Epidemic Proportions
The Johns Hopkins Undergraduate Public Health Research Journal

The Changing Face of Public Health

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EpidemicProportions

The Johns Hopkins Undergraduate Public Health Research Journal

On the Cover

A young girl from the South Gobi region of Mongolia stands in front of her family's satellite dish.

On the Back Cover

A Mongolian child peeks out from the door of his family's traditional "ger," a one room, round tent that is easily transportable to fit the nomadic lifestyles of this herding culture.

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LETTER FROM THE EDITORS

Dear Readers,

We are pleased to present you with the Fall 2009 issue of *Epidemic Proportions*, the Johns Hopkins Undergraduate Public Health Research Journal.

The face of public health is continually changing, much like our own faces change as we age, learn, and grow. In recent years, with the advent of globalization and the development of new technology, public health has changed not only in terms of delivery techniques, policy goals, prevention methodologies, and treatment measures, but also in how we have come to define the field itself.

In this issue, we chose to illustrate several of the changing facets of the field. For example, while public health previously focused on medical illness and disease, the field has now expanded to address bio-behavioral issues such as obesity, mental health, and pain management. In our Research section, Kenneth Witmer (class of 2010) shares his findings regarding how distraction can reduce human perception of pain.

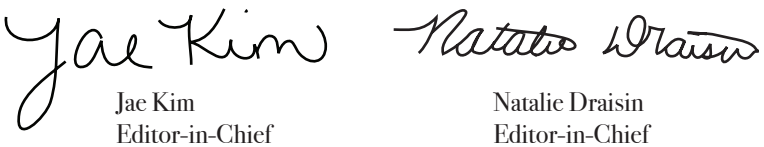
The boundaries of the field also encompass environmental issues that impact public health. We must not only ensure sustainability of resources for our needs, but also for those of future generations. In our Perspectives section, we interview environmentalist Dr. Cindy Parker, who discusses her new book, *Climate Chaos: Your Health at Risk*, and the introduction of a new undergraduate major, Global Environmental Change and Sustainability. Additionally, in our Editorials section, Halshka Graczyk (class of 2010) presents a compelling account of Mongolia's strife in grappling with the effects of widespread mercury poisoning on gold mining workers.

Politicians, government agencies, and public health practitioners also collaborate to create new policies and reforms in order to ensure that the law supports the needs of public health initiatives. Among many issues, we highlight the increasingly problematic challenges surrounding proper regulation and safe disposal of waste and garbage. In our Features section, Dave Iaconangelo (class of 2010) paints an honest and revealing portrait of Venezuela's extensive problems with poor waste management.

The profound magnitude and broad scope of the modern field of public health reflects the social, physical, political, and economic complexities of today's world. In the years to come, the field will undoubtedly continue to expand and evolve, and we are certain that many revolutionary changes will come from you. We invite you to read our journal and see your own reflection in the changing face of public health.

The future of public health is in your hands.

Best regards,



Jae Kim
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Natalie Draisin
Editor-in-Chief

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Front Row *(from Left to Right)***:** Sheng-Sheng Zhang, Liana Senaldi, Rashmi Basapur, Farah Chowdhury **Middle Row:** Caitlin Choi, Meg Rose, Natalie Draisin, Jae Kim, Meredith Mirrer, Halshka Graczyk **Back Row:** Lauren Kohan, Karthik Rao, Nick Arora, Kevin Brown, Annie Fehrenbacher **Not Pictured:** Sarah Sabshon, Karen Nie

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COVER LETTER

Global Health at the Johns Hopkins University

Thomas C. Quinn, M.D., M.Sc.
Director, Johns Hopkins Center for Global Health
Professor of Medicine, Public Health, and Nursing

The field of global health continues to expand across the landscape of American universities and into the daily language of policy makers and political leaders. This is truly a transforming time to be engaged in global health with a new administration in Washington, D.C. and its leaders expressing a renewed commitment to advancing global health as an instrument of economic development and foreign policy. In his first four months in office, President Obama proposed a $61 billon global health initiative addressing HIV, malaria, tuberculosis, neglected tropical diseases and maternal child health. Our university leaders are likewise recognizing the multi- and inter-disciplinary nature of global health that can serve as a uniting force across the schools that make up our university campus.

With all this excitement and energy surrounding this topic, many have asked, "What is global health?" The term is often used loosely to encompass a variety of health related issues including: inequities, poverty, environmental changes, globalization, human rights, justice, and civil unrest. Global health emphasizes transnational health issues, determinants, and solutions; it involves many disciplines within and beyond the health sciences and promotes interdisciplinary collaboration; and is a synthesis of population-based prevention with individual-level clinical care. While achieving full agreement may be difficult, it is undeniably true is that global health has captured the hearts and minds of students and faculty who wish to work collectively to solve the world's health problems.

At Johns Hopkins University, public health has become the largest undergraduate major with over 400 students currently enrolled. Certainly, those engaged in public health studies, research and service are likewise engaged in global health, since it embraces the disciplines of public health and international health. All three areas share the following: a priority on a population-based and preventive focus; concentrations on poor, vulnerable, and underserved populations; and an emphasis on health as a universal public good, as well as the importance of solid systems and structures.

What has placed global health on the minds of our politicians is the spread of globalization, which shapes the health of populations around the world and threatens our own health and security. This interconnectedness also underscores the ultimate societal goal of economic equity and the reduction of health disparities domestically and internationally. A new infection that may occur in Southeast Asia today could be in the U.S. tomorrow. The burgeoning diabetes epidemic in the Middle East is a heavy reminder of our own increasing epidemic of obesity and diabetes. The solutions to these are frequently the same and need to be equally distributed across societies.

We have witnessed the exponential growth in global health interest across the nation on American college campuses as well. In a recent survey of 55 universities, 37 had developed an interdisciplinary program in global health, with a third of those having been instituted within the last 12 months. In the U.S., all training levels of students, undergraduates and graduates, have shown a greater than 100 percent increase in enrollment in global and public health over the past three years. In addition, most universities have developed formal, significant relationships within institutions around the world, with the majority in Africa and Asia. Hopkins leads the list with 641 active international projects in 121 countries involving 372 investigators from multiple schools in our campus. No other university in North America has this level of faculty commitment working with international partners to improve health, promote social good; and uphold human dignity and rights.

The leadership of Hopkins' Schools of Public Health, Medicine, and Nursing recognize the collaborative efforts of their faculty and their commitment by forming the Center for Global Health at Johns Hopkins University. Since its inception two years ago the Center has awarded $50,000 pilot research grants to support 20 junior faculty in global health initiatives, and supported travel grants to 87 students at the undergraduate and graduate schools to work with faculty mentors in 32 different countries. In addition, the Center has offered 25 M.P.H. and M.H.S. scholarships at the Bloomberg School of Public Health for outstanding students seeking a career in global health. The Center forged twinning relationships with a variety of other universities in developing countries, most notably at Makerere University in Uganda, one of the leading institutions of sub-Saharan Africa.

The Johns Hopkins University promotes and engages in global health work in nearly every country of the world on a daily basis with boundless dedication and energy from the faculty, students, and now, from the new leadership of the University. In the next decade we will undoubtedly witness many advances and improvements in the ever-expanding field of global public health.

PRESIDENT'S ADDRESS

A Second Golden Age of Public Health

Ronald J. Daniels, J.D., LL.M.
President, The Johns Hopkins University

When I was child, on three successive Sundays beginning in late April, thousands of families across North America lined up at schools, churches and hospitals to receive a sugar cube or a spoonful of pink syrup. The medicine was the newly-developed oral polio vaccine, and these "Sabin Sundays"–named after the oral vaccine's inventor–were a fitting conclusion to one of the most heroic public health battles of the 20th century. By 1994, polio had been eliminated from the United States. So far this year, less than a thousand cases have been reported worldwide, and efforts are ongoing to eradicate polio completely in the next few years.

In some sense, the 20th century was the 'golden age' of public health. Between the founding of the world's first school of public health here at Johns Hopkins in 1916, and the 1980 announcement of the successful global eradication of smallpox led by D.A. Henderson (who would later serve as dean of our Bloomberg School of Public Health), there was a long succession of achievements in public health. These advances in sanitation, disease control, vaccination, workplace safety, and many other areas were responsible for a revolution in the length and quality of human life span. In the United States, life expectancy increased by more than 30 years in the 20th century, of which 25 years can be attributed to advances in public health.

So the question becomes: What next? If someone asked, "What's the biggest public health challenge facing us today?" I would answer simply: complacency.

All the great achievements of public health over the past century fostered a sense of mission accomplished, a belief among many that the big problems had been met, addressed and conquered. The nation as a whole began to pay less attention to public health needs; our elected officials moved their focus and resources on to other problems. By the year 2000, there were 50,000 fewer public health employees in the United States than there had been twenty years earlier. At the same time, the nation's population grew significantly, and resulted in the ratio of public health workforce to the U.S. population to decline from 220 per 100,000 to 158 per 100,000 – a 30 percent reduction in force. Moreover, more than a quarter of the nation's public health workforce will become eligible to retire in the next three years. Some experts are now warning that a public health workforce crisis is headed our way.

Yet, it is just at this moment of extreme duress for the nation's public health infrastructure that we have been repeatedly and forcefully reminded of how profoundly important this work is to maintain our safety and security. In 2002, Severe Acute Respiratory Syndrome– known as SARS –erupted in China and quickly spread to 37 countries around the world, killing more than 700 people before it was successfully contained. Then in 2005, Hurricane Katrina devastated the Gulf Coast, displacing tens of thousands and leaving many communities without water, sanitation or medical services. And today, we are engaged in a race against the clock as we try to limit the effects of a swine flu pandemic in the hopes that the H1N1 virus does not mutate into a more resistant pathogen.

These events make it clear that in this era of unprecedented climatic change and global health emergencies, the need for more robust and vigorous public health capabilities is more important than ever. Luckily, there has been a groundswell of new interest in public health studies, not only here at Johns Hopkins University – where public health has become the fastest growing major on the Homewood campus– but also all across the country. New programs in public health and global health are emerging and entirely new schools of public health are being launched. This comes not a moment too soon. The Association of Schools of Public Health estimates that over the next decade schools of public health will need to train three times the current number of graduates to meet the projected needs. Even that number, however, will not begin to address the critical health needs of the world's most impoverished regions, as for example in sub-Saharan Africa, where 11 percent of the world's population bears 24 percent of the world's burden of disease– yet commands less than one percent of the world's health expenditures.

I encourage you to read carefully through this issue of *Epidemic Proportions* where you will find reports about ongoing work in areas ranging from hygiene practices in rural India to a faith-based community rehabilitation program in West Baltimore; from individualized cancer immunotherapy to prescription drug abuse on college campuses. The breadth of subject matter and depth of creative thinking applied to this work is ample evidence that something is stirring in the field of public health. New technologies, new approaches, and most importantly, a whole new generation of dedicated public health leaders are emerging to address the tremendous health challenges we face on a global scale. It gives me great hope that the profound scope of today's problems is balanced with a growing number of driven and passionate students and leaders in public health at Johns Hopkins University and other institutions. I have great confidence that a second golden age of public health will unfold.

Research

RESEARCH

Genetic Engineering of T-Lymphocytes to Target Tumor Cells

Liana Senaldi, Class of 2010
Molecular and Cellular Biology, Public Health Studies

Introduction

Cancer immunotherapy attempts to harness the immune system, including T cells, to target and eliminate malignant T cells in the host. However, generating efficient tumor immunity presents a major challenge to the scientist. The immune system is unable to recognize the tumor cells. These cells are resistant to T cell attack and grow uncontrolled. Tumor cells have many characteristics that allow them to escape detection by the immune system. The lack of target antigens on their surface, the difficulty of the immune system in overcoming tolerance to self-antigens on the tumor, and the decreased expression of immune recognized antigens by the tumor all contribute to the ineffective targeting of T cells to cancer cells.[1]

In bone marrow transplantation therapy for leukemia, tumor cell degradation is increased by the presence of healthy donor T cells able to target and kill remaining tumor cells. This is called a graft-versus-leukemia effect, which helps the patient to go into remission. However, infusion of T cells included in the donor bone marrow graft can also generate complications as a result of graft-versus-host disease.[2] In graft-versus-host disease, the T cells from the donor's marrow may identify the patient's normal tissue as foreign, attacking the patient's healthy cells and causing severe side effects for the patient. This shows that T cells can beneficially kill cancer cells, but may be dangerous as well.

