Child morbidity as described by hospital admissions for primary school aged children in Tonga 2009–2013

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ABSTRACT

AIMS: To describe inpatient utilisation patterns for primary school aged children in Tonga.

METHODS: We described admissions for children aged 5–11 years to the main hospital in Tonga from January 2009 to December 2013. Rates with 95% confidence intervals (CI) were compared using rate ratios (RR).

RESULTS: There were 1,816 admissions. The average annual admission rate was 20.2/1,000 (95% CI 19.3–21.1). Hospital admission rates were higher in younger than older children (5–7 versus 8–11 years, RR=1.28, 95% CI 1.18–1.41) and in boys than girls (RR=1.52, 95% CI 1.38–1.68). Injury and poisoning (28%), non-respiratory infectious diseases (19%), respiratory conditions (16%), abdominal/surgical conditions (13%) and dental (9%) were the most frequent admission reasons.

A larger proportion of younger versus older children were hospitalised for dental (16% vs 1%, P<0.001) or respiratory conditions (18% vs 14%, P=0.02). A larger proportion of older children were hospitalised for abdominal/surgical conditions (15% vs 11%, P=0.008), other infectious diseases (21% vs 17%, P=0.04), other conditions (10% vs 6%, P<0.001) and cardiac conditions (2% vs 1%, P<0.001).

CONCLUSIONS: In children 5–11 years in Tonga, 85% of admissions were for five groups of conditions. These data inform priority areas for healthcare spending and enable comparisons over time and between different Pacific countries.

The Millennium Development Goals have provided a focus for the global reporting of child health in recent decades[1] by describing child population health using under-five year, neonatal and infant mortality rates.[2] The more recently adopted Sustainable Development Goals continue the focus on mortality measures in the under-five age group with the stated goal "By 2030, end preventable deaths of newborns and children under five years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-five mortality to at least as low as 25 per 1,000 live births".[3] While this preschool-age focus has been necessary, a consequence of it has been relative ignorance of the health of children beyond five years of age.[4]

Eighty-four percent of deaths globally in children <5 years old are due to seven causes: neonatal problems, pneumonia, diarrhoea, malaria, measles, human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS), and injuries.[2] A range of initiatives have resulted in improvement nutrition, immunisation, newborn health and case management of diseases such as pneumonia and diarrhoea.[5] As a result, more children are now surviving beyond five years of age.

For primary school aged children in resource-limited countries, both cause of death and burden of disease have been investigated less comprehensively than in the under five-year age group. The data that are available suggest that allergic disease and bronchiectasis are becoming more prevalent in primary school aged children in developing countries.[6,7] Gastro-intestinal conditions, including acute, chronic, persistent diarrhoea and consti-pation, are also common.[8,9] The global burden of disease study reports that globally unintentional injuries are the cause of 10–20% of deaths in children aged 5–14 years.[10] Dental caries is a common chronic disease in childhood,[11] estimated to affect 60–90% of school aged children,[12] despite being largely preventable.[13]

Health issues that are prevalent in primary school aged children predict future public health priorities, and social and economic development.[14] Currently, global research in the developing world context in this age group is limited to studies that have focused on specific health issues such as nutrition,[15] ear and hearing health,[16] respiratory health,[17] parasitic disease,[18] communicable disease,[19–21] vision,[22] anaemia,[23] disability,[24] behaviour[25] and oral health.[26] To date there does not appear to be any study that has quantified disease burden at a population level in this age group in the developing world setting.

In addition to being limited in scope, studies of health in school-aged children in resource-limited countries has been restricted to the African and Asian regions.[1] In the Pacific region, the 5–12 year-old age group has received minimal attention and the available information is largely anec-dotal.[27] Research on the strategies to improve health in this primary school age group is just as scant, although there is growing evidence for school-based interventions.[28–30]

This lack of data is of specific relevance to New Zealand, where 11.3% of the popu-lation identify with a Pacific ethnicity and over a third (35.7%) of Pacific peoples were aged under 15 years in the 2013 Census compared to one-fifth (20.4%) of the total population.[31] Contemporary data on women of child bearing age in New Zealand shows that approximately half of those of Pacific ethnicity were born in the Pacific. Hence, their health during childhood in the Pacific is likely to impact upon their adult health in New Zealand and the health of their children.[32]

In order to identify priority areas for promoting health in primary school aged children in the Pacific, an understanding of the predominant health issues affecting them is required. Our aim in this study was to describe patterns of hospital utilisation for primary school aged children living in Tonga to help begin to understand the epide-miology of primary school aged health in the Pacific region.

