Prevalence and Health Consequences of Smoking among Pacific Islanders: A Systematic Review Study

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Abstract

Introduction: Smoking remains to be a main cause of preventable death and illness in both developing and developed countries. The high prevalence of smoking consumption contributes to significant health-related diseases. While the rate of smoking use is reducing in most countries, Pacific countries still have a high smoking prevalence. This systematic review study is aimed at understanding the prevalence of smoking and its health consequences among Pacific countries.

Methods: This systematic review study utilized five databases including Medline, Embase, Web of Science, PsychInfo, and Scopus to find relevant studies. Cochrane library guideline was used to process and appraise the quality of the articles. Articles that were published in English, from 1st January 2000 to 1st August 2016, were included in the search using keywords such as Pacific, Smoking, Tobacco, and risk factors and consequence. The titles, abstracts, and full texts of all relevant articles were reviewed by two coders and a data extraction sheet including studies characteristics, participants, and methodological information was made. A descriptive statistical analysis was applied to measure the frequency and health consequences of smoking among Pacific countries.

Results: Twenty-four studies were reviewed. Most of the studies were conducted in South Pacific countries (37.5%) using descriptive methodology. Most of the studies focused on community (37.5%) as the target group. There was a range of 3%-75% in smoking prevalence in different populations. While the highest prevalence of smoking consumption in community based studies was reported among men in Kiribati, the highest prevalence in hospital based studies was 40% among Pacific males in New Zealand and the lowest was among pregnant women in the western Pacific Region. Smoking has been recognized as the most common risk factor of hemorrhagic stroke (25%), more than any other disease and condition among Pacific people.

Conclusion: The results of this study highlighted different ranges of smoking prevalence among different Pacific countries based on genders. For example, the Cook Islands have the highest smoking rates in both males and females (26.2% vs. 20.5%) while youth males and females have a lower prevalence (13.6% and 10.3%, respectively) [8]. The prevalence of smoking is also different in different Pacific countries based on genders. For example, the Cook Islands have the highest smoking rates in both males and females (18.3% vs. 16.8%, respectively) while Fijian males and females have a lower prevalence rate of smoking (8.6% vs. 6.5%, respectively) [1,8]. It is important to note that the Pacific Islands are in the midst of a Non-Communicable Disease (NCD) crisis, of which smoking has been identified as a contributing factor [1].

There is a need for more studies to be conducted in the Pacific to determine the prevalence and health consequences of smoking among Pacific people so that control measures can be implemented to prevent the burden of smoking within these small island populations. As there are not any systematic review studies, this study is aimed to understand the prevalence and health consequences of smoking among Pacific islanders.

Methodology

A systematic review study was conducted to understand the prevalence and health consequences of smoking among Pacific Islanders. Five databases were used to search studies including; Medline, Embase, Web of Science, PsychInfo, and Scopus. These databases were chosen based on similar previous systematic review studies. Different key terms were used to find relevant studies including; “Pacific”, “Smoking”, “Tobacco”, “Cigar”, “risk factors”, and consequences. The conjunctions “AND” and “OR” were used to combine different key terms to find the articles narratively.
Studies with different quantitative research methodologies such as cross-sectional study, cohort study, randomized controlled trials (RCTs), quasi randomized trials (QRCs) and also qualitative study were included in this study. All studies published from 1st January 2000 to 1st August 2016 and in the English language were included in this study while those not in the English language, or if their full text was not available, have been excluded. This time period was chosen in order to include recently published studies and also new insights on the health consequences of smoking on different populations.

To access the relevant studies, the Cochrane Library Guideline was used and three stages were implemented to obtain the appropriate research. Two coders separately reviewed articles in each stage to reduce bias. At the first stage, the titles of all searched articles were scanned and reviewed and many articles were omitted because they were not relevant. At the second stage, the abstract of the remaining articles were reviewed and those not relevant or having some methodological issues were omitted. At the third stage, the full texts of the remaining articles were reviewed and some articles were omitted. Overall, 21 studies met the study inclusion and exclusion criteria. The search process is shown in Figure 1.