T cells require two distinct extracellular signals to induce proliferation and differentiation effector (cytotoxic) cells. These signals are referred to as signal 1 and signal 2. The first signal is produced when the tumor antigen binds to the T cell receptor (TCR). The second signal for T cell activation is provided by molecules, which are called co-stimulatory receptors because they function together with bound T cell receptors to activate T cells. In the absence of this co-stimulation, T cells that encounter recognized antigens undergo cell death, called apoptosis, or enter a state of unresponsiveness, called anergy.

In order to develop more effective therapies to treat leukemias and other cancers, researchers are focusing their attention on genetic approaches that modify a patient's own T-lymphocytes to more specifically target their tumor cells. The introduction of chimeric antigen receptors is one such approach. Artificial T cell receptors are engineered by combining the variable domain of a monoclonal tumor antibody to the T cell receptor's signaling domain.[3] Chimeric antigen receptors (CARs) can be directed towards predefined targets, such as the antigens on the surface of tumor cells.[4] To date, such receptors can only deliver a signal 1 alone. An additional co-stimulatory receptor is necessary for the effective activation and expansion of T cells.

Co-stimulatory receptors are molecules on the surface of T cells which bind to a specific ligand on antigen-presenting cells, providing the T cell with a stimulus (signal 2). Co-stimulation can be provided through a number of different T cell molecules (including CD28, 4-1BB, and DAP-10) utilizing distinct mechanisms that physically reorganize the T cell receptor complex, which lowers the threshold for T cell receptor signaling, amplifies T cell activation, and ultimately modifies the outcome of antigenic activation by enhancing proliferation and preventing T cell anergy or death.[3]

Previous attempts to enhance chimeric antigen receptors protein domains that are able to generate co-stimulation signals have resulted in only modest improvements in T cell survival and proliferation.[3] Therefore, it is necessary to look for other genetic approaches to generate a more robust and effective T cell co-stimulation. Since chimeric antigen receptor molecules providing signal 1 alone is not enough, we decided to engineer two separate receptors, the first to provide signal 1 and the second to provide signal 2. Both receptors would use scFvs, single-chain variable fragments, as binding regions, but use different signaling domains. The first chimeric antigen receptor, 19z1, provides signal 1 by binding to the antigen CD19 on the surface of B cell tumors. The second receptor provides signal 2 by binding to prostate specific membrane antigen (PSMA).

Previous studies conducted by Dr. Renier Brentjens at Memorial Sloan-Kettering Cancer Center reported that the combination of both activation and co-stimulation signals (TCR zeta chain and CD28 sequences) within a single receptor, 19-28z receptor, resulted in limited tumor cell specificity and reduced elimination of B cell tumors which expressed the CD19 antigen on their surfaces. However, the signal 2 provided by this receptor was not optimal, and such T cells would also target and kill normal B cells.[1] Therefore, it was necessary to engineer the T cell to include two separate receptors, one (19z1) for the activation signal 1, and the other for the co-stimulatory signal 2. The addition of a separate receptor for the co-stimulatory signal should, thus, amplify the T cell response by providing co-stimulation. Co-stimulation should allow T cells to produce interleukin 2, to proliferate, and to kill in an antigen dependent manner.[1] Furthermore, by targeting a separate tumor antigen with this second receptor, the specificity of the T cell for tumor cells is enhanced and may reduce the degradation of normal B cells.

In order to develop more effective therapies to treat leukemias and other cancers, researchers are focusing their attention on genetic approaches that modify a patient's own T-lymphocytes to more specifically target their tumor cells.

In the current study, the signaling domains of two T cell co-stimulation receptors were chosen to be linked to the second scFv specific for PSMA. The two co-stimulation receptors utilized were 4-1BB (CD137) and DAP10. These receptors are members of the TNFR (tumor-necrosis factor receptor) superfamily involved in co-stimulation of T cell responses. DAP10 and 4-1BB induced signals are each dependent on TNFR-associated factor 2 and contribute to T cell survival by up-regulation of prosurvival members of the Bcl-2 family.[3] First discovered in B cell leukemias, Bcl-2 is an anti-apoptotic protein that protects cells from apoptosis by preventing the activation of pro-apoptotic caspase proteins.

In the present study, I constructed two fusion receptors: one receptor included the 4-1BB signaling domain sequence and the other fusion receptor included the DAP10 signaling domain sequence. The receptors contained a scFv specific to PSMA which was previously generated in the laboratory. The scFv was then fused to sequences for either HIS6 or MYC tags to allow for antibody-mediated recognition of receptor expression, followed by another fusion to the signaling domains of either 4-1BB or DAP10. These fusion receptors are specific for PSMA, a glutamate carboxypeptidase that is expressed on the surface of normal prostate epithelial cells and is over-expressed in the majority of prostate carcinomas. PSMA is also associated with an array of solid tumors, therefore acting as an attractive target for immunotherapy.[1] While PSMA is not normally expressed on the surface of B cell tumors, the laboratory has previously generated a B cell tumor genetically modified to express PSMA. Thus, an artificial model is used to test this hypothesis. In the future, second co-stimulatory receptors may be generated to match true secondary antigen targets naturally expressed on B cell tumors like CD5 on chronic lymphocytic leukemia.

Methods and Materials

Polymerase Chain Reaction (PCR) of 4-1BBH6

PCR of the 4-1BBH6 fragment was performed by using 1µl of a 1:25 dilution of the previously generated 19z1' 41BB chain DNA. 1µl of 41BBH6F primer (CATCACCATCACCATCACCCATCTCCAGCCGACCTCTCTCCGGG) and 41BBR primers was used. The buffer solution was made up of 5µl of Invitrogen10x, 2µl of MgSO4, 1µl of dNTP, 0.2µl of Taq polymerase, and 39µl of H20. The cycle was repeated 30 times. The 41BBH6 DNA fragment was then fused to the PSMA scFv fragment by overlapping PCR to generate the P-41BBH6 gene.

PCR of DAP10H6

The aforementioned procedure was also used to carry out the PCR of DAP10H6 with 1µl of DAP10H6F primer (CATCACCATCACCATCACCAGACGACCCCAGGAGAGAG AGATC) and DAP10R primer. The DAP10H6 DNA was then fused to PSMA scFv by subsequent overlapping PCR to generate the P-DAP10H6 gene.

Direct Ligation with Taq-amplified (TA) Cloning Technology

Taq polymerase has a terminal transferase activity that adds a single 3'-A (adenosine) overhang to each end of the PCR product. TOPO TA Cloning vectors contain 3' T (thymine) overhangs that allow for the direct ligation of Taq-amplified PCR products with 3'-A overhangs. This enables fast, five minute TOPO cloning, and yields up to 99 percent recombinants. 2µl of the overlap PCR product was combined with 1µl salt solution, 2µl sterile water, and 1µl of the TOPO vector.

Transformation of DNA Plasmids

The recombinant plasmids were inserted into E. coli bacteria. The plasmid containing the DNA fragment of interest was replicated in the bacteria. The TOPO plasmid carries a gene that made the bacteria resistant to the antibiotic, ampicillin, allowing only bacteria that carried the plasmid to grow on ampicillin-containing media. 2µl of the TOPO Cloning Reaction from both P-4-1BBH6 and P-DAP10H6 was added to E-coli cells and incubated on ice for 30 minutes. The bacterial cells were heated for 45 seconds at 42°C to enhance entry of plasmid into the bacteria. 250µl of SOC recovery medium was added to the cells and bacteria were subsequently incubated for one hour at 37°C. The cells were then plated on LB agar plates containing 100µg/mL ampicillin.

Plasmid Mini-prep and Restriction Digest

After allowing the cells to grow overnight at 37°C, resulting bacteria colonies were picked and mixed with 2ml LB with ampicillin and incubated overnight. The plasmid DNA was isolated from bacteria using a plasmid mini-prep isolation protocol from a commercially available kit (Invitrogen). In order to verify that the DNA contained the desired gene, the plasmids were isolated from bacteria, and cleaved with the restriction enzymes, Nco1 and BamH1, which cut the DNA at specific recognition sites consisting of six base pair palindrome sequences. The varying DNA fragments were separated by size through agarose gel electrophoresis.

DNA Sequencing

Although the recombinant plasmids were digested with specific restriction enzymes (as described above) and the fragments were separated by gel electrophoresis to establish that the fragment size matches the control, it is also necessary to verify the specific sequence of the chimeric receptor due to the possibility of point mutations that could have occurred. The plasmid DNA was sequenced in the DNA sequencing core facility at Memorial Sloan-Kettering Cancer Center.

Generation of 4-1BBH6 Retroviral Particles for T cell Modification

The P-41BBH6 gene will be subsequently subcloned by restriction enzyme digestion and ligated into the SFG retroviral vector plasmid which would allow for the generation of viral particles containing this gene. This virus can subsequently be used to transfer this gene into human T cells. To do so, we will transfect in H29 viral packaging cells with the resulting P-41BBH6 SFG plasmid. This will generate viral particles used to transduce the stable retroviral producing PG13 cell line which will produce P-41BBH6 viral particles used to infect human T cells.

Protein Analysis

The expression of the fusion receptors in T-cells will be monitored by flow cytometry. Specific antibodies to the epitope tags or the CD19 receptor will be used to stain the cells. Fluorescent molecules that are attached to the antibodies are used to detect their presence. Flow cytometry was carried out using a FACScan cytometer with Cellquest software. Expression of PSMA-specific fusion receptor will be directly demonstrated using anti-HIS6 antibodies.

Results

The goal of the present study is to genetically engineer a novel T cell receptor that is able to deliver a co-stimulatory signal upon interaction with PSMA. A series of receptors that comprise of a PSMA-specific scFv fragment coupled to a signaling element derived from either 4-1BB or DAP10 were successfully generated.

After constructing the P-41BBH6 and P-DAP10H6 genes by PCR, the resulting DNA fragments were cloned into the SFG retroviral

Figure 1: T-cell responses upon binding to antigens found on both tumor cells and normal B-cells[9]
(adapted from Alberts et. al, edited by L. Senaldi to illustrate current research)

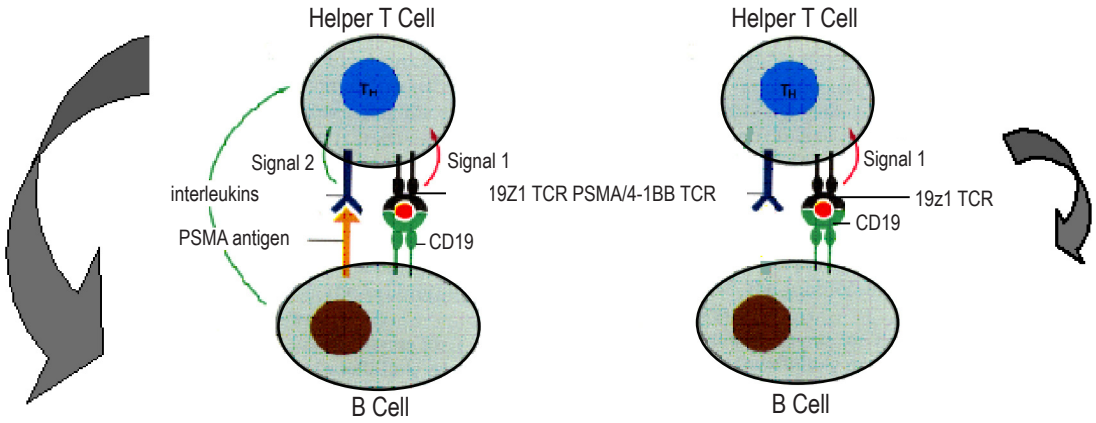

Figure 1: Demonstration of T-cell responses among normal and tumorous cells. The picture on the left represents the robust T-cell response against the tumor cells, upon the binding of both antigens to the T-cell receptors. The picture on the right demonstrates the minimal T-cell response since the B-cell only contains one antigen.[9]

fragment, the plasmid DNA was extracted from bacteria and digested with the same restriction enzymes (Bam H1 and Nco1) to remove the desired fragment.

The desired gene products were separated by agarose gel electrophoresis to verify that the plasmids contained the desired genes. The SFG P-41BBH6 plasmid was 7,435 bp and the SFG P-DAP10H6 plasmid was 7,372 bp in size.

The plasmids were digested using restriction enzymes BamH1 and Nco1, and separated on a 1 percent agarose gel by electrophoresis. As predicted, the P-41BBH6 insert gene was about 1,100 bp and the P-DAP10H6 inserted gene was about 1,000 bp in size. To further verify that the plasmids contained the exact desired sequences, the DNA was sequenced by the sequencing core facility at Memorial Sloan-Kettering Cancer Center. Sequence analysis confirmed the correct sequence of the inserted genes. FACS (Fluorescence Activated Cell Sorting) analysis will be carried out using anti-HIS6 antibodies to verify the expression of the fusion receptors.