Methods

Study setting

We completed our study in Tonga, a South Pacific nation of 170 islands (36 inhabited), with the majority of the population living on the main island of Tongatapu. The total esti-mated population of Tonga (2011) is 103,252[33] with 38% in the 0–14 age year group.[34]

We completed an audit of published liter-ature on child health research in Tonga. This audit identified a small literature generally focused on single health issues or diseases, for example immunisation,[35–37] nutrition,[38–40] rheumatic heart disease,[41–43] respiratory disease[44,45] and oral health.[46]

The Tongan healthcare system

In Tonga, health services are free and services are accessible except for those living in the outer islands.[34] Primary health care in Tonga is delivered through 14 health centres. There is one central referral hospital (Vaiola Hospital), and three community hospitals located on three of the smaller groups of islands.

Ethics

Ethical approval was granted by the University of Auckland Participants Ethics Committee and the Tonga National Health Ethics and Research Committee.

Study sample

We collected data on all admissions to Vaiola Hospital from January 2009 to December 2013 of children aged 5–11 (inclusive) years. Vaiola is a 200-bed hospital with a dedicated 34-bed paediatric inpatient facility. There is one paediatric consultant, two junior paediatric registrars and two paediatric interns.

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Table 1: Groupings and subgroupings of diagnoses for children aged 5–12 admitted to Vaiola Hospital in Tonga 2009–2013.

Respiratory conditions	Injury and poisoning	Abdominal and surgical conditions	Non-respiratory infectious diseases	Chronic conditions	Other conditions	Dental conditions	Cardiac conditions	Neoplasms
Pneumonia Asthma Throat pain/ infection Ear infection Other acute upper respiratory Other respiratory	Injury/poisoning Open wound (unknown cause)	Appendicitis Gastroenteritis Other abdominal and pelvic conditions Liver or renal disease General or orthopaedic surgery	Skin infection Parasitic infection Fever of unknown origin Other infection/ infectious disease	Disability/ chronic disease Allergy	Pain Neurology Haematology Sexual abuse Unspecified			

The hospital uses a data system called the Tonga Hospital Information System, developed by iSOFT in 2009. The system has admission, discharge and transfer data capabilities together with a disease classification component. Hospital admission and discharge data is collected and coded using ICD10 and ICD10AM disease classification. For each admission, data were extracted that described child gender and age, diagnosis, facility admitted to and length of hospital stay.

Inclusion and exclusion criteria

All inpatient admissions to Vaiola Hospital for children aged 5–11 (inclusive) years from January 2009 to December 2013 were included in this study. We included all admissions and thus potentially included multiple admissions for the same child. Emergency department-only events were excluded.

Data analysis

Discharge diagnosis data were grouped into 27 diagnostic categories based on the most frequent reasons for hospital admission in children aged 0–14 years (neonates excluded) in New Zealand from 2006 to 2010.[47] These 27 diagnostic categories were then organised into the following diagnostic groups: respiratory conditions; injury and poisoning; abdominal and surgical conditions; non-respiratory infectious diseases; chronic conditions; other conditions; dental conditions; cardiac conditions; and neoplasms (Table 1). Note that gastroenteritis is included in abdominal and surgical conditions rather than in non-respiratory infectious diseases. For a further breakdown of diagnoses and groupings, see Appendix 1. The data did not include external cause codes, so for the injury and poisoning category it was not possible to differentiate between intentional and unintentional injury. For this study, open wounds were included in the injury and poisoning group as it was assumed that otherwise the ICD10 code for skin infection would have been used.

Seasons were separated into 'wet and warm' (November to April) and 'dry and cool' (May to October). Admissions were grouped into two age groups: 5–7 and 8–11 years. In Tonga, children attend primary school from age 5 to 11 years (inclusive). To allow for a comparison of younger with older primary school aged children we then divided the sample into two age groups: 5–7 years and 8–11 years.

