias C, Valderrabano V, Oberli H.

Routine pin tract care in external fixation is unnecessary: a randomised, prospective, blinded controlled study. *Injury* 2012 Nov;43(11):1969-1973. Epub 2012 Aug 16.

INTRODUCTION: Pin site infections are seen in up to 40% of external fixators (ExFix) and are therefore the most common complication with this device. There is no consensus in the literature as to the appropriate regimen for pin tract care and infection prevention. This study is the first intra-subject, randomised, prospective controlled trial comparing daily pin tract care to no pin tract care at all. **METHOD:** Consecutive patients series (56 patients, 16 female, age 4-68 y, mean 24 y, in total 204 pins) recruited in the National Referral Hospital in Honiara in the Solomon Islands over a 2 year period. Exclusion criteria were application of ExFix for less than two weeks or a non-standard ExFix. Pin treatment was allocated into groups anatomically, proximal and distal. Randomisation was intra-subject and intra-group: 101 pins had daily pin site care and 103 had no treatment at all. **ENDPOINTS:** Soft-tissue interface, stability of the pins, torsional stability as determined with a torque metre, osteolysis and pain. Assessment of pin sites blinded. Statistical analysis using the paired t test for parametric data and the Wilcoxon rank test for non-parametric data (Stat View). **RESULTS:** No significant difference between the two groups. Soft-tissue interface 36% vs 35% (granulation/secretion), stability 20 vs 25 pins with loosening. No significant osteolysis (7 vs 6 pins). Torque: mean 0.75 Nm, max.: 3.05 Nm vs 0.60 Nm, max.: 3.55 Nm, no significant difference. No differences in demographics (age, localisation, sex, time of fixation). **CONCLUSION:** This study shows that routine pin tract care is unnecessary in external fixation treatment of injuries.

10 Chiang TY, Lin WC, Kuo MC, Ji DD, Fang CT.

Relapse of imported vivax malaria despite standard-dose primaquine therapy: an investigation with molecular genotyping analyses.

Clin Microbiol Infect 2012 Jul;18(7):E232-E234. Epub 2012 Mar 27.

Taiwan CDC investigated four cases of recurrent imported vivax malaria during 2003-2010. Molecular genotyping results and the lack of inter-episodes travel history indicated that two of the patients, who acquired vivax malaria in Indonesia and the Solomon Islands, respectively, suffered relapses after an interval of 3-4 months, despite completing standard-dose primaquine therapy (30 mg/day for 14 days) for the first episode. Treatment with a higher dose of primaquine (60 mg/day for 14 days) prevented further relapse in both patients. This finding calls for further monitoring of the therapeutic efficacy of primaquine in treating *Plasmodium vivax* acquired in southeast Asia and Oceania.

11 Chidlow GR, Laing IA, Harnett GB, Greenhill AR, Phuanukoonnon S, Siba PM, Pomat WS, Shellam GR, Smith DW, Lehmann D.

Respiratory viral pathogens associated with lower respiratory tract disease among young children in the highlands of Papua New Guinea.

J Clin Virol 2012 Jul;54(3):235-239. Epub 2012 May 16.

BACKGROUND: Acute lower respiratory tract infections (ALRI) commonly result in fatal outcomes in the young children of Papua New Guinea (PNG). However, comprehensive studies of the viral aetiology of ALRI have not been conducted in PNG for almost 30 years. **OBJECTIVES:** To determine the viruses associated with ALRI among children living in the PNG highlands using sensitive molecular detection techniques. **STUDY DESIGN:** Parnasal swabs were collected routinely between 1 week and 18 months of age and also during episodes of ALRI, as part of a neonatal pneumococcal conjugate vaccine trial. A tandem multiplex real-time PCR assay was used to test for a comprehensive range of respiratory viruses in samples collected from 221 young children. Picornavirus typing was supported by DNA sequence analysis. **RESULTS:** Recognized pathogenic respiratory viruses were detected in 198/273 (73%) samples collected from children with no evidence of ALRI and 69/80 (86%) samples collected during ALRI episodes. Human rhinoviruses (HRV) species A, B and C were detected in 152 (56%) samples from non-ALRI children and 50 (63%) samples collected during ALRI episodes. Partial structural region sequences for two new species C rhinoviruses were added to the GenBank database. ALRI was associated with detection of adenovirus species B ($p < 0.01$) or C ($p < 0.05$), influenza A ($p < 0.0001$) or respiratory syncytial virus ($p < 0.0001$). Multiple viruses were detected more often during ALRI episodes (49%) than when children displayed no symptoms of ALRI (18%) ($p < 0.0001$). **CONCLUSIONS:** The burden of infection with respiratory viruses remains significant in young children living in the PNG highlands.

12 Colquhoun S, Ogaoga D, Tamou M, Nasi T, Subhi R, Duke T.

Child health nurses in the Solomon Islands: lessons for the Pacific and other developing countries.

Hum Resour Health 2012 Nov 21;10(1):45.

OBJECTIVES: To understand the roles of nurses with advanced training in paediatrics in the Solomon

Islands, and the importance of these roles to child health. To understand how adequately equipped child health nurses feel for these roles, to identify the training needs, difficulties and future opportunities. DESIGN: Semi-structured interviews. SETTINGS: Tertiary hospital, district hospitals and health clinics in the Solomon Islands. PARTICIPANTS: Twenty-one paediatric nurses were interviewed out of a total of 27 in the country. RESULTS: All nurses were currently employed in teaching, clinical or management areas. At least one or two nurses were working in each of 7 of the 9 provinces; in the two smaller provinces there were none. Many nurses were sole practitioners in remote locations without back-up from doctors or other experienced nurses; all had additional administrative or public health duties. Different types of courses were identified: a residential diploma through the University of Papua New Guinea or New Zealand and a diploma by correspondence through the University of Sydney. CONCLUSIONS: Child health nurses in the Solomon Islands fulfill vital clinical, public health, teaching and administrative roles. Currently they are too few in number, and this is a limiting factor for improving the quality of child health services in that country. Current methods of training require overseas travel, or are expensive, or lack relevance, or remove nurses from their work-places and families for prolonged periods of time. A local post-basic child health nursing course is urgently needed, and models exist to achieve this.

13 Corser CA, McLenachan PA, Pierson MJ, Harrison GL, Penny D.

The Q2 mitochondrial haplogroup in Oceania.

PLoS One 2012;7(12):e52022. Epub 2012 Dec 20.

Many details surrounding the origins of the peoples of Oceania remain to be resolved, and as a step towards this we report seven new complete mitochondrial genomes from the Q2a haplogroup, from Papua New Guinea, Fiji and Kiribati. This brings the total to eleven Q2 genomes now available. The Q haplogroup (that includes Q2) is an old and diverse lineage in Near Oceania, and is reasonably common; within our sample set of 430, 97 are of the Q haplogroup. However, only 8 are Q2, and we report 7 here. The tree with all complete Q genomes is proven to be minimal. The dating estimate for the origin of Q2 (around 35 Kya) reinforces the understanding that humans have been in Near Oceania for tens of thousands of years; nevertheless the Polynesian maternal haplogroups remain distinctive. A major focus now, with regard to Polynesian ancestry, is to address the differences and timing of the 'Melanesian' contribution to the maternal and paternal lineages as people moved further and further into Remote Oceania. Input from other fields such as anthropology, history and linguistics is required for a better understanding and interpretation of the genetic data.

14 Culotta E.

Anthropology. Turning from war to peace in Papua New Guinea.

Science 2012 Sep 28;337(6102):1593-1594.

15 Davy CP, Patrickson M.

Implementation of evidence-based healthcare in Papua New Guinea.

Int J Evid Based Healthc 2012 Dec;10(4):361-368. doi: 10.1111/j.1744-1609.2012.00294.x.

AIM: The aim of this research was to understand how health workers in developing countries reach

diagnostic and treatment decisions. In developing countries, health workers are often forced to make diagnostic and treatment decisions based on limited knowledge, unhelpful information, infrequent and low technology back-up services and without the support of more senior staff. Yet patients continue to be treated. This paper investigates how primary healthcare workers in such contexts reach these diagnostic and treatment decisions. METHOD: Using a qualitative methodology, 58 primary healthcare workers from the three primary healthcare facilities in Papua New Guinea – aid posts, sub-health centres and health centres – participated in an in-depth interview, in order to investigate how diagnostic and treatment decisions were made. RESULTS: Although participants were originally trained in the biomedical model, they lived and worked in a context where other belief systems operated to diagnose and treat illness. This led to the coexistence of at least three models of treatment: the biomedical model, traditional indigenous health practices and Christian beliefs. Thus, a homogenous biomedical understanding of health and well-being was not possible in this setting, and treatment options did not always follow the biomedical recommendations. CONCLUSIONS: In developing countries where competing medical frameworks exist, evidence-based practices may be more difficult to implement. Although the skill and knowledge of the provider and availability of treatment resources are still important, belief in the accuracy of the diagnosis and the potency of the treatment by the patient and the patient's community as well as the health provider may be just as significant.

16 Fedden S, Boroditsky L.

Spatialization of time in Mian.

Front Psychol 2012;3:485. doi: 10.3389/fpsyg.2012.00485. Epub 2012 Nov 19.

We examine representations of time among the Mianmin of Papua New Guinea. We begin by describing the patterns of spatial and temporal reference in Mian. Mian uses a system of spatial terms that derive from the orientation and direction of the Hak and Sek rivers and the surrounding landscape. We then report results from a temporal arrangement task administered to a group of Mian speakers. The results reveal evidence for a variety of temporal representations. Some participants arranged time with respect to their bodies (left to right or toward the body). Others arranged time as laid out on the landscape, roughly along the east/west axis (either east to west or west to east). This absolute pattern is consistent both with the axis of the motion of the sun and the orientation of the two rivers, which provides the basis for spatial reference in the Mian language. The results also suggest an increase in left to right temporal representations with increasing years of formal education (and the reverse pattern for absolute spatial representations for time). These results extend previous work on spatial representations for time to a new geographical region, physical environment, and linguistic and cultural system.

17 Foong RX, Rajasingam D.

Learning from low-resource maternity care using pregnancy outcomes from the Solomon Islands.

Int J Gynaecol Obstet 2012 Dec;119(3):284. Epub 2012 Sep 19.

18 Gessain A, Cassar O.

Epidemiological aspects and world distribution of

HTLV-1 infection.

Front Microbiol 2012;3:388. Epub 2012 Nov 15.

The human T-cell leukemia virus type 1 (HTLV-1), identified as the first human oncogenic retrovirus 30 years ago, is not a ubiquitous virus. HTLV-1 is present throughout the world, with clusters of high endemicity located often nearby areas where the virus is nearly absent. The main HTLV-1 highly endemic regions are the Southwestern part of Japan, sub-Saharan Africa and South America, the Caribbean area, and foci in the Middle East and Australo-Melanesia. The origin of this puzzling geographical or rather ethnic repartition is probably linked to a founder effect in some groups with the persistence of a high viral transmission rate. Despite different socio-economic and cultural environments, the HTLV-1 prevalence increases gradually with age, especially among women in all highly endemic areas. The three modes of HTLV-1 transmission are mother to child, sexual transmission, and transmission with contaminated blood products. Twenty years ago, de Thé and Bomford estimated the total number of HTLV-1 carriers to be 10-20 million people. At that time, large regions had not been investigated, few population-based studies were available and the assays used for HTLV-1 serology were not very specific. Despite the fact that there is still a lot of data lacking in large areas of the world and that most of the HTLV-1 studies concern only blood donors, pregnant women, or different selected patients or high-risk groups, we shall try, based on the most recent data, to revisit the world distribution and the estimates of the number of HTLV-1 infected persons. Our best estimates range from 5 to 10 million HTLV-1 infected individuals. However, these results were based on only approximately 1.5 billion of individuals originating from known HTLV-1 endemic areas with reliable available epidemiological data. Correct estimates in other highly populated regions, such as China, India, the Maghreb and East Africa, is currently not possible, thus the current number of HTLV-1 carriers is very probably much higher.

- 19 **Gething PW, Elyazar IR, Moyes CL, Smith DL, Battle KE, Guerra CA, Patil AP, Tatem AJ, Howes RE, Myers MF, George DB, Horby P, Wertheim HF, Price RN, Mueller I, Baird JK, Hay SI.**

A long neglected world malaria map: *Plasmodium vivax* endemicity in 2010.

