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Insights about Fall Prevention of Older Adults in the State of Hawai‘i

Yuka Yamazaki MD, PhD, MPH; Cullen T. Hayashida PhD; Valerie Yontz PhD, MPH, MS, RN-BC

Abstract
The senior population in Hawai‘i is growing at a dramatic pace. In the older population, falls and fall-related injuries are leading causes of morbidity and mortality. Moreover, the health care costs for falls are very high. The State of Hawai‘i has taken measures to prevent falls through the promotion of medication reviews, vision checks, home assessments, and exercise. However, current published examinations of fall preventive measures have been insufficient, and more research is needed to confirm risk factors, effectiveness of preventive measures, and to explore future objectives. This paper examined the validity of fall risk factors and fall preventive measures for Hawai‘i’s seniors by conducting mail questionnaire surveys to a sample of seniors using medical alert services from one company in Hawai‘i. The results of chi-square analysis suggest that having reduced ability to perform Activities of Daily Living (ADL) and reduced Instrumental Activities of Daily Living (IADL) were associated with a greater risk of falls (P < .01). In addition, those who fell were more likely to talk about fall preventions with their family members or friends and health providers compared with those who did not (P = .048 and .003, respectively). Evidence-based exercise programs for strengthening muscles and controlling physical balance may be needed to improve ADL and IADL. Furthermore, the results suggest that seniors do not accept that they are at risk of falling before they actually fall. Public health providers should consider how they approach seniors, and how they inform them of the importance of fall prevention across the life span.

Keywords
older adults, falls, fall prevention, Activities of Daily Living (ADLs), Instrumental Activities of Daily Living (IADLs)

Introduction
The older adult population in Hawai‘i has been growing at a significant pace and faster than the US average. In 2010, only Alaska and Nevada had faster population growth rates than Hawai‘i for persons aged 85 years and over. The proportion of elderly residents aged 65 or older in Hawai‘i has increased 300% since statehood (from roughly 5% in 1960 to 15% in 2012) compared with a 33% increase for the US population as a whole (from 9% to 14% over the same period). The Hawai‘i Long-Term Care Commission Report (2011) projected a 50% increase in the proportion of Hawai‘i’s population aged 65 or over by 2020.

As the number of older adults in Hawai‘i increases, policy-makers, health care providers, and public health professionals are forced to pay more attention to older adults’ health and their quality of life. Older adults are increasingly at higher risk of injury and illness. In particular, falls and fall-related injuries are a major threat to older adults’ health and are associated with increased morbidity and mortality. The “Injuries in Hawai‘i: 2007-2011 Report (2012)” shows that among older adults falling is the number one cause of death from injuries, non-fatal hospitalization, and non-fatal emergency room visits in Hawai‘i. In addition, the report mentions that rates of Emergency Department (ED) visits for Hawai‘i residents aged 85 and older were four times more than those who are 65 to 74 years old, and five to eight times higher than rates for other adult-aged residents. Moreover, financial charges for fall related ED visits and hospitalizations were estimated at $116.6 million for the period from 2007 to 2011 period in Hawai‘i. Therefore, prevention of falls is crucial to improve older adults’ quality of life and to decrease the financial burden in Hawai‘i.

To reduce the number of falls, the State of Hawai‘i Health Department has promoted four preventive measures: (1) physical activity, (2) medication management, (3) home assessment with needed modifications. Multiple public awareness campaigns on television, buses, radio, and in print are used to disseminate those preventive measures to the community. Physical activity reduces the risk of falls by improving strength, balance, coordination, and flexibility. Likewise, medication reviews completed by trained professionals such as pharmacists reduce harmful effects or drug interactions which may increase fall-risks such as dizziness or drowsiness. Vision checks are crucial in fall prevention because older adults tend to have narrow vision and low vision acuity. Finally, home assessments make homes safer for seniors by recommending grab bars, railings, and ramps reducing hazards such as clutter, rugs, and dim lighting.

Despite efforts at implementing fall preventative measures, the task of raising awareness regarding fall prevention is difficult for the following two reasons. First, older adults are generally unaware of or underestimate their fall risk. Second, seniors, families, caregivers, healthcare providers, and the community often think that falls are an inevitable consequence of aging, and thus, cannot be avoided.

There are insufficient scientific evaluations of fall prevention measures in Hawai‘i. Only one study evaluated a program that addresses both the physical and mental aspects of exercise to reduce falls in institutionalized older adults, and there are no reports examining the effectiveness of fall preventive measures for community-dwelling older adults. On the other hand, there are a variety of randomized controlled trials conducted elsewhere investigating fall prevention programs. Therefore, as a first step, this study examined how the aforementioned fall preventive measures and other risk and preventive factors are related to fall risk identified by past cross-sectional studies.
Methods

Study Design and Site
Across-sectional study was carried out using a structured mailed questionnaire to the client base of a local personal emergency response system (PERS) Company that serves the entire state of Hawai‘i.

Participants
Five hundred eighty-five subscribers of the PERS Company were sent a questionnaire. The company started providing PERS services in 2003, and at the time of the study, it was serving about 600 clients daily throughout the state from Kaua‘i, O‘ahu, and Maui to Hawai‘i Island. The company partners with a larger national company, Philips Lifeline, America’s largest and most experienced medical alert company.

Personal Emergency Response System
The system operated by the company is designed to enable those who are frail and living alone to access immediate help because of illness or having experienced a fall. The system components are a pendant which transmits a radio signal for help, a base communicator that receives and transmits a signal to a Call Center at any time and pre-designated responders who are summoned for help. Such systems have become widely accepted in the U.S., serving millions every day by safeguarding the wellbeing of seniors in the home setting so that immediate access to help can prevent a small problem from becoming a medical crisis.

Data Collection
Self-administered questionnaires were distributed and collected by mail between April and June 2014. Self-addressed stamped envelopes were included with the questionnaires to improve response. There were no extrinsic incentives for participation. Upon receipt, the completed questionnaires were labeled with an identification number and reviewed for completeness. The questionnaire assessed subscribers’ service satisfaction level and their functional status. The latter was assessed by their self-reported ability to perform activities of daily living (ADL) for eating, dressing, grooming, bathing, walking, and toileting as well as instrumental activities of daily living (IADL) skills including independence in handling their finances, using the telephone, shopping, and preparing meals. In terms of the ADL and IADL scale, we used a 5-point scale since it provides responders with more gradations and increases our ability to better assess their perceived level of disability. This study assumed that a 5-point disability scale is reliable and valid with more gradations in comparison to a 2 or 3-point scale as it has been typically used in previous studies. However, any scale beyond a 5-point scale would probably introduce less reliability and validity since it would probably not be as meaningful nor as interpretable for respondents. Data were also collected on the number of prescribed and non-prescribed medicines taken per day, perceived fall experience, frequency of falls, fear of falling, physical balance, daily exercise, instability after taking medicines, vision, difficulties with using stairs safely, conferring with family members or friends about how to reduce their risk of falling, talking to a health care provider about how to reduce risk of falling, having vision checked, having medications reviewed by a health care provider, having one’s home assessed for safety, and adopted the recommendations of a home safety assessment (See Appendix).

Question items about satisfaction level, functional status, and medication information came from the annual survey of the PERS Company and other questions on fall related factors, came from existing Center of Disease Control Prevention (CDC)’s fall risk questionnaire. Regarding the PERS company’s question items, they were not pre-tested. However, those questions were used for 3 years from 2012 to 2014, and the results did not vary in these 3 years.

In addition, to investigate the impact of ethnicity on the utilization of PERS services, demographic data from the parent company were merged and analyzed with data from the questionnaire. The results will be published in another paper.

In this study, we only analyzed the data from the questionnaire.

Statistical Analysis
Chi-square tests were conducted to examine the associations between fall experience and several variables including subcategories of ADL and IADL, fear of falling, physical balance, exercise, side effect of medication, vision problem, difficulties with using stairs, talking with family and friends about fall prevention, talking with health providers about fall prevention, vision check, medication review, home assessment, and modification recommendations for home safety assessment.

Regarding ADL and IADL, the 5-point scale was re-categorized into 3 groups as dependent (1), partially independent (2, 3, and 4), and independent (5). The Chi-square tests were then conducted to examine the associations between fall experience and independence level of walking, toileting, bathing, shopping, and preparing meals. These subcategories are strongly associated with lower levels of morbidity and strongly related to gait function. In addition, the gait issue is an important risk factor for physical functional declines and falls.

The statistical software package SAS, version 9.4 was used for all analysis. P-values less than .05 were considered statistically significant.

Ethical Considerations
Ethical approval for research involving human subjects was obtained from the Institutional Review Board at University of Hawai‘i at Manoa (IRB #23116). The information gathered was managed in a strictly confidential manner.

Results
Demographic of Respondents
The questionnaire was returned by 244 of the 585 subscribers resulting in a 42% response rate. Demographic data is presented in Table 1. Among the respondents, 47% reported falling within the past 12 months; 43% fell once, 29% fell twice, and 28%...
fell greater than or equal to three times within the past 12 months. About 3% did not take any prescribed-medications, 60% took from 1 to 5, 32% took 6-10, and 5% took more than 10 prescribed-medications. About 24% did not take any non-prescribed medications, 68% took 1-5, and 8% took more than 5 non-prescribed medications. About 52% of respondents reported exercising, 58% reported having a vision check, 44% had their medication reviewed, and 48% had a home assessment. About 13% of respondents did all four preventive measures.

Characteristics of Those Who Tend to Fall

Results of the $\chi^2$ tests are shown in Table 2. First, those who fell were more likely to talk with friends or family members about how they can reduce their risk of falling, compared with those who did not fall ($P < .05$). Second, compared with those who did not fall, those who fell were more likely to talk with health providers about how they could reduce their risk of falling ($P < .05$). There were no significant differences between fall experience and four preventive measures.

Those who were partially dependent or dependent of skills of bathing, toileting in ADL, shopping, and preparing meals in IADL were more likely to fall compared with those who were independent of those skills ($P < .01$).

Discussion

Summary of Findings

Overall, 47% of the respondents fell within the past 12 months. Among the 47% who fell, 43% fell once, 29% fell twice, and 28% fell greater than or equal to three times. Those who fell were more likely to talk with friends, family members, and health providers about how they could reduce their risk of falling. These results do not indicate that talking with friends, family members, and health providers about fall preventions confer a greater at risk of falls. Low functional levels of ADL and IADL were associated with risk of falling among older adults.

The Limitations of Fall Prevention Measures

Compared with those who did not fall, those who fell were more likely to talk with friends, family members, and health providers about how they could reduce their risk of falling. These results may suggest that older adults might tend to deny their risk of falls before they actually fall. However, Klein and his associates point out that a substantial proportion of falls occur among people who are neither frail nor at high risk. In addition, the self-perceived risk of falling is often judged too optimistically and older adults might regard falls as a relevant problem for others but not for themselves. The Hawai’i State Department of Health points out that about 44% of respondents of their survey perceived having a low level of awareness of fall risk and fall prevention.

<table>
<thead>
<tr>
<th>Table 1. Respondent Attribute</th>
<th>Item</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall experience in past 12 months</td>
<td>Yes</td>
<td>110 (47.0)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>124 (53.0)</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>10</td>
</tr>
<tr>
<td>The number of falls in past 12 months</td>
<td>Once</td>
<td>45 (42.5)</td>
</tr>
<tr>
<td></td>
<td>Twice</td>
<td>31 (29.2)</td>
</tr>
<tr>
<td></td>
<td>Greater than or equal to three times</td>
<td>30 (28.3)</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>4</td>
</tr>
<tr>
<td>The number of oral medicines Prescribed</td>
<td>0</td>
<td>6 (2.7)</td>
</tr>
<tr>
<td></td>
<td>1-5</td>
<td>135 (60.3)</td>
</tr>
<tr>
<td></td>
<td>6-10</td>
<td>71 (31.7)</td>
</tr>
<tr>
<td></td>
<td>11-12</td>
<td>(5.4)</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>20</td>
</tr>
<tr>
<td>Non Prescribed</td>
<td>0</td>
<td>53 (23.5)</td>
</tr>
<tr>
<td></td>
<td>1-5</td>
<td>154 (68.1)</td>
</tr>
<tr>
<td></td>
<td>6-</td>
<td>19 (8.4)</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>18</td>
</tr>
<tr>
<td>Exercise</td>
<td>Yes</td>
<td>119 (52.4)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>108 (47.6)</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>17</td>
</tr>
<tr>
<td>Vision Check</td>
<td>Yes</td>
<td>133 (57.6)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>98 (42.4)</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>13</td>
</tr>
<tr>
<td>Medication Review</td>
<td>Yes</td>
<td>101 (43.9)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>129 (56.1)</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>14</td>
</tr>
<tr>
<td>Home Assessment</td>
<td>Yes</td>
<td>110 (47.6)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>121 (52.4)</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>13</td>
</tr>
<tr>
<td>All Four Measures</td>
<td>Yes</td>
<td>30 (13.0)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>200 (87.0)</td>
</tr>
<tr>
<td></td>
<td>No Answer</td>
<td>14</td>
</tr>
</tbody>
</table>

