

Retrospective Autopsy-Based Analysis of Fatal Drowning in Fiji from 2011 to 2014

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Abstract

Globally drowning remains a leading cause of unintentional mortality. Low and middle-income countries have the highest rates of drowning; and island countries surrounded by water have considerable attribution of deaths due to drowning.

This study uses the records of the Forensic Pathology Unit in Fiji to establish trends and ascertain high-risk groups associated with drowning mortality. In addition, the medical cause of death certificates (MCDC) from the Ministry of Health and Medical Services were utilized to provision validations and provide additional foresight where epidemiological trends needed to be established.

In this study many high risk groups and patterns were identified. The high risk groups identified included the age group from 0 to 29 years of age, the male gender group and the iTaukei and the Fijians of other Descent, also emphasis on water safety and drowning prevention for the Eastern and Western division of Fiji to reduce the high fatal drowning rates. Drowning remains a preventable cause of mortality and everyone must be involved in the prevention of fatal drowning.

Keywords: Autopsies; Drowning; Forensic; Injury; Medico-legal; Unintentional

Background

In 2012, an estimated 372, 000 people died from drowning, making it the world's third leading unintentional injury killer and it continues to be among the ten leading causes of death of children and young people in every region of the world [1]. Low and middle income countries have the highest rates of drowning and account for more than 90 % of such fatalities [2] as people have close daily contact with water for work, transport and agriculture [1].

Fiji lies in the heart of the Pacific Ocean between longitudes 174° East and 178° West of Greenwich and latitudes 12° South and 22° South. Fiji is located in the Melanesian ethno-geographical group and has a total land area is 18,333 sq. km. Fiji contains approximately 330 islands and there are two major islands - Viti Levu which has an area of 10,429 sq. km and Vanua Levu having an area of 5,556 sq. km. The estimated population of Fiji in 2015 was noted to be 869,458 [3] and 897,932 in 2016 [4].

Drowning is preventable and the first World Congress on Drowning in 2002 defined drowning as the process of experiencing respiratory impairment from submersion/immersion in liquid [1]. This simply means that the access to air by the lungs is prohibited by submersion or immersion of the body in water or fluid medium. Dead bodies that are found submerged or immersed in water and other fluids in every manner and place tend to produce difficult medico-legal autopsies. In

any setting when a deceased is found in water it is possible that the deceased [5-8].

- Died from natural disease before falling into the water;
- Died from natural disease while already in the water;
- Died from injury before being thrown into the water;
- Died from injury while in the water;
- Died from exposure and hypothermia in the water;
- Died from effects of immersion other than drowning;
- Died from drowning.

Fatal drowning is an unnatural death that requires a medico-legal autopsy in Fiji. At autopsy, findings are often non-specific and the diagnosis rests on a combination of circumstances and clinicopathologic correlation [7,8]. Some authors consider the diagnosis to be one of exclusion [7,9].

Fiji is one of the most developed Pacific Island countries with a well-established modern judicial system [10]. Fiji's common law system is based on the English model and has the Magisterial Service, Police Force and Forensic specialists conducting Medico-legal death investigation (MDI) according to the Inquest Act of 1968. The MDI in Fiji is initiated by the Police or the Magistrate respectively [11] similar to that of the European Continental system.

Objective

This study aims at describing the epidemiology and identifies high risk groups and patterns of drowning fatalities in Fiji from 2011 to 2014.