The bibliographies of the final articles were re-searched and some new articles, which were not accessible in the databases, were considered in the study. Finally, three studies were added based on the bibliography search and 24 studies were analyzed.

The data extraction sheet was made (Table 1) and the needed information related to the study, participants, methodology, and results for each study were included in it. A descriptive analysis was applied to measure the frequency and also health consequences of smoking among Pacific Islanders.

![Figure 1: The process to achieve relevant articles; Risk Evaluation classification.](image-url)

<table>
<thead>
<tr>
<th>N</th>
<th>Article/Study</th>
<th>Participants</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
</table>
| 1 | Romero and Pulvers [2]  
Year: 2013  
Type: Cross-sectional  
Country: USA | Number: 490  
Male: Not Specified  
Female: 70%  
Age: Mean age: 21 years | Place: School Based (University)  
Sampling Method: purposive sampling  
Data Collection: Survey | Prevalence: 19% of participants were smokers. Current smoking by race was 26% PI, 19% AA, and 17% Caucasian. |
| 2 | Arliss RM [27]  
Year: 2006  
Type: Cross-sectional  
Country: USA | Number: 466  
Male: Out of 138 Asians 43% were male, out of 328 non-Asians 46% were male  
Female: Out of 138 Asians 57% were female, out of 328 non-Asians 54% were female  
Age: 18-35 years | Place: School Based (Community College)  
Sampling Method: Unknown  
Data Collection: Questionnaire Survey | Prevalence: Out of 138 AAPI participants- 20.3% were smokers, 7.7% 11 or more cigarettes per day. |
| 3 | Nosa et al. [21]  
Year: 2014  
Type: Cross-sectional Survey  
Country: New Zealand | Number: 2,208  
Male:  
Female: Age: 10-13 Years | Place: School-Based Sampling Method: Purposive sampling  
Data Collection Tool: Questionnaire | Prevalence: The prevalence of Pacific ever-smokers (for 2007) in Year 7 was 15.0% (95% Confidence Interval CI 12.0%–18.3%) and Year 8, 23.0% (95% CI 19.5%–26.7%). |
| 4 | Butler et al. [28]  
Year: 2004  
Type: Cohort  
Country: New Zealand | Number: 1398  
Male:  
Female: Age: Infants 6 weeks and older | Place: Hospital based Sampling Method: Purposive  
Data Collection Tool: Questionnaire, Interview | Prevalence: Out of 1398 mothers 31% are smokers |
| 5 | Chen et al. [29]  
Year: 2004  
Type: Cross-sectional Survey  
Country: Marshall Islands | Number: 3,294  
Male: 1,558  
Female: 1,700  
36 non-respondents for gender  
Age: 9-20, mean age 14 | Place: School based Sampling Method: Stratified Sampling  
Data Collection Tool: Survey Questionnaire | Prevalence: The rate of smoking among 18 year olds was 33.5%. |
| 6 | Wu et al. [22]  
Year: 2013  
Type: Cohort  
Country: USA | Number: 355,498  
Male: Unknown  
Female: Unknown  
Age: ≥ 12 years old | Place: Community Sampling Method: Multistage area probability sampling  
Data Collection: Survey Questionnaire | Prevalence: The prevalence of smoking among Native Hawaiians/Pacific islanders was 26.7% in 2010 |
| 7 | Caleychetty et al. [7]  
Year: 2014  
Type: Cross-sectional  
Country: LMICs- African Region, Southeast Asian Region, Western Pacific Region, European Region | Number: 58,922 pregnant women  
