Low Health literacy in Robeson County as a Primary Casual Factor in Differences in Morbidity and Mortality between the State of North Carolina as well as Wake and Mecklenburg counties..docx

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Low Health literacy in Robeson County as a Primary Casual Factor in Differences in Morbidity and Mortality between the State of North Carolina as well as Wake and Mecklenburg counties.

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**Historical Perspective:**

Relative to state and major urban county figures the portrait of health in Robeson county is different and not for the better. The modern health state of Robeson county was set up by decades of economic and social hardships that were not felt in the same intensity or nature by other populations in the state. The origins of the difference lie in the Robeson county’s unique demographic composition, which immediately is distinguished as the county is a “Minority Majority county.” Robeson County is not unique in the status as a minority majority county, but the ethnic composition has resulted in a demographically, culturally and historically distinct county. Figure 1., illustrates the racial composition of Robeson county as compared to the North Carolina racial portrait. Historically speaking the lands that are contained within the modern definitions of Robeson county include the territorial and spiritual home of the Lumbee tribe. The Lumbees make up 41.3% of Robeson County’s population and have shaped the narrative of the region. (US Census Bureau, 2018). The Lumbees also make up close to a third of the state’s total American Indian population. (US Census Bureau 2018).

The narrative that played out in Robeson county since colonial times reveals a pattern of conflict, economic hardships and innate disadvantages. Many of the disadvantages brought on by racially motivated social and legal policies were not remedied by civil rights era legislation and persist in a veiled form today. The veil that stands over Robeson county is of political origins and is the federal denial to recognize the Lumbees tribal status. The results of the political opposition to the recognition of the tribe have deprived the county and the Lumbee’s of financial and support resources and has limited social progress and facilitated the growth of violence in the community. Poverty is not isolated to the Lumbee or to any one ethnic group in Robeson county but rather is a ubiquitous reality that 29% of the population experiences. (US Census Bureau 2018). Poverty is not unique to Robeson county, but occurs at a rate twice as high as the state average which is 14.7% and the social consequences of poverty are compounded by the disenfranchisement of the Lumbee. The poverty that exists in Robeson county is transgenerational and has been present throughout majority of the county’s history. The protracted nature of the poverty in Robeson County was noted in the year 2000, when Robeson County was included in the USDA’s list of counties that were identified as being persistently impoverished. The USDA included Robeson county in this list because county poverty rates were consistently over 20% from 1970 – 2000. (Sirota, 2012) The particular stresses of Robeson County life are reflected in its health outcomes and can be recognized as statistically different from state averages and of major urban counties.
**Figure 1.** 2018 Racial composition of Robeson county as compared to the North Carolina state racial composition

1. All population data included in figure 1 was sourced from US Census Bureau “2018 Quick Facts”
2. “White”, is defined as the percent population from the US Census category “White Alone” with the reported percentage from the US Census category “Hispanic Alone” in order to produce a distribution that accounted for the socio-cultural differences between Europeans and Hispanics
Background:

In recent years rural health has been at the forefront of national political discussions and the complexity of the issues at hand have begun to surface. Morbidity and Mortality statistics support the widely published fact that rural health outcomes differ from urban health outcomes but cannot and do not reveal causes of the issue(s) at hand. Health is a subjective term and its definition changes in each singular context, which makes a general discussion of health outcomes of limited use. However educational data in the context of the difference in outcomes between Robeson county and state and urban data point towards “Health illiteracy” as a primary factor in the differences. (US Census Bureau, 2017) The United States Department of Health and Human services defines “Health literacy” as being, “The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (NAAL, 2006) There are no published studies that directly document the prevalence of Health illiteracy in Robeson county. However novel and historic estimates suggest that close to half of the adult population is functionally health illiterate (White, 2019).
Assessing Health Literacy:

Health literacy as a condition is linked extensively to social economic status and has been increasingly becoming more of a focus point for educational research. Nationally representative surveys have been employed in last 30 years and continue to be the standard means of assessing literacy in the United States and the marker studies include the 2003 National Assessment of Adult Literacy (NAAL 2006) Program for the International Assessment Adult Competencies PIAAC (2012, 2014, and 2017). The 2003 NAAL inquiry organized their assessment of health literacy around three target areas of health and health care information and services, which were: clinical, prevention, and navigation of the health care system. (NAAL 2006) The assessment itself consisted of a 28 health literacy tasks that were designed to require the participant acquire, understand and act on health information obtained which could be reported using the developed scales of general literacy. The three rounds of PIAAC have been conducted as of fall of 2017; however, the data has not been released as of spring of 2019.

Assessments of health literacy have been conducted in clinical settings additionally and have been largely influenced in their reporting and methodologies by the NAAL assessment.

Reporting and Results of NAAL investigation:

NAAL established a system of reporting and defining health literacy tasks by utilizing a numerical scale which reported health literacy through the previously established general literacy scale. The tasks were assigned a score based on the average general literacy score of participants who had a 67% probability of successfully completing the assigned task. Their reporting method can be better understood by an example of one of the tested health tasks. The pool subjects were assigned and given a short list of medical instructions the task of identifying what is “Permissible to drink” before a specified medical procedure. The general literacy score of the respondents who correctly completely the task is then analyzed and an independent score is created that reflects the literacy score of a future participant who would have a 67% probability of completing the same task. Additionally, NAAL categorized literacy scores into Performance levels, which were intended to identify and characterize the relative strengths and weaknesses of score ranges. In total the NAAL report utilized four performance levels which represented literacy level and were: Below basic, Basic, Intermediate, and Proficient. In total 12% of the 19,000 American adults over the age of 16 were categorized as having a “Proficient” health literacy level. Whereas, 36% of the sample was found to possess a “Basic” or “Below Basic” health literacy level. Alone these statistics identify the magnitude of the national epidemic of health illiteracy but the NAAL demographic analysis of health literacy provides further insight and increases the clinical value of the report.
Figure 3. Explanatory theoretical health course diagram:

3a. Theoretical Course

Theoretically Health Action Framework

1. Awareness of Health Status
   ↓
2. Acquisition of appropriate Resources
   ↓
3. Utilization of Acquired Resources
   ↓
4. Health Outcome

Requisite Ability or Precursor Event

- Self realization
- Physician identification
- Individual seeking of Information
- Acute Entry into the healthcare system
- Usage of individually acquired information
- Adherence to Post-treatment instructions

Good or Poor Health Outcome

3b Health Literate approach

Health Literate Patient

1. Awareness of Health Status
   ↓
2. Acquisition of appropriate Resources
   ↓
3. Utilization of Acquired Resources
   ↓
4. Health Outcome

Requisite Ability or Precursor Event

- Self realization
- Physician identification
- Individual seeking of appropriate Information
- Timely and appropriate entry into the healthcare system
- Appropriate usage of individually acquired information
- Full Adherence to Post-treatment instructions