Percentages do not include “No Answer”.
Table 2. Association between Fall Experience and Other Characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total</th>
<th>Non-Fell</th>
<th>Fell</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talked with family and friends</td>
<td>83 (36.4)</td>
<td>36 (15.8)</td>
<td>47 (20.6)</td>
<td>.048*</td>
</tr>
<tr>
<td>Yes</td>
<td>145 (63.6)</td>
<td>84 (36.8)</td>
<td>61 (26.8)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talked with health providers</td>
<td>77 (33.8)</td>
<td>27 (11.8)</td>
<td>50 (21.9)</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Yes</td>
<td>151 (66.2)</td>
<td>93 (40.8)</td>
<td>58 (25.4)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependent (1)</td>
<td>27 (12.1)</td>
<td>13 (5.8)</td>
<td>14 (6.2)</td>
<td>.687</td>
</tr>
<tr>
<td>Partially Independent (2,3,4)</td>
<td>197 (87.9)</td>
<td>103 (46.0)</td>
<td>94 (42.0)</td>
<td></td>
</tr>
<tr>
<td>Independent (5)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Bathing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependent (1)</td>
<td>27 (11.9)</td>
<td>11 (4.9)</td>
<td>16 (7.1)</td>
<td>.008**</td>
</tr>
<tr>
<td>Partially Independent (2,3,4)</td>
<td>65 (28.8)</td>
<td>26 (11.5)</td>
<td>39 (17.3)</td>
<td></td>
</tr>
<tr>
<td>Independent (5)</td>
<td>134 (59.3)</td>
<td>82 (36.3)</td>
<td>52 (23.0)</td>
<td></td>
</tr>
<tr>
<td>Toiletng</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependent (1)</td>
<td>17 (7.6)</td>
<td>8 (3.6)</td>
<td>9 (4.0)</td>
<td>.001**</td>
</tr>
<tr>
<td>Partially Independent (2,3,4)</td>
<td>59 (26.3)</td>
<td>19 (8.5)</td>
<td>40 (17.9)</td>
<td></td>
</tr>
<tr>
<td>Independent (5)</td>
<td>148 (66.1)</td>
<td>90 (40.2)</td>
<td>58 (25.9)</td>
<td></td>
</tr>
<tr>
<td>IADL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shopping</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependent (1)</td>
<td>71 (31.7)</td>
<td>30 (13.4)</td>
<td>41 (18.3)</td>
<td>.001**</td>
</tr>
<tr>
<td>Partially Independent (2,3,4)</td>
<td>82 (36.6)</td>
<td>38 (17.0)</td>
<td>44 (19.6)</td>
<td></td>
</tr>
<tr>
<td>Independent (5)</td>
<td>71 (31.7)</td>
<td>50 (22.3)</td>
<td>21 (9.4)</td>
<td></td>
</tr>
<tr>
<td>Prepare Meals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependent (1)</td>
<td>55 (24.4)</td>
<td>23 (10.2)</td>
<td>32 (14.2)</td>
<td>.004**</td>
</tr>
<tr>
<td>Partially Independent (2,3,4)</td>
<td>72 (32.0)</td>
<td>32 (14.2)</td>
<td>40 (17.8)</td>
<td></td>
</tr>
<tr>
<td>Independent (5)</td>
<td>96 (43.6)</td>
<td>64 (28.4)</td>
<td>34 (15.1)</td>
<td></td>
</tr>
</tbody>
</table>

*P<.05, **P<.01

The challenge therefore is to determine how health providers can enhance older adult awareness of the dangers of falls. One possibility is to create coordinated community initiatives. The Hawai‘i State Department of Health has undertaken such an initiative several years ago. The Department of Health Fall Prevention Task Force initiated an educational awareness campaign built upon the four foundations of fall prevention and specifically targeted fall prevention messages to older adults, families, clinical professionals/paraprofessionals, the public, students, and policymakers. The Task Force has also collaborated and partnered with professionals, organizations, agencies and the general public to increase their awareness of fall prevention resources in their community as a crucial way to decrease senior falls. The challenge is how to deliver the fall prevention message to older adults and increase the acceptance of the fall prevention tips and to acknowledge that they are really older and at risk of falls. Future objectives include finding ways of approaching older adults and ways of encouraging them to adopt fall prevention measures. The use of positive slogans such as “Maintain Your Independence” or “Good Balance” might be more persuasive and effective at changing attitudes in comparison to directly referring to “Fall Prevention”. Moreover, activities, exercise, and lectures which older adults can enjoy with different age groups may also be effective to increase their motivation for fall prevention and retain their motivation. Exclusive exercise programs for seniors or only for the frail might be avoided to reduce the stigma of aging. An example of an alternative type of approach may be found in the diabetes exercise program in the Marshall Islands. Marshall Islands introduced an intergenerational exercise program for diabetes patients and this program has been succeeding in improving glycemic control. Diabetes patients do exercise with friends, young adults, and children in the community.
Association ADL and IADL and Fall Experience

Previous studies mentioned that ADLs and IADLs deficits are predictors of falls.\(^2\), \(^7\) Similar to those previous studies, the present results also suggest a significant association between low ADLs and IADLs levels and the fall experience. For example, those who were dependent or partially independent of skills of bathing, toileting in ADL, shopping, and preparing meals in IADL were significantly likely to fall, compared with those who were independent of these skills. The activities of bathing, toileting, shopping, and preparing meals all involve good mobility. Thus, declining levels of ADLs and IADLs in those skills mean that the mobility has also probably declined.\(^3\) In addition, declined ADL and IADL measures may also be reflected in gait issues leading to falls.

In association with ADLs and IADLs, most falls in older adults result from inadequate balance.\(^4\) Exercise helps improve physical balance and strengthens muscles which are crucial to prevent falls.\(^5\), \(^6\) However, in this study, no difference was observed between daily exercise and fall experience. This result could also imply that the respondents were not being active enough or with an appropriate exercise to improve their balance and strengthen muscles. Therefore, as the Fall Prevention State Plan mentions, professional trainers should continue offering older adults more evidence-based exercise programs to specifically increase muscle strength and improve balance and make use of Tai Chi classes for balance training.\(^7\) Add to that, step training which include single or multiple volitional or reactive steps in an upright (standing or walking) position in response to an environmental challenge (e.g., avoiding an obstacle or responding quickly) may be worth introducing since this type of training has been shown to prevent falls by approximately 50% in older adults in both community and institutional settings.\(^8\) Finally, use of a pedometer has been found to be effective in increasing participants’ motivation and enhance the benefit of exercise on lower-extremity physical function.\(^9\)

Limitations

This study has limitations. First, respondents were recruited from only one PERS company. Additionally, all subjects of this study were medical alert users, therefore, they may have already been more sensitized about fall prevention issues in comparison to the general older adult population. Thus, the results may not be generalizable.

Second, reporting bias might also exist. It is not clear if all of the respondents were PERS users. While the target population was seniors, some may have experienced difficulty answering the questions accurately and so family members might have answered the questions on their behalf.

Third, no information was collected about the respondents’ present illnesses and age which can influence independence and the need for homecare services. These factors should be examined in future work. In addition, no information about family structure and living arrangements was collected. For example, living alone might influence the desire to use PERS services.

Finally, this study was cross-sectional, thus, causality cannot be determined. For example, it is not possible to determine whether decline in ADLs or IADLs causes falls or fall experiences.

Conclusion

The aging population in Hawai‘i continues to accelerate rapidly and injuries among older adults due to falls will continue to affect their quality of life and health care costs. This study found that reduced ADLs and IADLs are associated with falls. However, the problem is that older adults have not adopted broader fall preventive measures such as medical alert services, exercise, medication checks, vision checks, and home assessment while they are still independent. Older adults generally do not acknowledge that they are at risk of falling. To overcome this barrier, it is crucial for public health providers to consider how to conduct more creative and unobtrusive approaches to educate older adults.

Conflict of Interest

Dr. Hayashida had a financial interest as owner of the PERS Company and paid for the mailing and collection of the completed questionnaires. No other authors reported any financial interest with the respondents.

References

3. Health Trends in Hawai‘i. Elderly Pop Growth in Hawai‘i. http://www.healthtrends.org/ele-
## Appendix

(1) Can you tell us how independent you are as a subscriber or user of our service for the following activities of daily living? (If you are a family member, please provide an assessment of the subscriber’s condition.) (Circle)

<table>
<thead>
<tr>
<th>Skills</th>
<th>Dependent</th>
<th>Independent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Eating</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Bathing</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Dressing</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Grooming</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Toileting</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Handle Finance</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Use Telephone</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Shopping</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Prepares meals</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

(2) How many prescribed and over-the-counter medications do you as the subscriber take? (eg. eye drops, pills, injectables, herbas, traditional or alternative medications, etc.)

1. Prescribed medications
2. Non-prescribed medications (i.e. over-the-counter medicine)

(3) Have you fallen in the 12 months? Yes No
(4) If ‘yes’, how many times have you fallen in the 12 months? enter number →
(5) Are you afraid of falling? Yes No
(6) Do you consider yourself to have good balance? Yes No
(7) Do you exercise daily? Yes No
(8) Do you feel unsteady after taking your medicines? Yes No
(9) Can you see clearly? Yes No
(10) Do you have any difficulties with using stairs safely? Yes No
(11) What have you done to reduce your chance of falling? Check all that apply.

- Talked to a family member or friend about how I can reduce my risk of falling
- Talked to a health care provider about how I can reduce my risk of falling
- Had my vision checked
- Had my medications reviewed by a health care provider or pharmacist
- Had my home assessed for safety
- Adopted the recommendations from home safety assessment (reduce clutter, secured rugs or improved lighting)

Other. Please describe

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Life Expectancies in Hawai‘i: A Multi-ethnic Analysis of 2010 Life Tables

Yanyan Wu PhD; Kathryn Braun DrPH; Alvin T. Onaka PhD; Brian Y. Horiuchi MPH; Caryn J. Tottori MA; Lynne Wilkens DrPH

Abstract
The objective of this study is to examine longevity disparities in Hawai‘i by race/ethnicity and gender based on age-specific death rates in 2010. Abridged life tables for Chinese, Japanese, Filipino, Hawaiians, and Caucasians in Hawai‘i are presented for the age groups: <1, 1-4, every 5-year interval from 5-84, and 85+ years for the year of 2010. Death data were provided by the Hawai‘i Department of Health Office of Health Status Monitoring, and population data were based on 2010 Census modified based on ethnicity estimates from the Hawai‘i Health Survey. Life expectancy at birth in Hawai‘i has increased consistently from 69.5 years in 1950 to 82.4 years in 2010. Longevity disparities seen in past decades continue to persist between the longest-living groups, Japanese and Chinese, and the shortest-living group, Native Hawaiians, with a gap of approximately 10 years. In addition, females lived 6 years longer than males on average. Racial/ethnic disparities in longevity can be partially explained by differences in socioeconomic status, health behaviors, health care access, and racism. Native Hawaiians continue to have the shortest life expectancy of the ethnic groups examined, requiring expanded efforts to address Native Hawaiian health across the life course. Our findings also support more ethnic-specific research to understand the health care needs and utilization patterns of each group.

Keywords
Life expectancy, life table, health disparities

Abbreviations
HHS: Hawai‘i Health Survey
HBRFSS: Hawai‘i Behavioral Risk Factor Surveillance System
ACE: Adverse Childhood Events

Introduction
Life expectancy at birth is widely used as an index of overall health and social conditions in different populations. Life expectancy at birth in the United States (US) has improved dramatically over the past century. Throughout the second half of the century, advances in medicine, along with healthier lifestyles and better access to health care, have yielded impressive improvements in life expectancy above age 65 years. Estimates published nationally suggest that life expectancy above age 65 years, largely reflective of socioeconomic status, health behaviors, health care access, and racism. Native Hawaiians continue to have the shortest life expectancy of the ethnic groups examined, requiring expanded efforts to address Native Hawaiian health across the life course. Our findings also support more ethnic-specific research to understand the health care needs and utilization patterns of each group.

In this paper, we present disaggregated life tables for the year 2010 for five major ethnic groups in Hawai‘i—Native Hawaiian, Caucasian, Chinese, Japanese, and Filipino—by gender. Estimates were based on the following age groups: <1, 1-4, 5-year intervals from 5-84 and 85 years and above.

Data and Methods
Life tables can be estimated in two ways according to the length of the age interval in which data are presented. A complete life table contains data for every single year of age, while an abridged life table contains data by 5- or 10-year age intervals. The abridged life table method was used for US life tables estimated prior to 1997. The World Health Organization’s Global Program on Evidence for Health Policy also uses the abridged method for the construction of life tables of their member states. We apply the abridged method proposed by Chiang. This method also was used in the estimation of the 1980, 1990 and 2000 series of life table reports for Hawai‘i.

Death record data were provided by the Hawai‘i Department of Health. Numbers of death were calculated based on the mean number over a period of 3.5 years centering on April 1, 2010. Population estimates are based on the Hawaii Census 2010, adjusted by ethnicity estimates from the Hawai‘i Health Survey (HHS), a random-sample telephone survey patterned after the National Health Interview Survey.

The ethnic categorization schema of the HHS differs from that of the US Census. It is based on paternal ethnicity for mixed offspring, with exceptions for Caucasians and Native Hawaiians. When only one parent is Caucasian, the child takes the ethnicity of the non-Caucasian parent, and when one parent is Hawaiian or part-Hawaiian, the child is classified part-Hawaiian regardless of the other parent’s ethnicity. For this study, we combined pure Hawaiians and part Hawaiians (under the term “Native Hawaiian”, indicating that the individual can trace his/her ancestry to pre-colonization), as the number of full-blood Hawaiians is small. Because the HHS classification system is used for death records, HHS population estimates are a better match than US Census estimates in constructing life tables.
Results
Life Expectancy at Birth Increased by 12.9 Years in 60 Years in Hawai‘i
Table 1 shows the life expectancy at birth for the overall population and the five ethnic groups (Chinese, Japanese, Filipino, Caucasian, and Native Hawaiian) in Hawai‘i from 1950 to 2010, as well as the national life expectancy in the US for the total population and for Caucasians and African Americans. The life expectancy at birth in Hawai‘i in 2010 was 82.4 years, 3.7 years higher than the national average for the total US population (78.7 years) and for Caucasians (78.9) and African Americans (75.1). In the past six decades, life expectancy at birth in Hawai‘i increased by 12.9 years, compared to a 10.5-year increase in the nation (9.8 years for Caucasians and 14.9 years for African Americans). Table 1 and Figure 1 show the trend of life expectancy at birth in Hawai‘i for the overall population and the five ethnic groups. Filipinos had the largest increase in life expectancy between 2000 and 2010, at 3.4 years. Native Hawaiians had the lowest life expectancy of the five ethnic groups, with a consistent 10-year gap between the longest living ethnicities (Japanese from 1950 to 1970 and Chinese thereafter). The longevity gap was 10.2 years in 1950 and 11.1 years in 2010 with a range from 8.6 years to 11.8 years. Looking more closely, the gap in life expectancy between Caucasians and Native Hawaiians in Hawai‘i has decreased over time, from 6.7 years in 1950 to 4.0 years in 2010, while the gap between Caucasians and Japanese increased from 3.4 years in 1950 to 7.1 years in 2010, and the gap between Caucasian and Chinese increased from 0.5 years to 7.1 years. Due to limited sample size, the life tables for other Pacific Islanders such as Samoan or Tongan were not calculated in this paper.

