The Influence of Community and Individual Health Literacy on Self-Reported Health Status

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BACKGROUND: Individual health literacy is an established predictor of individual health outcomes. Community-level health literacy may also impact individual health, yet limited research has simultaneously considered the influence of individual and community health literacy on individual health.

OBJECTIVE: The study goal was to determine if community health literacy had an independent relationship with individual self-reported health beyond individual health literacy.

DESIGN: We used data from the 2008 and 2010 Hawai'i Health Survey, a representative statewide telephone survey. Multilevel models predicted individual self-reported health by both individual and community health literacy, controlling for relevant individual-level (education, race/ethnicity, gender, poverty, insurance status, age, and marital status) and community-level variables (community poverty and community education).

PARTICIPANTS: The sample included 11,779 individuals within 37 communities.

MAIN MEASURES: Individual health literacy was defined by validated self-reported measurement. Communities were defined by zip code combinations. Community health literacy was defined as the percentage of individuals within a community reporting low health literacy. Census data by ZIP Code Tabulation Areas provided community-level variables.

KEY RESULTS: In descriptive results, 18.2 % self-reported low health literacy, and 14.7 % reported self-reported poor health. Community-level low health literacy ranged from 5.37 % to 35.99 %. In final, multilevel models, both individual (OR: 2.00; 95 % CI: 1.63–2.44) and community low health literacy (OR: 1.02; 95 % CI: 1.00–1.03) were significantly positively associated with self-reported poor health status. Each percentage increase of average low health literacy within a community was associated with an approximately 2 % increase in poor self-reported health for individuals in that community. Also associated with poorer health were lower educational attainment, older age, poverty, and non-White race.

CONCLUSIONS: Both individual and community health literacy are significant, distinct correlates of individual

general health status. Primary care providers and facilities should consider and address health literacy at both community and individual levels.

KEY WORDS: health literacy; health status; socioeconomic factors; disparities; community health.

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INTRODUCTION

Individual health literacy is a well-established predictor of individual health outcomes.¹ Because the maintenance of good health, as well as the management of both chronic disease and illness, takes place within communities, community health literacy also may play an important role in individual health.^{2–5}

To our knowledge, no study has established whether community and individual health literacy are independent, distinct correlates of health.

This topic is important for several reasons. From a clinical perspective, it is critical to identify meaningful health predictors at both the individual and contextual level in order to develop meaningful tools and interventions.^{6,7} From a research perspective, a key goal is to better understand the pathways by which health literacy might impact health, including pathways that move beyond an individual focus.² From a policy perspective, health literacy is an important social determinant of health, not only because it can help to explain racial/ethnic disparities,⁸ but because it is actionable at multiple levels (e.g., individual, clinical, organizational) and across different sectors (e.g., education, medicine, pharmacy).^{9–11}

Previous research supports the hypothesis that community health literacy is independently associated with health. Research in community-level education, a factor likely to be associated with, but not identical to, community-level health literacy,^{12–14} has found that education impacts individual health above and beyond the socioeconomic characteristics of individuals and their families.^{12–14}

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Research also suggests that community health literacy is likely to be particularly important to certain communities. Studies using predictive models to estimate health literacy show considerable variation across communities, including “hot spots” of low health literacy that are likely candidates for focused, community-based intervention.^{15,16} With limited agency budgets, empirical evidence of the relationship of community health literacy to health is needed to support such efforts.

This study addressed this research gap by examining if community health literacy had an independent relationship with health beyond individual health literacy and other individual and community-level factors. The outcome of interest was self-rated individual health, a valid, well-used predictor of individual health. For example, those with better self-rated individual health have less morbidity and mortality.¹⁷ We hypothesized that lower community health literacy was a significant, independent predictor of poor health.

METHODS

Sample

Combined data from the 2008 and the 2010 Hawai‘i Health Survey (HHS) were used. The HHS is a population-based phone survey conducted annually by the Hawai‘i State Department of Health (DOH), Office of Health Status Monitoring (OHSM).¹⁸ Respondents 18 years and older reported health and demographic information for themselves and household members. Health literacy items were included in 2008 and 2010 and were asked only of primary respondents (who thus comprise this study sample). Sampling of households was stratified by island and random within island. Neighbor islands were oversampled in comparison to Oahu.