Good Health Outcome
3c. Health Illiterate course

Figure 3: Depiction of Theoretical Health outcome as a function of health literacy. 3a. Definitions of the theoretical components that generally can be isolated from the management of most health conditions

3b. Portrays the ideal path which is carried out by a health literate patient

3c. Depicts the deviation from the ideal course which is seen in individuals with inadequate levels of health literacy

<table>
<thead>
<tr>
<th>Health Illiterate Patient</th>
<th>Requisite Ability or Precursor Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Awareness of Health Status</td>
<td>• Self realization - Less likely to know symptoms or warning signs</td>
</tr>
<tr>
<td></td>
<td>• Physician identification - Less likely to undergo preventive health screenings</td>
</tr>
<tr>
<td>2. Acquisition of appropriate Resources</td>
<td>• Individual seeking of Information - More likely to have issues finding appropriate information</td>
</tr>
<tr>
<td>3. Utilization of Acquired Resources</td>
<td>• Acute Entry into the healthcare system - More likely to enter health care system with more severe issue</td>
</tr>
<tr>
<td>4. Health Outcome</td>
<td>• Usage of individually acquired information - More likely to misinterpret or utilize inappropriate information</td>
</tr>
<tr>
<td></td>
<td>• Adherence to Post-treatment instructions - Less likely to adhere fully or correctly</td>
</tr>
</tbody>
</table>

Poor Health Outcome


**Literature review:**

Health literacy as a social construct is defined by a set of assumptions which the US Department of Health and Human Services (HHS) communicates in their institutionally established definition. The definition reflects the public understanding of Health literacy as a “compound skill”, and frames the foundational components and requisite abilities in the form of three abstractions. The United States Department of Health and Human Services documents the abilities and states they are the capacity to: obtain, process, and understand basic health information and are referenced as being necessary to formulate an appropriate response to a particular health related situation. The included reports work to expand the established institutional definition of the individual abilities required to be proficiently health literate in various environments. Additionally, substantial research in the field has been directed towards incorporating and addressing the impacts of technological advancements.

**Reported Epidemiology of Health Literacy**

The body of data relevant to population estimates of health literacy is found either in governmental primary reports or published scholarly journals. In particular, the United States Department of Health and Human Services, United States Department of Education and the United States Census Bureau have contributed the vast majority of data in the field. The United States Department of Education (USDE) collected the first national assessment of health literacy in 2003 and based their survey on the USDHHS’s definition of health literacy. Raw data was released in two sets, one which was limited and open to general public navigation and a second which referred to as the restricted file. Kutner et al. authored the initial analysis of the data from the National Assessment of Adult Literacy (NAAL) and serves as a platform for population health literacy analysis to this day.

Health illiteracy presents similar to other social determinants of health and exists along demographic lines. Reported gender was shown to be a statistically significant division in terms of average health literacy score and status distribution. Women, as a group were found to have a higher average literacy score as well as a smaller percentage of women were identified as possessing below basic health literacy. (Kutner 2006) Age additionally was shown to be a cohort that was statistically significant as well. However, the only age group that was found to be statistically different in percent identified as health illiterate were individuals over the age of 65. (Kutner 2006) Whereas the reported confidence intervals from the other age groups precluded any conclusions regarding a distinct association.
Race and ethnic groups were additional demarcating factors that produced statistically different average health literacy scores and distribution of health literacy statuses. American Indian, Black, Hispanic and multiracial groups were shown to have similar distributions that contained significantly lower percentage of individuals identified as having proficient health literacy rating. The group with the lowest percentage of individuals who were identified as being proficiently health literate were Blacks who as a group were found to only have 2% proficient individuals. However, the lower ethnic/racial cohort were also all found to have less than 10% of their populations rated as proficient. In comparison, the higher racial/ethnic cohort which consists of Whites and Asian/Pacific islanders were found to have over 13% of the group rated as having proficient health literacy. (Kutner 2006) Additionally and arguably the most significant of the demographic lines that the sample was distributed along was by highest education attainment group. A general positive relationship was found between average health literacy score and each higher level of educational attainment. Alarming was the statistically significant distance in scores between those with less than a high school education and the distribution of the group who was identified as possessing a below basic health literacy level which was 49%. The NAAL data also revealed that average health literacy scores grouped by poverty threshold were statistically significant. (Kutner 2006)

The established portrait of at-risk populations ascertained by the initial analysis of NAAL has been validated and expanded upon by newer investigations. Despite the agreement of the demographic structure of health literacy, new insights concerning relational social class and health literacy were found. (Rikard 2016) Novel insights were gathered from a recategorization of response categories and subsequent regression analysis of the derived variables. Further analysis of respondent ethnic association was increased by isolating nativity status of the Hispanic population. (Rikard 2016) Economic measures from 2003 NAAL were rescaled and subsequently analyzed and reported in units of thousands of dollars, rather than in divided units.

Limitations of the NAAL are widely recognized and discussed. The primary limitation of the data is a product of the sample size and has been found to be its precision when used to estimate percent lacking basic prose literacy skills. At the state level, North Carolina’s 95% Confidence interval is relatively narrow and estimates that 14% of the population over 16 years old lacks basic prose literacy skills. (Mohadjer 2009) Precise, certainly not with a credible interval of 5.5% but the estimate is still valuable and has political value. (Mohadjer 2009) Whereas the credible interval for the Robeson county estimate is 22.8%, which prevents the use in comparisons as the estimate is not statistically distinguishable. The median credible interval width for county estimates was found in context to the measure to be 15 percent, while the median was calculated to be 6 percent for state estimates. The residual impact of the report revealed a need for identification of statistically powerful predictive variables, which was identified as the primary causative agent for the imprecision of the Mohadjer’s estimate model. (Mohadjer 2009) In particular county level predictive variables were found to be the weakest area, strictly due sample sizes and population differences. In the case of ascertaining an estimate for Robeson county’s percent lack basic prose literacy rate the national institutionally defined methods are inaccurate, and fail to appropriately weight predictive variables given the county’s social environment. Research and reported associations between literacy and specific
Multiple valid scales exist that measure adult health literacy which have been developed and implanted since 2003. (Hodge 2018, Debusche 2018, Russell 2018, Libokiene 2018 and Wiess 2005) While there is not an accepted gold standard test used in all clinical or population assessments the most frequently administered and cited tests are Test of Functional Health Literacy in Adults (TOFHLA), Rapid Estimate of Adult Literacy in Medicine (REALM) and Newest Vital Sign (NVS). (Berkman 2011) Research following the release and of the 2003 NAAL has been predominately oriented to increasing the implications that health literacy has on health behaviors and outcomes. The findings of the data support but do not prove the hypothesis that the differences in mortality rankings resulted from differing population rates of health literacy.