Comparing Hawai‘i to national statistics, life expectancy estimates for African Americans over the same time period were 1.5 to 5.2 years below those for Native Hawaiians (Table 1). Similarly to the gap between Caucasians and Native Hawaiians in Hawai‘i, the life expectancy gap between Caucasians and African Americans nationally has decreased over time, from 8.3 years in 1950 to 3.8 years in 2010. Unfortunately, the US Census does not publish life expectancy estimates for Asian Americans or Pacific Islanders.

Females Live about 6 Years Longer than Males
Life expectancy by gender for 2000 and 2010 are listed in Table 1. The life expectancy at birth in 2010 for females was 6.4 years longer than that of males in Hawai‘i. The gender gap in Hawai‘i was greater than the national difference, at 4.8 years for the total US population, but similar to the gender gap for African Americans (6.2 years). The gender gap also varies by ethnicity in Hawai‘i. Filipinos and Japanese had the largest difference (7.3 years and 6.8 years, respectively). The gender gaps in Chinese and Caucasians were below the population average (4.7 years and 5.1 years, respectively). The gender difference in Native Hawaiians was 5.5 years.

Life Expectancy and Mortality Differ across Ethnic Groups by Age Groups
Life expectancies for 2010 by gender, ethnicity, and age group are presented in Table 2. In general, the life expectancies in all the age groups are consistent with that of birth, except that the life expectancy for Filipino males exceeded Japanese males at age 80-84 years. Filipino females outlived Japanese females at age 75 and Chinese females at age 80.

<table>
<thead>
<tr>
<th>Table 1. Life Expectancy at Birth by Ethnicity 1950 to 2010 and Gender Gap in 2000 and 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Population</td>
</tr>
<tr>
<td>Year</td>
</tr>
<tr>
<td>1950</td>
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<tr>
<td>1960</td>
</tr>
<tr>
<td>1970</td>
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<tr>
<td>1980</td>
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<td>1990</td>
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<td>2000</td>
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<tr>
<td>2010</td>
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<tr>
<td>Female</td>
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<tr>
<td>Male</td>
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<tr>
<td>Gender gap</td>
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<tr>
<td>2010</td>
</tr>
<tr>
<td>Male</td>
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<tr>
<td>Gender gap</td>
</tr>
</tbody>
</table>
**Table 2. Life Expectancy for Hawai‘i Population and Ethnic Groups by Gender and Age Groups in 2010**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>All Ethnic groups</th>
<th>Chinese</th>
<th>Japanese</th>
<th>Filipino</th>
<th>Caucasian</th>
<th>Hawaiian</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall M F</td>
<td>Overall M F</td>
<td>Overall M F</td>
<td>Overall M F</td>
<td>Overall M F</td>
<td>Overall M F</td>
</tr>
<tr>
<td>&lt;1</td>
<td>82.4 79.2 85.6 87.8 85.3 90.0 84.7 81.2 88.0</td>
<td>84.3 80.8 88.1 80.6 78.3 83.4 76.6 73.9 79.4</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1-4</td>
<td>81.8 78.7 85.1 87.0 84.5 89.3 84.2 80.7 87.6</td>
<td>83.8 80.3 87.5 79.9 77.6 82.6 76.2 73.5 79.0</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>5-9</td>
<td>77.9 74.7 81.1 83.0 80.5 85.3 80.3 76.8 83.6</td>
<td>79.8 76.4 83.6 75.9 73.7 78.6 72.3 69.5 75.1</td>
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</tr>
<tr>
<td>10-14</td>
<td>72.9 69.8 76.2 78.0 75.6 80.3 75.4 71.9 78.7</td>
<td>74.8 71.4 78.6 71.0 68.7 73.8 67.3 64.6 70.1</td>
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<tr>
<td>15-20</td>
<td>68.0 64.8 71.2 73.0 70.6 75.3 70.4 66.9 73.7</td>
<td>69.8 66.4 73.6 66.0 63.7 68.8 62.3 59.6 65.1</td>
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<tr>
<td>20-25</td>
<td>63.1 60.0 66.3 68.1 65.6 70.3 65.5 62.0 68.8</td>
<td>65.0 61.5 68.7 61.2 59.0 63.9 57.5 54.9 60.2</td>
<td></td>
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<tr>
<td>25-30</td>
<td>58.3 55.3 61.4 63.1 60.7 65.4 60.7 57.2 63.9</td>
<td>60.1 56.8 63.8 56.4 54.2 59.1 52.8 50.2 55.4</td>
<td></td>
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</tr>
<tr>
<td>30-35</td>
<td>53.5 50.5 56.5 58.2 55.7 60.5 55.7 52.3 58.9</td>
<td>55.3 52.1 58.9 51.6 49.5 54.2 48.0 45.6 50.4</td>
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<tr>
<td>35-40</td>
<td>48.7 45.8 51.6 53.3 50.9 55.5 50.9 47.5 54.0</td>
<td>50.5 47.3 54.0 46.9 44.8 49.4 43.3 40.9 45.6</td>
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<tr>
<td>40-45</td>
<td>44.0 41.2 46.8 48.4 46.0 50.6 46.0 42.7 49.2</td>
<td>45.7 42.6 49.2 42.2 40.1 44.5 38.7 36.4 40.9</td>
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<tr>
<td>45-50</td>
<td>39.4 36.6 42.1 43.5 41.1 45.7 41.3 38.0 44.3</td>
<td>41.0 38.0 44.4 37.6 35.6 39.8 34.2 32.1 36.2</td>
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<tr>
<td>50-55</td>
<td>34.9 32.3 37.5 38.8 36.5 40.9 36.7 33.6 39.6</td>
<td>36.4 33.5 39.7 33.2 31.4 35.3 29.8 27.9 31.8</td>
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<tr>
<td>55-60</td>
<td>30.6 28.1 33.0 34.1 31.9 36.1 32.2 29.2 34.9</td>
<td>31.9 29.0 35.0 28.9 27.2 30.8 25.8 24.0 27.6</td>
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<td></td>
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<tr>
<td>60-65</td>
<td>26.4 24.1 28.6 29.5 27.4 31.4 27.8 24.9 30.4</td>
<td>27.6 24.8 30.6 24.8 23.3 26.5 21.9 20.3 23.4</td>
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</tr>
<tr>
<td>65-70</td>
<td>22.3 20.2 24.3 25.0 23.0 26.8 23.6 20.9 25.9</td>
<td>23.3 20.7 26.2 20.7 19.4 22.2 18.3 16.8 19.6</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>70-75</td>
<td>18.5 16.6 20.3 20.7 18.9 22.4 19.6 17.1 21.6</td>
<td>19.4 16.9 22.1 16.9 15.7 18.1 15.1 13.9 16.1</td>
<td></td>
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</tr>
<tr>
<td>75-80</td>
<td>15.0 13.2 16.5 16.9 15.2 18.3 15.8 13.5 17.7</td>
<td>15.7 13.5 18.1 13.4 12.4 14.3 12.1 11.1 12.9</td>
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<td></td>
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<tr>
<td>80-85</td>
<td>11.9 10.3 13.2 13.3 11.8 14.5 12.4 10.2 14.1</td>
<td>12.5 10.5 14.9 10.4 9.6 11.0 9.5 8.7 10.1</td>
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<td></td>
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<tr>
<td>85+</td>
<td>9.3 7.9 10.3 10.2 9.1 11.1 9.5 7.6 11.0</td>
<td>10.1 8.2 12.4 7.8 7.2 8.3 7.5 6.9 7.9</td>
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</tr>
</tbody>
</table>
Figure 2 examines the mortality rate per 10,000 populations for the age groups (0-4, 5-19, 20-44, 45-64 and 65-84). Even though the life expectancy at birth for Caucasians was the second lowest, the average mortality rate from birth to 4 years for Caucasians was only second to the Chinese. The mortality rate between 5-19 years was the lowest but with the highest variation due to the small numbers of death. A consistent pattern of mortality rates for both females and males across the five ethnic groups is observed. The mortality rate for Chinese females was approximately 3 per 10,000 for those aged 20-44 years, 15 for those 45-64 years, and 127 for those 65-84 years. The corresponding death rate for Japanese and Filipinos was about 1.5 times higher for the three age groups, whereas Caucasians and Native Hawaiians were about 2 times and 3 times higher than Chinese respectively. There was a similar pattern in males, except the overall mortality rate is higher than that of females, and the ethnic gap is a little higher. Filipinos had lower mortality rates compared to Japanese in the older age-groups (65-84 for females, 45-64, and 65-84 for males).

Discussion
Life expectancy in Hawai‘i increased steadily from 1950 to 2010 for all racial/ethnic groups. While the 10-year gap in longevity between Native Hawaiians and the longest-living ethnic groups (Japanese and Chinese) has remained constant over the past 60 years, the gap in life expectancy between Native Hawaiians and Caucasians in Hawai‘i has decreased.

Differences in life expectancy have been linked to social and economic disparities. Most recently, for example, an analysis of a merged tax-record-death-record database found that higher income was associated with greater longevity across the US. In Hawai‘i, the 2010 Hawai‘i Behavioral Risk Factor Surveillance System (HBRFSS) data suggest that only 24% of Native Hawaiians have household incomes at $75,000 or higher, compared to Caucasians (43%), Chinese (43%), and Japanese (41%) residents. Similarly, only 20% of Native Hawaiians age 25+ have a 4-year-college degree or higher, compared to Chinese (53%), Japanese (45%), and Caucasian (45%) residents. However, socio-economic indicators do not appear to explain the increases in life expectancy seen in Filipino residents, of whom only 27% have college degrees and only 25% have household incomes of $75,000 or higher.

Disparities in life expectancy also have been linked to differences in health behavior. For example, the Honolulu Asia Aging Study (HAAS) found that avoidance of overweight, hyperglycemia, hypertension, smoking, and excessive alcohol consumption were associated with survival in Japanese males in Hawai‘i. Looking at 2010 HBRFSS data, both Native Hawaiians and Caucasians have a higher prevalence of lifetime smoking (100+ cigarettes), at 47.6% and 49.2%, respectively, compared to 24.4% of Chinese, 27.3% of Filipinos, and 36.2% of Japanese. However, the percentage of current, everyday smokers was much higher among Native Hawaiians (90.6%) than among Caucasians (9.8%), Filipinos (7.7%), Japanese (7.2%), and Chinese (5.1%). Similarly, the prevalence of obesity was much higher among Native Hawaiians (43.7%), compared to the other four ethnic groups (Chinese 14.7%, Japanese 13.9%, Filipino 19.9% and Caucasian 20.6%). More effective tobacco cessation and weight control interventions may increase life expectancy for Native Hawaiians.
Another culprit in health disparities is differential access to health care. HBRFSS 2010 data suggest that 9.2% of Filipinos had no health plan coverage, compared to an average of 5.4% for other ethnic groups. Filipinos and Native Hawaiians had the highest percentage reporting that they did not see a doctor in the past 12 months because of cost (10.3% and 9.5%, respectively), compared to 7.3% of Caucasians, 3.4% of Japanese, and 2.5% of Chinese.

A growing body of research shows that the experience of racial discrimination can negatively impact health, as it both decreases one’s participation in health care and increases one’s participation in risky health behaviors. Work by Kaholokula and colleagues suggests that ethnic discrimination may be a chronic psychosocial stressor for Native Hawaiians and that strong perceptions of discrimination are associated with stress-related chronic diseases, such as hypertension and diabetes. For example, a study of 143 adult Native Hawaiians found that those reporting a strong Hawaiian ethnic identity perceived more racism in their environment than those who identified less strongly, and that greater perceived racism was significantly associated with lower diurnal cortisol levels. Chronically low cortisol levels have been associated with increased risk for stress-related disorders, such as atherosclerosis, hypertension, obesity, and diabetes. More research is needed on the experience of racism by different ethnic groups in Hawai’i and the link between this experience and access to health care, engagement in risky behaviors, morbidity, and mortality.

Another relevant area of research is on adverse childhood events (ACEs). A number of papers have been published on the health of 17,337 adult members of the Kaiser Health Plan members who completed a survey about ACEs they may have experienced. As a whole, findings from this research show strong linkages between the experience of abuse, neglect, parent death, and poverty in childhood and increased risk for physical and mental health conditions in later life. Findings from this dataset also suggest greater risk of premature death in families of health plan members who reported more ACEs, leading the authors to conclude that “adverse childhood experiences may be an indicator of a chaotic family environment”. In Hawai’i, questions from the CDC ACEs module were added to the BRFSS in 2010. Findings suggest that the prevalence of ACEs is inversely related to socio-economic status income and directly related to number of health conditions and risk behaviors. Looking by ethnicity, the prevalence of ACEs is lowest for Chinese (40.3%) and Japanese (44.8%), intermediate for Filipinos (52.0%), and highest for Caucasian (63.8%) and Native Hawaiians (74.9%), inversely mirroring life expectancy ranking by ethnicity. This supports the need for more research on ACEs and for interventions that can improve health and wellbeing across the life course.

Another factor that must be considered when interpreting these data is the fact that immigrants to Hawai’i may return to their home countries for end-of-life care. According to practitioners in Hawai’i’s community health centers, which serve many of the state’s new immigrant groups, it is very likely that older Filipinos return to the Philippines when they are sick and near death, taking advantage of strong family support systems and low medical costs in their natal homes. This may confound the true life expectancy of this population, which may in fact be artificially lower than that calculated.

In most disparities research in the US, Caucasians serve as the “gold standard” against which other race/ethnic groups are compared. In Hawai’i, however, the Japanese and Chinese groups have the longest life expectancy and, by and large, the best socio-economic, health, and utilization statistics. When compared to Caucasians, the life expectancy gap between Native Hawaiians in Hawai’i is decreasing, similarly to the gap between Caucasian and African Americans nationally. What is increasing is the gap between both the Native Hawaiian and Caucasian groups and the Chinese and Japanese residents of Hawai’i. The data also show that mortality rates for Native Hawaiians and Caucasians are significantly higher than for Chinese in every age group, reinforcing the need for programs that address health disparities over the life course, not just in adulthood. Also of interest would be more research on the reasons for the successes of the Chinese and Japanese groups that can be applied to the shorter-living groups.

