Health Policy Brief

The High Economic Cost of Low Health Literacy in Wisconsin

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Health Illiteracy: The Institute of Medicine defines health literacy as "The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions."

A Failing Grade: The 2003 US Department of Education National Assessment of Adult Literacy Survey (NAALS) contained, for the first time, a *Health Literacy Component*. Only 12 percent of Adults surveyed were judged to have *Proficient* health literacy.

An Economic Drain: Low health literacy is a major source of economic inefficiency in the state of Wisconsin. First approximations place the order of magnitude of the cost of low health literacy, to the Wisconsin economy, in the range of **$3.4 billion** to **$7.6 billion** annually. If unchanged, this translates into a present value cost of between **$51.7 billion** and **$116.3 billion** (using a social discount rate of 7%).

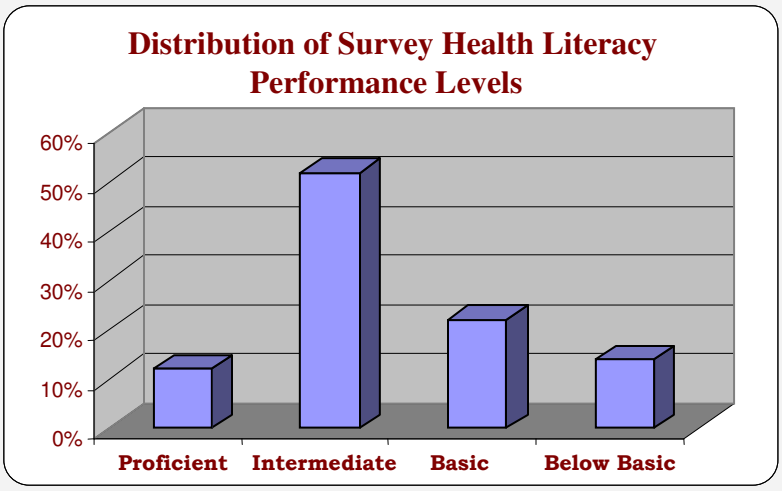
I. Health Literacy

Having the necessary skills to read and fill out medical and insurance forms, communicate with healthcare providers, and follow basic instructions and medical advice are critical to obtaining appropriate healthcare. At virtually every point along the healthcare services chain patients are required to read and understand important healthcare information. Examples include reading signs in hospitals and clinics about where to go and where to sign-in; written and oral instructions in brochures and pamphlets; directions on taking prescription medications. Fear and embarrassment are likely to inhibit many Americans from seeking clarifications about instructions and medical advice. Cultural and language barriers further exacerbate the transmission of medical information, advice, and instructions.

According to the 2003 National Assessment of Adult Literacy Survey (NAALS), which for the first time studied health literacy in the United States, only 12 percent of the more than 19,000 adults surveyed were judged to have *proficient* health literacy. Fifty-two percent had what the Department of Education classified as *Intermediate* health literacy; and 22 and 14 percent were determined to have *Basic* or *Below Basic* health literacy, respectively. These

categories are the same as those recommended by the National Research Council's Board on Testing and Assessment Board to measure adult literacy. These results are summarized below in Figure 1.

Figure 1: Distribution of Health Literacy Performance Levels from the 2003 NAALS Health Literacy Survey



The four different categories of health literacy performance used in the Department of Education's NAALS survey reflect abilities to perform various tasks at the patient-healthcare system interface. Examples from each of the categories are:

- **Below Basic Health Literacy**
  - Circling the date of a medical appointment on a hospital appointment slip;
  - Identify how often a person should have a specified medical test, based on information in a clearly written pamphlet.
- **Basic Health Literacy**
  - Give two reasons a person with no symptoms of a specific disease should be tested for the disease, based on a clearly written pamphlet;
  - Explain why it is difficult for people to know if they have a specific chronic medical condition, based on information in a one-page article about the medical condition.
- **Intermediate Health Literacy**

- Identify the substances that may interact with an over-the-counter drug to cause a side effect, using the over-the-counter drug label;
- Find the age range during which children should receive a particular vaccine, using a chart that shows all the childhood vaccines and the ages children should receive them.

➢ **Proficient Health Literacy**

- Find the information required to define a medical term by searching through a complex document;
- Evaluate information to determine which legal document is applicable to a specific healthcare situation.