**Behavioral and Health Outcomes Associated with Health Literacy**

Health outcomes can be qualitatively divided based on many measures some of which include temporality, severity, and demographically. While not limited to these descriptors organizing the body of research along categorical lines is not straightforward. However, relevant outcome-based studies in the field of health literacy all relate to health literacy and its impact on a task that in part or in whole is considered under the umbrella of health literacy. A large portion of the outcomes research relate the degree of understanding possessed and a specific literacy level or health behavior.

Research and resources have also been directed at health literacy interventions as a means of both combating the problem and revealing further information. The problem of health illiteracy theoretically could be eliminated if a common threshold of adequate understanding and executive function could be actualized. Research of health outcomes and health literacy is multifocal even within specific contexts and rarely controlled to the same level as bench research.

Communication of information is the basis for medical interactions and from a patient centric perspective, possession of information is what motivates health seeking behavior. Correct understanding of risk leads to appropriate usage of preventive and diagnostic services. Patient understanding has been studied and assessed in the following areas primarily: understanding of general illnesses, understanding of current conditions and their treatments, as well as understanding of relative risk. Associations of limited health literacy and as it pertains to health literacy in peer reviewed journals were predominately measured using the REALM and TOFHLA tests. Patients with lower health literacy scores were shown to have an inadequate understanding of both chronic and acute conditions and their management. (Williams 1998, Schillenger 2002) The body of information with direct data isolated and
obtained from Robeson county surrounding patient understanding is limited oral health information and cervical cancer screening tests. (Wells 2010 and Paskett 2004)

Nationally obtained REALM scores revealed an association between low literacy levels and reduced knowledge of markers of hypertension used in the daily management of chronic hypertension. (Williams 1998) Only 55% Patients belonging to the lowest reading level of health literacy who were suffering from chronic hypertension themselves knew that a blood pressure reading of 160/80 was high as compared to 92% of patients with adequate literacy. (Williams 1998) Additionally 50% of diabetic patients with inadequate health literacy levels were shown to not possess an understanding the symptoms of hypoglycemia, which is statistically lower than the 94% of diabetic patients with adequate health literacy. (Williams 1998) Further research identified a reciprocal relationship between HbA(1c) level and TOFHLA-short form scores which is evidence of an independent association between inadequate health literacy and poor glycemic control. (Schillenger 2002) Chronic conditions are not limited to adults and research revealed associated with literacy and child chronic disease outcomes. (Ross 2001)

Further studies showed the impact of literacy on childhood chronic disease outcomes relate to caregiver literacy level. (Ross 2001) Beginning in pregnancy maternal literacy level has been implicated in various health outcomes. (Loraine 2004) In particular it was identified that women with pregestational diabetes as well was not possessing an adequate degree of health literacy were shown to be associated with several factors known to negatively impact birth outcomes. However, meaning differences in birth outcomes between the literacy groups of the pregestational diabetic mothers were not found. (Loraine 2004)

Extending into the perinatal period health literacy has been shown to influence maternal childrearing behaviors, in particular continuance of breast feeding to two months. (Kaufman 2001) Mothers with low levels of literacy determined by the REALM test, were reported 23% to breast feed to at least 2 months. Whereas mothers in the higher literacy group were reported that 54% of the sample population breast feed at least until 2 months. (Kaufman 2001) Additionally peer reviewed journals have also investigated the role of maternal health literacy and childhood diabetic outcomes. (Ross 2001) Scholarly work has overwhelming provided consistent evidence supporting the role of parental health literacy level in child health outcomes, with the narrow minority concluding contrarily. (Mackert 2015, Zoellner 2008) It was found that maternal literacy level and not the affected child’s literacy level was associated with negative outcomes. Likewise, it was shown that low maternal literacy level was associated with lack of knowledge of weight based medication dosing as well as the use of nonstandardized instruments when dosing liquid medications. (Yin 2007) More generally, low health literacy was also estimated to limit or pose a barrier to completing 50% of medicine related tasks for parents of children with medical conditions. (Yin 2009) Similarly elderly populations face medication related issues that were found to increase with lower literacy abilities. (Sewar 2018, Munigala 2018)

Outside of the direct management of chronic conditions research has identified multiple associations that pertain to different health outcomes and behaviors. Inadequate literacy levels impose barriers to self-efficacy and appropriate use of health care systems. (Curtis 2012)
Related to hospital readmission risk is patient understanding and self-management of conditions and recovery after direct provider care. Low levels of literacy were demonstrated to impact patient engagement prior to the visit, during the encounter and following the examination. (Munigala 2018, Brewer 2009, Menendez 2017, Lindquist 2017, Chew 2004) Primary data additionally examined the role low literacy levels had in preoperative regimen adherence, which typically includes but is not limited to fasting and medication continuance information. (Chew 2004) Low levels of health were found to have subsequent pre-procedural impacts as well and most significant of these include ethical considerations regarding the patients understanding of informed consent. (Hadden 2017)

Researchers have also brought up questions surrounding the clinical assessment of patients using standardize health literacy assessments such as TOFHLA and REALM. Several researchers believe the use of a standard health literacy assessment in a clinical setting, the benefits would not outweigh the associated harm that accompanies the test taking. (Paasche-Orlow 2008, Davis 2002) Whereas research supports focus of interventions surrounding health illiteracy towards mitigating the effects of low literacy rather than the clinical assessment of it. (Adibi 2018, Brinkman 2018, Karnoe 2018) The particular ameliorating research efforts have been directed towards increasing usability and understandability of existing information channels. Coupe et al. found that in populations with diverse literacy abilities the use of visual representations to communicate information was more effective than written or verbal methods. (Coupe 2018).

The future of research in the field of health literacy will be directed by novel association produced by PIACC which is expecting to be published in the coming months. In the meantime significant resources need to be redirected to correcting the failing education system and publicly identify and confront disruptive cultural trends that interfere with social and educational progress. Research in the clinical setting that highlights the specific areas of misunderstanding and functional limitations will continue to provide policy makers and medical educators with the information necessary to combat the issues at hand.
Annotated Bibliography:


   Abidi et al’s study was one of the later articles I came across but nonetheless it contributed to body of knowledge that I have collected thus far. The study was unusual and shifted my focus from health outcomes associated with health literacy to a new domain being communication methods and a broader understanding of literacy which includes technologic competencies. The study brought up the concerns of a small group of patients and physicians who used the DWISE application to acquire information about their chronic diabetes. The study will be useful in the discussion section of my paper but it lacked sound statistical conclusions and therefore will not add to the strength of my argument.


   Brewer et al’s study was substantial and provided clarification to a pressing clinical issue. The study quantified understanding of reoccurrence risk through a statistical comparison of REALM scores with comprehension measures of either verbal descriptors of risk or numerical representations. Brewer et al found that verbal descriptors such as the physician saying “high chance” or “low risk,” were more consistently understood. Whereas individual understanding of risk and the related health decision were more variable than the verbal descriptor results. Brewer et al’s
study is of great use in my argument as increased the knowledge surrounding literacy and decision making.


