children under two years of age. The SMD between the intervention and control groups was 0.48, with a 95% CI of 0.38 to 0.58 in a random model. The test for overall effect gave z = 9.17, P < 0.001. For the two studies with feeding frequency as a percentage (Table 4) showed pooled risk ratio (RR) of 0.99, 95% CI (0.87-1.13). The test for overall effect, z = 0.09, P = 0.926.

Dietary diversity for children aged six months to two years

In the RCT conducted in Brazil [49], health workers who received nutrition training provided counseling to caregivers. Children whose caregivers were counseled by trained health workers had a higher dietary diversity compared to their counterparts (P < 0.001). Similar interventions were conducted in India [47,48,51]. In these trials, too, children in intervention groups had significantly higher dietary diversities compared to their counterparts in control groups. Other RCTs conducted in Pakistan [29], Peru [32], and China [52] showed similar results: high percentages of children in intervention group consumed each type of food items compared to their counterparts in the control group (Table 5).

Discussion

This is the first systematic review to evaluate the effectiveness of nutrition training of health workers on child feeding practices. Previous reviews showed the effectiveness of maternal nutrition education and complimentary feeding interventions to improve child feeding practices [18] and nutrition status [34,40]. Our study helps to show a possible pathway to improve child nutrition status by starting with health worker training. We found that training of health workers can help to improve feeding practices of children between six months and two years of age. The children whose caregivers were counseled by the trained health workers had a higher mean feeding frequency, energy intake, and dietary diversity compared to their counterparts.

Strong evidence thus suggests that nutrition training of health workers improves energy intake, feeding frequency, and dietary diversity of children between six months and two years of age. Such a significant outcome may be conceived of through the following pathway: First, nutrition training can increase or refresh health workers' nutrition and food sciences-related knowledge. Indeed, two RCTs conducted in Brazil [19] and India [46] found that nutrition training of health workers improved their knowledge in nutrition. Nutrition training can be used to update health workers' nutrition knowledge and to alert them to new findings pertinent to their environments [16,28,29,53]. This will enable them to address determinants of undernutrition specific to their areas, and to improve their communication, counseling, and undernutrition management skills [19,29,32,48,49]. Updated management skills including tailored counseling may also be important for the effective transfer of knowledge to the end users – in this case, the caregivers.

Second, nutrition knowledge transfer by skilled and trained health workers may be achieved when they counsel caregivers who visit health facilities [20]. Similarly, trained health workers may also access caregivers through outreach and home visits even in rural areas, and may achieve a similar outcome through such routes [47,54]. Previous RCTs showed improved nutrition knowledge and knowledge retention among caregivers counseled by health workers who received nutrition training [16,29,31,32,49,54].

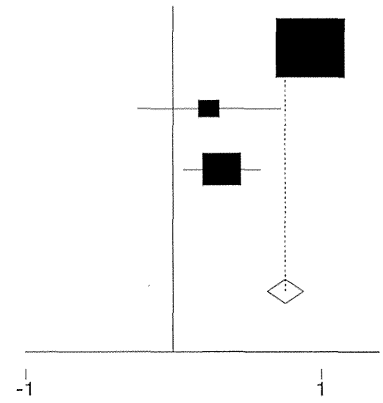
Third, the counseled caregivers can serve as agents of change. Caregivers endowed with updated nutrition knowledge through frequent counseling can improve their own child feeding behaviors [16,20,28,29,31,32,47-49,52,55]. Such behaviors may include food preparation hygiene, feeding frequency, proper mixing of quality foods, increased energy intake, and dietary diversity. Thus, children's growth can improve and their risk of undernutrition can be minimized [34]. Secondarily, other determinants of undernutrition such as food-borne infections can be reduced [32,56,57] and food preparation hygiene improved [52].

Nutrition counseling from trained health workers has been proven effective even in areas of limited food availability [31,34]. In such circumstances, caregivers were able to choose the right mix of foods under availability constraints. For example, in the RCT conducted in Bangladesh, about a third of families were poor and lived in food-insecure households. Despite such hardship, nutrition knowledge gained from trained health workers motivated and changed their feeding behavior. Thus, they could provide the required balance of foods to their children [31].

The findings of this review should be interpreted in light of several limitations. First, the selected studies came from different regions and there is a risk of regional variations. Such regional variations can cause differences in characteristics of participants as shown in Table 2. Also, the selected studies were conducted in the context of different health systems. In this case, the nutrition training was conducted to the health workers of different carders. For example, in Bangladeshi and India studies, training was conducted among nutritionists and other health carders including medical officers. In other settings, training was conducted among health carders available in such settings, including doctors, primary health care providers, auxiliary nurses, midwives, health assistants, and community health workers as shown in

Table 3 Effectiveness of the intervention on the energy intake per day mean energy intake (kJ/day)

Study, year	SMD	95% CI	% Weight	Forest plot
Bhandari N, 2004	0.93	0.78-1.07	72.07	
Santos I, 2001	0.24	−0.24-0.73	6.32	
Pachon H, 2002	0.33	0.07-0.59	21.61	
I-V Pooled SMD	0.76	0.63-0.88		
Heterogeneity chi-square = 19.91 (d.f. = 2) p < 0.001				
Test of SMD = 0; z = 12.17 p < 0.001				



Median energy intake (kJ/day)

Bhandari N, 2001	0.38	0.10-0.67	42.45	
Vazir S, 2012	1.55	1.31-1.80	57.55	
I-V pooled SMD	1.06	0.87-1.24		
Heterogeneity chi-squared = 37.63 (d.f. = 1) p <0.001				
Test of SMD = 0: z = 11.22 p < 0.001				