**Limitations**

Hawai’i is one of the smallest, yet most multicultural states in the US, with a population of 1.3 million. Thus, numbers of deaths by age-gender-ethnic group can be low and vary dramatically year to year. Therefore, mean numbers of deaths over a 3.5-year period and the abridged life table method with five-year-intervals were used to reduce potential variation, and the life tables for Koreans and other Pacific Islanders such as Samoans and Tongans were not calculated in this paper. Also, we used the established Hawai’i state algorithm for ethnicity classification. The classification schema has been used in Hawai’i since before statehood (1959), when mixed-ethnic marriages were less common. Although there are fewer multiracial sub-populations in older adults and new immigrants to Hawai’i, interracial marriages have become very common in Hawai’i; Hawai’i Department of Health data suggest that about 50% of babies born in the state in 2009 and 54.5% in 2015 were of mixed ethnicity. This trend might complicate the established ethnic classification system in the future. At the same time, the number of immigrants and their children is growing, and the percentage of foreign-born immigrants in the state’s population rose from 14.7% in 1990 to 17.6% in 2013. We found limited research on the experience of racism by different ethnic groups in Hawai’i. Finally, socio-economic and health behavior data are not linked to the death record, restricting us from investigating predictors of life expectancy disparities.

**Conclusion**

Our gender-ethnic-age-specific life-table analysis revealed substantial longevity disparities among the five largest ethnic groups in Hawai’i. Although substantial variation in socio-economic status, health behavior, and health care access exists...
by ethnicity in Hawai‘i, these variations do not fully explain disparities in life expectancy. As Native Hawaiians continue to have the shortest life expectancy of the five groups, we recommend expanding efforts to improve Native Hawaiian health across the life course. Our findings also support more research to understand ethnic-specific health behaviors, health care needs, utilization patterns, and experiences of ACEs and racism.

**Conflict of Interest**
Authors declare no conflict of interests.

Authors’ Affiliations:
- University of Hawai‘i, Department of Public Health Sciences, Honolulu, HI (YW, KB)
- Hawai‘i Department of Health, Honolulu, HI (ATO, BYH, CJT)
- University of Hawai‘i Cancer Center, Honolulu, HI (LW)

Correspondence to:
Yanyan Wu PhD; 1960 East-West Rd., Biomed D104F, Honolulu, HI 96822; Email: yywu@hawaii.edu

**References**

Breastfeeding in Samoa: A Study to Explore Women’s Knowledge and the Factors which Influence Infant Feeding Practices

Lucy E. Archer MBChB; Thomas F. Dunne BMedSc; Lauren J. Lock MBChB; Lucy A. Price MBChB; Zubair Ahmed PhD

Abstract
A decline in breastfeeding rates in Samoa has been reported over the last century. To assess the length of time women breastfeed, their knowledge of both the advantages of and recommendations for breastfeeding, and the factors that influence their decisions to continue or discontinue breastfeeding, a questionnaire was distributed at Tupua Tamasese Meaole Hospital. One hundred and twenty-one eligible participants were included aged 18-50 years (mean age 28.2). Ninety percent of participants initiated breastfeeding, and the majority (76%) of babies were exclusively breastfed for at least the recommended 6 months. Many mothers introduced complementary (solid) foods later than World Health Organization (WHO) and United Nation’s International Children’s Fund (UNICEF) recommendations of 6 months. Awareness of the advantages of breastfeeding was mixed. The most widely known advantage was “the development of an emotional bond between mother and baby” (67%). Other advantages were less widely known. Only a small minority were aware that breastfeeding reduces risk of maternal diabetes and aids weight loss post partum. Doctors and healthcare workers were listed as the top factors encouraging breastfeeding. Participants’ comments revealed a generally positive attitude towards breastfeeding, a very encouraging finding. Participants identified that the number of breastfeeding breaks available at work and the length of their maternity leave were factors discouraging breastfeeding. Future studies are necessary to determine if problems identified in this study are applicable on a national level. These could be important to determine measures to improve breastfeeding practices in Samoa.

Keywords
Breastfeeding; Samoa; Advantages; Infant nutrition; Perceptions

Introduction
Breastfeeding is the healthiest way for babies to feed. Evidence shows numerous benefits: it provides the optimal nutrients, growth factors and antibodies for the baby; aids maternal weight loss; helps to develop the emotional bond between mother and baby; acts as natural birth control and protects against maternal cancers. In developing countries where there is an increased risk of infections associated with bottle feeding, breastfeeding is the most hygienic method of infant feeding. The World Health Organization (WHO) recommends initiation of breastfeeding within 1 hour of birth, exclusive breastfeeding for 6 months and continued breastfeeding with initiation of solid foods. Long-term benefits include a reduced obesity risk for baby and a reduced risk of developing diabetes for both mother and baby. Obesity, defined as a Body Mass Index (BMI) >32kg/m² for Polynesians, is a major problem in the independent nation of Samoa. A study published in 2014 showed 64.6% of females and 41.2% males in Samoa were obese. This compares with 36% prevalence of obesity (defined as BMI >30kg/m² in this population) in adult males and females in the United States. Furthermore the prevalence of diabetes mellitus is very high, with 23% of Samoans diagnosed with the condition and potentially others going undiagnosed. By encouraging optimal breastfeeding practices, this disease burden could be reduced.

Traditionally, nearly all babies in Samoa were breastfed. In 1951 the average age of weaning was 20 months. However, there has been a notable decline in breastfeeding rates in the latter half of the 20th century alongside the introduction of western diets, progressive urbanization, and migration of families to urban areas with more work available for women. In 2009, the United Nation’s International Children’s Fund (UNICEF) reported only 51.3% of women were exclusively breastfeeding up to 6 months.

The Government of Samoa and UNICEF report suggests working commitments are a major barrier to breastfeeding. Traditionally, women would return to their parents’ family for support while breastfeeding; this practice is often not possible for working mothers today. Women are legally entitled to a minimum of 4 weeks paid maternity leave, which does not enable mothers to exclusively breastfeed for 6 months. Employers are legally obliged to provide mothers with opportunities to breastfeed or express breast milk at work. However, there are practical difficulties to this. For example, with Samoa’s hot climate, having an appropriate place for milk storage may not be possible in all work places. Samoa bureau of statistics shows that 2.6%-25.6% of women aged 15-49 years were employed; meaning employment cannot be the sole reason for decline in breastfeeding rates as at least 75% of women are not employed.

The UNICEF report also highlights the availability of formula milk in Samoan shops as a potential influence on the cultural shift away from breastfeeding. A qualitative study among Maori women by Glover, et al, identified five influences to the decision of infant-feeding: the breakdown in the breastfeeding norm within their family; early interruptions or difficulties establishing breastfeeding; negative or insufficient support for breastfeeding; lack of knowledge about breastfeeding; and returning to work. A similar study in American Samoa highlighted convenience of formula milk, perceptions of insufficient milk, and pain as barriers to breastfeeding. These factors may be transferable to mothers in independent Samoa.

This study aims to identify factors that influence Samoan women’s decision and ability to breastfeed. Further aims include: to determine whether Samoan women intended to breastfeed; to assess the awareness among Samoan mothers of the recom-
mended time to exclusively breastfeed and the advantages of breastfeeding, and finally to determine whether employment status has an influence on length of time mothers breastfeed. This information could enable the Ministry of Health in Samoa to identify methods to further improve support available for mothers.

Methods
Ethics statement: Ethical approval was gained from the University of Birmingham’s Ethical Review committee and Ministry of Health Research Committee Samoa and Tupa Tamasese Meaole (TTM) Hospital. Written informed consent was obtained from all participants prior to completion of the questionnaire.

This cross-sectional prevalence study used a quantitative questionnaire (appendix 2) distributed at TTM Hospital, Apia, the national hospital of Samoa. The 12 questions used a tick-box format, including information about participants’ demographics, length of time participants exclusively breastfed, knowledge of breastfeeding recommendations, and knowledge of advantages of breastfeeding. This questionnaire was created by the researchers using knowledge gained through previous research. The Center for Disease Control and Prevention breastfeeding study was used to develop questions and a qualitative study among Maori women, particularly those questions based around factors encouraging and discouraging women to breastfeed.13,14

The questionnaire also included a qualitative aspect using a comments section to allow exploration of cultural and other influences. Knowledge of advantages of breastfeeding and WHO breastfeeding recommendations were also assessed, as research shows knowledge and education is a determinant of breastfeeding practices.14,15 After data was entered into a database, questionnaires were destroyed and each response given a numerical value.

Eligible participants were females aged 18-50 years, with a child >6 months of age (mothers with a child above this age are more likely to have experienced the factors discussed in the questionnaire). Participants were recruited in the antenatal clinic waiting area. Women attending the clinic (as patients and their friends or family present) were asked if they had previously had a child. Other participants were recruited in the pediatric clinic waiting area. No incentives were offered for participation. Exclusion criteria were non-Samoan citizens and people who cannot speak either English or Samoan.

The questionnaire was translated from English into Samoan by two medical students attending the University of Samoa, fluent in both English and Samoan. It was distributed in clinic waiting rooms in both languages. A healthcare professional was able to read the consent form (appendix 1) and questionnaire to illiterate patients. If there were queries regarding the questionnaire, the principal investigator and a health care professional were available to discuss these. Convenience sampling was used in order to prevent interference with clinic or ward activities. Data collection took place over 2 weeks during May 2015.

Statistical Analysis
Data was analyzed using Microsoft Excel. To test whether significant differences existed in the length of exclusive breastfeeding and knowledge of breastfeeding the Student’s t-test was used. To calculate whether a significant difference existed between the percentage of employed and unemployed participants who reported breastfeeding, a Chi-square test was applied with Yates’ correction.

Results
Demographics
One hundred and twenty-six women responded to the questionnaire. Five of these were excluded; 2 because the participants had not yet had a child, 2 because the participants had not answered more than 1 question, and 1 because the participant was a non-Samoan citizen. This left 121 participants. The percentage of participants who were employed (35%) and have a college level of education or higher (96%) was significantly greater than the general population of Samoa (25% and 30% respectively).16 Participants’ babies were born between 1986 and 2014. The majority of participants intended to breastfeed (97%), compared to those who said they did not intend to breastfeed (n=2, 3%). Table 1 shows participants’ demographics.

Length of Exclusive Breastfeeding
Out of the 121 participants, 117 responded to the question regarding length of exclusive breastfeeding. Seven participants gave 2 responses, and 2 participants gave 3 responses as they are multiparous. (Figure 1). This gave N=128 for number of responses. The majority of participants achieved at least 6 months exclusive breastfeeding 108 (84%; P<.0001, Student’s t-test). Despite this, only 9 (7%) babies were weaned at 6 months. Ninety-nine women (77%; P<.0001, Student’s t-test) reported exclusive breastfeeding beyond 6 months.

Knowledge of Breastfeeding
Participants’ reporting of extended exclusive breastfeeding is reflected in the participants’ knowledge of the recommended breastfeeding times (Table 2). Eight respondents (7%) were correct in selecting 6 months as the WHO recommended length of time to exclusively breastfeed, while 75 (67%; P<.0001, Student’s t-test) gave a value greater than 6 months.2 Twenty-five (22%) respondents selected “don’t know.” Participants were presented with a list of facts and asked to identify which they believed to be an advantage of breast feeding (multiple options including “don’t know” could be selected) (Table 3). The 2 most popular statements were: “develops an emotional bond between mother and baby” (84, 72%) and “reduces risk of long term health problems for baby” (67, 58%). The other advantages listed were known to less than half of respondents (Figure 2). Only 2 participants were aware of all the listed advantages. Very few participants were aware that breastfeeding reduces risk of diabetes (10, 9%) or helps the mother lose weight (6, 5%).
Table 1. Participant Demographics

<table>
<thead>
<tr>
<th></th>
<th>Participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>121</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>28.2</td>
</tr>
<tr>
<td>Range</td>
<td>18-50</td>
</tr>
<tr>
<td>Missing/Unknown</td>
<td>9</td>
</tr>
<tr>
<td><strong>Employment Status</strong></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>40 (35%)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>73 (65%)</td>
</tr>
<tr>
<td>Missing/Unknown</td>
<td>8</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>45 (39%)</td>
</tr>
<tr>
<td>Rural</td>
<td>70 (61%)</td>
</tr>
<tr>
<td>Missing/Unknown</td>
<td>6</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>Primary School</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Secondary School</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>College</td>
<td>73 (64%)</td>
</tr>
<tr>
<td>University</td>
<td>37 (32%)</td>
</tr>
<tr>
<td>Missing Unknown</td>
<td>7</td>
</tr>
<tr>
<td><strong>Intention to Breastfeed</strong></td>
<td></td>
</tr>
<tr>
<td>Planned to breastfeed</td>
<td>113 (97%)</td>
</tr>
<tr>
<td>Did not plan to breastfeed</td>
<td>3 (3%)</td>
</tr>
<tr>
<td>Missing/Unknown</td>
<td>5</td>
</tr>
</tbody>
</table>

Percentages exclude unknown/missing

Figure 1. Category which Participants Selected as the Length of Time They Exclusively Breastfed

Table 2. Length of Time of Exclusive Breastfeeding

<table>
<thead>
<tr>
<th></th>
<th>Participants perceiving this to be the recommended length of time of exclusive breastfeeding (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>121</td>
</tr>
<tr>
<td>Don’t know</td>
<td>25 (22%)</td>
</tr>
<tr>
<td>No breastfeeding</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>&lt;2 weeks</td>
<td>0</td>
</tr>
<tr>
<td>1 month</td>
<td>0</td>
</tr>
<tr>
<td>2 months</td>
<td>0</td>
</tr>
<tr>
<td>3 months</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>4 months</td>
<td>0</td>
</tr>
<tr>
<td>5 months</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>6 months</td>
<td>8 (7%)</td>
</tr>
<tr>
<td>7-12 months</td>
<td>9 (8%)</td>
</tr>
<tr>
<td>&gt;12 months</td>
<td>66 (59%)</td>
</tr>
<tr>
<td>Unknown/Missing</td>
<td>9</td>
</tr>
</tbody>
</table>