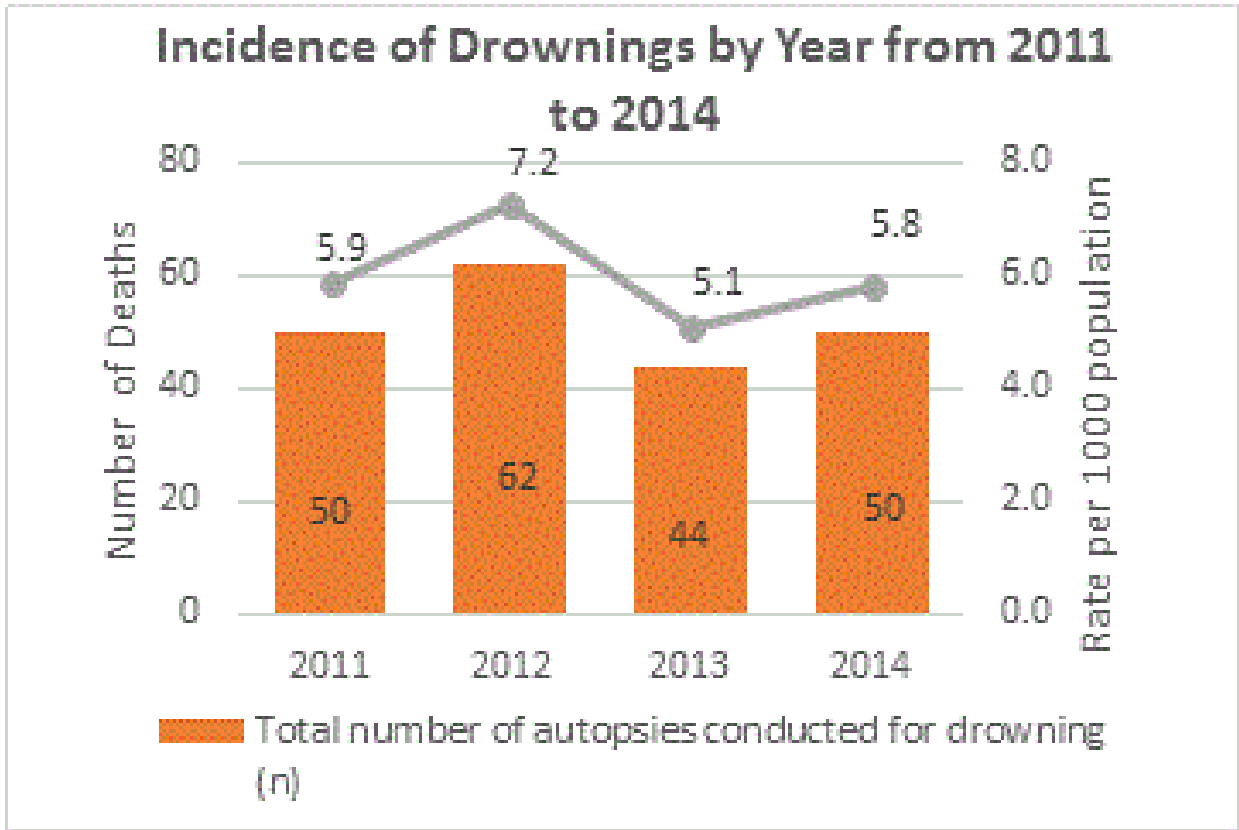
Materials and Methods

The present study is based on the autopsies conducted in the mortuaries in Fiji from the calendar year 2011 to 2014 by the Fiji Forensic Science Service. The statistical analysis of these cases of fatal drowning includes the general age, sex, accidental or homicidal (intent) and epidemiology. This study encompasses drowning cases confirmed at autopsy and information provided from Police narrative situation reports. The National Health Research Ethics Review

Committee had granted scientific, technical and ethical approval for this paper on June 7th 2016.

Results

The total 2943 medico-legal autopsies were conducted over the calendar years from 2011 to 2014. Over the four calendar years from 2011 to 2014, the total number of fatal drowning's was 206 which were 7% of the total medico-legal autopsies (Graph 1).



Graph 1: Total number and rates of medico-legal autopsies conducted for fatal drowning from 2011 to 2014.

Table 1 showed 18 more fatal drowning cases that were captured by the MCDC within the MOHMS but were excluded from the medico-legal process.