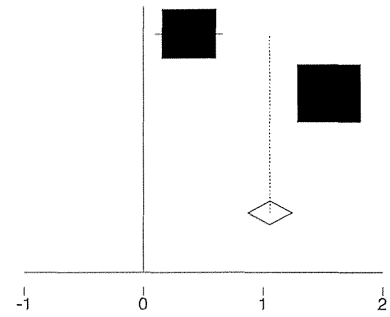
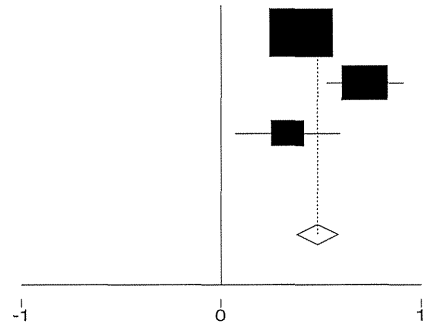


Table 4 Effectiveness of intervention on the feeding frequency per day mean feeding frequency per day

Study, year	SMD	95% CI	% Weight	Forest plot
Bhandari N, 2004	0.40	0.26-0.54	55.94	
Shi L, 2009	0.72	0.53-0.91	28.82	
Pachon H, 2002	0.33	0.07-0.60	15.24	
I-V Pooled SMD	0.48	0.38-0.58		
Heterogeneity chi-squared = 8.42 (d.f. = 2) p = 0.015				
Test of SMD = 0 : z = 9.17 p <0.001				



Feeding frequency >3 times per day

Study, year	RR	95% CI	% Weight
Roy SK, 2005	0.80	0.66-0.98	52.01
Kilaru A, 2005	1.20	1.01-1.43	47.99
M-H pooled RR	0.99	0.87-1.13	
Heterogeneity chi-squared = 8.93 (d.f. = 1), p = 0.003			
Test of RR = 1: z = 0.09, p = 0.926			

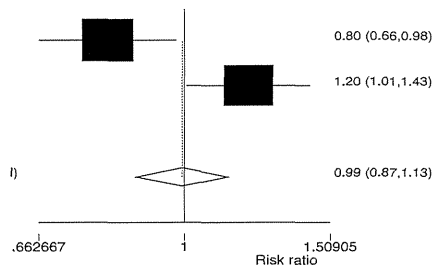


Table 5 Effectiveness of the intervention on the dietary diversity of children under two years of age

Author, Year	Outcome	Intervention (%)	Control (%)	P-value
1. Santos I, 2001	Dietary diversity at 18 months	N = 206	N = 216	P-value
	Egg yolk	19.20	8.20	P < 0.01
	Shredded chicken and beef	15.50	6.30	P < 0.01
	Chicken liver	20.50	6.80	P < 0.001
	Oil, margarine or butter	16.90	0.50	P < 0.001
2. Bhandari N, 2004	Dietary diversity at 18 months	N = 435	N = 394	
	Cereal legume gruel or mix	49.6	31.7	P < 0.001
	Milk cereal gruels or mix	133.3	14.9	P < 0.001
	Undiluted milk	60.5	12.9	P < 0.001
	Added oil/butter	24.1	5.8	P < 0.001
	Snacks	58.2	54.1	
	Commercially available bread	23.0	10.7	P < 0.001
	Home-made bread	82.1	86.3	
	Rice	8.3	7.6	
	Potatoes	29.0	22.1	P < 0.001
	Legumes	29.7	23.9	P < 0.01
	Milk	98.6	95.9	
	Vegetables	26.0	24.1	
	Fruits	144.8	40.4	
3. Penny ME, 2005	Dietary diversity at18 months	N = 171	N = 167	
	Egg, chicken liver or fish	64.0	57.0	
4. Zaman S, 2008	Dietary diversity at 18 months	N = 126	N = 131	
	Eggs	47.6	26.7	
	Chicken/beef/mutton	60.3	39.7	
	Liver	30.9	19.9	
	Added ghee/butter/oil	53.9	38.2	
	Thick kitchuri	65.9	44.3	
5. Shi L, 2010	Dietary diversity at 12 months	N = 256	N = 234	
	Bread, rice, noodles	100	98.3	
	Roots or tubers	90.9	73.8	
	Yellow/orange foods	97.2	76.7	
	Green leafy vegetables	97.6	87.9	
	Beans/peas/lentils	92.1	67.2	
	Fruits	99.6	96.6	
	Eggs	98.8	92.2	
	Meat or organ meats	96.9	58.2	
	Cooking oils/fats	96.5	79.7	
6. Kilaru G, 2005	Dietary diversity at 11 months	N = 173	N = 69	
	At least 5 different groups	42.0	19.0	P = 0.01

Table 5 Effectiveness of the intervention on the dietary diversity of children under two years of age *(Continued)*

7. Vazir S, 2012	Dietary diversity at 15 months	N = 170	N = 168
	Rice	99.5	94.9
	Goat/chicken liver	38.0	13.1
	Goat meat	43.5	33.0
	Poultry	37.5	18.9
	Banana	79.3	61.9
	Buffalo milk	81.5	72.7
	Egg	73.9	54.0
	Spinach	42.4	29.5
	Pulses	89.7	71.6
	Added fat	42.4	29.5

Table 2. To minimize this limitation, we selected RCTs and cluster RCTs as these studies can minimize the effect that could have been caused by differences in intervention and control groups. Meta-analysis pools the SMDs of each study into a single effective size. This can help to reduce any discrepancies arising from variations across studies.

Second, we could not conduct a meta-analysis for the dietary diversity outcome. This was due to the differences in types of foods reported in the trials included in this study. Such differences were also due to regional variations in the typical diet. Also, in all the selected studies, dietary diversity was not a primary outcome. Lack of a standard method for data collection on dietary diversity might also be a reason for such differences. To minimize the effect of variations in food type, regional, and methodological aspects, we compared the results of diets consumed within the trials. All the seven trials showed better dietary diversity for the intervention compared to the control groups. Therefore, despite the regional and methodological differences in reporting dietary diversity, all studies showed the effectiveness of the intervention on dietary diversity among children under two years of age.

