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LETTER

MESSAGE FROM THE MINISTER OF HEALTH AND THE MINISTER OF OUM

Leituala Dr Ben Matalavea
Editor-in-Chief
Samoa Medical Journal

Dear Dr Matalavea:

Please accept my congratulations on the launch of the Samoa Medical Journal (SMJ) during the opening ceremony of the Medical Conference entitled "Heart Disease in Samoa." This is a proud day for Samoa to mark the production of such an important journal which has come about through a close collaboration between Oceania University of Medicine, the Ministry of Health, Samoa Medical Association, National Health Services and doctors at the TTM Hospital.

I have always believed that a Medical School can and should be a catalyst for positive change by not only training quality doctors but by ensuring that their knowledge is kept updated and our Samoan citizens can receive quality health care that reflects worlds best practice. I also believe that this long overdue journal will promote a strong culture of clinical research and critical analysis of patient management among the medical profession in Samoa. This journal will provide a creative outlet for our local medical and allied health community to publish their findings and to express and exchange ideas to encourage lifelong learning and critical thinking habits. I hope that this journal will encourage collaborative research projects with international doctors and scientists because such collaboration is vital if this journal is to set high international standards.

I wish you, your Editorial Board, and members of the medical and allied health community in Samoa continued success in this very important initiative for our country. It pleases me greatly to see that Oceania University of Medicine is being embraced by the medical and wider community and I am confident that through your continued collaborative efforts great things will be achieved and translated into improved health care for our citizens. This is a milestone that will be celebrated by all Samoans.

With Best Wishes,

Minister of Health & Minister of OUM
Gatoloaifaana Amataga Alesana-Gidlow

LETTER

MESSAGE FROM THE PRESIDENT OF THE SAMOA MEDICAL ASSOCIATION

Dear Editor:

The publishing and launching of the inaugural Samoa Medical Journal (SMJ) is a remarkable achievement reflecting a significant progress in medical education for the medical and allied health professions in Samoa.

The Samoa Medical Association (SMA) wishes to acknowledge the pivotal role of the Oceania University of Medicine (OUM) in facilitating and coordinating the many issues involved with creation of the journal and providing the necessary and crucial technical expertise.

Since its foundation in 1948, the SMA has strived to fulfil the need to provide its members with continuing medical education opportunities. These opportunities are very limited given the scarce resources available in small island countries like Samoa, however the SMA conducts annual scientific conferences as part of their annual general meetings and weekly CME meetings to try and meet some of this need. The journal is therefore a landmark development that will make significant contributions towards continuing medical education for the medical profession in Samoa.

The publishing of the Samoa Medical Journal challenges the SMA to engage its members in conducting and publishing medical and health research papers relevant to Samoa. It is also hoped that medical and other health professionals in the region, and beyond, will also contribute to our journal. The creation of an online version of this journal will expedite the publication of medical data and news from Samoa and make the articles available world-wide at the click of the mouse.

Until now most of the research that addressed the health and disease of Samoan people was conducted by well resourced overseas researchers. Now an opportunity exists for us to drive such collaborative projects and publish the results in collaboration with the faculty and expertise offered by OUM.

The SMJ also offers a good forum for the health workers of the pacific region, and beyond, to discuss challenging health issues facing our region. This allows exchange of knowledge, skills and experiences that lead to improvement in the quality in health services in an ongoing manner.

For this historical achievement it is proper that we reflect and pay tribute to honour the work and great contribution by all the founding, late and senior members of the SMA, whom when celebrating the SMA s' 50th anniversary in 1997, dreamt of establishing a Samoa Medical Journal to publish some of the great work they have done in the past. Our pioneers and most of these distinguished doctors have passed away and they would have been very proud to have seen that their dream has finally been realised.

The SMA therefore wishes to congratulate OUM for helping us realise this goal. The SMA also pledges its full support to this collaborative effort to ensure the journals' continuous success.

Uitualagi Dr Tia Vaai
President 2009-2010
Samoa Medical Association

MESSAGE FROM THE EDITOR

It is my pleasure to write the inaugural Editorial column. The idea of a Samoa Medical Journal (SMJ) has been germinating for over 10 years and finally the idea has come to fruition. The Samoa Medical Association (SMA) is grateful to the Oceania University of Medicine (OUM) for making this Journal a reality. The Editorial Board is represented by members of OUM and the SMA with support and contributions from the Ministry of Health, National Health Services TTM Hospital and last but not least the Samoa GP Association. This shows major projects can be realized when different sectors work collaboratively. In time, the SMJ will become a recognized forum for learning and exchange of ideas by and for medical professionals in Samoa and the Oceania region.

An important decision made by the Editorial Board prior to launch was that the journal must be for the many and not just for a few who are engaged in clinical research. All of us, whether we are doctors, nurses, physiotherapists, dentists or in any other field of health care, must take a greater responsibility for managing and solving the many unique health issues and problems that we face in our region. We must engage in research and voice our opinions by publishing them in this, our local journal. To ensure wide readership, the journal will carry a variety of articles of general interest, as well as scientific articles, based on topics relevant to our region. Articles in the following categories are welcome: Editorials, Letter to Editor, Major and Minor Reviews, Original Research, Notable Clinical Cases, Lessons from Practice, Diagnostic Dilemma, Viewpoint, Opinion, Hypothesis, Medico-Legal issues, Topic for Debate, Clinical Ethics, Conference Report, Medical History in Samoa, From Bench to Bedside, Personal Perspective, Snapshot, Letter, Obituary, Book Review, New Drugs & Old Drugs, Clinical Update and the HINARI column (latest research news). With so many categories, I am sure that all of you will be able to make regular contributions to this journal.

The SMJ will be officially launched on the 2nd of October, 2009 to coincide with the 1st OUM Medical Conference entitled "Heart Disease in Samoa." The journal and the medical conference are two major new initiatives driven by OUM and its partner Samoa Medical Association that should nurture a culture of clinical research and critical analysis of health care and patient management. The journal will encourage the publication of educational material that promotes an in-depth understanding and prevention of the emerging 'epidemic' of non-communicable diseases such as diabetes and cardiovascular disorders in Samoa. I encourage the new generation of medical doctors and allied health professionals to create and publish new research data in this journal and adopt critical thinking habits to address our health problems. This journal should also encourage international research collaborations that result in joint publications of high international standards. Finally I want to thank my Editorial Board for their tireless contributions and efforts to make SMJ a reality. Thanks also to our reviewers, both local and international, who provided invaluable peer review to ensure sub-standard articles were revised appropriately or in some cases rejected. This is a major milestone for the medical fraternity in Samoa and I encourage all my colleagues in the health care sector, both public and private, to embrace and support this journal. The continuing success of this journal should give us a sense of pride and achievement. Please contribute articles to this journal in a timely manner to ensure it becomes an important forum for the exchange of medical ideas and knowledge which will ultimately translate to better health care and management of all Samoans.

Faafetai lava
Leituala Dr Ben Matalavea
Editor-in-Chief
Samoa Medical Journal

REVIEW

THE ROLE OF MATERNAL DIET IN PROGRAMMING OBESITY, HYPERTENSION AND METABOLIC DISEASE AND ITS RELEVANCE TO THE WESTERN PACIFIC POPULATION

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Abstract

The increasing prevalence of non-communicable diseases reflects an escalating cost and burden to society. Metabolic diseases such as hypertension, diabetes, insulin resistance, renal diseases and cardiovascular disease are a few of the interrelated diseases that are traditionally attributed to lifestyle factors such as obesity. However these diseases may also be programmed *in-utero*, as a result of exposure to a sub-optimal *in-utero* environment. Maternal factors such as dietary intake, central adiposity and general heath during gestation may significantly contribute to the programming of an offspring disease phenotype. Ethnicity is an identified independent risk factor as indigenous societies appear to have a greater risk of expressing cardiovascular and metabolic disease phenotypes compared with their Western counterparts. This together with the shift towards Western diets and an increasingly sedentary lifestyle caused by changing work habits increases the propensity for diabetes and hypertension in indigenous populations.

This review discusses the developmental origins of obesity and related diseases and the impact of obesity and related cardiovascular and metabolic disease. We discuss these implications in reference to the global community as well as the Western Pacific.

Introduction

Previously associated with Western populations, obesity is now widespread and is prevalent in regions such China, India, South America and the South Pacific. Globally, approximately 1.6 billion adults are obese creating a crucial public health issue throughout the world[1]. In developing nations worldwide, societies are undergoing rapid transition from agrarian to urban lifestyles and the variety and availability of food is rapidly changing. This situation is relevant to many nations throughout the Western Pacific and may also contribute to the obesity epidemic that is seen in this geographic region.

Type 2 diabetes mellitus (T2DM) and obesity-related hypertension are also at epidemic levels in developing nations, especially among indigenous and ethnic groups. Although there are adult risk factors for the development of obesity and related disease, emerging evidence suggests that the environment encountered during foetal development can also play a major role in the determination of these diseases. This review discusses the developmental origins of health and disease with regard to the development of obesity and associated metabolic and cardiovascular disease. Wherever possible we present these data in context of the Western Pacific Region.

Obesity

Body mass index (BMI) is used to identify obesity in individuals. Adults with a BMI (kg/m^2) between 25 – 29.9kg/m^2 are classed as overweight, whereas obesity is defined as having a BMI $\geq$ 30kg/m^2 [2]. This index has, no doubt, gained popularity because of its ease of measurement. However, BMI is not the best estimate of obesity; waist measurements (a measure of abdominal obesity) may be more representative of an unhealthy accumulation of body fat, as opposed to BMI which is an index of overall body heaviness[3]. Moreover when assessing metabolic disease, BMI measures require ethnic-specific cut-off points. BMI markers are based on European populations and may underestimate the true prevalence of diabetes among those who may be considered as non-obese according to western standards[4]. Across the Western Pacific, ethnic groups demonstrate varied body composition in terms of muscle mass and height.

Estimating the Prevalence of Obesity

Obesity is of particular importance for Australasia and the Western Pacific region. Table 1 shows recent obesity estimates for a selection of countries in the WHO Western Pacific region. Australia and New Zealand show high incidences of obesity but disparity between obesity rates exists in individuals of Caucasian, Maori and Island descent, suggesting that genetic determinants of body size and obesity interact with the environment. Indeed, Island states throughout the Pacific have obesity prevalences that are amongst the highest in the world. The discrepancy between obesity prevalence in urban and rural populations highlights the fact that the environment is an important modulator of bodyweight and similar ethnic groups in differing environments have different disease profiles.

Childhood obesity is associated with dyslipidaemia, hyperinsulinaemia, endothelial dysfunction and hypertension[5]. Although the long term consequences of the rise in childhood obesity are still unknown, 22 million chil-

dren under the age of 5 are overweight[6] and early onset of T2DM and cardiovascular disease may shift in the prevalence of metabolic diseases to a younger generation.

Obesity and Type 2 Diabetes Mellitus

Longstanding obesity is one of the greatest risk factors for the development of T2DM and globally it is estimated that the prevalence of diabetes will increase from 171 million individuals in the year 2000 to 366 million in 2030, even if obesity rates remain constant[7]. Indigenous peoples and ethnic minorities within developed nations, show an increased susceptibility to T2DM when compared with their Caucasian and Europid counterparts [4, 8, 9, 10, 11, 12]. The Pacific Islanders are one such group of people who show an increased incidence and prevalence of T2DM (see Table 2)[7].

Secondary Consequences of Obesity and Diabetes Mellitus

The International Diabetes Federation reports that diabetes is the fasting growing contributing factor of kidney failure and the leading cause of end stage renal disease (ESRD) where approximately 30 percent of diabetics develop kidney disease. This trend is especially on the rise among the Aboriginal population in the Northern Territory of Australia; this population is five times more likely to develop renal impairment and complications compared with their non -Aboriginal counterparts[14] that may be associated with low birth weight[15] and low nephron number[16] characteristic to the population.

