Exploring Uninsured Options under Budget Constraint

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ABSTRACT

The nation's compounding financial instability has constrained the budgets of middle-low-income populations, which has in turn promoted an exponential increase in the number of medically uninsured individuals. Since the Affordable Care Act (2010) was enacted, the nominal healthcare coverage available in the exchange marketplace has still been costly for circa 36 million uninsured Americans who daily struggle to meet their basic needs. This situation reflects a fragmented healthcare system that fails to comprehend its consumers' socioeconomic and racial inequalities. Public and private entities have individually attempted to address such disarray, but a truly collaborative effort to improve the nation's health status has yet to be realized. This paper details how system dynamics can break through the uninsured status quo of racial minorities in the United States. By infusing R. Chisholm's theory of knowledge and V.R. Fuchs' social determinants of health into M. Grossman's model of health and production possibilities frontiers (PPF), we, as nation, will reduce the prevalence of four major comorbidities--infant mortality, postpartum hemorrhage, malignant cancer, and diabetes--while simultaneously decreasing unscheduled absenteeism rates in the workplace. Essentially, this model integrates system dynamics into a parametric approach to create a collaborative environment amongst consumers, healthcare practitioners, and third-party payers. Although the findings show a potential savings of approximately US$16,000 per consumer per year, the application of this technique faces a few challenges due to discord between the healthcare industry segments, third-party payers, and underserved racial communities. Finally, I propose that healthcare stakeholders implement "itinerant patient-centered clinics," a form of affordable care accessible to diverse minorities nationwide.

Keywords – fragmented healthcare system, production possibility frontier, social determinants of health, theory of knowledge, and itinerant patient-centered clinics

I. INTRODUCTION

Consecutive financial crises in the United States have prevented millions of American citizens from fully participating in the economic mainstream of society. The Great Recession of

2007 accelerated this process by depleting the savings of millions to the point that poverty status has become irreversible to one-third of the nation. As pinpointed by Wolff (2010), indebtedness skyrocketed among the middle-to-low income classes after the last recession. The debt-to-ratio income surpassed 36% for young and middle-aged households. Currently, the top wealthiest 1% owns 42.7% of the nation's wealth, and the following 19% share 50.3%. At the bottom of the social ladder, 80% partage only 7% (pg.15-18).[1] This population lacks access to banking services (106 million underbanked), health care coverage (~36 million uninsured), education (46.2 million illiterate), and employment (93.2 million unemployed/partially employed), and hence they are unable to afford their minimal needs—food, housing, health care, and safety consistently (FDIC, 2011; BLS, 2014; WSJ, 2015,2016: KFF,2016).[2] As a result, 21% of all Americans under age 18 and 38% of adults, including seniors, are living below the poverty threshold line without any form of health care (HHS, 2011; SAHIE,2013).[3] They are labeled "*medical uninsured*" because do not qualify for any welfare assistance due to categorical criteria and yet are ineligible for Medicaid or Medicare benefits (Segen, 2012).[4] Without further alternatives, the *medical uninsured populations* have been utilizing hospitals (emergency-rooms) for non-emergency healthcare to address their primary care routines (CDC, 2011; GAO,2014).[5] Based on the 2011-National Hospital Ambulatory Medical Care Survey, the number of outpatients for general medicine reached 125.7 million, the equivalent of 3 points above the previous indexes (19.5%) due to budget constraint (CDC,2011; AHA, 2014).[6] For the medically uninsured populations, this status quo has promoted material deprivation, social exclusion, poor health outcomes, and ultimately death (Murali & Oyebode,2004; O'Campo et al., 2015).[7]

The endless fragmentation of the US healthcare system not only put at risk millions of American lives, it also has compromised the economic stability of the country by significantly impacting the labor productivity and supply, consumption of goods, and capital formation

[1] Wolff, E. (2010). *Recent trends in household wealth in the United States: Rising debt and the middle-class squeeze* – an Update of 2007. Levy & Economics Institute of Bard College. Work Paper 589.

[2] Federal Deposit Insurance Corporation (2011). The 2011 National survey of bank's effort to serve unbaked and underbanked. Reports 2011 and 2013.
US Bureau of labor and Statistics (2014). Unemployment rates for state database.
Wall Street Journal (2015,2016). US unemployment maybe 42. % by Louis Jacobson and What the unemployment rates show by Jo Mcginty.
The Henry Kaiser Family Foundation (2016). New estimates of eligibility for ACA coverage among uninsured by Garfield, R et al.

[3] US Department of Health and Human Services (2015) National health interview survey early estimates.
US Department of Commerce Economic and Statistics Administration. Real GDP by States and Indicators

[4] Segen, J.C. (2012). The concise dictionary for modern medicine. The Parthenon Publishing Group

[5] US General Accountability Office (2014). Health care transparency: Actions needed to improve cost and quality information for consumers. GAO-15-11.
Center for Diseases Control and Control (2011). National Hospital Ambulatory Medical Care Survey: Outpatient Department Summary

[6] American Hospital Association (2015). Rethinking the Hospital Readmission Program. Pg. 1-8

[7] Murali & Oyebode (2004). Poverty, Social Inequalities & Mental Health pg. 216-224
O'Campo, P at al. (2015). Social Welfare Matters: When, How, &Why unemployment insurance impacts poverty and health conditions.

(Shurcke et al 2006).[8] Last year, unscheduled absenteeism due to medical conditions cost $320 billion to the US corporations, corresponding to in average to the amount of $3,200 per employee per year or 10% of the total healthcare expenditure (Gellatly,1995; Circadian, 2015).[9] As underlined Adam Smith (1776), "the loss of productivity reflects the weakness in the productive powers of labor, and hence a disturbance among the different ranks and conditions of people in society (Wealth of the Nations).[10]

For those who are still part of the economic mainstream (i.e. insured and underinsured), life has become harrowing. They live from paycheck to paycheck, carrying an average of $75,600 in debt predominantly resulting from medical bills. According to the Bureau of Labor and Statistics Report (2014), only 32.48% of all employed Americans are currently covered by employer-provided health insurance.[11] However, their coverage still requires additional high deductibles, co-payments, and out-of-pocket fees that range between $5,000 and $10,000 for preventive physical check-ups.[12] Over the past years, unpaid medical bills have been the leading cause of filing for bankruptcy protection in the United States. Studies focusing on medical-related-bankruptcy emerged in 2005, when Health Affairs published the *Illness & Injury as Contributors for Bankruptcy*, a study conducted by Himmelstein et.al. They investigated 1171 personal bankruptcy files in five civil courts. At that time, the statistical analysis indicated that between 1.9- 2.2 million Americans filed bankruptcy due to medical-related-bills, including a percentage of middle class insured people (pg.65-67).[13] The topic sparked the interest of other scholars surfacing new studies because bankruptcy was adding more distress to the ill individuals and their families, and hence compromising the recovery process (Himmelstein et. al.; 2009; Emami, 2010; Kalousova & Burgard, 2013; NerdWallet, 2013, 2014; Wall Street Journal, 2015).[14] Outside of bankruptcy, about 56 million adults between the ages of 19-64 continue to struggle with health-care-related bills, and in the upcoming years, another 10 million

[8] Suhrcke et al (2006). Chronic Disease: An economic perspective. London, Oxford Health Alliance.

[9] Gellatly, I.R. (2006). Individual and group determinants of employee absenteeism: Test of a causal model DOI: 10.1002/job.4030160507

Circadian Information Limited Partnership LLC (2015). Absenteeism: The bottom-line killer (pg.3-5)

[10] Smith, A (1776) An Inquiry into the Nature and Causes of the Wealth of Nations.

[11] Bureau of Labor and Statistics (2014) Report of National and local health insurance coverage

[12] Kellerman, A.L. (2011). A decade of healthcare cost growth has wiped out real income gains for an average US Family Health Affairs

[13] Himmelstein, D., Thorne, D., Warren, E., & Woolhandler, S. (2005) Illness and injury as contributors to bankruptcy. Health Affairs. Vol 30

[14] Hammerstein et al. (2009)). "Medical bankruptcy in the United States, 2007: Results of a National Study". The American Journal of Medicine 122 (8): 741–746

Emami, S. (2010). Consumer over-indebtedness and health care costs: How to approach the question from a global perspective. *World Health Report (2010) Background Paper, 3*.