Third, our results showed a significant heterogeneity among the selected studies. This might manifest in differences in training duration and qualifications of health workers, in targeted age groups, in follow-up procedures, and in regional context. We could not retrieve the training duration for all of the selected trials. However, some of the selected trials used a standardized Integrated Management of Childhood Illness (IMCI) training manual developed by WHO, while others used results of formative research conducted prior to the trial. Moreover, results from all the selected studies were consistent. Although these studies were conducted in different regional contexts, they all showed a significant improvement in feeding practices when health workers received nutrition training.

Fourth, due to time limitations, we did not register a study protocol prior to the review process. To minimize such limitations, we developed the in-house review protocol based on the pre-set guidelines before starting the evidence search. The protocol was shared among the research team and the three independent researchers who conducted the evidence search. We evaluated each step of data collection as a team to verify the scrupulous use of the protocol. To this end, we were satisfied that the original protocol was adhered to.

Fifth, our results may also not be generalizable beyond the low- and middle-income countries where the selected studies were conducted. However, based on the global nutrition situation, these are the areas with the highest burden of child undernutrition. These results may thus be especially useful to scale up the nutrition training of health workers toward improving the current child undernutrition situation.

Despite its limitations, our study also has notable strengths. This is the first systematic review to examine the effectiveness of nutrition training of health workers on child feeding practices. Second, we used the GRADE method to critically assess the quality and strength of the evidence presented. Overall, the evidence of intervention effectiveness on feeding frequency and energy intake was of high quality. Thus, the results of this systematic review may help to design policies to improve feeding practices of children through training of available health workforce cadres.

In conclusion, nutrition training for health workers can improve feeding practices for children under two years of age. Such practices include feeding frequency, energy intake, and dietary diversity. Training materials should be prepared based on the local context and should include information on how to identify foods that are available, affordable and acceptable, which is particularly important in areas of limited food availability. Moreover, trained health workers offer the prospect of an accessible and reliable information resource for local

families. In this way, nutrition training for health workers can serve as an important entry point for a sustainable strategy toward improving the nutrition status of young children.

Additional files

Additional file 1: Search strategy: PubMed.

Additional file 2: Risk of bias assessment.

Competing interest

The authors declare that they have no competing interest.

Authors' contributions

BFS conceived the research questions, designed the study, participated in the literature review and analyses, and prepared the first draft. KCP refined the research question, participated in analysis, and refined the first draft. LBM contributed to the study design, participated in the literature review and analyses, and helped to prepare the first draft. PS participated in the literature review and analysis. DPU revised the protocol and the drafted manuscript. MJ reviewed the study protocol, the manuscript, and approved the submission. JY participated in the research design, analyses, and preparation of the first draft and revisions. All the authors read and approved the final version of the manuscript for submission.

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Migration of Health Workers in the Pacific Islands: A Bottleneck to Health Development

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Abstract

Human resources for health (HRH) are a crucial component of a well-functioning health system. Problems in the global HRH supply and distribution are an obstacle to achieving the health-related Millennium Development Goals and other health outcomes. The Pacific Island region, covering 20 000 to 30 000 islands in the South Pacific Ocean, is suffering a serious HRH crisis. Yet updated evidence and data are not available for the 22 Pacific Island Countries and Territories. The objective of this study was thus to explore the current HRH situation in the Pacific Island region, focusing particularly on the issue of health workforce migration. HRH trends and gaps differ by country, with some showing increases in HRH density over the past 20 years whereas others have made negligible progress. Currently, three Pacific Island countries are facing critical HRH shortages, a worsening of the situation from 2006, when HRH issues were first brought to widespread global attention. In this region, skilled personnel migration is a major issue contributing to the limited availability of HRH. Political commitment from source and destination countries to strengthen HRH would be a key factor toward increasing efforts to train new health personnel and to implement effective retention strategies.

Keyword

human resources for health, Pacific Islands, migration

Introduction

Profound inadequacies in available human resources for health (HRH) pose a persistent global challenge with far-reaching repercussions. Critical shortages are often coupled with skill mix imbalances and uneven geographic distribution. The resulting HRH crisis creates a serious bottleneck for achieving the health-related Millennium Development Goals and other health development objectives, including the emerging health systems agenda of tackling noncommunicable diseases in low-income and middle-income countries.[1] Health workforce insufficiencies

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also negatively affect preparedness for and response to global security threats posed by emerging and epidemic-prone diseases, including avian influenza, severe acute respiratory syndrome, and hemorrhagic fevers, as well as natural and man-made disasters.[2] Moreover, with the growing impact of climate change on health, the need for skilled health workers is greater than ever.[3]

The World Health Organization (WHO) underscored the key challenges facing the world's health workforce in its annual World Health Report (WHR) for 2006, titled, "Working Together for Health."[4] Among the key HRH challenges highlighted was the adverse effect of health workers out-migration, a factor that continues to be especially significant among the low-income countries.[5] Loss of health workers through migration not only weakens already compromised health systems but also represents a costly loss of scarce and expensively trained human capital. In sub-Saharan Africa, for example, financial losses due to migration of doctors from only nine countries was estimated at more than $2 billion.[6] Loss of significant numbers of key health workers affects core national strategies for health sector development, creating problems for health care as well as for human resource planning and development. Countries most affected by such impacts tend to be relatively poorly performing economies, notably the small Pacific Island states.[7]

Despite advances in bringing the health workforce to the fore in international health policy arenas and alongside individual examples of progress in tackling the problem, the health workforce continues to be acutely felt in the Pacific Island Countries and Territories (PICTs). Based on projections for health care professional shortages in 2015, the greatest doctor shortages will be in PICTs—Papua New Guinea (PNG) and Vanuatu, both of which have a 0.50 doctor per 1000 population deficit.[8] Yet evidence for this critical region is still very limited. Since the WHR 2006, no synthesis of available HRH data has been undertaken for the 22 PICTs comprising the WHO for Western Pacific Region.