Obesity and Hypertension

Blood pressure positively correlates with body weight; the Gaussian distribution that exists between body mass and arterial blood pressure is shifted to the right in obesity[17]. Established obesity is associated with a range of interrelated factors such as altered renal structure and function, vascular endothelial dysfunction, cardiac remodelling and systemic inflammation, all of which can contribute to the origins of obesity-related hypertension[18].

Table 1: Recent national adult obesity prevalence rates in from selected countries of the Western Pacific

Country [subset]	Survey year	Percentage BMI >= 30 kg/m²		
		Male	Female	Both
Australia	2007-2008	25.6	24	
Cook Islands [Urban]	1996-1996	52	57	
Cook Islands [Urban]	1993-1993.	39.6	38.8	38.8
Fiji [Indigenous]	2004-2004	21.2	41.7	
Fiji [India]	2004-2005	6.5	19.3	
Fijian [Other]	2004-2006	24.5	50	
Kiribati	2004-2006	41.7	58.9	50.6
Micronesia	2002-2002	30	55.8	42.6
Nauru	2004-2004	55.7	60.5	58.1
NZ [Caucasian]	2006-2007			24.3
NZ [Asia]	2006-2007			11
NZ [Maori]	2006-2007			41.7
NZ [Pacific Islands]	2006-2007			63.7
New Zealand [Europeans/ Other]	2002-2004	19.4	21	
New Zealand [Asia]	2002-2004	4.5	5.7	
New Zealand [Maori]	2002-2004	38.6	36.6	
New Zealand [Pacific Islands]	2002-2004	50.7	56.1	
Samoa	1995-1995	32.9	60.2	
Tokelau	2007-2007	58.6	67.8	63.4
Vanuatu [Urban]	1998-1998	17.6	28.5	22.98
Vanuatu [Rural]	1998-1998	2.6	4.7	3.69

Abbreviations: BMI, Body Mass Index; NZ, New Zealand; Micronesia, Federated States of Mi-

Table 2: Prevalence of T2DM in selected countries in the Western Pacific region in 2007 and projected incidence for 2025

a. Population number as described in the CIA World Factbook 2000, growth and age distribution adjustment to that of world population growth from 2005 to 2025. b. New Zealand data only self reported; total diabetes calculated as twice that reported.

Selected countries of the Western Pacific Region	Population (Ages 20-79) 2007	Population (Ages 20-79) 2025	DM prevalence (%)			
Country/Territory	(000's)	(000's)	National (2007)	National (2025)	Global comparative (2007)	Global Comparative* (2025)
Australia	14,504	**17,547**	6.4	**7.7**	5.0	**6.0**
Cook Islands[a]	13	**17**	5.5	**6.3**	5.5	**6.4**
Fiji	510	**626**	8.5	**10.2**	9.2	**10.5**
French Polynesia	165	**220**	13.1	**16.0**	13.5	**15.6**
Kiribati[a]	67	**106**	6.4	**7.0**	6.4	**6.9**
Marshall Islands	38	**61**	8.8	**10.3**	8.8	**10.1**
Micronesia[a]	55	**64**	5.2	**8.2**	5.9	**7.3**
Nauru[a]	8	**12**	30.7	**33.0**	30.7	**32.3**
New Zealand[b]	2,790	**3,244**	7.7	**8.8**	6.4	**7.3**
Palau[a]	13	**18**	8.9	**10.3**	8.9	**10.1**
Papua New Guinea	3,043	**4,901**	1.9	**2.8**	2.9	**4.1**
Philippines	47,038	**70,161**	6.5	**7.9**	7.6	**9.3**
Samoa	90	**114**	6.5	**8.1**	7.5	**9.1**
Solomon Islands	246	**415**	2.0	**3.0**	3.0	**4.4**
Tokelau[a]	1	**1**	8.5	**9.4**	8.5	**9.3**
Tonga[a]	55	**63**	11.9	**14.4**	12.9	**15.2**
Tuvalua[a]	7	**10**	13.4	**15.8**	13.4	**15.7**
Vanuatu	109	**172**	2.2	**3.2**	3.0	**4.3**

Esler and colleagues[19] show that skeletal muscle and renal sympathetic drive are increased in humans with obesity related hypertension although cardiac sympathetic drive is not augmented. Michaels and colleagues[20] show that long-term fat feeding in rabbits is associated with an increase in renal responsiveness to electrical stimulation, resulting in an increase in sodium retention. The mechanisms by which the sympathetic nervous system becomes activated in obesity related hypertension are unclear, however hypertension rates will follow obesity rates and further studies are required.

The Impact of Obesity on Indigenous Populations Ethnicity, Obesity and Diabetes: The Thrifty Genotype Hypothesis

It is suggested that Pacific Islanders, Indians and other South East Asian populations are genetically more prone to obesity and diabetes when compared with Caucasians [10, 12, 21, 22, 23]. Neel [24] first proposed the "thrifty genotype" hypothesis, suggesting that polymorphisms that conferred survival advantages during times of fluctuating feast and famine are selected by positive evolutionary pressure. This promotes survival in periods of famine but in the face of continuing abundant food, such genes would promote obesity. This evolutionary perspective is consistent with what is known about Polynesian voyagers who settled the island nations[25] and perhaps explains the higher prevalence of obesity, hypertension and diabetes in these societies.

Risk Factors for Indigenous Groups

Lifestyle factors that mediate T2DM include increas-

ing obesity[26, 27], modernisation, a change to Western diets, environmental risk factors and a sedentary lifestyle. An example of this shift in risk factors is the Island state of Nauru. In 2007, 30.7 percent of the Nauruan population between the ages of 20 – 79 years were diabetic[13]. Obesity rates in this population are also extremely high (see Table 1). Equally, Samoans were found to be increasingly obese or at risk of becoming diabetic following migration from rural to urban areas and also abroad to developed countries[25, 28, 29]. Reports based on dietary intake among Samoans[28], Fijians[30, 31], Maori and Pacific Islanders residing in Auckland, New Zealand[32] and an extensive study of the dietary patterns of Pacific Islanders[33] show that a significant difference between these ethnic groups and the European population is the relative serving size and frequency of consuming high energy, high fat and high sodium food. Figure 1 shows the macronutrient intake of several Western Pacific states. The overall dietary profile does not directly correlate with obesity rates suggesting the involvement of other factors.

Developmental Programming of Adult Disease

Lifestyle and dietary factors contribute to obesity and related metabolic and cardiovascular disease in Pacific Islanders, however a body of evidence suggests that these diseases may originate in early life [34,35] . Converging lines of evidence suggest that an adverse *in-utero* environment can predispose or "programme"[36] individuals to express these diseases later as adults. In agreement with these hypotheses, the increasing incidence of obese and diabetic cases among ethnic groups over the past two or three decades may involve an interaction between a longstanding thrifty phenotype and genotype and an *in-utero* component that when coupled with a change in maternal diet and an increase in maternal obesity, exacerbates the development of offspring obesity and T2DM[37]. Maternal dietary manipulation or placental insufficiency may be the principle factors involved in the onset of adult diseases such as obesity, hypertension, T2DM and metabolic syndrome[38].

Human Studies

Initial studies, such as that by Barker[34] correlated birth weight and the subsequent risk of cardiovascular disease, diabetes and hypertension with an inverse association being observed between birth weight and the incidence of disease. The Dutch Hunger Winter during the Second World War, although a tragic event in human history, provides an opportunity to analyse the effects of calorie restriction in the human. The Hunger Winter occurred over winter/spring of 1944-45 due to a blockade of Holland by occupying forces. The official ration was reduced to between 400-800 calories a day. Following liberation, by the summer of 1945 rations returned to 2000 calories a day[39]. Individuals exposed to famine early in gestation were, at age 60 years, more likely to be overweight than those not exposed to the famine[39]. Those exposed in early gestation show dyslipidaemia in adulthood[40]. Those affected by the Dutch Hunger Fam ine show epigenetic modifications (alterations in gene methylation) that may underlie the programmed phenotype[41].

In order to identify the mechanisms that drive the developmental programming of adult disease, a range of experimental animal models have been used. The maternal diet has frequently been manipulated, including protein and calorie and micronutrient restriction[42, 43, 43]. Offspring born to these protocols often have low birth weight and those that develop metabolic and cardiovascular disease in later life exhibit characteristic catch-up growth that clearly exacerbates the adverse consequences of developmental programming[38, 45].

Maternal nutritional restriction is still a serious health issue in areas of the world. However, perhaps more pertinent to Western societies and many states in the Western Pacific is the issue of maternal obesity and the consumption of fat-rich diets.

Maternal Obesity

Data from the United States estimates that nearly 23 percent of pregnant women are overweight, and 19 percent are obese[46]. There are no data for obesity in pregnancy across the Pacific states, however it is likely high given the overall rates of obesity in women of childbearing ages. Figure 2 shows the rates of obesity for men and women across states in the Pacific. Interestingly, for many of the island nations, female obesity prevalence is greater than that for males.

Gestational Diabetes Mellitus

Obesity in pregnancy is associated with an increased risk of maternal and foetal complications, including preeclampsia and gestational diabetes[47, 49.] Congenital abnormalities are also associated with maternal obesity[47]. Mothers who develop gestational diabetes mellitus (GDM) during pregnancy exhibit symptoms similar to T2DM such as insulin resistance and glucose intolerance, and foetal glucose exposure is increased[47, 48]. Offspring tend to be born fatter[49] even when they are average weight for gestational age.

The onset of T2DM in women during pregnancy may also have an intergenerational effect, as *in-utero* exposure to diabetes has previously been shown to programme obesity and T2DM in offspring[50]. Exposure to hyperglycaemia *in-utero* impairs nephrogenesis resulting in a reduced nephron endowment in the foetus[51] that has been associated with increased risk of developing essential hypertension and chronic renal failure[52].

Many developed nations, including Australia, USA and Europe derive more than 900 calories per day from fats and sugar[53]. The caloric intake and macro/micronutrient composition of diets for areas of the Western Pacific have been collated and are shown in Figure 1. Interestingly, the variability in macronutrient intake does not correlate directly with obesity in these nations- for example Fiji has a relatively low obesity rate compared to other Pacific States, however fat intake is still high.

Further studies in this regard would be interesting and maybe important in defining whether island populations are at increased risk of programmed disease as a result of maternal obesity, diabetes, or dietary fat intake.