The possible reason for this is that these cases most probably presented during disaster or in difficult to reach areas (highlands or distant islands) where mortuaries were not accessible for the preservation of the deceased corps for autopsy. These extra 18 drowning fatalities captured by the MCDC within the MOHMS were certified accordingly by medical officers.

The average population based mortality rate for fatal drowning over the 4 year period in this study (Graph 1) stood at 6 per 100, 000 population.

Reviewing the major Fiji Police divisions in Fiji, Graph 2 showed that from 2011 to 2014 the Eastern division has the highest rates of 138.1 per 100, 000 followed by Western division of 29.4 per 100, 000.

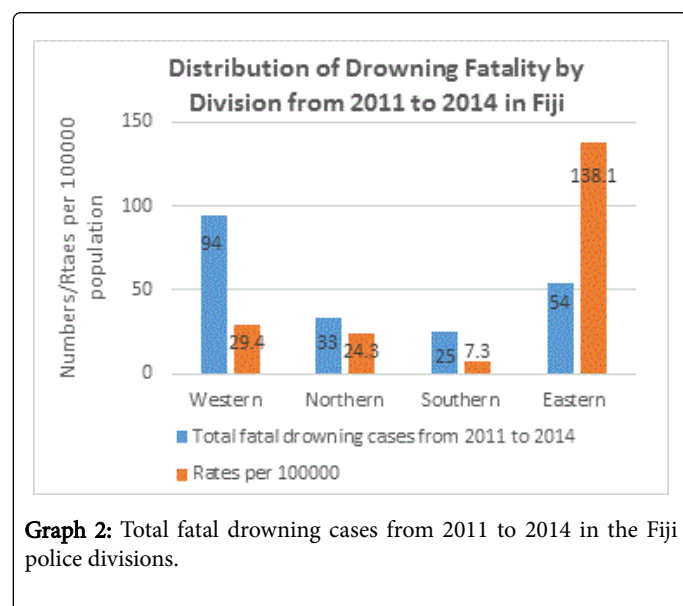
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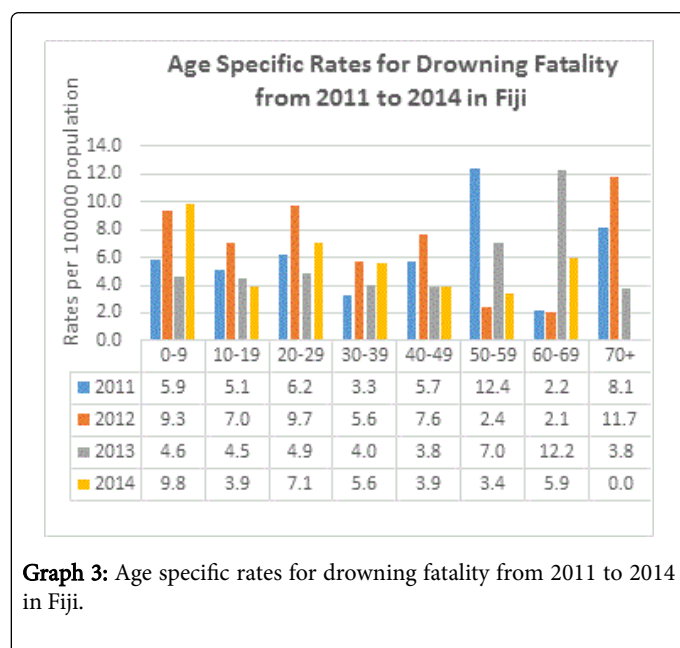
Year	Number of Autopsies (N)	Number of autopsies for fatal drowning (n)	Proportion of fatal drowning from total autopsies (%)	Cases from MCDC (MOHMS)
2011	678	50	7.4	54
2012	776	62	8	67
2013	732	44	6	52
2014	757	50	6.6	51
2011-2014 Total	2943	206	7	224

Table 1: Distribution of drowning fatality by year (MCDC: Medical Cause of Death Certificates, MOHMS: Ministry of Health and Medical Services).