Discussion

The antigen recognition and signaling functions of antigen receptors are mediated by distinct proteins of the antigen receptor complex.[5] When T cell receptor molecules recognize antigens, signals are delivered to the T cell by molecules associated with the T cell antigen receptors.[6]

Effective activation of T cells requires two signals. The first is provided by the T cell receptor, signal 1. The second signal, or co-stimulatory signal, is provided by receptors on the T cells which bind to specific ligands on the surface of antigen presenting cells (APCs) or target cells, signal 2. The expansion of functional tumor-specific T cells requires both signals and is of the utmost importance for tumor immunity and subsequent eradication. Co-stimulation responses in tumor specific T cells are crucial for effective adoptive immunotherapy. Chimeric T cell receptors combine antigen recognition and signal transduction within a single molecule. The antigen specificity of the artificial receptor relies on the binding of its extracellular domain, which usually consists of the variable domains of a monoclonal antibody to antigen.[5]

CD28 signaling is important for initial survival and proliferation of cells. However, within hours of activation, additional co-stimulatory molecules are upregulated and may serve to sustain, diversify, or differentiate the T cell response. A T cell receptor has been previously engineered to contain the signaling domains of human TCR zeta chain and CD28 fused in series within a single molecule. However, the resulting co-stimulation delivered to T cells in this setting was sub-optimal, and the resulting T cells are less specific to tumor cells and may also damage normal tissues. By generating T cells with two chimeric receptors to initiate separate mechanisms for signal 1 and 2, the efficacy and specificity of the tumor specific T cell could be improved.

Artificial chimeric receptors containing a co-stimulatory signal, such as 4-1BB or DAP10, can be used to enhance the specificity and effectiveness of T-lymphocytes to tumor antigens.[7] Extensive evidence supports the role of 4-1BB as a co-stimulatory molecule that can function independently of CD28 to activate T cells. 4-1BB can influence cytokine production, proliferation, and survival of T cells in vitro and in vivo.[3]

I have created a separate scFv-based PSMA-specific chimeric receptor designed to provide a separate co-stimulatory signal to the T cell upon binding to the PSMA antigen. The fusion receptor enables transduced T cells to generate a co-stimulatory signal and proliferate in an antigen-dependent manner. This supports the notion that these cells could be expanded both in vitro, and more importantly, in vivo in the tumor-bearing host. The P-41BBH6 receptor binds to the PSMA ligand found on the tumor cell triggering a 4-1BB co-stimulatory signal within the T cell. The benefits of this genetically engineered T cell receptor include antigen specificity to targeted tumor cells, proliferation of antigen specific T cells, and reduced targeting of normal B cells.

Figure 1 illustrates this benefit, in which there is an elevated T cell response against the tumor cells, and a minimal T cell response against normal B cells. CD19 is an antigen found on both normal B cells and malignant B cells. In this project, however, we have generated the tumor cells to also express the PSMA antigen. T cells with both the 19z1 T cell receptor (specific for CD19) and P-41BBH6 co-stimulatory receptor (specific for PSMA) would be expected to mount a more robust attack on tumor cells and a minimal response to normal B cells which fail to express the PSMA antigen. This mediates a signal 2 through the P-41BBH6 receptor. Because the co-stimulatory receptor is antigen specific, in this case

PSMA specific, the T cells are preferentially activated by cells expressing both antigens. The co-stimulation of the PSMA specific co-stimulatory T cell receptor, P-41BBH6, should provide the second signal for a productive, optimal, T cell response in vivo.[8]

Genetic modification of T cells to recognize these cancerous cells enables scientists to generate more specific T cells to clinically relevant numbers and extend their viability.[11]

Once a T cell has been stimulated by the antigen, other accessory proteins on its surfaces, such as co-stimulatory receptors are called into play to increase the strength of T cell binding and response to the target cell. The combined action of signal 1 and signal 2 provokes T cell proliferation. It further allows T cells to stimulate their own proliferation by simultaneously secreting a growth factor called interleukein-2 (IL-2) and synthesizing cell-surface receptors that bind it.[9]

An antigen presenting cell that lacks a co-stimulatory ligand does not stimulate responses of T cells and may therefore induce T cell anergy. This outcome may be avoided through the introduction of a co-stimulatory chimeric antigen receptor as proposed here. Adoptive therapy using autologous T cells that are genetically modified by such chimeric antigen receptors offers the potential benefit of tumor-specific killing, as well as decreased toxicity relative to conventional chemotherapy and adoptive transfer of non-self, or allogeneic, T cells, which can result in graft-versus-host disease.[10]

Genetic modification of T cells to recognize these cancerous cells enables scientists to generate more specific T cells to clinically relevant numbers and extend their viability.[11] The transfer of specific chimeric antigen-recognition receptors into T cells offers great potential to target T cells to any tumor-associated antigen of interest. The success of immunotherapy in treatment of B cell malignancies is dependent on a better understanding of both the immune system, tumor immunology, and the scientific establishment of thorough clinical trials to test these novel approaches.[11] This field of medicine holds tremendous promise, and scientists are currently testing other genes in order to make T cells more robust in mounting immune responses against tumor cells.

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RESEARCH

Behavioral Analgesia:
The Effects of Distraction on Nociceptive Sensation

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Introduction

Chronic pain is an epidemic with devastating economic and psychosocial impacts, affecting nearly 50 million Americans at any given time and costing in excess of 125 billion dollars annually.[1,2] Pain is the number one motivator for health care utilization, accounting for over 50 million lost workdays per year, and producing profound detrimental effects on overall quality of life.[3,4]

It is widely accepted that multiple factors contribute to an individual's overall experience of pain, including both cognitive and behavioral coping strategies. One of these techniques, distraction, has demonstrated analgesic effects in chronic pain patients, during medical procedures and in the context of clinically applied noxious stimuli.[5,6,7] Brain imaging studies suggest that the endogenous opioid systems may play a role in the perception of painful stimuli, presumably by descending inhibitory pathways releasing opioids.[8,9,10] Although some evidence exists for the involvement of endogenous opioids in analgesia resulting from distraction, no studies have directly investigated these mechanisms.

Another coping strategy, catastrophizing, a set of negative emotional and cognitive processes including magnification, pessimism, and feelings of helplessness when in pain, is a critically important risk factor for adverse pain related outcomes. Greater catastrophizing has been associated with greater post-operative use of opioid analgesics and reduced analgesic benefit.[11,12] Recent brain imaging studies also suggest that catastrophizing may be involved in amplifying pain processing in multiple regions within the pain neuromatrix.[13]

To determine the effectiveness of distraction as a strong behavioral analgesic technique, and to locate successfully its mechanisms of action, additional research is needed. Further study on distraction and its analgesic effect will improve our current understanding of pain and mind-body interactions. Therefore, this distraction research protocol utilizes Positron Emission Tomography (PET) to further current understanding of the functional mechanism of distraction as a behavioral analgesic in the brain. Hypotheses include: 1) The use of distraction-induced behavioral analgesia will cause a decrease in carfentanil binding to opioid receptors and 2) the magnitude of the distraction effect is positively correlated with the increase in opioid receptor occupancy by endogenous opioids.

Methods and Materials

Healthy individuals between the ages of 21 and 60 were recruited to participate in the study in response to flyers that were posted throughout the community. Individuals expressing interest called the research laboratory and a telephone screening was then conducted. For this particular study, participants were required to be right-handed and have adequate vision, or wear contact lenses, due to the experimental setup required for the brain imaging sessions.

Eligible participants were scheduled for an in-person screening session. This first visit with prospective participants included obtaining informed consent, the completion of questionnaires, confirmation of eligibility, practice performing the distracter task, and familiarization with the capsaicin cream. Subjects completed a variety of questionnaires including a Health History Form, the Beck Depression Inventory (BDI), and the Pain Catastrophizing Scale (PCS). Individuals with abnormally high or low pain ratings from the capsaicin were excluded from the study. After the initial screening, an MRI was performed for later use in the analysis of the PET scan results.

During the first PET session, a pre-testing questionnaire was completed, and a 10% capsaicin cream was applied to the left hand to induce a painful and/or uncomfortable sensation. Participants rated the pain using a computerized system on a 0 to 100 scale. Fifteen minutes after the application of capsaicin, a transmission scan was performed. The radioactive drug, carfentanil, was injected after 25 minutes and PET images were acquired over a 90 minute interval. The second PET session followed identical imaging procedures. However, during the second session, capsaicin was applied, and the participant played a series of randomized attention-engaging video games in order to allow observation of the effects of distraction on pain ratings. Extra monetary incentives were provided for achieving higher scores, thereby engaging maximum levels of attention. Computerized ratings were again obtained. A series of post-testing Pain Catastrophizing Scale (PCS) questions were given at the end of each session to determine the extent of the participants' negative view of the painful experience. Additionally, in both sessions, the areas of secondary hyperalgesia and flare on the hand resulting from the capsaicin cream were recorded and measured using a Planix planometer.

Results

Because research is ongoing, there are not yet significant results. However, it is expected that the most active brain regions will include the periaqueductal gray area and the anterior cingulate cortex, which have high densities of endogenous opioid receptors. The behavioral analgesic effects produced by distraction

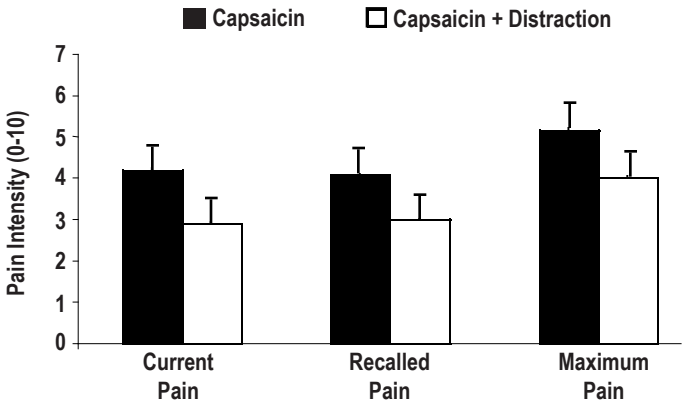

Figure 1: Pain ratings during an undistracted session of capsaicin & during a session involving simultaneous capsaicin treatment and video game playing.

are hypothesized to result from the binding of these opioids. Likewise, ^{11}C-carfentanil, a ligand-based radioactive drug used for PET imaging, binds to opioid receptors. Thus, during the pain only PET session, regions dense in our in opioid receptors should show greater ^{11}C-carfentanil binding potential. With little binding of endogenous opioids, carfentanil will be more effective in binding to these opioid receptors. In the combined PET session, during which participants perform the distracter task simultaneously with the noxious stimulus, it is expected that distraction will result in a decrease in binding of ^{11}C-carfentanil to opioid receptors. This effect can be attributed to an increase in endogenous opioid receptor binding. Endogenous opioids would compete with and prevent the binding of ^{11}C-carfentanil, indicating that endogenous opioids are responsible for the behavioral analgesic effect of distraction.

Additionally, it is expected that greater catastrophizing will result in lesser analgesic benefit from the video game distractor task. Therefore, there would be a smaller decrease in ^{11}C-carfentanil binding for high catastrophizers relative to low catastrophizers as a result of a reduced release of endogenous opioids.

Discussion

The results from the initial pilot study highlight the effectiveness of distraction using attention-requiring videogames as an efficacious behavioral analgesic strategy. This was evident in the reduction of pain ratings reported while playing videogames. As shown in Figure 1, the use of distraction as a behavioral analgesic resulted in an approximately 30-35% reduction in capsaicin pain ratings. Additionally, results from the pilot study showed that high catastrophizers not only reported higher pain ratings as a result of the capsaicin cream but also experienced a reduced behavioral analgesic effect from the distractor task.

Based upon this information, the current study utilizes positron emission tomography (PET) to elucidate the specific brain regions active during distraction and to identify whether endogenous opioid activity produces the observed analgesic effect. Although the results are forthcoming, it is likely that endogenous opioid release and receptor binding in the brain as a result of distractor or other attention-engaging tasks are largely responsible for the decrease in nociceptive somatosensation resulting from capsaicin.

Further research is required to fully elucidate the mechanism responsible for the behavioral analgesic effects of distraction. Therefore, another study utilizing naloxone, an opioid receptor antagonist, will be performed to confirm the analgesic effects of endogenous opioids. This study is designed to determine the degree to which the blockade of endogenous opioid receptors reduces the analgesic effects of distraction. Using a comparable set-up as the pilot study, subjects will participate in four sessions, two capsaicin sessions and two capsaicin/distraction sessions in randomized order. In one capsaicin alone session and one capsaicin/distraction session, subjects will be administered naloxone. In the other two sessions, saline will be used as a control. It is hypothesized that with the administration of naloxone, the analgesic effects of the video game distractor task on capsaicin will not be observed due to the inhibition of endogenous opioid receptors in the brain.