The PICTs cover 20 000 to 30 000 islands located over a vast stretch of the South Pacific Ocean. Population sizes range from 1167 in Tokelau to 6 609 745 in PNG, with wide variations in social and economic conditions, health infrastructure, and health workforce training throughout the region. Despite the uniqueness of each nation or territory, the region shares a number of distinct and broadly common characteristics: small populations dispersed over large distances, occupying small land areas and vulnerable to environmental threats and natural disasters. Moreover, they share a lack of resources and a geographical isolation that is the basis of many of the challenges they face in health workforce education, training, and development.[9] Like many other parts of the world, the region has recently experienced a major shift in disease burden, with noncommunicable diseases overtaking communicable diseases as a critical health and development issue; rates of chronic disease in PICTs are now among the highest in the world and the leading cause of morbidity and death in the region.[10,11]

The well-known link between health workforce density, service delivery, and population health outcomes has been clearly demonstrated.[12,13] The impact is reflected in health system performance indicators, including measures of maternal and child health.[14] It is not then surprising that some of the highest under-5 and maternal mortality rates are found in PICTs, where ratios of health workers to population are especially low (Tables 1 and 2). Of particular note, the migration of health workers, both regionally and internationally, imposes a significant burden on the health sectors of countries in the Pacific Island region. It is in this context that we frame the present review of the current state of HRH in the 22 PICTs.

Current State of Human Resources for Health

In the WHR 2006,[4] PNG was the only country of the 22 PICTs to be listed as one of the 57 countries facing critical shortage of HRH. Recent data from the Western Pacific country

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Table 1. Maternal Mortality Ratio per 100 000 Live Births in Pacific Island Countries and Territories[a]

Country	1999-2002	2003-2006	2007-2010
American Samoa	123.0	NA	NA
Cook Island	0.0	0.0	0.0
Federation of Micronesia	159.7	317.0	0.0
Fiji	35.3	50.5	27.5
French Polynesia	21.1	0.4	22.6
Guam	0.0	0.0	NA
Kiribati	103.0	158.0	0.0
Marshall Islands	73.8	0.0	143.0
Nauru	300.0	NA	NA
New Caledonia	NA	NA	0.0
Niue	NA	0.0	NA
Northern Mariana Islands	0.0	NA	NA
Palau	NA	11.6	0.0
Papua New Guinea	330.0	733.0	NA
Samoa	19.6	3.0	NA
Solomon Islands	125.0	236.0	103.0
Tokelau	0.0	NA	0.0
Tonga	78.2	83.3	36.4
Tuvalu	0.0	0.0	NA
Vanuatu	NA	70.0	86.0

Abbreviation: NA, not available.
[a]No data available for Pitcairn Island and Wallis and Futuna. The table presents the most updated data during the mentioned period.

health information profiles 2011[15] show changes in the health workforce density in these countries compared with the data presented in the WHR 2006 (Table 3). Among the PICTs, although the average density of doctors, nurses, and midwives has increased to 4.87 per 1000 population (from 3 per 1000 population in 2006), the number of countries with critical shortages has also increased to 3. In PNG, health workforce density remains critically low at 0.52 per 1000 population; meanwhile, Samoa and Vanuatu have also acquired HRH crisis status with health workforce densities of 1.21 and 1.73 per 1000 population, respectively. The Solomon Islands are also worth mentioning here, as the territory has a health workforce density of 2.32 per 1000 population, at the borderline of the critical shortage cutoff. On the other hand, there are PICTs such as Tokelau and Niue with densities as high as 13.61 and 12.67 per 1000 population, respectively.

Trends in Density Between 1996 and 2010

Using data from the Global Health Observatory repository[16] and the Western Pacific Country health information profiles 2006-2011,[15,17-21] we have observed trends in the density of doctors, nurses, and midwives for the 13 PICTs for which data were available. Between 1996 and 2010, the density of doctors decreased in Nauru, Micronesia, and Samoa, whereas it remained stable in PNG. In Kiribati, Marshal Islands, Niue, Solomon Islands, Tonga, and Tuvalu, the density of doctors increased. Between 2001 and 2010, densities decreased in Fiji, Palau, and Vanuatu (Figure 1).

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Table 2. Under-5 Mortality Rate per 1000 Live Births in Pacific Islands Countries and Territories[a]

Country	1999-2002	2003-2006	2007-2010
American Samoa	4.9	NA	NA
Cook Island	10.2	11.0	7.1
Federation of Micronesia	NA	41.0	39.0
Fiji	22.4	25.8	23.2
French Polynesia	9.0	14.7	6.5
Guam	12.3	10.0	NA
Kiribati	69.0	69.0	61.0
Marshall Islands	48.0	NA	28.0
Nauru	19.1	37.9	37.9
New Caledonia	9.1	NA	NA
Niue	NA	0.0	NA
Northern Mariana Islands	7.4	NA	NA
Palau	29.0	23.1	12.2
Papua New Guinea	88.0	74.7	NA
Samoa	13.7	13.0	15.0
Solomon Islands	73.0	52.0	37.0
Tokelau	0.0	NA	0.0
Tonga	13.9	NA	19.7
Tuvalu	25.4	32.4	24.6
Vanuatu	NA	36.0	31.0

Abbreviation: NA, not available.
[a]No data available for Pitcairn Island and Wallis and Futuna. The table presents the most updated data during the mentioned period.

Between 1997 and 2010, density of nurses and midwives decreased in the Marshall Islands and PNG but increased in 11 other PICTs. Increases in density varied by country: Palau showed the biggest increase in density, from 1.5 per 1000 in the 1997-2000 period to 5.8 per 1000 in the 2006-2010 period. Although there were no data available for Niue for the 1997-2000 period, between 2001 and 2010, this country showed an increase in density from 10 to 15 per 1000 population (Figure 2).