The HHS is administered in English. In 2008 and 2010, approximately 4 % of households sampled were excluded for English-proficiency requirements. The 2008 HHS had a Council of American Survey Research Organizations (CASRO) completion rate of 40.1 %, yielding data from 5,954 respondents. The 2010 HHS had a 29.9 % CASRO completion rate, yielding data from 5,987 respondents. The completion rate difference between 2008 and 2010 was due to a 2010 sampling frame change to include cell-phone-only households. Sample data were weighted to reflect the adult population of Hawai‘i and to account for the complex sampling designs.

Communities

Zip codes were self-reported and grouped into meaningful combinations (hereafter called “communities”) by OHSM, with input by island District Health Officers and researchers

within the Department of Health, and considering previous data requests to ensure local relevance for the community definition. In HHS protocol, where possible, unknown zip codes were imputed from phone prefix and island data to the zip code of the majority of households. Zip codes were imputed for 181 individuals within 27 communities.

Any community without a sample size over 100 that contained a Relative Standard Error (RSE) > 30 % for the community health literacy estimate was not considered to have a reliable health literacy estimate and was combined with nearby communities until RSE < 30 was reached. (The RSE is the standard error divided by the point estimate times 100 to make a percentage.) The > 30 % RSE cutoff follows National Center for Health Statistics guidelines (<http://www.cdc.gov/nchs/data/statnt/statnt24.pdf>).

Ten communities had a RSE > 30 % for the community health literacy estimate. Four of these communities had sample sizes over 100 and were retained. Five of these communities were combined with a neighboring community to ensure reliable estimates. The community of Hana presented an exception. Hana had less than 100 respondents and > 30 % RSE (35.6 %). However, because Hana is an extremely isolated community on Maui, it could not reasonably be combined into meaningful groupings with others and was retained as its own community. We ran the final study models without Hana and found no substantive changes.

A total of 142 respondents were excluded from the study because the zip code could not be imputed, valid health literacy and/or health status measurement was lacking, or they reported zip codes lacking census data (e.g., P.O. box) so their contextual information could not be determined. The final sample contained 11,779 respondents embedded within 37 communities.

Study Variables

Individual-Level Variables. Consistent with prior research,^{19–22} *individual health literacy* was measured by the self-reported question, “How confident are you filling out medical forms by yourself?” The single self-reported health literacy item has been validated against the most commonly given in-person health literacy tests, performing well in identifying low health literacy (AUROC $\geq$ 80) against both the Rapid Estimate of Adult Literacy in Medicine and the Test of Functional Health Literacy in Adults.²¹ Individuals were coded as having *low health literacy* if they responded “not at all,” “a little bit,” or “somewhat” confident, and as having adequate health literacy if they responded “quite a bit” or “extremely” confident.

For *self-reported health*, as is typical for this item, respondents were coded as in *poor health* if they answered “fair” or “poor” to the question “Would you say your health in general is excellent, very good, good, fair, poor, or don’t know?”

Individual-Level Controls. Because low health literacy and poor health status have been associated with less education, older age, minority race/ethnicity, rural residence, lack of insurance status, and poverty in previous research,^{11,23,24} these characteristics were used as control variables in multivariate models, as was gender, which is associated with both health literacy and health.^{1,22,23,24} *Race/ethnicity* was self-reported from the first racial/ethnic group indicated in response to the question: “What race do you consider yourself to be?” Groups included White, Japanese, Native Hawaiian, Filipino, Chinese, other Asian/Pacific Islander, and other race. *Age* was in years (18–105). *Education* was less than high school (HS), HS, or greater than HS. *Health insurance status* was insured (1) or not (0). *Gender* was male or female. *Being not at or near poverty* was estimated according to US Department of Health and Human Services poverty guidelines for Hawai‘i²⁵ from self-reported pre-tax income. Individuals at or under 199 % of poverty were coded as 0, and others at 1. *Marital status* was 1=yes or 0=no. *Location* of residence was coded by county: O‘ahu, Hawai‘i Island, Maui (including Lana‘i and Moloka‘i) and Kaua‘i (including Ni‘ihau).