PLoS Negl Trop Dis 2012;6(9):e1814. Epub 2012 Sep 6.

BACKGROUND: Current understanding of the spatial epidemiology and geographical distribution of *Plasmodium vivax* is far less developed than that for *P. falciparum*, representing a barrier to rational strategies for control and elimination. Here we present the first systematic effort to map the global endemicity of this hitherto neglected parasite. **METHODOLOGY AND FINDINGS:** We first updated to the year 2010 our earlier estimate of the geographical limits of *P. vivax* transmission. Within areas of stable transmission, an assembly of 9,970 geospatially *P. vivax* parasite rate (PvPR) surveys collected from 1985 to 2010 were used with a spatiotemporal Bayesian model-based geostatistical approach to estimate endemicity age-standardised to the 1-99 year age range (PvPR(1-99)) within every 5x5 km resolution grid square. The model incorporated data on Duffy negative phenotype frequency to suppress endemicity predictions, particularly in Africa. Endemicity was predicted within a relatively narrow range throughout the endemic

world, with the point estimate rarely exceeding 7% PvPR(1-99). The Americas contributed 22% of the global area at risk of *P. vivax* transmission, but high endemic areas were generally sparsely populated and the region contributed only 6% of the 2.5 billion people at risk (PAR) globally. In Africa, Duffy negativity meant stable transmission was constrained to Madagascar and parts of the Horn, contributing 3.5% of global PAR. Central Asia was home to 82% of global PAR with important high endemic areas coinciding with dense populations particularly in India and Myanmar. South East Asia contained areas of the highest endemicity in Indonesia and Papua New Guinea and contributed 9% of global PAR. **CONCLUSIONS AND SIGNIFICANCE:** This detailed depiction of spatially varying endemicity is intended to contribute to a much-needed paradigm shift towards geographically stratified and evidence-based planning for *P. vivax* control and elimination.

- 20 **Gibbs P, Worth H.**

'Eat coffee candy and die': sex, death and Huli funerals.

Sex Health 2012 Nov;9(5):497-498. doi: 10.1071/SH12018.

BACKGROUND: Sex and death have traditionally been linked in Huli culture in the Southern Highlands in Papua New Guinea. Huli regarded that close contact with women could result in men becoming sick or dying. However, there has been rapid social and economic development in the area and Huli traditions are changing. At the same time, HIV prevalence is rising. **METHODS:** Twenty-five semistructured in-depth interviews were carried out with key informants during a study on HIV risk in the Southern Highlands. Interviews were conducted mostly in Tok Pisin. Interviews were transcribed and the data were analysed through thematic coding. **RESULTS:** Huli people use 'eating coffee candy' as a metaphor for engaging in sex at funerals. This is very new and against traditional values, where women attended funerals and men only built the coffins and buried the body. Nowadays, sex occurs at funerals. This change has disturbed older people because it has not only changed the customary meaning of the funeral space, but it has also encouraged the spread of HIV. Huli use the fatalistic expression 'Eat coffee candy and die' to refer to funerals as a space of HIV risk. **CONCLUSION:** Huli community and church leaders, and health workers are attempting to deal with the situation by not allowing men to stay at the funeral site overnight, burying the dead on the same day they die and using customary village law to charge men caught having sex at a funeral. However, traditional beliefs and rapid social change in the context of an HIV epidemic need to be taken into account.

- 21 **Gibson RS, Cavalli-Sforza T.**

Using reference nutrient density goals with food balance sheet data to identify likely micronutrient deficits for fortification planning in countries in the Western Pacific region.

Food Nutr Bull 2012 Sep;33(3 Suppl):S214-S220.

BACKGROUND: Collection of nationwide food consumption data at the individual level is the preferred option for planning fortification programs. However, such data are seldom collected in low-income countries. In contrast, Food Balance Sheets (FBS), published annually for approximately 180 countries, may provide a source of national data for program planning. **OBJECTIVE:** To explore

the use of micronutrient densities from FBS data to identify likely deficits for eight micronutrients in national diets. **METHODS:** Micronutrient densities in the daily available food supply per capita were calculated from the micronutrient contents of 95 food commodities in 17 Western Pacific Region countries. Densities were compared with reference nutrient density goals developed to ensure that at least 95% of individuals, irrespective of life-stage group, are likely to have adequate intakes. **RESULTS:** Of the eight micronutrients, Cambodia and Korea D.P.R. had likely deficits for six; China, Fiji, Kiribati, Korea Republic, Lao P.D.R., Philippines, Solomon Islands, Vanuatu, and Viet Nam had likely deficits for five; Brunei Darussalam, Malaysia, Mongolia, New Zealand, and Papua New Guinea had likely deficits for four; and New Caledonia had likely deficits for three. The most frequent deficits were for iron, zinc, and calcium (all countries), followed by vitamin B2 and vitamin A ($n = 13$), vitamin B1 ($n = 2$), and vitamin B12 ($n = 1$). **CONCLUSIONS:** The nutrient density approach could be applied to FBS data for ranking countries according to likely micronutrient deficits, but it provides no information on distribution of nutrient supply for fortification program planning. The approach described here could be applied to data from Household Consumption and Expenditures Surveys (HCES) to characterize households at greatest risk.

22 Grabenstein JD, Klugman KP.

A century of pneumococcal vaccination research in humans.

Clin Microbiol Infect 2012 Oct;18 Suppl 5:15-24. Epub 2012 Aug 6.

Sir Almroth Wright coordinated the first trial of a whole-cell pneumococcal vaccine in South Africa from 1911 to 1912. Wright started a chain of events that delivered pneumococcal vaccines of increasing clinical and public-health value, as medicine advanced from a vague understanding of the germ theory of disease to today's rational vaccine design. Early whole-cell pneumococcal vaccines mimicked early typhoid vaccines, as early pneumococcal antisera mimicked the first diphtheria antitoxins. Pneumococcal typing systems developed by Franz Neufeld and others led to serotype-specific whole-cell vaccines. Pivotaly, Alphonse Dochez and Oswald Avery isolated pneumococcal capsular polysaccharides in 1916-17. Serial refinements permitted Colin MacLeod and Michael Heidelberger to conduct a 1944-45 clinical trial of quadrivalent pneumococcal polysaccharide vaccine (PPV), demonstrating a high degree of efficacy in soldiers against pneumococcal pneumonia. Two hexavalent PPVs were licensed in 1947, but were little used as clinicians preferred therapy with new antibiotics, rather than pneumococcal disease prevention. Robert Austrian's recognition of high pneumococcal case-fatality rates, even with antibiotic therapy, led to additional trials in South Africa, the USA and Papua New Guinea, with 14-valent and 23-valent PPVs licensed in 1977 and 1983 for adults and older children. Conjugation of polysaccharides to proteins led to several pneumococcal conjugate vaccines licensed since 2000, enabling immunization of infants and young children and resultant herd protection for all ages. Today, emergence of disease caused by pneumococcal serotypes not included in various vaccine formulations fuels research into conserved proteins or other means to maximize protection against more than 90 known pneumococcal serotypes.

23 Guillaume L, Ofanoa R, Swillen L, Singh N, Bossin HC, Schaffner F.

Distribution of *Aedes albopictus* (Diptera, Culicidae) in southwestern Pacific countries, with a first report from the Kingdom of Tonga.

Parasit Vectors 2012 Nov 6;5:247.

BACKGROUND: *Aedes (Stegomyia) albopictus* is currently one of the most notorious globally invasive mosquito species. Its medical importance is well documented, and its fast expansion throughout most continents is being monitored with concern. It is generally assumed that its expansion through the Western Pacific island countries has not progressed since its establishment in Fiji in 1989. However, the current status of *Ae. albopictus* in the Pacific region is largely unknown. **FINDINGS:** According to data from the literature and our own observations, *Ae. albopictus* is currently present in the following countries of the southern Pacific region: Papua New Guinea, Solomon Islands, Fiji, and the Kingdom of Tonga, where it was first detected in July 2011. It is absent from New Caledonia and French Polynesia where routine entomological surveillance is carried out, and was not detected during entomological work in 2007, either on the Cook Islands or on the Wallis and Futuna Islands. The species was not reported from American Samoa in 2004, but it is mentioned as probably present in Vanuatu. This is the first report of *Ae. albopictus* in Tonga. **CONCLUSIONS:** The introduction and establishment of *Ae. albopictus* in Tonga was expected due to the geographical proximity of this country to Fiji where the species is strongly established. The pathway of introduction is unknown. The expansion of *Ae. albopictus* in the Pacific region poses an increasing threat to public health given the role this mosquito plays as primary vector of emerging infectious diseases such as Chikungunya fever.

24 Horwood PF, Luang-Suarkia D, Bebes S, Boniface K, Datta SS, Siba PM, Kirkwood CD.

Surveillance and molecular characterization of group A rotaviruses in Goroka, Papua New Guinea.

Am J Trop Med Hyg 2012 Dec;87(6):1145-1148. Epub 2012 Nov 5.

In this study, we investigated the molecular epidemiology of group A rotaviruses in cases of acute gastroenteritis in Goroka, Papua New Guinea. From April 2008 through November 2010, 813 diarrheal stool samples were collected from children <5 years of age hospitalized with acute gastroenteritis. Rotavirus antigen was detected in 31.2% of samples using a commercial enzyme-linked immunosorbent assay. Genotyping revealed the presence of the globally circulating strains G1P[8] (50.0%), G3P[8] (23.0%), and G2P[4] (8.2%). The globally emerging strains G9 and G12 were detected in 1.2% and 6.1% of samples, respectively. Mixed infections were detected in a high proportion of samples (11.9%), with 9.0% and 3.7% of samples displaying multiple G and P genotypes, respectively.

25 Howse G.

Elements of Pacific public health laws: an analysis of the public health acts of Papua New Guinea, Vanuatu, the Solomon Islands, and Fiji.

Asia Pac J Public Health 2012 Sep;24(5):860-866.

Pacific countries are sovereign nations with distinctive histories, ethnicity, customs, primary resources, economies, and health systems. Despite these and other acknowledged differences, similarities exist in many areas such as geography,

legal history, and culture. Many share the experience of colonization, with imported British laws and the subsequent experience of independence. Most Pacific countries are also developing countries. This article broadly describes approaches to legislating in public health in Papua New Guinea, Fiji, Vanuatu, and the Solomon Islands and notes common elements in their public health laws, in particular, in relation to administration, allocation of powers and responsibilities, interaction with local government, communicable disease control, and nuisance. The article concludes that many Pacific public health laws could deliver better support for current health policy, more sensitivity to the culture and customs of the region, and better management of public health risk through laws that are better suited to their Pacific environment, easier to understand, more flexible, and more relevant to current health policy.

- 26 **Hunter E.**
"Creating Futures" in Papua New Guinea: just the beginning.
Australas Psychiatry 2012 Dec;20(6):507-511. Epub 2012 Oct 31.

OBJECTIVES: "Creating Futures 2012: PNG" was the largest mental health conference to date in Melanesia. This paper describes the history, purpose and content of this initiative as a means to facilitate capacity building in Papua New Guinea (PNG), increase binational cooperation and develop a regional mental health network. **CONCLUSIONS:** Fifty Australian professionals were recruited to work with PNG colleagues to develop a suite of 20 workshops on locally identified themes. Over 300 delegates from across PNG and the western Pacific attended the four-day meeting, which was framed by Professor Vikram Patel in a series of presentations on global health. Feedback from PNG delegates and potential ongoing activities are described.

- 27 **Inui S, Hosoya T, Shimamura Y, Masuda S, Ogawa T, Kobayashi H, Shirafuji K, Moli RT, Kozone I, Shin-ya K, Kumazawa S.**
Solophenols B-D and solomonin: new prenylated polyphenols isolated from propolis collected from the Solomon Islands and their antibacterial activity.
J Agric Food Chem 2012 Nov 28;60(47):11765-11770. Epub 2012 Nov 14.

Three new prenylated flavonoids, namely, solophenols B (1), C (2), and D (3), as well as a new prenylated stilbene, solomonin (4), were isolated from propolis collected from the Solomon Islands. In addition, 17 known compounds were identified. The structures of the new compounds were determined by a combination of methods, including mass spectrometry and NMR. These new compounds and several known compounds were tested for antibacterial activity against *Staphylococcus aureus*, *Bacillus subtilis*, and *Pseudomonas aeruginosa*. Most of them exhibited potent antibacterial activity. These findings may indicate that propolis from the Solomon Islands has potential applications as an ingredient in food additives or pharmaceuticals.