Gaps in Human Resources for Health

Based on parameters defined by Scheffler and colleagues,[5,22] we assume that a country needs 0.55 doctors per 1000 population and 1.73 nurses and midwives per 1000 population to meet population health needs. Using this threshold and the most recent data available from the WHO Western Pacific Region database, we calculated the gaps in these cadres. Such analyses revealed that 7 out of 22 PICTs (Fiji, Kiribati, Northern Mariana, PNG, Samoa, Solomon Islands, and Vanuatu) are facing critical shortages of doctors (Figure 3). The doctor shortages in terms of density ranged from 0.15 per 1000 population in Kiribati to 0.50 per 1000 population in PNG.

Regarding the density of nurses and midwives, we found that 4 out of 22 PICTs (PNG, Samoa, Tuvalu, and Vanuatu) are facing critical nurse shortages (Figure 4). The nurse and midwife density shortages range from 0.1 per 1000 population in Tuvalu and Vanuatu to 1.26 per 1000 population in PNG. Among these countries, PNG, Samoa, and Vanuatu are facing crises of doctor, nurse, and midwife shortages.

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Table 3. Latest Data on Density of Doctors, Nurses, and Midwives in the Pacific Island Countries and Territories[a]

Country	Density of Doctors, Nurses, and Midwives per 1000 Population
American Samoa[b]	2.69
Cook Island[c]	3.65
Federation of Micronesia	3.04
Fiji	2.48
French Polynesia	6.72
Guam[d]	0.84
Kiribati	4.30
Marshall Islands	2.92
Nauru	7.41
New Caledonia	7.13
Niue	12.67
Northern Mariana Islands	3.09
Palau	7.26
Papua New Guinea	0.52
Pitcairn islands	No available data
Samoa[e]	1.21
Solomon Islands	2.32
Tokelau	13.61
Tonga	4.43
Tuvalu	5.11
Vanuatu	1.73
Wallis and Futuna	5.21

[a]All data correspond to densities after the year 2006.
[b]Data from 2003.
[c]Data from 2004.
[d]Density only for doctors.
[e]Data from 2005.

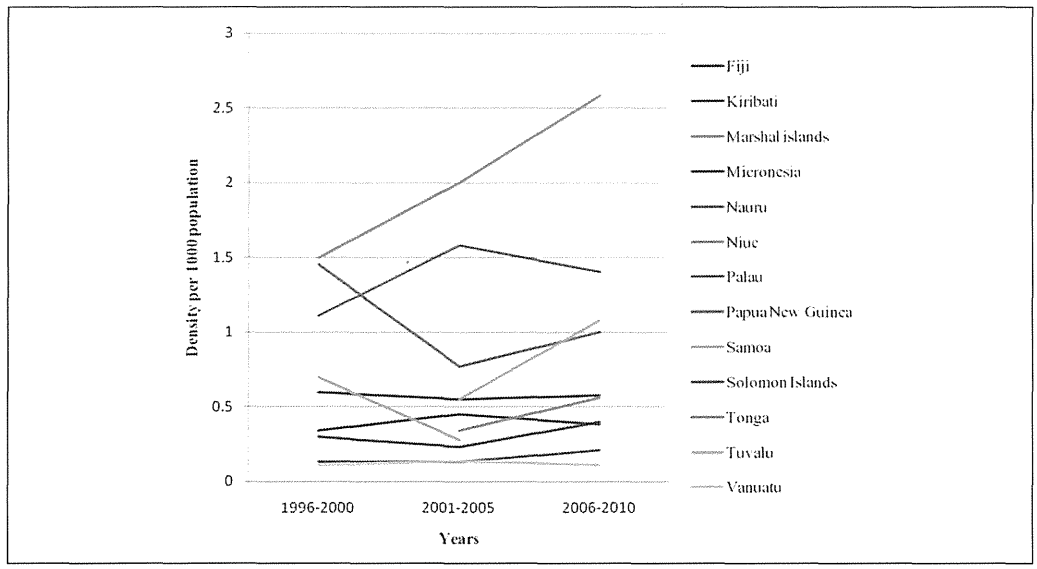

Figure 1. Trends in doctor density during 1996-2010 in the Pacific Island Countries and Territories

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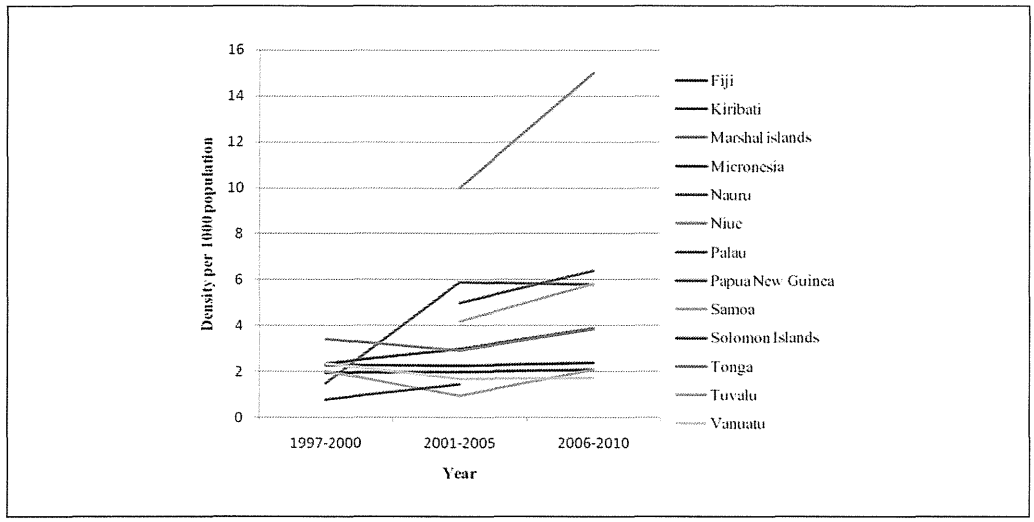