II. Impact on Health Outcomes and Expenditures

Conceptually, health literacy may be viewed as an input into the production of an individual's stock of health capital. The notion of a health capital production function is longstanding in the health economics literature, dating back to 1972 and the seminal research by Michael Grossman; it is used widely to model how individuals make decisions about their health, by seeking medical care and treatment, adopting healthy or unhealthy lifestyles, and managing their overall state of health and physical wellbeing. An individual's level of health literacy is a critical input into their health production function and will determine the efficiency with which they seek care and receive treatment. The unique features and institutional characteristics of healthcare and healthcare markets, such as informational asymmetries, barriers to communication and understanding of health care information and instruction, suggest that low health literacy levels may lead to vast inefficiencies in the production of health capital.

"An individual's level of health literacy is likely to be a very important determinant of their health capital production."

---Professor Michael Grossman, Graduate Center, City University of New York; Director, NBER Health Economics Program

Some of the important features of this model and how health literacy levels influence health outcomes and resource expenditures are summarized below.

Conceptual Model:

- **Health literacy, along with other factors such as education, income, and gender, affects an individual's ability to produce health (stay healthy).**

- **Medical care demand is used as an input to produce health and as a consequence it depends on health literacy.**

- **Direct links between health literacy, outcomes, and medical expenditures.**
    - Timing between preventive and curative treatment
    - Search for best treatment given a medical condition
    - Search for best medical providers
    - Search for best diagnostic

- **Indirect links between health literacy, outcomes, and medical expenditures.**
    - Insurance
    - Education and income among other determinants of health outcomes and expenditures

Recent research and empirical evidence support this model of health literacy and its influence on healthcare expenditures and health outcomes. Examples are highlighted below.

Empirical Research and Evidence:

- **Nielsen-Bohlman, Panzer and Kindig (2004) found that individuals with limited health literacy reported poorer health status and were less likely to use preventive care.**

- **Baker et al. (1998; 2002) and Schillinger et al. (2002) found individuals with low levels of health literacy were more likely to be hospitalized and have bad disease outcomes.**

- **Howard (2004) estimated that inpatient spending increased by approximately $993 for patients with limited health literacy.**

- **Baker et al. (2007) found, after controlling for relevant covariates, that lower health literacy scores were associated with higher mortality rates within a Medicare managed care setting.**

- **Friedland (2002) estimated that low-functional literacy may have been responsible for an additional $32 billion to $58 billion dollars in healthcare spending in 2001. A substantial part of these expenditures is financed by Medicaid and Medicare.**

- **Vernon et al. (2007), extending Friedland's work, estimated that the annual cost of low health literacy to the U.S. economy was $106 billion to $238 billion.**

III. Economic Cost of Low Health Literacy

The empirical evidence on the links between health literacy levels, health outcomes, and healthcare resource utilization is extensive. However, only Friedland (2002) has attempted to estimate the aggregate cost of low health literacy in the U.S. His analysis was undertaken prior to the release of the 2003 NAALS survey which, as previously mentioned, contained a health literacy component for the very first time. As a result, he had to rely on measures of adult literacy to proxy health literacy—a reasonable approach in the absence of health literacy data.

The objectives of the current policy brief is to employ Friedland's (2002) and Vernon et al.'s (2007) methods to estimate, using healthcare expenditure data from the state of Wisconsin, and the newly released NAALS survey of health literacy levels in the U.S., the cost of low health literacy in Wisconsin. While Friedland and Vernon emphasized several econometric limitations in their studies, such as simultaneity and endogeneity, their approaches are reasonable for undertaking first approximation estimates of the cost of low health literacy. We adopt these assumptions and modeling methodology to guide the current analysis for the state of Wisconsin. Individuals with *Basic* or *Below Basic* health literacy were classified as having low health literacy in our analysis. It should be emphasized, however, that our calculations, like Friedland's and Vernon et al.'s, are broad and employ numerous assumptions. Our intent is to approximate only the order of magnitude of the economic costs of low health literacy in the state Wisconsin. The value of such approximations is to raise awareness of the relative size and magnitude of the economic costs involved. It is from this perspective, and within this context only, that our estimates should be considered.