Kalousova, L. & Burgard, S.A. (2013). "Debt and foregone medical care. Journal of Health and Social Behaviour 54 (2): 204–20

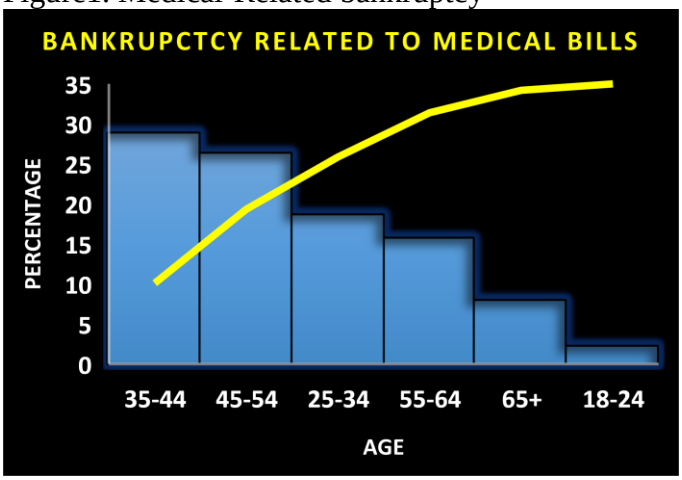
Mangan, D. (2013). Medical bills are the biggest cause of US bankruptcies: study. CNBC of March 2013.

Lamontagne C. (2014). Medical bankruptcy accounts for majority of personal bankruptcies. NerdWallet

Stech Katy (2015) The future of personal bankruptcy in a post-Obamacare world. Published by Wall Street Journal on July1st., 2015.

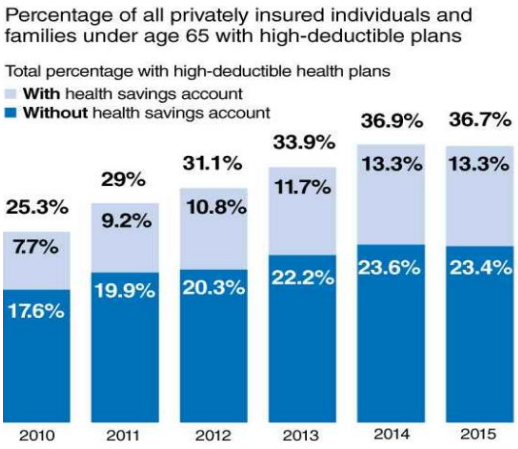
will be accumulating medical bills they cannot pay off, (NerdWallet, 2013,2014)[10] as illustrated in figures 1 and 2.

Figure1. Medical-Related bankruptcy



Note. Adopted from NerdWealth. Retrieved from www.nerdwelath.com

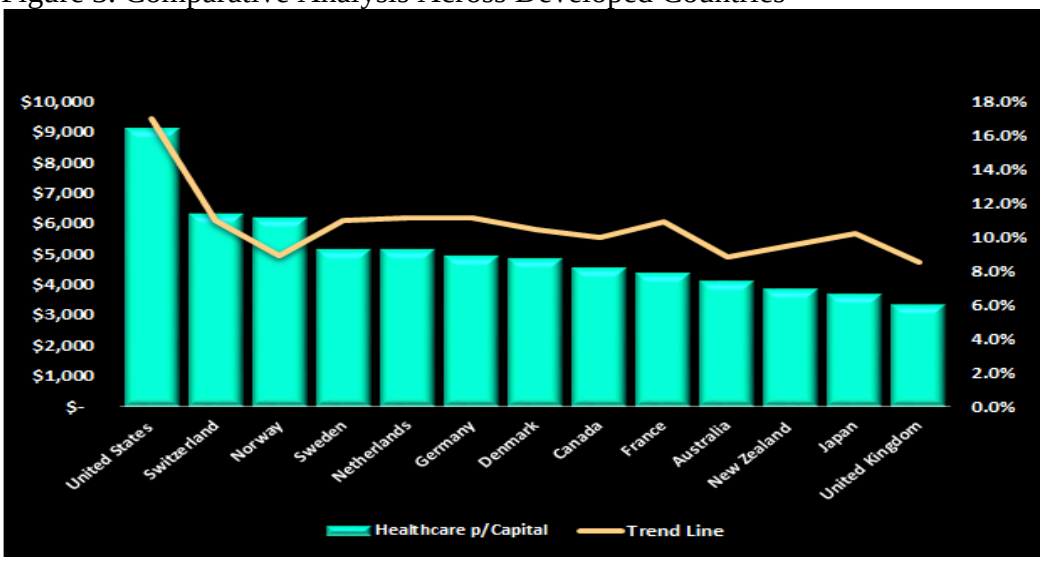
Figure2. High-Deductible plans



Note. Adopted from HHS. Retrieved from www.cnbc.com

The American healthcare system is one of the most expensive in the world at $3.4 trillion in federal spending for 2015, but is not the best delivery system for its costs (US Census, 2015) as shown in figure 3. In the 2014 Organization for Economic Cooperation and Development (OECD) Report issued by OECD on 43 countries, the United States received the following rankings: first in obesity (above 13.2%), in consumption of pharmaceuticals (above $ 502.00 per person), and in infant mortality amongst wealthy nations (6:1 death per 1,000 live births), 17th in morality from cardiovascular diseases (below 35.2 per 100,000 pop), 25th in cancer mortality (below 25.4 per 10,000 pop.), 28th in doctors per capita (0.7 doctors per 1,000 pop in cities), and 25th in hospital beds (below 1.4 beds per 1,000 pop.).

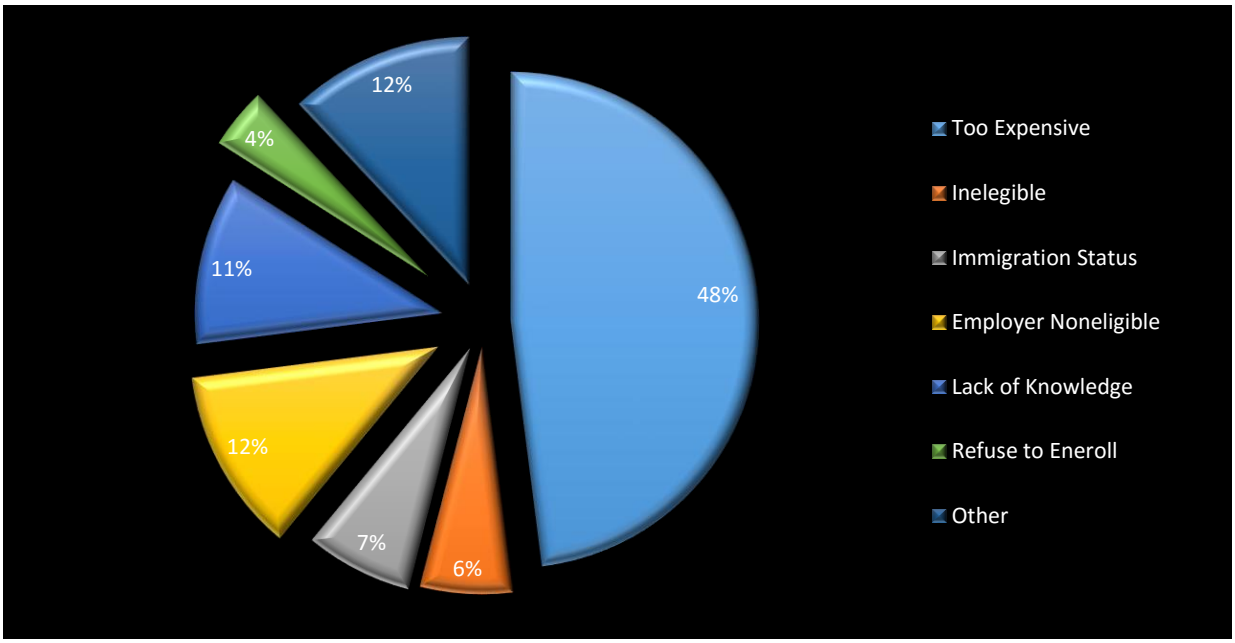
Figure 3. Comparative Analysis Across Developed Countries



Note. Adopted from the Organization for Economic Co-operation & Development. Retrieved from http://stats.oecd.org/index.aspx

Economists attribute the cost of the US healthcare delivery system to the principles of the free market, solidly rooted in supply and demand. However, this system is carved by features and characteristics of an oligopolistic structure that dictates market share (usually controlled by the largest players), pricing behavior (kinked demand curve), and strategic interaction between rivals (game theory).[15] With a few firms controlling the prices of products, services, and supplies, access to care has become unfeasible for low-income racial minorities, who earn the standard minimum wage between $6.50 and $7.25 per hour (BLS, 2015).[16] In other words, household income, e.g. salaries, wages, retirement income, and cash social benefits, limit the consumption options of goods. A budget constraint forces consumers to make choices suitable to their monetary resources towards optimal utility (a benefit in return of consuming a product or services) as shown on figure 4.[17] Under the standard of macroeconomic assumptions, consumption delivers utility through a utility function.[18] For example, if Maria consumes a quantity X of vitamins in a given period, we can infer she receives Y units of health utility. In regards to the consumption of healthcare insurance, uninsured populations do not appraise the optimal tradeoffs between price and utility due to budget constraint.[19]

Figure 4 – Key factors of Uninsured Population in the United States



Sources – Adapted from The Henry J. Kaiser Foundation. Retrieved on3.20.2016 from www. http://kff.org/uninsured/fact-shee

[15] Hirschman, A. O. (1964). "The paternity of an index". The American Economic Review (American Economic Association) 54 (5): 761. JSTOR 1818582.