Overall, identification of the precise role that the opioid system plays in the analgesic effect of distraction could further current knowledge of mind-brain interactions in the context of both acute and chronic pain. And, furthering our understanding of the role of catastrophizing in this process may help target psychosocial interventions intended to alleviate chronic pain. With the goal of developing improved intervention strategies and clinical applications, it may be possible to decrease the negative impact and burden of the chronic pain epidemic on our health care system, while at the same time increasing the overall quality of life of millions of individuals across the globe.

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RESEARCH

The Effectiveness of *Trans*-Fat Labeling

Evaluating the Impact of Including *Trans*-Fat Information on Nutritional Labels

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Introduction

In 2003, the Food and Drug Administration (FDA) amended its nutrition labeling regulations to address the burgeoning scientific evidence that links dietary intake of *trans*-fatty acids to coronary heart disease (CHD). The new regulation, which took effect January 1, 2006, requires *trans*-fat content to be included on the Nutrition Facts panel of conventional foods and dietary supplements. By mandating thorough transparency of all heart-unhealthy fatty acids in foods, the FDA provided more accurate information for consumers to conduct product comparisons. Failure to provide appropriate guidelines for *trans*-fat intake on the new label, however, limits the regulation's effectiveness based upon the consumer's nutritional knowledge. Nonetheless, the new label encourages manufacturers to reformulate their products in a healthier manner. By influencing *trans*-fat consumption from the supply level, this regulation potentially alters the nutrition of consumers and lowers the public health burden of CHD.

Nutritional Problem

Trans-fatty acids are formed from the partial hydrogenation of vegetable oil. They were first widely used in processed foods during the 1960s, when public health professionals looked unfavorably upon saturated fats and tropical oil consumption due to established cardiovascular effects. As manufacturers looked at alternatives, they found *trans*-fats to be cheap, accessible, and effective in increasing flavor stability and product shelf life. Thus, this practical option replaced saturated fats in the American diet. By 1989, the average daily intake of *trans*-fat in the US population was about 5.3 grams (2.6 percent of calories per day) for individuals three years of age and older.[1] This was approximately four to five times the amount of saturated fats consumed.[2] Figure 1 displays the distribution of *trans*-fat in

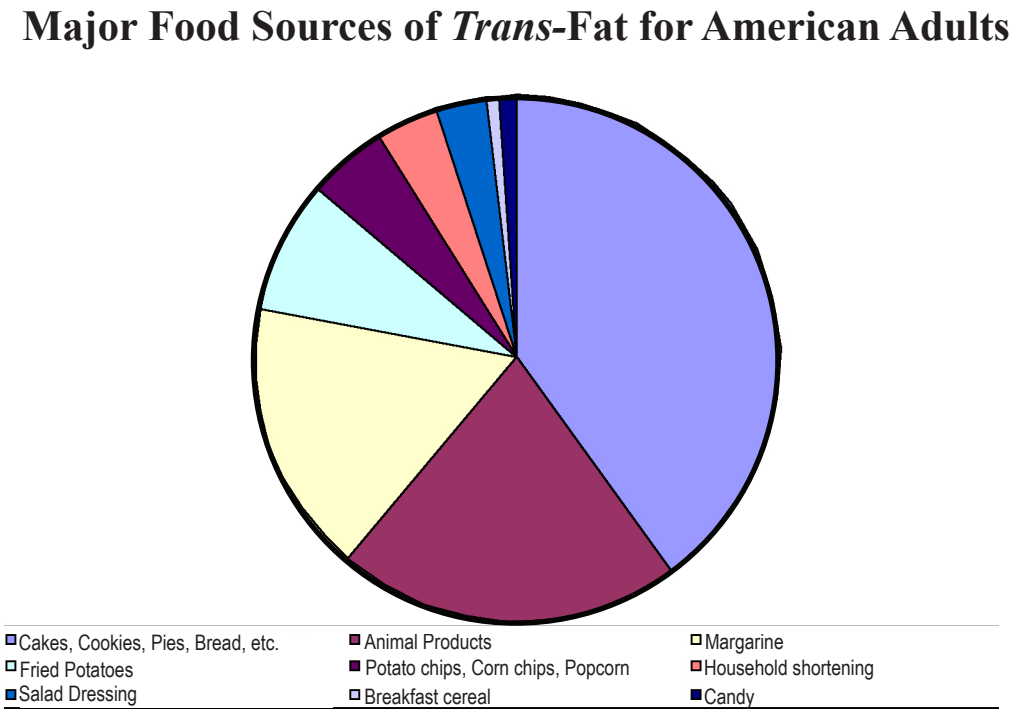

Figure 1: Using data based on FDA's economic analysis published in the article titled "*Trans*-Fatty Acids in Nutrition Labeling, Nutrient Content Claims, and Health Claims" (July 11, 2003), this graph illustrates the distribution of *trans*-fat in the American diet.[3]

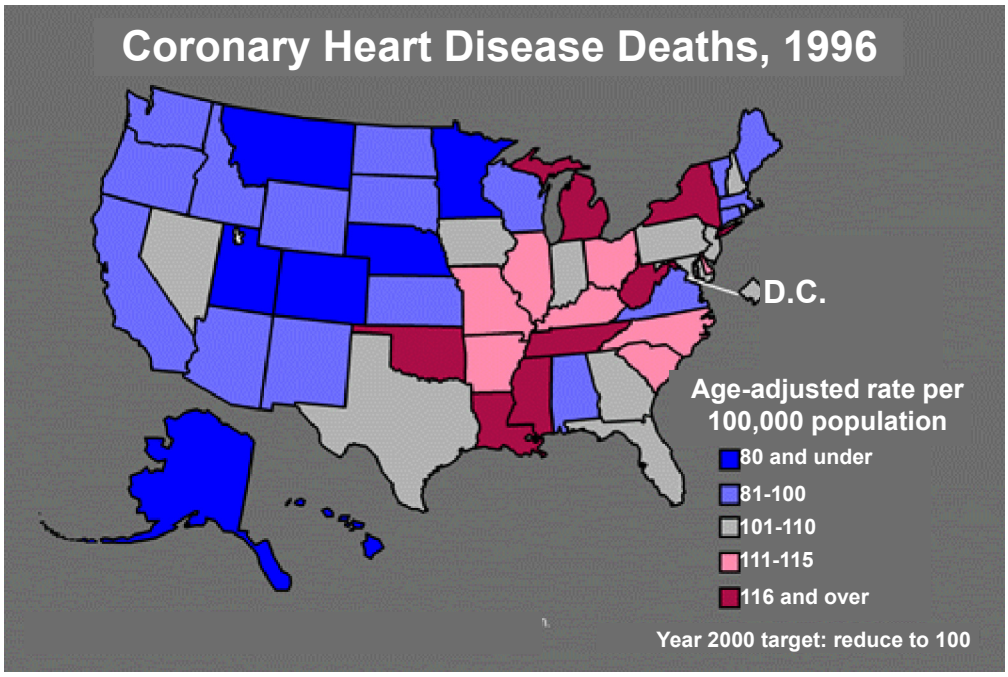

Figure 2: United States Coronary Heart Disease Death Patterns in 1996[9]

the typical American diet by 2003.[3] Later scientific evidence, however, demonstrated that *trans*-fat, like saturated fats, was associated with increased low-density lipoprotein (LDL) or "bad" cholesterol. Furthermore, *trans*-fat alone was linked to reduced high-density lipoprotein (HDL) or "good" cholesterol.[4] As a result of this unfavorable cholesterol ratio, a leading risk factor of hardened and narrowed arteries, *trans*-fat has been claimed to increase coronary heart disease (CHD) "more than any other macronutrient."[5]

Coronary heart disease (CHD) refers to the condition where coronary circulation is limited to the heart muscle due to plaque blockages, which are often made of cholesterol.[6] The resulting decreased oxygen supply often results in angina, myocardial infarctions and weakened heart muscles that may contribute to arrhythmias and heart failure. CHD has been the most common type of cardiovascular disease (CVD) and the leading cause of death in the United States through most of the 20th century and the 21st centuries.[7] While blacks generally have higher mortality rates due to CHD than whites, males have higher mortality rates due to CHD than females.[8] Southeast states also have higher mortality rates than northwest states (Figure 2).[9] In 2004, 15.8 million people had CHD, 7.9 million presented with a myocardial infarction (MI), and 8.9 million presented with angina pectoris.[8] The economic burden of CHD was more than several hundred billion dollars in health care services, medications, and lost productivity.[8]

Policy

In response to the rising prevalence of CHD and possibly dramatic consequences of prolonged *trans*-fat intake, the FDA enacted the Code of Federal Regulations Title 21, Part 101 in 2003, which required the nutrition labeling of *trans*-fatty acids present in foods, including dietary supplements by January 2006.[3] This declaration was to be printed on a separate line immediately under the line indicating the content of saturated fats in the food product (Figure 3).[10]

Context

When the nutrition label was originally created through the Nutrition Labeling and Education Act (NLEA) of 1990, evidence regarding the health effects of *trans*-fatty acids was contradictory. Such variations were due to varying background diets, fatty acid profiles, degree and type of hydrogenated oils, and poor comparison of fats.[11] Concerned about prematurely including misguiding evidence on labels, FDA chose to only include total fats and saturated fats because they had already established risks.[3] A few months after the NLEA activation, however, Mensick and Katan published convincing evidence that *trans*-fatty acids raised LDL and also raises HDL cholesterol levels. A few months after the NLEA activation, however, Mensick and Katan published convincing evidence that *trans*-fatty acids raised LDL and also raises HDL cholesterol levels.[12] Multiple subsequent research studies further supported this association.[13-20] By 1994, *trans*-fat was a recognized risk factor for CHD. The Center of Science for the Public Interest (CSPI) reacted to the new evidence and petitioned for a change in the label on February 14, 1994.

Figure 3: Example of New Label[10]

Nutrition Facts

Serving Size 1 cup (228 g)
Servings Per Container 2

Amount per serving

Calories 260	Calories from Fat 120
	% Daily Value*
Total Fat 13g	**20%**
Saturated Fat 5g	**25%**
Trans Fat 2g	
Cholesterol 30mg	**10%**
Sodium 660mg	**28%**
Total Carbohydrate 31g	**10%**
Dietary Fiber 0g	**0%**
Sugars 5g	
Protein 5g	

Vitamin A 4% • Vitamin C 2%
Calcium 15% • Iron 4%

* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400 mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

The economic burden of CHD was more than several hundred billion dollars in health care services, medications, and lost productivity.[8]

The organization requested that the FDA amend food labels based on revised saturated fat definitions and group saturated fats with *trans*-fat due to their similar adverse cardiovascular effects. [3]

In response, the FDA issued a proposed NLEA amendment to mandate *trans*-fatty acids content (amount in grams) disclosure in nutrition labels separately. They also proposed to include the percent daily value (percent DV) value with an attached warning footnote below the nutrition facts box, stating "Intake of *trans*-fat should be as low as possible."[3]

Consumers, consumer advocacy organizations, health care professionals, and governments have generally supported these FDA amendments.[21-25] Impact analysis estimated that the amendment could prevent 600 to 1,200 cases of CHD after three years of enactment.[3] In addition to improving the cardiovascular health among US consumers, the proposal showed promise in decreasing the burden of health care costs. Preventing these heart attacks was valued at 4.1 billion dollars per year.[3] The FDA report also estimated that 200 to 500 deaths would be prevented each year.[3] Thus, this mandate appeared to effectively promote public health.

However, organizations like the Grocery Manufacturers Association (GMA), the world's largest association of food, beverage and consumer products companies, attempted to defer these label changes. While claiming to welcome quantitative labeling of *trans*-fat, they argued for time extensions to file comments that were vehemently against the percent DV and footnote addition.[26,27] The GMA stated in their comment to the FDA that compelling commercial speech through footnotes violated the first amendment.[26] In addition, the GMA contended that that "dramatic" messages could cause negative impressions of *trans*-fats.[26,27] Without feasible alternatives for companies to eliminate the consumption of *trans*-fat in a normal diet, they feared that manufacturers would be steered toward saturated fat rather than healthier oils. Figure 4 was included in one of the GMA comments to exemplify such cases. In this company's attempt at lowering *trans*-fat content, the stick margarine's saturated fat substantially increased.[26] Without sufficient evidence of the daily reference intake, the GMA speculated that the label change would cause malnutrition among the health-conscious who may avoid nutrient-rich foods because of their seemingly high *trans*-fat content.