- 28 **Jimenez Soto E, La Vincente S, Clark A, Firth S, Morgan A, Dettrick Z, Dayal P, Aldaba BM, Varghese B, Trisnantoro L, Prasai Y; Investment Case Team for India, Indonesia, Nepal, Papua New Guinea and the Philippines.**
Developing and costing local strategies to improve maternal and child health: the investment case

framework.

PLoS Med 2012;9(8):e1001282. Epub 2012 Aug 7.

- 29 **Jorim RY, Korape S, Legu W, Koch M, Barrows LR, Matainaho TK, Rai PP.**

An ethnobotanical survey of medicinal plants used in the Eastern Highlands of Papua New Guinea.
J Ethnobiol Ethnomed 2012 Dec 18;8:47.

BACKGROUND: The Eastern Highlands area of Papua New Guinea (PNG) has a rich tradition of medicinal plant use. However, rapid modernization is resulting in the loss of independent language traditions and consequently a loss of individuals knowledgeable in medicinal plant use. This report represents a program to document and preserve traditional knowledge concerning medicinal plant use in PNG. This report documents and compares traditional plant use in the Eastern Highlands districts of Unggai-Bena, Okapa, and Obura-Wonenara, and puts these new records in context of previously documented PNG medicinal plant use. **METHODS:** This manuscript is an annotated combination of Traditional Medicines survey reports generated by UPNG trainees using a survey questionnaire titled "Information sheet on traditional herbal preparations and medicinal plants of PNG". The Traditional Medicines survey project is supported by WHO, US NIH and PNG governmental health care initiatives and funding. **RESULTS:** Overall, after "poisoning" (synonymous with "magic") the most commonly recorded ailments addressed by medicinal plant use were pain, gynecological disease, gastrointestinal maladies, anemia or malnutrition and malaria. However, the recorded indications for plant use varied widely amongst the different survey locations. Unlike many areas of PNG, mixing of ingredients was the most common mode of preparation recorded, except for two areas where the consumption of fresh plant material was more common. Throughout the Eastern Highlands oral administration was most common, with topical application second. Overall, leaves were most commonly used in the preparations of the healers interviewed, followed by bark and stems. Several new medicinal uses of plants were also documented. **CONCLUSIONS:** Collaboration between the WHO, UPNG and the PNG Department of Health initiated Traditional Medicine survey program in order to preserve traditional knowledge concerning medicinal plant use in PNG. This effort promotes integration of effective and accessible traditional practices with Western protocols. The Traditional Medicine surveys are particularly important because, in the absence of the clinical validation, the documentation of the consistent use of a given plant for specific indication by a large number of herbalists, across a wide range of ethnic traditions, may be considered as a positive criterion for the promulgation of said use amongst PNG's recently formed traditional healer associations.

- 30 **Kelly A, Kupul M, Nake Trumb R, Aeno H, Neo J, Fitzgerald L, Hill PS, Kaldor JM, Siba P, Valley A.**
More than just a cut: a qualitative study of penile practices and their relationship to masculinity, sexuality and contagion and their implications for HIV prevention in Papua New Guinea.
BMC Int Health Hum Rights 2012 Jul 20;12:10.

BACKGROUND: Male circumcision (MC) has been shown to reduce vaginal transmission of HIV to men. While community acceptability is important in a country's preparedness to introduce MC, it is equally important to map contemporary MC and other penile cutting practices, and the socio-cultural dimensions

underpinning these practices. **METHODS:** A total of 486 men and women (n=276 and n=210, respectively) participated in 82 semi-structured and 45 focus group discussions from four different provinces of Papua New Guinea (PNG), each representing one of the four socially and geographically diverse regions of the country. **RESULTS:** Of the men interviewed 131 self-reported that they had undergone a penile alteration with some reporting multiple types. Practices were diverse and could be grouped into five broad categories: traditional (customary) penile cutting; contemporary penile cutting; medical circumcision; penile inserts; and penile bloodletting practices in which sharp objects are used to incise the glans and or inserted and withdrawn from the male urethra in order to induce bleeding. Socio-cultural traditions, enhanced sexual pleasure and improved genital hygiene were key motivators for all forms of penile practices. **CONCLUSIONS:** The findings from this study highlight the complex and diverse nature of penile practices in PNG and their association with notions of masculinity, sexuality and contagion. Contemporary penile practices are critical to a community's acceptance of MC and of a country's ability to successfully implement MC in the context of a rich and dynamic culture of penile practices. If an MC program were to be successfully rolled out in PNG to prevent HIV it would need to work within and build upon these diverse cultural meanings and motivators for penile practices already commonly performed in PNG by men.

- 31 **Khositseth S, Bruce LJ, Walsh SB, Bawazir WM, Ogle GD, Unwin RJ, Thong MK, Sinha R, Choo KE, Chartapisak W, Kingwatanakul P, Sumboonnanda A, Vasuvattakul S, Yenchitsomanus P, Wrong O.** Tropical distal renal tubular acidosis: clinical and epidemiological studies in 78 patients. *QJM* 2012 Sep;105(9):861-877.

BACKGROUND: Distal renal tubular acidosis (dRTA) caused by mutations of the SLC4A1 gene encoding the erythroid and kidney isoforms of anion exchanger 1 (AE1 or band 3) has a high prevalence in some tropical countries, particularly Thailand, Malaysia, the Philippines and Papua New Guinea (PNG). Here the disease is almost invariably recessive and can result from either homozygous or compound heterozygous SLC4A1 mutations. **METHODS:** We have collected and reviewed our own and published data on tropical dRTA to provide a comprehensive series of clinical and epidemiological studies in 78 patients. **RESULTS:** Eight responsible SLC4A1 mutations have been described so far, four of them affecting multiple unrelated families. With the exception of the mutation causing South-East Asian ovalocytosis (SAO), none of these mutations has been reported outside the tropics, where dRTA caused by SLC4A1 mutations is much rarer and almost always dominant, resulting from mutations that are quite different from those found in the tropics. SLC4A1 mutations, including those causing dRTA, may cause morphological red cell changes, often with excess haemolysis. In dRTA, these red cell changes are usually clinically recessive and not present in heterozygotes. The high tropical prevalence of dRTA caused by SLC4A1 mutations is currently unexplained. **CONCLUSION:** A hypothesis suggesting that changes in red cell metabolism caused by these mutations might protect against malaria is put forward to explain the phenomenon,

and a possible mechanism for this effect is proposed.

- 32 **Kim SY, Lee Y, Sohn M, Hahm KH.** Developing a tool for assessing public health law in countries. *Asia Pac J Public Health* 2012 Sep;24(5):867-871. Epub 2012 Oct 2.

At present, the World Health Organization (WHO) is in the process of developing a tool designed to assess the status of public health legislation in a given country. An Expert Consultation on Public Health Law was convened in Manila, Philippines, in May 2011. The participants agreed that the tool could serve as a guide for a regional approach to assist Member States in assessing the scope, completeness, and adequacy of their public health law. Given the broad definition of "public health" and the laws that affect health, directly or indirectly, the participants further agreed to narrow the field to 4 areas based on significant WHO works/policies, each organized into an independent module: (1) International Digest on Health Law, (2) Primary Health Care, (3) International Health Regulations 2005, and (4) Framework Convention on Tobacco Control. The tool would be drafted in a questionnaire format that asks the respondent to determine whether primary and/or subsidiary legislation exists in the country on a specific topic and, if so, to cite the relevant law, describe the pertinent points, and attach and/or link to the full text where available. The participants agreed that the respondents should include government officials and/or academics with legal competency. Version 1 of the tool was piloted in the Philippines, the Republic of Korea, Samoa, and Vanuatu. At a 2nd Expert Consultation on Public Health Law, convened in Incheon, Republic of Korea, in October 2011, in conjunction with the 43rd Conference of the Asia-Pacific Academic Consortium on Public Health, the participants determined that the tool was generally usable, certain concerns notwithstanding, such as the risk of standardizing compliance with WHO policies. The agreed next step is to finalize the analysis tool by August 2012, marking the end of stage I in the development process. Stage II will consist of team building and networking of responsible officers and/or professionals in the countries. The tool will be further developed to reflect specific in-country situations.

- 33 **Knox J, Marshall C.** Chromoblastomycosis in a Solomon Islander. *Med J Aust* 2012 Sep 17;197(6):350.
- 34 **Lisciandro JG, Prescott SL, Nadal-Sims MG, Devitt CJ, Richmond PC, Pomat W, Siba PM, Holt PG, Strickland DH, van den Biggelaar AH.** Neonatal antigen-presenting cells are functionally more quiescent in children born under traditional compared with modern environmental conditions. *J Allergy Clin Immunol* 2012 Nov;130(5):1167-1174. e10. Epub 2012 Jul 19.

BACKGROUND: One explanation for the high burden of allergic and autoimmune diseases in industrialized countries is inappropriate immune development under modern environmental conditions. There is increasing evidence that the process of immune deviation already begins in utero, but the underlying immunologic mechanisms are not clear. **OBJECTIVE:** We sought to identify differences in the function of neonatal antigen-presenting cells (APCs) in children born in settings that are more traditional versus those of modern societies. **METHODS:**

Cord blood mononuclear cells were collected from newborns from Papua New Guinea (PNG; traditional) and Australia (modern) and compared for differences in APCs and T-cell phenotype and function. RESULTS: Australian cord naive T cells (CD4(+) CD25(-)CD127(+) cells) showed an enhanced and more rapid proliferative response in an autologous, APC-dependent culture system, a result of differences in neonatal APCs rather than T-cell function. This included an increased capacity to process antigen and to upregulate activation markers after stimulation. In contrast, resting PNG APCs exhibited higher baseline levels of activation and inhibitory markers and were less responsive or nonresponsive to stimulation in vitro. CONCLUSIONS: This study supports the hypothesis that prenatal environments can influence the developing immune system in utero. Children born under modern environmental conditions exhibit increased APC reactivity at birth compared with children born under traditional environmental conditions. The functionally more quiescent nature of PNG neonatal APCs might protect against the development of harmful inflammatory responses in early life.

35 **Manning L, Laman M, Rosanas-Urgell A, Michon P, Aipit S, Bona C, Siba P, Mueller I, Davis TM.**

Severe anemia in Papua New Guinean children from a malaria-endemic area: a case-control etiologic study.

PLoS Negl Trop Dis 2012;6(12):e1972. Epub 2012 Dec 13.

BACKGROUND: There are few detailed etiologic studies of severe anemia in children from malaria-endemic areas and none in those countries with holoendemic transmission of multiple *Plasmodium* species. METHODOLOGY/PRINCIPAL FINDINGS: We examined associates of severe anemia in 143 well-characterized Papua New Guinean (PNG) children aged 0.5-10 years with hemoglobin concentration <50 g/L (median [inter-quartile range] 39 [33-44] g/L) and 120 matched healthy children (113 [107-119] g/L) in a case-control cross-sectional study. A range of socio-demographic, behavioural, anthropometric, clinical and laboratory (including genetic) variables were incorporated in multivariate models with severe anemia as dependent variable. Consistent with a likely trophic effect of chloroquine or amodiaquine on parvovirus B19 (B19V) replication, B19V PCR/IgM positivity had the highest odds ratio (95% confidence interval) of 75.8 (15.4-526), followed by *P. falciparum* infection (19.4 (6.7-62.6)), vitamin A deficiency (13.5 (5.4-37.7)), body mass index-for-age z-score <2.0 (8.4 (2.7-27.0)) and incomplete vaccination (2.94 (1.3-7.2)). *P. vivax* infection was inversely associated (0.12 (0.02-0.47)), reflecting early acquisition of immunity and/or a lack of reticulocytes for parasite invasion. After imputation of missing data, iron deficiency was a weak positive predictor (6.4% of population attributable risk). CONCLUSIONS/SIGNIFICANCE: These data show that severe anemia is multifactorial in PNG children, strongly associated with under-nutrition and certain common infections, and potentially preventable through vitamin A supplementation and improved nutrition, completion of vaccination schedules, and intermittent preventive antimalarial treatment using non-chloroquine/amodiaquine-based regimens.