Sample distribution was described using proportions and means with standard deviations (SD) or medians with interquartile ranges (IQR) depending upon the normality of data distribution. Proportions were compared using the chi square test and means and medians using the t-test and the Wilcoxon rank sum test respectively.

For rate calculations, the population and projected population of 5–11 year-olds as defined at the 2006 and 2011 national census were used as the denominator. Of note, the national census in 2011 had a slightly lower actual count than the projected population growth from 2006. There was no explanation for this from the 2011 census report. Hospital admission rates by season, age, gender, diagnostic group and admission facility were described. Rates were compared using rate ratios (RRs) and 95% confidence intervals (CI). Statistical analysis was completed using SAS version 9.3 (SAS Institute, Cary, NC, US) and Stats-Direct version 2.7.9 (Altrincham, Cheshire, UK) software.

Table 2: Hospital admission rates for children aged 5–11 years (inclusive) admitted to hospital in Tonga from 2009 to 2013 by season, age and gender.

Variable	n (%, 95% confidence interval)	Population[†]	Rate per 1,000 (95% CI)	Rate ratio (95% CI)
Year of admission				
2009	305 (17, 15–19)	18,036	16.9 (15.1–18.9)	1.00
2010	328 (18, 16–20)	18,125	18.1 (16.2–20.1)	1.07 (0.91–1.25)
2011	346 (19, 17–21)	17,813	19.4 (17.4–21.6)	1.15 (0.98–1.34)
2012	415 (23, 21–25)	17,915	23.2 (21.0–25.4)	1.37 (1.18–1.59)
2013	422 (23, 21–25)	17,990	23.5 (21.3–25.8)	1.39 (1.19–1.61)
Season				
Wet and warm (November to April)	924 (51, 49–54)	89,879	10.3 (9.6–11.0)	1.00
Dry and cool (May to October)	892 (49, 47–51)	89,879	9.9 (9.3–10.6)	0.96 (0.88–0.97)
Age in years				
5	375 (21, 19–23)	13,178	28.5 (25.7–31.4)	1.00
6	308 (17, 15–19)	13,125	23.5 (20.9–26.2)	0.82 (0.71–0.96)
7	226 (12, 11–14)	13,030	17.3 (15.2–19.7)	0.61 (0.51–0.72)
8	218 (12, 11–14)	12,899	16.9 (14.7–19.3)	0.59 (0.50–0.70)
9	227 (13, 11–14)	12,736	17.8 (15.6–20.2)	0.63 (0.53–0.74)
10	228 (13, 11–14)	12,549	18.2 (15.9–20.7)	0.64 (0.54–0.75)
11	234 (13, 11–14)	12,362	18.9 (16.6–21.5)	0.67 (0.56–0.79)
Age group in years				
5–7	909 (50, 48–52)	39,333	23.1 (21.6–24.6)	1.00
8–11	907 (50, 48–52)	50,546	17.9 (16.8–19.1)	0.78 (0.71–0.85)
Gender				
Female	681 (37, 35–40)	42,910	15.9 (14.7–17.1)	1.00
Male	1,135 (63, 60–65)	46,969	24.1 (22.8–25.6)	1.52 (1.38–1.68)

[†]Based upon 2006 and 2011 census.

Results

Over the study interval there were 1,816 admissions of children aged 5–11 years to Vaiola Hospital, giving an average annual admission rate of 20.2/1,000 (95% CI 19.3–21.1). In comparison with 2009, the admission rate was greater in 2012 (RR=1.37) and 2013 (RR=1.39). Admission rates were higher in younger than older children (5–7 versus 8–11 years, RR=1.28) and in boys compared with girls (RR=1.52), and varied by season (dry and cool vs wet and warm, RR=0.96) (Table 2).

Of the 1,816 admissions, 1,474 (85%) were due to diagnoses that placed them in one of five diagnostic groups: injury and poisoning (28%), non-respiratory infectious diseases (19%), respiratory conditions (16%), abdominal, gastrointestinal and surgical conditions (13%) and dental conditions (9%). The median length of stay was three days (IQR 2–6) (Table 3).