Although food industrial associations like the GMA seem to have consumers' best interests at heart, there are enormous, competing economic incentives to motivate their disapproval of FDA label changes. The cost of changing the labels of approximately 78,000 food products and dietary supplements was estimated to be about $205 million dollars.[3] In addition, it was feared that explicit inclusion of percent DV and the footnote could bring an unhealthy stigma upon their products. Especially because the recommended DV's for *trans*-fat was low, values of ≥ 100 percent DV may appear. Combined with the footnote, even the less health-conscious consumers would avoid the product.

In 2003, the FDA withdrew the footnote and percent DV due to the lack of evidence supporting a specific quantitative value for daily *trans*-fat intake in a normal diet. However, because even low amounts of *trans*-fat may substantially increase an individual's risk of CHD, the additional *trans*-fat labeling line on the Nutrition Facts Panel continued to be warranted.

Implementation

The campaign to include *trans*-fat on the nutrition facts panel lasted approximately 12 years from the CSPI Petition in 1994, to the final enactment in 2006. Compared to the enactment of the NLEA, which established the entire label in nine years, he process of developing this amendment took unusually long. Even with the NLEA clause, which reserved the right of adding or deleting nutrients on the food label to the Secretary of Health and Human Services, he or she must first establish that the change was "necessary to maintain healthy dietary practices."[3] For this specific amendment, nine of the twelve years was spent compiling the research to prove such a necessity. In 1999, the FDA had to withhold finalization so they could consider the 2001 Report of National Cholesterol Education Program from the Institute of Medicine, National Academy of Sciences, and 2000 Dietary Guidelines.[28] After consideration, the FDA synthesized the research with different lobbyists' comments from two comment periods and made their final ruling. The last three years allowed companies to print new labels. Thus, the time for the entire process was justified.

By January 1, 2006, all manufactured food products and supplements had new nutrition labels that exposed the products' *trans*-fat contents. There were some products still on the shelf with old labels, but only due to the lag time from the distribution chain. Additionally, legislation enforcement discretion was granted to products that had < 0.5 grams of *trans*-fat per serving.[2] Based on current evidence, the influence of the new label change in directly guiding consumer consumption practices is debatable. The FDA had projected a mere 1 percent decrease in *trans*-fat intake as a result of *trans*-fat labeling.[3,29] Kim et al., however, reported that labeling was effective at least in

Figure 4: Nutrition Panels Before and After the Reformulation of Stick Margarine to Lower Trans-Fat Levels[26]
Left: Current Formula of Stick Margarine
Right: New Formula of Stick Margarine

Nutrition Facts

Serving Size 1 tbsp (14g)
Servings per Container

Amount Per Serving	
Calories 100	Calories from Fat 100
	% Daily Value*
Total Fat 11 g	**17%**
Saturated Fat 2 g	10%
Trans Fat 1.5 g	
Polyunsaturated Fat 4 g	
Monounsaturated Fat 3.5 g	
Cholesterol 0 mg	**0%**
Sodium 115 mg	**5%**
Total Carbohydrate 0 g	**0%**
Protein 0 g	**0%**
Vitamin A 10% (30% as Beta Carotene)	
Vitamin D 15%	
Not a significant source of Dietary Fiber, Sugars, Vitamin C, Calcium and Iron	
*Percent Daily Values (DV) are based on a 2,000 calorie diet	

Nutrition Facts

Serving Size 1 tbsp (14g)
Servings per Container

Amount Per Serving	
Calories 100	Calories from Fat 100
	% Daily Value*
Total Fat 11 g	**17%**
Saturated Fat 5 g	25%
Trans Fat 0g	
Polyunsaturated Fat 4.5 g	
Monounsaturated Fat 2 g	
Cholesterol 0 mg	**0%**
Sodium 115 mg	**5%**
Total Carbohydrate 0 g	**0%**
Protein 0 g	**0%**
Vitamin A 10% (30% as Beta Carotene)	
Vitamin D 15%	
Not a significant source of Dietary Fiber, Sugars, Vitamin C, Calcium and Iron	
*Percent Daily Values (DV) are based on a 2,000 calorie diet	

guiding saturated fat intake.[30] They found an overall 11 percent decrease in saturated fat intake because of nutrition labeling alone.[30]

Despite the inconsistent findings of estimated direct consumer impact, media coverage of the food industry's reactions to the amendments increased awareness of *trans*-fat. Many began to call the consumption of *trans*-fat-free products a "fad."[31] Evidence of this fad gushed from headlines like "Yes, Deep-Fried Oreos, but Not in Trans-fat."[32] An online consumer research survey conducted in spring 2006 by the American Heart Association from a sample of 1,000 adults aged 18-65 indicated that 84 percent of respondents had heard of *trans* fat.[11]

Unfortunately, awareness did not necessarily correlate with understanding. Half of those interviewed did not know the adverse health effects of *trans*-fat and fewer than half could identify foods that typically contained *trans*-fat.[11] Without the dietary guidelines once proposed through the footnote, the intended benefits of the label were limited by consumer education. Because *trans*-fat was associated with CHD risk, which tended to be higher among those with lower socioeconomic status and education, the ultimate effectiveness of the amendment on modifying direct consumer practices could be low.

Even so, the amendment served as a catalyst for many companies to look for oil alternatives with less or no *trans*-fat.[33] Companies, such as Kellogg and Frito Lays, found soybean oil and corn oil, respectively, as a *trans*-fat substitute.[11,33,34] Similar reformulations to "no *trans*-fat" increased product sales to around 12 percent for many companies.[35] However, reformulation did not occur without trade-offs as the new oil supply became much less stable and their shelf life shorter. Other companies chose *trans*-fat-free substitutes like tropical oils like palm and coconut oil, which introduced high levels of saturated fats back into the American diet.[26,27]

Evaluation

The FDA performed an extremely thorough evaluation of the policy throughout its development. A regulatory impact analysis and flexibility analysis, included in the final rule, considered the economic effects in each industry and quantified the estimated lives affected. Further investigations, however, are required to determine the accuracy of these conjectures. To evaluate the true impact of the amendment, FDA must weigh the actual reformulation, labeling, and testing costs against the observed health care and productivity savings. No such investigations have yet been planned. Nevertheless, individual researchers could detect the amendment's effectiveness by monitoring consumption of *trans*-fat intake and CHD incidence through existing sources like National Health and Nutrition Examination Survey (NHANES). It should be noted that attributing health outcomes to the amendment would probably be impossible due to competing public health initiatives to decrease CHD incidence. However, these surveys, at the very least, are adequate tools to monitor *trans*-fat consumption practices.

The FDA had projected a mere 1 percent decrease in trans-fat intake as a result of *trans*-fat labeling.[3,29]

Conclusion and Recommendations

While the direct benefits of the *trans*-fat labeling amendment are questionable due to their dependence on consumer education and compliance, the reformulations that were undertaken due to this new regulation can allow the FDA to achieve its goal in reducing CHD incidence. Guiding Americans to maintain healthy dietary practices, however, will require additional research to promote the quantification of an appropriate *trans*-fat percent DV intake. Regulations will also need to be considered to allow the inclusion of dietary advice on the Nutrition Panel. A simpler, possibly pictorial, system should be devised to make product comparisons more accessible to the less educated. In addition, based upon the increased frequency of Americans dining out, the FDA should consider expanding its regulation to restaurants. If the FDA is able to better control *trans*-fat production and communicate effectively healthy dietary practices, the amendment could further decrease CHD risk and health care costs.

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Image courtesy of Halshka Graczyk

A Study of Rumors:
Qualitative Evidence on Patterns of Human Trafficking in Costa Rica

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Introduction

On July 26, 2007, Costa Rica's Vice Minister of Governance and Police Ana Durán called for the implementation of protocols for intervention in different public institutions dealing with human trafficking. Describing human trafficking as an international crime of drastic proportions, Durán mentioned that 12.3 million people are in situations of forced labor and trafficking, according to an estimate published by the International Labor Organization.[1] Durán also pointed out that other estimates of the number of people affected by human trafficking range from four to 27 million individuals, an immense difference that can only be explained after examining extremely nuanced data presented in this research. Although Durán's intention was to mobilize the citizens of Costa Rica to recognize the magnitude of the problem of human trafficking, her statement did more to raise questions about the prevalence and characteristics of this clandestine enterprise.

Human trafficking is by no means a novel phenomenon, but the field of research investigating its causes, forms, and consequences is relatively new. According to Noor Denkers, an official of the International Labor Organization Project for the Eradication of Child Labor (ILO-IPEC) in Costa Rica, anti-trafficking organizations are all "operating on rumors" Indeed, UNESCO has developed a Trafficking Statistics Project, which is entirely devoted to tracing the origins of the widely disparate estimates about trafficking (Figure 1). According to its meta-analysis of the most commonly referenced trafficking statements, many estimates on the prevalence of trafficking are extrapolations based on methodology that does not accurately characterize the modes in which trafficked persons move. UNESCO notes that these numbers "take on a life of their own, gaining acceptance through repetition, often with little inquiry into their derivations".[2] Despite the lack of reliable data to characterize the problem, misleading numbers continue to permeate reports on trafficking.

Unfortunately, the reality in the field of study of irregular migration and the underground economy is that the collection of accurate quantitative data is limited by several factors. Because definitions of trafficking and corresponding legislative policies vary widely from country to country, data collection and information sharing is ad hoc rather than systematic. In most countries there are no centralized agencies that act as overseers of such data collection, so individual agencies gather information that suits their own agendas.[3] For example, an agency with a religious mandate to eradicate prostitution may focus data collection on cases of human trafficking for purposes of sexual exploitation, while disregarding other forms of labor exploitation. Morals simply state that such an agency may design its service provisions specifically with the aim of helping women to leave a life of prostitution. On the other hand, governmental agencies may be more concerned with the number of prosecutions of traffickers, and thus may be more inclined to focus on hard statistics of cases opened and convictions. Such a stance may be less concerned with the interpersonal and psycho-social needs of victims except when relevant to their criminal proceedings.[3]

Conflicts between research methodology and ethical concerns for the safety and confidentiality of victims may also impede the collection of reliable quantitative data on trafficking, making randomized sampling difficult. These challenges, in turn, hinder the validity and generalizability of studies on trafficking. Access to first-person experiences is extremely limited, and participation of victims who are currently in a trafficking situation is almost impossible to obtain. The few quantitative studies that have attempted to characterize patterns between victims' experiences with trafficking are plagued by steep drop-out rates because there are few incentives for victims to remain in studies over time. Often victims return home or simply cease recalling the trauma they have experienced.[4] Since there are such vast limitations to systematic research on this clandestine phenomenon, what can anecdotal qualitative evidence offer to the study of human trafficking?

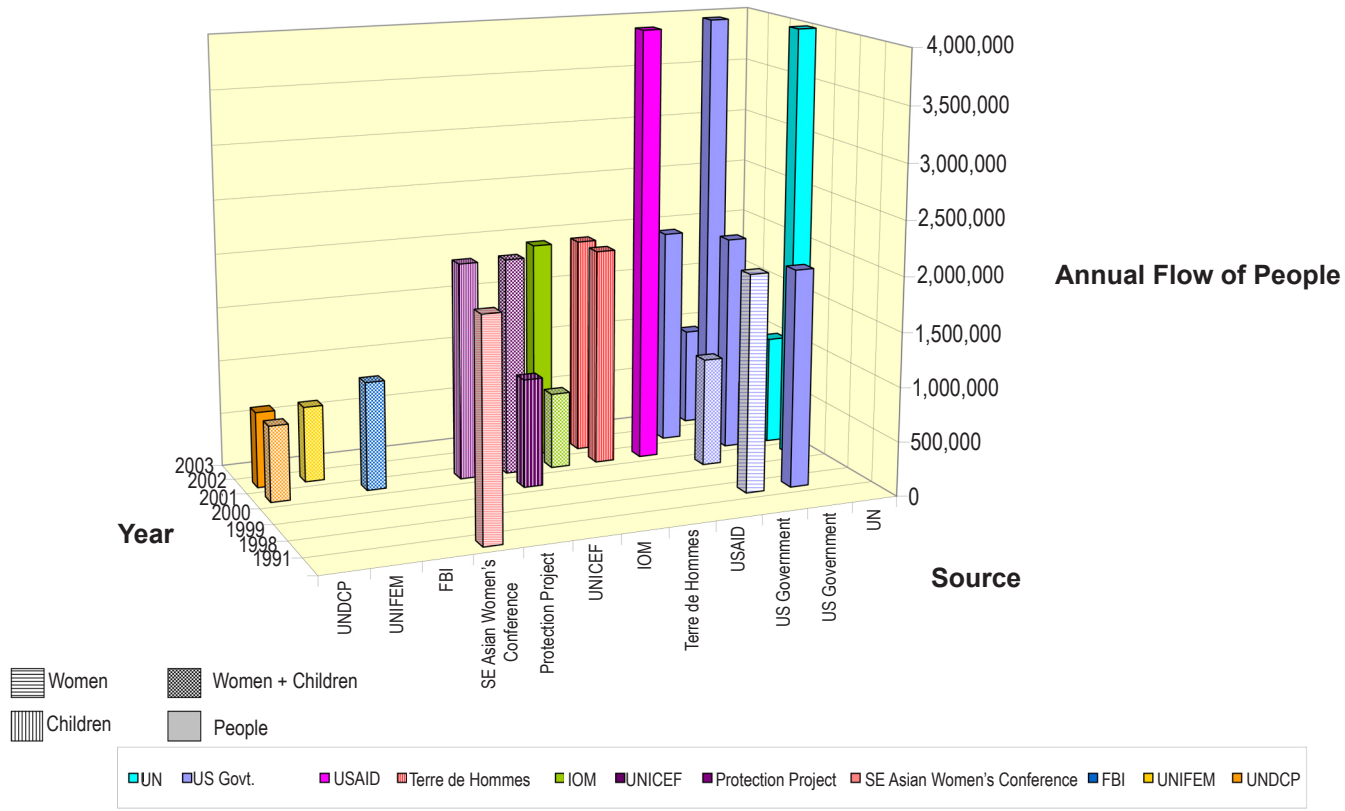
First, it is beneficial to assess the positions of "experts" in various sectors of trafficking to evaluate the level of congruence within the field. This study will demonstrate that the positions of experts on trafficking vary widely on the origins and appropriate responses to traf-

"Young people are traveling to the United States and Europe. It's very easy to get trapped in trafficking networks."