Figure 2. Trends in nurse density during 1997-2010 in the Pacific Island Countries and Territories

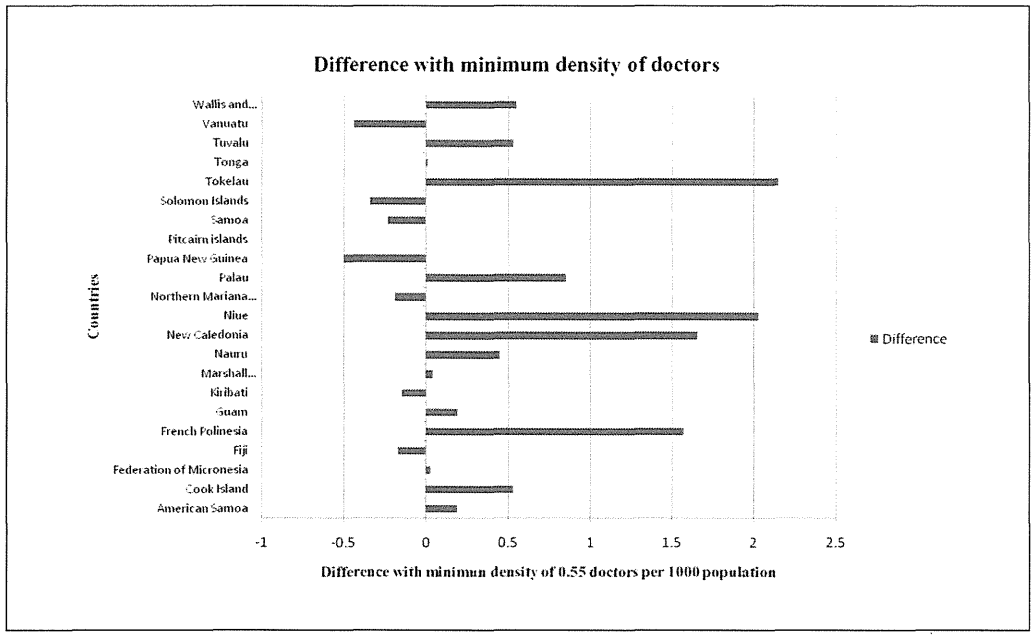

Figure 3. Doctor density levels in relation to the minimum threshold among the Pacific Island Countries and Territories

Migration of Human Resources for Health From the Pacific Islands

Migration Patterns

The capacity of a health system to deliver services to a population depends critically on the availability of a skilled health workforce. Loss of significant numbers of health workers not only hampers progress toward the Millennium Development Goals but also affects service provision,

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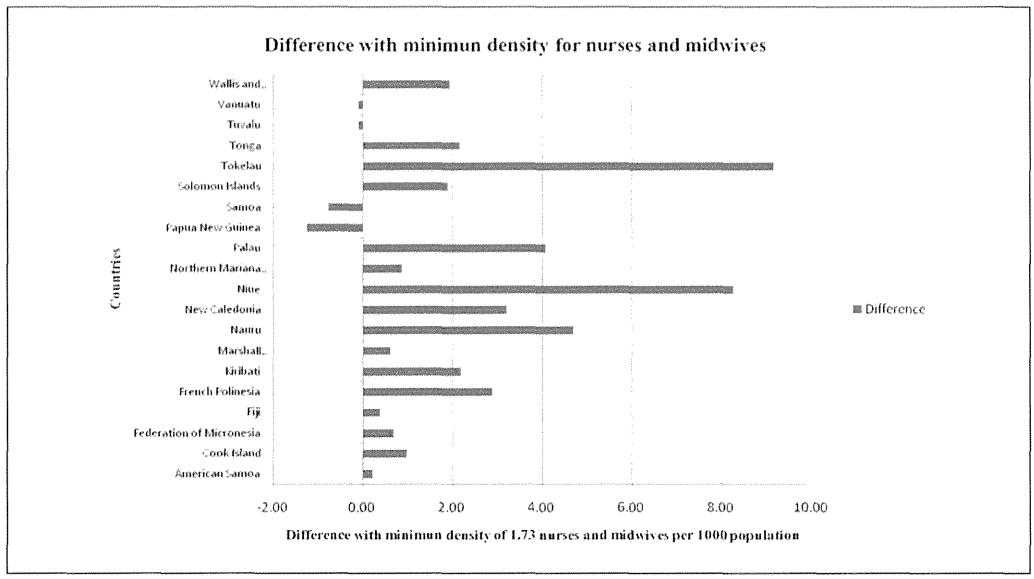

Figure 4. Nurse and midwife density levels in relation to the minimum threshold among the Pacific Island Countries and Territories

quality of care, and distribution of the health workforce. In broad terms, it contributes to the poor performance of health systems in the region. Although health workforce availability in the countries that retain a close political relationship with the United States (US-affiliated Pacific Islands) is better than in other PICTs, partially because of better salaries and working conditions, migration of skilled health workers is considered to be the major cause of health workforce shortages in the PICTs.[23]

Three types of migration of health workers can be observed in the Pacific Region according to Diallo's[24] classification on migration: internal, international, and the "cross-industry" migration of workers leaving the health sector to work in the nonhealth sector. The first type, internal migration, is the movement of health workers within a country, from district to district, or between rural and urban areas. In the Pacific Region, this type of migration has grown significantly as more people move from outer and isolated rural areas to more metropolitan coastal regions.[23] Disparities in the urban–rural distribution of health workforce have increased, as the nation's general population has concentrated in more urban areas, such as Tongatapu in Tonga, Upolu in Samoa, South Tarawa in Kiribati, and Efate in Vanuatu.[23]