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Table 3: Diagnostic groups and length of stay for children aged 5–11 years admitted to hospital in Tonga from 2009–2013.

Diagnostic group	n (% of all admissions, 95% CI[†])	Rate per 1,000[‡] (95% CI)
Injury and poisoning	**485 (28, 27–30)**	**5.6 (5.2–6.2)**
Injury/poisoning	377 (22)	4.4 (4.0–4.9)
Open wound (unknown cause)	108 (6)	1.3 (1.0–1.5)
Non-respiratory infectious diseases	**328 (19, 17–21)**	**3.8 (3.4–4.3)**
Other infection/infectious disease	209 (12)	2.4 (2.1–2.8)
Skin infection	97 (6)	1.1 (0.9–1.4)
Fever of unknown origin	18 (1)	0.2 (0.1–0.3)
Parasitic infection	4 (0)	0.05 (0.01–0.1)
Respiratory conditions	**282 (16, 14–18)**	**3.3 (2.9–3.7)**
Pneumonia	126 (7)	1.5 (1.2–1.7)
Asthma	56 (3)	0.7 (0.5–0.8)
Other respiratory	47 (3)	0.5 (0.4–0.7)
Throat pain/infection	25 (1)	0.3 (0.2–0.4)
Ear infection	22 (1)	0.3 (0.2–0.4)
Other acute upper respiratory	6 (0)	0.07 (0.02–0.1)
Abdominal and surgical conditions	**228 (13, 11–15)**	**2.7 (2.3–3.0)**
General or orthopaedic surgery	98 (6)	1.1 (0.9–1.3)
Other abdominal and pelvic conditions	61 (3)	0.7 (0.5–0.9)
Appendicitis	43 (2)	0.5 (0.2–0.3)
Gastroenteritis	23 (1)	0.3 (0.1–0.4)
Liver or renal disease	3 (0)	0.03 (0.007–0.09)
Dental conditions	**151 (9, 7–10)**	**1.7 (1.4–2.0)**
Other conditions	**142 (8, 7–9)**	**1.6 (1.3–1.9)**
Unspecified	60 (3)	0.7 (0.5–0.9)
Neurology	43 (2)	0.5 (0.3–0.6)
Pain	26 (1)	0.3 (0.2–0.4)
Haematology	12 (1)	0.1 (0.07–0.2)
Sexual abuse	1 (0)	0.01 (0.003–0.06)
Neoplasms	**51 (3, 2–4)**	**0.7 (0.5–0.9)**
Cardiac conditions	**49 (3, 2–4)**	**0.5 (0.4–0.7)**
Chronic conditions	**33 (2, 1–3)**	**0.3 (0.2–0.5)**
Disability/chronic disease	26 (1)	0.3 (0.2–0.4)
Allergy	7 (0)	0.07 (0.03–0.2)
	median (IQR)	
Length of stay in days	**3 (2–6)**	

[†]CI confidence interval.
[‡]Assuming a total population of 85,915 based on 2011 Census data.