Percentages exclude unknown/missing

Table 3. Advantages of Breastfeeding

<table>
<thead>
<tr>
<th></th>
<th>Participants aware of that advantage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>121</td>
</tr>
<tr>
<td>Develops an emotional bond between mother and baby</td>
<td>84 (72%)</td>
</tr>
<tr>
<td>Reduces risk of long term health problems for baby</td>
<td>67 (58%)</td>
</tr>
<tr>
<td>Reduces baby’s risk of infection</td>
<td>50 (43%)</td>
</tr>
<tr>
<td>Reduces risk of breast cancer for mother</td>
<td>36 (31%)</td>
</tr>
<tr>
<td>Natural birth control</td>
<td>21 (18%)</td>
</tr>
<tr>
<td>Reduces baby’s risk of cot death</td>
<td>16 (14%)</td>
</tr>
<tr>
<td>Reduces risk of diabetes for mother</td>
<td>10 (9%)</td>
</tr>
<tr>
<td>Helps mother with weight loss</td>
<td>6 (5%)</td>
</tr>
<tr>
<td>Don’t know</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Unknown/Missing</td>
<td>5</td>
</tr>
</tbody>
</table>

Participants could select more than one option hence percentages do not add up to 100. Percentages exclude unknown/missing.
Factors Affecting Breastfeeding

Eighty-nine (77%) participants stated that they were encouraged by a doctor to breastfeed and 48 (41%) by another healthcare worker (multiple categories could be selected) (Table 4). Family support was shown to be important as “encouragement from their partner/husband” (35, 30%) and “other family” (37, 33%) were highly selected options. Other factors were selected by fewer women. This question gave participants the option to add further comments. Many of these comments showed that the participants see breastfeeding as being very important. Such responses as “to make baby healthy,” “to stop baby becoming sick,” and “to show your baby your love as a mother, it is the right thing to breastfeed” highlight this. One participant mentioned that the money saving aspect of breastfeeding factored in her decision. The factors most frequently identified as making breastfeeding difficult were job related: “limited breaks to breastfeed at work” (23, 20%), and “limited maternity leave” (21, 18%). Table 5 reports other factors identified as discouraging breastfeeding. The comments for this question further highlight the participants’ views on the importance of breastfeeding. Employment related comments included “You should take care of your baby wisely, the health of your baby is more important than your work.” Some participants mentioned that they found breastfeeding and work difficult, eg, “it is hard to breastfeed while you are working also” and “Less time for breastfeeding at times of work.” However, others said they had no trouble with breastfeeding. Despite work factors being the most reported discouraging factor for participants breastfeeding, we found no significant difference (P > .05) between employed and unemployed women in the likelihood that they would breastfeed (exclusively and following the introduction of solid foods).

Discussion

This study explored the influences and beliefs surrounding breastfeeding practices among Samoan women. The results show that the majority of participants planned to (and did) breastfeed, with most reporting exclusive breastfeeding for >12 month”. In fact, more than half of participants believed that breastfeeding for >12 months is the recommended length of time to exclusively breastfeed for, while nearly one quarter of participants said they did not know. This statistic differs from the Samoa Demographic and Health Survey 2014 which suggests that 28.1% of women exclusively breastfeed beyond 6 months. This difference could partly be subject to recall bias and also confusion with the definition of ‘exclusive breastfeeding’. Despite this difference, both this study and the Demographic and Health Survey suggest a proportion of women exclusively breastfed beyond 6 months. Delayed introduction of solid foods can increase risks of obesity, type 1 diabetes, iron deficiency anaemia, and lead to poor sleep outcomes. 17-19

<table>
<thead>
<tr>
<th>Table 4. Factors Encouraging Breastfeeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>participants who were encouraged to breastfeed by this factor (%)</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Doctor</td>
</tr>
<tr>
<td>Healthcare worker</td>
</tr>
<tr>
<td>Other Family</td>
</tr>
<tr>
<td>Partner/Husband</td>
</tr>
<tr>
<td>Traditional birthing assistant</td>
</tr>
<tr>
<td>Support group</td>
</tr>
<tr>
<td>Media advertisement</td>
</tr>
<tr>
<td>Traditions</td>
</tr>
<tr>
<td>Leaflets</td>
</tr>
<tr>
<td>Was not encouraged to breastfeed</td>
</tr>
<tr>
<td>Unknown/Missing</td>
</tr>
</tbody>
</table>

Participants could select more than one option hence percentages do not add up to 100. Percentages exclude unknown/missing.

<table>
<thead>
<tr>
<th>Table 5. Factors Discouraging Breastfeeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>participants who were discouraged to breastfeed by this factor (%)</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Limited breastfeeding breaks at work</td>
</tr>
<tr>
<td>Limited maternity leave</td>
</tr>
<tr>
<td>Lack of support at home</td>
</tr>
<tr>
<td>Tobacco use</td>
</tr>
<tr>
<td>Difficulty initiating breastfeeding</td>
</tr>
<tr>
<td>Health problems/illness</td>
</tr>
<tr>
<td>Pain/discomfort</td>
</tr>
<tr>
<td>Experiences of family and friends</td>
</tr>
<tr>
<td>Lack of support from healthcare workers</td>
</tr>
<tr>
<td>Fatigue</td>
</tr>
<tr>
<td>Formula milk advertisement</td>
</tr>
<tr>
<td>Medications</td>
</tr>
<tr>
<td>Perceptions of breastfeeding in public</td>
</tr>
<tr>
<td>Difficulty storing breast milk</td>
</tr>
<tr>
<td>Fear of transmitting infection</td>
</tr>
<tr>
<td>Fear of not producing enough milk</td>
</tr>
<tr>
<td>Unknown/Missing</td>
</tr>
</tbody>
</table>

Participants could select more than one option hence percentages do not add up to 100. Percentages exclude unknown/missing.
Knowledge of advantages varied widely among participants, however only 2 women were aware that all factors listed were advantages. Only a minority were aware that breastfeeding reduces risk of diabetes for the mother and helps with weight loss. With diabetes and obesity being major health issues in Samoa, increasing awareness of advantages of breastfeeding could be beneficial.

Doctors and healthcare workers were the highest selected factors that encouraged breastfeeding. This could be due to bias as participants were selected at the national hospital, therefore targeting potentially more health-conscious citizens who are more likely to have contact with health care professionals. Limited maternity leave and limited breastfeeding breaks at work were the most prevalent discouraging factors. If these problems are true on a national level, these could be overcome by legislating an increase in paid maternity leave from the current 4 weeks to WHO recommendations of 4 months. The Nutrition Center, Ministry of Health in Samoa already produce advice leaflets’ for employers and employees, aiming to tackle these issues.

Some participants reported being discouraged from breastfeeding because of tobacco use. The Center for Disease Control and Prevention recommends breastfeeding as the optimal source of nutrition for the baby despite presence of nicotine in breastmilk. Encouragement of smoking cessation for breastfeeding mothers should be combined with emphasis on continued breastfeeding, particularly as independent Samoa has a high proportion of smokers (33.6% of men and 13.3% of women) compared with the United States (17.2% of men and 14.2% of women) in 2013.

Some participants reported difficulty initiating breastfeeding. Advice is provided at TTM Hospital to all new mothers regarding initiating of breastfeeding, however 36% of mothers do not receive postnatal care within 48 hours of delivery, and 33% do not receive any postnatal care. Encouraging women to attend a postnatal check, along with advertising peer support groups and community nurse services could be useful for mothers who are experiencing difficulties. Increasing awareness of these groups by making these leaflets readily available could be valuable to Samoan mothers. These groups could help women with other problems reported such as pain, discomfort and fatigue.

A small number of women mentioned they were concerned about transmitting infections via breast milk. Although the Government of Health estimated that HIV prevalence was <0.1% in 2014, mothers may have other infections such Hepatitis B (estimated 3% prevalence). There is currently no evidence to suggest that babies are at increased risk of Hepatitis B from breastfeeding. Increased education surrounding this may be beneficial. This could be achieved by adding detail about Hepatitis B transmission to Ministry of Health breastfeeding leaflets. Women may also be worried about transmitting other infections, eg, viral illness to their babies. It would be useful to research which infections women are worried about transmitting further, to determine whether these problems encountered can be overcome through support groups and advice from midwives and leaflets.

It is encouraging that the majority of respondents state they achieved exclusive breastfeeding for at least 6 months. Recent health campaigns (billboard advertisements, leaflets, and information given by healthcare professionals on the labour ward) by the Ministry of Health in Samoa, may have contributed to this, however some women gave birth as long ago as 1986 which was before these health campaigns. The results may indicate that exclusive breastfeeding for longer than 6 months and a later introduction of food is prevalent among the research population.

It is promising to see evidence suggesting many women received encouragement to breastfeed from doctors and healthcare professionals. There were a high number of very positive comments stating participants’ beliefs about the importance of breastfeeding. Only one woman stated that they received encouragement to breastfeed through the Ministry of Health’s publication of leaflets. Although some woman gave birth before these leaflets were published in 2012, 68% gave birth to at least one of their children from 2012 onwards. This suggests that their distribution and availability could be improved. Leaflets containing breastfeeding advice and information are available for distribution in both the Ministry of Health building and in the waiting room of antenatal clinics at TTM hospital. However, the location of these in the clinic is not entirely obvious, particularly as many women wait outside the waiting room for their clinic appointments in the old hospital and very few patients will visit the Ministry of Health foyer. Distribution could be improved by all pregnant women being handed these leaflets routinely as part of their antenatal appointment. Despite recommendations, not all pregnant women attend this clinic. To further improve distribution, healthcare professionals travelling to rural clinics across the islands could take with them a selection of leaflets to give to any pregnant women or those with infants. Furthermore, it could be beneficial for the National Health Service to work with traditional healers, to aid the delivery of this information.

This study is limited by the relatively small sample size. This could be a topic for a larger scale study in the future. In order to avoid difficulties in comprehension, the questionnaire was translated into Samoan. However, a method to determine comprehensibility to lay people would have been via a pilot study. This was however not possible due to the time constraints.

The demographics of the women selected were different to the general population of Samoa. For example, our study shows that parity among the research population was 1.2; however, the average parity in Samoa is 4.6. Due to multiparous responses to the question regarding length of time of exclusive breastfeeding, the analysis of this question is limited and should be interpreted with caution. Seven women gave 2 responses and 2 women gave 3 responses. In addition, there were a greater proportion of participants receiving a college or university education. This could be due to the study being conducted in the national hospital in the city of Apia. It is possible that mothers who are educated may be more likely to live closer to the university, be more health aware and therefore attend hospital appointments. It is common for
Samoan women to deliver at home and not attend the hospital for antenatal or postnatal checks. It is therefore possible that the group selected via convenience sampling is not a good representation of the whole population. Another limitation may be that, as many participants were aware that breastfeeding is the best thing for their baby (highlighted by many of their comments), they may have exaggerated the length of time they breastfed. Despite participants being assured that their answers would remain anonymous, reporter bias could still be present. Furthermore, some of the questions rely on accurate recall. The large age range of women and the spread of years which their children were born (1986-2014) introduces elements of recall bias, as well as cultural shifts with time, especially with rapid urbanization and modernization undergone by Samoa.

Although a qualitative approach may have provided in-depth understanding of women’s views, due to limitations (including the language barrier, participants not having time for face to face interviews, and the influence of researcher bias) a quantitative structure was used. The study attempted to overcome this with the inclusion of a comments section. Ten participants in this study stated they had given birth prior to the adoption of a breastfeeding policy by the Ministry of Health in 1995. In order to assess the effectiveness of this policy, a future study with a larger cohort should aim to compare the effects of year of birth on the length of time women breastfed. A further improvement would be to utilize a stratified sampling technique including participants from smaller district hospitals and rural health clinics across both the islands Upolu and Savai’i to allow for a more representative population.

Despite limitations, this study is useful in identifying certain areas which need further research in order to improve breastfeeding practices in independent Samoa. Future studies should aim to identify a more representative population to study awareness of the advantages of breastfeeding and identify methods to improve education and awareness. Research should aim to clarify the disparity in rates of exclusive breastfeeding identified in this study in comparison to the Samoa Bureau of Statistics. The problems participants experienced related to breastfeeding in employment are vital to further investigate and identify methods to improve mothers working rights.

**Conflict of Interest**

None of the authors reported any conflicts of interest. This work was supported by a grant from British Medical and Dental Students Association.

**Acknowledgements**

The Ministry of Health of Samoa. The Medical Students at the National University of Samoa who assisted our translation.
Appendix 1

UNIVERSITY OF BIRMINGHAM

Project Title: Breastfeeding in Samoa: A study to explore women’s knowledge and the factors which influence infant feeding practices.

This consent form is for women aged 18-50 years who have had a baby in the past. I am inviting you to take part in this research which is looking at factors which influence women’s decision to breastfeed.

Hello,

My name is Lucy Archer. I am a 4th year medical student from Birmingham University, England. I am researching the factors which influence women’s decision to breastfeed and reasons why women stop breastfeeding. There are many advantages to breastfeeding for both mothers and babies. I am doing this research in order to identify areas in which women could be helped to breastfeed for longer.

This research will involve completing the questionnaire attached, consisting of 12 questions. You do not have to answer all of the questions. Your participation in this research is entirely voluntary and it is your choice whether to take part or not. All the information collected will be anonymous.

If you have any questions please come and speak to me or ask a member of staff who can find me.

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Print Name of Participant __________________

Signature of Participant __________________

Date _________________________________

Day/month/year
Appendix 2

Questionnaire
Please tick the correct box for each question below.