[16] US Bureau of Labour and Statistics. Wage and Hour Division /www.dol.gov/featured/minimum-wage

[17] Lipsey, R. G. (1975). *An introduction to positive economics*. Weidenfeld & Nicolson. pp. 214–7

[18] Neumann-Morgenstern theorem proved that any individual expected maximize the value of an investment based on a real-valued function. A decision utility describes the rational behaviour of a decision maker.

[19] Web Finance, Inc (2016) A technique of reducing or forgoing one or more desirable outcomes in exchange for increasing or obtaining other desirable outcomes in order to maximize the total return or effectiveness under given circumstances.

To control healthcare expenditures and address the major gaps of a fragmented healthcare delivery system, the United States government passed the Patient Protection and Affordable Care Act in 2010 (PPACA- Public Law 111–148), targeting primarily uninsured populations to reduce the largest expenditure – hospitalizations.[20]

With the enactment of the PPACA, the key private and public stakeholders assumed that the U.S. impoverished populations would be able to shoulder the financial burden of expensive coverage premiums derivable from the healthcare marketplace exchange. They expected that healthy American uninsured populations would immediately enroll and therefore generate enough funds to subsidize the unhealthy pool. But the leadership team did not take into account the exorbitant increases and variations of medical care costs, premiums, out-of-pocket spending, and families' existing medical debts. Besides, public leaders ignored the statistical analysis reported by the National Research Council (NRC,1995) suggesting a new Supplemental Poverty Measure (SPM): an inflation adjustor manual based on families' real expenditures, including food, shelter, utilities, clothing, transportation, and others. By rejecting, the NRC recommendations of a new poverty adjustor coefficient, the US government vetoed 10 million eligible Medicare and Medicaid applicants from receiving early-onset medical care.[21] These strategies neither de-escalated the cost of healthcare nor contributed to reduce the comorbid conditions of the applicants. In fact, they worked in quite the opposite manner. Hospitalization rates grew exponentially, whereas the expenditures of Medicare and Medicaid skyrocketed in such way that lawmakers redefined the section 1886(q) of the Social Security Act into a Hospital Readmission Reduction Program (HRRP), and subsequently into the section 3025 of PPACA aiming to bring the costs of hospitalization down from the current $920 billion (CMS, 2010).[22]

In October of 2012, the Centers for Medicare and Medicaid Services (CMS) implemented HRRP forecasting a savings of approximately $428 billion by decreasing acute myocardial infraction, (AMI), heart failure (HF), and pneumonia (PN) hospital readmissions. However, the implementation of HRRP has been an ongoing undertaking with each sector of the hospital industry having its own goals, responsibilities, and competencies. The challenge started with hospitals facing dichotomies between the two distinct policies, ACA and Title 42 of The Public Health and Welfare, and has extended to the unfair monetary penalties charged to all hospitals that exceeded the standardized readmission rates.[23] Although the reduction of preventable hospitalizations is an essential piece of cost-control, its practice cannot inhibit patients' clinical treatment and safety. In the case of HRRP, the symbiosis between quality of care and cost control have not yet happened based on national healthcare public reports.

The inaccuracy of standardized metrics and risk adjustment rates neither included the utilization rates of dual-eligible (Medicare/VA, Medicare/ Medicaid) recipients nor the demographic characteristics of the of the regions (Arbaje et al., 2008; Krumholz et al., 2012:

[20] PPACA-Affordable Care Act. (2010). 42 CFR part §412.150 through §412.154
[21] National Research Council (1995). Supplemental Poverty Measure (SPM)
[22] Affordable Care Act (2010). Section 3025 Hospital Readmission Reduction Program (HHRP)
Cost of hospitalization in 2014 was estimated in $920 billion.
[23] Title 42 of The Public Health and Welfare, Chapter 7-Social Security (US Congress, 2011

AHA 2014).[24] Under those circumstances, 150,000 hospitals were unfairly penalized with unbearable fines for exceeding the CMS readmission rates. To put it in another perspective, the implementation of HRRP, rather than improving quality of care and managing costs, has contributed to the shutdown of hundreds of hospitals nationwide.[25]According to a new survey, conducted by two nonprofit organizations, circa 57 inner-city hospitals have closed over the past three years, and 283 are in danger of ending their operations due to financial deficits aggravated by CMS penalties. In the inner-cities of Alabama, Arizona, Idaho, Illinois, Louisiana, Mississippi, New Mexico, North Dakota, Tennessee, Texas, and West Virginia, the closure of hospitals represent a calamity for patients who have to commute over 40 miles radius to access care.[26] These closures have significantly raised the infant mortality ratio up to 3.2 points above the national average (6:1 per 1,000 lives birth) along with postpartum hemorrhage (140,000 deaths per year), and the adult mortality for non-communicable diseases (i.e. heart disease, cancer and lung disease) has reached 1.5 times higher than the national average of 169 deaths per 100,000[27] (See Appendix A).

When all the inconsistencies of the healthcare delivery system became more visible to consumers, the utility function of health care lost its reliability and intrinsic purpose – maintaining and improving the state of complete physical, mental, and social well-being[28] At the present time, uninsured Americans no longer believe their monetary investments in healthcare insurance produce tangible and intangible benefits in an equitable manner. The lack of immediate return on the investment (ROI) has altered consumers' perception of the tradeoff, leading them to postpone the acquisition of healthcare coverage. They are more likely to invest in products and services that provide immediate health benefits today rather than buy protection for an uncertain sick times in the future.

In response to the administrative disarray, this study suggests an interactive social healthcare model as a paradigm shift of the existing oligopolistic healthcare structure rooted exclusively in pricing strategy (i.e. inelastic price). I argue that it is time to meet the consumers in locus in quo instead they meet the providers in institutional healthcare settings, which are impersonal, risky, and costly to maintain. Through *itinerant patient-centered clinics*, healthcare practitioners can focus on consumers' health conditions, safety, timeliness, effectiveness, efficiency, and equity[29]. Another way to enact this concept is by "*decentralizing healthcare services*" in small cells (e.g. vans, busses, trucks) to promote a positive multiplier effect in the

[24] Arbaje et al. (2008). Post-discharge environmental and socioeconomic factors and the likelihood of early hospital readmission among community-dwelling beneficiaries.

[25] Canters for Medicare and Medicaid Services (2012) Hospital Readmission Reduction Program

[26] Becker's Hospital CFO (2015). A state-by-state breakdown of 57 hospitals closures. Retrieved from http://www.beckershospitalreview.com/finance/ on 3/20/16.

[27] See Appendix A – Rates of infant mortality in states with high prevalence of racial minorities are also those with high number of inner-cities hospitals closed. These populations have no primary care for medical routine.

[28] World Health Organization – definition of health

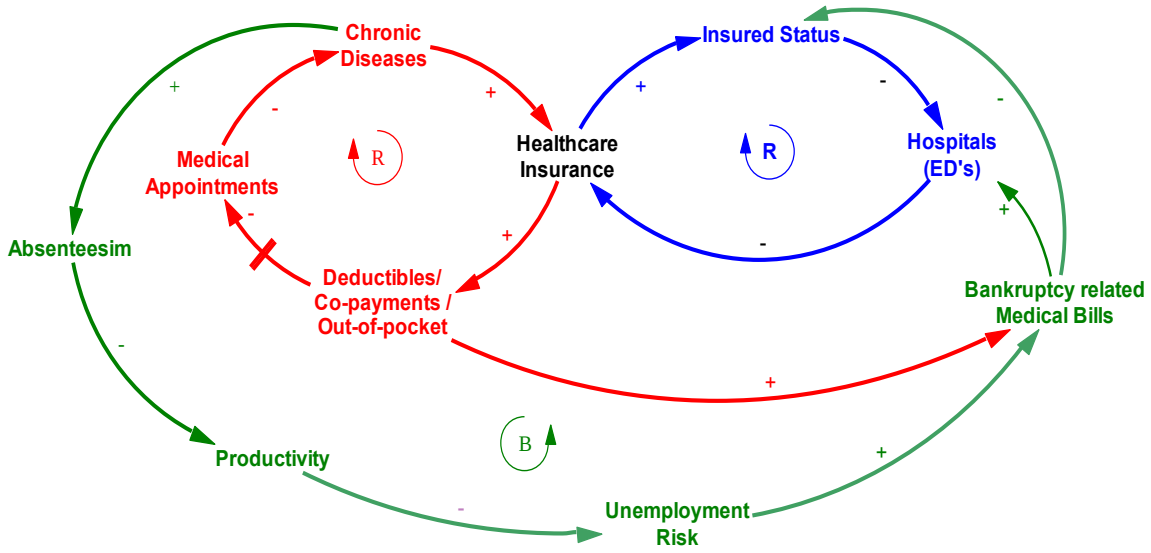
[29] Equity in this context means quality of care tailor to consumers' cultural background and other personal characteristics that directly impact their physical, mental and social health status.

domestic economy. Financially, itinerant patient-centered clinics will instantaneously reduce the preventable hospitalizations, whereas minimize the number of bankruptcies due to medical bills. In addition, it will decrease the number of unscheduled absenteeism in workplaces. Medically, these services will decrease the national prevalence of infant mortality, postpartum hemorrhage, asthma, diabetes, cancer, and cellulitis before they reach epidemic levels. At same time, through cost-effective preventive care, these major chronic diseases will be address in early-onset stage, decreasing the cost of late-onset treatments. Finally, this model, will contribute to lessen the adverse social association of income inequality and good health care.

