

Clustering of Multiple Risk Behaviors among Ethnically Diverse Adolescents Living in Hawaii

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Abstract

The current study examined the prevalence and clustering of 5 health-risk behaviors among adolescents in Hawaii, including physical inactivity, low fruit and vegetable consumption, junk food consumption, excessive television time, and inadequate sleep. High school students were recruited from 5 classrooms in Oahu Hawaii. Data were collected in the spring semester of 2011. Proportions were used to describe the prevalence of single and multiple health risk behaviors. Significant health behavior clusters were revealed using an observed-to-expected (O/E) ratio method. Participating adolescents ($n = 114$) were 11th and 12th grade students with a mean age of 16.28 ($SD = 0.62$). Participants were predominantly female (75%) and Filipino-American (68%). Seventy-seven percent of adolescents were physically inactive, 90% watched excessive TV, 66% consumed inadequate fruits and vegetables, 94% reported inadequate levels of sleep, and 80% consumed excessive junk food. Overall, 94% reported at least 3 risk factors, 73% reported at least 4 risk factors, and 37% reported all 5 risk factors. No significant clusters were found. Conclusion: Health-risk behaviors cluster and occur more often than expected among adolescents living in Hawaii. Non-significant clustering may be due to insufficient variability within the sample data; future examinations of this highly understudied population are necessary.

Keywords

Filipino-American, Adolescents, Multiple Health Risk, Behavioral Clustering

1. Introduction

Over the last 20 to 30 years, the prevalence of youth obesity has spread to epidemic proportions [1], becoming a

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global health concern [2]. Associated highly with obesity are modifiable lifestyle risk factors, including certain dietary habits [3], physical inactivity, sedentary activity [4], and sleep deprivation [5]. Unfortunately, the diet of most US adolescents includes high fat foods and inadequate amounts of fruits and vegetables [6], and only 8% meet national physical activity recommendations [7]. Although youth are recommended to spend no more than 2 hours per day engaged in sedentary screen time [8], over 30% of youth reported watching television and using the computer for 3 or more hours per day [9]. In addition, youth typically obtain less than the recommended 9.2 hours of daily sleep [10] [11].

Evidence suggests that common health-risk behaviors cluster or co-occur among youth [12] [13], are highly associated with youth obesity [14], and worsen across youth development [15]. There is ample evidence supporting the clustering of sedentary behavior, physical inactivity, high dietary intake, and low fruit and vegetable consumption among adolescents [16]-[21]. Multiple health risk behaviors are commonly interrelated among adolescents and likely a consequence of similar developmental pathways [22]. Prevention researchers are strongly recommended to target the co-variation of adolescent health behaviors [23], as additional evidence supports clustering among healthy behaviors and likely success of comprehensive lifestyle promotion [24] [25]. However, such research among youth remains limited and no examinations to date have considered the lifestyle behaviors of ethnically diverse youth.

The current research targeted adolescents (predominantly Filipino) residing in Hawaii, where the obesity epidemic has become a severe concern [26]. Asian-Americans, including Filipinos, are among the fastest growing ethnic minority population in the United States [27]. Filipino populations demonstrate greater risk of developing obesity and related illnesses [28]-[30]; however, a better understanding of certain cultural components is required to develop effective health promotion strategies [31] [32]. Currently, Filipino youth are highly underrepresented in medical/behavioral research [33].

The current study objective was to assess the prevalence and distribution of multiple health risk behaviors including physical inactivity, excessive television time, low fruit and vegetable consumption, excessive junk food consumption, and inadequate sleep. Investigating the co-occurrence and clustering of these behaviors will aid in the understanding of behavior-related risk among Filipino-American adolescents, as well as inform early intervention efforts.

2. Methods

2.1. Study Population

Participating adolescents were 11th (85%) and 12th (15%) grade high school students residing in Oahu, Hawaii. Through a university-teacher partnership, students were recruited from five separate high school classrooms. The school was located in a highly populated city with a predominantly Filipino American community and a median household income of \$49,444. During the 2010/11 school year, the high school student population was primarily Filipino American (65.5%) followed by Samoan (9.3%), Part-Hawaiian (6.5%), and other or mixed ethnicities (18.7%). Forty-nine percent of students were included in the free/reduced school lunch program during that same year, which was slightly higher than the average Hawaii public high school at 47% [34]. Participating adolescents were born in the United States, with the majority born in Hawaii. The immigrant status of adolescents' parents varied with most born in Hawaii; however, this information was collected unsystematically via hand count during adolescent focus groups.