Experimental Animal Models of Maternal Obesity

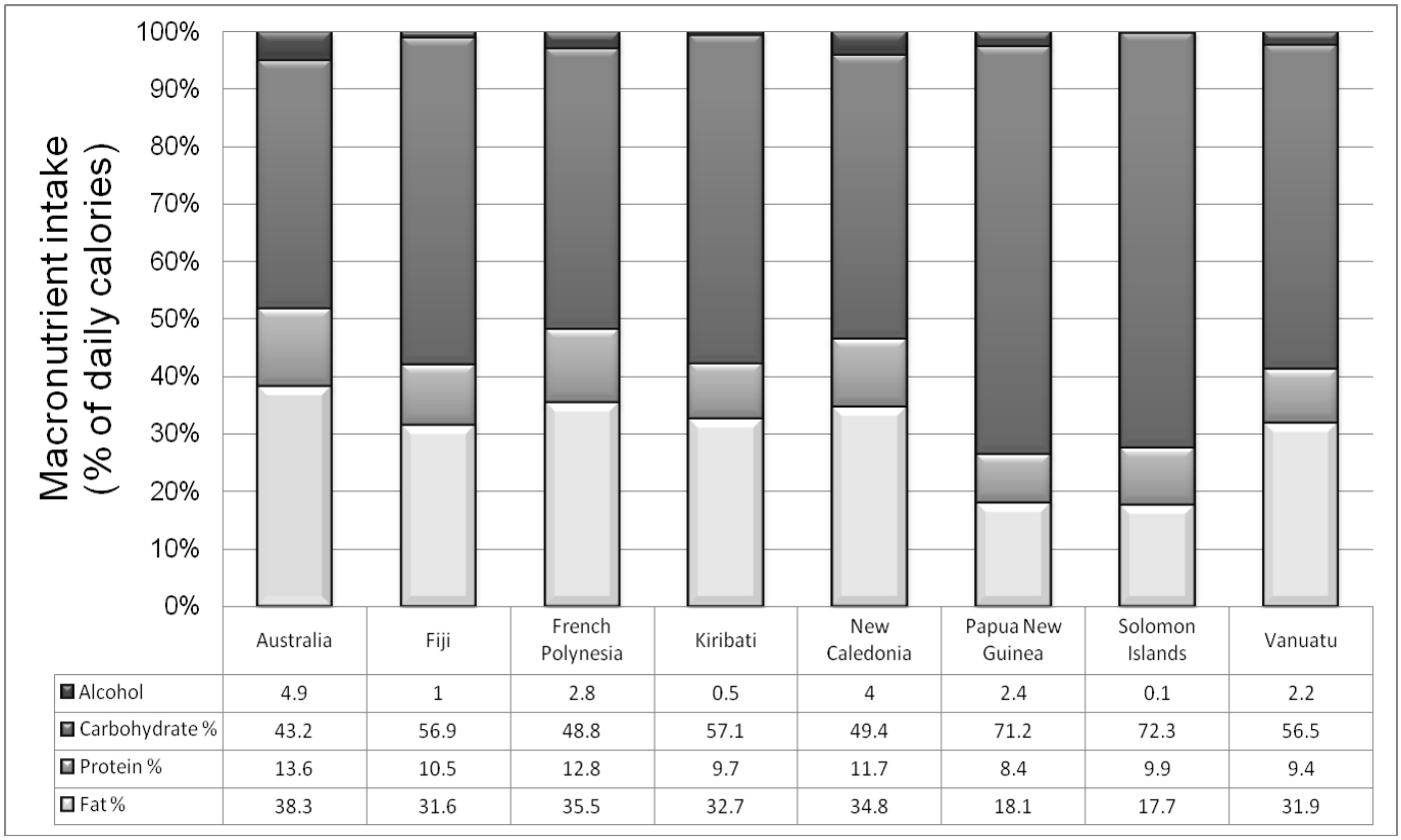
Animal models provide valuable insights into the effects of maternal high fat diets on offspring development. Early studies demonstrated that offspring of fat fed rats had altered vascular function, hypertension, endothelial dysfunction, dyslipidaemia, obesity and hyperleptinaemia[54, 55], insulin resistance, and mitochondrial dysfunction[56] - a constellation of signs that are consistent with the metabolic syndrome in humans[38]. More recent studies[56] have demonstrated that alterations in aortic structure in offspring of fat fed rats, adult rats exposed to high fat *in-utero,* and during lactation, had low renin hypertension and a reduction in activity and gene expression of the renal Na^+K^+ -ATPase[57, 58].

Mechanisms Underlying Metabolic Programming

Alterations within adult physiology and gene expression are commonly seen in human and animal models of developmental programming. The manner by which the *in-utero* environment can change foetal development is still unknown, however there are clearly two requisites; the foetus must detect a change in environment and alter gene expression to cope with this altered environment. Cytokines, glucocorticoids, insulin or glucose are thought to act as cues that instigate altered foetal development[59]. Epigenetic modifications such as gene methylation and histone acetylation are, most likely, the mechanism for altering foetal gene expression offspring[60].

Conclusion

Metabolic diseases are due in part to lifestyle factors, a genetic disposition, and a programming effect during development. Among Pacific Islanders, obesity is one of the commonly identified risk factors that drives these disease states. Although the risk factors for Western populations are well defined, ethnic specific cut off points for obesity, especially central adiposity, may need revision for this population. Furthermore, there is a need for up to date statistics on obesity, diabetes, hypertension and dietary patterns across the region to better inform as to the most pertinent risk factors. What is becoming more apparent is the important role the maternal condition before and during gestation



	Australia	Fiji	French Polynesia	Kiribati	New Caledonia	Papua New Guinea	Solomon Islands	Vanuatu
Alcohol	4.9	1	2.8	0.5	4	2.4	0.1	2.2
Carbohydrate %	43.2	56.9	48.8	57.1	49.4	71.2	72.3	56.5
Protein %	13.6	10.5	12.8	9.7	11.7	8.4	9.9	9.4
Fat %	38.3	31.6	35.5	32.7	34.8	18.1	17.7	31.9

Fig. 1 Macronutrient Intake

The contribution of macronutrient intake to daily caloric load in populations across the Western Pacific. The relative fat, protein and carbohydrate intakes vary between countries, however imbalances in macronutrient intake is not consistently associated with increases in the prevalence of obesity and diabetes in many countries, suggesting that factors other than dietary imbalance are driving the disease process. Data from Hughes 2003[32]. Unfilled bars indicate % fat intake, light grey fill indicates % protein intake, dark grey represents % carbohydrate intake and black filled bars % alcohol intake.

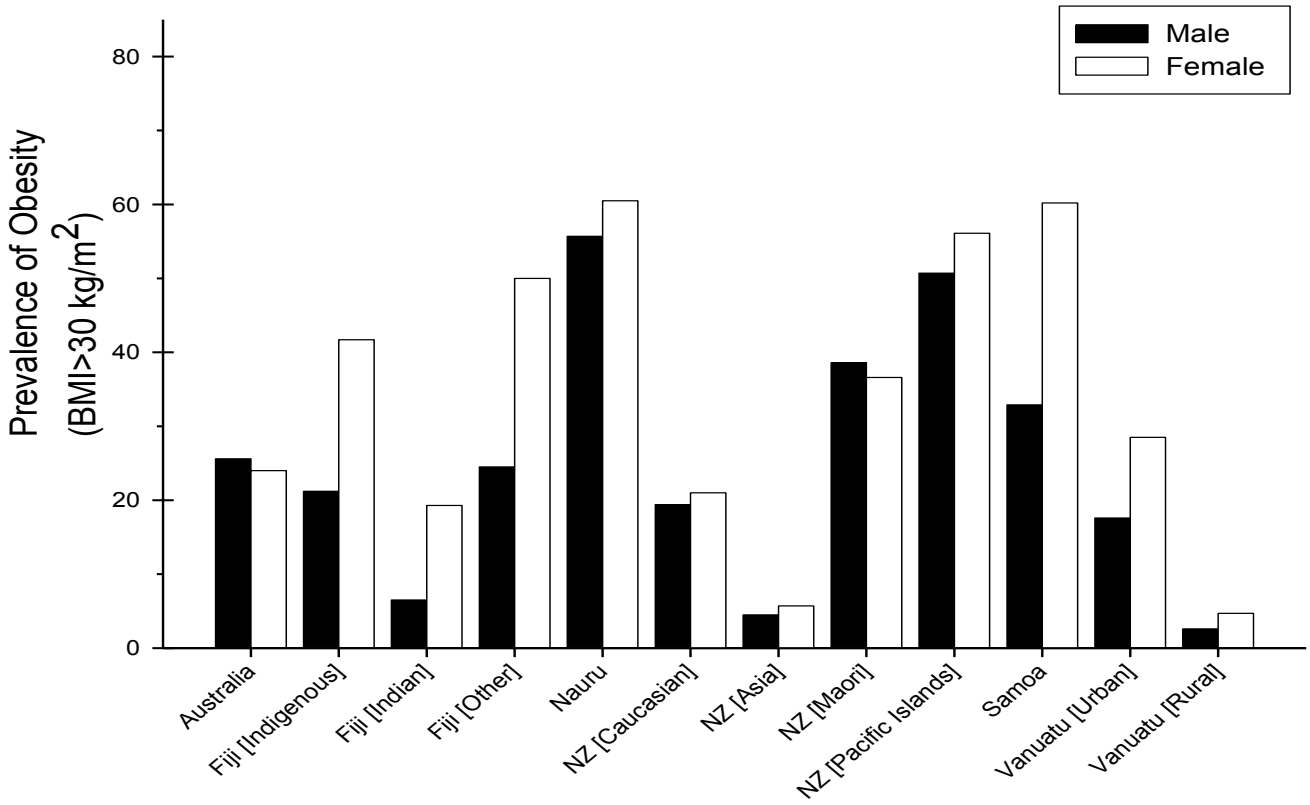


Fig. 2. Prevalence of obesity in adult men and women in areas of the Western Pacific. Adult obesity varies throughout the region and within individual states. Obesity varies significantly with gender and ethnicity. Differences between rural and urban dwellers in the same country are striking as are the differences between rates of obesity for a particular ethnic group that now resides in another country (e.g. New Zealand data). Data are from the WHO Database on Body Mass Index (2006). Male data are show as black filled bars and female data as unfilled bars. Ethnicity and place of abode are shown in parentheses. NZ=New Zealand.

plays in predisposing their offspring to these phenotypes. Maternal health and well-being including obesity, gestational diabetes, nutritional or dietary intake are just a few of the important parameters which may need to be monitored during pregnancy especially in ethnic communities throughout the Pacific Islands who have a higher predisposition or risk of expressing these phenotypes.

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CASE REPORT

PHAEOCHROMOCYTOMA - An Incidental Finding on Autopsy

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Abstract
Phaeochromocytoma is an uncommon tumour of the adrenal medulla. This report describes an autopsy case in which a large suprarenal mass was found incidentally[1] which was then confirmed histologically as Phaeochromocytoma.

Case

A 44 year old male who had gone fishing became suddenly unconscious and was declared as 'dead on arrival' in the ER. He had no significant past history. The autopsy was performed. There were no significant external findings on autopsy. Internal examination revealed congested and oedematous brain with intracerebral haemorrhages in the right hemisphere and left ventricle. The heart showed left ventricular hypertrophy. The right kidney was normal. The left kidney was enlarged with a suprarenal mass.

Pathology

Macroscopy
The specimen received was a capsulated grey-brown to yellow piece of tissue measuring 10x 8 x 2cms. The cut surface was homogeneous yellow with areas of haemorrhages.

Microscopy
Microscopic examination revealed a capsulated tumour composed of large polygonal cells arranged in well defined nests separated by a vascular network. (Fig.1) The cells contained finely granular eosinophilic cytoplasm and oval nuclei. The tumour cells revealed minimal cellular and nuclear pleomorphism. Many areas of haemorrhage are noted in the tumour substance. (Fig. 2)

Discussion

The term phaeochromocytoma was first coined by Ludwig Pick, a pathologist, in 1912, although Frankel, in 1886, made the first description of a

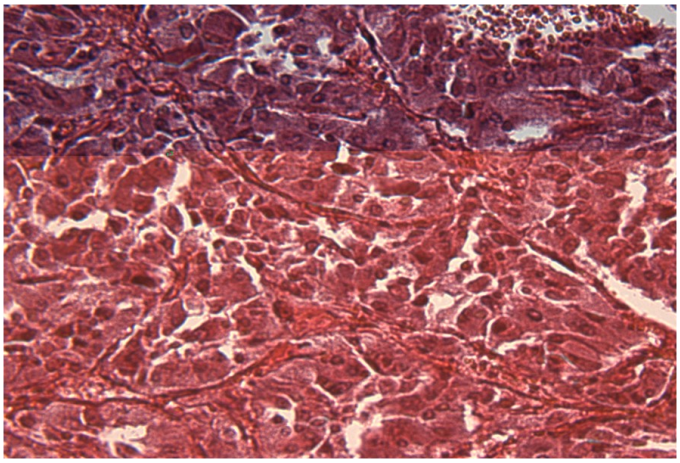

Fig 1. Histology section shows well defined nests of polygonal cells separated by capillary network. (Original magnification X 100)

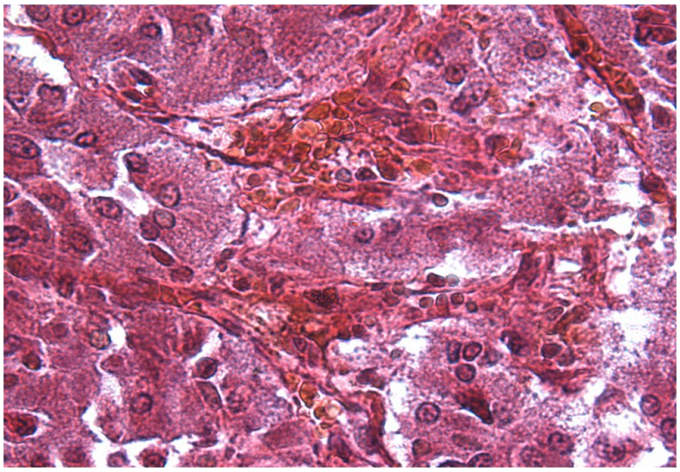

Fig. 2. Histology section shows areas of haemor rhages in the tumour substance. The tumour cells are large with granular eosinophilic cytoplasm. (Original magnification X 200)

patient with phaeochromocytoma. This is a neuroendocrine tumour of the adrenal medulla or extra-adrenal chromaffin tissue. It may produce, store and secrete nor-epinephrine, epinephrine or both.