Male:  
Female: All Female  
Age: Range 15–49 | Place: Hospital Based Sampling Method: Purposive Sampling  
Data Collection: Survey Questionnaire | Prevalence: Current tobacco smoking in pregnant women ranged from 0-6% (0.3–0.8%) in the African region to 3-5% (1.5–12.1) in the Western Pacific region. |
<table>
<thead>
<tr>
<th>Study Authors</th>
<th>Year</th>
<th>Type</th>
<th>Country/Region</th>
<th>Sample Size</th>
<th>Age/Duration</th>
<th>Study Design</th>
<th>Data Collection/Method</th>
<th>Place</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tautolo et al. [5]</td>
<td>2011</td>
<td>Cohort</td>
<td>New Zealand</td>
<td>1,477 mothers</td>
<td>Male: Female: 1,477</td>
<td>Number of daily cigarette smokers</td>
<td>Place: Hospital Based Sampling Method: Random Sampling Data Collection: Interview</td>
<td>Increase in mothers’ smoking prevalence over time was noted (p = 0.002). Significantly, for about 25% of Pacific children both their parents were current smokers.</td>
<td></td>
</tr>
<tr>
<td>Wong et al. [30]</td>
<td>2003</td>
<td>Cross-sectional</td>
<td>USA</td>
<td>288,831</td>
<td>Male: Not specified</td>
<td>Number of cigarettes smoked per day were higher between BMI and CHD (p = 0.04).</td>
<td>Prevalence of daily cigarette smoking was lower among AANHPI current cigarette smokers (68.4%) versus non-AANHPIs (76.8%).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tautolo et al. [9]</td>
<td>2011</td>
<td>Cohort</td>
<td>New Zealand</td>
<td>766 Fathers</td>
<td>Male: 766 Fathers</td>
<td>Mortality rates of current smokers compared to never smokers &amp; ex-smokers (p &lt; 0.001).</td>
<td>Place: Hospital Based Sampling Method: Purposive Sampling Data Collection: In depth Interview</td>
<td>Risk Factors</td>
<td></td>
</tr>
<tr>
<td>Barzi et al. [34]</td>
<td>2008</td>
<td>Cohort</td>
<td>Asia Pacific Region</td>
<td>51,267</td>
<td>Male: Unknown</td>
<td>Number of cigarettes smoked per day were higher for ANZ than Asia - P &lt; 0.001.</td>
<td>Place: Community Based Sampling Method: Purposive Sampling Data Collection:</td>
<td>Risk Factors</td>
<td></td>
</tr>
<tr>
<td>Nakamura et al. [35]</td>
<td>2008</td>
<td>Cohort</td>
<td>USA</td>
<td>563,144</td>
<td>Male: Not Specified</td>
<td>Risk for haemorrhagic stroke (intra-cerebral haemorrhage) among present smokers compared to non-smokers (P = 0.003) .</td>
<td>Place: Community Based Sampling Method: Available sampling Data Collection: Questionnaire</td>
<td>Risk Factors</td>
<td></td>
</tr>
<tr>
<td>Huxley et al. [36]</td>
<td>2007</td>
<td>Cohort</td>
<td>Asia Pacific</td>
<td>4,801,25</td>
<td>Male: Female: 480,125</td>
<td>Risk for lung cancer mortality associated with current smoking in Asia versus Australia and New Zealand - (P &lt; 0.0001) For women, the corresponding estimates were 2.35 (95% CI: 1.29, 4.28) in Asia versus 19.33 (95% CI: 1.00, 37.3) in Australia and New Zealand; for homogeneity p &lt; 0.0001.</td>
<td>Place: Hospital based Sampling Method: Purposive Sampling Data Collection Tool: Questionnaire</td>
<td>Risk Factors</td>
<td></td>
</tr>
</tbody>
</table>
**Results**