   Brinkman et al’s study is becoming increasingly relevant as obesity and metabolic issues become more prevalent. In particular, this study revealed that utilizing a scientific approach to track usage and benefits of internet-based decision aids for adolescents with diabetes is not as straightforward as it might appear. The study emphasized the relationship and dynamic between caregiver and the adolescent and stated that differing views of the potential benefit of the tool led to barriers to usage. The study suggested that it may be more impactful to study the factors and motivational barriers to using “new” decision aids.


   Chew et al’s investigative study into the impact of low health literacy on surgical practice widened my lens into the effects of Low Health Literacy (LHL). His team concluded based on their cohort study that there was a strong negative association between LHL and adherence to preoperative instructions. The study was conducted using a sample population of VA patients who underwent “Ambulatory surgery”. The team was prompted to conduct this study because nonadherence to preoperative instructions may lead to increased morbidity, delays in surgery, surgery cancellations, and general increases in healthcare costs.


   Coupe et al’s study provided points for a general discussion of health literacy including that from their study diversity in language and literacy ability makes the use of visual representations of information more effective than written formats. The study repeats the political dialogue of diversity and sensitivity of policy rather than solutions. The information surrounding the benefit of visual communication of health information is the sole contribution of the study and the remainder is of limited value.

Curtis et al study surrounding Asthma disparities provided data that was consistent with established demographic trends. However, the study accurately publishes the idea that health literacy differences are only the factors that result in the differing outcomes. Socioeconomic status in the context of asthma outcomes were shown to relate to cultural patterns of accessing and using the health care systems. Having said this literacy is not connected functionally to any innate quality of a ethnicity or social group and referencing literacy as a cause of an ethnic disparity is misguided unless educational barriers are mentioned as well.


The Davis et al team’s study and report added substantial information to my review of health literacy and its relationship with health outcomes. The study clearly articulated the realities of the issues that low levels of literacy poses in the different facets of life for cancer patient and barriers to successful clinical communication they cause. They concluded that in the published state the R.E.A.LM and T.O.F.H.L.A literacy assessments are not adequate for clinical use in Oncology clinical settings, without specific tailoring. This study is different from the majority of the articles in that the authors directly addressed the clinical application of REALM and TOFHLA and did not lobby for its use in its current state.


Hadden et al’s study researched an ethically important subject, readability of informed consent documents. The study looked into 217 IRB consent forms and assessed them based on their individual use of plain language and understandability to generate a reading level of difficulty for the forms. The study reported that the average level the forms were rated at was 10th grade. The findings of the study illustrate the ethical importance of literacy in the medical field. The report demonstrate the relationship between literacy level and meeting the requirements for protection of
human subjects in institutional research as well which could have field level implications.


Hodge et al investigated the feasibility and potential benefits of “Telepractice” to overcome barriers to illiteracy. The study proved to be less focused on the medical angle of the illiteracy and more so on the developmental and educational aspects of the issue. The sample of the study was small and the results were not terribly impactful or insightful. Hodge’s team concluded that remote digital assessment of literacy status was not significantly different than face to face evaluation methods. The fact that remote assessment is not different could potentially be of benefit to physicians who practice remotely at times.


In terms of new developments or paradigm shifts in clinical medicine most of the change is being seen as the internet and computers are becoming further incorporated into medical education and practice. Karnoe et al’s study added to the changing movement by investigating the potential impacts of health illiteracy on digital health services and additionally formulating a tool kit to assess the competencies of patients using the digital services. The testing done surrounding the reliability of their ehealth literacy test proved to validate the efficacy of the test and was supported by log linear agreement in their Rasch models.


Kaufman et al’s report was not broad in its findings, however it did produce a statistically claim. The report found there was a difference in terms of the continuance of breast-feeding between low and adequate literacy groups. Only 23% of lower level group was found to breast feed for at least 2 months. Whereas 54% of the higher literacy group breastfed for at least 2 months. These findings add to the increasing alarming portrait of mothers and caregivers with low health literacy.

The USDE’s report and analysis of the 2003 National Assessment of Adult Literacy proved to be an invaluable resource by establishing a clear and concise direction for future studies to build on. The report provided evidence for the hypothesized sociologic distribution of health illiteracy and revealed the gravity of the issue. The major takeaways from the report included the clustered racial distribution of levels of health literacy as well as the income divide in health illiteracy. The assessment was extensive and consisted of 19,000 participants and’s methods of reporting and measuring health illiteracy were a first of its kind and provided language that is clear and holds clinical value.


Liobikiene et al undertook a massive investigation into the ability of European Union members to acquire health information off of the internet and utilize it in the management of their own conditions. Liobikiene’s team able to acquire data from 26,601 individuals in over 27 EU member countries. The study was not significantly impactful as a whole but the article did provide additional support for the internet as a primary source for individuals to acquire health information as well as a model for pathway of acquiring internet based information. The article will be useful in my study as further evidence of the role and importance of digital communication in efforts against health illiteracy.


Lindquist et al investigated the efficacy of the PlanYourLifespan.org’s collection of patient education resources. The tested the ehealth application by performing a double armed randomized control trial and different time points through an in-person survey. The burdens associated with poor health are highly concentrated over two populations children and the group most affected the elderly. The elderly in many cases are not in total control of their health and relay on a network of caregivers. Lindquist et
al’s study illuminated and reinforced the benefit of the application by statistically showing that Senior’s who used PYL demonstrated an increased understanding of posthospitalization and home services compared to the control group.


Endres et al investigated and discussed the functional connection between low literacy level and self-care and medical service utilization in women with pregestational diabetes. Endres’ study broadened the limited collection of relevant data to include Women’s health measures in the larger discussion. The study always addressed several of the many factors that complicate the study of health literacy and outcomes including Age groups, Spanish speaking individuals and education level.


Mackert et al provided creative insights and perspective into the larger health literacy and communication discussion. Mackert’s team focus their study on investigating the potential benefits of including men in prenatal health discussions. The focus in particular was improving infant mortality rates by attempting to reduce risk factors that drive infant mortality. Mackert’s team concluded that including men in discussions through e-health avenues was a promising approach to communicating effectively with lower health literate audiences and would be relevant and impactful in combat infant mortality. The study lacked real usage data of e-health applications but suggested that future studies should research the relationship between usage and specific health outcomes/behaviors.


Mendez et al’s study will certainly be of great use in my paper seeing as it thoroughly investigated the role of health illiteracy in patient behavior in a clinical setting. The study surveyed and analyzed the patients ability to ask questions during their first time visiting the hand center of Tuft University Medical complex. The study highlighted the relationship between question asking and low levels of health literacy
which was that the group as a whole asked significantly fewer questions. Additionally
the study revealed that only one other characteristic separated the group that asked
more questions than the other group and it was race. Non whites were found to ask less
questions and this relates back to the group that is most commonly found to possess
low levels of health literacy being non whites.