Figure 1: Admissions to Vaiola Hospital from 2009–2013 for children aged 5–11 years.
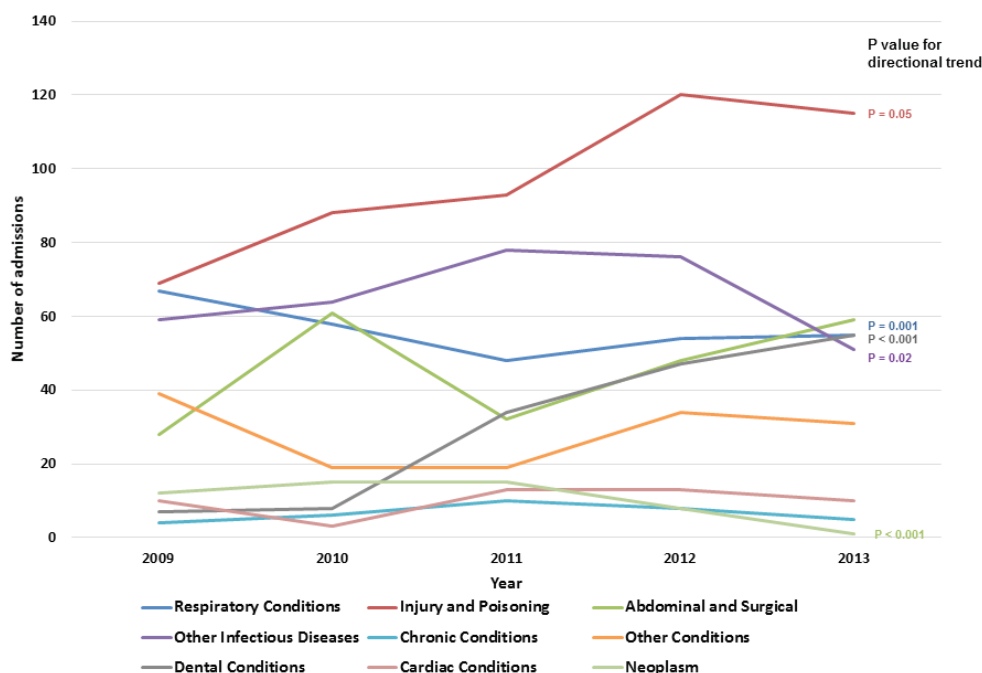
Between 2009 and 2013, year-to-year variability was evident in the frequency of several of the diagnostic groups: respiratory conditions (P=0.005); abdominal and surgical conditions (P<0.001); other infectious diseases (P=0.02); other conditions (P=0.004); dental conditions (P<0.001) and neoplasms (P=0.001). Directional trends were present for respiratory conditions (P=0.001), injury and poisoning (P=0.047), other infectious disease (P=0.02), dental conditions (P<0.001) and neoplasms (P<0.001) (Figure 1). The proportion of hospital admissions per year due to respiratory conditions (P=0.001), other infectious diseases (P=0.02) and neoplasms decreased (P<0.001). The proportion of hospital admissions per year for injury and poisoning (P=0.047), and dental conditions increased (P<0.001).

The number of admissions by diagnostic group varied by age (Figure 2). A larger proportion of younger (5–7 years) versus older (8–12 years) children were admitted for treatment of dental (16% vs 1%, P<0.001) or respiratory conditions (18% vs 14%, P=0.02). A larger proportion of older children were admitted for abdominal and surgical conditions (15% vs 11%, P=0.008), other

infectious diseases (21% vs 17%, P=0.04), other conditions (10% vs 6%, P<0.001) and cardiac conditions (2% vs 1%, P<0.001).

The number of admissions by diagnostic group varied with gender (Figure 2). A larger proportion of boys than girls had a hospital admission for injury or poisoning (31% vs 22%, P<0.001) or neoplasm (4% vs 1%, P<0.001). A larger proportion of girls than boys had a hospital admission for a dental (15% vs 5%, P<0.001) or a cardiac condition (5% vs 2%, P<0.001).

Admissions by diagnostic group varied by season (Figure 2). A larger proportion of the hospital admissions in the dry/cool season were for respiratory (18% vs 14%, P=0.013) or dental conditions (5% vs 3%, P<0.001). A larger proportion of the hospital admissions in the wet/warm season were due to injury and poisoning (30% vs 26%, P=0.04) or for abdominal and surgical conditions (15% vs 11%, P=0.006).

There were six in-hospital deaths over the five-year study period in the age group 5–11 (inclusive) years, three due to neoplasms and one each due to encephalopathy, sepsis and hepatic failure.