This tumour is curable if diagnosed and treated on time, but may be fatal if remaining unrecognised or mistreated. This case report explains the similar outcome of an undiagnosed phaeochromocytoma leading to hypertensive cerebral haemorrhage which is an unusual but not unheard cause of death in forensic service. A similar case has been mentioned in the literature[3].

The catecholamines secreted by the tumour caused repeated attacks of hypertension which ultimately led to rupture of intracranial vessels and fatal intracerebral and intra-ventricular bleed. Left ventricular

hypertrophy of the heart was also secondary to hypertension.

This tumour is called a '10% tumour' because 10% of them are bilateral, 10% are at extra-adrenal sites, 10% occur in children, 10% recur and 10% can turn into malignancy. The tumours in adults are seen in the age group of 40 – 60 years; 80% are unilateral; 97% are intra-abdominal, solitary, highly vascular, and weighing from 100 grams to 3Kg.

Mechanism of release of catecholamines from the tumour cells is yet unknown.

The patient usually presents with severe attacks of hypertension resistant to conventional treatment and or with symptoms of sympathetic stimulation[2]. On examination, severe and sustained rise in blood pressure is recorded with variable arrhythmias and ECG changes[2].

Phaeochromocytoma sometimes occurs in the context of Multiple Endocrine Neoplasia (MEN type 2) together with medullary carcinoma of thyroid gland[4]. MEN type 2 is a rare familial syndrome caused by mutations in the RET proto-oncogene and is inherited as an autosomal dominant disorder. Diagnosis is made by demonstration of increased production of catecholamines or their metabolites. 24 hour urine sample is the most preferred specimen and free epinephrine is the more specific component for diagnostic purposes (>50 ug/day of free epinephrine suggests the presence of phaeochromocytoma). Measurement of plasma metanephrine is a highly sensitive (99%) technique for phaeochromocytoma but has limited value due to the requirement of high quality assays like HPLC (High Pressure Liquid Chromatography). Other modes of investigation like CAT scans and MRI scans are the preferred choices to localise the tumour[5]. Phaeochromocytoma is a surgically correctable cause of hypertension[5]. Unresectable tumours can be treated by long term use of adrenergic blocking drugs and inhibitors to catecholamine release. Patients with benign tumours localised to adrenals, when treated promptly, will have survival normal to age matched populations. With metastasis the overall 5 year survival reduces to 50%.

Forensic Pathology Service in Samoa

The pathology department in Samoa is based in Tupua Tamasese Meaole Hospital under the National Health Services. The Department provides routine laboratory services as well as Forensic Services. Forensic autopsies which are referred from the Coroner[6] are performed by the Forensic Consultant Pathologist with the assistance of a mortician and a mortuary technician, but at times of necessity, the Forensic Pathologist asks for help from the Clinical Pathologist.

Take Home Message

We describe a rare case with the incidental finding on autopsy of a supra-renal tumour.
On histology, it was confirmed as phaeochromocytoma of the adrenal gland. This is an uncommon tumour with a fatal outcome if it goes unrecognised.

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VIEWPOINT

INTESTINAL NEMATODE INFECTIONS: Causes for Being Neglected

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ABSTRACT
Aetiology of many intestinal diseases remains obscure, although the role of helminthiases is suggested. Single stool sample microscopy (SSSM), a routine test for intestinal helminth infections, shows negativity in many cases. The diagnostic sensitivity of SSSM and microscopy of multiple stool samples (MSSM) was preliminarily compared; MSSM has been proven to be seven times more sensitive than widely accepted SSSM. Other ways exist for the enhancement of diagnostic sensitivity of intestinal helminthiases detection in non-endemic areas (like Samoa), such as McMaster's method. Their introduction requires effective collaboration between clinicians and laboratory specialists and setting up quality systems in clinical laboratories.

It is commonly believed that intestinal helminthiases, especially those caused by geohelminths, are easy to diagnose. Both population and clinical studies of helminthic infections rely upon a diagnostic test that is a single stool sample microscopy (SSSM). This procedure is based on the evaluation of a native stool smear for the helminth ova or, more rarely, of parasitic larvae.

The life cycle of helminthic females, however, does not imply producing ova every day or on a strictly regular basis. Moreover, circadian rhythms have been described for producing eggs by some parasitic nematodes [1]. The existence of such irregular patterns suggests that multiple stool sample microscopy (MSSM) with a series of at least three specimens collected every day or every other day has a better diagnostic sensitivity than SSSM. The former approach would reduce probable false negativity of SSSM caused by the choosing of a potentially improper day for collecting a stool specimen. Its diagnostic value has been recently reviewed in every detail in an excellent monograph by L.S.Garcia [2].

In order to evaluate the importance of the sampling protocols for a better diagnostic sensitivity of stool microscopy, we[3] have been detecting helminth ova in the stool samples of 102 randomly selected patients with chronic gastroenterological conditions during four consecutive days. Most eggs of *T. trichiura* and *A. lumbricoides* have been discovered in the specimens collected on the second and third sampling days, not on the first day. That pattern was observed both before mebendazole therapy and afterwards, including mebendazole-resistant cases. The aforementioned findings evidenced in favour of MSSM show promise for the introduction of this technique in an out-patient setting; recently, a notification has been received of a routine use of three consecutive stool specimens for diagnostic microscopy in suspected cases of intestinal helminthiases in the Institute for Medical Research in Belgrade, Serbia (Prof. O. Djurković-Djaković, personal communication).
An additional way of increasing the sensitivity of SSSM may well be the use of alternative diagnostic techniques for a better visualisation of helminth eggs. For example, the McMaster technique developed at the McMaster Laboratory housed at the University of Sydney, Australia, is the most commonly used test for identifying and quantitation of parasite elements in faeces. Its use has been described in every detail with many variations in the evaluation of faecal egg counts in small ruminants, horses, cows, and pigs. In humans, McMaster technique has been employed only for quantitative estimation of the effect of anthelminthic drugs in endemic areas: mebendazole against hookworms[4], albendazole against hookworms, Trichuris and Ascaris[5], mebendazole against Trichuris[6], pyrantel and piperazine against Ascaris[7], and tetramizole against Ascaris, hookworms and Enterobius[8].

However, nothing has been known about the sensitivity of the McMaster method in non-endemic areas with no connection to anthelminthic therapy of already recognised helminthic infections. Our preliminary study[9] has demonstrated that the McMaster technique may be successfully used for the diagnosis of intestinal helminth infections in a non-endemic area, with egg load varying from very low (15 - 60 epg for *T. trichiura*) to moderate (1650 – 4500 epg for *A. lumbricoides*). Its diagnostic performance was equal to that of a reference assay (native stool smear), despite the patient cohort being small (n = 32). Detecting and identifying helminth eggs with the McMaster method is much easier technically than using the native stool smear and better images can be obtained on photomicrographs of the eggs for further study when necessary. Quantitative assessment of the sample provided by the McMaster method is an extra benefit for a clinician willing to quantitatively evaluate the efficacy of a specific antiparasitic therapy if required.

Therefore, different ways exist for the enhancement of diagnostic sensitivity of intestinal helminth egg detection in patients' stool samples in non-endemic areas such as Samoa. Introduction of such techniques would require an effective collaboration between clinicians and laboratory specialists and setting up appropriate quality systems in the hospital laboratories. This would lead to a substantial decrease in the underdiagnosis of intestinal helminthiases, especially in clinical conditions (like irritable bowel syndrome)

in which the possible role of parasitic infections have always been underestimated[10].

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REVIEW

CLINICAL COMPENDIUM OF RESPIRATORY MUSCLE TESTING

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Introduction
The main goal of the ventilatory system is to ensure delivery of oxygen to tissues and evacuation of carbon dioxide[1,2]. Insufficient ventilation leads to alveolar hypoventilation with subsequent hypoxemia and hypercapnia (ventilatory/type II failure). The respiratory pump represents the principal component of the ventilatory system (Figure 1).

Fig 1. The Respiratory Pump

Complex neuronal pathways regulate ventilation via the respiratory centre located in the medulla oblongata. Synaptic transmission from the 1st to the 2nd motor neuron is followed by the motor endplate and finally by the contraction of respiratory muscle fibers. As for all skeletal muscles the same physiological principals apply for respiratory muscles[2,3].

Ventilatory failure is always linked to inspiratory muscle failure. This failure results from an imbalance between the capacity and the load imposed on the respiratory pump[1,2,4] .Impaired ventilation can result from both an increase in load (e.g. interstitial lung disease), a reduction in capacity (e.g. myopathic disorders) or from the combination of both (e.g. COPD).

Two major questions are addressed by respiratory muscle testing:[2,4]
1. Are the respiratory muscles impaired, and if so, how severely?
2. Is the demand on the respiratory muscles increased and how severe is it?

By answering these questions the differential diagnoses, particularly in the case of latent or manifest ventilatory insufficiency, are narrowed down. In addition, quantifying respiratory muscle function serves as an important progression parameter in different diseases and is used for therapy monitoring (e.g. COPD, neuromuscular diseases, non-invasive ventilation).

The objective of this review is to provide the reader with the needed information of how to apply each particular method of respiratory muscle testing in addition to the discussion of the most important basic characteristics of each method.

Methods
Clinical signs and symptoms (e.g. dyspnea under exertion, tachypnea, paradox ventilation) lead the way to suspect ventilatory failure. Lung function testing and blood gas analysis are essential and need to be supplemented by different tests assessing respiratory muscle strength and related ventilatory characteristics[4,5] .Two major categories of respiratory muscle tests exist: volitional and non-volitional tests. It is the combination of the tests that establishes a reliable diagnosis. Selective respiratory muscle weakness (e.g. isolated diaphragmatic dysfunction in the presence of phrenic nerve palsy) can escape detection by certain tests. It is therefore highly recommended to perform complete respiratory muscle testing and to include all of the available tests in all cases of suspected respiratory muscle dysfunction. Screening is performed by volitional and non-invasive tests. In the event of pathological findings the more complex non-volitional and finally invasive procedures are applied[4,5,6] . Table 1 illustrates the non-pathological threshold values for each particular test and reflects the current consensus of (inter-)national guidelines and current studies[2,4,5,6,7,8] .

Table 1. Threshold values (non-pathological) for respiratory muscle testing.

[All kPa]	**Female threshold value** (non-pathological)	**Male threshold value** (non-pathological)
$P_{0.1}$	<0.3	<0.3
$PImax_{1.0}$ RV	>6.0	>7.0
$PImax_{peak}$ RV	>7.0	>8.0
PEmax	>7.0	>10.0
$P_{0.1}$/ $PImax_{1.0}$	<4.5	<4.5
$P_{0.1}$/ PImax-	<2.0	<2.0
$P_{0.1}*t_i/V_T$	<0.5	<0.5
Sn Pna	>6.0	>7.0
Sn Pdi	>8.0	>10.0
Tw Pmo	>1.0	>1.0
Tw Pdi	>1.8	>1.8

$P_{0.1}$: mouth occlusion pressure at 0.1 s inspiration;
$PImax_{1.0}$ / $PImax_{peak}$ RV: maximal inspiratory mouth *occlusion pressure (residual volume, hold over 1 s / peak value)*;

PEmax: maximal expiratory mouth occlusion pressure;
$P_{0.1}$/PImax: respiratory capacity;
$P_{0.1}$*t_i/V_T: specific inspiratory impedance;
Sn Pna: sniff nasal pressure;
Sn Pdi: sniff transdiaphragmatic pressure; /
Tw Pmo: twitch mouth pressure;
Tw Pdi: twitch transdiaphragmatic pressure

Table 2 summarizes the characteristics of each particular respiratory muscle test. Beyond the methods which assess respiratory muscle strength, and are discussed in this review, there are several means to assess fatigue and/or endurance of the respiratory pump (e.g. electromyogram or muscular relaxation time). However, general clinical acceptance of these methods is poor due to their high complexity.