Twenty-four studies met the study’s inclusion and exclusion criteria. As Table 2 shows, 54.2% of the studies were conducted from 2005-2009, 33.3% were conducted from 2010 to the present, while only 12.5% were conducted from 2000-2004. More than half (58.3%) of the studies were cohort while 41.7% were cross-sectional. Of the studies, 37.5% were conducted in the South Pacific while 33.3% were conducted in the Asian Pacific, and 29.2% in the American Pacific.

The highest number of studies were conducted in the USA (7 studies, 29.2%), followed by New Zealand (6 Studies, 25%), Asia Pacific (8 studies, 33.3%), Tonga, Vanuatu, and the Federated States of Micronesia (FSM) (1 Study each, 4.2%). The total study population is 4,245,437 people. For the 10 studies which specified Region, 29.2% were conducted in the American Pacific, followed by New Zealand (6 Studies, 25%), Asia Pacific (8 studies, 33.3%), Tonga, Vanuatu, and the Federated States of Micronesia (FSM) (1 Study each, 4.2%).

As shown in Figure 2, 37.5% of the studies were conducted in communities, followed by 33.3% in hospitals, 25% in schools, and 4.2% in both school and community.

The results in Table 3 show that most of the studies (70.8%) used purposive sampling method, 12.5% random sampling, 4.2% convenience sampling, 8.3% stratified sampling, and 4.2% did not mention the type of sampling used. Of the studies, 87.5% used questionnaires, 4.2% used both questionnaire and observation, while 8.3% of the studies did not mention the data collection tool used.

The prevalence of smoking among Pacific people ranges from as low as 3% to as high as 75%. The highest prevalence, which was 75%, was found among Kiribati men, followed by 68.4% among native Hawaiians Pacific islanders, 64.2% among native Hawaiian students, and 51.8% among Pacific Island adolescents in Hawaii and California. The lowest prevalence was 3%, which was among pregnant women in the western Pacific region, followed by 15% among 17 year Pacific Island students in New Zealand, 17% among 15 year old boys in Pohnpei, and 29% among 15 year old boys in Tonga.

**Table 1:** Data Extraction Sheet.

<table>
<thead>
<tr>
<th>Variables Frequency Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year of the studies</strong></td>
</tr>
<tr>
<td>2000-2004</td>
</tr>
<tr>
<td>2005-2009</td>
</tr>
<tr>
<td>2010 &lt;</td>
</tr>
<tr>
<td><strong>Cohort</strong></td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td><strong>America-Pacific</strong></td>
</tr>
<tr>
<td>7</td>
</tr>
</tbody>
</table>

**Figure 2:** The frequency of the studies based on the study setting.
The prevalence is then broken down according to three specific study areas namely communities, schools, and hospitals. For the community-based studies, the lowest prevalence was 5% among women in Vanuatu and the highest was 75% among men in Kiribati. The highest prevalence in hospital-based studies was 40% among Pacific fathers in New Zealand while the lowest was 3% among pregnant women in the western Pacific Region. For schools, the highest prevalence of smoking among students was 52.1% and the lowest was 15%.

From the 12 articles reviewed on health consequences, smoking has been found to be a common risk factor for several diseases or conditions. Smoking has been found to be more commonly associated with hemorrhagic stroke than any other disease or condition among Pacific people as confirmed by 3 (25%) of the studies. On the other hand, smoking has been found to be least associated with the following: CHD (2 studies, 16.6%), higher mortality rate (2 studies, 16.6%), reduced birth weight (1 study, 8.3%), increased behavioral problems (somatic, attention deficit, aggressiveness) for children of smokers (1 study, 8.3%), maternal asthma (1 study, 8.3%), ischeamic heart disease (1 study, 8.3%), and upper aero-digestive tract cancer (UADTC) (1 study, 8.3%).

It is important to note that none of the studies highlighted smoking as a risk factor in schools. In communities, smoking has been found to be a common risk factor for developing hemorrhagic stroke, as highlighted in 2 studies (28% of the 7 community-based studies). In the community, smoking is least related to ischemic heart disease, coronary heart disease, UADT cancers, increased mortality, and increased cancer death rates, each of which constitutes 14.3% of the articles, respectively.

From four hospital-based studies, smoking is uniformly associated with the following diseases/conditions: coronary heart disease (1 study, 25%), higher lung cancer mortality (1 study, 25%), behavioral problems among children of smokers (1 study, 25%), and reduced birth weight (1 study, 25%).