2.2. Data Collection

Informed consent preceded all study procedures, which were approved by the University Institutional Review Board and the State of Hawaii Department of Education. Participating adolescents completed self-reported surveys in-class, followed by corresponding focus groups. A trained social worker led the follow-up focus group discussion (≈30 - 35 minutes), encouraging participating adolescents to expand and/or adjust their survey responses. This two-step assessment ensured understanding of survey questions, and allowed adolescents to elaborate on the meaning and reasoning of their answers. Data analyzed in the current study included participants' self-reported demographics and health behaviors.

2.3. Measures

Participants responded to questions pertaining to their demographics, physical activity, television viewing time,

fruit and vegetable consumption, junk food consumption and sleep. Demographic data included age, grade, gender and ethnicity. The current analysis is part of a larger, subsequent study that examines potential correlates within the physical environment.

Physical activity was measured as the frequency (days per week) and duration (minutes per day) of moderate and vigorous activity. Moderate physical activity was defined as an “activity that requires some effort, and makes your breathing harder than normal. Some examples would be fast walking, bicycling, swimming, weight lifting, baseball, softball, tennis, volleyball, hula, yoga or dancing.” Vigorous physical activity was defined as an “activity that makes your heart beat quickly, and makes you breath very hard (cannot maintain a conversation). Some examples would be running, jogging, fast bicycling, aerobic dance, rollerblading, paddling, fast swimming, soccer, basketball, football, or martial arts.” The specific types of physical activity used to describe the two intensity levels were based on results of previous focus groups with Filipino adolescents [35]. Risk for inadequate physical activity paralleled evidence-based guidelines. Specifically, youth are recommended to engage in at least 60 minutes of moderate to vigorous physical activity most days of the week [36]. Participants not meeting this recommendation were considered “At Risk” for inadequate physical activity (PA).

Fruit and vegetable consumption was measured as sizes established from the food guide pyramid; therefore, 1 serving of fruit and 1 serving of fruit juice were defined to participants as “one medium piece of fresh fruit, 1/2 cup of fruit salad, 1/4 cup of raisins, apricots, or other dried fruit, 6 oz. of 100% orange, apple, or grape juice (do not count fruit punch, lemonade, Gatorade, Sunny Delight or fruit drink)”. One serving of vegetables was defined as “1 medium carrot or other fresh vegetable, 1 small bowl of green salad, 1/2 cup of fresh or cooked vegetables, or 3/4 cup of vegetable soup (do not count French fries, onion rings, potato chips, fried tempura or fried okra).”

Participants responded to two separate questions regarding fruit and vegetable consumption. The first asked, “How many servings of fruits do you usually eat each day”, and the second asked, “How many servings of vegetables do you usually eat each day”. For each question, response options included “none, 1, 2, 3, 4, 5, and 6 or more”. Participants who reported less than 5 servings of fruit and vegetables combined were considered at risk for inadequate fruit and vegetable consumption. Youth are recommended to consume 2 cups of fruit (4 servings) and 2 1/2 cups of vegetables each day [37]. Participating adolescents reporting less than 5 servings of fruits and vegetables combined were considered “At Risk” for inadequate fruit and vegetable consumption (FV).

Junk food consumption was assessed by giving participants a list of common snacks and foods high in saturated fat and sugar (*i.e.*, junk foods). During a previous visit to the classroom, participants were asked to list the high fat and sugar foods they typically consume, which were then operationalized into junk food servings prior to survey data collection. One junk food serving was specified for each listed snack, and participants were asked to report the number of servings they consume in a typical day. Junk food servings were determined via kcal; one junk food serving was represented as high fat/sugar foods with portion sizes containing ≥ 300 kcal. The calories and portion sizes were based on the U.S. Department of Agriculture’s Calorie Counter National Nutrient Database for Standard Reference [38].