Contextual-Level Variables

Community Health Literacy was defined by the proportionately weighted average of the percentage of low health literacy by zip codes with a community. This method of determining community health literacy was chosen as the strongest available estimate, as it is based on a direct measurement of health literacy. Community health literacy was continuous, as research has not yet determined an optimal community health literacy threshold.²⁶

Contextual-Level Controls. Census 2000 data were obtained by ZIP Code Tabulation Area (ZCTA) and linked to the study file using the HHS zip codes. Using the census ZCTA data, *education* was measured by the percentage of the population over the age of 24 years old with a college degree,¹⁴ a commonly used variable in research and the measurement of educational trends. *Poverty* was measured by the percentage of families in the zip code living at or below the poverty level. These variables are commonly used community socioeconomic status variables associated with individual health.²⁷ Also, on the individual level, these factors have been associated with both health literacy and self-reported health.^{1,22,23,24}

Statistical Analyses

Chi-square analysis examined bivariate associations between control variables and both individual health literacy and individual

self-rated health. A series of multi-level, logistic regression models was estimated to predict poor self-reported health. The first model included only individual-level health literacy. The second model added all other individual-level characteristics, to see the association of individual health literacy on health status when other individual-level variables were controlled. The third model included only community-level health literacy. The fourth model added the other community-level characteristics (specifically poverty and education) to investigate the association of community health literacy when related community-level variables were included. The fifth model included only the health literacy variables at both the community and individual-level. The final model included all individual-level and community-level characteristics. All data were analyzed in SAS 9.3 (2011, Cary, NC: SAS Institute, Inc) and Mplus Version 7 (2012, Los Angeles, CA) accounting for the complex survey design.

RESULTS

Among individuals, 18.2 % of the sample self-reported low health literacy, and 14.7 % self-reported poor health (Table 1). Compared to individuals with good health, those with poor self-reported health were significantly more likely to report low health literacy, to have less education, to be older, to be male, to be poorer, and to be unmarried. Self-reported poor health status also varied significantly across race/ethnicity. Across communities, the percentage of individuals within a community with low health literacy ranged from 5.37 % to 35.99 %.

The series of logistic models is presented in Table 2. Individual low health literacy was significantly positively related to poor health status in unadjusted analyses (OR: 2.43; 95 % CI: 2.02–2.92) (Model 1). Individual low health literacy (OR: 2.01; 95 % CI: 1.65–2.46) remained significantly positively associated with poor health status after controlling for individual-level control variables (Model 2).

Similarly, models looking at community health literacy alone (Model 3) and at community health literacy along with other community-level factors (Model 4) show that community health literacy was significantly associated with poor health status in both unadjusted (OR: 1.03; 95 % CI: 1.02–1.05) and adjusted (OR: 1.03; 95 % CI: 1.01–1.04) community-level analyses.

Model 5, which includes only individual and community health literacy without controlling for any other factors, shows that both individual health literacy (OR: 2.41; 95 % CI: 2.01–2.89) and community health literacy (OR: 1.02; 95 % CI: 1.01–1.04) were separately associated with self-rated health.

Finally, Model 6, including all individual and contextual study variables, shows that both individual (OR: 2.00; 95 %

Table 1. Descriptive Statistics 2008 and 2010 Hawaii Health Survey- Individual Level (n=11,779)

	Individuals with poor health	Individuals with good health		Individuals with low health literacy	Individuals with adequate health literacy		Total
Weighted % of Total Sample	14.72	85.28		18.19	81.81		100
	%	%	<i>P</i>	%	%	<i>P</i>	%
Health Outcomes							
Poor health	—	—		25.30	12.37	<0.001	14.72
Health Literacy							
Low health literacy	31.26	15.93	<0.001	—	—	<0.001	18.19
Race/Ethnicity			0.002				
White	23.05	28.97		18.24	30.30		28.10
Hawaiian	18.94	13.99		14.19	14.84		14.72
Chinese	5.31	6.37		7.17	6.00		6.22
Filipino	12.27	14.63		20.78	12.83		14.28
Japanese	23.90	23.19		22.78	23.37		23.29
Other AA/PI	4.53	4.93		7.52	4.28		4.87
Other	12.01	7.91		9.16	8.37		8.51
Demographics							
Education			<0.001			<0.001	
< HS	9.00	3.57		10.81	2.94		4.37
HS	40.57	27.53		43.42	26.34		29.45
> HS	50.44	68.90		45.77	71.05		66.18
Age Group			<0.001			<0.001	
Young (18–24)	6.60	12.12		17.96	9.99		11.30
Middle (25–64)	62.22	70.56		60.18	72.09		69.34
Older (65–84)	23.68	14.05		15.46	15.46		15.47
Elderly (85+)	7.49	3.27		5.36	2.46		3.89
Female	55.34	49.64	0.022	47.44	51.16	0.14	50.49
Not poor	59.10	72.29	<0.001	59.75	71.64	<0.001	69.89
Insured	93.02	94.21	0.382	91.70	94.55	0.01	94.04
Married	33.10	42.44	<0.001	31.83	43.12	<0.001	41.06
Location			0.117			0.003	
O'ahu	67.91	68.92		64.09	69.82		68.77
Big Island	15.29	13.27		14.41	13.39		13.57
Kaua'i	6.24	5.40		6.84	5.23		5.52
Maui	10.57	12.40		14.66	11.67		12.13

CI: 1.63–2.44) and community health literacy (OR: 1.02; 95 % CI: 1.002–1.04) still significantly predicted self-reported health after controlling for other individual-level and contextual-level factors. Other factors significantly predicting poor health in the final models included Native Hawaiian, Filipino, and other race (all compared to Whites), low individual educational attainment, older age, and individual poverty.