Age: _____ years  Are you a registered citizen of Samoa?  Yes ☐  No ☐

1. Do you have a child?  Yes ☐  No ☐

2. What year(s) did you have your child(ren)? _______________

3. Do you have a job?  Yes ☐  No ☐

4. What is your level of education?  No schooling ☐  Primary school (up to year 8) ☐  Secondary school (up to year 13) ☐  College ☐  University Degree ☐

5. Do you live in a rural or urban area?  Rural ☐  Urban ☐

6. Did you plan to breastfeed your baby(ies)?  Yes ☐  No ☐

7. How long did you breastfeed only (no formula milk or other food)?  Did not breastfeed ☐  <2 weeks ☐  1 month ☐  2 months ☐  3 months ☐  4 months ☐  5 months ☐  6 months ☐  7-12 months ☐  >12 months ☐  (please tick more than one box if you have had more than one baby)

8. If you continued to breastfeed as well as introducing solid foods, how old was your baby when you stopped breastfeeding altogether?
Did not breastfeed at all ☐  Did not continue whilst introducing solid foods ☐  <3 months ☐  4-6 months ☐  7-9 months ☐  10-12 months ☐  13-15 months ☐  16-18 months ☐  19-21 months ☐  22-24 months ☐  >24 months ☐

9. Do you know what the recommended length of time to exclusively breastfeed for is?
No breastfeeding ☐  <2 weeks ☐  1 month ☐  2 months ☐  3 months ☐  4 months ☐  5 months ☐  6 months ☐  7-12 months ☐  >12 months ☐  Don’t know ☐

10. What of the following are the advantages of breastfeeding?
Please tick all those that apply.  Don’t Know ☐  Reduces baby’s risk of infection ☐  Reduces baby’s risk of cot death ☐
Develops emotional bond between you and baby ☐  Reduces risk of long term health problems for baby ☐
Reduces risk of breast cancer for mother ☐  Helps mother with weight loss ☐  Natural birth control ☐

11. Which of the following factors encouraged you to breastfeed?
Please tick all those that apply.  Doctor ☐  Health Care Worker ☐  Traditional Birthing Assistant ☐  Partner/Husband ☐  Support Group ☐  Other family ☐
Traditions ☐  Leaflets ☐  Friends ☐  Media advertisement ☐  Was not encouraged ☐
Other (Please give details) ____________________________________________________________________________

12. Which of the following influenced you not to breastfeed, made breastfeeding more difficult or influenced your decision to stop breastfeeding? Please tick all those that apply.
Lack of support at home ☐  Lack of support by health workers ☐  Experiences of your family or friends ☐  Health problems ☐  Limited maternity leave ☐
Limited breastfeeding breaks at work ☐  Difficulty storing breast milk ☐  Tobacco use ☐  Perceptions of breastfeeding in public ☐  Fear of not producing enough milk ☐
Pain/discomfort ☐  Tiredness ☐  Medications ☐  Difficulty initiating breastfeeding ☐  Fear of transmitting infection ☐  Formula milk advertisement ☐
Other (please state) ____________________________________________________________________________

**Thank you very much for taking the time to complete this questionnaire.**
Introduction

New, emerging, and re-emerging infectious diseases are among the most urgent public health threats and economic challenges facing global communities in the new millennium. Recent examples of outbreaks include the emergence and rapid spread of Ebola virus disease in Guinea, Liberia, and Sierra Leone;\(^1\) Middle East respiratory syndrome in Saudi Arabia;\(^2\) and Korea;\(^3\) avian influenza in Vietnam;\(^4\) polio in Pakistan;\(^5\) and the currently burgeoning epidemic of Zika virus (ZIKV) infection with associated microcephaly and other congenital neurological abnormalities in Brazil;\(^6\) and elsewhere in South America, with autochthonous ZIKV transmission in Puerto Rico\(^7\) and Florida,\(^8\) and a recent travel-associated microcephaly case in Hawai‘i.\(^9\) Also, in the State of Hawai‘i, on Hawai‘i Island, the largest outbreak of dengue fever\(^10\) was recorded since 1943, with 264 confirmed cases occurring between September 11, 2015 and March 30, 2016.

Thus, the past half-century has witnessed the emergence of previously unrecognized infectious diseases, such as HIV/AIDS, hantavirus pulmonary syndrome, severe acute respiratory syndrome and severe fever with thrombocytopenia syndrome, and the resurgence of once-conquered diseases, such as tuberculosis and poliomyelitis, so that today, infectious diseases have regained their prominent position as one of the leading causes of morbidity and mortality worldwide. Among the myriad factors responsible for the alarming worldwide resurgence of infectious diseases are the unprecedented population growth with uncontrolled urbanization, the rapid movements of people, animals (and their endo- and ecto-parasites), and commodities via jumbo jets and high-speed trains, the insidious breakdown of public health infrastructure, and the misplaced emphasis on curative rather than preventive medicine.\(^11\)

Geographic Setting

Comprising 132 islands, reefs and shoals that extend for more than 2,400 km in the middle of the Pacific Ocean, the Hawaiian Archipelago lies 4,000 km from the US Mainland and nearly 8,000 km from mainland Asia. With its year-round, mild tropical weather, Hawai‘i serves as a principal US gateway to and from Asia, and as a major tourist destination for people worldwide.

It is also home to some of the Nation’s most important Army, Navy, Air Force, and Marine Corps military bases. Thus, the heavy tourist traffic from Asia and elsewhere and the presence of military assets places Hawai‘i at high risk for natural and deliberate introductions of infectious diseases. Moreover, by virtue of its geographic location and strong ties to academic institutions and ministries of health in the Asia-Pacific region, the University of Hawai‘i at Manoa is strategically positioned as a sentinel post to monitor the emergence and spread of newly recognized and re-emerging infectious diseases.

Significance

Asia is generally considered the geographic birthplace of numerous newly recognized emerging infectious diseases, nearly all of which are either vector-borne or zoonotic. In recent years, these newly identified microbes have caused major outbreaks or epidemics, resulting in significant loss of human lives and devastating economic consequences worldwide. Accordingly, as originally conceived, the Pacific Center for Emerging Infectious Diseases Research (http://pceidr.jabsom.hawaii.edu/) was part of a larger vision to develop a regional translational science center of research excellence focusing on the development and deployment of rapid diagnostics, effective treatments, and affordable vaccines for newly recognized and neglected infectious diseases.
infectious diseases, which disproportionately affect ethnic minority and underserved geographically remote communities in the Asia-Pacific region (Figure 1). Funding for the development of technical cores in biocontainment, bioinformatics, and molecular and cellular immunology and the building of human capital, from the Centers of Biomedical Research Excellence (COBRE) initiative of the Institutional Development Award (IDeA) program, of the National Institute of General Medical Sciences of the National Institutes of Health (NIH), has been leveraged by broad support and investments from upper administration for faculty recruitment, resulting in heightened research productivity, as measured by peer-reviewed publications in high-impact journals and presentations at scientific conferences, as well as additional extramural funding in the form of investigator-initiated research project grants. Thus, the Pacific Center for Emerging Infectious Diseases Research has had a profound impact on creating the conditions that accelerate the pace of scientific discovery, heighten research productivity, and increase competitiveness for extramural funding.

**Historical Overview**

In 2003, the once-respected tropical medicine program at the University of Hawai‘i at Manoa had lost much of its previous stature, primarily through faculty attrition, hiring freezes, and diminished institutional support. Changes began to occur in 1999 with the appointment of a new medical school dean, who declared that selected areas of research excellence would be developed, while maintaining the stellar problem-based learning curriculum and excellent community health training programs. Thus, in response to the regional resurgence of infectious diseases, and in response to needs of the University and the State to regain research excellence in tropical infectious diseases, highly productive, intramural NIH investigators were recruited to provide leadership in developing a nationally recognized research and training program in emerging infectious diseases.

The Pacific Center for Emerging Infectious Diseases Research was established during the initial phase of COBRE funding and considerably strengthened and transformed during the second phase. The construction of a fully State-funded BioSciences Building offered unparalleled laboratory space in which COBRE-funded investigators moved into in December 2005. The centralization of COBRE activities in state-of-the-art laboratories with adjoining spaces for core facilities, including the BSL-3/ABSL-3 Biocontainment Core, transformed the Center from a virtual concept into a brick-and-mortar entity for leading-edge biomedical sciences research. The centralization of the COBRE Center also brought COBRE faculty into physical proximity with other research faculty within selected high-priority research areas, resulting in heightened resource sharing and scientific exchange. Renewed funding for the COBRE for cardiovascular research and the COBRE on reproductive biology are direct consequences of this co-location of core facilities and human capital, as well as continued generous institutional commitment.

Not surprisingly, the investments in the Pacific Center for Emerging Infectious Diseases during the past 10 years have been leveraged into additional extramural grant support totaling more than $35 million. As importantly, the availability of cores have made possible an expanded critical mass of researchers engaged in emerging infectious diseases research. Thus, the Center is now well positioned to transition the core resources, developed during Phases I and II, into sustainable core facilities capable of supporting high-caliber basic, clinical, and translational research aimed at improving the diagnosis, treatment and prevention of new, emerging and re-emerging infectious diseases.

**Organization and Governance**

The overall organizational and governance structure of the Pacific Center for Emerging Infectious Diseases Research comprises visionary leadership; a dedicated and talented team of extramurally funded local mentors with study section experience; an External Advisory Committee, composed of NIH-funded senior scientists recognized for their seminal contributions in emerging infectious diseases research, who will serve as additional mentors; and a Steering Committee, composed of the COBRE Principal Investigator, Program Coordinator, Core Directors, representative core users, and COBRE Evaluator, which sets policies and monitors the overall operations of the Center. Finally, a collaborative Small Grants Program provides modest funding to faculty on a competitive basis to heighten research productivity and increase grants success, leading to further growth and competitiveness of the Center and its cores.

**Building and Diversifying the Scientific Workforce**

COBRE funding has supported the career development of faculty from across the University of Hawai‘i at Manoa, including the John A. Burns School of Medicine (Sandra P. Chang, Guliz Erdem, Peter R. Hoffmann, Pakieli H. Kaufusi, James F. Kelley, Mukesh Kumar, Axel T. Lehrer, Apichai Tuanyok, Saguna Verma, Wei-Kung Wang), Cancer Center (Brenda Hernandez), Office of Public Health Studies (Allison Imrie), College of Natural Sciences (Hongwei Li, Tung T. Hoang), and Pacific Bioscience Research Center (Angel A. Yanagihara). Further, many more faculty and students, as well as scientists from the local biotech community, have benefited from the research and training services provided by the COBRE cores of biocontainment, bioinformatics, and molecular and cellular immunology. The profound impact of mentoring and project funding for each COBRE-supported investigator cannot be overstated. COBRE support has been transformative for their professional development, as evidenced by peer-reviewed scientific publications in high-impact journals and presentations at national and international scientific meetings, as well as successful research grants awarded by NIH and other funding agencies.

Moreover, the Center mentors have collectively been proactive in pursuing funding opportunities for expanding and diversifying the scientific workforce for emerging infectious diseases research. Building pipelines to diversify and expand the workforce for biomedical research cannot be confined to
college students but must start much earlier. As such, programs targeting high school students from underserved communities across the Pacific and initiatives aimed at providing international research experiences for undergraduate and graduate students and post-doctoral fellows have been developed to train future generations of biomedical and biobehavioral scientists, as well as to grow and diversify the user base for the COBRE cores. Examples of such training grants are listed in Table 1. COBRE mentors have also participated actively in other research infrastructure- and career-building programs, such as the IDEAS Networks of Biomedical Research Excellence (INBRE) and the Minority Access to Research Careers (MARC). Moreover, COBRE mentors have assisted in the implementation of science education projects for school children on remote islands in Micronesia, funded by the Science Education Partnership Award (SEPA) program. Investments in building such pipelines of students and post-doctoral fellows will lead to long-term desirable outcomes of sustaining the Center.

COBRE Core Resources
Optimizing and streamlining core operations, growing and diversifying the core user base, and strengthening the core fiscal well-being are all part of the strategic plan for the sustainability of the COBRE cores. Just as the core values of institutions of higher learning are grounded in teaching, research and service, the triad of customized and collaborative service, research and development, and education and training guides each of the three technical cores (Figure 2) for biocontainment, bioinformatics and molecular and cellular immunology. In so doing, each core will expand and diversify the research workforce and create new revenue streams for sustainability.

Bioinformatics Core
Established with COBRE funds at a time when little attention was being paid to bioinformatics at University of Hawai‘i at Manoa, the Bioinformatics Core is increasingly gaining the widespread demand and appreciation it deserves, particularly from faculty engaged in big-data, team-science research. A major thrust of the Bioinformatics Core is to provide customized services and education and training for data science, particularly as it relates to genomics, metagenomics, and epigenetics. Fortuitously, a six-story, 74,000-square-foot, energy-efficient, state-of-the-art Information Technology Center, dedicated in December 2013, supports essential statewide information services and protect critical information and communication resources for the entire University of Hawai‘i System. Moreover, a new High-Performance Computing Cluster, with storage capacity to support “big data” applications, has been installed. University of Hawai‘i President, Dr. David Lassner, a strong advocate of bioinformatics, has pledged that the infrastructure of the COBRE Bioinformatics Core will become fully supported within the next five years.

Bioncontainment Core
The Biocontainment Core manages the ABSL-3/BSL-3 facility in the BioSciences Building in Kaka‘ako, as well as provides services for research involving ABSL-2 and BSL-2 microbial agents. Core personnel develop pathogen-specific standard operating procedures, as well as develop and perform project-specific assays (such as production of virus stocks, virus titrations, plaque-reduction neutralization tests), animal inoculation, and collection of biological fluids and tissues. In addition, Core personnel assist in obtaining State and Federal permits for importing infectious agents and in shipping infectious agents to national and international collaborators; ensure the maintenance and recertification of the ABSL-3/BSL-3 facility; and develop training modules and improved methods for working with ABSL-3/BSL-3 and ABSL-2/BSL-2 agents.

Table 1. Training Grants to Strengthen and Diversify the Scientific Workforce

<table>
<thead>
<tr>
<th>Principal Investigator(s)</th>
<th>Grant Number</th>
<th>Project Title</th>
<th>Project Period</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hui GSN</td>
<td>R25DK078386*</td>
<td>NIH/NIDDK</td>
<td>Pacific High Schools Step-Up to Biomedical Research</td>
<td>04/01/07-02/28/17</td>
</tr>
<tr>
<td>Taylor DW</td>
<td>D43TW009074</td>
<td>NIH/FIC</td>
<td>Training of Cameroonian Scientists in Research on Malaria</td>
<td>08/01/11-07/30/16</td>
</tr>
<tr>
<td>Nerurkar VR, Zunt JR, Kolans JC, John CC</td>
<td>R25TW09345*</td>
<td>NIH/FIC</td>
<td>Northern/Pacific Universities Global Health Research Training Consortium</td>
<td>07/01/12-06/30/17</td>
</tr>
<tr>
<td>Nerurkar VR, Taylor DW</td>
<td>T37MD008636</td>
<td>NIH/NIMHD</td>
<td>International Biomedical Research Training for Hawaiian &amp; Pacific Island Students</td>
<td>12/01/13-11/30/18</td>
</tr>
</tbody>
</table>

*Funding decisions to continue these grants until 2022 are pending.
Molecular and Cellular Immunology Core
Equipped with specialized instrumentation, including FACSAria, FACSCalibur, Attune NxT and Guava flow cytometers, ELISPOT reader and Luminex® technology, and staffed by a dedicated Core Manager with long-standing experience in optimizing specimen processing and data collection and analysis, the Molecular and Cellular Immunology Core provides hitherto unavailable capability and capacity to the research community within the University of Hawai‘i System and beyond. In fact, prior to COBRE funding, services particularly for flow cytometry were either nonexistent or quite rudimentary. The Molecular and Cellular Immunology Core also provides training in flow cytometry and other immune-based assays, as well as develops new assay platforms, such as those based on Luminex® technology.