Annual and Present Value Cost Estimates

- **We use 2007 population data for each of the 72 counties in the state of Wisconsin from the Wisconsin Department of Health Services, Bureau of Health Information and Policy; and the percentage of the populations in these counties that are adults. c**

- **Per capital healthcare expenditure data for the state of Wisconsin were obtained from Kaiser Family Foundation Health State Facts (KFFHSF) data.**

- **We use 2003 NAALS Health Literacy survey, which estimates 36% of US adult population has Basic or Below Basic health literacy levels. If this national estimate is also representative of the population in Wisconsin, 1.6 million adults in Wisconsin have Basic or Below Basic health literacy.**

- **Using the OSEDA and KFFHSF data and Vernon et al.'s (2007) modeling assumptions, our results imply the annual cost of low health literacy to the state of Wisconsin lies between $3.3 billion (lower bound) and $7.5 billion (upper bound). County-level estimates are reported in the methodology appendix to this brief.**

- **Assuming this annual cost is incurred in perpetuity, and using a social discount rate of 7% (recommended by the US Government's Office of Management and Budget), this implies the present value cost of low health literacy to the state of Wisconsin will be between $50.7 billion (lower bound) and $114.1 billion (upper bound).**

IV. Health Policy Considerations

Recent research documents both (1) the prevalence of low health literacy among adults in the US and (2) the links between low health literacy and health outcomes and medical expenditures. The economic costs are likely to be very substantial. Efforts to improve the health literacy in Wisconsin will go a long way towards eliminating some of the inefficiencies in the provision of healthcare in the state and empowering patients to better manage their own healthcare (preventative or otherwise). Low health literacy is at a crisis level; it has only recently been uncovered in a systematic way through the recently released NAALS health literacy survey and analysis. Public policy actions, if taken expeditiously, could result in considerable cost savings to the state of Wisconsin's healthcare system through better health outcomes and more efficient use of healthcare resources. Failure to take appropriate actions carries a very high cost: both to the state economy and to many patients individually.

References

Baker DW, Parker RM, Williams MV, Clark WS. 1998. Health Literacy and the risk of hospital admission. *Journal of General Internal Medicine.* 13(12): 791-798.

Baker, D., Wolf, M., Feinglass et al. 2007. Health Literacy and Mortality Among Elderly Persons. *Achieves of Internal Medicine.* July 23, 2007 p 1503-1509.

Baker DW, Gazmararian JA, Williams MV, Scott T, Parker RM, Green D, Ren J, Peel J. 2002. Functional health literacy and the risk of hospital admission among Medicare managed care enrollees. *American Journal of Public Health* 92(8): 1278-1283.

Friedland R. 2002. What Did the Doctor Mean? Estimating the Direct Health Costs of Low Functional Literacy. Working Paper.

Friedland R. 1998. New estimates of the high costs of inadequate health literacy. In: *Proceedings of Pfizer Conference "Promoting Health Literacy: A Call to Action."* October 7-8, 1998, Washington, DC: Pfizer, Inc., 6-10.

Howard DH, Gazmararian J, Parker RM. 2005. The impact of low health literacy on the medical costs of Medicare managed care enrollees. *The American Journal of Medicine*, 118, 371-377.

National Center for Education Statistics. 2006. *The Health Literacy of America's Adults: Results from the 2003 National Assessment of Adult Literacy.* Washington, D.C.: U.S. Department of Education.

Nielsen-Bohlman, Panzer and Kindig (2004). Health Literacy: A Prescription to End Confusion. National Academy Press, Washington, DC.

Vernon J. Trujillo A., Rosenbaum S., and DeBuono, B. 2007. Low Health Literacy: Implications for National Policy: Available online at George Washington University: http://www.gwumc.edu/sphhs/departments/healthpolicy/chsrp/downloads/LowHealthLiteracyReport10_4_07.pdf

About the Author

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Dr. Vernon is a professor in the Department of Health Policy and Management at the University of North Carolina at Chapel Hill. He is he the former Senior Economic Policy Advisor to the Office of the Commissioner at the US Food and Drug Administration. He is a Faculty Research Fellow with the National Bureau of Economic Research (NBER) and is currently a Visiting Professor at the Wharton School of Business at the University of Pennsylvania in 2008. He has testified before the US Senate on several occasions and advises the both government and industry on regulatory and anti-trust issues.