Volitional tests on respiratory muscle function

1. Mouth occlusion pressure at 0.1s of inspiration: $P_{0.1}$

The $P_{0.1}$ reflects an indirect measure of the central respiratory drive. This measure is influenced by several factors (e.g. tidal volume) due to its dependency on pressure generation and transmission. Misjudgment of the central respiratory drive can result if this linkage is disrupted (e.g. muscle relaxants: maximal central respiratory drive and zero $P_{0.1}$).

In practice, airways are occluded at the mouth (≥120 ms) during quiet breathing and $P_{0.1}$ is registered after 100ms. To exclude adaptation of the ventilatory pattern prior to $P_{0.1}$ registration the occlusion is applied without notifying the patient in advance. At least 2 breaths separate each consecutive assessment of $P_{0.1}$ and the median of 5 congruent measurements is registered[2,5].

2. Maximal inspiratory/expiratory mouth occlusion pressure: PImax/PEmax

PImax and PEmax currently reflect the most widely applied methods for assessing global respiratory muscle strength. Both methods are independent from pathological resistance/compliance changes due to the missing changes in lung volume (isometric contraction). It is important to avoid pure static pressure development due to the risk of inconsistent glottis closure. A standardized leakage (canula with 4 cm in length and internal diameter of 1 mm) ensures a minimal airflow at all times.

PImax can be assessed at functional residual capacity (FRC) or residual volume (RV) without (FRC) / with (RV) additive thoracic retraction forces. PImax is registered as peak-value ($PImax_{peak}$) or plateau-value over 1s ($PImax_{1.0}$, more widely-used)[2,5,7] . PEmax is assessed as peak-value at total lung capacity (TLC)

Table 2. Respiratory muscle testing: method characteristics. $P_{0.1}$: mouth occlusion pressure at 0.1 s inspiration;

	Non-volitional	Invasive	Technical Complexity	Reproducibility	Variance of Normal Values	Data Basis of Normal Values
$P_{0.1}$	—	—	–	-	↔	excellent
PImax	—	—	↔	↔	-	excellent
PEmax	—	—	↔	–	-	sufficient
$P_{0.1}$/ PImax	—	—	↔	↔	-	sufficient
$P_{0.1}$*t_i/V_T	—	—	–	-	↔	insufficient
Sn Pna	—	—	↔	--	—	sufficient
Sn Pdi	—	yes	--	--	—	sufficient
Tw Pmo	yes	—	-	--	–	insufficient
Tw Pdi	yes	yes	--	--	–	insufficient

PImax: maximal inspiratory mouth occlusion pressure;
PEmax: maximal expiratory mouth occlusion pressure;
$P_{0.1}$/PImax: respiratory capacity;
$P_{0.1}$*t_i/V_T: specific inspiratory impedance;
Sn Pna: sniff nasal pressure;
Sn Pdi: sniff transdiaphragmatic pressure;
Tw Pmo: twitch mouth pressure;
Tw Pdi: twitch transdiaphragmatic pressure.

analog to PImax. The pressure is generated solely by the expiratory muscles and it has to be taken care that there is no use of buccal muscles. As a result from the positive pressure gradient from the mouth to the mouth-piece leakage is a common problem in PEmax assessment.

In practice, PImax (from RV) and PEmax (from TLC) are measured at a volitional maximal inspiratory/ expiratory effort with occluded airways. It is essential that the examiner motivates the patient to achieve truly maximal efforts. The maximal value out of seven trials is registered. Each consecutive assessment of PImax/PEmax is separated by at least 30 s. The test series should not end with the highest achieved value and differences between the two highest values should be ≤10 %[2,4,5,7] .

3. Respiratory capacity: $P_{0.1}$/PImax
The ratio of $P_{0.1}$/PImax is referred to as the respiratory capacity and reflects the momentary operational demands of the inspiratory muscles. Inspiratory muscle weakness with false-low $P_{0.1}$ values results in the risk to overlook an increase in the central respiratory drive. This risk is minimised by considering the respiratory capacity. $P_{0.1}$/PImax is expressed as % where higher values represent reduced capacity. Values above a defined threshold (app. 20-25 %) indicate the risk of ventilatory failure[2].

4. Specific inspiratory impedance: $P_{0.1}*t_i/V_T$
Physically, this value represents a resistance. Here, $P_{0.1}$ reflects the pressure needed to achieve a certain inspiratory flow (V_T/t_i). $P_{0.1}*t_i/V_T$ reflects the load which is momentarily imposed on the inspiratory muscles. The higher the impedance (i.e. the pressure needed to achieve a certain inspiratory flow), the higher the load imposed on the inspiratory muscles. $P_{0.1}*t_i/V_T$ considers the level of momentary ventilation which sole consideration of $P_{0.1}$ does not.

5. Sniff pressures: Sn P
In contrast to all aforementioned static airway-occluded methods Sn P represent dynamically-assessed measures. Patients perform short, maximal inspiratory efforts through the nose. The assessment of Sn P is better tolerated than static respiratory efforts. In addition, the variance is smaller and the reproducibility higher compared to PImax.

5.1. Nasal sniff pressure: Sn Pna
Son Pna reflects an important non-invasive parameter for assessing inspiratory muscle strength. It has to be considered that impaired pressure transduction from the pleura (e.g. end-stage COPD) might underestimate inspiratory pressure generation.

5.2. Transdiaphragmatic sniff pressure: Sn Pdi
The invasive assessment of Sn Pdi achieves an increase in diaphragmatic specificity, independent from pleural pressure transduction. Sn Pdi is assessed by transnasal application of enteric balloon catheters and is calculated as the difference between esophageal and gastric pressure (q.v. *twitch pressures*).

In practice, Sn P are registered from FRC during a maximal, short inspiration (lasting <0.5 s) through the nose with the mouth closed. The examiner motivates the patient to achieve truly maximal efforts. Seven trials are performed and the maximal value is registered. Each consecutive measurement of Sn P is separated by at least 30 s (q.v. *PImax/PEmax*). The test series should not end with the highest achieved value and differences between the two highest values should be ≤ 10 %[4,5].

Non-volitional tests on respiratory muscle function
All of the methods discussed above have one substantial disadvantage in common: their dependency on the patient's motivation and cooperation. Therefore, low values cannot simply be attributed to respiratory muscle impairment but rather might reflect false-low values caused by insufficient maximal effort. Methods independent from the patient's cooperation and motivation have to be applied to objectify these results.

1. Twitch pressures: Tw P
The current gold-standard technique in (non-volitional) assessment of respiratory muscle strength is represented by pressure registration during stimulation of the phrenic nerves. Former electric stimulation has been almost entirely replaced by magnetic nerve stimulation which is painless and reliable. Here, short-term, high-energy magnetic fields induce a current over the phrenic nerves, resulting in a singular diaphragmatic contraction. For safety reasons, all patients with cardiac pacemakers or other implanted electrical devices or metal parts have to be excluded from this technique. Bilateral anterior magnetic phrenic nerve stimulation (BAMPS) has proven to be the most reliable method achieving supramaximallity[8,9,10].

Tw P are registered close to FRC due to the linear relationship between lung volume and Tw P[8,10]. A standardized resting period of 15-20 min should precede Tw P assessment to avoid excessive demands on the diaphragm (e.g. caused by physical exercise). Consecutive measurements are separated by at least 30 s. Figure 2 illustrates exemplary pressure-time curves for Tw P.

2. Twitch mouth pressure: Tw Pmo
Non-invasive Tw Pmo reliably assesses respiratory muscle strength if the pressure transduction from the pleura to the mouth is not impaired. A trigger mechanism (a certain flow or pressure value at the leakage, q.v. *PImax/PEmax*) avoids inconsistent glottic closure. An inspiratory pressure trigger achieves the narrowest limits of agreement between Tw Pmo and esophageal (≈ pleural) pressure[8,10].

3. Transdiaphragmatic twitch pressure: Tw Pdi
As an invasive procedure Tw Pdi is assessed following transnasal balloon catheter placement[4,5,8] .Tw Pdi is calculated as point-to-point subtraction of gastric (Tw Pga, ≈ 1/3 Tw Pdi) from esophageal twitch pressure (Tw Pes, ≈ 2/3 Tw Pdi). The standardized balloon

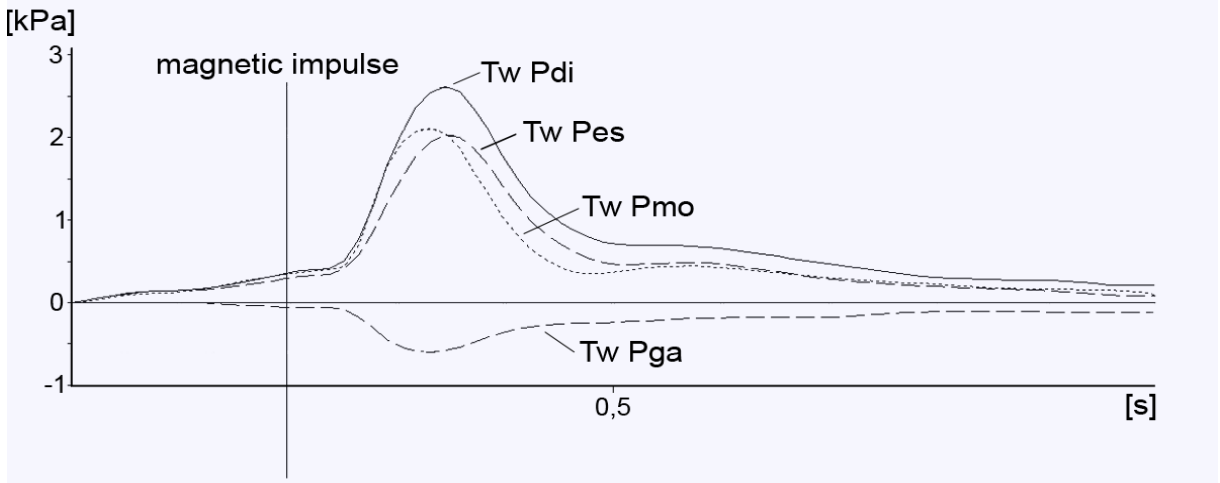

Fig 2. Twitch Pressures

catheter placement is as follows: both balloons are initially placed in the stomach. While pulling back the catheter a pressure reversal is seen at the proximal balloon at the esophageal-gastric passage. From there the catheter is pulled back another 5-10 cm and then safely fixed. Verification of correct catheter position is achieved by sniff maneuvers (q.v. *sniff pressures*).[5] As standard the balloons usually contain 1.0 (esophageal) and 2.0 (gastric) ml of air depending on the pressure-tension relationship of the balloons. No trigger is needed for sole Tw Pdi registration since glottic closure does not influence pressure transduction from the pleura to the esophagus or stomach. In contrast to all aforementioned parameters which represent maximal volitional efforts, Tw P are registered as the mean of five trials[5].

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LITERATURE REVIEW

DIABETES MELLITUS IN SAMOA: An Epidemiological and Quality of Care Review

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Abstract

Aim – To review the epidemiology of diabetes, risk factors, complications and quality of diabetes care in Samoa.

Method – Search of MEDLINE using the term diabetes, Samoa and other relevant keywords to identify all studies. All types of diabetes, impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) were included.