18. Mohadjer, L., Kalton, G., Krenzke, T., Liu, B., Van de Kerckhove, W., Li, L., Sherman,
Indirect County and State Estimates of the Percentage of Adults at the Lowest
Level of Literacy for 1992 and 2003* (NCES 2009-482). National Center for Education
Statistics, Institute of Education Sciences, U.S. Department of
Education, Washington, D.C.

The statistical analysis and published estimates from Mohadjer et al’s report
prove to be valuable both politically and for guiding future work. The models were not
intended to be thought of a perfect but rather understood as solid and logical start
points. The methods used calculated indirect estimates which was distinct in that the
models used incorporated data from outside of the NAAL report as well. The reasoning
behind their selection of included predictor variables was a notable contribution to the
field. Only 13% of US counties were sampled and the remaining 87%’s estimates were
based of off model calculations.

Mo1138 *Understanding Pancreatic Diseases: National pancreas foundation’s (NPF) animated pancreas patient (APP) - informing patients for better health outcomes.*

I categorize Munigala et al’s article in a similar vein as Adibi’s in that its
contribution to the body of literature surrounding health literacy is focused on solutions
and in particular digital solutions. The study was aimed at determining the feasibility
and reliability of the digital platforms that utilize different communication avenues to
educate patients. The scope of the application was limited to Pancreatic conditions and
the feedback they receive will prove to be useful In my discussion as the greater
majority proved to benefit directly from the application. The study also stated that
patients believed that the application would be useful in furthering discussions with
their current providers.

Paasche-Orlow provides a necessary tool for any future study of health literacy and policy decisions. His paper explains and produced a conceptual model that untangles the socio-biologic action and consequences of limited health literacy. The model itself was intended to be “open sourced” and later added to and refined to reflect the environment and population that employs it. The model references many of the articles I cited prior to reading this and is well written and supported. The model is not intended to be viewed as a deterministic cause and effect pathway but rather as a theoretical model that illustrates the most direct paths between literacy and health.


Rikard et al’s analysis of the 2003 NAAL report produced results and insights consistent with the larger body of insights surrounding the NAAL report. The study emphasizes the idea that health literacy is a social construct and provided that health literacy is accumulated between individuals and their associations with various social institutions. The sociologic information presented by Rikard et al will be very important in communicating the complexity of the issue. In particular Rikard et al’s commentary on relational social class and social resources explain in detail the process of accumulating health literacy skills.


The British report on parental and child mental ability and social factors that impact glycemic control proved to be useful. The main finding of the investigation was that there was a statistical significant reciprocal relationship between HbA1c level and parental literacy level. This association adds to the collection of peer reviewed findings that demonstrate the impact of health literacy on health outcomes. However it is very unlikely that the environment was controlled to a degree to eliminate of social factors.
Russel et al’s study contributed to the knowledge surrounding the clinical use of the Newest Vital Sign test (NVS). Ultimately they concluded that the Test, and Retest properties of NVS are similar between Telephone and in person administration. The study should be useful in my discussion but does not provide any information that would link health illiteracy to rural populations. Additionally the study's statistical analysis does not take in to account correct information learned from the first attempt which raises questions of the potential worth of the study as a whole.

Sewar et al’s study looked into a various serious issue that is prevalent globally and occurs in an extremely vulnerable population, the elderly. Sarwar’s team looked into the role that educational attainment had in the prevalence of PIMs, which are potentially inappropriate medicines and polypharmacy. The process in which patients are given or obtain PIMs is multifocal and the occurrence in part can be attributed to patient communication or self-management of healthcare. The results of the study painted a scary picture of geriatric life as 2/3rds of the patients were found to be taking 5 to 9 prescriptions and that education level directly related to the likelihood of experiencing polypharmacy.

Schillenger et al approached the clinic issue of illiteracy as it relates to the management of Diabetes Mellitus, a condition which typifies the current epidemiologic state. The team’s study articulates that patients who were health illiterate or in their words “patients with inadequate health literacy” were less likely to achieve tight glycemic control. This article is based on living patient acquired clinical data unlike many pub health articles which base points off of mortality rates and consequently adds substance to the field.

Weis et al tested and proved that the Newest Vital Sign test (NVS) could be a quick and reliable clinical tool used to determine the literacy level of patients in a primary care setting. The study compared the accuracy and reliability of NVS by comparing results of the NVS with the patients results from the long version of TOFHLA. The work ultimately revealed that a health literacy could accurately estimated in 3 minutes. The report additionally provided a conversion scale that would allow the NVS reports to be understood in terms of the identifiers established by TOFHLA. The study is reproducible and was a major report in terms of marketing the practically and efficiency of health literacy assessment.


Baker et al’s article is certainly not recent however I believe it is not antiquated and remains relevant in the greater body of the field. The self-management of chronic conditions is essential to patient safety, health outcomes and mitigating the financial burdens of disease in the modern age. The conclusions that Baker’s teams made were based off of a survived population of a substantial number. The study provides a glimpse into the lived reality of health illiterate patients and the problems it poses in their capacity to care for themselves and understand their situations.


Yin et al’s report investigated and report the relationship between parental literacy level and medicine administration skill. Yin et al found that caregivers with lower literacy levels frequently reported the use of nonstandardized measuring equipment. This is an alarming finding and it points to the urgent need for intervention and the utter incompetency of a large population. Additionally, it shows that the impact of the illiterate spans beyond the individual without adequate literacy.

Illiteracy is an illusive topic to measure period but its effects in the context of public health are even more difficult. Yin et al performed statistical analysis that revealed an empirical correlation between low parent health literacy and specific health management tasks. In particular the study revealed that 46.4% of participants that were found to have below basic health literacy ratings were unable to perform at least 1 of 2 medication related tasks. The conclusion of the study supports my belief that addressing health illiteracy may ameliorate health disparities in Robeson county as compared to Wake and Mecklenburg counties.


Zoellner et al focused their report on Low health literacy and how it related in particular to weight-related child health outcomes. The study aimed to find and observe the relationship between parental literacy levels and how their child fared in terms of attaining the goals, attendance, retention in the program, and reach of weight management practice. The study concluded that parental Health literacy status had no influence on reach, attendance, and retention in the program, however they noted that there were differences between the high and low literate groups. The study suggested and pointed to economic factors being more influential in the different outcomes rather than health literacy levels. This study was helpful to my work in that it speaks to the convoluted nature of health outcomes and in particular the many competing and coinciding factors.
Table 1. Summary of Non Government-Robeson County Research Studies