Nidia Zúñiga, International Labor Organization Project to Eradicate Child Labor
July 29, 2008

Factsheet #1
Worldwide Trafficking Estimates by Organizations

Figures cited by or attributed to various organizations regarding the annual flow of trafficked people worldwide.
(date compiled on June 2004)



Above: Figure 1[2]

ficking. This is not to say that their opinions are of no value, but rather that researchers and service providers tend to adopt positions on trafficking that serve their professional needs and the needs of their clients. When assessing qualitative evidence, the researcher must be aware of the possibility that opinions put forth by informants may be interlaced with unsubstantiated facts and estimates. The anecdotal evidence put forth by service providers, policy analysts, and governmental workers does not become irrelevant if discrepancies are encountered. On the contrary, only through addressing these discrepancies can we begin to decipher why there are so many limitations in this field of research. Second, the lack of accurate statistical data on human trafficking necessitates the involvement of trafficked persons in offering "data" relevant to their personal experiences. An important way to improve strategies for the prevention of trafficking and for the protection of the rights of victims is to directly approach these individuals about challenges they faced and involve them in the search for solutions.

This project seeks to add to the discovery of knowledge on the country, community, and organizational factors shaping contemporary human trafficking, with a focus on transnational flows. Although this study is part of a larger project on trafficking connections between Latin America and Europe, the results and analysis in this report are limited to fieldwork conducted in San José, Costa Rica during July and August 2008. Costa Rica was chosen as a study site due to its classification as a source, transit, and destination country for human trafficking, primarily receiving victims from other developing countries in Latin America and sending victims to the United States and Western Europe for purposes of commercial sexual exploitation.[5] Conclusions and final recommendations on further research on human trafficking will be presented based on the analysis of qualitative interviews with researchers, service providers, and public officials working to combat human trafficking in Costa Rica.

Methodology

The study begins with an overview of the current debate on human trafficking to provide a conceptual framework of the factors that contribute to the transnational trend. The study design involves in-depth interviews (one hour or more) with ten organizational leaders and service providers working with trafficked persons in San José, Costa Rica who were identified by researchers as key informants. A standard interview protocol and written consent form were utilized in all interviews. Both forms were available in English and Spanish, and informants were provided with a copy of all consent documentation. Additional follow-up questions were used to gain information about organization-specific projects and intervention services. Fundación Rahab also provided a tour of a vocational training school and a child-care center in construction for former victims of trafficking for sexual purposes.

Unfortunately, interviews with victims were not permitted in this study due to restrictions imposed by the Homewood Institutional Review Board of the Johns Hopkins University due to concerns over confidentiality and risks for victims. Nonetheless, case study information about specific victims' experiences was drawn from secondary and tertiary sources including informant interviews in service agencies and newspaper articles. In addition to

utilizing data from interviews with organizational contacts, this study references information provided by anti-trafficking organizations to obtain supporting evidence to flesh out the country narrative of Costa Rica. This information was also used to understand what efforts are being made to bolster prevention, monitoring and prosecution of human trafficking.

Conceptualizing Human Trafficking

Dr. Penelope Saunders, former Executive Director of Different Avenues, a non-governmental organization in Washington D.C. that provides healthcare to marginalized populations, delineates between three main positions within the current trafficking debate.[6] The first and perhaps the most widely recognized is the abolitionist stance held by groups such as the Coalition Against Trafficking of Women (CATW) which portrays prostitution as the root of the human trafficking problem. The language utilized by these groups is often heavily laden with a sense of moral responsibility to "save" or "rescue" women from the evils of prostitution. Groups such as CATW often describe human trafficking as a form of modern-day slavery.

Non-abolitionist groups such as the Global Alliance Against Trafficking in Women (GAATW) define trafficking more broadly to include all forms of labor exploitation rather than focusing exclusively on forced prostitution. Non-abolitionists recognize sex work as a form of labor – governed by the laws of each nation – but oppose abuse and coercion within the sex industry as they oppose exploitation in all other labor sectors.

Groups such as CATW often describe human trafficking as a form of modern-day slavery.

The third and most radical position comes from sex workers unions such as the Network of Sex Work Projects (NSWP) who critique the very basis of the trafficking debate by questioning the motives of anti-trafficking advocates. For example, the NSWP claims that the historical basis for the anti-trafficking debate has centered more on "protecting 'innocent' women from becoming prostitutes than on ensuring the human rights of those in the sex industry".[6] The NSWP is strongly opposed to the depiction of human trafficking put forth by abolitionists as a form of modern-day slavery.

The most commonly referenced definition of human trafficking was established in 2000, in the Palermo Protocol, more widely known as the *United Nations Protocol to Prevent, Suppress, and Punish Trafficking in Persons, Especially Women and Children, Supplementing the United Nations Convention Against Transnational Organized Crime.* The UN protocol emphasizes that human trafficking is an act of transporting or receiving an individual for purposes of exploitation, which may take many forms. Some of the forms highlighted in the protocol include forced prostitution, domestic servitude, slavery-like practices, and organ harvesting. The protocol also emphasizes that the consent of the individual being trafficked cannot be used as a justification for exploitation. This distinction blurs the line between smuggling and trafficking and allows for a wider application of the term "trafficking".[7]

For purposes of this study, I take a non-abolitionist position on human trafficking, acknowledging that forced prostitution is a common form of labor exploitation, but is certainly not the only form. I will describe human trafficking as a violation of human rights characterized by exploitation, which may manifest itself in many ways. Because the human trafficking debate tends to focus on sexual exploitation, the everyday abuses of migrants in sectors such as agriculture, domestic service, and manufacturing have largely been ignored. Nonetheless, the vast majority of service providers and policy groups interviewed for this project agree that trafficking for purposes of sexual exploitation is the most common form of trafficking in Costa Rica, and the number of women affected far outpaces the number of men. As a result, the implications discussed in this report will focus principally on the experiences of victims of sexual exploitation. This is not to suggest that I personally believe that trafficking research should focus on this subset of victims, but rather because these are the individuals most commonly encountered in the service sector in Costa Rica, the setting in which this study was conducted.

Results

In-depth interviews (one hour or more) were conducted with ten organizational leaders in San José: Rocio Rodriguez and Adriana Guevera of Alianza Por Tus Derechos, Milena Grillo and Ivania Monge of Fundación Paniamor, Noor Denkers and Nidia Zúñiga of the International Labor Organization Project for the Eradication of Child Labor (OIT-IPEC), Ana Salvado of Save the Children, Agueda Marin of the International Organization for Migration (IOM), Mariliana Morales of Fundación Rahab, and Cheryl Neely of the U.S. Embassy in Costa Rica. Email communication was also utilized to acquire data from Nora Bruna of Defense of Children International and follow-up information on case studies from Rodriquez and Marin.

Information on the demographic profiles of victims trafficked to, through, or out of Costa Rica was provided by the representatives from the local Costa Rican organizations. Neely only provided information on the role of U.S. Embassies in each nation of the world to provide supervision of anti-trafficking programs that are sponsored by the U.S. State Department. In addition, she provided information on the role of the Embassies in drafting country narratives for the annual Trafficking in Persons Reports.[5]

All informants agree that human trafficking in Costa Rica disproportionately affects women, and that the ratio of women to men involved in trafficking for sexual purposes is even more skewed. Denkers and Zuniga estimate that the percentage of women trafficked for sexual purposes is as high as 95 percent of victims, and that the average age of initiation into networks of trafficking reported by informants was 12 years old. Little information was known about racial or ethnic vulnerabilities, although several informants mentioned nationality as a vulnerability factor noting that Nicaraguans and Dominicans are particularly susceptible. There was also very little known about the average length of time individuals tend to be held by captors in a situation of trafficking.

The most commonly reported countries of origin for victims in Costa Rica varied widely between interviews. The most widely referenced sending countries were the Dominican Republic (7), Nicaragua (7), and Colombia (4). Several also mentioned the issue of internal trafficking throughout Costa Rica, particularly from rural areas to tourist hot spots on the coasts and the metropolitan area of San José. Honduras, El Salvador, Guatemala, Ecuador, Panama, Mexico, Romania, and Uzbekistan were also mentioned by informants as origincountries for victims of trafficking in Costa Rica. There was a great variety in responses to this question, displaying a lack of information sharing between agencies. While officials from IOM and ILO-IPEC both referenced a study conducted by Fundación Paniamor on the origins of victims in Costa Rica, many of the other

agencies had information from vastly different sources, such as international studies or their own internal records. It is unclear whether this reporting is based on the demographic backgrounds of clients served specifically at each agency or data from national statistics. Many commented that there is a lack of data at the national level due to loopholes in the penal code that do not define internal trafficking as a form of trafficking. Thus, these crime statistics are recorded under lesser offenses such as kidnapping or transporting a minor.[8] Note: New legislation to include internal trafficking in the national definition of human trafficking was passed by the Costa Rican National Assembly in February 2008 after the conclusion of this project .

The most commonly reported countries of destination for victims of trafficking in Costa Rica were more consistent across the board. These countries were the United States (6), Mexico (4), Spain (3), and Japan (3). Holland and Canada were also mentioned by one informant each. Many mentioned regions, such as Central America and Europe, without highlighting specific countries. This preference for broad categories could be a result of gaps in international data sharing or because these individuals were trafficked through several countries within the same region.

Many other factors of victims' experiences were discussed in interviews with informants, as well as services provided by each agency and the informants' opinions about what actions are necessary to improve prevention, public awareness, and victim protection. These responses varied widely from interview to interview. Common vulnerability factors leading to trafficking included poverty, a history of family violence in the home, and lack of economic and educational opportunities. All informants agree that debt bondage is a common threat used to keep victims trapped, as are physical threats and threats to harm family members of the victims in the country of origin. Informants disagree on the most pressing needs for victims of trafficking upon entering the service setting; some mentioned health care, while others mentioned housing or material assistance.

Discussion

The results encountered in informant interviews demonstrate patterns as well as inconsistencies. The divergent responses of informants confirms the hypothesis that even experts in the field are not in agreement about the major sources of trafficking and the most pressing needs for victims assistance. Additionally, information provided about demographics of trafficking tend to reflect the clientele of each individual's agency, although this may not be in proportion to the actual demographics of trafficked persons in San José, much less the region of Central America in general. It is difficult to make any broad assumptions about the state of trafficking in Costa Rica based on such a small sample of interviews and limited observation of NGO facilities. Nonetheless, certain questions may be highlighted to show commonalities and discrepancies between respondents.

Two conclusions can be drawn from the information provided by informants on proportion of women to men affected by human trafficking. First, one might take the informants' statements at face value and assume that human trafficking is a severe form of gender-based violence that disproportionately affects women. Second, it can be concluded that there are limited services available for victims of other forms of human trafficking, particularly men in situations of forced labor. This too would be a reasonable assumption to make, as several of the organizations interviewed did not even offer services for victims who had not experienced sexual exploitation. Likewise, several of the agencies only provided services to minors, and this population is assumed to be more likely to suffer sexual exploitation as opposed to other forms of labor exploitation. This is in line with discourse that prioritizes sexual exploitation as the major form of human trafficking at the expense of all other forms.