DISCUSSION

Our study goal was to determine whether community health literacy had an independent relationship with health status. As hypothesized, lower community health literacy was a significant predictor of poor health status, even when individual health literacy and other factors were considered. Specifically, each percentage increase of average low health literacy within a community was associated with an approximately 2 % in increase in poor self-reported health for individuals living in that community.

Individual health literacy also remained significantly and strongly associated with health status in the final model. Interestingly, the odds ratios of both individual health literacy

and community health literacy were not particularly impacted by the addition of each other in final models, indicating distinct relationships between these two health literacy variables in predicting self-reported individual health.

These findings imply that, all other factors being equal, an individual living in a community with higher rates of low health literacy will have worse health status than an individual living in a community with lower rates of low health literacy. This may be because communities with higher rates of low health literacy have fewer options for reliable answers to health-related questions, assistance with health-related materials, or navigation to health resources (e.g., clinics and libraries). Communities with varying health literacy may also have differential preferences for types of health knowledge. For instance, communities with a lower level of health literacy may place a “greater reliance on personal experience and information obtained through lay networks.”^{3, p.867} Thus, public health messaging available across a region may be less effective in communities with higher levels of low health literacy.

At the same time, individual health literacy skills were also highly relevant to health status. Individuals with higher health literacy in a lower health literacy environment still retain their skills, and may have access to a variety of

Table 2. Models Predicting Poor Individual Self-Reported Health Status

	Individual (unadjusted)	Individual (adjusted)	Community (unadjusted)	Community (adjusted)	Individual & Community (unadjusted)	Individual & Community (adjusted)
Model Number	1	2	3	4	5	6
	OR (95 % CI)	OR (95 % CI)	OR (95 % CI)	OR (95 % CI)	OR (95 % CI)	OR (95 % CI)
Individual Factors						
Low Health Literacy	2.43 (2.02–2.92)	2.01 (1.65–2.46)	N/A	N/A	2.41 (2.01–2.89)	2.00 (1.63–2.44)
Race/Ethnicity						
White	–	1.00	–	–	–	–
Hawaiian	–	1.86 (1.58–2.19)	–	–	–	1.84 (1.57–2.15)
Chinese	–	1.12 (0.79–1.59)	–	–	–	1.13 (0.79–1.61)
Filipino	–	1.41 (1.11–1.80)	–	–	–	1.38 (1.08–1.76)
Japanese	–	1.12 (0.93–1.36)	–	–	–	1.12 (0.92–1.36)
Other AA/PI	–	1.08 (0.68–1.72)	–	–	–	1.06 (0.66–1.70)
Other	–	2.10 (1.64–2.69)	–	–	–	2.09 (1.63–2.68)
Education						
< HS	–	1.94 (1.45–2.60)	–	–	–	1.91 (1.43–2.55)
HS	–	1.55 (1.30–1.86)	–	–	–	1.54 (1.28–1.85)
> HS	–	1.00	–	–	–	1.00
Other Factors						
Age	–	1.03 (1.02–1.03)	–	–	–	1.03 (1.03–1.03)
Female	–	1.01 (0.89–1.14)	–	–	–	1.01 (0.89–1.14)
Not in or near poverty	–	0.72 (0.61–0.84)	–	–	–	0.73 (0.62–0.85)
Big Island	–	0.85 (0.67–1.08)	–	–	–	0.78 (0.62–0.98)
Kaua'i	–	1.00 (0.77–1.30)	–	–	–	0.88 (0.66–1.18)
Maui	–	0.76 (0.61–0.94)	–	–	–	0.70 (0.55–0.88)
O'ahu	–	1.00	–	–	–	1.00
Insured	–	1.07 (0.75–1.54)	–	–	–	1.07 (0.75–1.54)
Married	–	0.68 (0.58–0.78)	–	–	–	0.68 (0.58–0.79)
Community Factors						
Community Health Lit	–	–	1.03 (1.02–1.05)	1.03 (1.01–1.04)	1.02 (1.01–1.04)	1.02 (1.002–1.03)
Community Poverty	–	–	–	1.02 (1.004–1.04)	–	1.02 (0.995–1.04)
Community Education	–	–	–	1.00 (0.99–1.01)	–	1.00 (0.98–1.01)

sources for reliable health information. Similarly, individuals with low health literacy in a higher health literacy environment may not be fully able to take advantage of the health information available and/or may not find materials targeted to their needs.