Wisconsin Literacy Notes: Vernon used the Federal Medical Expenditure Panel data for total cost per year per adult. It lists cost by state. Vernon did not do any adjustment for those with or without access to healthcare, just total adult population of each county, an estimate of the percentage in the state for adults with low health literacy from the NAAL (National Assessment of Adult Literacy, 2003) and an estimate of how much extra it costs for each adult.

Appendix on Cost Calculations

This appendix presents the cost calculations. We did not have access to individual-level NAALS data, which would have enabled us to undertake the necessary econometric analyses to generate more precise and reliable estimates. Please refer to the caveats and limitations of these calculations, which are described in the brief. These calculations are intended only to be suggestive, and to motivate future research: they should not be taken out of context.

As noted in the brief, we employ many of the same assumptions used by Friedland (2002) and Vernon et al. (2007), who estimated the direct medical cost of low functional adult literacy and low health literacy, respectively; we employ the newly released health literacy survey data results from NAALS in our calculations. We also use contemporary cost and population data from Social and Economic Data Analysis (OSEDA) and the Kaiser Family Foundation Health State Facts (KFFHSF).

It is important to emphasize that there are other sets of assumptions and approaches that could be used to arrive at such top-line calculations. These alternatives might also be very reasonable in approximating the order of magnitude of the direct healthcare cost burden of low health literacy levels. We describe only our approach.

Even in such rudimentary approximations as the ones described here, it is necessary to undertake sensitivity analyses, in order to better understand the key drivers of the economic cost of low health literacy to the state of Wisconsin.

We outline our base case calculation below. We first present the data and key assumptions (along with variable designations for demonstrating our calculations), and then document our methods.

Key Data and Estimates:

1. According to the most recent Kaiser Family Foundation Health State Facts data, 2004 per capital medical expenditures (C_A) in Wisconsin were $5,670. The Annual growth rate in these expenditures for the same year was reported to be 6.0%. At this rate, 2007 healthcare expenditures were approximated to be $6,753.
2. 2007 Wisconsin Department of Health Services, Bureau of Health Information and Policy Information reports that the total population in the state of Wisconsin in 2007 was 5,641,581, of which, according to Kaiser Family Foundation Health State Facts, 74% were adults (18 and older). Thus, the adult population (Q) in 2007 in the state of Wisconsin was 4,174,770.

3. The 2003 NAALS health literacy survey reports that the proportion of adults at *Below Basic* health literacy levels was 14 percent, with another 22 percent classified as having only *Basic* health literacy levels.

4. Friedland (2002) reports that adults in the bottom 20 percent of predicted *functional literacy* scores (low literacy) have average per capita medical expenditures that are approximately twice (196 percent) as much as the per average cost for the entire population. We define this ratio to be λ.

5. Friedland (2002) dichotomizes incremental direct medical costs incurred by low literacy adults into the following: the proportion attributable to low functional literacy and the proportion attributable to other factors (covariates). He models the former using a range from 1/3 to 2/3. We define this proportion of the incremental costs to be α.

Methods—Annual Estimates:

To simplify the exposition, we define the ratio of average direct medical expenditures for adults with *low* health literacy to the average direct medical expenditures for the entire adult population as follows:

$$C_L = \lambda C_A \tag{1}$$

The following equations will also be useful:

$$C_A = pC_L + (1-p)C_{NL} \tag{2}$$

$$\Delta C = C_L - C_{NL} \tag{3}$$

Obviously, equation (3) is the incremental, or marginal, direct medical cost associated with having low health literacy, relative to not having low health literacy. The proportion of this marginal cost, α, that is attributable to low health literacy is unclear and cannot be answered rigorously without adequate data and appropriate econometric techniques. We were unsuccessful in obtaining the necessary individual level data from the Department of Education's National Center for Education Statistics despite repeated efforts and requests for help. For this reason we rely on Friedland's analysis and model of the cost of low adult literacy to generate our estimates of the cost of low health literacy in the state of Wisconsin.

Combining and re-arranging terms in (1)-(3) yields the following useful algebraic representation of incremental costs (conditional on $0 > \lambda p > 0$):

$$\Delta C = C_A\left(\lambda - \frac{1-\lambda p}{1-p}\right) \tag{4}$$

It is also obviously the case that λ is necessarily greater than unity (by definition and p lies on the interval [0, 1]. Multiplying equation (4) by α, which also lies on the interval [0, 1], generates a measure the proportion of the incremental cost between low health literacy individuals and non-low health literacy individuals that is attributable (independently caused by) low health literacy.