Junk food servings were specified to participants in portion sizes. One serving was defined for the following foods: Ice cream (1/2 cup), soda pop (1 can/bottle/medium size), French fries (1 cup/1 medium size), spam musubi (1 with/without egg), chips (1 snack bag/1 cup/10-12 chips), pretzels (1 cup/15 - 20 pretzels/1 grab bag), gummy candy (1/4 cup jelly beans/2 fun size packs/9 gummy worms), chocolate bar (1 bar/2 fun bars/4 small pieces), cookies (4 medium cookies/2 big cookies, skittles (2 fun size/1 package/1/4 cup, one brownie, popcorn/caramel corn (1 cup/1 package). Participating students also reported commonly eating junk foods defined by multiple servings including the following: Burger with or without cheese (1 medium patty/1/4 pound = 2 servings), pizza (1 slice = 2 servings), cake (1 piece = 2 servings), and nachos with beef, cheese and sour cream (6 servings). Participants who reported consuming ≥ 3 servings of junk food daily were considered “At Risk” for excessive junk food consumption (J).

Television time was measured by asking participants to report how much time they spend watching television on a typical day with the question, “On average, how many hours per day do you watch television or movies”. Those reporting > 2 hours per day were considered “At Risk” for excessive television time (TV).

To assess *sleep*, participants responded to the following question regarding how much they typically sleep each day, “On average, how many hours per day do you sleep”. Those reporting < 9 hours of sleep per day were considered “At Risk” for inadequate sleep (S).

2.4. Statistical Analysis

The observed prevalence of single health behavior risk factors was described as a binary variable (At Risk = 1; Not at Risk = 0), and single risk behavior prevalence rates were calculated for each of the five health risk behaviors. Prevalence rates for each of the five behaviors were used to determine clustering of behavioral risk factors [12] [39] [40].

Clustering of behavioral risk factors was assessed using the observed to expected ratio (O/E) method, and the strongest associations among risk factors were identified using 95% confidence intervals. Clustering occurs when the observed proportion is greater than the expected proportion, indicating that certain combinations of behaviors occur more often than expected based on single behavior prevalence rates [12]. To calculate the observed proportion for each of the 32 risk factor combinations, the number of participants reporting each independent combination was divided by the total ($n = 114$). The expected proportions were calculated by multiplying the single risk behavior probabilities, using both the at-risk and not at-risk prevalence of each behavior. For example, the calculation for the probability of having all 5 risk factors (PA, TV, FV, J, and S) would be: $0.766 \times 0.895 \times 0.664 \times 0.804 \times 0.939$. However, the calculation for the probability of being at risk for PA, TV, FV and J, but not S, would be: $0.766 \times 0.895 \times 0.664 \times 0.804 \times 0.061$. In the latter example, instead of using the proportion of those who were at risk for inadequate sleep, we used the proportion of those who were NOT at risk for inadequate sleep (6.1%). The expected proportion of a single risk behavior, such as PA, would be calculated as: $0.766 \times 0.105 \times 0.336 \times 0.196 \times 0.061$.

After calculating the observed and expected proportions for all 32 non-overlapping combinations, clustering of risk behaviors was assessed by dividing the observed proportions by the expected values for each combination (O/E ratio). Proportions > 1 indicate significant clustering. Ninety-five percent confidence intervals were calculated for each of the ratios [12] [39] [40]. All statistical analyses were performed using SPSS, version 20. Significance was judged at the $P < 0.05$ level.

3. Results

Characteristics of the study population are presented in **Table 1**. With a predominantly female sample (76%), we did not compare prevalence or clustering of single or multiple behavioral risk factors by gender.

3.1. Single Behavioral Risk Factors

The most common single behavioral risk factor was inadequate sleep, with a prevalence of approximately 94%. Excessive television time was the second most common, with approximately 90% at risk, followed by excessive junk food consumption (79%). **Table 2** indicates the prevalence for being “At Risk” as well as “Not at Risk” for each behavior.

Table 1. Characteristics of youth in the study population (2011).

	Adolescents			
	Male		Female	
N (%) 114	24		76	
Mean Age (SD)	16.3 (0.603)		16.2 (0.524)	
Grade Level	12 th N (%)	11 th N (%)	12 th N (%)	11 th N (%)
Grade Level	4 (3.50)	25 (21.90)	13 (11.40)	73 (64.04)
Ethnicity	N	%	N	%
Filipino American	20	17.86	58	51.79
Filipino American Mixed Ethnicity	7	6.25	16	14.29
Pacific Islander Mix	1	0.89	6	5.36
Other	-	-	4	3.57

Data collected from high school students in Oahu, Hawaii.