<table>
<thead>
<tr>
<th>Study (n=30)</th>
<th>Methods</th>
<th>Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paskett et al</td>
<td>Researchers surveyed subjects about knowledge, attitudes, and behaviors regarding breast and cervical carcinoma screening</td>
<td>N= 897 Low income minority women from Robeson County who were older than 40 years old Principal the women were African American or Native American</td>
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<tr>
<td></td>
<td></td>
<td>The study concluded that overall Native American and African American women in Robeson County had inaccurate beliefs and more barriers to screening compared to White women. 43% of the patients responded did not mention Mammograms in the survey of cancer screening methods</td>
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<tr>
<td></td>
<td></td>
<td>The study is generalizable to other rural triracial and minority majority populations but may not be generalizable to urban minority populations</td>
</tr>
<tr>
<td>Wells et al</td>
<td>Self administered survey that assessed factors influencing access to dental care, oral health, oral health knowledge and oral health related quality of life</td>
<td>N= 118 Lumbee Indians who attended the Lumbee Homecoming festival in Pembroke, North Carolina</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Males had significantly less oral health knowledge than females (p=0.0072) Those with only a high school education or less than a high school education had significantly less oral health knowledge than those who had obtained a higher level of education</td>
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<tr>
<td></td>
<td></td>
<td>That sample population demographics included a higher percentage of individuals that had obtained a bachelor’s degree or higher than is found in the larger population</td>
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</table>

Table 2. Summary of Research Studies
<table>
<thead>
<tr>
<th>Study</th>
<th>Methods</th>
<th>Subjects</th>
<th>Key findings</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Adibi et al (2018)</td>
<td>Developed a Digital collection of Diabetes related knowledge and evaluated problems associated with physician and patient usage of the interface and to test the usability of the platform Abidi et al analyzed computer screen activity, observation logs using ATLAS.Ti software which utilizes an algorithm to identify and pinpoint thematic patterns in the observation logs.</td>
<td>N= 10 randomly selected Primary care physicians who practice in Halifax Canada N= 11 Adults with diabetes in the Halifax area Exclusion criteria only disallowed physicians who aided in the construction of the database and patients who were not proficient in English</td>
<td>Physicians top concerns about the Web application relate to liability issues and that it would result in increased work. Patients top concerns about the Web application relate to preference which they largely spoke to preferring a direct line of contact with providers, Additionally PCP’s and patients believe that technology ineptness would deter and limit the potential user of the software.</td>
<td>Size of Sample Generalizability of the sample in restricted by the location of the study and the demographic composition of the tested population Generalizability is also impacted by the language used in the study which was only English.</td>
</tr>
<tr>
<td>2. Brinkman et al (2018)</td>
<td>Randomized control trial that studied the usage of internet diabetic tools and information sites. N= 66 users who were, Adolescents from western united states who were Ages≥ 11 &lt;18 who in the last 6 months to a year had Hb_a1c ≥7.5% N= 66 caregivers</td>
<td>Diabetic Decision aids were found to benefit the users if they properly adhered to the information presented The study further illuminated the dynamic between adolescent-caregiver where the adolescent viewed the Decision aid as an additional burden of their disease.</td>
<td>The study is limited by the number of participants and the wide range of socio-demographics that were surveyed and which could potentially impact the reliability of the data.</td>
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<tr>
<td>3. Brewer et al (2009)</td>
<td>REALM assessment intended to study how literacy relates to post treatment cancer patients understanding of reoccurrence risks produced by genomic tests, the health literacy differences were analyzed using t-tests and levene tests for equality of variance. N= 163, Post Treatment female breast cancer survivors</td>
<td>Women with lower levels of health literacy had a less precise understanding of risk. On average risks rates communicated in percent were understood more variably than risk rates communicated</td>
<td>The sample population contained a overrepresentation of college graduates which could potentially have skewed the results.</td>
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</tr>
<tr>
<td></td>
<td>Study Description</td>
<td>Health Literacy</td>
<td>Nonadherence to Preoperative Instructions</td>
<td>Limitations</td>
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<td>4.</td>
<td>Chew et al (2004)</td>
<td>Health Literacy was assessed using S.T.O.F.H.L.A. Then a Cohort study was conducted to test the independent association between health literacy status and self-reported adherence to preoperative instructions</td>
<td>The determinants of nonadherence to preoperative instructions are complex; the study suggests that LHL is a contributing cause. LHL was more prevalent amongst older patients (65+) Patients with LHL were more likely with an odds ratio 1.9 to be nonadherent to preoperative medication instructions</td>
<td>The clinical setting could limit the generalizability of the results. The patient adherence assessment was self-reported and could potentially have affected the accuracy of the report.</td>
</tr>
<tr>
<td>5.</td>
<td>Coupe et al (2018)</td>
<td>One on one semi-structured interviews were conducted and documented patients’ experiences following weight loss intervention and recorded. The audio types were later analyzed using Braun and Clarke’s six stage thematic analysis procedure. N=25 of British citizens living in the greater Manchester metropolitan area.</td>
<td>Diversity in language and literacy ability makes the use of visual representations of information more effective than written formats.</td>
<td>The limited sample size as well as the subjective measure used to analyze data limit its use and generalizability.</td>
</tr>
<tr>
<td>6.</td>
<td>Curtis et al (2012)</td>
<td>Cohort Study of asthma patients to investigate asthma outcomes and Socioeconomic status which were analyzed using multivariate models. N= 353 adults aged 18-40 with persistent asthma from 2004-2007 in Chicago, IL.</td>
<td>The study data was split amongst demographic lines and showed that African American patients had significantly worse ratings in all of the asthma outcome categories.</td>
<td>The study attempted to make claims that separated factors that resulted in asthma outcomes when doing so produced data that doesn’t contribute any worthwhile information.</td>
</tr>
<tr>
<td>7.</td>
<td>Debussche et al (2018)</td>
<td>Data was collected from self administered questionnaires that included scale reliability analysis, Confirmatory factor analysis, and health literacy profiles which were obtained via descriptive statistics. N= 175 participants of a health education and support programs in Paris, France.</td>
<td>The Patients results from the questionnaire were found to be statistical proof for the reliability of the 9 scales of the French Health literacy questionnaires. P=0.000 and a correlated residuals fit index of 0.925</td>
<td>The study could be limited in terms of its generalizibility due to the fact that it was conducted in France. The paper itself was translated also and the conclusions may also be slightly</td>
</tr>
<tr>
<td></td>
<td>Study Title</td>
<td>Description</td>
<td>Findings/Implications</td>
<td>Notes</td>
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<tr>
<td>8.</td>
<td>Hadden et al (2017)</td>
<td>Analysis of readability of informed consents from Institutional Review Boards</td>
<td>N=217 informed consents written between 2013 and 2015</td>
<td>The study showed that the feasibility of using a clear and understandable template for generating informed consent documents</td>
</tr>
<tr>
<td>9.</td>
<td>Hodge et al (2018)</td>
<td>Rural Australian children were given literacy assessments remotely by web-based application administered to test for the feasibility and reliability of telepractice assessments</td>
<td>N= 37 Rural Children ages 8 to 12 who attended a rural Australian multidisciplinary reading clinic</td>
<td>Spearmans’s correlation test reveal strong agreement between telepractice and face to face assessments of literacy ( R= 0.79-0.99) Bland-Altman plots comparing the two delivery methods also indicated a strong agreement between the groups.</td>
</tr>
<tr>
<td>10.</td>
<td>Karnoe et al (2018)</td>
<td>Statistical analyses of results from 7 surveys that tested Technology confidence and competency, knowledge of health and disease and other factors needed to be able to engage in eHealth resources</td>
<td>N=450 respondents from a general population sample and an outpatient group between 2011 and 2015</td>
<td>All seven tools used in the assessment were validated based statistical fit according to the Log Linear Rasch models The EHLA is suitable for studies that need tools for assessing eHealth literacy</td>
</tr>
<tr>
<td>11.</td>
<td>Kaufman et al (2001)</td>
<td>Covariate analysis of Breast-feeding duration and maternal health literacy score as indicated by REALM level</td>
<td>N= 61 first time mothers aged 18 y/o who spoke English as their first language</td>
<td>23% of low literacy mothers when shown to breast feed for at least 2 months where 54% of highly literate mothers were reported to</td>
</tr>
<tr>
<td>12.</td>
<td>Kutner et al (2006)</td>
<td>Survey distributed and administered in multiple formats: Computed Assisted Personal interviewing and Private in-</td>
<td>N= 17,178, 16 years or older living in households</td>
<td>The study resulted in a scale that position reflected the General literacy score of the average of individuals</td>
</tr>
</tbody>
</table>
person interviewing that required subjects to complete 28 health tasks and assessed the individuals ability to complete the objectives and was intended to report a level of health literacy.