Therefore, the fraction of Wisconsin healthcare expenditures attributable to low health literacy may be expressed as follows:

$$\frac{pQ\left(\alpha C_A\left(\lambda - \frac{1-\lambda p}{1-p}\right)\right)}{pQC_L + (1-p)QC_{NL}} = p\alpha\left(\lambda - \frac{1-\lambda p}{1-p}\right) \qquad (5)$$

This expression is, of course, subject to the same parametric constraints mentioned previously. A key consideration in generating a cost estimate is how to map the estimate of incremental costs (based on predicted adult literacy from MEPS) associated with low functional literacy into our calculations using the new NAALS health literacy data. Any mapping will necessarily be speculative, as is the case with several other aspects of our estimate.

Our approach was the following. Because it seems plausible, if not probable, that individuals with low health literacy scores are more likely to come from the tail of the distribution associated with high healthcare expenditures than individuals with low functional literacy scores. Health literacy is obviously a more direct and precise measure of an individual's ability to obtain, process and make appropriate health decisions than functional literacy; it may capture additional elements (that functional literacy does not) of the challenges faced by some individuals in navigating the Wisconsin healthcare system and managing their own healthcare needs and requirements. Thus, Friedland's estimate of 196 percent higher costs (relative to the population average) for individual's below the first quintile of predicted functional literacy scores will underestimate this ratio (of costs) for individuals below the first quintile of health literacy scores (we hope to test this empirically, and also address a critical endogeneity issue, if we are eventually able to obtain the individual-level data from the 2003 NAALS).

For this reason, we believe a 20 percent threshold for our calculations will be a lower bound. It seems plausible, therefore, to model the range from 20 percent to 36 percent (the latter represents, of course, the percentage of individuals at *Below Basic* and *Basic* health literacy from NAALS). We acknowledge, as Friedland did per his cutoff point, that our upper bound is arbitrary.

In sum, our calculations are simple and based on a number of assumptions. The parameter values and ranges used in our calculations are summarized below:

C_A= $6,753
Q = 4,174,770
Lower bound p = 0.20
Upper bound p = 0.36
Lower bound $\alpha = 1/3$
Upper bound $\alpha = 2/3$

These values were used to generate the follow tableau of estimated annual costs.

Table A1: Annual Healthcare Costs Attributable to Low Health Literacy in Wisconsin

PARAMETER VALUES	$\alpha = 1/3$	$\alpha = 1/2$	$\alpha = 2/3$
$p = 0.20$	$2,255,377,745	$3,383,066,617	$4,510,755,490
$p = 0.28$	$3,508,365,381	$5,262,548,071	$7,016,730,762
$p = 0.36$	$5,074,599,926	$7,611,899,889	$10,149,199,852

Obviously, the range of cost estimates is very large. In the brief we report the range from $3.3 billion to $7.6 billion, i.e., when α = 1/2.

Table A2: Annual Healthcare Costs Attributable to Low Health Literacy in Wisconsin by County (*p*=0.28)

County	2007 Adult Population	Cost Estimate
Adams	17,685	$22,292,459
Ashland	12,762	$16,087,085
Barron	36,679	$46,235,934
Bayfield	12,503	$15,760,738
Brown	183,998	$231,940,278
Buffalo	10,942	$13,792,785
Burnett	13,361	$16,842,181
Calumet	33,660	$42,430,414
Chippewa	47,438	$59,798,049
Clark	24,672	$31,100,768
Columbia	43,208	$54,466,851
Crawford	13,390	$16,879,277
Dane	369,331	$465,563,608
Dodge	69,728	$87,896,550
Door	23,861	$30,077,743
Douglas	34,398	$43,361,202
Dunn	33,943	$42,787,682
Eau Claire	76,561	$96,509,643
Florence	4,182	$5,271,662
Fond Du Lac	77,927	$98,231,778
Forest	7,915	$9,977,801
Grant	39,695	$50,036,573
Green	27,662	$34,870,115
Green Lake	14,992	$18,898,411
Iowa	18,165	$22,898,665
Iron	5,710	$7,197,229
Jackson	15,623	$19,694,233
Jefferson	62,182	$78,384,500
Juneau	21,246	$26,781,328
Kenosha	120,267	$151,603,858
Kewaunee	16,295	$20,541,014