Research Question – What medical options are available to insured populations under budget constraint?

To answer this question, the investigator applied a multidisciplinary approach by combining philosophical (pre-analytical "*aporia*"), along with parametric (utility function), and non-parametric (socio-ecological) methods, and system dynamic simulations (nonlinear).[30] The process starts with a causal loop diagram (CLD) showing the relationships between uninsured status, chronic diseases, productivity, bankruptcy and utilization of ED's illustrated on figure 5

Figure 5. Causal Loop Diagram of Health Status & Medical Bills



Author- Nella M Porter, MSW, MHA – March 2016.

[30] Chisholm (theory of knowledge), Grossman (production possibility frontier), Fuchs (socioecological framework), and Sterman (system dynamics).

The philosophical approach employs Chisholm's (1989) theory of knowledge, which explains consumers' mindsets through the concept of "*greater reasonability*." Chisholm suggested a link between directly evident knowledge and indirectly evident beliefs about the external world, the past, and other matters about which we gain knowledge (pg. 10-13).[31] In a few words, knowledge is an association of perception, memory, evidence, and belief with positive and/or negative coherence of conditions and sources that can be found justifiable. For instance, let's admit that health insurance prices are equitable, and Mary is processing the external world framed by her socioeconomic identities, as follows:

Mary believes in healthcare coverage
Mary justifies it
Mary accepts healthcare coverage price
Mary has adequate evidence to prove it
Then, health coverage price is true for Mary

In contrast,

Paul believes that healthcare coverage is costly
Paul has adequate evidences based on his own past experiences
Paul is sure this is true
Then, Paul reasonably believes health coverage is costly

Applying Chisholm's *aporia* to uninsured populations, we can infer that they have established their own *greater reasonability* about health insurance based on past experiences and beliefs, and hence they have resisted enrolling in coverage due to knowledge and budget constraint (45-47).[32] But Chisholm also argued that reasoning is elastic and can be reshaped or transformed by new events (pp. 50-53). Given these points, we can speculate that uninsured people's own *greater reasonability* is changeable if healthcare leaders are willing to deliver new prices and conditions for their goods (i.e. if elastic knowledge equals elastic price and terms). As a society, we have seen a few isolated attempts of public and private entities to move towards an inclusive healthcare system. But all insurance and healthcare providers have neglected and to some extent penalized disabled-bodies by denying suitable coverage. They have charged higher prices for their pre-existing medical conditions, or providing inadequate treatments for such conditions.[33]

To reconcile such disarray, I am proposing to infuse Grossman's (1972) model into the people's own *greater reasonability*, while healthcare leaders adjust the price and terms of the current healthcare premiums.[34] This collaborative effort can bring a positive multiplier effect on

[31] Chisholm (1989). Theory of Knowledge
[32] Socrates aporia and wisdom of emptiness reflect by Chisholm means impasse, puzzlement
[33] Medical pre-existing condition is defined as any injury, illness, sickness, diseases or other physical, medical, mental or nervous conditions
[34] Grossman, M (1972). On the concept of health capital and demand for health. *Journal of Political Economy, 80*(2), 223-55

comorbidities, costs and labor productivity and supply. Grossman defined an individual's utility as a function of the time spent with health (***H_t)*** and everything else ***(Z_t):***

$$U_t = U\,(H_t, Z_t)$$

Unpacking Grossman's equation, (***Ut***) utilization of time is a constant variable of 24 hours that determines the health status upon its distribution across lifespan. For example, knowledgeable individuals (I_1) invest 1 hour daily exercising to reduce the risk of cardiovascular disease, whereas individuals without such knowledge (I_2) spend the same time sitting on the couch eating. The lack of health related knowledge for I_2 leads to poor utilization of time along with detrimental consumption of the existing health capital, which consequently accelerates the decline of their total health status. This decline exacerbates rapidly when individuals are unable to determine their own health status, what I shall term "knowledge constraint." Along with the desirable tradeoffs between **H** and ***Z***, there are other factors, time and budget constraint, that obstruct the individuals' ability to gain total utility (***U_t***). Operating independently or dependently of each other, these variables impact the production of ***H*** and ***Z*** during individuals' lifetime. Grossman coined such a limit the "production possibility frontier" (PPF) for ***H*** and ***Z,*** which focuses on the tradeoffs of time working, enjoyment, health improvement, and time sick. In other words, one's health status is framed by knowledge, budget, and time constraints. It also can be ameliorated when we recycle knowledge through the following equation.

$$\Theta = 24 = T_W + T_Z + T_H + T_S$$

Where

T_W - time spent working,
T_Z - time spent enjoyment,
T_H - time spent improving health and
T_S - time spent sick

The value of disseminating this equation among diverse populations is to decrease ***Ts*** (time spent sick), which impacts time working, time of enjoyment, and time to re-establish a prior healthy status. In practical terms, the reduction of ***Ts*** has multiple positive socioeconomic outcomes such as (a) lowering of the unexpected absenteeism rates in workplace, (b) containing cost of healthcare expenditures, (c) decreasing of prevalence and incidence of chronic diseases in early life stage, and (d) increasing of ***U*** (***T_H, Tz, and Tw***) to be reinvested in ***T_H***.

Figure 6. PPF of +$55,000 (a full time job)

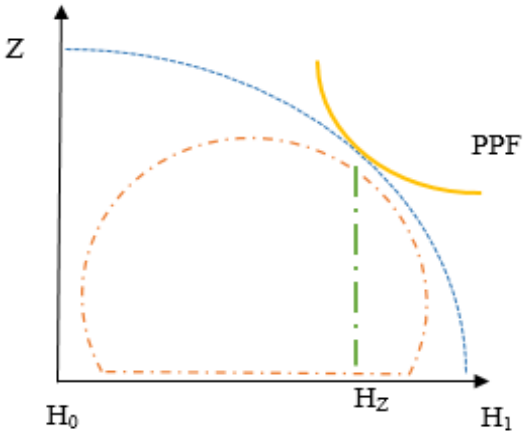
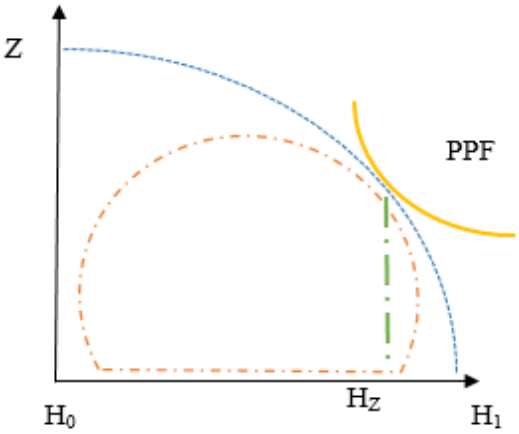


Figure 7. PPF of $36,000 (2 part time jobs)



or

Comparing the PPFs of two groups of individuals with different socioeconomic status (SES), we noticed that individuals with a full time job can invest up to 2 hours daily in health improvement,

$$\Theta = 24 = T_W + T_Z + T_H + T_S$$
$$10 + 12 + 2 + 0$$

whereas individuals with two part-time jobs have no time to left to invest in their health improvement because they consume approximately 73.2% of their total time in working (i.e.17.56 hours working). Over lifetime, this systematic utilization of time working ***(Tw***), leads to poor physical, mental, and social outcomes (***T_H),*** which consequently increases the proportion of time spent sick ***(Ts).***

$$\Theta = 24 = T_W + T_Z + T_H + T_S$$

Scenario 1	17 + 0 + 0 + 4	resulting in presenteeism
Scenario 2	0 + 0 + 0 + 24	resulting in absenteeism

Racial minorities invest highly in time working ***T_W*** but not in improving health T_H due to policies that promote budget constraint. This cycle starts with no implementation of PPACA – Part II, sections 1511-1515 – Employer Responsibilities, consequently employees cannot rely on employers to obtain affordable health coverage. Second, the Congressional Budget Office estimated that each employee costs +$5,800 per employee/per year, an unfeasible cost for small businesses. Third, employers are mandated to provide healthcare coverage when their personnel exceed 50 full-time employees. Four, tax incentives are still in debating in the US Congress, i.e. "Cadillac" plans. When all those factors come together, low-income racial populations are environmentally more exposed to multiple chronic diseases at young age and risky behaviors than Whites. Their recovery is longer, complex, and expensive because the diseases already

achieved late-onset. As a result, these populations struggle to make financial decisions about health care investing.