<table>
<thead>
<tr>
<th>13. Lobiokeine et al (2018)</th>
<th>Data for the study was obtained via survey which was conducted through the company Eurobarometer and the respondents were interviewed over phone in their native languages. The survey was conducted between September 14th and 15th of 2014.</th>
</tr>
</thead>
<tbody>
<tr>
<td>N= 1,161 Prison inmates</td>
<td>who had a 67% probability of completing the task. Additionally the study created performance level cut off groups which allows for characterization of strengths and weakness of groups.</td>
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<tr>
<td></td>
<td>entirely objective. The primary limitation of the data produced is that is requires a significant level of prior knowledge to accurately interpret.</td>
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<tr>
<th>14. Lindquist et al (2017)</th>
<th>Multisite randomized controlled trial that was 2 armed with an attention control and “Plan Your Lifespan” intervention with equal and random allocation to the assigned groups. The groups were tested for understanding of conditions at multiple time points post</th>
</tr>
</thead>
<tbody>
<tr>
<td>N= 385</td>
<td>PYL intervention was proven to statically improve subjects understanding of home-based services that may be required following hospitalization (P≤0.000001)</td>
</tr>
<tr>
<td>79.5% Female</td>
<td>The group demographic composition was skewed towards White Females which could have biased the results and limited</td>
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<tr>
<td>62.9% White</td>
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<tr>
<td>Mean age= 71.9 years old</td>
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<tr>
<td>Nonhospitalized adults age ≥65 years living in urban, suburban, and rural areas of Texas, Illinois, and Indiana</td>
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<tr>
<th>15. Loriane et al (2004)</th>
<th>Subjects completed the TOFHLA short form and questionnaire and included in a cross-sectional study that was designed to find the relationships between Health literacy status and multiple pregnancy outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>N= 74</td>
<td>Compared to Women with Adequate HL women with LHL were: more likely to: More likely to have an unplanned pregnancy P= 0.02</td>
</tr>
<tr>
<td>English and Spanish speaking pregnant women with pregestational diabetes: (class B or higher, either type 1 or 2) from two Chicago area university clinics and one community based high risk obstetric</td>
<td>Significantly less likely to have either discussed pregnancy ahead of time with an endocrinologist or obstetrician P=.01 additionally they are also less likely to have</td>
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<tr>
<td></td>
<td>The sample size was some small enough that potentially the division based on language spoken may have influenced the results</td>
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13. Lobiokeine et al (2018) Data for the study was obtained via survey which was conducted through the company Eurobarometer and the respondents were interviewed over phone in their native languages. The survey was conducted between September 14th and 15th of 2014.

14. Lindquist et al (2017) Multisite randomized controlled trial that was 2 armed with an attention control and “Plan Your Lifespan” intervention with equal and random allocation to the assigned groups. The groups were tested for understanding of conditions at multiple time points post.

15. Loriane et al (2004) Subjects completed the TOFHLA short form and questionnaire and included in a cross-sectional study that was designed to find the relationships between Health literacy status and multiple pregnancy outcomes.

N= 26,061 All subjects were citizens of one of 27 EU states and belonged to various social, ethnic and demographic groups.

The study revealed that the most common method that Europeans employed to ascertain health information was the internet. The study also noticed a pattern between the socioeconomic development status of a country and the corresponding level of health knowledge.

The study was conducted over a huge and very diverse population and consequently culture and language differences may have biased the results.

The primary limitation of the data produced is that is requires a significant level of prior knowledge to accurately interpret.

The group demographic composition was skewed towards White Females which could have biased the results and limited.

Compared to Women with Adequate HL women with LHL were: more likely to: More likely to have an unplanned pregnancy P= 0.02

Significantly less likely to have either discussed pregnancy ahead of time with an endocrinologist or obstetrician P=.01 additionally they are also less likely to have