Future Research and Action Plan
Increased funding and resources are warranted for research into the factors that govern the emergence and epidemic spread of vector-borne and zoonotic infectious diseases, as well as whether newfound still-orphar viruses cause infection and disease in humans. By taking full advantage of the existing infectious disease research excellence and clinical expertise in Hawai‘i and the Asia-Pacific region, and by networking the regional partners it will be feasible to develop and deploy broad suites of microbial antigens for point-of-care rapid diagnostics, broad-spectrum anti-pathogen countermeasures and effective treatments, including the repurposing of drugs for new applications, and off-the-shelf vaccine constructs to be better prepared to respond to the next infectious disease outbreak and to ensure the protection and health of the general public.

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Authors’ Affiliations:
- Department of Pediatrics, John A. Burns School of Medicine, University of Hawai‘i at Manoa, Honolulu, HI (RY)
- Department of Tropical Medicine, Medical Microbiology and Pharmacology, John A. Burns School of Medicine, University of Hawai‘i at Manoa, Honolulu, HI (VRN, GH)
- Information Technology Services, University of Hawai‘i at Manoa, Honolulu, HI (GAJ)

References
Challenges Investigating Health Outcomes in Chinese Americans Using Population-Based Survey Data

Michelle Tong BA and Tetine Sentell PhD

Abstract
Chinese Americans constitute the largest percentage of Asian Americans. In Hawai‘i, Chinese Americans make up approximately 4.7% of the total state population. Accurately assessing health disparities across specific Asian American subgroups is critically important to health research and policy, as there is often substantial variability in risk and outcomes. However, even for Chinese Americans, the largest of the Asian American subgroups, such analyses can present challenges in population-based surveys. This article considers these challenges generally and then specifically in terms of the issue of health literacy and heart disease in Chinese Americans using existing population-based survey data sets in the United States, California, and Hawai‘i.

Keywords
health literacy, Chinese Americans, limited English proficiency

Chinese in the United States
The United States (US) is home to almost 15 million Asians.1 Chinese Americans constitute the largest percentage of Asian Americans (23%),2 and are the fastest growing Asian American population.3 Overall, Chinese Americans make up 1.2% of the total US population or 3.8 million individuals.4

Some states have much higher proportions of Chinese residents than the US average. California alone accounts for 40% of all Chinese Americans with 1.1 million individuals.5 Many other states have large populations of Chinese Americans and/or have seen significant recent growth in their Chinese population, including Texas, New Jersey, Massachusetts, Florida, and Pennsylvania.6

In Hawai‘i, Chinese Americans make up approximately 4.0% of the total state population or 54,955 individuals.6 This accounts for 1.5% of the total US Chinese American population.4,6

Distinct Characteristics
Accurately assessing health disparities across specific Asian American subgroups is critically important to health research and policy, as there is often substantial variability in risk and outcomes.7,8 Chinese Americans have distinct socio-demographic characteristics, including immigration patterns, history, language, and culture, that are associated with distinguishable health risk factors.

Immigration History
In the US, a significant proportion (76%) of Chinese immigrants over the age of 18 are immigrants.7 In Hawai‘i, this proportion is 44%.9 Chinese immigration to the US began with laborers seeking economic opportunities due to turmoil in their native country. Many of these immigrants were Cantonese-speaking men from the southern province of Guangdong.7 However, due to ethnic discrimination and concern about competition for jobs, the US government slowed migration with a series of exclusionary agreements and laws restricting immigration from China starting with the Exclusion Act of 1882.10 Until the 1970s, there was little immigration from China. When immigration into the US increased again in the 1970s, many Chinese came from Hong Kong and Taiwan. More recently, many Mandarin speakers have been emigrating from mainland China.7

As for migration to Hawai‘i, many Chinese immigrants came for plantation work starting in the 1850s. This immigration was slowed by the exclusionary agreements mentioned above. The majority of Hawai‘i’s current Chinese population is Hawai‘i-born. There has been an uptick of recent immigrants from China as well, often arriving for education or economic opportunities.11

Language Preferences
In 2008, almost 62% of Chinese immigrants in the US reported limited English proficiency.12 A significant portion (34%) of US-born individuals with Chinese ancestry speak some form of Chinese dialect at home.13 This shows that language is an important aspect to Chinese populations in the US because it continues to be passed down through the generations despite the natural acculturation process. Many of the individuals may prefer communicating in Chinese when discussing health issues. For instance, a study found that the majority of Chinese immigrants preferred to communicate in Mandarin with their physicians.14

Historically in Hawai‘i, the Chinese American population mainly spoke Cantonese though the numbers who speak Mandarin have increased recently.11 Approximately 60.2% or 10,450 of Chinese individuals in Hawai‘i do not speak English well.15
In addition to language, the Chinese have distinct cultural practices for health, including the use of herbal medicines, Tai chi, and acupuncture. Many Chinese practice traditional Chinese medicine, either in place of, or along with, mainstream Western medicine. Among a study of Chinese, Korean, and Vietnamese immigrants, Cantonese participants reported highest usage of herbal remedies to prevent high blood pressure. This may be due to the bicultural system of health care in China, which includes the usage of both Western medicine and traditional Chinese medicine.

In the US, as in Hawai‘i, the Chinese community is more collectivist compared to the more individualistic American approach. Collectivism focuses on maintaining in-group relationships and working for the greater good of a specified group. The Chinese community, especially recent immigrants, may be far removed from mainstream American society generally and the US health care system specifically. Chinese adults in Chicago were found to have lower insurance coverage compared to US estimates for Asian Americans overall. Furthermore, Chinese elders notably under-utilize the US health care system, which can be additionally hampered by confusion about eligibility and cost due to linguistic or cultural barriers.

Chinese American Health Issues

Chinese Americans experience unique health disparities, including limited access to culturally relevant care and often significant linguistic barriers. Chinese immigrant groups were also found to desire more accurate health information from their healthcare providers than they were receiving. Providers may not clearly explain conditions to them and/or may not present the information in a language they can readily understand.

These access and communication factors are associated with health consequences. While Chinese Americans often have better health outcomes compared to other Asian subgroups, this is not true across all domains. Chinese Americans have higher rates of hypertension compared to other Asian American groups and Whites. Additionally, Chinese American women are less likely than many Asian American and Pacific Islander women to report having a recent Pap smear or mammogram. Underuse of colon cancer screening is also seen among Chinese American men and women. While the Chinese population in Hawai‘i has the longest longevity among other Asian American and Pacific Islander groups, they still have worse health outcomes than White comparison populations (and often other Asian groups) in varied outcomes including longer hospitalizations for mental health issues, higher rates of obstetric trauma for vaginal deliveries compared to Whites, and higher risk of 30-day potentially preventable hospitalizations after a stroke.

While much important groundwork exists, many aspects of Chinese Americans’ health issues remain understudied. Analyzing data about Chinese Americans can be a particular challenge in population-based health surveys.

Importance of Population-Based Health Surveys

Population-based health surveys are those that seek to describe a full population, often in a large geographic location such as a city, state, or a nation, using a survey instrument. The population-based portion is in contrast to research that might consider a very specific group of people, such as those who are hospitalized or those who attend a certain health center. The survey portion is in contrast to other study methods, such as in-depth interviews and open-ended questions that might be analyzed qualitatively. Data from such surveys are extremely important to health policy as they describe critical population-level health needs to help communities design appropriate programs, identify disparities, and determine funding.

One example is the National Health and Nutrition Examination Survey (NHANES), which utilizes a combination of interviews and physical examinations to assess the health of the US population. Another example is the cross-sectional New York City Community Health Survey, which is administered through the telephone and annually gathers a sample of approximately 8,500 randomly selected adults aged 18 and older from all five boroughs of New York City.

Inherent difficulties exist with studying minority groups, such as Chinese Americans, in such population-based studies. First, while Asian Americans may be included in the sampling frame for many population-based studies as part of the population, when it comes time for analysis, their data may not be included or may be grouped with the “other” race/ethnicity. They may have numbers too small for stable estimates or for reporting of data that can still meet privacy rules. Often to have numbers large enough to include in the analyses, heterogeneous Asian Americans are classified together and sometimes combined with Pacific Islanders, leaving distinct characteristics of Asian American subgroups hidden. While detailed subgroup data may exist in the full collected data from a population-based survey, this sometimes will not be released into public access files where many analyses take place due to privacy concerns from the small sample sizes within subgroups, limiting their utility for health-related research.

Another issue, as noted above, is that Chinese Americans have distinct language preferences. Some groups are not able to speak English at all. Many large population-based surveys are only offered in English or, if in another language, include only Spanish. This is because the resources required to translate, and field surveys in many different languages present a high cost burden to the researcher or agency administering the survey. Rarely do population-based surveys interview in both Mandarin and Cantonese. Thus, any Chinese American who does not speak English well, may be excluded from the population-based sample, and the health issues and challenges of a large group of people would remain hidden.
A common problem across studies involves recruiting enough participants, especially in research where the outcome is a rare disease. These challenges become compounded further when the focus is on a specific ethnic group. Even when the number of people interviewed may be large enough to consider common health issues, like the prevalence of diabetes or the average age of heart disease by gender, the number may be too small to consider very specific health issues or rarer diseases, particularly in combination.

One option that can help with the small sample sizes for subgroup analyses is to combine data across years. However, not all important health factors can be included on population-based health surveys and some that are included may only be asked some years when there is particular funding or interest in a topic. For instance, a survey may ask detailed information about cancer screening only in one year. Other relevant topics for health in Chinese and other Asian American subgroups, such as acculturation status, may not be asked at all in many population-based studies.

We consider the strengths of six population-based surveys to consider health issues in Chinese Americans: three national (the NHANES, the NHIS, and the BRFSS), two from Hawai’i (the HHS and the H-BRFSS), and one from California (the CHIS).

National Health and Nutrition Examination Surveys (NHANES)
The NHANES includes both a survey at individuals’ homes as well as clinical tests, providing critical surveillance data. As this is expensive, the NHANES only interviews 5,000 individuals per year. Starting in 2011-2012, the NHANES has been oversampling Non-Hispanic Asians and also including selected survey and/or questionnaire materials translated into traditional Mandarin, simplified Mandarin, and traditional Cantonese, along with other Asian languages. Respondents could choose their preferred language. However only “non-Hispanic Asian” is available for analysis in the public use data file variables.

The National Health Interview Survey (NHIS)
The NHIS is conducted by the US Census Bureau and collects health information continuously throughout the year through personal household interviews. The NHIS monitors the health of the nation, including health status, health care access, health insurance coverage and progress toward achieving national health objectives, and health disparities. NHIS has personal interviews from up to 51,000 households per year. Even in this large data set, Chinese subgroup information is not included in the public use file for confidentiality reasons. The NHIS also only interviews in English and Spanish.

Behavior Risk Factor Surveillance System (BRFSS)
The BRFSS is a national telephone survey that collects data from all 50 states, the District of Columbia, and three US territories regarding health-related risk behaviors, chronic health conditions, and use of preventive services. Since the BRFSS includes data from over 400,000 adult interviews each year, it is the largest continuously conducted health survey system in the world. The survey is administered in English and Spanish. Homes with no English or Spanish speakers are not eligible for participation.

Hawai’i-specific Behavior Risk Factor Surveillance System (H-BRFSS)
The H-BRFSS includes health prevalence information from residents in Hawai’i and evaluates a variety of health behaviors that may result in risk factors for health issues. The H-BRFSS interviews only in English. Besides the core questions that all states must ask, states can add questions of their own choosing of relevance to their states.

Hawai’i Health Survey (HHS)
The HHS is a continuous telephone survey that assesses the health status and demography of Hawai’i’s population and is designed after the NHIS. Weighting is done to accommodate for the difficult to reach populations in Hawai’i such as those without landline telephones and the homeless. The HHS interviews only in English.

California Health Interview Survey (CHIS)
The CHIS is a random-digit-dial (RDD) telephone survey administered by UCLA Center for Health Policy Research and is representative of the non-institutionalized population of California. The CHIS interviews in Mandarin and Cantonese, allowing for participation by Chinese individuals with limited English proficiency. Enough individuals were interviewed that data from Chinese populations, including non-English speakers, is available in the public use data. The CHIS has been a critical source of health information around disparities for Asian subgroups, including non-English speakers.

Considering Heart Disease and Low Health Literacy in Chinese Americans Using Population-Based Surveys
As socioeconomic and cultural factors are associated with cardiovascular disease (CVD) and related risk factors, it is critical to understand these differences among Asian subgroups.

More research is needed specifically on cardiovascular risk and incidence across Asian subgroups generally and among the Chinese specifically. There is reason to believe there is differential, if not higher, risk for Chinese compared to Whites and to other Asian subgroups.

Heart disease is the second leading cause of mortality in Chinese Americans, after cancer. Chinese Americans were found to have higher prevalence of hemorrhagic strokes, poorly controlled hypertension and left ventricular hypertrophy, compared with Whites. As Chinese have lower body mass index (BMI) compared to Whites given the same body fatness, the World Health Organization and others have recommended lowering the BMI thresholds to define overweight and obesity in Asians. While the typical Chinese diet has less fat and animal protein compared to Western diets and is thus likely to be
cardio-protective, sodium intake can be high. Furthermore, BMI is a larger contributor to hypertension in Chinese than in Whites and African Americans, indicating that BMI may play an important biological role in health disparities among Chinese Americans.39

As defined by the Office of Disease Prevention and Health Promotion, health literacy is “the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.”40 Especially in older populations, individuals are more likely to suffer from low health literacy and have chronic conditions such as CVD.41 Among patients with heart failure in an integrated managed care organization, low health literacy was found to be significantly associated with higher all-cause mortality.42 Additionally, lower health literacy was associated with increased risk of death after hospitalization for acute heart failure.43 Lower health literacy was also associated with less heart-health specific knowledge among those with heart failure.44,45

Chinese Americans, particularly those with low English proficiency, have a high prevalence of low health literacy.45 Low health literacy has been associated with poorer health outcomes across many conditions. For instance, low health literacy has been found to contribute to poorer physical and mental health, as well as affect the ability to perform tasks associated with daily living, and lowered the general quality of life.46 Additionally, a systematic review reported higher rates of hospitalization for individuals with lower health literacy than in their counterparts who had higher health literacy.47 Improving health literacy is a practical, important goal that holds promise to greatly diminish negative health outcomes.