II. MODELING

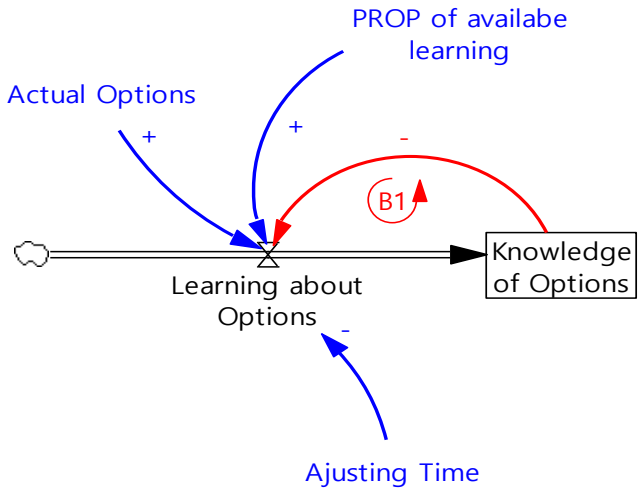
" If a man neglects education, he walks lame to the end of his life."
(Plato-428-348 BEC)

Knowledge is defined as a human capacity to interpret information acquired from experiences and education. Indeed, knowledge is an intellectual capital that continuously grows by extracting information and ideas from external environment. It is then cultivated, processed, shared, stored, and renovated into new knowledge over a period of time[35]. Knowledge is not static, but recyclable. The acquisition and use of knowledge empowers individuals, communities, and societies to changes their environments. To do this, individuals must realize that knowledge is available and that they must take the initiative to learn and apply it. But knowledge is monetized and just the elite can *access* it on their own. Racial minorities have often been excluded from the process due to budget constraint, since they are compacted in the 80% that share 7% of all available resources.

Health status like knowledge can be monetized in the market through investment options. One of the critical factors among uninsured populations is their limited stock of ***Knowledge Options*** due to budget constraint. This first section of the model has one stock Knowledge ***of Options*** and three variables as following: ***Actual Options*** is defined as the total of available options, whether they are accessible by the uninsured populations or not. ***Proportion of Available Learning*** is a fraction of all existing options that can be learned based on individuals' assets (capital, knowledge, and structure). ***Learning about Options*** correspond to the proportion of available options over a period of time, and ***Adjusting time*** is related to a duration of the process to learn about the options**.** Such mechanisms result in a ***balancing loop (B1)*** depicted in the figure 7. As uninsured individuals increase their ***Learning about Options***, they also increase the ***Knowledge of Options.*** As the ***Knowledge of Options*** increase the ***Learning about Options*** slow down and the growth of knowledge diminishes, balancing the accumulation of ***Knowledge of Options*** at a level where knowledge stops growing and knowledge does not lead to more change in options. The same principle applies to healthcare insurers and providers, practitioners, and payers.

[35] Merriam-Webster Dictionary – knowledge definition
Francis Bacon (1597). Meditationes Sacrae
Thomas Hobbes (1668).Opera Philosophica

Figure 7. Main Structure of Knowledge Options



Actual Options - 100

Units- Options

Proportion of Available Learning - 0.45* Assets/Assets

Units -Dmnl

Learning Options - Prop. of Available Options (Actual Options–Knowledge of Options)/ Adjusting Time

Units - Options/Year

Knowledge of Options – INTEG Learning about Options

Initial Value - 35

Units Options

Adjusting Time - 0.4

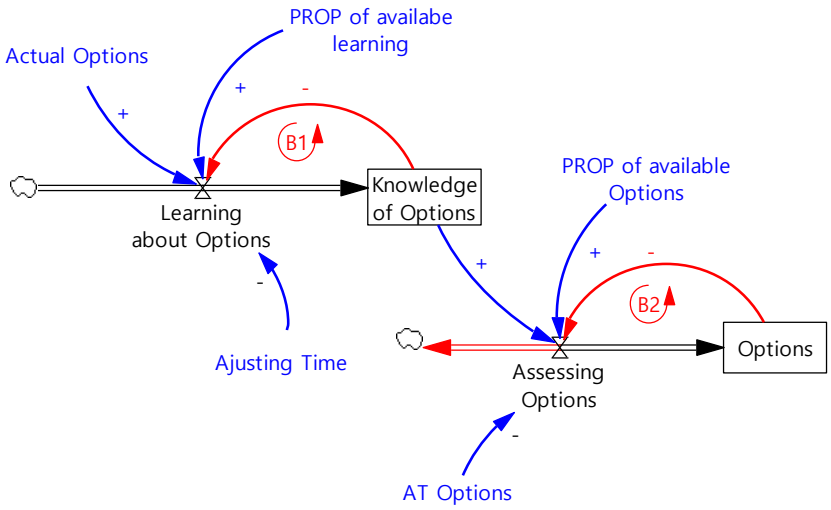
Units – Year

As the uninsured populations learn more about the different the options, their degree of knowledge also increases. This outcome is known from the ***Managing the Knowledge-Creating Context: A Strategic Time Approach***. Chong claimed that when knowledge increases the proportion of available options increases based on managing knowledge process successfully.[36] The framework for understanding and utilizing knowledge is embedded on the relationship between time and knowledge processes. As knowledge of options increase, the proportion of available options also increases, and subsequently, the number of options. After some time, uninsured become aware of the potential options, and hence they can increase the health capital by investing more frequently in prevention and maintenance of their own health to preserve the existing health status. Applying the same concept to healthcare leaders, the knowledge of

[36] Reinmoeller, P., Chong, C-L (2002). Managing the knowledge-creating context: A strategic time approach

uninsured budget constraint should promote more affordable products and services towards sustainable consumption of care

Figure 8 Main Structure for Assessing Options



Proportion of Available Options - 0.25* Assets/Assets

Units- Dmnl

Assessing Options - Prop of available Options*(Knowledge of Options-Options)/ AT Options

Units- Options/Year

Options- INTEG of Assessing Options

Initial Value – 20

Units - Options

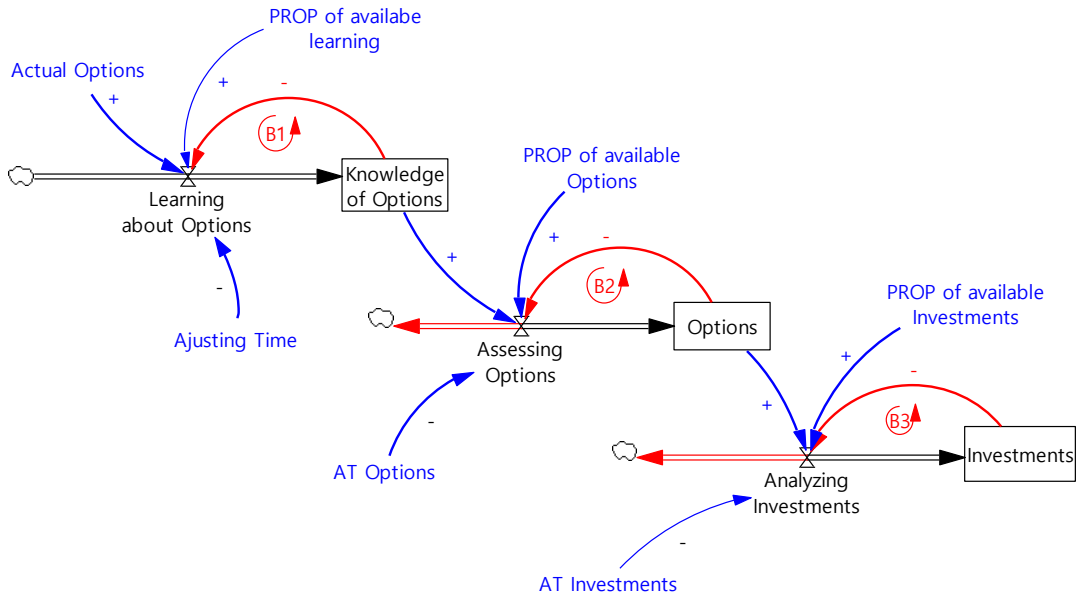
AT Options - 0.2

Units – Year

As occurred in the previous mechanism, this second section is also a ***balancing cycle (B2)*** that decreases the flow of ***Assessing options*** by the time employed **(AT**) to assess the ***Options.*** The cumulative effect of both ***AT (AT, and AT options***) extends the duration of the process and decreases the number of options available because some options expires within hours, others in weeks, and others in months. The inverse is also valid, less time spent in ***Assessing Options,*** increase the stock of ***Options*** available within certain time. ***Options*** is fluidic and volatile, needing a constant inflow and outflow of knowledge. For example, uninsured populations are mainly composed of low-income minorities with no professional qualification.

