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Self-reported segregation experience throughout the life course and its association with adequate health literacy

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Abstract

Residential segregation has been shown to be associated with health outcomes and health care utilization. We examined the association between racial composition of five physical environments throughout the life course and adequate health literacy among 836 community health center patients in Suffolk County, NY. Respondents who attended a mostly White junior high school or currently lived in a mostly White neighborhood were more likely to have adequate health literacy compared to those educated or living in predominantly minority or diverse environments. This association was independent of the respondent's race, ethnicity, age, education, and country of birth.

Keywords

racial composition; residential segregation; health literacy; community health center

Background

Residential segregation has been referred to as the “structural lynchpin” that maintains structural inequality in the United States (Bobo, 1989) and is one of the many causes of disparities in health (Acevedo-Garcia et al., 2003). Prior research has found associations between segregation and poor health status, poor birth outcomes, infectious diseases, exposure to toxins, and mortality (Yankauer, 1950, Polednak, 1996b, Polednak, 1996a, Polednak, 1991, Osypuk and Acevedo-Garcia, 2008, Morello-Frosch and Jesdale, 2006, LaVeist, 2003, Laveist, 1993, LaVeist, 1989, Bell et al., 2006). Segregation shapes socioeconomic conditions not only at the individual and household levels but also at the neighborhood and community levels (Williams and Collins, 2001), affecting access to healthcare services, quality jobs, education, safety, and social networks (Charles, 2003).

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Declaration of Conflicting Interests

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Segregation adversely affects minority access to healthcare services. Smith reports that the United States has a legacy of segregation in healthcare similar to that found in education, housing, and employment, and because of segregation in healthcare minorities receive less care and lower quality care compared to Whites (Smith, 1999). Prior studies provide some evidence that residential segregation reduced minority access to health care providers, particularly to physician care (Fossett et al., 1991a, Fossett et al., 1991b). Fewer providers locate in minority communities because of lower provider reimbursement rates. Higher proportions of Blacks and Hispanics are covered by Medicaid or are uninsured. Also, Blacks and Hispanics have lower incomes and are therefore less able to pay for services out-of-pocket. Physician participation in Medicaid was lower in communities with higher percentages of minority residents (Bronstein et al., 2004, Mitchell, 1991, Perloff et al., 1997). Minority communities have fewer healthcare resources and thus Blacks and Hispanics are more reliant on community health centers, hospital outpatient departments and emergency rooms for ambulatory care (Gaskin et al., 2007, Lillie-Blanton et al., 2001). Living in Black and Hispanic neighborhoods reduces the likelihood that Blacks and Hispanics will visit a physician, nurse practitioner, physician's assistant, nurse or other healthcare providers during the year (Gaskin, 2012). Residential segregation has also been found to be associated with the decreased availability of pharmacy services where minority communities have less access to opioids and over-the-counter drugs compared to White communities (Cooper et al., 2009, Morrison RS, 2000).

Access to informal sources of health information has also been found to be affected by segregation. Social networks provide health information that influence and support health behaviors. The social networks of persons living in minority communities reduces the availability of health information for any individual resident simply because there are fewer persons available in the community to offer informed advice about health and healthcare resources. Compared to Whites, minorities, particularly those who are low income, have less informal access to physicians and other health professionals because they do not reside or work in their communities (Cornwell and Cornwell, 2008). Studies report that higher rates of perceived discrimination and lower rates of trust in medical providers among African Americans and Hispanics contribute to disparities in healthcare use (Burgess et al., 2008, Casagrande et al., 2007, Hausmann et al., 2010, Johnson et al., 2004, LaVeist et al., 2000, LaVeist et al., 2003). In general, these negative experiences of some African Americans and Hispanics within healthcare may bias the advice they offer to family members and friends discouraging healthcare use and healthy behaviors promoted by the physicians and other healthcare professionals.

Segregation may also impact individuals' skills and knowledge needed to use health information, or their health literacy. Health literacy, or the degree to which individuals can obtain, process, and understand basic health information and services needed to make appropriate health decisions (Nielsen-Bohlman, 2004), is a critical predictor of health knowledge, health outcomes, and health care utilization (Nielsen-Bohlman, 2004, Berkman, 2004). Limited health literacy has been associated with a higher rate of hospitalization (Baker, 1998, Baker, 2002), lower use of preventive services (Baker, 1998), and less effective management of chronic conditions (Williams and Collins, 2001, Baker, 1998, Gazmararian, 2003).