La Crosse	87,459	$110,246,968
Lafayette	12,345	$15,561,817
Langlade	16,639	$20,974,249
Lincoln	23,813	$30,018,272
Manitowoc	64,761	$81,635,227
Marathon	103,254	$130,157,590
Marinette	33,453	$42,169,413
Marquette	12,134	$15,295,917
Menominee	3,688	$4,649,177
Milwaukee	690,744	$870,724,277
Monroe	32,559	$41,043,178
Oconto	30,154	$38,010,825
Oneida	30,637	$38,619,696
Outagamie	130,215	$164,143,609
Ozaukee	66,560	$83,902,332
Pepin	5,900	$7,437,399
Pierce	31,368	$39,540,722
Polk	34,985	$44,100,953
Portage	54,691	$68,940,866
Price	12,401	$15,632,104
Racine	146,438	$184,593,556
Richland	14,158	$17,847,631
Rock	120,546	$151,955,151
Rusk	11,942	$15,053,355
St. Croix	60,045	$75,690,897
Sauk	45,961	$57,936,850
Sawyer	13,726	$17,302,343
Shawano	32,363	$40,795,629
Sheboygan	89,234	$112,484,240
Taylor	15,174	$19,127,352
Trempealeau	21,530	$27,140,433
Vernon	21,977	$27,702,999
Vilas	18,472	$23,284,719
Walworth	78,322	$98,729,177
Washburn	13,743	$17,323,461
Washington	98,820	$124,568,973
Waukesha	291,643	$367,633,809
Waupaca	41,218	$51,957,644
Waushara	20,004	$25,216,120
Winnebago	127,976	$161,321,628
Wood	58,780	$74,095,568

***** Note sum of county costs does not exactly equal state-wide cost estimate because on minor discrepancies in reported percentage of population that are adults. Results are very close.

Methods—Present Value Long Run Estimates:

Calculating present value, long run costs over a horizon of t years is straightforward. We first consider the case of an infinite time horizon, as $t \to \infty$. From a social welfare perspective this is the appropriate horizon.

For simplicity, we assume that annual healthcare costs attributable to low health literacy levels (as described in this appendix) remain constant over time. If r is social discount rate, then present value healthcare costs from low health literacy levels are represented as follows:

$$\Omega = \sum_{t=0}^{\infty} \frac{\omega}{(1+r)^t} = \omega + \frac{\omega}{r} = \omega\left(1 + \frac{1}{r}\right) \tag{6}$$

It is straightforward to show this infinite geometric series converges; it is a basic perpetuity and inclusive of current year's cost. The annual cost due to low health literacy levels is measured, as has been shown before, as follows:

$$\omega = pQ\alpha C_A\left(\lambda - \frac{1-\lambda p}{1-p}\right) \tag{7}$$

Alternatively, shorter time horizons may be considered when calculating these costs. Equation (8) is the present value cost of low health literacy levels over the finite time horizon of n years (and inclusive the current year's cost).

$$\Omega = \sum_{t=0}^{n} \frac{\omega}{(1+r)^t} = \omega + \frac{\omega\left(1 - \frac{1}{(1+r)^n}\right)}{r} \tag{8}$$

It is easy to see by inspection that the ratio on the right-hand side in (8) is simply the present value difference between two perpetuities: one that begins in t = 1 and the other that begins in year t= n.

Table A2 summarizes the present value cost estimates over 5, 10, 25, and 50 years—inclusive of the base, or current, year. Thus, we are considering n future years plus the current year—a total of n+1 years of costs. An infinite time horizon calculation is also shown. We consider the same p values as used in Table A1, but use the base case (midpoint) value of $\alpha = ½$.

Table A3: Finite Time Horizon Present Value Healthcare Costs Attributable to Low Health Literacy in Wisconsin

PARAMETER VALUES	$p = 0.20$	$p = 0.28$	$p = 0.36$
5 Years	$17,254,307,687	$26,840,034,179	$38,822,192,295
10 Years	$27,144,310,862	$42,224,483,562	$61,074,699,438
25 Years	$42,807,914,838	$66,590,089,748	$96,317,808,386
50 Years	$50,071,910,697	$77,889,638,862	$112,661,799,068
∞	$51,712,589,720	$80,441,806,231	$116,353,326,870

The values in Table A3 demonstrate the sensitivity of the present value cost estimates to both the time horizon considered and, of course, the assumed value of p.