The information on most common countries of origin for victims of trafficking in Costa Rica is highly instructive due to its wide breadth. Although several countries were repeatedly mentioned, many informants also listed at least one country that was not referenced by any other informants. The incongruence between informants on countries of origin demonstrates the complexity of mapping routes of trafficking, particularly across continents.

As per Grillo and Monge, Fundación Paniamor along with Save the Children has pioneered the use of "Mapping Crime Methodology" to characterize clandestine criminal behavior and patterns of trafficking of children for sexual purposes. By calling on key informants and working with law enforcement in vulnerable areas such as Guanacaste, Limón, and Jacó, the two agencies have jointly produced a series of maps. The patterns of trafficking on the maps are stratified by variables such as gender, type of trafficking, child vs. adult populations, as well as related phenomena such as concentrations of commercial sexual exploitation of children (CSEC) reports and sex tourism. The results of this collaborative effort led to the launch of the Latin American Network of Missing Persons Database, implemented to track cases of "desaparecidos" (the disappeared), in particular missing children. According to Grillo and Salvado, this methodology should provide all of the common routes of trafficking throughout the country within four years of implementation. Despite the success of this project – which has been in effect since 2005 – there is a sense that the traffickers are becoming increasingly sophisticated and tend to adapt to new movement patterns more rapidly than researchers can discover new routes, making this mapping technique continually outdated.

Salvada explains that the maps are used for investigative purposes within the police force and are not available to the public in Costa Rica. Similar projects have been implemented in other Latin American countries such as Nicaragua, where the maps are used for public awareness campaigns to notify the public of areas known to harbor trafficking rings. Because this initiative is based in the civil society sector and each country can decide how to use the results, there are many limitations on information sharing, which is crucial for combating transnational trafficking. This also has major implications for intervention, since transnational coordination is necessary to effectively reintegrate victims of trafficking, particularly in repatriation cases. With such a wide variety of possible origins and an ever-changing landscape of fluid populations, it is vital that international – as well as national – mechanisms for treatment referrals and and case management services be implemented. Long-term follow-up is virtually impossible without international and regional cooperation.

Information on the most common age of entry into trafficking was particularly disturbing: the common perception among organizations is that the trafficking problem in Costa Rica is of major concern for the country's children. Guevera and Rodriguez comment that Costa Rica is a country with a thriving sex tourism industry, and minors are often entangled in trafficking networks that are able to cavort with hotels and businesses to hide the trade. Luckily, Fundación Paniamor and the World Tourism Organization (WTO) have taken strides to implement an anti-trafficking Code of Conduct among hotels in tourist areas. Industries who sign onto the Code of Conduct are able to list this certification in order present an image that they are committed to the fight to end human trafficking and child sex tourism. While the Code of Conduct has seen significant suc-

cess, as indicated by Grillo, there remain limitations to its power since it is industry-based and self-regulated. Businesses found to be in violation of the Code are dismissed, but no real penal sanctions are applied.

Virtually no information was known about the average length of time that victims remain under the control of traffickers. This is particularly distressing since multiple respondents stated that victims of trafficking suffer from Stockholm Syndrome, which is a sense of attachment to one's captor for daily needs and an inability or unwillingness to escape. Denkers and Zuniga suggest that the longer an individual remains under the control of a trafficker, the less likely he or she is to leave the trafficking situation. Additionally, the recuperation time needed to adjust to "normal" life afterwards may take many years.

Multiple respondents stated that victims of trafficking suffer from Stockholm Syndrome, which is a sense of attachment to one's captor for daily needs and an inability or unwillingness to escape.

The services and policy objectives of the agencies varied greatly. No institutionalized protocol for identifying and treating victims of trafficking exists in Costa Rica, although IOM and Save the Children have published a "Guide of Psycho-social Intervention for the Direct Assistance with Victims of Human Trafficking".[9] While the guide provides comprehensive recommendations on services for victims as well as ways to reduce further re-traumatization in the service setting, it has no binding enforcement mechanism, and it is unknown whether direct service agencies even use it. What is more likely is that each agency refers individuals to a combination of NGOs and public institutions for specialized services such as housing, food, health care, psychological treatment, and legal support. This may mean that an individual would receive different services if referred to one organization rather than another. Although it appears that Costa Rica has a high level of coordination between agencies due to the geographic centralization of the major service providers in San José, it is unclear whether victims of trafficking are offered the same access to rehabilitation and reintegration services depending on which organization(s) they encounter first. Some service providers also believe that victims who cooperate with law enforcement receive additional benefits and protections not offered to victims who do not wish to prosecute their traffickers.

Conclusions

A great deal of ambiguity remains regarding the state of human trafficking in Costa Rica and the coordination of services available to victims. It appears that there is overlap in agencies that provide services to migrants and trafficking victims (IOM, ILO-IPEC), exploited children and trafficking victims (Alianza, Paniamor, ILO-IPEC, DNI, Save the Children), and sex workers and trafficking victims (Rahab). No agencies have yet been encountered that target their services specifically for victims of trafficking. Programs on trafficking are integrated into themes that are already commonly addressed within agencies such as commercial sexual exploitation of children (CSEC), sex tourism, and illegal migration.

Human trafficking remains an issue that is often relegated under the auspices of other related fields, and services for victims of trafficking may be based on protocols for related but distinct populations such as domestic violence victims, sex workers, or torture victims. While these protocols provide a basis on which to assess needs of specific types of trafficking victims, they fail to account for the wide range of trafficking forms and circumstances as well as the plethora of interconnected adverse health outcomes of trafficking victims. A protocol is needed to properly assist victims of trafficking in a service setting that is comprehensive yet flexible, recognizing that the experience of victimization is deeply personal and unique.

Much more quantitative and qualitative research is necessary to formulate a protocol that accurately addresses the needs of trafficking victims. However, researchers should be mindful of balancing psycho-social risks to victims of participating in research against the necessity for rigorous standards of validity and reliability. Human trafficking research cannot be approached without careful planning and a willingness to abandon a project, if necessary. There are grave security concerns for both the victim and researcher, as well as service providers involved in research. The drivers of this invisible, secret enterprise wish to keep it out of the public eye, and those who threaten to reveal these secrets open themselves to physical danger, in addition to to emotional and psychological threats.

Finally, researchers must value the stability and wellbeing of participants over any (perceived) need to achieve a research goal. Ethics and safety for victims of trafficking must take precedence over all other objectives, and applied research that integrates treatment intervention with data collection is preferred. It is crucial that researchers formulate new strategies for studying this unseen population. Improving methods for tracking patterns of human trafficking may limit the spread of this violent epidemic and the grave health and psychological consequences inflicted on its victims.

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Features

Rural Hygiene Practices in India:

The Implementation of a Village-Based Water Treatment System and Its Broader Governmental and Social Effects

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It was almost certainly food intolerance; maybe something in all of that ice cream and pudding from the past two weeks. Michelle's three-year-old son, Jacob, however, was now running a high fever and the diarrhea had shown little sign of abating. Should she take him to the emergency room? A few hours later, a technician at the Children's Hospital of Philadelphia was testing a stool sample from Michelle's son using a simple enzyme immunoassay. A pediatrician soon informed her that her son was infected with rotavirus. The main form of treatment, he explained, was proper symptom management: providing the child with plenty of liquids or oral rehydration fluids such as Pedialyte to replenish minerals and nutrients lost during the diarrheal episodes. By the following week, Jacob had all but forgotten about his ordeal and had returned to indulging his indefatigable sweet tooth.

Some 8,000 miles away in the village of Jhangola in Uttar Pradesh, India, four-year-old Vaishali was suffering from chronic diarrhea. Her mother, Subhadra, had followed the advice of a traditional midwife and withheld fluids from her child for the past two days. But the girl's condition had only worsened. Vaishali's hands and feet felt cold against her mother's touch and the pink of her lips had become a foreboding shade of blue. Overcome with panic, Subhadra sought the aid of a local social worker and made the four-hour journey to a government-run hospital in New Delhi. However, upon reaching the hospital, she was faced with a labyrinth of red tape and it was not until the early hours of the next day that Vaishali was finally seen by a physician. Immediately recognizing the urgency to replenish water and electrolytes, the doctor began administering fluids to Vaishali intravenously. By now, however, her severe dehydration had caused a rapid drop in blood pressure and volume, ultimately leading to multiple organ failure. Within only hours, Vaishali was lost.

Subhadra's account is tragically common in rural, isolated parts of India. Of the 2.2 million lives claimed annually across the globe by gastrointestinal illnesses, the vast majority are children under five years of age in developing countries.[1] Contaminated drinking water is the main contributor to life-threatening forms of diarrhea caused by cholera, dysentery, and a whole range of bacterial, viral, and parasitic organisms. The World Bank estimates that approximately 21 percent of all communicable diseases in India are attributable to unsafe drinking water.[1] Of this disease burden, the World Health Organization (WHO) estimates that diarrhea alone was the cause of death for 600,000 Indian children in 2006, or 1,600 deaths every day.[1] Although improvements in water and sanitation infrastructure have been made in an effort to reach India's UN Millennium Development Goal of establishing sustained access to clean, portable water in villages, many areas with limited resources in the country continue to be without access to safe drinking water.

The underlying causes for the prevalence of gastrointestinal illness in developing countries like India are mainly inadequate personal hygiene and a lack of effective, household based drinking water sanitation techniques. Although families in rural areas often have access to improved water sources provided by local water municipalities, a serious risk is posed for re-contamination of drinking water at the point of use because of unsafe transport and storage practices. Storage containers are usually left uncovered and families will often use unsanitary containers, including old 55 gallon oil drums or used plastic and metal buckets. A lack of municipal sewage systems and septic tanks for rural communities compounds water contamination and the growing burden of waterborne infectious disease.

Of the 2.2 million lives claimed annually across the globe by gastrointestinal illnesses, the vast majority are children under five years of age in developing countries.[1]

Subhadra's village has been long plagued by conditions like these. According to the Indian government, as of 2008, the state of Uttar Pradesh has more than 3,000 rural habitations that still do not have access to a safe drinking water point source, one of the highest rates in the country.[2] Geological factors and highly variable rainfall contribute to difficulties with sustaining a clean water supply for hard to reach areas in the state. Because of the extent of drainage problems in Jhangola, government sponsored development projects led to the construction of large open drains in the village a few years ago. Still, the majority of the roads in the village lack sewers and most homes are without an effective system of sanitation.

Five years ago, Subhadra's family built a pit sanitation system for their home, which the municipality had agreed to clean periodically. When the municipality failed to follow through on their promise, she had little motivation to complain because she did not want to bring attention to the fact that her family did not own title to the land. The hand-made pit system was soon overrun, as was the case in other homes, and eventually several streets in the village were flooded with sewage. When she approached the male dominated panchayat (village council) about the state of her home and the need for a new sewer system, her protest was cut short by the pardan (panchayat leader) who insisted that sanitation was the least of their worries.

People crowd around a water tank in India desperately trying to acquire water to bring back to their families.

Over a period of ten weeks in 2007, I conducted research in Jhangola and the city of Pune in Maharashtra to understand waterborne and gastrointestinal illness in rural and urban regions. I was often frustrated by the lethargic attitude of village leaders towards suggestions for change. Skepticism, aversion to foreign influence, and even superstition, particularly among tribal people, hampered the exchange of new ideas. Introducing villagers to new ways of thinking was more complex than I had initially anticipated. I had convinced myself that my own ideas, based on contemporary western medical thought, could be applied to this community; only after being met with failure did I recognize that the most effective community leader is one who puts the needs and perspectives of the community above personal biases. The people of Jhangola demonstrated to me the commonality of humans and the importance of cooperation over competition. Rather than assume the throne of paternalism and reciprocal deference, I instead sought to develop relationships of trust and partnership. After learning about previous rural works projects that had been used by politicians to embezzle public funds, I became more attuned to the villagers' apprehension toward my proposals. I chose to frame my calls for investment in rural health development within the larger goal of economic progress, which appealed to the common interest in increasing employment and productivity.

My efforts were eventually successful and the panchayat agreed to appropriate Rs1000 (about $25) to hire professional contractors from neighboring New Delhi to build a new sewer system. They also granted me permission to use a microbusiness model for implementing a water treatment system for the village, the funding for which was obtained from the local water municipality. This system utilized a solar powered sodium hypochlorite disinfectant generator, a technology that is promoted by the Centers for Disease Control and Prevention.[3] The generator was purchased from Pristine Water Electro Chlorinators, a water treatment company based in New Delhi. A solar panel was purchased from Sunera Energy (India) Pvt. Ltd. and was fitted on the generator to prevent the need for conventional electric power.