To our knowledge, only one prior study has examined the relationship between segregation and health literacy. Kaphingst and colleagues (2012) found that self-reported racial composition of high school was a significant predictor of health literacy among those educated in the United States (Kaphingst, 2012). Building upon this analysis, we explore the relationship between health literacy and segregation experiences across the lifecycle in multiple contexts. We examine individuals' past and current experiences of segregation

through the racial composition of their neighborhoods, schools, and places of worship. We hypothesize that segregation experience influences health literacy in two ways. One, segregation limits the quality of education and training available to minorities. Predominantly minority communities tend to have fewer resources and poor performing school systems, thus persons growing up in these communities tend to lack the skills required for adequate health literacy. Second, segregation limits one's social interactions with persons outside one's racial or ethnic group. Persons living in minority communities are less likely to have informal contact with medical professionals and are more likely to have informal contact with persons who have negative opinions of the healthcare system. Hence, community knowledge and norms about health and health behaviors in minority communities are compromised relative to White communities because there are fewer persons available in minority communities to offer medically accurate advice about health and healthcare resources. We seek to examine the association between racial composition of five physical environments and adequate health literacy in a diverse population of community health center patients.

Methods

Setting

Suffolk County is a suburb of New York City with a population of approximately 1.5 million residents; 72% non-Hispanic White, 7% non-Hispanic Black, and 17% Hispanic (2010 US Census). The nonwhite population increased by 41% between 2000 and 2010. Although Suffolk County is becoming more diverse; it is *not* becoming more integrated. Regardless of their income, Blacks and Hispanics tend to live in segregated communities, (Powell, 2004) and these communities tend to have higher poverty rates, lower median incomes, poorer schools, older housing stock, and lower home ownership rates (Powell, 2004). The dissimilarity index is a common measure of segregation that ranges from 0 (perfect integration) to 100 (complete segregation) (Massey, 1989). The dissimilarity index measures evenness, i.e., the proportion of minority residents who would have to change census tracts in order for the population to be evenly distributed. Based on 2010 U.S. Census data for Suffolk County, the Black-White dissimilarity index is 62 and the Hispanic-White dissimilarity index is 41. In other words, approximately three-fifths of Blacks and two-fifths of Hispanics in Suffolk County would need to move out of their current neighborhoods and into predominately White communities in order to create diverse neighborhoods (Rusk, 2002). Suffolk County is slightly more segregated for Blacks and less segregated for Hispanics than the average U.S. city with a population of more than 100,000. In 2010, the mean Black-White dissimilarity index is 57 and Hispanic dissimilarity index is 48 (LaVeist, 2011). Residential segregation coupled with a suburban mass transportation system has led to fragmented health care access. The Suffolk County Department of Health Services (SCDHS) is a safety net provider for the county with a network of eight family health centers located in minority and medically underserved communities.

Data Collection

Participants in this study were recruited between August and November 2008. Patients in the waiting rooms of the eight SCDHS family health centers were approached by trained data collectors and asked to complete a survey in either English or Spanish. Inclusion criteria were that patients be at least 18 years old and speak either English or Spanish. Approximately 65% of those approached agreed to participate in the study. Of the 1,318 patients who agreed to participate, 1,061 (81%) completed all components of the survey. The primary reason for incomplete surveys was being called in for care. There were no significant differences in demographic characteristics between individuals with complete surveys and those with incomplete surveys. Survey respondents were generally similar to the

underlying Suffolk County Department of Health Services patient population with respect to gender and age, but our sample had larger proportions of Whites, Blacks, Native American and Asians, and a smaller proportion of Hispanics, compared to the SCDHS patient population. This study was approved by the Stony Brook University Committee on Research Involving Human Subjects, the Suffolk County Department of Health Services Institutional Review Board, and the National Institutes of Health Office of Human Subjects Research. All participants completed a verbal consent process and received a written information sheet about the study before completing the survey. Participants were first asked to complete a self-administered written questionnaire (53 questions); once complete they were verbally administered the Newest Vital Sign (6 questions to assess health literacy) by a trained data collector who recorded responses.