### Discussion

As shown in the results of this study, the prevalence of smoking in the Pacific is as high as 59.3% in women and 75% in men. However, the prevalence for smoking varies in other studies, as shown in Rasananath et al. [1] with (22%-57%) in males and (0.6%-51%) in females, as reported in 2007 in Pacific Island countries and territories [1,9]. The variation could be the result of the inclusion of more recent studies of prevalence reports in this study. In addition, smoking was found to be more prevalent in men. This shows that Pacific Island males are more likely to be smokers than their female counterparts [8,9]. This is due to the social norm and men's positions and roles in Pacific Island societies, as supported by Kessaram et al. [10]. The findings in this study regarding high prevalence of smoking among males are consistent with studies in the United States, Asia, and Europe [11-13].

In addition, this study found the prevalence among Pacific youths to be as high as 52.1%. This is very high as compared to youths in Europe 22%, Asia 5.4% [14,15]. Many Pacific Islanders come from low-middle income families and, as highlighted by other studies, smoking prevalence is higher among youths from disadvantaged groups [16-18]. Moreover, the consequences of smoking found in this study include the following: hemorrhagic stroke, ischemic heart disease, coronary heart disease, UADT cancers, increased mortality, increased cancer death rate, higher lung cancer mortality, behavioral problems among children of smokers and reduced birth weight. As shown in the results, the consequences of smoking found to be most common within communities is hemorrhagic stroke. The results of such a high rate of hemorrhagic stroke in Pacific communities is largely due to the high prevalence of smoking and poor diets among Pacific people [1,6,19]. For the hospital-based studies it was found that smoking is homogenous across four main consequences and they are as follows: CHD, higher lung cancer mortality, behavioral problems among children of smokers, and reduced birth weight. Other studies have also shown that smoking is commonly linked to the occurrence of CHD and lung cancer [20,21].

The results from this study show that from 2000-2004 only three studies were conducted. The number increased to 13 from 2005-2009 and then dropped back down to 8 from 2010 to the present. This drop is a concern because there is limited research done in the Pacific. All of the studies reviewed are either cohort or cross-sectional in nature and lack any interventional study. As supported by Nosa et al. [21], the lack of any interventional study presents some limitation when it comes to determining actual causality for a certain disease or condition, whether it is actually a result of smoking or otherwise [22]. Furthermore, the results also show that many of the studies were conducted in communities and hospitals (37.5% and 33.3%, respectively), while only 25% of studies were conducted in schools. More studies need to be conducted in the schools considering that Pacific Island adolescents have higher prevalence of smoking as highlighted by Wu et al. [22,23]. Additionally, it is important to have more studies on smoking done in schools because it is at this age where behavior change is easier and they can also act as influencers for others close to them (family, peers) to also quit smoking [23]. Moreover, most of the studies (70.8%) included in this review utilized the purposive sampling method. A randomized sampling approach would significantly reduce bias in the results and increase the generalizability of the results [24].

From the results, smoking is more prevalent in men, as well as youths, in the Pacific. Therefore, smoking interventions and policy efforts need to be directed toward prevention and reduction of smoking among males and youths of the Pacific Islands. Tobacco prevention strategies focusing on all people, through increasing people’s knowledge about the harmful effects of smoking, can be more successful [25]. Schools can be one of the more important places, as highlighted in this study, to implement tobacco prevention and cessation programs. It is very important to recognize the target groups, such as adult smokers as highlighted, and develop comprehensive plans for tobacco prevention and control. Developing anti-smoking mass media campaigns, while considering people’s cultural beliefs, to change smoking behavior is essential [25]. People need to be informed about the policies and adherence to smoking policies in schools. Policy makers need to practice other activities such as increasing smoking cost through taxation, and expanding anti-smoking zones and environment.
As a limitation of the study, it is noted that the search was only on English-language publications, which may affect accessibility to other valuable studies which were published in languages other than English.

Conflict of Interest
There are no conflicts of interest to disclose.

References
33. Asia Pacific Cohort Studies Collaboration. Impact of cigarette smoking on body mass index and coronary heart disease: a pooled analysis of 3264 stroke and 2706 CHD events in 378579


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