The sample size was some small enough that potentially the division based on language spoken may have influenced the results.
<table>
<thead>
<tr>
<th></th>
<th>16. Mackert et al (2015)</th>
<th>Subjects HL status was assessed using NVS questionnaire and were interviewed and then asked to use “My Pregnancy Today” which is an e-health application that provides maternity related content Subjects were obtained from non-profits and were Adult Males N=32 and the average age of participants was 33.2</th>
<th>E-health is a promising approach to communicating effectively with lower health literate audiences Study found no relationship between health literacy and usage of the e-health application Small mobile devices are a good way to overcome barriers associated with convivence or work restrictions Small sample size Results are not generalizable The application was in English only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17. Menendez et al (2017)</td>
<td>Data was collected from audio recordings of orthopedic office visits to one of three orthopedists during their first meeting. Patients questions were assessed using Roter Interaction Analysis system which consisted of 11 categories Immediately following the visit patients health literacy status was identified using the Newest Vital sign literacy test N=84 first time patients of the Tufts Orthopedic center Mean age of 51 37% had government funded health insurance</td>
<td>Patients with limited health literacy asked fewer questions during the clinical visit 5±4 versus 9±7 for patients who had adequate levels of health literacy Race was the only other patient characteristic that determined the number of questions asked non whites asked fewer question than whites did (5±4 versus 9±7) The study was divided between traumatic and non traumatic conditions which could have influenced the results seeing as emotional/ stress state can influence attention and cognition</td>
</tr>
<tr>
<td></td>
<td>18. Mohadjer et al (2009)</td>
<td>Indirect county and state estimates of percent lacking basic prose literacy skills calculated using a stepwise regression analysis N= 17,178, 16 years or older living in households N= 1,161 Prison inmates</td>
<td>Study demonstrate the imprecision of the data to formulate small area county estimates of LBPS where as the state estimates were more usable given the median credible interval was 5% The data was not collected from all counties nor states and is not entirely representative of the estimated populations which may have caused the imprecision of the estimates</td>
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<tr>
<td></td>
<td>Study Title and Authors (Year)</td>
<td>Study Description</td>
<td>Participants</td>
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<td>19.</td>
<td>Munigala et al (2018)</td>
<td>Retrospective study that analyzed the Animated Pancreas Patient education website and YouTube audience data and was survey based</td>
<td>Subjects were visitors to APP and completed online feedback survey (N=4869)</td>
</tr>
<tr>
<td>20.</td>
<td>Paasche-Orlow et al (2007)</td>
<td>Analyzed current findings in medical and public health literature on health literacy and derived an evidence based causal model</td>
<td>Evidence that was used to construct casual model was acquired from 62 peer reviewed sources</td>
</tr>
<tr>
<td>21.</td>
<td>Rikard et al (2016)</td>
<td>Analyzed the results of the 2003 NAAL using a series of weighted OLS regression models to calculate the association between multivariable social variables</td>
<td>N= 14,592 respondents of NAAL which were ages 18 and older</td>
</tr>
<tr>
<td>22.</td>
<td>Ross et al 2002</td>
<td>Cohort analysis which compared tests groups WRAT scores and HbA1c levels</td>
<td>N=78 children with TD1 and their mothers</td>
</tr>
<tr>
<td>23.</td>
<td>Randomized Control trial that were assessed using</td>
<td>N= 216 , 18 years or older who</td>
<td>The data revealed that NVS could be</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Study Design</td>
<td>Methodology</td>
<td>Findings</td>
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<tr>
<td>Russell et al (2018)</td>
<td>NVS in person or via telephone to acquire Test-retest reliability of opioid safe use intervention</td>
<td>denied recent use of opioids at a Urban Chicago academic emergency department</td>
<td>accurately administered by telephone and should a trend of decreased reliability of retest data that occurred after 7 days health literacy consultant for Merck and that relationship may have biased the operation of the study</td>
</tr>
<tr>
<td>Sarwar et al (2018)</td>
<td>Cross Sectional study that investigated the influence of Polypharmacy and potentially inappropriate medications (PIMs) according to education levels and was assessed using Beer’s criteria</td>
<td>N= 385 Ages ≥65 between December 2017 and February 2018</td>
<td>2/3rds of the subjects were found to be considered to undergoing polypharmacy (5 to 9 drugs) and or excessive pharmacy &gt;10 Additionally Sarwar found that the likelihood of having a PIMs or polypharmacy increased the lower educational level of patients The location and development status of Pakistan may limit the studies generalizability</td>
</tr>
<tr>
<td>Schillinger et al (2002)</td>
<td>Cross Sectional Observational study comparing Health literacy status which was obtained using TOFHLA to Diabetes outcomes</td>
<td>N= 408 English or Spanish speaking patients older than 30 and had type 2 diabetes Excluded people with dementia or were too ill to participate</td>
<td>Patients with LHL were less likely to achieve tight glycemic control (HbA_1c ≤7.2%) OR = 0.57 CI= 95% P 0.05 For each 1-pt decrement in s-TOFHLA score the patients HbA_1c value increased by .02 (p= 0.02) The study design did not provided causal proof of LHL with Diabetes outcomes Diabetes self care regimen is one of the most difficult chronic disease regimens to maintain</td>
</tr>
<tr>
<td>Weis et al (2005)</td>
<td>Administered TOFHLA and NVS to patients and timed the assessment. Results from NVS were statistically analyzed and tested for agreement and were intended to test the reliability of NVS.</td>
<td>N= 250 English speaking and N=250 Spanish Speaking patients 18 years or older from 3 University of Arizona school of Medicine affiliated Primary care clinics in Tucson, Arizona</td>
<td>The research proved that NVS was a quick and reliable means of assessing health literacy in a clinical setting and To test the agreement and accuracy of NVS, the literacy scores were compared to TOFHLA scores. However Weis et al used the Long formatted TOFHLA which is not as frequently used. Additionally the demographics of the primary care patients used for the study are not nationally</td>
</tr>
<tr>
<td>27. <strong>Williams et al (1998)</strong></td>
<td>Cross-sectional survey of patients relating TOFHLA scores with their knowledge of their chronic disease</td>
<td>N total = 402 Selection criteria was having a either Hypertension or Diabetes and being prescribed a daily medication. The study was conducted at two large urban hospitals. One in Torrence, CA at the Harbor-UCLA Medical center and the other being Grady Memorial hospital in Atlanta, Ga</td>
<td>55% percent of patients identified as being in the LHL group did not know that a blood pressure reading of 160/100 mmHg was considered high. Results of the different areas surveyed shows that many patients who attend formal diabetes educational programs did not know the basics of their disease and self-management skills.</td>
</tr>
<tr>
<td>28. <strong>Yin et al (2007)</strong></td>
<td>Cross-sectional analysis of caregivers and their knowledge of weight based dosing and reported nonstandardized instrument usage as compared to their TOFHLA level</td>
<td>N = 292 caregivers were given literacy and health task assessments</td>
<td>23.3% percent of caregivers rated as having inadequate health literacy reported the use of nonstandardized instruments when dosing liquid medications.</td>
</tr>
<tr>
<td>29. <strong>Yin et al (2009)</strong></td>
<td>Cross-sectional study that utilized a logistic regression analyses to describe factors associated with low parental health literacy</td>
<td>Subjects were selected from participants of the 2003 National Assessment of Adult Literacy N= 6100</td>
<td>28.7% percent of the parents had below-basic health literacy levels 68.4% of parents were not able to enter names and birth dates correctly on insurance forms 46.4% of parents were not able to perform at least 1 of 2 related medication related tasks.</td>
</tr>
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</table>
| 30. **Zoellner et al (2008)** | Self labeled as being a "Quasi-experimental trial" That followed the | N=101 Eligibility criteria included children ages 8 to 12 years | No significant difference in HL scores were found | Small sample size Experimental design with a short
| Community Based participatory research and systems based approach which included self administered surveys | old with a BMI at of above 85th percentile in the Rural Dan River region of Virginia | between parents who enrolled their children in the study and those who did not | Retention rates were also similar between groups Parental HL status did not significantly influence improvements in effectiveness outcomes (P<.001) | follow up period could have limited the findings |

**Appendix**

**Supplementary Figures:**

Figure 1b. Urban North Carolina Racial Composition
References:


28. Sarwar M, Iftikhar S, Sarfraz M. Influence of education level of older patients on polypharmacy, potentially inappropriate medications listed in beer's criteria, and unplanned hospitalization: A


33. Wells PL. *An oral health survey of the Lumbee tribe in southeastern North Carolina*.