Racial composition measure

Respondents' self-reports of the perceived racial composition of five environments (i.e., their junior high (ages 11–14), high school (ages 13–18), neighborhood growing up, current neighborhood, and current place of worship) were assessed using a five part item adapted from the Behavioral Risk Factor Surveillance System (Centers for Disease Control and Prevention). For each item, respondents indicated the approximate racial composition (e.g., mostly Whites, some Whites, mostly Blacks, about half Blacks) from among 13 response options based on four racial and ethnic groups (i.e., Whites, Blacks, Hispanics, Asians). We created indicators (i.e., mostly White) of racial composition in each of the environments. Respondents that reported being educated outside of the US were re-coded 0 (not mostly White) for the racial composition of junior high and high school. Country of education was based on responses to the question, "If you did not go to school in the United States, in what country did you go to school?" Responses were used to create a dichotomous indicator variable for education in the US (1=yes, 0=no).

Health literacy measure

Participants' health literacy was assessed using the Newest Vital Sign (NVS) (Weiss et al., 2005). This six-item measure consists of information contained in a standard food nutrition label, and requires reading comprehension and numeracy skills. The NVS is available in both English and Spanish. The validity and sensitivity of this measure in detecting limited health literacy, compared with existing measures such as the Rapid Estimate of Adult Literacy in Medicine (REALM) (Davis et al., 1993), and the Test of Functional Health Literacy in Adults (TOFHLA) (Parker et al., 1995), has been previously reported (Weiss et al., 2005, Osborn et al., 2007). Participants received a NVS score ranging from 0 to 6 based on the number of correct answers. Scores from 0–1 reflect a high likelihood of limited health literacy, 2–3 a possibility of limited health literacy and 4–6 adequate health literacy (Weiss et al., 2005).

Sample

Analysis is limited to respondents (n=836) that self-identified as Non-Hispanic White, Non-Hispanic Black, or Hispanic, with non-missing responses to the racial composition and health literacy questions. Respondents' race and ethnicity were determined by their responses to two survey questions; 1) what is your ethnicity? (i.e., Hispanic, non-Hispanic) and 2) what is your race? (i.e., African-American or Black, White, Asian/Pacific Islander, Native American, or Other).

Data Analysis

Bivariate associations between dichotomous indicators for "mostly White" responses of racial composition in each environment were assessed with an indicator for adequate health

literacy (NVS score = 4) using 2×2 tables and chi-squared test. Analyses were conducted with the overall sample and then stratified by race/ethnicity (non-Hispanic White, non-White). Logistic regression analyses were conducted to determine the significant predictors of adequate health literacy from all 5 environments (reported mostly White or not), controlling for respondent race, ethnicity, country of birth, education and age. Age was modeled continuously, dichotomous indicators were created for race (non-Hispanic Black vs. other), ethnicity (Hispanic vs. other), country of birth (US vs. other) and education (< high school vs. high school or more). Data were analyzed using SAS/STAT® Software Version 9.2 for Windows (Cary, NC); statistical significance was assessed as $p < 0.05$.

Results

Table 1 shows the racial/ethnic breakdown and distribution of adequate health literacy in the sample used in analysis. The proportions of respondents in each race/ethnicity group were almost equal; 30% were Non-Hispanic Whites, 33% were Non-Hispanic Blacks and 37% were Hispanics. Overall, approximately 36% of our sample had adequate health literacy according to the NVS; a higher percent of Non-Hispanic Whites (63%) had adequate health literacy as compared with Non-Hispanic Blacks (29%) and Hispanics (20%), these differences were statistically significant ($\chi^2_{df2} = 119.92$, $p < 0.0001$). A little less than two-thirds were born in USA (62%), those born in USA were more likely to have adequate health literacy (49%) as compared with respondents born outside of USA (15%, $\chi^2_{df1} = 98.50$, $p < 0.0001$). A majority of respondents had at least high school education (82%); higher percent of which had adequate health literacy (41%) as compared with respondents with less education (13%, $\chi^2_{df1} = 41.16$, $p < 0.0001$). The mean age for overall sample was 37.0, standard deviation 13.5; mean age for those with adequate health literacy was 36.6, standard deviation 13.4. In the last column of Table 1 we present 2010 U.S. Census data for Suffolk County, NY. Our sample from community health centers is more diverse than the Suffolk County population in terms of race (33% vs 7% Black), ethnicity (37% vs 17% Hispanic), and foreign born (38% vs 16%); however the samples are similar in terms of education (82% vs 90% at least high school education) and age (35 vs 40 years).