Results – We found four relevant articles. Analysis of the data reveals that a higher prevalence of type 2 diabetes was found in 1991 (compared to 1978) in each age group (except 25-34 year group) in both males and females. Prevalence of type 2 diabetes was higher in females. The age-standardised prevalence of type 2 diabetes in urban areas (13.4 percent females; *vs* 9.5 percent males) was higher than in rural areas (5.6 percent females *vs* 5.3 percent males) in 1991. Prevalence of obesity also increased from 26.8 percent to 46.6 percent in males and 47.2 percent to 65.3 percent in females during 1978-1991, with a higher prevalence in the urban population. Diabetes prevalence remained higher in urban (than rural) subjects after adjusting for differences in obesity and age. Proliferative diabetic retinopathy was found in 4.5 percent of known diabetes subjects in 1991. The same survey found elevated urinary albumin concentration in 15.0 percent with IGT, 26.0 percent in newly diagnosed diabetes and 23.4 percent in known diabetes subjects. A 2002 survey found diabetes prevalence to have increased to 23.1 percent (22.9 percent males; 23.3 percent females) and obesity 57.0 percent which showed an increasing prevalence in both males and females with higher rates in females and urban areas.

Conclusions – Prevalence of diabetes had increased during 1978-1991 and more than doubled by 2002. Data on the prevalence of undiagnosed diabetes, pre-diabetes or gestational diabetes are limited and/or outdated but for every diagnosed case of diabetes at least four undiagnosed cases can be estimated for the region[1]. Diabetes prevalence was higher in females and urban populations consistently. The effect of obesity on glucose intolerance was not consistently observed in Samoans. Prevalence of obesity had also shown a rapidly increasing trend during 1978-1991 and 1990-1995. Increase in diabetes prevalence could not be explained by the increase in obesity alone. Diabetes complications such as diabetic retinopathy and albuminuria were common in those with pre-diabetes and newly diagnosed diabetes.

Introduction

Diabetes Mellitus is a global health problem that causes a significant burden in many countries and has become an important cause of morbidity and mortality in developing countries, reaching epidemic proportions. Acute and long term complications of diabetes pose a significant economic burden on developing economies.

Type 2 diabetes (T2D) (previously known as Non Insulin Dependent Diabetes Mellitus) is the type found commonly in adults and results from an interaction between genetic predisposition and environmental factors resulting in a defect in insulin secretion and action. Pacific Island populations are known to have a high prevalence of this disease. According to the World Health Organization (WHO) 85-90 percent of diabetes in the Western Pacific Region (WPR) is type 2.

Diabetes is diagnosed using specific criteria and hyperglycaemia not high enough to diagnose diabetes is classified as "pre-diabetes." Pre-diabetes can be Impaired Fasting Glucose (IFG) when fasting plasma glucose is between 5.6-6.9 mmol/l or Impaired Glucose Tolerance (IGT) when two-hour plasma glucose is between 7.8-11.0 mmol/l. Pre-diabetes is a risk factor for the development of diabetes and cardiovascular disease. Lifestyle factors like obesity, inadequate physical exercise and a high fat low fibre diet are thought to promote the onset of T2D. Such lifestyle factors are associated with westernization and economic development in developing countries and therefore T2D presents as a major and growing public health problem in the Pacific[1].

This review discusses trends in prevalence of diabetes, risk factors, complications and quality of diabetes care in Samoa.

Prevalence of Diabetes and Obesity

The first study on prevalence of T2D in Samoa was conducted in 1978 and showed a high prevalence of diabetes and obesity. Obesity is a known risk factor for development of T2D. A follow up survey in 1991 using similar methods confirmed an increase in the age standardized prevalence of T2D and obesity during the 13 year period from 1978-1991. The age-standardised prevalence of T2D in urban areas (Apia) had increased from 8.1 to 9.5 percent in males and from 8.2 to 13.4 percent in females. In rural areas

(Tuasivi) the increase was from 2.3 to 7.0 percent in males and from 4.4 to 7.5 percent in females. In the other rural area included in this survey (Poutasi) the increase was dramatic (from 0.1 to 5.3 percent) in males, but minimal in females (5.4 to 5.6 percent). Age-standardised prevalence of T2D was consistently higher in females in urban and rural areas than in males[2]. Another study into rural vs urban prevalence using similar methods found diabetes in the urban population to be more than two times that in the rural (7.0.1 percent *vs* 2.7 percent)[3]. A cardiovascular disease (CVD) risk factor prevalence survey during 1990-1995 found a diabetes prevalence of 3.3 percent in males, 5.4 percent in females, with the highest prevalence in females aged 55+ years[4].

In surveys on ten Pacific Island (PI) populations, Mauritius and Rodrigues confirmed the high prevalence of obesity. Some populations had some of the highest prevalence of obesity in the world when data were presented as an aggregate and contributed to the risk of T2D. Investigators postulated a genetic susceptibility to obesity combined with high energy intakes and reduced physical activity as possible factors in the PI populations[5]. The CVD risk factor survey which included an urban - rural mix (Savaii, Upolu, Apia) found the prevalence of obesity to be 32.9 percent in males and 62.0 percent females[4]. Other investigators who consider PI as a group of diverse people have analysed data separately. They have also found Polynesians and some Micronesians to have a very high prevalence of obesity and diabetes but the cause for this was not clear. Some factors involved were thought to be related to urbanisation and migration[6]. Other investigators have found diabetes to be rare among indigenous Pacific populations maintaining a traditional lifestyle but high in urbanised Pacific populations[7]. The WHO STEPS survey (in 2002) found diabetes prevalence in Samoa to have increased to 23.1 percent (22.9 percent males; 23.3 percent females) and obesity to 57.0 percent which showed an increasing prevalence in both males and females with higher rates in females and urban areas[8]. Age standardised prevalence rates of diabetes are shown in Table 1.

The effect of obesity on glucose intolerance was not consistently observed in Samoans. An increasing age-standardised prevalence of IGT and diabetes was observed with increasing Body Mass Index (BMI) in males but not in females. Investigators noted that the urban -rural differentials in prevalence of abnormal glucose tolerance were altered little by adjusting for differences in BMI.

Therefore environmental factors such as diet, physical activity and stress, acting independently of BMI, must have contributed significantly to the observed rural/urban differentials of abnormal glucose tolerance[9]. However the 'SEARCH for Diabetes in Youth Study' on Asian, Pacific Islander and Asian-Pacific Islanders in the U.S. found most with T2D to be obese (Asian 71.0 percent ; PI 100.0 percent). PI consisted of Native Hawaiians and Samoans. All Asian, PI and Asian–Pacific Islanders with T2D were obese confirming the association of obesity and T2D. However Asian and Asian–Pacific Islanders with diabetes (Type 1 and 2) had lower mean BMIs than Pacific Islanders. The majority of youth in all three subgroups had Type 1 diabetes (T1D) with older (10-19 years) youth having an incidence of T2D almost double that of T1D. In this study, diabetes type was reported by health care professionals or abstracted from medical records and confirmed that Micronesians are frequently affected by T2D but T1D was not common[10].

Diabetes Complications

Data on microvascular complications (retinopathy, nephropathy, neuropathy) and macrovascular complications (cardiovascular disease, cerebrovascular disease, peripheral vascular disease) in Samoa is scarce. Diabetes is known to have a long time-lag between onset and diagnosis and many patients present with long term complications at the time of diagnosis. One of the earliest studies on prevalence of diabetic retinopathy and nephropathy in patients with T2D or IGT from Samoa was conducted in 1991 and found proliferative diabetic retinopathy in 4.5 percent of diabetes patients. Elevated urinary albumin concentration was found in 15.0 percent with IGT, 26.0 percent in newly diagnosed diabetes and 23.4 percent in known diabetes subjects confirming that diabetic complications are common[11].

Risk factors

Genetic factors cannot explain changes in prevalence, which are due to rapid changes in lifestyle and associated factors such as obesity, unhealthy diets, and physical inactivity[12]. No reliable data are available on physical activity in Samoa. Risk factors associated with diabetes are now reasonably well understood but the prevention and control in the Pacific may not be straightforward[13].

Extrapolation of data

Investigators have modelled the influence of the ratio of diagnosed: undiagnosed cases of diabetes, population demographic changes, age at onset of diabetes, mortality and incidence of diabetes on the prevalence of diabetes in Samoa over a five-year period. The expected increase in prevalence was from 11.7-17.9 percent over five years which is an increase by 53.0 percent[14].

Treatment

The only data available on treatment showed that in 2002, 56.8 percent males and 68.5 percent females with diabetes were taking tablets and 4.0 percent males and 5.3 percent females were taking insulin as treatment[15].

Conclusions

Data on the prevalence of diabetes complications are

Table 1: Age standardised prevalence (percent) of diabetes mellitus

Reference	Year of study		Diabetes prev. in **Apia**	Diabetes prev. in **Tuasivi**	Diabetes prev. in **Poutasi**	Diabetes prev. in **Upolu**	Diabetes prev. in **Savaii**	Diabetes prev. in **Samoa**
Collins VR, Dowse GK, Toelupe PM, et al	1978	**Males**	8.1	2.3	0.1			No data
		Females	8.2	4.4	5.3			No data
Collins VR, Dowse GK, Toelupe PM et al	1991	**Males**	9.5	7.0	5.4			No data
		Females	13.4	7.5	5.6			No data
McGarvey ST	1990 - 1995	**Males**	No data			No data	No data	5.4%
		Females	No data			No data	No data	3.3%
McMurray C	2002	**Males**	No data			No data	No data	22.9%
		Females	No data			No data	No data	23.3%
		Males & females	27.0%			19.7%	20.3%	23.1%

aged and not available to assess the extent of undiagnosed diabetes, pre-diabetes or gestational diabetes. Prevalence of diabetes and obesity was high and had shown an alarming increase from 1978. Diabetes prevalence was higher in urban population and in females. Increase in diabetes prevalence could not be explained by genetic factors or obesity alone. Diabetic retinopathy and albuminuria were common in known diabetes, pre-diabetes and newly diagnosed diabetes.

The WHO had identified Samoa among the 10 "fattest" countries in the world and it called upon the governments in the Asia-Pacific region through the Western-Pacific Declaration to undertake specific action for improving diabetes awareness and management in the region. Health planners and policy makers of the Samoa Ministry of Health have also identified T2D as a priority.

Optimal diabetes care requires an organised systematic approach by a team of health care professionals. In Samoa, diabetes care is provided by hospitals and community based physicians. Standards for diabetes care have been specified by the American Diabetes Association (ADA) and International Diabetes Federation (IDF) for screening, diagnosis and treatment. These standards provide clinicians and health planners with process and outcome criteria (treatment goals). ADA standards are comprehensive while IDF global guidelines classify three levels of care, standard, minimal and comprehensive. IDF/WPR (Western Pacific Region) guidelines also contain clinical monitoring protocols. When constrained by resources and trained manpower the most pragmatic level of care can be targeted. The IDF/WPR guidelines have identified the need to improve diabetes care in most countries of the WPR. One strategy to meet this end is early diagnosis of diabetes and complications and effective management by allocation of adequate sustainable resources. Strengthening the capacity of national health systems to deliver and monitor equitable, affordable and effective diabetes services is important. Quality improvement beginning with the assessment of existing quality and audits carried out using structure, process and outcome criteria is a key strategy identified by the WHO for WPR[16].

Primary prevention involves screening of high risk groups and promotion of healthy lifestyles. Lifestyle intervention studies have consistently shown that modest changes can reduce the progression from IGT to diabetes by 50.0-60.0 percent. Among many studies that confirmed the benefit of lifestyle changes is the Diabetes Prevention Program (DPP) randomised trial that showed that a combined program of weight loss, healthy diet and increase of physical exercise lowers the risk of development of T2D. These simple lifestyle changes can be very effective and cheap to implement over relatively short periods of time but sustainability depends on regular reinforcement and follow up. This should be feasible in a church-based family-oriented Samoan cultural setting based on the success of the pilot, urban, church-based lifestyle intervention programme conducted on Samoans living in New Zealand[17]. The population approach to prevention and control of T2D needs inter-sectoral coordination and community participation. This is an arduous but achievable challenge facing Samoa in the 21st century.