Figure 2: Admissions to Vaiola Hospital from 2009–2013 for children by diagnostic group versus age, gender and season of admission.
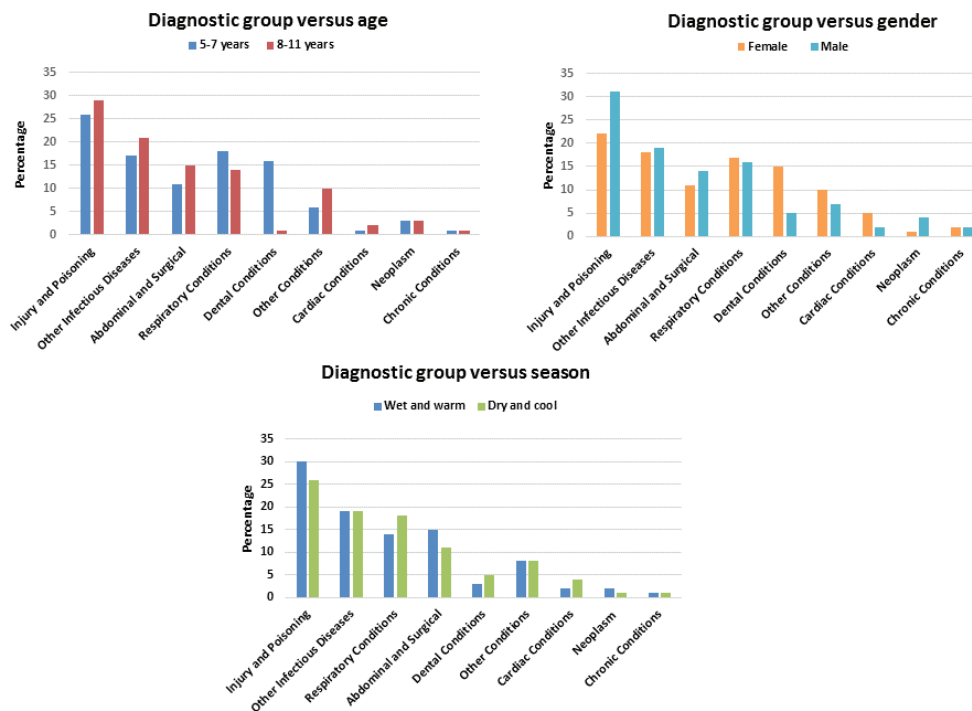
Discussion

Our study of hospital admissions from 2009–2013 of children in Tonga aged 5–11 years showed an average annual hospitalisation rate of 20.2/1,000, with injury and poisoning, infectious diseases, respiratory conditions, abdominal, gastrointestinal and surgical conditions and dental conditions accounting for 85% of hospital admissions. Hospitalisation rates decreased with increasing age. A larger proportion of hospital admissions among younger children (5–7 years old) were for dental or respiratory conditions and a larger proportion of hospital admissions among older children (8–11 years old) were for abdominal and surgical conditions, other infectious diseases and cardiac conditions.

This is the first study that has quantified population disease burden in this age group in the Pacific. The primary school age group is important because it is an age when diseases such as asthma, rheumatic heart disease and obesity, which cause long-term morbidity, can first manifest clinically.[14] This age group is also one for whom health care is facilitated by the potential ease of access created by school-based delivery of healthcare.

Our intention in this first study was simply to describe the prevalent causes of disease burden and how these varied by demographic characteristics. As such, our study has a number of limitations. As we restricted our analysis to hospital admission data we were unable to describe health status or to consider the many important health issues that are infrequent causes of hospital admission. Thus our study provides no information, for example, about nutritional status, vision and hearing; nor any understanding of emotional, psychological, social, cognitive or behavioural wellbeing. Nor do our data allow for any consideration of the status of the child's environment, including family, culture, economics, school and home environment. It does however provide baseline information and point of focus to inform future investigations and policy development.

It is important to acknowledge that due to external cause coding not being available, it was not possible to identify if an injury was intentional or unintentional. A number of child advocates in Tonga have highlighted the need for more work to be done on preventing child maltreatment, as well as improving the processes in place for managing and recording it. A recent

study on violence against women in Tonga placed the nation among the highest in the world for levels of physical violence against women by non-partners.[48,49] Another study comparing three Pacific Island countries reported that Tongan children expressed the highest levels of violence against them, including in the criminal justice system, schools and home.[50]

In low-resource countries such as Tonga, many children do not access hospital care regardless of the severity of their disease. This is certainly the case for acute lower respiratory infection in developing countries where most deaths take place outside hospitals.[51] Hospital admission data is consequently likely to underestimate the burden of disease. In global burden of disease studies, hospital discharge data is only one of nine different data sources used to show burden of disease and years lived with disability. These studies also use systematic reviews for disease sequelae, reports to governments, population-based disease registries, antenatal clinics, outpatient data, household surveys, re-analysis of cohort studies and indirect prevalence studies.[52] The hospital data presented therefore needs to be interpreted with some caution, however this should not be a deterrent to presenting this part of the picture, particularly in countries where there is such a lack of baseline information.