They earn the minimum wage ranging between $ 6,50 to $7.25 per hour without benefits[37]. These populations are ineligible for social benefits despite their financial struggles and needs. As a result, their earnings are utilized for survival. They cannot access knowledge of healthy behaviors due to budget constraint. However, healthcare leaders can increase their ***Options*** by disseminating health education & promotion on a regular basis. For instance, by promoting the idea of preventive investment in immunizations, screening, counselling, and other medical routines that are culturally tailor to consumers' lifestyle, we can decrease the prevalence of communicable diseases nationwide. These steps will produce immediate tangible health benefits for all stakeholders. The ROI in dollars can be measured through an increase in net monthly income, improved school attendance for children, decreased absenteeism for employers, and a substantial reduction in welfare expenses for the government to name a few.

Figure 9. Main Structure of Investments



Proportion of Available Investments - 0.1* Assets/Assets

Units-Dmnl

Analyzing Investments - Prop of available Investments*(Options-Investments)/ AT Investments

Units - Options/Year

Investments - INTEG of Analyzing Investments

Initial Value - 15

Units - Options

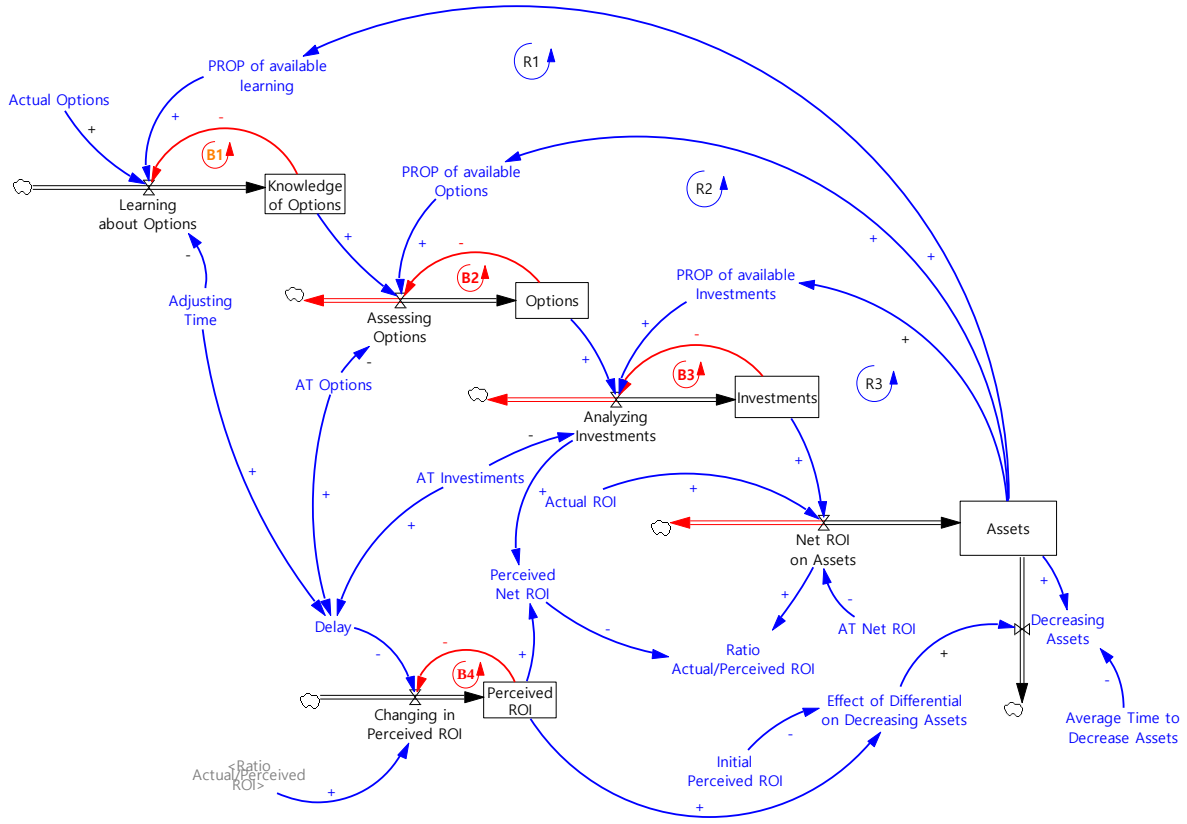
AT Investments – 0.05

[37] US Bureau of Labor & Statistics Minimum wage per state.

Units - Year

As depictured in figure 9, ***Investments*** results from a cumulative effect of ***AT (AT+ AT Options + AT Investments)*** on ***Analyzing Investments***. The effect of three delays reduce the volume of ***Investments*** considerably, and hence decrease the ability to generate new investments. For uninsured populations, this cumulative effect postpones the entire investment process by weeks, months, or eventually years, causing a drastic damage on their overall health status. The ***balancing cycle*** **(B3)** slows down the transit of ***Investments*** back in to the valve of ***Analyzing Options*** due to individuals' budget constraint. In addition, the inconsistent inflow of ***Options*** lessens their ability to maximize health (H_t) and assets (Z_t). Therefore, it is vital to maintain health programs constantly over the calendar year to reduce unhealthy pitfalls that depletes individuals' current health status. For example, eating a donut may contribute to Z_t, (immediate short-term gratification), but it also increases an individual's sugar levels in the blood, leading to diabetes ***Ts*** (posterior long-term pain). In other words, increasing the stock of ***Options*** increases the levels of ***Investments*** in healthy behaviors. In Grossman's model, this course of actions increase T_W, T_Z, T_H and a decrease T_S (times sick over time).

Figure 10 Main Structure of Assets and Knowledge of Options



Delay – Adjusting Time + AT Investments + AT Options
Units – Year
Changing in Perceiving ROI - (("Ratio Actual/Perceived ROI")-1) *Perceived ROI/Delay
Units – US Dollar/Year/Options
Perceived ROI - INTEG Changing in Perceived ROI
Initial Value - 1
Units – US Dollar/Options
Perceived Net ROI Analyzing Investments*Perceived ROI
Units – US Dollar/Year
Ratio Actual ROI/Perceived ROI - Net ROI on Assets/Perceived Net ROI
Units – Dmnl
NET ROI on Assets – Investments*Actual ROI/AT Net ROI
Units – US Dollar/Year
AT Net ROI - 0.3
Units – Year
Actual ROI - 1
Units – US Dollar/Year
Initial Perceived ROI - 1
Units – US Dollar/Year
Assets - INTEG Net ROI on Assets-Decreasing Assets
Initial Value – 5
Units – US Dollars
Effects of Differential Decreasing Assets - Perceived ROI/Initial Perceived ROI
([(0,0)- (1,1)],(0.0030581,0.0263158),(0.0856269,0.184211),(0.195719,0.280702),
(0.314985,0.473684),(0.440367,0.513158),(0.538226,0.557018),(0.574924,0.657895),
(0.70948,0.710526),(0.840979,0.833333))
Units - Dmnl
Decreasing Assets – Assets*Effect of Differential on Decreasing Assets/Average Time to Decrease Assets
Units - US Dollar/Year
Average Time to Decrease Assets - 1
Units – Year

This last section depictures a series of strategies used by consumers to maintain, change, and recycle **Assets** (i.e. preservation of a healthy status), aiming to maximize ***Net ROI on Assets.*** For healthcare consumers, it is paramount that the ***Net ROI on Assets*** exceeds the ***Actual and Perceived ROI,*** in order to preserve and improve physical, mental and social conditions. The three reinforce loops **R1, R2, and R3** linking ***Assets*** to ***PROPs of available Learning, Options, and Investments*** reflect the direct impact of Assets on each stage of the process of producing

health as defined by Grossman's utility function $U_t = U(H_t, Z_t)$[38]. For uninsured populations the three reinforce loops work negatively due to budget constraint. It means, the lack of ***Assets*** decreases their ***PROPs of available Learning, Options, and Investments,*** which reduces their abilities to produce H_t and Z_t across lifespan. The balancing cycle ***(B4) illustrates*** the time lag necessary for ***Changing in Perceived ROI*** to take place.

III. SIMULATIONS

The purpose of all simulations were to test the impact of ***Assets*** on increasing or decreasing the ***Knowledge of Options, Options, and Investments*** through a cascade effect. In the case of uninsured populations, the impact of increasing knowledge increases all four dimensions, ***Tw, Tz, T_H and Ts*** simultaneously.