Table 2. Prevalence of single behavioral risk factors (2011).

	At Risk (%)	Not at Risk (%)
Inadequate Physical Activity (PA) ^a	71.9	23.4
Excessive Television Time (TV) ^b	89.5	10.5
Inadequate Fruit & Vegetable Intake (FV) ^c	65.8	34.2
Excessive Junk Food Intake (J) ^d	78.9	21.1
Inadequate Sleep (S) ^e	93.9	6.1

Data collected from high school students in Oahu, Hawaii. ^aInadequate physical activity: engaging in less than 60 minutes of activity per day; ^bExcessive television time: watching more than 2 hours of television per day; ^cInadequate fruit and vegetable intake: less than 5 servings of fruit and vegetables combined per day; ^dExcessive junk food intake: consuming 3 or more servings of junk food per day; ^eInadequate sleep: less than 9 hours of sleep per night.

3.2. Multiple Behavioral Risk Factors

All participants reported at least one or more behavioral risk factors, however, the majority of the study population (approximately 73%) reported having four or more risk behaviors. Three (2.6%) of the 114 participants reported having ONLY one risk factor, and five (4.4%) participants reported having ONLY two risk factors. Twenty percent reported three risk factors, and the largest proportion of adolescents reported four (36%) or five (37%) behavioral risk factors. These results are also shown in [Table 3](#).

3.3. Multiple Behavioral Clustering

The combination of having all five risk factors showed clustering with an O/E ratio of 1.17 (CI: 0.89 - 1.46), indicating that the proportion of occurrence for all five risk factors was 17% greater than would be expected if risk factors occurred independently. Among three-behavior patterns, PA/FV/S and TV/FV/S showed the greatest degree of clustering, occurring 92% and 73% more than expected (see [Table 4](#)).

4. Discussion

This study is an initial report of the prevalence and clustering of multiple health risk behaviors in a representative sample of Filipino-American adolescents residing in Hawaii, a highly understudied population. Approximately 93% of the study population had three or more risk behaviors, and 73% had four or five risk behaviors. In total, 100% of the sample reported at least one risk behavior. To our knowledge, few studies have examined the prevalence of multiple behavioral risk factors in youth, and none have examined such among ethnically diverse youth populations. Although not directly comparable, our results do mirror previous multiple health behavior studies among youth [12] [20] [41].

A similar study of 11 - 15 year olds in San Diego reported about 50% of participants did not meet physical activity guidelines (60 minutes per day), 33% watched over two hours of television per day, and over 88% did not meet dietary guidelines for fruit and vegetable servings per day (5 servings per day) [20]. In comparison with our junk food consumption measure, which defined “At Risk” as having three or more servings of 300 kcal common high fat/sugar snacks, Sanchez and colleagues used percentage of daily fat intake and defined “At Risk” as fat intake that exceeds 30% of daily intake. Approximately 80% of participants reported two or more risk behaviors, and almost 50% reported three or more risk behaviors [20].

In a 2005 study of Australian 14-year olds, approximately 10% of participants had three or four co-occurring health risk factors including, excessive television time, tobacco use, overweight and high blood pressure [41]. Within this population sample, about 36% of participants reported watching more than five hours of television per day. If this study had used US recommendations of no more than two hours per day, the prevalence of excessive television viewing time may have been more similar to our results (approximately 90% at risk).

In a representative sample of Canadian children and adolescents, ages 10 to 17, Alamian and Paradis [12] found that 65% had two or more risk behaviors, and 37% had three or more behavioral risk factors including, physical inactivity, sedentary behavior, tobacco smoking, alcohol use and high body mass index. Approximately 62% of participants reported inadequate physical activity, and 45% reported watching more than two hours of television per day. Higher behavioral risk was found in our study’s sample and Alamian & Paradis’s [12] sample of 16 to 17 year olds, with a higher likelihood of participants reporting three or more behavioral risk factors as opposed to just one or two.

Table 3. Prevalence of multiple behavioral risk factors (2011).