Table 2 displays the bivariate associations between racial composition of environment and adequate health literacy. In the overall sample, there were significant associations between racial composition and health literacy in all five environments. A higher percentage of respondents who reported attending a mostly White junior high school (60%), mostly White high school (60%), growing up in a mostly White neighborhood (58%), currently living in a mostly White neighborhood (55%), and attending a mostly White place of worship (52%) had adequate health literacy as compared to those who did not report mostly White in these five environments.

Among Non-Hispanic Whites, those respondents who reported attending a mostly White junior high school (71%), mostly White high school (74%), or currently living in a mostly White neighborhood (70%), were more likely to have adequate health literacy as compared to those who did not report a mostly White junior high school (53%), high school (51%), or current neighborhood (54%), these differences were statistically significant (p values 0.0042, 0.0002 and 0.0094, respectively). However, there were no statistically significant associations between racial composition of neighborhood growing up or place of worship and adequate health literacy among Non-Hispanic Whites.

For Non-Whites (Non-Hispanic Blacks and Hispanics), a higher percentage of respondents who reported attending a mostly White junior high school (45%), mostly White high school (43%), growing up in a mostly White neighborhood (39%), or currently living in a mostly White neighborhood (36%), had adequate health literacy as compared to those who did not

report a mostly White junior high school (20%, $p < 0.001$), high school (20%, $p < 0.001$), neighborhood growing up (22%, $p = 0.0005$), or current neighborhood (22%, $p = 0.0021$); these differences were statistically significant. However, there was no statistically significant association between racial composition of place of worship and health literacy among Non-Whites.

As presented in Table 3, logistic regression analyses indicated that racial composition of junior high school and current neighborhood environments were significant predictors for adequate health literacy after controlling for respondent ethnicity, race, country of birth, education, and age. People who reported attending a mostly White junior high school were 1.8 times more likely to have adequate health literacy as compared with people who reported attending a junior high school that was not predominately White. People who reported currently living in a mostly White neighborhood were 1.7 times more likely to have adequate health literacy as compared to those who reported currently living in a neighborhood that is not mostly White. Hispanics and non-Hispanic Blacks were less likely to have adequate health literacy as compared to their non-Hispanic White counterparts. People born in the USA, and those with at least a high school education were more likely to have adequate health literacy as compared to people born outside of the USA, and those with less than a high school education, respectively. Younger people were more likely to have adequate health literacy than older people (see table 3 for Odds Ratios, 95% confidence intervals and p-values).

We fit a model with all five environments, however, only current neighborhood mostly White was significant in the model ($p=0.0184$). We did not expect to develop a final model that contained all five environments due to the correlated nature of racial composition of environments. For example, those that reported attending a mostly White junior high school are more likely to report attending a mostly White high school (correlation coefficient=0.69, $p<0.0001$). Including multiple highly correlated variables into a single model introduces collinearity. Although the two environments in our final model are significantly correlated (correlation coefficient=0.27, $p<0.0001$) the model fits well and does not demonstrate signs of collinearity. We selected our final model based on Akaike Information Criterion and Schwarz Criterion (Stone, 1979, Atkinson, 1980).

Discussion

The results of this study indicate that, in a diverse sample of community health center patients, health literacy is associated with where one attended school and where one currently lives. We found that independent of race, ethnicity, age, education, and country of birth, the racial composition of one's junior high school and current neighborhood were associated with adequate health literacy. Respondents who reported attending a mostly White junior high school or currently living in a mostly White neighborhood were more likely to have adequate health literacy than those who did not report attending a predominately White junior high school, or currently living in a mostly White neighborhood, respectively. In our sample, the alternatives to attending a mostly White school or living in a mostly White neighborhood were to attend a school or live in a neighborhood that was mostly Black, Hispanic or diverse.