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INFLUENZA IN SAMOA: Value of Vaccines

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In a note published in the *Medical Journal of Australia* (1919, vol i, p.359) Surgeon Lieutenant Francis Temple Grey, R.N., M.B.Syd., who was the officer commanding the Samoa relief expedition, 1918, states that the epidemic arrived form New Zealand on November 7th, 1918, when natives form different parts of the group had assembled in Apia to meet friends coming from New Zealand; they went on board and carried the infection to the most distant parts of the group. The incubation period was 2 days; the scourge reached its height on the tenth day. The ages most affected were from 18 to 35 and the old. The mortality was greater among men than among women—in the proportion of 15 to 13. The incidence among the natives was 80%. Out of a population of 36,405 the deaths numbered 7,264. Surgeon Lieutenant Grey attributes the mortality partly to the fact that the natives, though apparently of fine physique, have generally a poor chest expansion, and to their habits. The native house has a raised floor of coral and lava pebbles, a thatched roof supported on poles and no walls, but at the beginning of the epidemic, when a native fell ill he lay down in his hut, and his family, having pulled down the blinds, which are normally only lowered in wet weather, lay down with him in sympathy. When the fever was at its height, on the third day, the natives cast off their clothes, pulled the blinds up, and many of the men went into the sea to cool themselves. This was often followed by pneumonia, although, except in children, few cases, even with precautions, escaped bronchopneumonia. At the height of the epidemic many lives were lost owing to want of food consequent on the cessation of its collection. On December 8th, 1918, food collection was resumed, and the decline of the epidemic was popularly dated from that. Bronchopneumonia and pneumonia were considered to be part of the disease rather than complications, for only 5% adults escaped one or the other. Bronchopneumonia usually set in on the fourth day and in fatal cases there was marked dyspnoea, cyanosis and delirium. Among the whites the incidence was put at 60%, and the case mortality at 2%.

We have received from Surgeon Captain E.T.P. Eames, R.N., Director of Medical Services, Australia, a copy of a note by Surgeon Lieutenant Grey on compulsory inoculation against Spanish influenza. The writer, as stated above, was in charge of the expedition sent to combat an epidemic in British Samoa, where he had an opportunity of witnessing the behaviour of the disease on virgin soil. The full dose of the vaccine used by him contained 125 millions of Micrococcus catarrhalis, and 50 million each of pneumococcus, streptococcus and a Gram-positive diplococcus. His experience showed Pfeifer's bacillus to be unnecessary as a constituent of a vaccine directed against the epidemic. Immunity begins to "peter out" after the fifth week, and he gave a full dose (50 million pneumococcus and streptococcus) every 5 or 6 weeks. Only the mildest reaction was observed. He did not inoculate children or the old, unless requested, as they appeared to have relative immunity.

He recommends compulsory inoculation on the first signs of the appearance of an epidemic influenza, and that the inoculations should be repeated every month or six weeks. He claims that this will decrease the incidence of the disease, mitigate its severity, and reduce the mortality to a low figure.

He advances the following evidence:
1. The entire ship's company of the man-o-war which took my expedition to the islands was inoculated. Communications with the shore at the various ports was, as far as possible, avoided, but this ideal was not entirely attained. Not one case developed.
[The ship returned to Australia in February, 1919 and in the middle of March an epidemic broke out, producing by the end of the month about 100 cases, without any deaths. He considers that this is evidence that inoculations made at the end of November and December gave immunity up to the middle of March and rendered the disease when it broke out, non-fatal.]
2. Every member of my expedition was inoculated at least four times in three months. Not a single case developed although the risk of infection was no small one when it is remembered that in Samoa alone one fifth of the entire population was wiped out by the scourge. Two officer had an illness of four to five days not as severe as the so-called influenza of normal times.
3. An interesting experiment to test the efficacy was provided by the Governor of American Samoa, who sent, against the wishes of British Samoa, forty natives from Pago Pago (a clean port) to Apia during the progress of the epidemic. These were isolated, inoculated and not released until judged to be in a positive phase. Not one contracted the disease, and the Secretary of Native Affairs, who knew their names and villages, reported all clear after a lapse of one month.
4. Ship's company and passengers of the steamer which brought the expedition from Suva to Sydney were inoculated without exception. We anchored in quarantine in Sydney, and on the second day a case was taken ashore. We remained on board, quarantined another week . Although the ship was very overcrowded, not another case developed.
5. The naval depot at Williamstown contains a floating population of about 500, half of whom live on shore, and the rest, of course, have a fair amount of shore leave. All hands have been inoculated twice in the last three months. Down to March there had been only fifteen cases, all mild except two, and no deaths. In March an influenza epidemic broke out in the naval depot characterized by high infectivity , extraordinary mildness, and an average age incidence of 18.5; it caused 100 cases within a fortnight, but it was not clear that it was true influenza.

From the beginning of the year to the date of the note (June 20th, 1919) 2,875 ratings were victualled at the depot. There were 345 cases of influenza, five with pneumonic signs, but no deaths.

LETTER

LESSONS LEARNT FROM THE SWINE FLU EPIDEMIC

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As the swine flu epidemic appears to be abating it is worthwhile to pause and look at some of the lessons the H1N1 or the Swine flu virus has left for us. There is no question that the number of people visiting doctors' clinics with influenza like illness in August has dropped significantly compared to the same period in July. However, recent tests confirm that the virus is still circulating, though in drastically reduced way, and it may continue to circulate at low levels as we approach the end of the year.

The biggest surprise from the swine flu that swept the country was the huge surge of visits to the doctors' rooms and the general outpatients at Tupua Tamasese Meaole (TTM) Hospital. This led to the creation of the semi-open air clinic in Apia, which saw a large number of people, both adults and children, sick with flu symptoms, all assuming of course by symptoms alone that they were having Swine flu. A major planning focus by the Samoa Ministry of Health (MOH) for the future is to avoid being swamped by a similar, possibly bigger demand for emergency room and doctors' room visits.

Border control measures undertaken by the MOH obviously did not stop the H1N1 virus from slipping undetected into the country. The main reason is the majority of people carrying the virus had no symptoms when they arrived at the airport (that is they were carrying the virus without being sick, which is technically referred to as the incubation period). Furthermore the majority of cases were so mild that infected people were mingling freely within the community and transmitting the virus without being aware of it. This is obviously an issue for agencies like the World Health Organization (WHO) in regards to how to detect similar viruses in people infected but where they have not quite developed the usual symptoms. The concern now is - how do we prepare for the next wave of the swine flu virus which experts are predicting will be more virulent? It won't necessarily occur in the next 6 months, in fact it might be a couple of years, but it will return. If we look at the history of new strains of influenza virus which appeared on the scene in the last 150 years almost all of them had a second wave.

The Spanish Flu epidemic of 1918 which killed a quarter of the Samoan population was actually the second wave. The first recorded influenza minor epidemic actually occurred in the 1830's which archives showed was brought in by one of the crew members on board the Rev. John Williams boat. Fortunately, through the foresight and wisdom of the missionary in recognizing the symptoms early, quarantining the sailor and burying him at sea stopped what could have been a catastrophic epidemic. There are no records to show how many Samoans got sick or died, but there was definitely a minor influenza outbreak.

Closure of schools by the MOH was the right thing to do at the time but there is no evidence from Samoa or abroad to show that this intervention can actually curb an epidemic although there is evidence from the USA which suggests banning large gatherings can prevent the transmission of the virus. Wearing of masks and hand washing are the two solid ways that have been shown to prevent the virus transmission.
There are currently trials in the USA to test the new H1N1 vaccine and it may be another couple of months before it is available. It is expected that cost will be an issue; however the MOH should seriously look at stockpiling this vaccine once it is available and of course a lot of Tamiflu tablets. The second wave would definitely be deadlier.

OCEANIA UNIVERSITY OF MEDICINE: The New Face of Innovative Medical Education & Research in Samoa and the South Pacific

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Samoa is a small, peaceful nation in the South Pacific with a population of approximately 189,000[1]. This country has a severe shortage of doctors and it faces numerous obstacles in attaining sufficient numbers of doctors and allied health professionals to meet its health needs in the decades ahead. According to Watters and Scott[2], Samoa had 35 doctors for every 100,000 citizens compared to 250 in Australia and 220 in New Zealand. This number could be as high as 70 doctors per 100,000 according to a source in Fiji[3].

In the absence of incontrovertible data, the true number of doctors may lie between 35 and 70. For the purpose of this article we could take an average of 55 doctors per 100,000 Samoan citizens. Samoa should aspire to have a steady-state level of 70-100 doctors for every 100,000 citizens by the year 2025 in order to realise a quality health care system. Such an increase would also ensure adequate health services in the rural and remote parts of the country by placing qualified doctors into the district hospitals.

Until recently the primary source for the training of doctors for Samoa has been the Fiji School of Medicine (FSM) which was established in 1885 by Dr. (later Sir) William McGregor[3]. However, local demands and restricted capacity has limited FSM's capacity to train additional doctors for Samoa. Here we present our views that the Oceania University of Medicine (OUM) can offer a cost-effective, quality medical education for Samoans and neighbouring island nations and its success can be assured by additional scholarships from the Samoan government, major government aid donors (such as AUSaid, NZaid) and the World Health Organization (WHO).

Developing and retaining a professional 'graduate' workforce is one of the key elements of developing and strengthening workforce capacity and economic stability and doctors are key to delivering effective healthcare. Previous studies tracking medical migration patterns in the Pacific islands suggest that many migrants remain connected to their island homes through return visits, sending remittances to family and retaining homes or land [4, 5]. Other studies indicate that Samoan graduates who are resident in New Zealand and Australia visit the island, often taking their children to visit 'home', but they do not necessarily return to live or to work[6]. The main reason appears to echo the findings of the international studies on medical and nursing workforce migration patterns in that the lack of availability of suitable employment and the disparities in potential income are major factors. Bedford and Hugo[7] cite Liava's[8] research in Tonga which indicates that successful return from long established residence in New Zealand to Tonga was predicated on four factors: (1) family reunification, (2) a sense of Tonga as 'home', (3) availability of suitable employment, and (4) availability of land.

Bedford and Hugo also note that attention should be paid not only to the fluidity of the population, but to the effectiveness of the population that remains at any one time on the island, *"the population that draws on the basic services and facilities (water, sewerage, commercial enterprises, accommodation, health services, employment, etc.)*[7] In light of the extensive mobility of Samoans and developments in tourism and business enterprises, this highlights issues at the micro-level relating to the viability of the smaller resident populations in the context of enduring sustainable development. There are also implications at the micro-level for the Samoan health workforce. There is a need to not only consider the 'effective population' in terms of the workforce that draws on health services, but also to determine the most appropriate shape, structure and skills of the health workforce so that it can deliver an effective service to the populations of Samoa and more widely in Oceania.

Although the causes of these wider public service issues are based largely outside the realm of medical education, **medical** education programmes and the medical schools that deliver them are one part of the solution. Governments, medical schools and communities have responded to workforce issues through a range of means including wholesale curriculum reform, affirmative action programmes (linked to local communities or to encourage and support applicants from specific ethnic groups) and the establishment of new medical schools.

To address some of these issues, the Oceania University of Medicine (OUM) was established in Apia (the capital of Samoa) in 2002 with the following mission:

To produce physicians with the requisite knowledge, skills, and attitudes to improve the health of underserved communities in Oceania and beyond, via traditional and innovative instructional modalities to help individuals overcome distance, personal, and professional barriers to realise their calling to the medical profession.

With the University's mission and objectives in mind, OUM aims to graduate doctors who:

- Are committed to rational, evidence-based, and compassionate healthcare;
- Engage in productive professional relationships to acquire, evaluate, and communicate information;
- Apply critical reasoning to medical care;
- Apply understanding of illness to its prevention, identification, and management and to the promotion and maintenance of health;
- Apply understanding of the practice of medicine in a community or population;
- Take responsibility for self-education and self-evaluation.

Establishing a quality new medical school is always difficult, but doing so in a remote island nation such as Samoa poses major challenges. However, the widespread implementation of online distance and internet/computer-based pedagogies that supplement traditional classroom learning provides novel opportunities for overcoming the traditional barriers to delivering a good medical curriculum.