This research provides important evidence for clinical medicine, policy, and research. Providers and health systems should consider a patient's individual and community health literacy to fully understand, contextualize, and improve health. For example, Fiscella et al. (2009) improved prediction of cardiovascular risk by incorporating a measure of poverty into a cardiovascular risk assessment tool.⁶ Health literacy may be similarly useful. Self-reported health literacy items could be feasibly added to intake materials or interviews to obtain individual-level data. If combined across a large enough sample, these self-reported items could also help to measure and map community health literacy for better clinical care and health planning.

Primary care providers and/or community health centers can also improve both individual and community health literacy. A systematic review of 52 primary care health literacy interventions found that 73 % were associated with health literacy improvements.²⁸ Clinics might also provide community health education events, like health fairs, to reach people beyond the traditional patient encounter. Innovative examples exist for improving community social determinants in the context of primary care.⁷ For instance,

clinics located in communities with high levels of low health literacy could consider inviting other services, such as adult education programs, to share space. Other clinics have co-located legal services, which can help patients with low health literacy consider their health-related legal needs. There is increasing funding with relevance for social health factors, including efforts supported by the Affordable Care Act.^{29,30} Our findings suggest that a large increase in health literacy across enough individual members of a community (which might be feasible for a clinical practice or community health center) could provide community-wide health benefits.

This study also has policy relevance. Medical professionals cognizant of the link between health literacy and health outcomes can be strong advocates for the importance of relevant public policy action, such as educational improvement, funding for adult literacy services, and simplified public aid forms. Additionally, policymakers and others should consider community health literacy when allocating resources within a state or larger region, or when developing targeted interventions.

Finally, this study has relevance to the field of health literacy research, revealing an important, understudied pathway by which health literacy may impact health outcomes beyond the individual-level. This should be considered across additional health outcomes in future studies.

Limitations

Our contextual controls were compiled from the 2000 Census data, as this information was not available at the ZCTA level from the 2010 Census data during our analysis. We did confirm our study findings using more recent 2007–2011 contextual data from the American Community Survey, finding comparable results.

Our study was performed in Hawai'i, a state with unique demographic characteristic, particularly a diverse racial/ethnic mix and limited racial residential segregation. As these factors may differentially impact community health literacy estimates in other locations, it will be important to test these findings across other communities.

Our key variables were self-reported. Also, we used only one measure of individual health literacy and one measure of community health literacy. Future research might consider using additional measures, including broader health literacy domains, such as oral health literacy, as communities might have different levels across different health literacy domains.

This study focused on communities, yet individuals likely have social relationships beyond their residence location.² For instance, a grandmother with very low health literacy, but involved family members with high health literacy who live in various locations (discussed in Paasche-Orlow & Wolf, 2007²), might be impacted differently by the community-level health literacy than a woman with the same health literacy skills who lacks such resources.

Finally, our models did not adjust for all aspects of community context relevant to health. Thus, our community health literacy indicator may be significantly associated with health because it is associated with one or more unmeasured community-level variables, such as the percentage over 65 years or racial/ethnic composition. Considering the relationships between community health literacy and a more diverse array of community-level factors are important areas for future research.

Our study provides evidence to spur future research on other related questions, such as: How might community health literacy vary with, and be independent from, formal education and individual skills? How might gender affect the relationship of health literacy and community health literacy, and how do relevant interventions targeted to women impact family health, as women are important sources of health information and healthcare utilization in families? How do relationships with primary care providers and/or specific disease-related education impact the relationships between individual and community health literacy and health? What is the mediating or moderating role of factors such as patient preferences and level of trust in the medical community?

CONCLUSIONS

Previous research has not specified the relationship between community and individual health literacy on individual health

status. This study finds that both individual and community health literacy are significantly associated with individual self-rated health. Primary care providers and facilities should consider and address health literacy at both community and individual levels.

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Conflict of Interest: The authors declare that they do not have a conflict of interest.

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