The current work extends the literature on segregation and health as previous research in the area has examined associations between segregation and health outcomes or health care utilization (Morello-Frosch and Jesdale, 2006, LaVeist, 1989, LaVeist, 2003, Laveist, 1993, Fossett et al., 1991a, Fossett et al., 1991b, Polednak, 1996a, Polednak, 1996b, Polednak, 1991, Bell et al., 2006, Gaskin et al., 2007, Lillie-Blanton et al., 2001, Osypuk and Acevedo-Garcia, 2008). These studies identify increased exposure to environmental health risks and

limited access to care as pathways by which segregation experiences influence minorities' health and health care. Examples of negative environmental health risk factors are the locations of sanitation and toxic waste facilities, bus and truck routes, liquor stores, bill boards advertising tobacco, high crime areas, illegal drug markets, and food deserts (LaVeist, 2000, Collins, 2010, Lillie-Blanton M, 1993, Powell, 2007, Pucci, 1998, Stoddard, 1997, Wilson, 1987). The limited availability of healthcare providers in minority communities is another barrier to health care access. This research indicates that prior and current segregation experiences may influence how individuals comprehend and use health information; thus providing another pathway for segregation to influence health behaviors and healthcare utilization. Perhaps this association is indicative of a disparity of in the quality of educational systems, health information available in minority social networks compared to White social networks or possibly there is a disparity in how health information is framed in minority communities compared to White communities.

Research has shown that racial composition directly impacts social resources (Berkman and Glass, 2000, Cohen, 2000, Cockerham, 1982) and health literacy (Kaphingst, 2011, Williams et al., 1998, Gazmararian et al., 2003, Persell et al., 2007). Social networks, a web of social ties that surround individuals, influence health outcomes, (Berkman and Glass, 2000) by creating a positive social environment and buffering the negative consequences of stressful life events (Cohen, 2000). When a health concern arises, individuals consult with people in their networks to understand and identify best strategies for treatment or prevention (Cockerham, 1982). The structural characteristics of social networks (e.g., size, density, and strength of relationships) give rise to the functional characteristics of networks (e.g., exchange of social support, social influence, and information); that, in turn, influence individuals' health-related beliefs and behaviors including participation in health or preventive care and adherence to medical advice (Heaney and Israel, 2008). Resources available within social networks such as social support and information may help alleviate undesirable consequences of low health literacy by facilitating access to health care services and promoting healthful behaviors (Lee et al., 2004, Mistry et al., 2001). Evidence exists for the protective effects of social networks in the management of cardiovascular disease (Shaya, 2010). The characteristics of social networks and social relationships are culturally determined (Kumar, 2008), and change throughout the life course (Heaney and Israel, 2008). Thus, it is important to assess the structural characteristics of social network systems (e.g., racial composition, average socioeconomic status of the network members) at different stages of life.

Limitations

The data in this study are from a sample of community health center patients in Suffolk County, NY and are not generalizable to the general population. However, our sample was diverse. We restricted our analysis to participants that self-reported as non-Hispanic White, non-Hispanic Black or Hispanic as other racial and ethnic groups were too small for group comparisons. Despite the sufficient sample size when we analyzed data for Blacks and Hispanics separately there were insufficient numbers of respondents that reported mostly White in each of the environments to examine differences with those that did not report mostly White. In addition the racial composition measure is self-reported and subject to the usual bias of such data; future research is needed to examine the validity of self-reported measures of racial composition. The Newest Vital Sign measures functional health literacy skills but does not assess other domains of health literacy (critical health literacy and interactive health literacy)(Nutbeam, 2008), which might have a different relationship with racial composition; an examination of the association between racial composition and other domains of health literacy is an area for future research. Despite its limitations we believe

the study findings may be generalizable to other suburban health center patient populations and have significant implications for future research.

Future research should examine if the associations between racial composition of junior high school and current neighborhood with adequate health literacy can be replicated in other populations and whether health literacy mediates the relationship between racial composition and various health outcomes. Studies are also needed to measure educational quality and/or individual social networks to gain insight about the pathways by which racial composition of environment impacts health literacy. Previous research has shown that educational attainment over predicts health literacy in this population (Kaphingst, 2012). Additional work is needed to understand the impact of the social environment on health literacy, in other words, whether the quality of education, social networks of individuals, or some other factors have greater impact. Future research should attempt to parse whether disparities exist in the quality of health information in social networks or how those networks frame health issues. This will allow for the development of targeted interventions to improve health literacy in segregated communities.