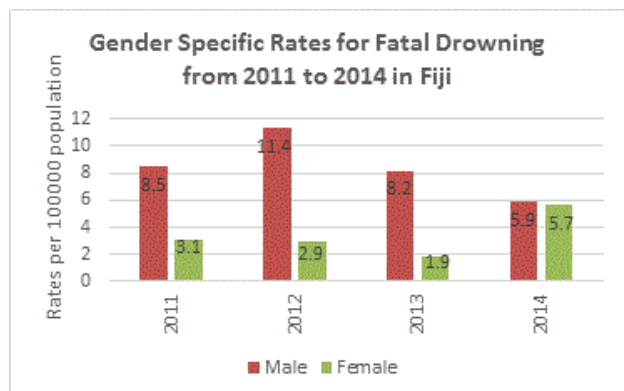


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According to the age specific rates, the highest clustered fatal drowning rates were noted in the 0 to 9 years age interval, followed by the 20 to 29 years of age, 10 to 19 years of age, and then the age groups from 30 to greater than 70 years of age respectively (Graph 3), also to not that the age groups 40 to greater than 70 years showed higher individual yearly rates.

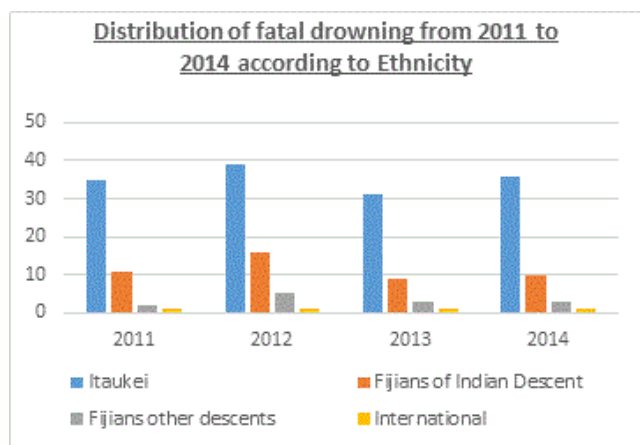


The gender specific rates from 2011 to 2014 as seen in Graph 4 showed an average male to female ratio 3:1 but the highest male to female ratio was 4:1 and the lowest male to female ratio was 2:1. The higher rates for males were noted from 2011 to 2013 but in 2014 there was male and female rates were almost equal.



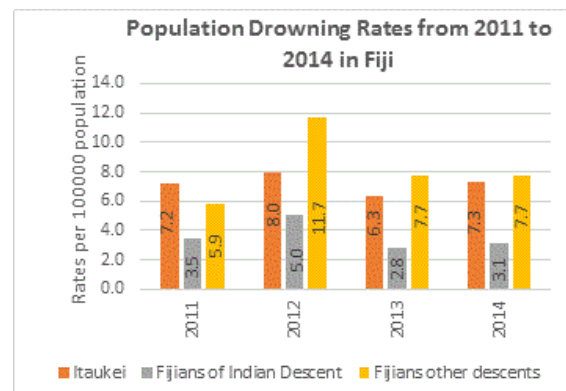
Graph 4: Gender specific rates for drowning from 2011 to 2014

Looking at the distribution of fatal drowning cases from 2011 to 2014 according to Ethnicity in Fiji (Graph 5), it showed that the iTaukei or the Indigenous Fijian populations comprised 68.4% of the fatal drowning whilst the Fijians of Indian and other descents comprised 22.3% and 9.3%, respectively.