The Tongan Hospital Information System enabled us to use electronic data to describe relationships between demographics and hospital utilisation. The use of ICD discharge codes and the creation of a smaller number of diagnostic groupings enabled comparisons over time and between population subgroups in this study, which can also be used with subsequent comparisons to different time intervals and other Pacific nations.

The temporal trends over the relatively short time interval of this study need to be interpreted with caution. The reduction in proportion of hospital admissions per year due to respiratory conditions and infectious diseases could be due to improved management of these conditions in the community and/or better preventative measures to combat such diseases. The increase in accident and injury admissions potentially indicates an area where more focused preventive strategies may be needed. The dramatic increase in dental admissions between 2010 and 2011 may be contributed by changes in documentation methods within the dental department. The larger number of younger children admitted to the dental department does indicate though the fragility of the primary dentition in this age group. The finding that younger children were at increased risk of admission with respiratory issues and that boys were at increased risk of admission with injury and poisoning is consistent with the global literature.[53,54]

Our findings appear consistent with the small number of reports from other countries of the prevalent health issues in this age group. Lozano et al[10] studied age-specific mortality across 21 global regions (Tonga and other Pacific countries were included as Oceania) between 1980 and 2010 and found that in the 5–14 year old age group, infectious diseases, HIV/tuberculosis, injuries and some cancers prevailed, with mortality rates low in this age group. In a study investigating health expenditure due to multiple chronic diseases in the 0–17 year age group in the US, Zhong et al[55] found the most prevalent chronic conditions were asthma/chronic obstructive pulmonary disease, allergic rhinitis and behavioural problems. In Australia, a study of children's wellbeing in their middle years (8–14 years) found a significant proportion of children had low wellbeing, and particularly those considered to be marginalised.[4] This marginalised group included those defined as "culturally and linguistically diverse", which would include migrants from Pacific Islands.

The data presented here are the first to describe child health in the primary school age group in Tonga. Our findings complement data reported in 2010 about 12–15 year-old children from 24 high schools in Tonga, which participated in a global school-based health survey. In this older age group, 59% were overweight and 21% obese. Among students that had ever used drugs, approximately two-thirds (68%) were using drugs before the age of 14 years. More than one-third (36%) of students had attempted suicide one or more times in the past 12 months. Bullying was a concern for 66% of students. Only 27% reported parents and guardians understanding their problems. Violence was significant with 49% reporting

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physical fights, 51% being attacked and 63% seriously injured in the past 12 months.[56] These prevalent concerning health issues highlight the need to determine earlier childhood predictors of adolescent health.[57]

This description of disease in primary school aged children requiring inpatient hospital care makes an important contribution to child health research in Tonga and the rest of the Pacific. These data and analyses provide a contemporary description that can be used to inform priority areas for healthcare spending and to enable comparisons over time and between different countries in the Pacific region. From these data the key areas to target for health prevention strategies are injury and poisoning, infectious diseases, respiratory conditions, abdominal and surgical and dental conditions. While this study cannot determine the best way to target these particular issues, it does establish a baseline description of disease burden against which the effectiveness of interventions can be measured.

This report of morbidity and mortality data represents the first phase of a more comprehensive description of the health status of children in Tonga. Our findings have helped to inform other projects in progress, which will allow a broader and more detailed description of the contemporary health status and challenges to health faced by children growing up in Tonga.

The global state of primary school children's health in resource-limited countries and the conditions which affect this age group remain relatively undefined. Although under five-year mortality rates do show the condition of overall society due to the vulnerability of this age group, they do not encompass the whole of child wellbeing. The current lack of global focus on the Pacific region and on the primary school age group in particular provides a challenge worth rectifying.

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Appendix 1: The nine diagnostic groups and the diagnostic categories within each of these groups.