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Table 1

Sample characteristics and adequate health literacy distributions

	Overall sample		Adequate health literacy		P	Suffolk County 2010 U.S. Census	
	n	%	n	%		n	%
Total	836		298	35.7		1,493,350	
Race/Ethnicity					119.92 <0.0001		
Non-Hispanic White	248	29.7	156	62.9		1,068,728	71.6
Non-Hispanic Black	278	33.3	81	29.1		102,117	6.8
Hispanic	310	37.1	61	19.7		246,239	16.5
Country of Birth	836		298	35.7	98.50 <0.0001	1,494,434	
USA	520	62.2	252	48.5		1,260,706	84.4
Other	316	37.8	46	14.6		233,728	15.6
Education	823		294	35.7	41.16 <0.0001	1,007,197 (25 yr +)	
HS Education+	675	82.0	275	40.7		906,031	90.0
< HS Education	148	18.0	19	12.8		101,166	10.0
	mean	SD	mean	SD	t	P	median
Age n = 816	37.0	13.5	35.0	13.4	0.73	0.4674	39.8

Table 2
Bivariate associations between mostly White environment and adequate health literacy

Environment	Adequate health literacy (n, %)		Likelihood of limited health literacy (n, %)		χ^2_{adj}	p
	For reported mostly White	no	yes	For reported mostly White		
Overall Sample (n=836)						
Junior High School (ages 11–14),	143 (59.8)	155 (26.0)	96 (40.2)	442 (74.0)	85.35	<0.0001
High School (ages 13–18)	137 (60.1)	161 (26.5)	91 (39.9)	447 (73.5)	81.64	<0.0001
Neighborhood Growing Up	150 (57.7)	148 (25.7)	110 (42.3)	428 (74.3)	79.96	<0.0001
Current Neighborhood	135 (54.7)	163 (27.7)	112 (45.3)	426 (72.3)	55.23	<0.0001
Place of Worship	92 (52.0)	205 (31.3)	85 (48.0)	451 (68.7)	26.10	<0.0001
Non-Hispanic Whites (n=248)						
Junior High School (ages 11–14),	97 (70.8)	59 (53.2)	40 (29.2)	52 (46.8)	8.19	0.0042
High School (ages 13–18)	94 (74.0)	62 (51.2)	33 (26.0)	59 (48.8)	13.77	0.0002
Neighborhood Growing Up	117 (66.5)	39 (54.2)	59 (33.5)	33 (45.8)	3.32	0.0685
Current Neighborhood	96 (70.1)	60 (54.1)	41 (29.9)	51 (45.9)	6.74	0.0094
Place of Worship	79 (69.3)	77 (57.9)	35 (30.7)	56 (42.1)	3.43	0.0640
Non-Whites (n=588)						
Junior High School (ages 11–14),	46 (45.1)	96 (19.8)	56 (54.9)	390 (80.2)	29.56	<0.0001
High School (ages 13–18)	43 (42.6)	99 (20.3)	58 (57.4)	388 (79.7)	22.60	<0.0001
Neighborhood Growing Up	33 (39.3)	109 (21.6)	51 (60.7)	395 (78.4)	12.26	0.0005
Current Neighborhood	39 (35.5)	103 (21.6)	71 (64.5)	375 (78.4)	9.44	0.0021
Place of Worship	13 (20.6)	128 (24.5)	50 (79.4)	395 (75.5)	0.45	0.5006

Table 3

Logistic regression model predicting adequate literacy

	Odds Ratio	95% CI[†]	p-value
Hispanic	0.352	0.221, 0.562	<0.0001
Black	0.340	0.223, 0.518	<0.0001
Junior High School (ages 11–14), –Mostly White	1.815	1.243, 2.650	0.0020
Current Neighborhood - Mostly White	1.739	1.196, 2.529	0.0038
Born in USA	3.236	2.103, 4.981	<0.0001
HS Education+	3.357	1.907, 5.911	<0.0001
Age	0.983	0.971, 0.996	0.0112

[†]CI: Confident Intervals