36 **Manning L, Laman M, Rosanas-Urgell A, Turlach B, Aipit S, Bona C, Warrell J, Siba P, Mueller I,**

Davis TM.

Rapid antigen detection tests for malaria diagnosis in severely ill Papua New Guinean children: a comparative study using Bayesian latent class models.

PLoS One 2012;7(11):e48701. Epub 2012 Nov 5.

BACKGROUND: Although rapid diagnostic tests (RDTs) have practical advantages over light microscopy (LM) and good sensitivity in severe falciparum malaria in Africa, their utility where severe non-falciparum malaria occurs is unknown. LM, RDTs and polymerase chain reaction (PCR)-based methods have limitations, and thus conventional comparative malaria diagnostic studies employ imperfect gold standards. We assessed whether, using Bayesian latent class models (LCMs) which do not require a reference method, RDTs could safely direct initial anti-infective therapy in severe ill children from an area of hyperendemic transmission of both *Plasmodium falciparum* and *P. vivax*. METHODS AND FINDINGS: We studied 797 Papua New Guinean children hospitalized with well-characterized severe illness for whom LM, RDT and nested PCR (nPCR) results were available. For any severe malaria, the estimated prevalence was 47.5% with RDTs exhibiting similar sensitivity and negative predictive value (NPV) to nPCR (≥96.0%). LM was the least sensitive test (87.4%) and had the lowest NPV (89.7%), but had the highest specificity (99.1%) and positive predictive value (98.9%). For severe falciparum malaria (prevalence 42.9%), the findings were similar. For non-falciparum severe malaria (prevalence 6.9%), no test had the WHO-recommended sensitivity and specificity of >95% and >90%, respectively. RDTs were the least sensitive (69.6%) and had the lowest NPV (96.7%). CONCLUSIONS: RDTs appear a valuable point-of-care test that is at least equivalent to LM in diagnosing severe falciparum malaria in this epidemiologic situation. None of the tests had the required sensitivity/specificity for severe non-falciparum malaria but the number of false-negative RDTs in this group was small.

37 **Marfurt J, Chalfein F, Prayoga P, Wabiser F, Wirjanata G, Sebayang B, Piera KA, Wittlin S, Haynes RK, Möhrle JJ, Anstey NM, Kenangalem E, Price RN.**

Comparative ex vivo activity of novel endoperoxides in multidrug-resistant *Plasmodium falciparum* and *P. vivax*.

Antimicrob Agents Chemother 2012 Oct;56(10):5258-5263. Epub 2012 Jul 30.

The declining efficacy of artemisinin derivatives against *Plasmodium falciparum* highlights the urgent need to identify alternative highly potent compounds for the treatment of malaria. In Papua Indonesia, where multidrug resistance has been documented against both *P. falciparum* and *P. vivax* malaria, comparative ex vivo antimalarial activity against *Plasmodium* isolates was assessed for the artemisinin derivatives artesunate (AS) and dihydroartemisinin (DHA), the synthetic peroxides OZ277 and OZ439, the semisynthetic 10-alkylaminoartemisinin derivatives artemisone and artemiside, and the conventional antimalarial drugs chloroquine (CQ), amodiaquine (AQ), and piperazine (PIP). Ex vivo drug susceptibility was assessed in 46 field isolates (25 *P. falciparum* and 21 *P. vivax*). The novel endoperoxide compounds exhibited potent ex vivo activity against both species, but significant differences in intrinsic activity were observed. Compared to AS and its

active metabolite DHA, all the novel compounds showed lower or equal 50% inhibitory concentrations (IC₅₀s) in both species (median IC₅₀s between 1.9 and 3.6 nM in *P. falciparum* and 0.7 and 4.6 nM in *P. vivax*). The antiplasmodial activity of novel endoperoxides showed different cross-susceptibility patterns in the two *Plasmodium* species: whereas their ex vivo activity correlated positively with CQ, PIP, AS, and DHA in *P. falciparum*, the same was not apparent in *P. vivax*. The current study demonstrates for the first time potent activity of novel endoperoxides against drug-resistant *P. vivax*. The high activity against drug-resistant strains of both *Plasmodium* species confirms these compounds to be promising candidates for future artemisinin-based combination therapy (ACT) regimens in regions of coendemicity.

- 38 **Massey PD, Wakageni J, Kekeubata E, Maena'adi J, Laete'esafi J, Waneagea J, Fangaria G, Jimuru C, Houaimane M, Talana J, MacLaren D, Speare R.** TB questions, East Kwaio answers: community-based participatory research in a remote area of Solomon Islands. *Rural Remote Health* 2012;12:2139. Epub 2012 Oct 24.

INTRODUCTION: East Kwaio is a remote region on the island of Malaita, Solomon Islands. Atoifi Adventist Hospital (the Hospital) is the only hospital and tuberculosis (TB) services provider in the region. If people come to the hospital with TB, they are usually admitted for the two-month intensive phase of treatment as there are no community-based TB services. Most people walk or travel by canoe to the hospital as there are no roads. East Kwaio is known to have high rates of TB; however, it has a low case detection rate and low treatment completion. The aims of this study were to explore why people with TB, especially from the mountain areas, present to the hospital so late in their illness or do not present at all. The study was part of a larger project to strengthen the research capacity of local health workers and community leaders, supported by visiting researchers from Australia. **METHODS:** Semi-structured interviews with TB patients, a focus group of key informants and direct interaction with a community with a history of TB were used to explore reasons why people present to the hospital late in their TB illness. **RESULTS:** Four interviews and a focus group of 12 key informants were conducted and a mountain hamlet with a history of TB was visited. The results represent the data from the interviews and the focus group. The time delay in presenting to the hospital from when participants first became unwell ranged between two and three years. In the mountain hamlet, two additional people with probable TB were seen who had not presented to the hospital during illnesses of five and nine months. Reasons for delays included: seeking care from traditional healers; the challenge of accessing health services due to distance, cost and cultural issues different from the hospital's worldview; social isolation when in hospital; and being old so not having long to live. Delays in diagnosis of people with TB will increase the risk of transmission to family and through hamlets and villages. This study has led to plans being developed to build a more culturally appropriate TB ward and community treatment program. **CONCLUSIONS:** The study has identified TB questions that need East Kwaio answers. It has shown that a small project can inform the development of important changes to TB services, such as the redevelopment and relocation

of the TB ward. To enable TB control, the local health services need to develop an understanding of, and appropriately engage with, traditional beliefs that influence how people interact with hospital TB treatment and management. This is the case even if the beliefs are based on a worldview different from that of the health service providers. Ongoing operational research is required into TB diagnosis and treatment services and the many factors that contribute to the high TB burden in this remote area.

- 39 **Mayor A, Bardají A, Felger I, King CL, Cisteró P, Dobaño C, Stanisic DI, Siba P, Wahlgren M, del Portillo H, Mueller I, Menéndez C, Ordi J, Rogerson S.** Placental infection with *Plasmodium vivax*: a histopathological and molecular study. *J Infect Dis* 2012 Dec 15;206(12):1904-1910. Epub 2012 Oct 10.

BACKGROUND: Evidence of the presence of *Plasmodium vivax* in the placenta is scarce and inconclusive. This information is relevant to understanding whether *P. vivax* affects placental function and how it may contribute to poor pregnancy outcomes. **METHODS:** Histopathologic examination of placental biopsies from 80 Papua New Guinean pregnant women was combined with quantitative polymerase chain reaction (qPCR) to confirm *P. vivax* infection and rule out coinfection with other *Plasmodium* species in placental and peripheral blood. Leukocytes and monocytes/macrophages were detected in placental sections by immunohistochemistry. **RESULTS:** Mono-infection by *P. vivax* and *Plasmodium falciparum* was detected by qPCR in 8 and 10 placentas, respectively. Seven of the 8 women with *P. vivax* placental mono-infection were negative in peripheral blood. By histology, 3 placentas with *P. vivax* mono-infection showed parasitized erythrocytes in the intervillous space but no hemozoin in macrophages nor increased intervillous inflammatory cells. In contrast, 7 placentas positive for *P. falciparum* presented parasites and hemozoin in macrophages or fibrin as well as intervillous inflammatory infiltrates. **CONCLUSIONS:** *Plasmodium vivax* can be associated with placental infection. However, placental inflammation is not observed in *P. vivax* mono-infections, suggesting other causes of poor delivery outcomes associated with *P. vivax* infection.

- 40 **Mendez FL, Watkins JC, Hammer MF.** A haplotype at STAT2 introgressed from Neanderthals and serves as a candidate of positive selection in Papua New Guinea. *Am J Hum Genet* 2012 Aug 10;91(2):265-274.

Signals of archaic admixture have been identified through comparisons of the draft Neanderthal and Denisova genomes with those of living humans. Studies of individual loci contributing to these genome-wide average signals are required for characterization of the introgression process and investigation of whether archaic variants conferred an adaptive advantage to the ancestors of contemporary human populations. However, no definitive case of adaptive introgression has yet been described. Here we provide a DNA sequence analysis of the innate immune gene STAT2 and show that a haplotype carried by many Eurasians (but not sub-Saharan Africans) has a sequence that closely matches that of the Neanderthal STAT2. This haplotype, referred to as N, was discovered through a resequencing

survey of the entire coding region of STAT2 in a global sample of 90 individuals. Analyses of publicly available complete genome sequence data show that haplotype N shares a recent common ancestor with the Neanderthal sequence (~80 thousand years ago) and is found throughout Eurasia at an average frequency of ~5%. Interestingly, N is found in Melanesian populations at ~10-fold higher frequency (~54%) than in Eurasian populations. A neutrality test that controls for demography rejects the hypothesis that a variant of N rose to high frequency in Melanesia by genetic drift alone. Although we are not able to pinpoint the precise target of positive selection, we identify nonsynonymous mutations in ERBB3, ESYT1, and STAT2 – all of which are part of the same 250 kb introgressive haplotype – as good candidates.

- 41 **Mitjà O, Hays R, Rinaldi AC, McDermott R, Bassat Q.**

New treatment schemes for yaws: the path toward eradication.

Clin Infect Dis 2012 Aug;55(3):406-412. doi: 10.1093/cid/cis444. Epub 2012 May 18.

- 42 **Negin J, Martiniuk AL, Farrell P, Dalipanda T.**

Frequency, cost and impact of inter-island referrals in the Solomon Islands.

Rural Remote Health 2012;12:2096. Epub 2012 Sep 19.

INTRODUCTION: Providing quality health services to people living in remote areas is central to global efforts to achieve universal access to health care. Effective referral systems are especially critical in resource-limited countries where small populations are separated by considerable distances, geographic challenges and the limitations of human resources for health. This study aimed to build an evidence base on inter-island referrals in the Solomon Islands, in particular regarding the number of referrals, reasons for referrals, and cost, to ultimately provide recommendations regarding referral practice effectiveness and efficiency. **METHODS:** Data were taken from the referral database collected and maintained by the National Referral Hospital (NRH) in the capital, Honiara. Data included age, sex, ward or department visited, date of travel back to home port, home port and province. Data were available and included for 2008, 6 months of 2009, all of 2010 and 1 month of 2011; a total of 31 months. Travel costs were taken from NRH administrative information and included in the analysis. In addition, 10 qualitative interviews were conducted with clinicians and policy-makers in the tertiary hospital and one provincial hospital to gather information regarding inter-island referrals, their appropriateness and challenges faced. **RESULTS:** In the Solomon Islands, referrals from outer islands to the NRH are substantial and are gradually increasing over time. The two most populous provinces outside of the capital, Western and Malaita, represented 51% of all referrals in the study period. Of those referred, 21% were less than 15 years of age - even though 40% of the country's population is under 15 - with 30% being young adults of 15-24 years. Orthopaedic conditions comprised the largest number of referrals, with obstetric and gynaecological conditions a close second. The cost of referrals is rapidly increasing and was almost US\$350,000 per year for the NRH alone. The amount budgeted for patient travel from the provinces to the NRH was a fraction of what is needed to cover the current number of referrals leading to a substantial

budget shortfall. There did not appear to be a clear link between number of doctors in each province and the rate of referrals. **CONCLUSION:** Improving the appropriateness of referrals can have a substantial impact on access, quality of care and costs. Improvements in equipment in remote facilities, in human resources for health and in information technology can strengthen the quality of care in outer islands. Reducing the burden on referral facilities will allow them to provide appropriate care to those most in need while building public trust in all layers of the health system.