These cost calculation exercises are a good-faith effort to gain insight into the order of magnitude of the economic costs of low health literacy in the state of Wisconsin, but it is only within this context that our results should be considered. Only rigorous econometric analyses using individual-level data from the 2003 NAALS survey has the potential to generate sufficiently precise estimates of these costs. Our first approximation calculations have only endeavored to better understand the potential order of magnitude of these costs.

The same methods were used to calculate multi-period costs by county. These results are shown below.

Table A4: Finite Time Horizon Present Value Healthcare Costs Attributable to Low Health Literacy in Wisconsin by County

County	5-YR Costs	10-YR Costs	25-YR Costs	50-YR Costs	∞ Horizon
Adams	$113,695,942	$178,865,363	$282,079,484	$329,945,030	$340,756,159
Ashland	$82,047,310	$129,076,038	$203,559,268	$238,100,864	$245,902,585
Barron	$235,812,392	$370,977,787	$585,050,237	$684,326,329	$706,749,277
Bayfield	$80,382,876	$126,457,566	$199,429,809	$233,270,685	$240,914,138
Brown	$1,182,941,211	$1,860,991,733	$2,934,875,600	$3,432,889,210	$3,545,372,821
Buffalo	$70,345,927	$110,667,535	$174,528,152	$204,143,511	$210,832,571
Burnett	$85,898,448	$135,134,613	$213,113,938	$249,276,848	$257,444,767
Calumet	$216,403,489	$340,443,887	$536,896,773	$628,001,793	$648,579,185
Chippewa	$304,981,856	$479,794,522	$756,659,587	$885,055,752	$914,055,892
Clark	$158,620,057	$249,539,548	$393,536,155	$460,314,577	$475,397,454
Columbia	$277,791,694	$437,019,220	$689,200,830	$806,150,043	$832,564,722
Crawford	$86,087,645	$135,432,255	$213,583,336	$249,825,897	$258,011,806
Dane	$2,374,466,320	$3,735,487,571	$5,891,047,839	$6,890,688,846	$7,116,472,294
Dodge	$448,289,759	$705,245,136	$1,112,206,307	$1,300,934,537	$1,343,561,550
Door	$153,402,428	$241,331,224	$380,591,223	$445,173,043	$459,759,786
Douglas	$221,150,691	$347,912,140	$548,674,576	$641,778,150	$662,806,945
Dunn	$218,225,626	$343,310,455	$541,417,493	$633,289,626	$654,040,282
Eau Claire	$492,218,234	$774,352,990	$1,221,192,795	$1,428,414,741	$1,475,218,829
Florence	$26,886,517	$42,297,610	$66,705,414	$78,024,532	$80,581,119
Fond Du Lac	$501,001,462	$788,170,681	$1,242,983,974	$1,453,903,624	$1,501,542,892
Forest	$50,888,755	$80,057,700	$126,254,935	$147,678,901	$152,517,815
Grant	$255,196,401	$401,472,524	$633,141,938	$740,578,622	$764,844,759
Green	$177,844,471	$279,783,211	$441,231,901	$516,103,725	$533,014,615
Green Lake	$96,385,627	$151,632,942	$239,132,616	$279,710,587	$288,875,711
Iowa	$116,787,713	$183,729,306	$289,750,162	$338,917,331	$350,022,451
Iron	$36,707,289	$57,747,554	$91,070,736	$106,524,360	$110,014,786
Jackson	$100,444,477	$158,018,284	$249,202,615	$291,489,346	$301,040,419
Jefferson	$399,776,426	$628,924,427	$991,844,791	$1,160,149,098	$1,198,163,071
Juneau	$136,590,060	$214,882,169	$338,879,761	$396,383,641	$409,371,728
Kenosha	$773,209,608	$1,216,405,917	$1,918,332,027	$2,243,850,240	$2,317,373,258
Kewaunee	$104,763,227	$164,812,501	$259,917,429	$304,022,337	$313,984,071
La Crosse	$562,281,304	$884,575,537	$1,395,019,180	$1,631,737,403	$1,685,203,654
Lafayette	$79,368,339	$124,861,508	$196,912,746	$230,326,505	$237,873,488
Langlade	$106,972,811	$168,288,597	$265,399,404	$310,434,538	$320,606,378
Lincoln	$153,099,114	$240,854,053	$379,838,702	$444,292,828	$458,850,729
Manitowoc	$416,355,775	$655,006,900	$1,032,978,135	$1,208,262,284	$1,247,852,756
Marathon	$663,829,407	$1,044,330,037	$1,646,959,891	$1,926,429,468	$1,989,551,733
Marinette	$215,072,332	$338,349,724	$533,594,175	$624,138,783	$644,589,599
Marquette	$78,012,197	$122,728,037	$193,548,158	$226,390,987	$233,809,017
Menominee	$23,711,721	$37,303,051	$58,828,748	$68,811,289	$71,065,991
Milwaukee	$4,440,865,725	$6,986,327,236	$11,017,782,065	$12,887,369,116	$13,309,642,520
Monroe	$209,328,311	$329,313,285	$519,343,267	$607,469,665	$627,374,292
Oconto	$193,862,712	$304,982,954	$480,973,136	$562,588,577	$581,022,611
Oneida	$196,968,075	$309,868,280	$488,677,536	$571,600,322	$590,329,639
Outagamie	$837,164,814	$1,317,019,631	$2,077,004,810	$2,429,447,913	$2,509,052,309
Ozaukee	$427,918,459	$673,197,202	$1,061,665,137	$1,241,817,129	$1,282,507,075