Figure 11. Simulation Results for Perceived Net ROI

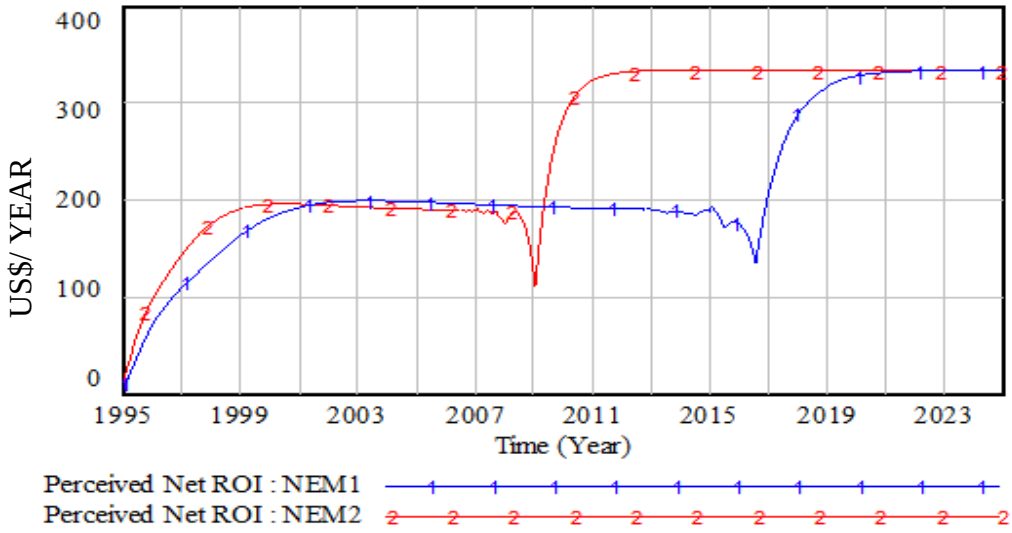


Figure 11 shows a potential gain of approximately $330.00 per individual/per year, starting in 2008. Computing this amount per citizen over a period of 8 years, it represents roughly an amount of $92.4 billion increment in ***Assets*** not gauging other financial oscillations during this period. This sum could be invested in preventive infant mortality or postpartum haemorrhage programs to save millions of American lives.

[38] Grossman, M (1972). Production Possibility Frontier of H_t (production of health) and Z_t (productions of everything else.

Figure 12. Simulation Results for Net ROI on Assets

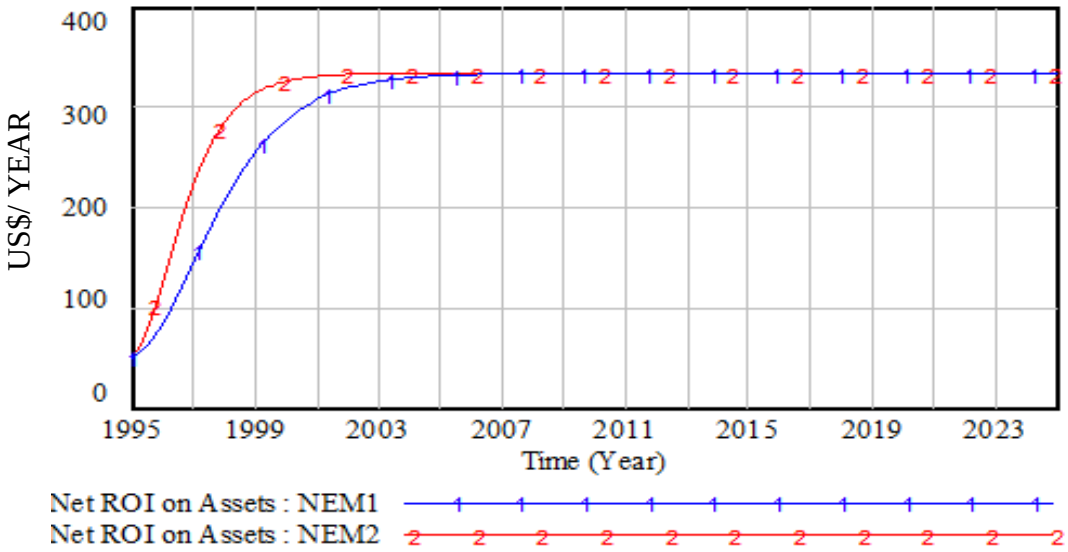


Figure 12 illustrates the loss in ROI between 1999 and 2003, which would have had significant impact on T_H, T_Z, and T_S. If Americans have started to invest in health in 1995, by 2001 they would have a considerable abetter health status, and increase ROI by US$ 330 yearly. The delay in promoting health behaviors as an asset has led the nation to absorb 17.9% of GDP in health expenditures.

Figure 13. Simulation Results for Ratio Actual/Perceived ROI

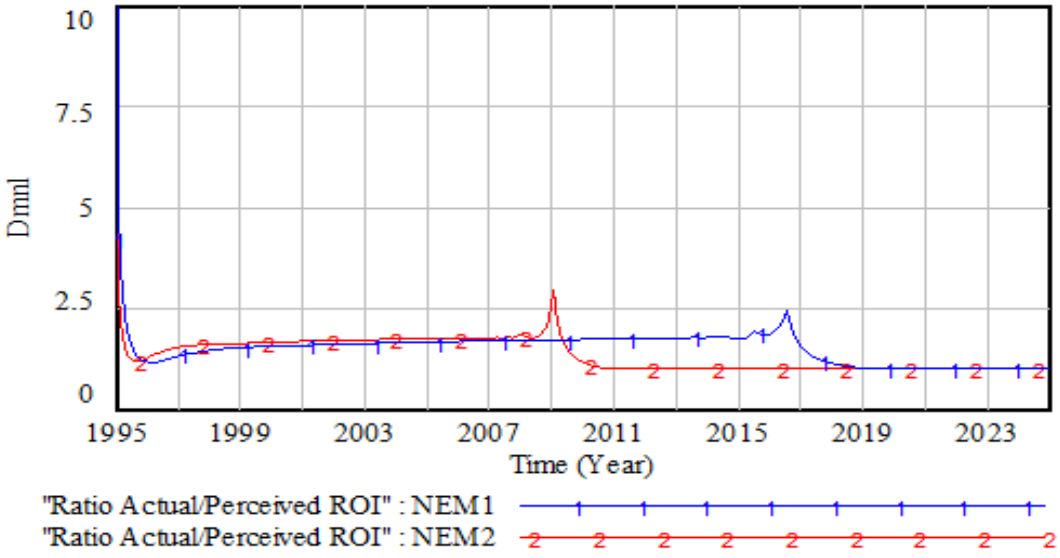


Figure 13 validates the benefit of minimizing the discrepancy between ***Actual ROI*** and ***Perceived ROI*** to produce a more sustainable ***Ratio Actual/Perceived ROI*** when investing in ***Assets.*** In healthcare context, it means an increasing commensal benefit to all stakeholders in terms of saving millions of lives and billions of dollars invest in health improvement rather than consumer billions of dollars in ineffective medical treatments that are now compromising the domestic economy of the country.

IV. DISCUSSION

A. Model Limitations -

According to Sterman (2000) "modelling is an iterative continual process of formulating hypothesis, testing, and revision of both formal and mental models" (pg.83).[39] Although modelling is challenging, it leads to reform of policies, new programs, and practices, while empowering people to change the status quo.

The vital pieces of this process are:

- **Boundaries**
- **Other factors beyond budget constraint (e.g. citizenship)**
- **Underinsured populations**
- **Policy-mandated ineligibility of individuals and Employers**
- **Incomplete knowledge and data**
- **Problem Articulation –** Partial representation of the problem, covering the time horizon from 1995 to 2014, although the problem started to emerge in 1963[40]
- **Testing –** It has not yet been tested

[39] Sterman, J (2000). Business Dynamics Systems thinking and modeling for a complex world (pg. 83-93).

[40] Fuchs ((1996). Economic values, and health care reform. *American Economic* Review.86(1):1-24.http://economicsfiles.pomona.edu/data/healthcare/ pg.15-18

Figure 14 – Table of Variables

ENDOGENOUS	EXOGENOUS
Cultural and linguist barriers	**Uninsured knowledge, beliefs, perceptions**
Cognitive and technical abilities	**Time constraint**
Data representing diverse uninsured populations	**Inconsistent data on uninsured populations -- mostly estimated**
Data representing Consumers' perspective is biased towards publishers	**Data available has limited credibility due to lack of rigorous criteria**
Past and current data of uninsured	**Health status at birth**
Variation in the stocks	**Federal and state policies**

B. Limitations of the Future Applications

In the US fragmented healthcare environment, conflicts of interests can annihilate profitable and even cost-effective solutions due to stakeholders with different agendas than the innovators of new solutions. Mobile-clinics in Russia, Australia, Iraq, Ukraine, Yemen, and Israel have proved to be a cost-effective healthcare delivering method for inner-city and rural populations. (WHO,2015). However, in the US, this solution has not found echo and support from healthcare providers and investors despite its high ROI. Across the US are only 1,500 mobile-clinics in operation. They are not even distributed across the 50 states nor serving the areas in needing. Despite the outstanding results – 3,125,668 in emergency room visits, plus $ 20,339,968 in prevention services annually, and profitability ratio of 36:1 for a full-sized van, and 45:1 for a bus, public and private organizations opted to lose $1.2B in co-ops (Oriol et al.,2008). Another operational obstacle relevant to the implementation of an itinerant patient-centered model is the lack of multilingual healthcare personnel able to culturally communicate with +62 million foreign-language speakers[41]. In inner-cities and rural areas 60% of the primary care patients come from an ethnic background different from their physician. In order to bridge the cultural gaps, we will need expand the health education and promotion materials to languages other than English. Then, knowledge would be accessible to everyone.