- 43 **Noro JC, Kalaitzis JA, Neilan BA.**

Bioactive natural products from Papua New Guinea marine sponges.

Chem Biodivers 2012 Oct;9(10):2077-2095. doi: 10.1002/cbdv.201100292.

The discovery of novel natural products for drug development relies heavily upon a rich biodiversity, of which the marine environment is an obvious example. Marine natural product research has spawned several drugs and many other candidates, some of which are the focus of current clinical trials. The sponge megadiversity of Papua New Guinea is a rich but underexplored source of bioactive natural products. Here, we review some of the many natural products derived from PNG sponges with an emphasis on those with interesting biological activity and, therefore, drug potential. Many bioactive natural products discussed here appear to be derived from non-ribosomal peptide and polyketide biosynthesis pathways, strongly suggesting a microbial origin of these compounds. With this in mind, we also explore the notion of sponge-symbiont biosynthesis of these bioactive compounds and present examples to support the working hypothesis.

- 44 **Núñez R, Cooperrider K, Doan D, Wassmann J.**

Contours of time: topographic construals of past, present, and future in the Yupno valley of Papua New Guinea.

Cognition 2012 Jul;124(1):25-35. doi: 10.1016/j.cognition.2012.03.007. Epub 2012 Apr 28.

Time, an everyday yet fundamentally abstract domain, is conceptualized in terms of space throughout the world's cultures. Linguists and psychologists have presented evidence of a widespread pattern in which deictic time – past, present and future – is construed along the front/back axis, a construal that is linear and ego-based. To investigate the universality of this pattern, we studied the construal of deictic time among the Yupno, an indigenous group from the mountains of Papua New Guinea, whose language makes extensive use of allocentric topographic (uphill/downhill) terms for describing spatial relations. We measured the pointing direction of Yupno speakers' gestures – produced naturally and without prompting – as they explained common expressions related to the past, present and future. Results show that the Yupno spontaneously construe deictic time spatially in terms of allocentric topography: the past is construed as downhill, the present as co-located with the speaker, and the future as uphill. Moreover, the Yupno construal is not linear, but exhibits a particular geometry that appears to reflect the local terrain. The findings shed light on how, our universal human embodiment notwithstanding, linguistic, cultural and environmental pressures come to shape abstract concepts.

45 Oppenheimer S.

Iron and infection: narrative review of a major iron supplementation study in Papua New Guinea undertaken by the Department of Tropical Paediatrics, Liverpool School of Tropical Medicine, 1979-1983, its aftermath and the continuing relevance of its results. *Paediatr Int Child Health* 2012 Nov;32 Suppl 2:S21-S29.

In 1978, I returned from a 2-year government posting as provincial paediatrician to East and West Sepik provinces of Papua New Guinea (PNG), having already enrolled on the Diploma of Tropical Medicine and Hygiene (DTM&H) course at the Liverpool School of Tropical Medicine. I had been too late to enrol for the more relevant Diploma in Tropical Paediatrics course, but, whilst on the DTM&H course, made up for lost time by presenting myself to Professor Ralph Hendrickse in his office. I outlined my proposal for a double-blind, controlled, randomised trial of iron intervention with the aim of improving iron nutrition and decreasing susceptibility to and morbidity from infections in a cohort of infants in PNG. My reason for suggesting such a study was the high rate of anaemia in infants there and my perception from the literature of the time that the balance of studies favoured a beneficial effect of iron supplementation on infectious susceptibility, and that iron deficiency was associated with reversible abnormalities of immune function (although it had and has since been difficult to demonstrate the severity and relevance of these in observational in-vivo studies in humans). Ralph made an on-the-spot decision, immediately offering me the opportunity to join his department on 1 January 1979 on temporary funding while I applied for (and secured) a major grant from the Wellcome Trust for this work.

46 Pelly EB.

Exploring men's health in indigenous Papua New Guinea.

Aust Nurs J 2012 Nov;20(5):47.

47 Phillips GA, Hendrie J, Atua V, Manineng C.

Capacity building in emergency care: an example from Madang, Papua New Guinea.

Emerg Med Australas 2012 Oct;24(5):547-552. Epub 2012 Sep 7.

BACKGROUND: Divine Word University (DWU) is an emerging national university of Papua New Guinea (PNG) based in the provincial capital of Madang, providing training for Health Extension Officers (HEOs). HEOs form the backbone of healthcare delivery in PNG as clinicians, public health officers and health centre managers. Both campus-based and clinical teaching at the nearby Modilon Hospital is limited because of significant resource constraints. **OBJECTIVE:** This article describes a visiting clinical lecturer programme in which Australasian emergency physicians and emergency registrars deliver teaching to HEO students at DWU and Modilon Hospital. **METHODS:** Volunteer doctors are briefed pre-departure and given prepared educational tools. Visits are from 2 weeks to 3 months, and include the possibility of accredited training for emergency registrars through the Australasian College for Emergency Medicine. DWU provides secure accommodation and assistance with travel and visa logistics. Tasks for visiting lecturers include delivering campus-based teaching on emergency medicine (EM) topics, structured and opportunistic bedside tutorials, and clinical teaching

and assistance with ED care alongside local EM clinicians. **DISCUSSION:** Programme evaluation has relied on qualitative feedback, which has been positive from all stakeholders. Visiting lecturers gain teaching skills and insights into the challenges of emergency healthcare delivery in an international, resource-constrained setting. Local staff receive assistance and support as well as learning new teaching skills. Students receive increased interactive learning opportunities. **CONCLUSION:** This programme provides positive models of both emergency care capacity building in a resource-constrained setting and training in international EM for Australasian clinicians.

48 Pulford J, Tandrapah A, Atkinson JA, Kaupa B, Russell T, Hetzel MW.

Feasibility and acceptability of insecticide-treated plastic sheeting (ITPS) for vector control in Papua New Guinea.

Malar J 2012 Oct 9;11:342.

BACKGROUND: This study assessed the feasibility and acceptability of utilizing insecticide-treated plastic sheeting (ITPS) as a malaria control intervention in Papua New Guinea (PNG). **METHODS:** ZeroVector® ITPS was installed in 40 homes across four study sites representing a cross section of malaria transmission risk and housing style. Structured questionnaires were completed at the time of ITPS installation (n = 40) and at four weeks post installation (n = 40) with the household head. Similarly, group interviews with the male and/or female household heads were completed at installation (n = 5) and four-week follow-up (n = 4). **RESULTS:** ZeroVector® ITPS was successfully installed in a range of homes employing traditional and/or modern building materials in PNG. The ITPS installations remained intact over the course of the four-week trial period and were highly acceptable to both male and female household heads. No dissatisfaction with the ITPS product was reported at four-week follow-up; however, the installation process was time consuming, participants reported a reduction in mosquito net use following ITPS installation and many participants expressed concern about the longevity of ITPS over the longer term. **CONCLUSION:** ZeroVector® ITPS installation is feasible and highly acceptable in a diverse range of PNG contexts and is likely to be favourably received as a vector control intervention if accessible en masse. A longer-term evaluation is required before firm policy or public health decisions can be made regarding the potential application of ITPS in the national malaria control programme. The positive study findings suggest a longer-term evaluation of this promising malaria control intervention warrants consideration.

49 Pulford J, Oakiva T, Angwin A, Bryant M, Mueller I, Hetzel MW.

Indifferent to disease: a qualitative investigation of the reasons why some Papua New Guineans who own mosquito nets choose not to use them.

Soc Sci Med 2012 Dec;75(12):2283-2290. Epub 2012 Sep 7.

This paper presents findings from a qualitative study designed to explore the reasons why some Papua New Guineans who own mosquito nets choose not to use them, whether on a regular or episodic basis. In-depth interviews (IDIs) were conducted with a sub-sample (n = 44) of participants in a country wide household survey who reported

owning or having access to a mosquito net, but not having slept under a mosquito net the night prior to survey. All IDIs were completed between December 2010 and June 2011. Analysis was informed by a general inductive methodology. Multiple impediments to regular mosquito net use were identified by study participants, although all were broadly grouped into the inter-related categories of net-, environmental- or human-factors. Indifference emerged as the most influential impediment towards regular net use presenting as a general attitudinal context in which a majority of participant responses were grounded. A lack of knowledge regarding malaria transmission pathways or the utility of mosquito nets did not appear to underlie this indifference. Rather, the indifference appeared to be rooted in a lack of fear of malaria infection cultivated through lived experience. A wide range of interventions could potentially promote greater mosquito net use amongst this population. However, the basis of any intervention strategy, given the pervasive indifferent attitude towards regular mosquito net use, should be to render individual mosquito net use as easy and as convenient as possible and to promote complementary malaria control strategies where appropriate.

50 **Razee H, Whittaker M, Jayasuriya R, Yap L, Brentnall L.**

Listening to the rural health workers in Papua New Guinea – the social factors that influence their motivation to work.
Soc Sci Med 2012 Sep;75(5):828-835. Epub 2012 May 10.

Despite rural health services being situated and integrated within communities in which people work and live, the complex interaction of the social environment on health worker motivation and performance in low middle income countries has been neglected in research. In this article we investigate how social factors impact on health worker motivation and performance in rural health services in Papua New Guinea (PNG). Face-to-face in-depth interviews were conducted with 33 health workers from three provinces (Central, Madang, and Milne Bay) in PNG between August and November 2009. They included health extension officers, community health workers and nursing officers, some of whom were in charge of the health centres. The health centres were a selection across church based, government and private enterprise health facilities. Qualitative analysis identified the key social factors impacting on health worker motivation and performance to be the local community context, gender roles and family related issues, safety and security and health beliefs and attitudes of patients and community members. Our study identified the importance of strong supportive communities on health worker motivation. These findings have implications for developing sustainable strategies for motivation and performance enhancement of rural health workers in resource poor settings.

51 **Redman-MacLaren M, MacLaren DJ, Harrington H, Asugeni R, Timothy-Harrington R, Kekeubata E, Speare R.**

Mutual research capacity strengthening: a qualitative study of two-way partnerships in public health research.
Int J Equity Health 2012 Dec 18;11:79.

INTRODUCTION: Capacity building has been employed in international health and development

sectors to describe the process of 'experts' from more resourced countries training people in less resourced countries. Hence the concept has an implicit power imbalance based on 'expert' knowledge. In 2011, a health research strengthening workshop was undertaken at Atoifi Adventist Hospital, Solomon Islands to further strengthen research skills of the Hospital and College of Nursing staff and East Kwaio community leaders through partnering in practical research projects. The workshop was based on participatory research frameworks underpinned by decolonising methodologies, which sought to challenge historical power imbalances and inequities. Our research question was, "Is research capacity strengthening a two-way process?" METHODS: In this qualitative study, five Solomon Islanders and five Australians each responded to four open-ended questions about their experience of the research capacity strengthening workshop and activities: five chose face to face interview, five chose to provide written responses. Written responses and interview transcripts were inductively analysed in NVivo 9. RESULTS: Six major themes emerged. These were: Respectful relationships; Increased knowledge and experience with research process; Participation at all stages in the research process; Contribution to public health action; Support and sustain research opportunities; and Managing challenges of capacity strengthening. All researchers identified benefits for themselves, their institution and/or community, regardless of their role or country of origin, indicating that the capacity strengthening had been a two-way process. CONCLUSIONS: The flexible and responsive process we used to strengthen research capacity was identified as mutually beneficial. Using community-based participatory frameworks underpinned by decolonising methodologies is assisting to redress historical power imbalances and inequities and is helping to sustain the initial steps taken to establish a local research agenda at Atoifi Hospital. It is our experience that embedding mutuality throughout the research capacity strengthening process has had great benefit and may also benefit researchers from more resourced and less resourced countries wanting to partner in research capacity strengthening activities.

52 **Reiling L, Richards JS, Fowkes FJ, Wilson DW, Chokejindachai W, Barry AE, Tham WH, Stubbs J, Langer C, Donelson J, Michon P, Tavul L, Crabb BS, Siba PM, Cowman AF, Mueller I, Beeson JG.**

The *Plasmodium falciparum* erythrocyte invasion ligand PfRh4 as a target of functional and protective human antibodies against malaria.