Respiratory conditions					
Asthma Asthma unspecified Status asthmaticus	**Bacterial/viral/other pneumonia** Lobar pneumonia Pneumonia unspecified Bronchiectasis Influenza with pneumonia	**Acute URTI** Acute obstructive laryngitis	**Throat pain/infection** Acute tonsillitis Chronic tonsillitis Hypertrophy of tonsils	**Ear infection** Chronic mucoid otitis media Acute suppurative otitis media Impacted cerumen Polyp of middle ear Periauricular sinus and cyst Disease of inner ear unspecified	**Other respiratory** Other disorders of lung Bronchopneumonia Pleural effusion Acute lower respiratory infection Obstructive sleep apnoea

Injury and poisoning					
Ingestion of noxious substance Ciguatera fish poisoning Concussion Dislocation Contusion Abrasion Crush injury Fracture Foreign body Abrasion Burn Unspecified injury Traumatic amputation Sprain Open wound Traumatic pneumothorax Non-fatal drowning Muscle/tendon injury	**Open wound** Open wound in different parts of the anatomy				

Abdominal or surgical conditions					
General surgery/orthopaedic surgery Ectopic testis Hypospadias Cleft palate Inguinal hernia Meckel's diverticulum Circumcision Intestinal adhesions Undescended testicle Removal of fixation plate Slipped upper femoral epiphysis Juvenile osteochondrosis	**Abdominal/pelvic pain/constipation** Constipation Unspecified abdominal pain	**Gastroenteritis** Diarrhoea and gastroenteritis Acute amoebic dysentery Nausea and vomiting	**Liver disease** Abscess of liver Acute and subacute hepatic failure	**Appendicitis** Acute appendicitis Unspecified appendicitis Other appendicitis	

Non-respiratory infectious diseases					
Skin infection Abscess Furuncle and carbuncle Local infection skin Cellulitis Granulomatous Impetigo	**Parasitic infection** Angiostrongyliasis Balantidiasis Brucellosis	**Fever of unknown origin** Febrile convulsions Persistent fever Fever unspecified	**Other infection/infectious disease** Viral infection unspecified Dengue fever Cystitis Meningococcal meningitis Osteomyelitis Acute disseminated encephalitis Infective myositis Pyogenic arthritis Bacterial meningitis Shigellosis Typhoid fever Urinary tract infection Meningococcemia Sepsis unspecified Keratitis Zoster Nonspecific lymphadenitis Acute periodontitis Pneumococcal meningitis Viral encephalitis Orchitis epididymitis Agranulocytosis Mastoiditis Sialoadenitis Meningitis unspecified Acute lymphadenitis Tubulo-interstitial nephritis Varicella		

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Appendix 1: The nine diagnostic groups and the diagnostic categories within each of these groups (continued).

Chronic disease					
Disability/chronic disease Systemic lupus erythematosus Mental disorder Congenital deformity Nephritic syndrome Deformity Cerebral palsy Polyarthritis Schizophrenia Juvenile rheumatoid arthritis Communicating hydrocephalus Osteoporosis	**Allergy** Allergic purpura Anaphylactic shock				

Other conditions					
Haematology Sideropenic dysphagia Epistaxis Aplastic anaemia Idiopathic thrombocytopenic purpura Coagulation defect	**Unspecified** Syncope and collapse Inflammatory condition of the jaw Disorder of male genital organs Hypoglycaemia unspecified Retention of urine Malaise and fatigue Other shoulder lesions Orthostatic hypotension Hydrocele unspecified	**Sexual abuse**	**Pain** Acute pain Headache Chronic regional pain syndrome Cramp and spasm Low back pain Myalgia Unspecified pain Cervicalgia	**Neurology** Nerve root and plexus disorder Epilepsy Unspecified convulsions Anoxic brain damage Autonomic nervous system disorder	

Cardiac conditions					
Cardiac Rheumatic mitral insufficiency Scarlett fever Congenital malformation of heart Supraventricular tachycardia Patent ductus arteriosus Acute rheumatic heart disease Rheumatic fever Palpitations Rheumatic chorea Unspecified atrial septal defect Obstructive hypertrophic cardiomyopathy Aortic valve insufficiency Rheumatic mitral insufficiency Rheumatic heart disease unspecified					

Teeth					
Teeth Dental caries unspecified Hereditary disturbance of tooth structure Disorder of teeth and support structures Developmental odontogenic cysts					

Neoplasm					
Neoplasm Hodgkin disease unspecified Malignant neoplasm Acute myeloid leukaemia Acute lymphoblastic leukaemia					

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