International migration is the second type of movement, in which health workers temporarily or permanently settle abroad.[24] Many health workers from PICTs migrate to the United States, Canada, Australia, New Zealand, and the United Kingdom.[23] Overseas recruitment of health workers from resource-poor countries, including the PICTs, can fill the vacancies in these countries, which have a constant need to expand their health workforce. These destination countries share similar immigration policies, in which acquisition of permanent skilled migrants is among the major objectives.[23] Apart from international migration to these five major destinations, migration within the PICTs region also heavily affects the Pacific Islands. In particular, Fiji is a major migration destination for health workers in the PICTs. It has the most advanced health care system in the region, which frequently attracts temporary migrant health workers from other PICTs.[23] The Fiji School of Medicine has provided specialist training for doctors since the late 1990s, but loss of graduates to overseas migration and to the local private sector has exacerbated the shortage of health workers in Fiji nevertheless.[23]

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The third type of migration, "cross-industry" migration, has a similar impact on health service delivery as do other types of migration. Health workers leaving their positions for more attractive positions in nonhealth sectors contributes to the loss of skilled health workers from the health sector.[24] This loss can come at a high cost to island states and health systems through the long training duration, high training costs, and resulting reduction of service quality.[23] The remittances from the migrants may not offset the loss because they do not return to the health sector. Indeed, a study on the remittances of migrant Tongan and Samoan nurses from Australia showed that remittances are mostly used in consumption objectives.[25]

Migration is usually not a one-way process. Beyond the three types of migration described above, influx of health workers, such as through the return migration of health workers and immigration of expatriate health workers, has also occurred in the Pacific region. Tonga is a country that has approximately the same amount of its population living overseas and in the country.[23] A qualitative study on return migration to a village in Tonga suggested that overseas training with bonding to return and the commitment to contribute to their home country may prompt workers to apply their skills locally on returning to the country.[26] Expatriate health workers also migrate into the PICTs. Expatriate doctors in Fiji were from Myanmar, Hungary, Pakistan, the Philippines, and Nigeria, whereas expatriate doctors and nurses in Palau came from more diverse countries.[23] Such health workers were under contracts of various durations.[23] However, the influx of health workers in the PICTs is of rather limited magnitude compared with international health workforce migration.

Reasons for Migration

Migration is a personal decision shaped by changing personal circumstances and by the social and economic context in which decisions are made.[27] Understanding the reasons for migration can shed light on potential solutions as the PICTs seek to retain their health workers.

An empirical study done by Brown and Connell[28] has shown that income and nonincome factors influenced the decision regarding present or future migration of 251 doctors and nurses from Fiji, Samoa, and Tonga. This study showed that income was the major reason for international migration among both doctors and nurses. Tongan nurses earn relatively less than do other Tongans, either abroad or at home. In Tonga, the differential between mean incomes of nurses and the national mean per capita income was greatest.[28] This becomes a push factor for Tongan nurses to migrate, making them more likely to do so than those from Fiji or Samoa.[28]

One nonincome factor affecting migration from the PICTs to Australia and New Zealand found in the same study is related to the residence of kin.[28] Both doctors and nurses are more likely to migrate overseas or return home when they have families abroad or in their home country. Other reasons for migration include dissatisfaction with evident career structures, lack of promotion opportunities, and lack of access to modern technology and training.[28] Low professional satisfaction in aspects of professional growth, working conditions, and recognition and value for professional roles are also key reasons for specialists in Fiji to leave the public sector and to migrate.[29]

Retention Issues

Because of the serious problems stemming from loss of health workers due to migration, retention of health workers in the PICTs has become a crucial area of focus for the region. PICTs facing health workforce shortages need to identify the major cause of the shortage and the incentives and retention strategies to encourage health workers to remain in the local health sector.[30]

Although financial incentives are major pulling factors from destination countries, providing financial incentives is not enough to motivate health workers.[31] Provision of career development

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support represents one of a few powerful incentives for health workers to remain in the country. A qualitative study collected data from 120 specialist trainees in the Fiji School of Medicine from 1997 to 2004. Of 120 trainees, 66 of the graduates were Fijian. Among Fijian graduates, 48.5% of trainees remain in the public sector in Fiji, indicating that local or regional postgraduate training may help to increase retention of doctors.[32]

The Situation of Migration

New Zealand and Australia are the most important destinations for emigrated specialized health workers from the Pacific Islands.[33] These two countries attract inordinate numbers of health workers from the economically disadvantaged and smaller nations and thus further weaken their health systems. A strong historical tie exists among the PICTs, New Zealand, and Australia, partly because of physical proximity as well as financial links in the form of Overseas Development Assistance and bilateral assistance.[34] Such assistance is far too meager to compensate for the professional loss from especially smaller islands in which the limited specialized health workforce is the backbone of an already weakened health system.

The census-based data analyzed in 2008 showed that 652 doctors and 3,467 nurses born in the PICTs were working in New Zealand and Australia in 2006.[35] Such numbers are higher or almost equal to the number of health workers who have remained to work in these small islands. The majority of these specialized health workers were from Fiji, a country with a doctor-to-patient ratio of 0.38, a ratio that falls well below the international standard.[36] According to census data, a total of 361 doctors and 1828 nurses in Australia and New Zealand were Fiji born. These numbers are higher than the 339 doctors and 1682 nurses who were working in Fiji in the same year.[36] The existing HRH gap in Fiji would have been narrowed if at least some of these migrants remained to work within the island.

After Fiji, PNG contributes the second highest number of emigrated skilled professional health workers in New Zealand and Australia. Census data reveal that 160 doctors and 441 PNG-born nurses were working in New Zealand and Australia in 2006.[35] According to the 2006 WHO report,[36] the number of doctors that emigrated to New Zealand and Australia is almost half of the doctors reported to be working in PNG. Importantly, PNG has the worst doctor-to-patient and nurse-to-patient ratios in the region and was declared an HRH crisis country in 2006.[4] It has a density of 0.05 per 1000 population for doctors and 0.53 per 1000 population for nurses[36] and the widest gap in terms of both nurses and doctors compared with the minimum required number of health workers.