PLoS One 2012;7(9):e45253. Epub 2012 Sep 20.

BACKGROUND: Acquired antibodies are important in human immunity to malaria, but key targets remain largely unknown. *Plasmodium falciparum* reticulocyte-binding-homologue-4 (PfRh4) is important for invasion of human erythrocytes and may therefore be a target of protective immunity. METHODS: IgG and IgG subclass-specific responses against different regions of PfRh4 were determined in a longitudinal cohort of 206 children in Papua New Guinea (PNG). Human PfRh4 antibodies were tested for functional invasion-inhibitory activity, and expression of PfRh4 by *P. falciparum* isolates and sequence polymorphisms were determined. RESULTS: Antibodies to PfRh4 were acquired by children exposed to *P. falciparum* malaria, were predominantly comprised of IgG1 and IgG3

subclasses, and were associated with increasing age and active parasitemia. High levels of antibodies, particularly IgG3, were strongly predictive of protection against clinical malaria and high-density parasitemia. Human affinity-purified antibodies to the binding region of PfRh4 effectively inhibited erythrocyte invasion by *P. falciparum* merozoites and antibody levels in protected children were at functionally-active concentrations. Although expression of PfRh4 can vary, PfRh4 protein was expressed by most isolates derived from the cohort and showed limited sequence polymorphism. **CONCLUSIONS:** Evidence suggests that PfRh4 is a target of antibodies that contribute to protective immunity to malaria by inhibiting erythrocyte invasion and preventing high density parasitemia. These findings advance our understanding of the targets and mechanisms of human immunity and evaluating the potential of PfRh4 as a component of candidate malaria vaccines.

- 53 **Riddell M, Senn N, Clements CJ, Hobday L, Cowie B, Kurubi J, Kevin A, Siba P, Reeder JC, Morgan C.** Rubella control in Papua New Guinea: age-specific immunity informs strategies for introduction of rubella vaccine. *Vaccine* 2012 Dec 14;30(52):7506-7512. Epub 2012 Oct 25.

AIM: To determine the age-specific immunity profile for rubella from three discrete study populations in Papua New Guinea, and to inform policy regarding the possible introduction of rubella vaccine. **BACKGROUND:** In 2005, the Western Pacific Region (WPR), of which Papua New Guinea (PNG) is a member state, declared the goal of regional measles elimination by 2012. Recently, WPR has incorporated an accelerated control goal for rubella and congenital rubella syndrome (CRS). PNG currently recommends two doses of measles vaccination at 6 and 9 months of age with a monovalent measles vaccine, which does not include rubella vaccine. **METHODS:** Convenience samples were collected from 1326 eligible participants in PNG and assessed for rubella immunity using the Dade Behring Enzygnost™ Anti-Rubella-Virus enzyme immunoassay. Nearly 34% were collected during an age stratified prospective survey of febrile patients in Madang Province; approximately 49% were collected from women of childbearing age in East Sepik and Milne Bay Provinces. Remaining specimens were collected from 6 to 7-month-old infants in Port Moresby prior to receiving the first dose of measles vaccine. **FINDINGS:** Of all samples tested, 65.2% (95% confidence interval (CI): 62.6-67.8) had evidence of immunity to rubella infection. Of women more than 15 years of age, 91.6% (95% CI: 89.4-93.5) were immune. The force of infection was highest between 5 and 19 years of age. **CONCLUSIONS:** Although a population-based sample was not used, our multi-centre study of the population immunity profile suggests that immunity against rubella is extremely high in most women of childbearing age, but women who become pregnant at an early age may be at high risk of rubella infection during pregnancy and potential delivery of an infant with CRS. Routine measles vaccine coverage, a proxy for measles-rubella vaccine coverage, as measured in recently published studies, is well below the WHO target of 80% coverage. Introduction of a child or infant dose of rubella vaccine requires caution and further study.

- 54 **Rosanas-Urgell A, Senn N, Rarau P, Aponte JJ,**

Reeder JC, Siba PM, Michon P, Mueller I.

Lack of associations of $\alpha(+)$ -thalassaemia with the risk of *Plasmodium falciparum* and *Plasmodium vivax* infection and disease in a cohort of children aged 3-21 months from Papua New Guinea.

Int J Parasitol 2012 Nov;42(12):1107-1113. Epub 2012 Oct 17.

Despite consistent evidence of a protective effect of $\alpha(+)$ -thalassaemia against severe *Plasmodium falciparum* disease, the mechanisms underlying this protection remain unknown. An increase in risk of *Plasmodium vivax* malaria in early childhood resulting in a cross-species protection against severe *P. falciparum* malaria has been proposed as a possible mechanism in Melanesian children. The association of $\alpha(+)$ -thalassaemia genotypes with a risk of *P. falciparum* and *P. vivax* infection and uncomplicated illness was reassessed in a cohort of 1,112 Papua New Guinean children, followed from 3 to 21 months of age. Three hundred and eighty-nine (35.0%) children were homozygous for $\alpha(+)$ -thalassaemia (α/α), 506 (45.5%) heterozygous ($\alpha\alpha/\alpha$) and 217 (19.5%) homozygous for the wild-type allele. No significant differences in the incidence of *P. falciparum* (Pf) or *P. vivax* (Pv) malaria were observed between $\alpha(+)$ -thalassaemia homozygote (Pf: incidence rate ratio (IRR)=1.13, CI (95) (0.82-1.56), $p = 0.45$, Pv: IRR = 1.15, CI (95) (0.88-1.50), $p = 0.31$), heterozygote (Pf: IRR = 0.98, CI (95) (0.71-1.34), $p = 0.93$, Pv: IRR = 1.14, CI (95) (0.88-1.48), $p = 0.33$) and wild-type children. The prevalence of infection with either species did not differ between $\alpha(+)$ -thalassaemia genotypes, although densities of *P. vivax* (but not of *P. falciparum*) infections were significantly higher in $\alpha(+)$ -thalassaemia homozygote and heterozygote children. An excessive risk of moderate-to-severe anemia (Hb <8 g/dl) was observed in $\alpha(+)$ -thalassaemia homozygote children (IRR = 1.54, CI (95) (1.12-2.11), $p = 0.008$). This study therefore failed to confirm an increased risk of *P. vivax* or *P. falciparum* malaria in very young, $\alpha(+)$ -thalassaemic children without significant levels of acquired immunity. This confirms the lack of protection by $\alpha(+)$ -thalassaemia against uncomplicated *P. falciparum* and challenges the hypothesis of immunological cross-protection between *P. falciparum* and *P. vivax* as a mechanism underlying $\alpha(+)$ -thalassaemia protection against severe *P. falciparum* disease in Melanesian children.

- 55 **Rosanas-Urgell A, Lin E, Manning L, Rarau P, Laman M, Senn N, Grimberg BT, Tavul L, Stanicic DI, Robinson LJ, Aponte JJ, Dabod E, Reeder JC, Siba P, Zimmerman PA, Davis TM, King CL, Michon P, Mueller I.**

Reduced risk of *Plasmodium vivax* malaria in Papua New Guinean children with Southeast Asian ovalocytosis in two cohorts and a case-control study. *PLoS Med* 2012;9(9):e1001305. Epub 2012 Sep 4.

BACKGROUND: The erythrocyte polymorphism, Southeast Asian ovalocytosis (SAO) (which results from a 27-base pair deletion in the erythrocyte band 3 gene, SLC4A1 Δ 27) protects against cerebral malaria caused by *Plasmodium falciparum*; however, it is unknown whether this polymorphism also protects against *P. vivax* infection and disease. **METHODS AND FINDINGS:** The association between SAO and *P. vivax* infection was examined through genotyping of 1,975 children enrolled in three independent epidemiological studies conducted in the Madang area of Papua New Guinea. SAO was associated with a statistically significant 46% reduction in the

incidence of clinical *P. vivax* episodes (adjusted incidence rate ratio [IRR] = 0.54, 95% CI 0.40-0.72, $p < 0.0001$) in a cohort of infants aged 3-21 months and a significant 52% reduction in *P. vivax* (blood-stage) reinfection diagnosed by PCR (95% CI 22-71, $p = 0.003$) and 55% by light microscopy (95% CI 13-77, $p = 0.014$) in a cohort of children aged 5-14 years. SAO was also associated with a reduction in risk of *P. vivax* parasitaemia in children 3-21 months (1,111/ μ l versus 636/ μ l, $p = 0.011$) and prevalence of *P. vivax* infections in children 15-21 months (odds ratio [OR] = 0.39, 95% CI 0.23-0.67, $p = 0.001$). In a case-control study of children aged 0.5-10 years, no child with SAO was found among 27 cases with severe *P. vivax* or mixed *P. falciparum*/*P. vivax* malaria (OR = 0, 95% CI 0-1.56, $p = 0.11$). SAO was associated with protection against severe *P. falciparum* malaria (OR = 0.38, 95% CI 0.15-0.87, $p = 0.014$) but no effect was seen on either the risk of acquiring blood-stage infections or uncomplicated episodes with *P. falciparum*. Although Duffy antigen receptor expression and function were not affected on SAO erythrocytes compared to non-SAO children, high level (>90% binding inhibition) *P. vivax* Duffy binding protein-specific binding inhibitory antibodies were observed significantly more often in sera from SAO than non-SAO children (SAO, 22.2%; non-SAO, 6.7%; $p = 0.008$). CONCLUSIONS: In three independent studies, we observed strong associations between SAO and protection against *P. vivax* malaria by a mechanism that is independent of the Duffy antigen. *P. vivax* malaria may have contributed to shaping the unique host genetic adaptations to malaria in Asian and Oceanic populations.

- 56 **Rosewell A, Addy B, Komnapi L, Makanda F, Ropa B, Posanai E, Dutta S, Mola G, Man WY, Zwi A, MacIntyre CR.**

Cholera risk factors, Papua New Guinea, 2010. *BMC Infect Dis* 2012 Nov 5;12:287.

BACKGROUND: Cholera is newly emergent in Papua New Guinea but may soon become endemic. Identifying the risk factors for cholera provides evidence for targeted prevention and control measures. METHODS: We conducted a hospital-based case-control study to identify cholera risk factors. Using stool culture as the standard, we evaluated a cholera point of care test in the field. RESULTS: 176 participants were recruited: 54 cases and 122 controls. Independent risk factors for cholera were: being over 20 years of age (aOR 2.5; 95% CI 1.1-5.4), defecating in the open air (or river) (aOR 4.5; 95% CI 1.4-14.4) and knowing someone who travelled to a cholera affected area (aOR 4.1; 95% CI 1.6-10.7); while the availability of soap for handwashing at home was protective (aOR 0.41; 95% CI 0.19-0.87). Those reporting access to a piped water distribution system in the home were twice as likely to report the availability of soap for handwashing. The sensitivity and specificity of the rapid test were 72% (95% CI 47-90) and 71% (95% CI 44-90). CONCLUSIONS: Improving population access to a piped water distribution system and sanitation will likely reduce transmission by enabling enhanced hygiene and limiting the contamination of water sources. The One step *V. cholerae* O1/O139 Antigen Test is of limited utility for clinical decision making in a hospital setting with access to traditional laboratory methods. Settlement dwellers and mobile populations of all age groups should be targeted for interventions in Papua New Guinea.

- 57 **Siba V, Horwood PF, Vanuga K, Wapling J, Sehuko R, Siba PM, Greenhill AR.**

Evaluation of serological diagnostic tests for typhoid fever in Papua New Guinea using a composite reference standard.

Clin Vaccine Immunol 2012 Nov;19(11):1833-1837. Epub 2012 Sep 19.

Typhoid fever remains a major global health problem. A major impediment to improving outcomes is the lack of appropriate diagnostic tools, which have not significantly improved in low-income settings for 100 years. We evaluated two commercially available rapid diagnostic tests (Tubex and TyphiDot), a prototype (TyphiRapid TR-02), and the commonly used single-serum Widal test in a previously reported high-burden area of Papua New Guinea. Samples were collected from 530 outpatients with axillary temperatures of $\geq 37.5^{\circ}\text{C}$, and analysis was conducted on all malaria-negative samples ($n = 500$). A composite reference standard of blood culture and PCR was used, by which 47 participants (9.4%) were considered typhoid fever positive. The sensitivity and specificity of the Tubex (51.1% and 88.3%, respectively) and TyphiDot (70.0% and 80.1%, respectively) tests were not high enough to warrant their ongoing use in this setting; however, the sensitivity and specificity for the TR-02 prototype were promising (89.4% and 85.0%, respectively). An axillary temperature of $\geq 38.5^{\circ}\text{C}$ correlated with typhoid fever ($p = 0.014$). With an appropriate diagnostic test, conducting typhoid fever diagnosis only on patients with high-grade fever could dramatically decrease the costs associated with diagnosis while having no detrimental impact on the ability to accurately diagnose the illness.