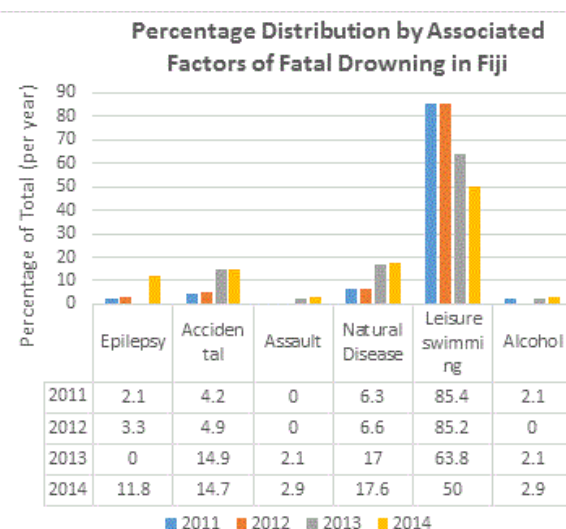
Graph 5: Distribution of fatal drowning cases from 2011 to 2014 according to ethnicity in Fiji.

The international component comprised of tourists and showed lowest percentage of 2% of the total fatal drowning. Furthermore, the population based mortality rates implicate iTaukei and Fijians of Other Descent groups as the most at risk (Graph 6).



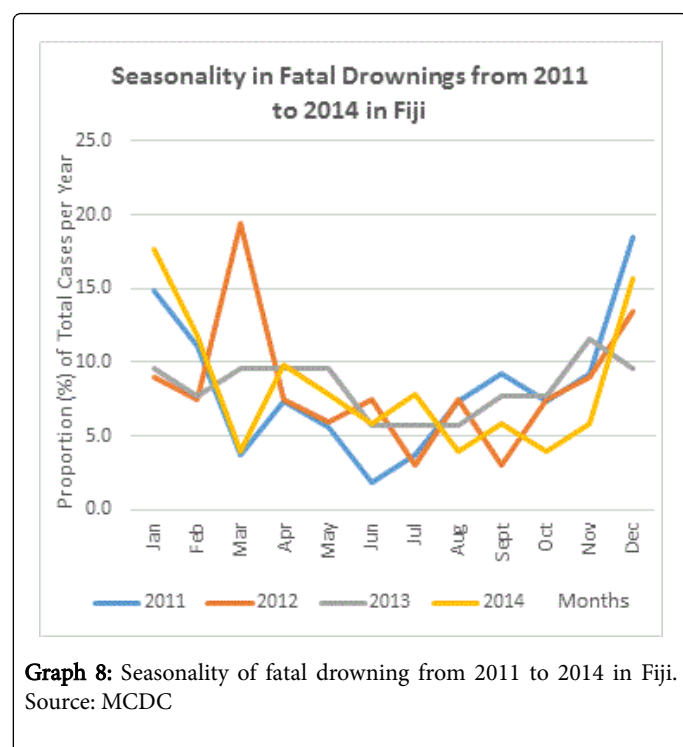
Graph 6: Drowning rates by ethnicity from 2011 to 2014 in Fiji.

Viewing the associated factors of fatal drowning from 2011 to 2014 (Graph 7), the highest cluster group were those in leisure swimming, followed by the natural disease and then accidental drowning. The lowest cluster groups were epilepsy, assaults and those associated with alcohol consumption. There were no fatal drowning cases presenting for medico-legal autopsies that was due to suicides.



Graph 7: Associated factors of fatal drowning from 2011 to 2014.

The greatest seasonality was noted between October to January in Graph 8. This coincides with the school breaks, Christmas breaks and many individuals opt for water sports during this period. Coinciding with the breaks are the hot and humid season, encouraging water activities.



Discussion

Fatal road traffic accidents [12] and fatal drowning share a 7% (Table 1) equivalent out of the 2943 medico-legal autopsies conducted for the period from 2011 to 2014. This is significant for the setting in Fiji as almost 1 in every 10 medico-legal autopsies is either for a fatal drowning or a fatal road traffic accident. Prevention of fatal drowning should be a priority and needs to be strengthened by dealing with the high risk groups identified in this paper.