Pepin	$37,932,203	$59,674,577	$94,109,747	$110,079,056	$113,685,956
Pierce	$201,665,489	$317,258,207	$500,331,815	$585,232,195	$604,408,179
Polk	$224,923,567	$353,847,592	$558,035,077	$652,727,017	$674,114,567
Portage	$351,612,028	$553,152,660	$872,348,982	$1,020,376,267	$1,053,810,380
Price	$79,726,817	$125,425,461	$197,802,128	$231,366,805	$238,947,875
Racine	$941,463,581	$1,481,101,449	$2,335,769,915	$2,732,122,390	$2,821,644,356
Richland	$91,026,442	$143,201,923	$225,836,483	$264,158,258	$272,813,788
Rock	$775,001,272	$1,219,224,545	$1,922,777,143	$2,249,049,638	$2,322,743,023
Rusk	$76,775,083	$120,781,821	$190,478,880	$222,800,888	$230,101,284
St. Croix	$386,038,519	$607,312,084	$957,761,061	$1,120,281,763	$1,156,989,426
Sauk	$295,489,374	$464,861,040	$733,108,751	$857,508,618	$885,606,136
Sawyer	$88,245,365	$138,826,760	$218,936,636	$256,087,589	$264,478,672
Shawano	$208,065,762	$327,327,056	$516,210,885	$603,805,755	$623,590,329
Sheboygan	$573,691,832	$902,526,472	$1,423,328,687	$1,664,850,698	$1,719,401,954
Taylor	$97,553,272	$153,469,868	$242,029,540	$283,099,084	$292,375,238
Trempealeau	$138,421,567	$217,763,477	$343,423,726	$401,698,663	$414,860,904
Vernon	$141,290,764	$222,277,271	$350,542,202	$410,025,060	$423,460,128
Vilas	$118,756,664	$186,826,842	$294,635,129	$344,631,218	$355,923,562
Walworth	$503,538,295	$792,161,602	$1,249,277,853	$1,461,265,501	$1,509,145,991
Washburn	$88,353,071	$138,996,202	$219,203,855	$256,400,151	$264,801,475
Washington	$635,326,357	$999,489,312	$1,576,243,861	$1,843,713,766	$1,904,125,730
Waukesha	$1,875,005,010	$2,949,739,844	$4,651,884,981	$5,441,254,736	$5,619,545,366
Waupaca	$264,994,243	$416,886,393	$657,450,370	$769,011,907	$794,209,701
Waushara	$128,607,191	$202,323,595	$319,074,272	$373,217,395	$385,446,406
Winnebago	$822,772,154	$1,294,377,237	$2,041,296,638	$2,387,680,488	$2,465,916,314
Wood	$377,902,026	$594,511,832	$937,574,433	$1,096,669,704	$1,132,603,682