- 58 **Sicuri E, Davy C, Marinelli M, Oa O, Ome M, Siba P, Conteh L, Mueller I.**

The economic cost to households of childhood malaria in Papua New Guinea: a focus on intra-country variation.

Health Policy Plan 2012 Jul;27(4):339-347. Epub 2011 Jun 22.

BACKGROUND: We compare direct and indirect household costs associated with malaria treatment for children <3 years in two provinces of Papua New Guinea. In particular, we explore the role of uncertainty around mean household costs and whether assuming a normal distribution for household costs limits the accuracy of any direct cost comparisons. METHODS: Exit surveys were undertaken at inpatient and outpatient health facilities. In order to handle uncertainty and facilitate comparisons, parametric and non-parametric bootstrap methods were used to estimate direct and indirect costs at the individual data level. The inpatient and outpatient incremental costs from Madang and Maprik health facilities were compared and significant differences between provinces were identified. RESULTS: Differences were noted between provinces for both inpatient and outpatient household costs. Total arithmetic mean costs for an outpatient malaria episode were US\$7.54 in Madang and US\$9.20 in Maprik. Total mean inpatient malaria episode costs were US\$25.20 in Madang and US\$14.08 in Maprik. As cost distributions were not normal, non-parametric bootstrap techniques were used for cost comparisons. Total household costs per outpatient episode of malaria were lower, although not significantly, in Maprik than in Madang (incremental cost of US\$-1.67; 95% CI -4.16 to 0.31), while total household costs per inpatient episode were significantly higher in Madang than in Maprik.

(difference of US\$11.16; 95% CI 5.47-25.33). A difference was noted between provinces in the proportion of indirect costs in total household costs for an outpatient visit: 76% in Madang vs 94% in Maprik. The proportion for indirect costs associated with inpatient visits varied less: 63% in Madang vs 68% in Maprik. **CONCLUSIONS:** Intra-country differences need to be considered in estimating household costs for both outpatient and inpatient malaria treatment. Our findings suggest that it is important to recognize the impact of both direct and indirect costs on individuals' capacity to afford treatment. Certain indirect costs are difficult to measure accurately, particularly respondents' interpretations of their productive versus non-productive time. Despite this, exploring intra-country cost variation can provide important information to health policy makers.

59 Sorokowski P, Sorokowska A.

Judgments of sexual attractiveness: a study of the Yali tribe in Papua.

Arch Sex Behav 2012 Oct;41(5):1209-1218. doi: 10.1007/s10508-012-9906-x. Epub 2012 Feb 14.

Preferences for waist-to-hip ratio (WHR), sexual dimorphism in stature (SDS), and leg-to-body ratio (LBR) have been investigated predominantly in Western cultures. The aim of the present study was to examine the preferences of a relatively isolated, indigenous population (i.e., Yali of Papua, inhabiting the mountainous terrain east of the Baliem valley). A total of 53 women and 52 men participated in the study. Study sites differed in distance from Wamena, the biggest settlement in the region, and frequency of tourists' visits. We found that the mate preferences among Yali men and women for WHR, LBR, and SDS were not exactly the same as in Western samples. Yali preferred low women's WHR and relatively high women's (but not men's) LBR. Women's and men's ratings of each SDS set were similar, which suggests that the "male-taller norm" in Yali tribe was far weaker than in Western cultures. Additionally, the observed preferences were modified by contact with different cultures, age, and accessibility of food resources (pig possession). Our results suggest that human norms of attractiveness are malleable and can change with exposure to different environments and conditions.

60 Spencer P, Fry RC, Kisby GE.

Unraveling 50-year-old clues linking neurodegeneration and cancer to cycad toxins: are microRNAs common mediators?

Front Genet 2012;3:192. doi: 10.3389/fgene.2012.00192. Epub 2012 Sep 28.

Recognition of overlapping molecular signaling activated by a chemical trigger of cancer and neurodegeneration is new, but the path to this discovery has been long and potholed. Six conferences (1962-1972) examined the puzzling neurotoxic and carcinogenic properties of a then-novel toxin [cycasin: methylazoxymethanol (MAM)- β -d-glucoside] in cycad plants used traditionally for food and medicine on Guam where a complex neurodegenerative disease plagued the indigenous population. Affected families showed combinations of amyotrophic lateral sclerosis (ALS), parkinsonism (P), and/or a dementia (D) akin to Alzheimer's disease (AD). Modernization saw declining disease rates on Guam and remarkable changes in clinical phenotype (ALS was replaced by P-D and then by D) and in two genetically distinct ALS-PDC-affected populations (Kii-Japan, West Papua-Indonesia) that used cycad

seed medicinally. MAM forms DNA lesions – repaired by O(6)-methylguanine methyltransferase (MGMT) – that perturb mouse brain development and induce malignant tumors in peripheral organs. The brains of young adult MGMT-deficient mice given a single dose of MAM show DNA lesion-linked changes in cell-signaling pathways associated with miRNA-1, which is implicated in colon, liver, and prostate cancers, and in neurological disease, notably AD. MAM is metabolized to formaldehyde, a human carcinogen. Formaldehyde-responsive miRNAs predicted to modulate MAM-associated genes in the brains of MGMT-deficient mice include miR-17-5p and miR-18d, which regulate genes involved in tumor suppression, DNA repair, amyloid deposition, and neurotransmission. These findings marry cycad-associated ALS-PDC with colon, liver, and prostate cancer; they also add to evidence linking changes in microRNA status both to ALS, AD, and parkinsonism, and to cancer initiation and progression.

61 Tynan A, Valley A, Kelly A, Law G, Millan J, Siba P, Kaldor J, Hill PS; Male Circumcision Acceptability and Impact Study, PNG (MCAIS).

Vasectomy as a proxy: extrapolating health system lessons to male circumcision as an HIV prevention strategy in Papua New Guinea.

BMC Health Serv Res 2012 Sep 4;12:299.

BACKGROUND: Male circumcision (MC) has been shown to reduce the risk of HIV acquisition among heterosexual men, with WHO recommending MC as an essential component of comprehensive HIV prevention programs in high prevalence settings since 2007. While Papua New Guinea (PNG) has a current prevalence of only 1%, the high rates of sexually transmissible diseases and the extensive, but unregulated, practice of penile cutting in PNG have led the National Department of Health (NDoH) to consider introducing a MC program. Given public interest in circumcision even without active promotion by the NDoH, examining the potential health systems implications for MC without raising unrealistic expectations presents a number of methodological issues. In this study we examined health systems lessons learned from a national no-scalpel vasectomy (NSV) program, and their implications for a future MC program in PNG. **METHODS:** Fourteen in-depth interviews were conducted with frontline health workers and key government officials involved in NSV programs in PNG over a 3-week period in February and March 2011. Documentary, organizational and policy analysis of HIV and vasectomy services was conducted and triangulated with the interviews. All interviews were digitally recorded and later transcribed. Application of the WHO six building blocks of a health system was applied and further thematic analysis was conducted on the data with assistance from the analysis software MAXQDA. **RESULTS:** Obstacles in funding pathways, inconsistent support by government departments, difficulties with staff retention and erratic delivery of training programs have resulted in mixed success of the national NSV program. **CONCLUSIONS:** In an already vulnerable health system significant investment in training, resources and negotiation of clinical space will be required for an effective MC program. Focused leadership and open communication between provincial and national government, NGOs and community is necessary to assist in service sustainability. Ensuring clear policy and guidance across the entire sexual and reproductive health sector will provide opportunities

to strengthen key areas of the health system.

62 Ulijaszek SJ, Henneberg M.

Results of epidemiological studies of blood pressure are biased by continuous variation in arm size related to body mass.

Hum Biol 2012 Aug;84(4):437-444.

In cross-sectional epidemiological studies, blood pressure (BP) is often found to be positively correlated with fatness. Usually sphygmomanometers with only one cuff size for adults are used to measure BP while arm circumference (AC) influences BP readings. We have studied cross-sectional anthropometric and BP data of adult men and women from three populations: Cook Islanders (n = 259), Papua New Guinean: Purari (n = 295), and Ok Tedi (n = 274). These were selected because of their diverse socio-economic, anthropometric, and BP characteristics. Partial correlations and regressions were used to analyze these data. Systolic and diastolic pressures (SBP, DBP) showed dependence on AC, body mass index (BMI), and skinfold thickness. Stature had some effect on SBP and DBP, independent of BMI and AC. When effects of AC and stature were statistically controlled, BMI did not correlate with either SBP or DBP. People of larger body mass have greater AC, and this biases BP readings. Average values of SBP and DBP in groups of underweight, normal, overweight, and obese people predicted by AC (sex, age, and BMI being statistically controlled) closely matched observed SBP and DBP averages in those groups. Out of 24 pairwise comparisons (3 samples from different populations \times 4 groups of BMI \times 2 pressure readings) of predicted and actual BP, only two produced statistically significant differences while 21 of the differences were 5 mm Hg or less. Correlations between BP and obesity found in epidemiological studies may be severely biased by effects of variation in AC. Sphygmomanometric measurements of BP should be corrected for continuous variation in AC.

63 Vallely A, Fitzgerald L, Fiya V, Aeno H, Kelly A, Sauk J, Kupul M, Neo J, Millan J, Siba P, Kaldor JM.

Intravaginal practices and microbicide acceptability in Papua New Guinea: implications for HIV prevention in a moderate-prevalence setting.

BMC Res Notes 2012 Nov 1;5:613.

BACKGROUND: The acceptability of female-controlled biomedical prevention technologies has not been established in Papua New Guinea, the only country in the Pacific region experiencing a generalised, moderate-prevalence HIV epidemic. Socio-cultural factors likely to impact on future product uptake and effectiveness, such as women's ability to negotiate safer sexual choices, and intravaginal hygiene and menstrual practices (IVP), remain unclear in this setting. **METHODS:** A mixed-method qualitative study was conducted among women and men attending a sexual health clinic in Port Moresby. During in-depth interviews, participants used copies of a hand-drawn template to indicate how they wash/clean the vulva and/or vagina. Interviewers pre-filled commercially available vaginal applicators with 2-3mL KY Jelly® to create a surrogate vaginal microbicide product, which was demonstrated to study participants. **RESULTS:** A total of 28 IDIs were conducted (women = 16; men = 12). A diverse range of IVP were reported. The majority of women described washing the vulva only with soap and water as part of their daily routine; in preparation for sex;

and following sexual intercourse. Several women described cleaning inside the vagina using fingers and soap at these same times. Others reported cleaning inside the vagina using a hose connected to a tap; using vaginal inserts, such as crushed garlic; customary menstrual 'steaming' practices; and the use of material fragments, cloth and newspaper to absorb menstrual blood. Unprotected sex during menstruation was common. The majority of both women and men said that they would use a vaginal microbicide gel for HIV/STI protection, should a safe and effective product become available. Microbicide use was considered most appropriate in 'high-risk' situations, such as sex with non-regular, transactional or commercial partners. Most women felt confident that they would be able to negotiate vaginal microbicide use with male sexual partners but if necessary would be prepared to use product covertly. **CONCLUSIONS:** Notional acceptability of a vaginal microbicide gel for HIV/STI prevention was high among both women and men. IVP were diverse in nature, socio-cultural dimensions and motivators. These factors are likely to impact on the future acceptability and uptake of vaginal microbicides and other biomedical HIV prevention technologies in this setting.

64 Vengiau G, Umezaki M, Phuanukoonnon S, Siba P, Watanabe C.

Diet and physical activity among migrant Bougainvilleans in Port Moresby, Papua New Guinea: association with anthropometric measures and blood pressure.

Am J Hum Biol 2012 Sep-Oct;24(5):716-718. Epub 2012 Jul 17.