Looking at the Fiji Police divisions, it was noted that the 46% of all drowning fatalities from 2011 to 2014 occurred in the Western part of Fiji. The possible reason is because the Western part of Fiji has fine weather and beautiful beaches that attract regular water activities. However, on the other hand when converted to rates per 100,000, the Eastern division showed the highest fatal drowning rates. The Eastern division is a marine division of Fiji consisting of small islands. Water safety and drowning prevention activities need to be directed to these two divisions.

Children of the age interval 0 to 9 years of age constituent the highest incidence of fatal drowning over the four year study period similar to those noted in other surveys in low- and middle-income countries [13,14]. To note that 91% of all global drowning fatalities occur in low- and middle-income countries [15]. Therefore, the age interval of 0 to 9 years of age can be identified as a high risk groups for fatal drowning in Fiji. Globally, the highest drowning rates are among children aged 1–4 years, followed by children aged 5–9 years [1]. The 20 to 29 age group had the second highest rates of fatal drowning from 2011 to 2014 due to this been the dynamic group where individuals are socially active and outgoing and are also early wage earners. Another study revealed a similar picture where majority of the drowning fatalities were noted to be in second and third decades, together accounting for 55% of drowning deaths [16].

In this study males dominate accounting for 72.3% of fatal drowning that are similar to other studies where males account for more than 70% [16,17].

With reference to the ethnic groupings in Fiji, the iTaukei or the Indigenous Fijians accounted for 68.4% of the fatal drowning from 2011 to 2014. This is a significant percentage particularly because there has been an increase of the average percentage of 62.3% for period of 1998 to 2010 [18]. Also for the fact that now approximately 7 out of 10 fatal drownings include the iTaukei or the Indigenous Fijian population and therefore, this is a high risk group.

Leisure swimming constituted the highest percentage (66.5%) with regards to associated factors in fatal drowning from 2011 to 2014. This included leisure swimming in various locations in Fiji like the sea, rivers and other water-pools. This activity is therefore one that deserves to be considered by rescue and emergency authorities in Fiji to address. Epilepsy made up 3.4% of the associated factors in fatal drowning from 2011 to 2014. Perhaps more emphasis needs to put on the importance of avoiding water-related activities that may lead to submersion and immersion for the setting in Fiji. The greatest efforts must be driven towards making individuals skilled in water activities such as swimming; and use of peer groups, safety groups while conducting water activities. Accidents formed 8.3% of the fatal drowning and alcohol is another important factor in fatal drowning though in this study it constitutes 1.5% of the fatal drowning as compared to 44% in another study [17].

Conclusion

Deaths from any cause produce great repercussions in a developing nation affecting society at all levels. That is why preventable deaths must be approached with vigilance. Drowning is a preventable cause of death and therefore, efforts must be put into reducing drowning deaths in Fiji.

Morbidity and mortality due to drowning can be prevented by understanding its epidemiology, common patterns and educating people about prevention especially when hindsight often shows that deaths from drowning are preventable [16].

In this study many high risk groups and patterns were identified. The high risk groups identified included the age groups from 0 to 29 years of age, those partaking in leisure swimming activities, the male gender group and the iTaukei and Fijian of Other Descent ethnic groups. Also emphasis on safety and caution in water activities should be put on the Eastern and Western divisions of Fiji to reduce the high drowning fatalities. People in Fiji engage regularly leisure swimming and this was the main associated factor of fatal drowning noted in Fiji. More water activity precautions are needed across the nation. The introduction of drowning prevention and water safety into the primary school education curriculum or system needs to be done. This will have an immediate and long-term benefit in the prevention of drowning fatalities in Fiji.

In general the average number of fatal drowning examined at autopsy from 2011 to 2014 was 52 per year. This is an indicator that more awareness and implementation of drowning prevention and water safety need to be carried out by the relevant authorities like the water safety council, marine rescue services, the Fiji Police, etc. Also the media plays a vital role in water safety education and creating a drowning prevention culture in Fiji. Ultimately, it is essential that everyone plays a role in prevention of fatal drowning.

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