Number of Health Risk Behaviors	At Risk (% of Sample)
1	2.63
2	4.39
3	20.17
4	35.96
5	36.84

Data collected from high school students in Oahu, Hawaii.

Table 4. Clustering pattern of behavioral risk factors (2011).

No.	Combinations	Observed %	Expected %	O/E Ratio	95% CI (P-Value)	
0	-	0	-	-	-	
1	PA	0	0.03	0	-	
1	TV	0	0.11	0	-	
1	FV	0	0.02	0	-	
1	J	0.88	0.05	18.06	-18.18 - 55.24 (0.12)	
1	S	1.75	0.19	8.78	-5.35 - 32.46 (0.02)	
	Total	2.6	0.42	6.23		
2	PA, TV	0	0.28	0	-	
2	PA, FV	0	0.06	0	-	
2	PA, J	0	0.12	0	-	
2	PA, S	0.88	0.51	1.72	-1.69 - 5.13 (0.10)	
2	TV, FV	0	0.21	0	-	
2	TV, J	0	0.41	0	-	
2	TV, S	1.75	1.70	1.03	-0.41 - 2.47 (0.03)	
2	FV, J	0	0.09	0	-	
2	FV, S	1.75	0.38	4.56	-3.39 - 10.29	
2	J, S	0	0.75	0	-	
	Total	4.38	4.50	0.96		
3	PA, TV, FV	1.75	0.54	3.22	-1.27 - 7.68 (0.02)	
3	PA, TV, J	1.75	1.06	1.66	-0.65 - 3.96 (0.01)	
3	PA, TV, S	1.75	4.36	0.40	-0.16 - 0.96	
3	PA, FV, J	0	0.24	0	-	
3	PA, FV, S	1.75	0.98	1.78	-0.71 - 4.29 (0.03)	
3	PA, J, S	1.75	1.91	0.92	-0.36 - 2.20 (0.01)	
3	TV, FV, J	0	0.79	0	-	
3	TV, FV, S	4.39	3.28	1.34	-0.16 - 2.58 (0.19)	
3	TV, J, S	6.14	6.37	0.96	0.31 - 1.20 (0.03)	
3	FV, J, S	0.88	1.44	0.61	-0.60 - 1.82 (0.14)	
	Total	20.18	20.99	0.96		
4	PA, TV, FV, J	1.75	2.04	0.86	-0.38 - 2.06 (0.024)	
4	PA, TV, FV, S	5.26	8.39	0.63	0.13 - 1.12 (0.001)	
4	TV, FV, J, S	10.53	12.26	.86	0.39 - 1.33 (0.012)	
4	PA, FV, J, S	0.88	3.68	0.24	-0.23 - 0.71 (0.12)	
4	PA, TV, J, S	17.54	16.30	1.08	0.64 - 1.51	
	Total	35.96	42.67	0.84		
5	PA, TV, FV, J, S	Total	36.84	31.37	1.17	0.89 - 1.46

Data collected from high school students in Oahu, Hawaii. PA: Physical inactivity; TV: Excessive television time; FV: Inadequate fruit and vegetable consumption; J: Excessive junk food consumption; S: Inadequate sleep.

Without common behavioral assessments, comparison of current results to previous research is difficult. Unlike the comparison studies, the current study did not measure risk factors such as tobacco or alcohol use. However, based on our sample and common behaviors assessed, the disparity between Filipino-American adolescents living in Hawaii and their Canadian, Australian and American counterparts is apparent. The current study is the first investigation among this highly understudied and unique population. Additional investigations among similar youth populations are warranted.

Limitations

Current study limitations are noteworthy. First, given the small sample size, results may not generalize to the greater population of Filipino-American adolescents; however, current results may be indicative of Filipino-American adolescents living in Hawaii. Second, the lack of variability within the sample limited the likelihood of uncovering statistically significant behavioral clusters. More specifically, the majority of the current sample (approx. 93%) was at risk for three or more risk factors, limiting the ability to detect patterns of specific behavior combinations that are most problematic.

5. Conclusion

These results suggest a need for future research among similar minority populations. The high prevalence rates for single and multiple health risk behaviors we report indicate a need for future population-level examinations. To inform development of effective behavioral interventions, future research should examine the social and physical environments contributing to the co-occurrence of health risk behaviors.

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