OBJECTIVES: Obesity and hypertension are increasing in Papua New Guinea. This study investigated the association of dietary pattern and physical activity level with anthropometric measurements and blood pressure in migrant Bougainvilleans in the capital city of Port Moresby. **METHODS:** Adults who had moved from Naasioi territory on Bougainville Island and resided in Port Moresby during the study period were studied (n = 70). The International Physical Activity Questionnaire was used to evaluate physical activity, and dietary pattern was assessed by per week consumption frequency of food items. **RESULTS:** The least square regression analysis revealed that interindividual variation in body mass index and waist circumference was explained by variations in physical activity but not by dietary pattern. Blood pressure was not associated with physical activity level or dietary pattern. **CONCLUSION:** The individual variation in anthropometric measurements in urban Papua New Guinea is mainly influenced by physical activity level.

65 Weitz CA, Friedlaender FR, Van Horn A, Friedlaender JS.

Modernization and the onset of overweight and obesity in Bougainville and Solomon Islands children: cross-sectional and longitudinal comparisons between 1966 and 1986.

Am J Phys Anthropol 2012 Nov;149(3):435-446. Epub 2012 Oct 5.

This set of cross-sectional and longitudinal data from children and young adults in certain Bougainville and Solomon Islands populations undergoing rapid modernization during the period 1966-1986 reveals very different responses to essentially the same stimuli – the introduction and widespread availability

of western dietary items and reductions in habitual activity. Our analyses of over 2,000 children and young adults first measured in 1966-1972, with follow-up surveys in 1968-1970 and 1985-1986, show changes in overweight/obesity in these communities have their onset around puberty, and are not related to differences in childhood growth stunting. The prevalence of overweight and obesity increased substantially during the period of this study among young adults, particularly women, and in groups with more Polynesian affinities, where the frequency of overweight (BMI ≥ 25) tripled over this 20-year interval. However, the BMI of the more Papuan groups on Bougainville remained remarkably stable, even though they were close to the epicenter of modernization during this period, the Bougainville Copper Mine.

66 **Wiessner P, Pupu N.**

Toward peace: foreign arms and indigenous institutions in a Papua New Guinea society. *Science* 2012 Sep 28;337(6102):1651-1654.

In 1990, shotguns and M-16s were adopted into Enga warfare, setting off some 15 years of devastation as youths (~17 to 28) took charge of interclan warfare. In response, people called on elder leaders to adapt customary institutions to restore peace; subsequently, war deaths and the frequency of war declined radically. Data from precolonial warfare, 501 recent wars, and 129 customary court sessions allow us to consider (i) the principles and values behind customary institutions for peace, (ii) their effectiveness, (iii) how they interact with and compare to state institutions of today, and (iv) how such institutions might have shaped our human behavioral repertoire to make life

in state societies possible.

67 **Williams C, Brian G.**

Using health rights to improve programme design: a Papua New Guinea case study.

Int J Health Plann Manage 2012 Jul-Sep;27(3):246-256. Epub 2012 Mar 1.

The non-state sector is becoming increasingly influential in funding and implementing global health programmes. However, their disease-specific focus and vertical interventions have led to criticism that these programmes can be unsustainable and unable to achieve long-term goals. This paper demonstrates that health rights can inform programme design to guide the design of appropriate and sustainable aid-funded health programmes. It draws on UN General Comment 14, which clarified the right to health duties of states and their international partners, and which determined that 'core obligations' in health must become progressively available, accessible, acceptable and of good quality. A rights-based tool assessed the design of activities proposed for Papua New Guinea by a consortium of Australian non-government organisations. The tool revealed that none of the 36 indicators was addressed in full. Five of the 12 indicators pertaining to availability were addressed partially, as were three of 10 relating to accessibility and one of six concerning human rights concepts. As shown by the case study, failure to address the indicators in this tool will result in simplistic programme designs that can win political or financial support, but will fail to respect health rights or deliver a quality health service, available, accessible and acceptable to all.

Papua New Guinea Institute of Medical Research Monograph Series

ISSN 0256 2901

1. Growth and Development in New Guinea. A Study of the Bundi People of the Madang District.
L.A. Malcolm. ISBN 9980 71 000 4, 1970, 105p.
2. Endemic Cretinism.
B.S. Hetzel and P.O.D. Pharoah, Editors. ISBN 9980 71 001 2, 1971, 133p.
3. Essays on Kuru.
R.W. Hornabrook, Editor. ISBN 9980 71 002 0 (also 0 900848 95 2), 1976, 150p.
4. The People of Murapin.
P.F. Sinnett. ISBN 9980 71 003 9 (also 0 900848 87 1), 1977, 208p.
5. A Bibliography of Medicine and Human Biology of Papua New Guinea.
R.W. Hornabrook and G.H.F. Skeldon, Editors. ISBN 9980 71 004 7, 1977, 335p. (with 1976 Supplement, 36p.)
6. Pigbel. Necrotising Enteritis in Papua New Guinea.
M.W. Davis, Editor. ISBN 9980 71 005 5, 1984, 118p.
7. Cigarette Smoking in Papua New Guinea.
D.E. Smith and M.P. Alpers, Editors. ISBN 9980 71 006 3, 1984, 83p.
8. Village Water Supplies in Papua New Guinea.
D.E. Smith and M.P. Alpers, Editors. ISBN 9980 71 007 1, 1985, 94p.
9. The Health of Women in Papua New Guinea.
Joy E. Gillett. ISBN 9980 71 008 X, 1990, 180p.
10. National Study of Sexual and Reproductive Knowledge and Behaviour in Papua New Guinea.
The National Sex and Reproduction Research Team and Carol Jenkins. ISBN 9980 71 009 8, 1994, 147p.
11. Childhood in Papua New Guinea.
H. Sheils Fenbury, Editor. ISBN 9980 71 012 8, 2009, 149p.

Monographs 1-5 are case-bound, 6-11 are paperbacks.

Monographs may be obtained from
The Librarian,
Papua New Guinea Institute of Medical
Research
PO Box 60, Goroka, EHP 441,
Papua New Guinea

Cost of each Monograph is K20 plus postage.

Applications for free copies of any monograph should be sent to the Director at the above address.

	Postage and Handling (PNG Kina)			
	AIRMAIL			
	Within PNG	Zone 1	Zone 3/4	Zone 6
1,2,10,11	10.00	20.00	60.00	75.00
3,4,5	20.00	40.00	90.00	105.00
6,7,8,9	5.00	10.50	17.50	17.50

K=PGK=Kina. Please make payment in Kina. If payment is made in any other currency, please add sufficient funds to cover all bank charges.

THE MEDICAL SOCIETY OF PAPUA NEW GUINEA

Society Membership and Journal Subscription

Membership of the Medical Society of Papua New Guinea is open to all health workers whether resident in Papua New Guinea or overseas. Members of the Society receive four issues of the Papua New Guinea Medical Journal each year. The Society organizes an annual symposium and other activities.

Membership dues are:-

Papua New Guinea residents:

Members – K150

Associate (Student) Members – K20

Overseas residents: K200; AU\$120; US\$120

I wish to join the Medical Society of Papua New Guinea as a

Full Member ☐

Please indicate your category

Medical Officer	[]
Scientific Officer	[]
Pharmacist	[]
Health Extension Officer	[]
Nursing Officer	[]
Laboratory Technologist	[]
Radiographer	[]
Social Health Worker	[]
Other (Please specify)	[]

OR a Student Member ☐
(for full-time students)

Medical Student	[]
Other Student (Please specify)	[]

I enclose my membership fee of

K.....for the year(s).....

Name:

Title:

Address:

.....

.....

Telephone:

Fax:

Email:

(Forward to the Membership Secretary,
Medical Society of Papua New Guinea,
PO Box 60, Goroka, EHP 441, Papua
New Guinea)

INFORMATION FOR AUTHORS

The Papua New Guinea Medical Journal invites submission of original papers and reviews on all aspects of medicine. Priority will be given to articles and subjects relevant to the practice of medicine in Papua New Guinea and other countries in the South Pacific.

Manuscripts are accepted for publication only with the understanding that they have not been published nor submitted for publication elsewhere. All manuscripts will be sent out for referees' comments as part of the peer review process.

Original Articles: Reports of original and new investigations or contributions.

Brief Communications and Case Reports: Contents similar to that of original articles but text should be no more than a total of 4 Journal pages including all figures and tables.

Reviews: Critical analysis of previously collected and published information.

Letters: Short reports of clinical experience or topics of interest. Text should not exceed 2 pages of the Journal.

Other types of manuscript may also be accepted for publication at the Editor's discretion.

Submitted manuscripts should conform to the instructions set out below. Manuscripts not conforming to these instructions will be returned.

MANUSCRIPTS

Submit the original with a virus-free electronic copy on disk as a word document or send by email to the Editorial Office. All sections including text, references, tables and legends should be in double spacing. Manuscripts should not be right justified. Each paper should include an informative Summary, Introduction, Patients/Materials and Methods, Results, Discussion and References. The title page should include the title, full names of all authors, names and addresses of institutions where the work has been done and full present address of the first or corresponding author.

References should be in the Vancouver style and include all authors. All references should be checked against the original source. Sample references are shown below.

- 3 **Garner PA, Hill G.** Brainwashing in tuberculosis management. *PNG Med J* 1985;28:291-293.
- 4 **Cochrane RG.** A critical appraisal of the present position of leprosy. In: Lincicome DP, ed. *International Review of Tropical Medicine*. New York: Academic Press, 1961:1-42.

ILLUSTRATIONS

Tables and figures should be prepared on separate pages. Figures should be sent as separate jpeg or tiff images. Do not paste the images into Word. Photographs should be glossy prints, either 7 cm or 14.5 cm in width. Photomicrographs should have internal scale markers. Each table should have a heading and footnotes which make it understandable without reference to the text. Each figure should have a legend; figure legends should be typed together on a separate sheet.

Abbreviations: Standard abbreviations and units should be used.

Drug Names: Generic names of drugs should be used.

Orthography: The Shorter Oxford English Dictionary is followed.

EDITORIAL MAIL

Manuscripts and other editorial communications should be forwarded to:

The Editor,
Papua New Guinea Medical Journal,
PO Box 60, Goroka, EHP 441,
Papua New Guinea
Email: pngmedj@pngimr.org.pg

SUBSCRIPTIONS AND ADVERTISEMENTS

Communications relating to advertisements or subscriptions should be addressed to the Journal as above. Matters related to the Society should be addressed to the Medical Society of Papua New Guinea, PO Box 6665, Boroko, NCD 111, Papua New Guinea.

Subscriptions: Members of the Medical Society of Papua New Guinea receive the Journal as part of their annual subscription. Others may subscribe and should contact the subscription secretary for a price.

CONTENTS

EDITORIAL

- Health services for all in 2050 – getting the balance right *J.D. Vince* 1

ORIGINAL ARTICLES

- Perceptions and use of maternal health services by women in rural coastal Madang Province *S. King, M. Passey and R. Dickson* 5
- A comparative study of intestinal helminths in pre-school-age urban and rural children in Morobe Province, Papua New Guinea *J.M. Shield and F. Kow* 14

Women in Health and Medicine in Papua New Guinea**EDITORIAL**

- Papua New Guinean women in health and medicine: celebrating women's achievements *A. Laumaea and C. Spark* 32

ORIGINAL ARTICLES

- Run to Win – the dedication, commitment and service of Judy Yaiyon *P. Aupae, R. Aupae and S. Aupae* 34
- The story of Francisca Trimas *T. Meki* 38
- Mother's love for bacterial babies: the commitment of Audrey Michael, Miton Yoannes and Tilda Orami to medical research *T. Gibbs and G. Vilakiva* 43
- Papua New Guinea's next generation of medical researchers: Celestine Aho, Patricia Rarau and Pamela Toliman *G. Vilakiva and T. Gibbs* 50
- Julie Kamblijambi-Kep – PhD candidate at RMIT University, Australia *M. Masta* 55
- The founder of the Friends Association – Tessie Soi *O. Topurua* 59
- Susan Setae and the Papua Hahine Social Action Forum *A. Laumaea* 64
- Turning negatives into positives: the life and work of Naomi Yupae *C. Spark* 67
- Humble beginnings: from Lalaura to the board rooms of Papua New Guinea – the story of Dr Evelyn Lavu *C. Spark* 74

MEDLARS BIBLIOGRAPHY

79