Samoa also has low doctor and nurse densities, yet the Samoan health workers in New Zealand and Australia rank third in population among other Pacific Islanders. Whereas in Samoa there were only 120 physicians and 346 nurses in 2006,[36] 42 Samoan-born doctors and 461 Samoan-born nurses were working in Australia and New Zealand.[35] Such migration drove the health worker densities lower than the internationally acceptable levels and thus created a negative balance and a gap in health service delivery.

In the census data on specialized health workers who emigrated to Australia and New Zealand, Tongan doctors constituted 26 whereas nurses numbered 421.[35] Tonga has only 35 doctors and 322 nurses working in its health system, giving rise to a doctor density of only 0.34 and a nurse density of 3.16 per 1000 population.[36] In simple terms, more Tongan nurses were working in Australia and New Zealand relative to those available in Tonga itself. Such a trend was also common in other PICTs such as the Cook Islands, where there are only 14 doctors and 49 nurses in the health system. This is equivalent to doctor and nurse densities of 0.78 and 2.72 per 1000 population, respectively.[36] Yet 14 doctors and 77 nurses born in the Cook Islands were working in Australia and New Zealand.[35] Migration of these specialized health workers could have been a factor that contributed to the gap in the health workforce of the Cook Islands.

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Other Pacific Island–born doctors and nurses working in Australia and New Zealand were from Niue, a country that had only 4 doctors and 12 nurses by the year 2006, whereas 7 Niue-born doctors and 47 Niue-born nurses were found in New Zealand and Australia in the same year.[35] Although, because of its small population size, the country was not regarded as a crisis country in the WHR 2006, such a trend left unchecked may collapse the entire health system of the Island. Kiribati had 20 doctors by 2006 and had also exported 6 to both countries; it also had 370 nurses working in the country whereas 18 were working in Australia and New Zealand.[28] Kiribati has a doctor density of 0.2, which is lower than the minimum recommended density by international standards.

Shortages of specialized health workers in the PICTs may be at least partially explained by migration. There were as many doctors and nurses working in just 2 developed countries (ie, Australia and New Zealand) as there were practicing in the Islands themselves. Such a trend is still not static; instead, many more health workers are still migrating, thus creating even a wider gap. If left unaddressed, it may lead to an HRH crisis in most of the small PICTs, where even the departure of a single physician or nurse may lead to the closure of a health facility.

Human Resources for Health After the Political Declaration in Samoa

The Pacific Code of Practice for Recruitment of Health Workers in the Pacific Region was developed in 2007.[33] This move was in response to the WHR 2006,[4] which called for government, development partners, and the WHO to step into the crisis in order to address critical HRH challenges: international health workers migration; national health workforce strategic planning, management, and support; scaling up of health workers production; and building partnerships and alliances in supporting national plans. The code was also created because of concern over the emigration of specialized health workers from the PICTs, further weakening their health systems. Therefore, in addressing the health resources problem in the region, health ministers formulated the Samoa Commitment[37] to manage migration, encourage health workers' return, scale up health worker production, and retain these health workers within their respective countries. The Samoa Commitment ultimately gave rise to the Pacific Code of Practice for Recruitment of Health Personnel from the Pacific region. Along with the code of practice, the process of developing a regional HRH strategy for 2006-2015 was set into motion.[38] Both strategic plans and the declaration aimed to improve the health workforce situation in the Pacific Island region.

Despite the Samoa Commitment that led to the Pacific Code of Practice and a regional HRH strategy for 2006-2015, which has been in action for years now, the PICTs have continued to bleed their scarce specialized health workers to the wealthier nations. In this sense, the Code and thus its regional strategy have not been successful in stemming the brain drain catastrophe in the health sector.

Compared with the time before the Samoa Commitment, the Pacific Code of Practice, and the HRH strategy for 2006-2015, doctor and nurse densities in some islands continue to fall even to this date. This has created a further negative drift in demand and in the real availability of health workers. PICTs that reported lower density of nurses post–Samoa Commitment included the Marshall Islands, Palau, and Vanuatu. A lower density of doctors was recorded in Fiji, Micronesia, Palau, Vanuatu, and PNG.[36] Nevertheless, in the wake of the Code of Practice, many PICTs have observed increases in health workforce densities. An increase in the density of doctors was recorded in Kiribati, the Marshall Islands, Nauru, Niue, Solomon, Tonga, and Tuvalu. Similarly, the density of nurses also increased in Fiji, Kiribati, Micronesia, Samoa, Niue, Tonga, and Tuvalu.[36]

Against such a backdrop, political determination within the countries themselves, as well as regional planning and strategies, may help forge a way to address the HRH crisis and have a

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common goal in achieving better health worker densities. Such a plan, if well designed and implemented across islands and wealthier recipient countries, may make it possible to halt the deterioration of the health workforce in the PICTs.

Conclusion

At present, PNG, Samoa, and Vanuatu are facing critical HRH crises. Some PICTs have increased their overall densities of doctors, nurses, and midwives; however, the number of countries in the region facing critical shortages has increased from 2006. Migration of skilled health personnel from the region is a major factor contributing to this situation. To ameliorate the deficit, support from destination countries to strengthen HRH in PICTs would make migration a win-win situation. In addition, the Pacific Island region must devote more resources to strengthening this key health system building block. To this end, efforts should focus on training new personnel and on retaining them with financial and nonfinancial incentives. The Asia-Pacific Academic Consortium for Public Health can provide a platform for knowledge exchange and enhance the research capacity in the region.[39] Regional political commitment will play an important role to sustain and enhance these efforts toward universal access to skilled health workers in the PICTs.

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