There is widespread illustration in practice that new medical schools do not need the full range of resources available to established medical schools. Lawson et al describe how the new Australian schools had '*the luxury of first choosing the curriculum and then devising the best way to deliver it, unlike older schools which had to impose new courses onto pre-existing structures'*[9]. OUM found itself in a similar position to all new medical schools around the world and could engage in an innovative paradigm that suited countries like Samoa which are geographically isolated but have access to a fast internet service.

OUM was founded on a paradigm reported by Neame[10] in an article entitled: *"Universities Without Walls: Evolving Paradigms in Medical Education."* OUM has taken a leadership role in creating a blended-learning medical curriculum utilising asynchronous and synchronous e-learning technologies as a primary delivery mode in the early pre-clinical phases of the program. A four year, graduate-entry programme was launched in 2002, comprising a two year pre-clinical phase followed by a further two year hospital and patient-based clinical programme. OUM has developed a complete pre-clinical curriculum benchmarked to international standards that is adapted to campus-based or distance education or a combination thereof. A wide range of international lecturers supplement the quality curricular material through distance-learning to students based in Samoa and elsewhere. Advances in internet technologies and online instructional teaching tools enable real-time classrooms to be run over the internet without lag issues (Moodle - Learning Management System)[11] (Elluminate Live! - Learning Management System)[12]. OUM students can therefore acquire a significant part of the knowledge and understanding of the basic, clinical, social and pathological sciences relevant to medicine via distance education and participation in online discussion groups.

Upon successfully passing a major hurdle examination at the end of the pre-clinical phase, students then progress to the clinical component, which comprises two years of clinical rotations or clerkships located in various countries, including Samoa, the USA and Australia. Core placements include all the major medical and surgical specialties so that students graduate with a wide range of experience in clinical medicine.

Students are prepared throughout their programme, not only to practice medicine competently, safely and compassionately, but also to pass licensing examinations in the country of their choosing. Currently, students are exposed to more knowledge than is required to pass the licensing examinations of the Australian Medical Council (AMC) and the United States Medical Licensing Examinations (USMLE) and it is anticipated that, as student and faculty numbers grow, the standards of OUM will become comparable with established medical schools in the USA, Australia and New Zealand. Increasing numbers of students are now passing these licensing examinations and OUM has set a target of 75-80 percent first- attempt pass rates as its internal benchmark.

The graduate-entry model consisting of two years of blended asynchronous plus synchronous distance education plus 2 years of hospital-based clinical training is, however, not appropriate for all aspiring medical entrants. This model is oriented to students who are graduates, wishing a career-upgrade or change, and who are highly motivated self-directed learners. Those that come from an allied health background do exceptionally well during the clinical phase. Most of these students have families and professional careers. In other words, these are the prototypical students who face the obstacles enunciated in our mission statement (see above). In order to meet the needs of students and healthcare in the South Pacific and stay competitive with medical schools in the local Asia Pacific regions, OUM had to develop a new programme for school leavers, i.e. those who did not have a bachelor's degree or other university level healthcare qualifications. To this end, OUM intends to introduce in 2010 a five-year campus based MBBS degree. As a result of this initiative, Samoan and Pacific Island students and governments (through funding choices for medical student scholarships) will have the additional choice of studying medicine at OUM or at other schools in the region such as the FSM.

There are many statements of opinion available in the literature describing what a quality medical school should be. We share some of the perspectives written by Dean Keith D. Lindor of the Mayo Medical School[13] in introducing that medical school and revised curriculum, summarising some of the key issues for a modern, innovative medical school:

1. The importance placed on educating the next

generation of physicians;
2. The friendly, collegial atmosphere among faculty, students and trainees at all levels;
3. The focus on the needs of the patient in all aspects of education, research and patient care;
4. The opportunity to learn and practice medicine with the best in the world;
5. The opportunity to conduct research in an environment where it can be directly translated to patient care;
6. The emphasis that the team is greater than the sum of its parts;
7. The excitement of working with others who are striving to do their best today, and to do even better tomorrow.

In addition to the IT infrastructure and international faculty, one of OUM's primary strengths is that the Apia campus is located within the National Hospital precinct which enables a seamless educational continuum between basic sciences and patient-based clinical training. This nexus encourages doctors of the hospital to visit the campus library to access online databases such as HINARI where more than 150 publishers offer more than 6200 journals[14], attend CME seminars and undertake teaching and research activities at the medical school. This collaboration also aims to develop research capacity in Samoa in clinical research and also in medical education. The conjoint arrangement enables educators from the campus, both clinical and non-clinical, to interact with the various medical departments and services such as biochemistry and pathology. OUM also has a clinical skills laboratory which supports students and practising clinicians to practice, develop and enhance clinical skills in a safe and supervised environment. In this way, OUM is engaging in what Bligh et al call a 'symbiotic curriculum'[15], in which medical schools have responded to the challenge of extending learning into the community. The 'symbiotic' curriculum design has been described as part of the PRISMS model.

The key features of the PRISMS model are that it is:
Product focused – i.e. practice-based linked with professional development. Students learn about basic science by applying it in the clinical context;
Relevant to students and communities, reflecting the needs of local health communities as well as student learning needs;
Inter-professional – programmes will espouse, encourage and reflect a culture of multi-professional learning, collaboration and teamwork;
Shorter courses taught with smaller numbers of students in each 'unit' (placement, learning set, group). This also reflects the worldwide shift towards graduate-entry programs with undergraduate education being better integrated with postgraduate training;
Multi-site locations – shift from large teaching hospitals with restricted patient mix to primary care and smaller hospitals and units. This incorporates the shift to a more immersed learning experience, especially in community settings so that students can establish closer relationships with patients and health colleagues essential for contemporary medical practice;
Symbiotic (organic whole) – this is the link with the PRISM where clinical education is the driving force. Partnerships between communities, medical schools, learners and teachers are important and medical education becomes part of an increasingly diffuse and dynamic health system where health care is only one part of the wider public service agenda.

The PRISMS model reflects some of the worldwide trends in medical education, however the specific idea of the 'symbiotic' curriculum (involving partnership with communities and a shift of location of clinical teaching) has been taken forward as a slightly separate and highly influential model in many medical schools, predominantly in Australia and the UK[16].

Despite high aspirations and a successful beginning, these are early days in the life of the new medical school in Samoa and OUM has many areas to improve and build upon before it can consider itself a medical school of high standards in the South Pacific. Attainment of an independent external accreditation sits on top of OUM's list. OUM was recently granted 'Applicant Status' with the Philippine Accrediting Association of Schools, Colleges and Universities[17]. This is an international accrediting body that is recognized by the National Committee on Foreign Medical Education and Accreditation (NCFMEA), a committee of the United States Department of Education. By subjecting itself to such an external accreditation, OUM was able to engage in the process of self-evaluation to identify strengths and also weaknesses that need to be rectified in the eight areas of operations that PAASCU will address. These include: (1) Faculty, (2) Curriculum, (3) Clinical Facilities, (4) Research, (5) Students, (6) Library, (7) Administration, and (8) General Facilities. The preliminary site visits by PAASCU will take place in November 2009.

Finally, OUM decided to make a major commitment to promote and engage in clinical research that is relevant to Samoa and the South Pacific. Not only is this a requirement for PAASCU accreditation (area 4 above) but is also consistent with its mission as a University dedicated to the creation of new knowledge as an institution of higher learning. Making an internationally significant contribution in the area of clinical research will take time, but steps have already been taken to engage in this area through its new Office for Research and Development. OUM plans to launch, in 2009, the *Samoa Medical Journal* and hold the first OUM conference with the theme "Heart Disease in Samoa" featuring international guest speakers. Both initiatives are being launched in partnership with the Samoa Medical Association, National Health Services and the Ministry of Health. OUM realises that engagement in research will result in a better understanding of disease prevalence and mechanisms, identifying specific research projects for MSc and PhD theses as the Medical School continues to grow. OUM places a high premium on medical and

educational research amongst its academic faculty and its partners in the health sector.

In conclusion, OUM, despite its youth, is on a journey to become a medical school of high quality in Samoa, the Oceania region, and beyond. To achieve this goal, its leadership must focus on good governance, achievement of an international accreditation, as well as graduating doctors that meet the approval of the communities they serve. The take home message is that Samoa is no longer isolated and a quality medical school can be realised there. The internet and a dedicated on-site and international faculty will ensure that Samoan and South Pacific Island medical students can get the same educational content and opportunities as those in New York, Melbourne, or London.

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BOOK REVIEW

How Doctors Think

by Gerome Groopman, MD
Houghton Mifflin Company, Boston 2007

According to a review in TIME magazine, this book should be read by "every physician who cares for patients, and every patient who wishes to get the best care." This is a thought provoking book that points out that on average, a physician will interrupt a patient describing her symptoms within eighteen seconds. In that short time, many doctors decide on the likely diagnosis and best treatment.

This book delves into the common basis for incorrect diagnoses. For example, in a study of one hundred incorrect diagnoses, inadequate medical knowledge was the reason for error in only four cases. This is surprising and counter-intuitive. Findings based on autopsies show that 10-15 percent of all diagnoses are incorrect. Clinical intuition is a complex sense that becomes refined over years and years of practice, of listening to literally thousands of patients' stories. Expertise is largely acquired not only by sustained practice but by receiving feedback that helps doctors understand their technical errors and misguided decisions. To become a stellar clinician, the journey has to start by acknowledging the errors, analysing them, and acting on them.

In this book you will read about 'availability,' 'anchoring' and 'zebra retreats' - common traps that can lead to incorrect diagnoses. The latter refers to the fact that once a particular diagnosis becomes fixed in a physician's mind, despite incomplete evidence, the first doctor passes on his (incorrect) diagnosis to his peers and subordinates. A good suggestion from this book is that when a case first arrives, you should not hear anyone else's diagnosis, begin by looking at the primary data.

This book warns about over reliance on MRIs—they find abnormalities in everybody. Trying to relate the abnormality to the pain can be the hard part. The MRI, a revered technology, can constrain a doctor's thinking. When radiologists were asked "Is this film normal?" they disagreed among themselves 20 percent of the time. With so many excellent imaging techniques, doctors hardly examine patients or take detailed histories anymore.

The relationship between doctors and pharmaceutical companies gets a serious discussion in this book. Are pharmaceutical companies striving to change the way doctors think about health and disease? Should all men with low testosterone be on hormone therapy, for instance?

The current culture of medicine, especially in the West, fosters lucrative networks of referrals and procedures, but discourages critical examination of their value. Doctors also should not be paralysed by potential litigation. Without risking failure there is zero chance of success. Some good advice for the young doctor - always read the recent literature regarding your patient who has an unusual clinical case, a variation of a diagnosis. I encourage our local doctors in Apia to read this book. A copy is held on reserve at the Oceania University of Medicine Library at the Motootua campus.

Book review by:
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Information for Authors

The ***Samoa Medical Journal*** (***SMJ***) is produced by Oceania University of Medicine, in partnership with the Samoan Ministry of Health and the Samoan Medical Association. This journal will be published three times per year, beginning in September 2009. The journal is published utilizing the editorial standards of the Council of Science Editors (www.CouncilScienceEditors.org).

The SMJ is intended to support and encourage medical research in Samoa and the Pacific, as well as providing a source of current information to practising physicians. Its goal is to be one element targeting improvements in the quality of health care available to residents in this underserved region. The journal focuses on the Pacific situation - epidemiology, public health, research, interesting case studies, reviews of endemic diseases, local medical news and reviews of relevant articles and books published elsewhere.

It is a great pleasure to invite you to contribute to the ***Samoa Medical Journal***. If you wish to submit your work to the journal, please email us the title and an abstract (up to 250 words) of your article. Alternatively, you may submit the full article.

Please note that submission of a manuscript is not a guarantee for acceptance for publication, as all manuscripts will be subjected to peer review.

Please could you also refer the journal to your colleagues and other contacts in the field, including your librarian, for promotional purposes, submissions and subscriptions.

I look forward to hearing from you soon.

Yours sincerely,

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SOSAIETE A FOMAI O SAMOA
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