It would be useful to consider cardiovascular risk by health literacy among Chinese Americans in population-based samples. However, an attempt to do so can illustrate many challenges mentioned above. As can be seen in Table 1, not all the surveys mentioned above include detailed information about Chinese racial identity. Even those that do may have sample sizes too small to make reliable estimates, especially using one year of data, and/or not have Chinese identity available in public access data due to privacy issues. While some questions about heart disease exist on all surveys (though not necessarily with identical wording or about precisely the same heart topics), health literacy questions have not typically been included in population-based surveys. Thus, a health literacy variable is not available for analyses around the relationship of heart disease using many important national data sets, including NHANES and NHIS. Questions to measure low health literacy are available on the HHS, the H-BRFSS, and the CHIS, but only for some years. (The H-BRFSS and HHS health literacy questions are available because interested researchers were able to add onto these particular surveys in these years.) Only one of these surveys, the CHIS, includes sampling of non-English speakers. Thus, only the CHIS could consider the issue of the relationship of cardiovascular risk by health literacy among non-English-speaking Chinese respondents. However, the CHIS only included the health literacy question on one year almost a decade ago. Therefore, that data is relatively outdated and data cannot be combined over years to get sufficient sample sizes for many analyses. Also, that data is California-specific and may not be relevant to Chinese populations in other locations.

**Conclusions**

There is a need for population-based research that includes Chinese Americans as well as other Asian and ethnic/racial subgroups for whom similar sample size and linguistic challenges exist. Hawai‘i and California, with high populations, have useful data on Chinese Americans compared to many other states. Data from these states can provide guidance for other states with smaller but growing populations of Asian Americans. However, even in Hawai‘i and California, Chinese Americans make up only 4% and 3.4% of the state populations, respectively.48,49 This can still result in small numbers in samples of population-level data, making analyses of this subgroup challenging, particularly when the goal is to consider multiple health outcomes. Certainly not all important research comes from population-based surveys. However, many health decisions are made using this data along with critical public health surveillance.

A recent position paper recommended certain changes to data surveillance systems to ensure they include meaningful data around heart health for Asian American subgroups, including

<table>
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<tr>
<th>Table 1. Available Data to Consider the Relationship of Heart Disease and Health Literacy in Chinese Americans in Some Population-Based Surveys</th>
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<tr>
<td><strong>Chinese Respondents</strong></td>
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<td>Potentially Available for Sub-Analyses</td>
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<td>Health Literacy Questions</td>
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<td>Heart Disease Questions</td>
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Chinese. These include oversampling Asian Americans across the 6 largest subgroups of country of origin, recognizing the wide range of socioeconomic status differences among Asian American subgroups. Increased research into methods to successfully recruit diverse populations into population-based studies exist, including multimodal approaches using targeted recruitment strategies. 

A recent report listed the federal data sets available to consider health disparities. Out of 153 listed, only 4 noted Chinese specific recruitment strategies. Recently, a number of major federal surveys, including the NHIS and the BRFSS, have started to classify Asian Americans into 7 subgroups, including Chinese. There is greater recognition of the importance of considering detailed information of Asian American subgroups. This paper presents some of the challenges of putting that information into practice in the large population-based surveys with which we monitor the health of our nation and use to make health policy decisions.

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Authors’ Affiliation:
Office of Public Health Studies, University of Hawaii at Manoa, Honolulu, HI

References


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THE WEATHERVANE
RUSSELL T. STODD MD; CONTRIBUTING EDITOR

AND THE WINNER IS…PARASITES.
The Nobel Prize in physiology and medicine was awarded to three scientists from Ireland, Japan and China. William D. Campbell, born in Ireland, did his research at Drew University in Madison, NJ, in the USA and Satoshi Omura is from Japan. They went halves on the $953,500 award. They each did research that led to the development of Ivermectin, which has dramatically reduced the incidence of river blindness caused by Onchocerca volvulus. Repeated biting by black flies of genus Simulium results in infection of O. volvulus that affects the skin to cause debilitating itching and corneal inflammation resulting in blindness. Because the black fly must live near running water, the visual impairment is called river blindness. Dr. Omura was humble in accepting the prize. “I’ve been learning all along from microbes, so it would be good if it could be given to microbes instead of me.” The third awardee is Chinese-born Tu Youyou for discovering the drug artemisinin which has significantly reduced the mortality rates for patients suffering from malaria. Malaria threatens more than 3.4 billion people worldwide with fatalities running about 450,000 each year. Dr. Tu found that an active component of the herbal plant Artemisia annua, later called artemisinin, was highly effective against the malaria parasite. Knowledge of traditional Chinese medicine was crucial to identifying the plant and to proving its effectiveness as a drug.

FATAL DRUG INTERACTION.
A 20-year-old college student was involved in a minor traffic accident and was brought to the hospital emergency room. He had severe back and neck pain, but X-rays showed no fracture. The ER physician prescribed Valium and OxyContin, failing to recognize that this combination can suppress the instinct to breathe, increase sleepiness and cause death. According to the Centers for Disease Control and Prevention the number of Americans dying from drug overdose has quadrupled in the past decade. Medical schools taught in the early 2000s that muscle pain and spasms could be routinely treated with both opioids and benzodiazepines (Xanax and Valium). Most overdose-education campaigns focus exclusively on the narcotic rather than decreasing their use with benzodiazepine. Shouldn’t they know that combining these drugs is dangerous? Unfortunately they do not. A petition has been forwarded to the Food and Drug Administration (FDA) requiring that a “black box warning” — the FDA’s strongest communication — be promptly applied. Such a warning will sound the alarm.

DRUG OVERLOAD.
Many health care providers are now adopting deprescribing as an approach to caring for their patients. Studies show that about 40% of adults 60 years and older are taking more than 5 prescription medications. Physicians need to conduct comprehensive medication reviews, using screening programs to identify side effects and possible interactions. They need to wean patients off unnecessary drugs or where risks outweigh benefits. Frequently patients cannot recall what drugs they are taking or why. Moreover a drug that was useful in times past may not be as useful currently. Statins prescribed to control cholesterol may not be needed in later years. Also, they can cause muscle weakness and increase the risk of falls. A 60 year-old patient with heart disease and a stroke may be taking as many as a dozen drugs. Michael Steinman, co-chair of the Beers panel and Professor in the division of geriatrics at the University of California, San Francisco, cautions that regimens have to be tailored to individual patients. “We don’t know if a patient is going to have side effects,” and some drugs are more effective on certain patients than others. A study by Cara Tannenbaum, geriatrician and director of Institute of Gender and Health at the Canadian Institutes of Health Research, reporting in JAMA Internal Medicine in 2014 found that directly educating older patients about the risks of sedative overdose led them to consult with a doctor or pharmacist. The drug was discontinued in 27% of cases. As always, take time to talk to your patient.

OKAY GOOD PEOPLE. IT’S TIME TO RETIRE THE 5 SECOND RULE.
Of course, it never was a “rule” but rather a custom that allowed the eater to pick up a dropped morsel. A September report in “Applied and Environmental Microbiology” states that is about 5 seconds too long for any moist food bit such as gummy candy, buttered or unbuttered bread, or watermelon. Robyn Miranda and Donald Schaffner of Rutgers University tested morsels dropped onto various surfaces coated with Enterobacter aerogenes. Food was left on stainless steel, ceramic tile, wood and carpet for periods ranging less than a second to five minutes. Researchers measured the amount of E. aerogenes, a usually harmless bacterium that shares attachment characteristics with stomach turning Salmonella. Longer contact meant more bacteria, but transfer depended on other factors. Carpet was less likely to transfer germs. Gummy candy stayed relatively clean. Watermelon picked up loads of bacteria in less than a second. Where does the ‘rule’ come from? No fixed date is known, but it might be attributed to Genghis Khan, who stated according to legend, that dropped food could lay for five hours and still be edible.

NEVER PLAY GAMES IN AN AIRPLANE AT LOW ALTITUDE.
Three Brazilian men were flying in a small aircraft at low altitude when another plane approached. The ‘fun-loving’ trio decided to moon the neighboring airplane, but lost control and crashed. All were found dead in the wreckage with their pants around the ankles. So they are out of the gene pool.

IF YOU ARE IN PAIN, SUE SOMEONE.
Kara Wilson sued the owner of the nightclub she was visiting, claiming damages when she fell from a window and knocked out her two front teeth. She was trying to exit the building via the bathroom window to avoid paying the $3.50 cover charge. The jury awarded her $13,000 and dental expenses. Justice prevails, or does it?

ADDENDA
- In 1997 about 1/3 of American homes had a computer.
- It’s a dull child that knows less than his father.
- It is now possible for a flight attendant to get a pilot pregnant.
- When I was growing up the fertility drug was alcohol.
- The world is proof that God is a committee.

ALOHA AND KEEP THE FAITH rts
(Editorial comment is strictly that of the writer.)
The following guidelines are developed based on many common errors we see in manuscripts submitted to HJM&PH. They are not meant to be all encompassing, or be restrictive to authors who feel that their data must be presented differently for legitimate reasons. We hope they are helpful to you; in turn, following these guidelines will reduce or eliminate the common errors we address with authors later in the publication process.

**Percentages:** Report percentages to one decimal place (eg, 26.7%) when sample size is >= 200. For smaller samples (<200), do not use decimal places (eg, 26%, not 26.7%), to avoid the appearance of a level of precision that is not present.

**Standard deviations (SD)/standard errors (SE):** Please specify the measures used: using "mean (SD)” for data summary and description; to show sampling variability, consider reporting confidence intervals, rather than standard errors, when possible to avoid confusion.

**Population parameters versus sample statistics:** Using Greek letters to represent population parameters and Roman letters to represent estimates of those parameters in tables and text. For example, when reporting regression analysis results, Greek symbol (β), or Beta (b) should only be used in the text when describing the equations or parameters being estimated, never in reference to the results based on sample data. Instead, one can use “b” or β for unstandardized regression parameter estimates, and “B” or β for standardized regression parameter estimates.

**P values:** Using P values to present statistical significance, the actual observed P value should be presented. For P values between .001 and .20, please report the value to the nearest thousandth (eg, P = .123). For P values greater than .20, please report the value to the nearest hundredth (eg, P = .34). If the observed P value is greater than .999, it should be expressed as “P > .99”. For a P value less than .001, report as “P < .001”. Under no circumstance should the symbol “NS” or “ns” (for not significant) be used in place of actual P values.

**“Trend”:** Use the word trend when describing a test for trend or dose-response. Avoid using it to refer to P values near but not below .05. In such instances, simply report a difference and the confidence interval of the difference (if appropriate), with or without the P value.

**One-sided tests:** There are very rare circumstances where a “one-sided” significance test is appropriate, eg, non-inferiority trials. Therefore, “two-sided” significance tests are the rule, not the exception. Do not report one-sided significance test unless it can be justified and presented in the experimental design section.

**Statistical software:** Specify in the statistical analysis section the statistical software used for analysis (version, manufacturer, and manufacturer’s location), eg, SAS software, version 9.2 (SAS Institute Inc., Cary, NC).

**Comparisons of interventions:** Focus on between-group differences, with 95% confidence intervals of the differences, and not on within-group differences.

**Post-hoc pairwise comparisons:** It is important to first test the overall hypothesis. One should conduct post-hoc analysis if and only if the overall hypothesis is rejected.

**Clinically meaningful estimates:** Report results using meaningful metrics rather than reporting raw results. For example, instead of the log odds ratio from a logistic regression, authors should transform coefficients into the appropriate measure of effect size, eg, odds ratio. Avoid using an estimate, such as an odds ratio or relative risk, for a one unit change in the factor of interest when a 1-unit change lacks clinical meaning (age, mm Hg of blood pressure, or any other continuous or interval measurement with small units). Instead, reporting effort for a clinically meaningful change (eg, for every 10 years of increase of age, for an increase of one standard deviation (or interquartile range) of blood pressure), along with 95% confidence intervals.

**Risk ratios:** Describe the risk ratio accurately. For instance, an odds ratio of 3.94 indicates that the outcome is almost 4 times as likely to occur, compared with the reference group, and indicates a nearly 3-fold increase in risk, not a nearly 4-fold increase in risk.

**Longitudinal data:** Consider appropriate longitudinal data analyses if the outcome variables were measured at multiple time points, such as mixed-effects models or generalized estimating equation approaches, which can address the within-subject variability.

**Sample size, response rate, attrition rate:** Please clearly indicate in the methods section: the total number of participants, the time period of the study, response rate (if any), and attrition rate (if any).

**Tables (general):** Avoid the presentation of raw parameter estimates, if such parameters have no clear interpretation. For instance, the results from Cox proportional hazard models should be presented as the exponentiated parameter estimates, (ie, the hazard ratios) and their corresponding 95% confidence intervals, rather than the raw estimates. The inclusion of P-values in tables is unnecessary in the presence of 95% confidence intervals.

**Descriptive tables:** In tables that simply describe characteristics of 2 or more groups (eg, Table 1 of a clinical trial), report averages with standard deviations, not standard errors, when data are normally distributed. Report median (minimum, maximum) or median (25th, 75th percentile [interquartile range, or IQR]) when data are not normally distributed.

**Figures (general):** Avoid using pie charts; avoid using simple bar plots or histograms without measures of variability; provide raw data (numerators and denominators) in the margins of meta-analysis forest plots; provide numbers of subjects at risk at different times in survival plots.

**Missing values:** Always report the frequency of missing variables and how missing data was handled in the analysis. Consider adding a column to tables or a footnote that makes clear the amount of missing data.

**Removal of data points:** Unless fully justifiable, all subjects included in the study should be analyzed. Any exclusion of values or subjects should be reported and justified. When influential observations exist, it is suggested that the data is analyzed both with and without such influential observations, and the difference in results discussed.
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