C. Recommendations

Itinerant-patient-centered clinics is a proven successful model in Australia, Iraq, Ukraine, Russia, and elsewhere. Nationwide, there are 1,500 mobile clinics operating in several states, but not in the ones we have high prevalence of infant mortality and chronic diseases (HHS,

[41] US Customs & Board Protection & US Census Bureau – 2010-Ethnic Study

MobileMap,2013). In St. Louis, the two mobile-clinics have brought a revenue of $45.00 for each $1.00 invested in child and prenatal care programs, whereas an expected ROI ratio is between *11.9:1 and 15:1 (Russell 3000)*[42]
Additional benefits are:

- Cost-effectiveness as proven by the Maryland Hospital's community outreach program
- Accurate primary data collection and analysis
- Preventive Health Programs tailored to patients' physical, mental, and social priorities while truly prevent them from become chronic ill. Immunizations, screening, and counselling are few effective strategies, but not enough to prevent consumers from getting sick. Those approaches should be complemented by annual liver and kidney detox and supplemental diet programs across lifespan along with family budgeting education.

V. CONCLUSION

The nation's compounding financial instability has constrained the budgets of middle-low-income populations, which has in turn promoted an exponential increase in the number of medically uninsured individuals. As a result, more and more individuals have limited money to invest in healthcare products and services that maintain or improve their overall well-being**.**

Currently, about 36 million Americans are medically uninsured. They use emergency-rooms to address their primary care routines. This problem mainly results from two underlying causes, one is the high cost of healthcare coverage available in the marketplace exchange, which is reinforced by the scarcity of primary care physicians (i.e. 0.7 per 1,000 in cities and 0.43 in inner-cities). When the high cost of care combines with scarcity of healthcare professionals, we have an annual healthcare expenditure of $3.4 trillion or 17.9% of the GDP, making the US healthcare system the most expensive in the world, but not the best delivery system despite all available technology.[43] According to a CDC report, the prevalence of one or more chronic diseases among Americans between the ages 18 and 64 reached 43%, leading to an astronomic consumption of healthcare goods today as well as in upcoming years.[44] This is one piece of evidence that illustrates the inefficiency of a fragmented healthcare delivery system that is unable to convey technology into affordable preventive services to consumers.

The nation's poor health status also negatively impacts productivity rates of all sectors of the economy by the exponential growth of unscheduled labor absenteeism or presenteeism. In 2014, unscheduled absenteeism cost US corporations $320 billion or the equivalent of 10% of the national GDP.[45] It did not include the cost of presenteeism (See the effects of presenteeism in

[42] Russell, F (2016). FTSE 3000 Index for market-capitalization. Benchmarking of US and London Stock Exchanged.

[43] Bodenheimer, T., Chen E., Bennett H.(2009). Confronting the growing burden of chronic disease: can US health care do the job? *Health Affairs* 28(1):64-74.

[44] Center for Diseases Control and Control (2011). National Hospital Ambulatory Medical Care Survey: Outpatient Department Summary.

[45] Circadian Tech Inc. (2005). Absenteeism. The bottom-line killer. Unscheduled absenteeism cost annually $3,200 per hourly employee and $2.650 per salaried employee, plus 1% increase in the payroll costs.

workforce paper). In addition to the low productivity, the economy experience an unusual rate of bankruptcy related to unpaid medical bills that often times result from high deductibles, co-payments and out-of-pocket expenses. Combining those effects, we see a nation with low economic growth (citation).

Under the lens of healthcare economists, the high cost is carved by the features and characteristics of an oligopolistic structure rooted in an inelastic pricing strategy. For 80% of the American population that share only 7% of the nation's wealth, healthcare coverage is unfeasible. Particularly for a healthy individual earning the minimum wage of $7.25 per hour, a premium will cost between $180 to $265 monthly with a $925 deductible. If the annual income of such an individual is $15,080 before taxes, his or her insurance will cost approximately $2,300 or 16.6% of the household income, without taking into account ancillary costs. For an unhealthy individual this cost can easily reach $10,000. For these reasons, moderate-to low-income Americans are medically uninsured. In a word, medically uninsured populations cannot afford the cost of healthcare products and services due to budget constraint (citation).

To address the medically uninsured status, I propose an exploratory research design investigating the availability of healthcare coverage to uninsured populations under budget constraint. Next, I apply philosophical (pre-analytical "aporia"), parametric (utility function) and non-parametric (socio-ecological framework) methods, and system dynamic simulations (nonlinear) to understand the underlying causes related to budget constraint. Finally, I establish a comparative analysis between the simulations and the outcomes reported by Maryland Hospital community outreach program.

The following recommendations should be enacted to improve the healthcare status of uninsured populations:

1. Healthcare stakeholders, particularly insurance companies, hospitals, public agencies, and suppliers should work more collaboratively towards a sustainable healthcare delivery system that offers equitable prices to all consumers.
2. An innovative methodology needs to be adopted that opposes the current oligopolistic structure and provides an elastic price based supply and demand.
3. Healthcare premiums should be based on income not on risk because low-income populations are more exposed to environmental diseases and have less ability to pay for insurance, which hurts the health status of the nation as a whole and increases comorbidity rates.
4. All individuals residing in the United States should be eligible for health insurance not only US citizens.
5. Based on the simulations, we should reinforce the preventive community outreach programs in order to save the total annual expenses of $16,000 per person, which can be assorted in $320 loss of assets, plus $858 in out-of-pocket for complementary services, plus $3,200 in absenteeism, plus $8,570

in preventable emergency room visits, plus $1,578 for ambulance, and $502 in medication.

The cost of healthcare products and services is a global concern for governments and citizens as a significant portion of the world population is ageing. Therefore, cost-effective solutions should be nurtured to mitigate the needs of those cannot afford the cost of a healthcare coverage because this status quo impacts the nation’s productivity, economic stability, and proliferates poverty.

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APPENDIX A

NATIONAL AVERAGE		ABOVE
Adult Mortality	29	(_1.54%)
Infant Mortality Ratio/100,000	6	(+1.03)
Low Birthweight< 1,500 Kg	8.	(+ 0.8%)
Yearly Premature Death p/100,000	5,69	(+2,551)

STATE	% Racial * Minorities	Infant ** Moratlity	% Low Birth Weight	%Adult *** Mortality	Total hospitals bed p/ 1,000 pop	Hospital Closures	Filed Bankrupcty	Yearly Premature Death/per 100,000
Alabama	34.0	8.6	10.0	33.5	3.1	5	no data available	10,095
Arizona	51.0	5.5	6.9	28.9	2	3	no data available	7,164
Arkansas	28.0	7.5	8.8	35.9	3.1	2	no data available	9,586
D. Columbia	63.0	7.3	8.5	21.7	5.4	3	no data available	6,780
Georgia	67.0	6.6	9.5	30.5	2.4	5	no data available	7,880
Idaho	18.0	5.8	6.9	28.9	2	1	no data available	6,747
Illinois	36.0	6.2	8.2	29.3	2.5	no data available	4	6,555
Louisiana	42.0	8.4	10.9	34.9	3.2	no data available	no data available	9,957
Mississippi	43.0	9.3	11.5	35.5	4.1	2	no data available	10,744
Missouri	19.0	6.6	8.0	30.2	3.2	1	1	8,117
New Mexico	60.0	6.1	8.9	28.4	1.8	3	no data available	5,819
North Carolina	38.0	7.2	8.8	29.7	2.2	3	no data available	7,604
South Carolina	36.0	7.2	9.7	31.2	2.3	2	no data available	8,592
Tennessee	26.0	7.0	9.1	31.9	3.1	6	no data available	9,088
Texas	56.0	5.8	8.3	32	2.3	11	2	7,084
West Viriginia	8.0	7.4	9.4	35.7	3.7	1	no data available	10,129
		7.03	0.8	1.54				2551

Note - Adopted Sources from The Henry Kaiser Family Foundation (*), Center for Diesases Control and Prevention **, and America Health Rankings ***
Also a complementary data was obtained from OECD library, and from Center for Science in the Public Interest