The generator utilizes solar energy to drive electrochlorination to generate a sodium hypochlorite solution from clean water and salt. This disinfectant solution is transferred to small plastic bottles (a three month supply) and sold to villagers for Rs20 (about $0.41). The solution can be added to drinking water to efficiently remove biological organisms and pathogens by inactivating viruses, bacteria, and protozoa. After assembling the machine in a centrally located hut, I trained Subhadra and two other village women to operate and maintain the machine. Women were selected to participate in the project because of their existing role in familial health care as well as to increase their influence on health-related decision making outside of their homes.

In two years, the model has lowered incidence of gastrointestinal illness in Jhangola by over 40 percent and it has increased awareness of water sanitation and hygiene issues among the village community. It has encouraged bridging the gap between knowledge and practice in diarrhea management in this rural setting. The program has also brought about the empowerment of women in the community and shed new light on gender based roles and needs with respect to personal hygiene and sanitation. Significantly, empowering women with legal and health awareness has enabled them to confront their political leaders about issues of hygiene and sanitation that had been left unaddressed in their communities.

After working in India and observing the local effects of liberalization, my conservative western perceptions about market justice and limited government intervention were changed. Indian philosophy encouraged

Only after being met with failure did I recognize that the most effective community leader is one who puts the needs and perspectives of the community above personal biases.

me to think more deeply about society's obligations to empower the individual. Gandhian thinking in particular encourages communities to enable the individual to become autonomous and able to manage a livelihood that guarantees his or her health and basic economic security. Although Gandhi's emphasis on protecting small scale village industries is no longer appropriate for India in today's global market, some of his ideals can still be implemented in public policy. To that end, I envision future Indian public policies which accept capitalism as as the basis for ending poverty, but remain enlightened by Gandhian ideals at the grassroots local level.

Until these changes are realized, however, diseases of poverty like water waterborne illness will continue to persist in India. Market based growth will be the basis for ending poverty in India, but only if the government and communities can empower the poor to choose a healthy and productive livelihood. Investing in rural health and education, as well as increasing government accountability, will be essential in achieving this goal and tapping the country's vast human resources. A laissez-faire approach to development will fail in providing opportunities for the poorest members (and largest fraction) of society to prosper in a rapidly developing India.

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FEATURES

A Doctor's Arrogance:
Reflections from Roatán, Honduras

Dawn Maxey, Class of 2009
Post-Baccalaureate Program

For three months in 2008, I volunteered as a pediatric assistant and medical interpreter, a translator trained in medical terminology, in Roatán, Honduras, a tiny Caribbean isle less than a third of the size of Rhode Island. It is an intensely tropical area that harbors thick, humid air and brilliant sunshine. Most of the locals are devastatingly poor.

Global Healing, a U.S. based organization with medical facilities in eight countries, managed a small pediatric clinic inside the public hospital located on the western seaboard and I served there along with a rotating American doctor. Each morning, the wooden benches outside our tiny makeshift clinic were filled with tight lipped mothers carrying their sick children. They would come as early as 6:00 A.M. by boat, taxi, and foot. By the time I unlocked the door at 8:00 A.M., the air was thick from nausea, sickness, and waiting.

We cared for our patients to the best of our abilities – pieced prescriptions together from trial packages, used styrofoam cups for asthma spacers, and gave vitamins to soothe worries. Often, the American doctor would shake his head and sigh about the primitive care these patients were receiving, weary from trying to fix previous mistakes that had been made during their treatment and care. However, no matter their condition, we treated each patient with respect while navigating our remedies around local customs such as tying red string around a newborn's finger (meant to keep her alive) and wrapping tiny shawls around midsections (to keep spirits away from the umbilical region). I believed we were making a difference.

Were we obligated to accept their decision, even though it was clear to us that the patient would die if we did?

But as time passed, I gradually became aware of the politics infringing upon our presence. Our clinic was poorly regarded by the hospital staff, who believed that American doctors were arrogant. From our perspective, we were merely healers curing the sick. In their view, however, we had forced our way into their system, stealing the pride and business of local physicians. In their eyes, we carried an omniscient attitude and

Children in Roatán, Honduras who are waiting in front of the clinic for treatment.

disdain for the ways in which their hospital operated. We brought fancy medicines and techniques that they could never attain with their limited resources and money. We were perceived to taunt them, and this apparent display of arrogance detracted from the care we strived to give in times of great need. One morning, the American doctor walked in furiously. A child on the ward had died of a preventable cause, he said, and the hospital had allowed it. Nurses on the ward had refused to give a premature infant an intravenous line because they had believed that the puncture would kill him. Our doctor had desperately tried to convince them otherwise, but each day, he could only sit and watch as the child's eyes sank further and further down into a rapidly decaying face. On the fifth day, the child's mother was given a wooden box and told to take her son home to die. She nodded solemnly, not knowing that the death could have been prevented and that superstition and stubborn pride had instead been the victors.

I was at a loss. But what more could we have done? Medical ethics in international health teaches us to respect local opinions and traditions. In the aftermath of tragedy, I was faced with a moral quandary: if local authorities refused our way of treatment, were we obligated to accept their decision, even when it was clear that the patient would die if we did?

I later realized that our dilemma might have been solved with humility. The local hospital ignored us because they believed that we thought we were above them, we shunned them because we thought they were ignorant, and all the while, a child's life was caught, and lost, in the crossfire. As Abraham Verghese, professor of Medicine at Stanford University writes, "Being a doctor is about getting joy, excitement, and intellectual pleasure from what we do. It is also about learning from our disappointments and mistakes; it is about humility."[1]

A vital part of the Hippocratic Oath has been forgotten: that doctors must live as members of society with special obligations to fellow humans. Too often we believe instead that others owe us these obligations. We are swift to offer our credentials, privileges, and opinions of what we believe is best before listening to what we consider a lesser point of view, and this sense of entitlement and arrogance has driven others to disregard us. Medical schools will continue to produce great physicians, but never great healers, until a sense of humility is taught. This is best achieved by a new philosophy, a constant reminder that doctors are not infallible and that often, the most humble can make the furthest advances. Lessons in modesty and human relations should be required, and the inclusion of such a course in the curriculum of medical schools should not be difficult. First, however, as Dr. William T. Branch, Jr. of Emory University School of Medicine stated, "They would have to believe that such work was important."[2]

The American physician in my clinic wanted desperately to change the hospital's opinion, but it was too late. "Who are you to determine what is right from wrong?" the Honduran doctors asked. "Who vested in you the power of God to say what is best?" To this, we had no answer. We could only insist on the American way, our sense of superiority clashing with their tenacity to hold their own.

During my time on Roatán, I had the privilege of helping to provide medical care to people who otherwise would have had none. In doing so, however, I also bore witness to a crippling stubbornness where medicine could not progress because of a lack of humility. My diagnosis, I'm afraid, is a doctor's arrogance.

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Practicing *Equanimity:*

Working with HIV/Tuberculosis Patients in Kakinada, India

Nick Arora, Class of 2010
Public Health Studies

William Osler's *Aequanimitas*, a speech delivered in 1889 urging medical graduates to practice equanimity, or evenness of mind, conjures a vision of the virtuous Father of Medicine, the power of his principles, and perhaps his time at Johns Hopkins. Interestingly enough, I was not introduced to these concepts at Hopkins, but rather in Kakinada, India, a developing port town quite literally halfway across the world from Baltimore. During my eight weeks in Kakinada in the summer of 2008, I learned of equanimity from Dr. Ravi Vadrevu, a dermatologist and HIV physician at the Sai Sudha Hospital. Observation of his practice showed that successfully managing such a significant volume of patients and clinical and administrative tasks relied on clear, critical thinking.

My journey began in early July 2008 when I landed on the single airstrip that serves as Kakinada's airport. As we descended, I was struck by the green beauty of the environment. The southeast port town has a landscape peppered with coconut trees, rice paddies, and huts made of palm leaves. Yet, the natural beauty is hampered by open air defecation, dusty settlements, congested streets, and overcrowding. This double standard prevails not only within the physical environment, but also stretches to the political and social landscape that cultivates health care, the economy, and culture. Like much of India, this southeast region's development faces obstacles in the forms of bureaucracy and corruption. Nonetheless, a driven movement of doctors, industrialists (owners of rice mills, fisheries, and other agricultural enterprises), and general citizens is pushing for educational improvement, business development, and health care reform.

While in Kakinada, I worked with two such physicians, Dr. Ravi Vadrevu and his wife Dr. Lalitha, at the Sai Sudha Hospital. The couple built the new hospital five years ago to provide state-of-the-art care to patients requiring medical services ranging from HIV/AIDS care to general surgery. During July and August, I served as an intern at the hospital while living on the top floor. Living at the hospital gave me a unique opportunity to witness a wide variety of clinical patients and surgeries, as well as work on research and education. I am still inspired by the efforts taken by the doctors and staff to accommodate 150 to 200 patients daily. These individuals, many of whom were physical laborers earning about 2,000 rupees ($50) per month, sometimes traveled up to 450 kilometers by overnight bus or train to see Dr. Ravi for HIV care. Their arduous journeys were justified, however, as Dr. Ravi has dramatically changed HIV treatment practices in the region. Where most doctors hesitate to touch HIV patients, Dr. Ravi freely comforts, consults, and even weeps along with patients while providing treatment in a private, secure, in-patient and out-patient setting. The equanimity with which he approaches patient care is inspiring.

After spending time in a government hospital, The Lady Hardinge Medical College, last summer, I could better appreciate the burden of infectious disease, especially among low-income individuals. Kakinada is located in the state of Andhra Pradesh, which is ranked as one of six high HIV prevalence states in India.[1,2] India has the highest case burden of HIV in the world, with an adult prevalence rate of 0.3 percent.[3] Tuberculosis (TB) is also a major public health threat in India and, worldwide, is the leading cause of morbidity and mortality among people living with HIV/AIDS.[4] According to the World Health Organization (WHO), India accounts for one-fifth of the global TB incident cases; annually, 325,000 Indians die from the disease annually.[5]

With the help of Dr. Amita Gupta, Professor of Infectious Diseases at the Johns Hopkins School of Medicine, Dr. Ravi, staff and I organized a project focusing on identifying the HIV/TB case burden by administering a comprehensive survey to patients, then addressing the problem through educational programming. From our initial interviews with patients, it became clear that these low-income physical laborers and housewives had poor nutritional diets and were not following HIV/AIDS treatment schedules. We therefore began our educational efforts by creating and distributing pamphlets and flip charts, written in Telugu, which served two purposes: to inform patients how to eat healthy local foods within cost constraints, and to advertise the importance of adhering to medical treatment schedules. We created similar materials to promote TB awareness, prevention, and treatment options. With these resources, clinicians, counselors, and staff at the Sai Sudha Hospital and additional sites could teach patients more effectively.

Observing individuals like Dr. Vadrevu uphold *equanimity* in the face of adversity is a moving example of human perseverance and drive.

While in Kakinada, I also learned of a non-profit organization known as the AIDS Awareness Group (AAG), spearheaded by Dr. Ravi. The primary objective of this organization is to provide testing and antiretroviral drugs (ARV's), the most effective anti-HIV medicines, to patients who cannot otherwise afford such services. On one afternoon, while standing at the entrance to the clinic, I saw blisters on a patient's feet burst, leaving a residue of blood on the dusty floor. Padma, like a staggering 26.4 percent of patients tested at voluntary counseling and testing centers in the East Godavari district, was HIV-positive.[6] For ten years, the AAG clinic has served as a respite for more than 900 patients like Padma, who, without its free ARV and anti-TB treatment, would be

East Godavari District provides care to a staggering 450-500 tribal patients that visit on every Sunday.

Above: The Sai Sudha Hospital (SSH), located in Kakinada, Andhra Pradesh, India provides state-of-the-art care to 250-300 patients daily, 30-40 of whom are HIV-positive.
Left, Bottom: The busy waiting room in the Sai Sudha Hospital (SSH) has seen a staggering 10,000 HIV-positive patients since the early 1990s.

left to die. While there is an urgent need for additional such clinics in the region, this need has not been met and as a result, patients like Padma must travel great distances to receive care. To address this need, AAG, Dr. Ravi and I are working toward adding another clinic in the summer of 2009 in the Rajahmundry region, a city west of Kakinada, where a large number of patients reside. To further publicize the organization and serve a broader population, we constructed a website, www.aagandhra.org and distributed educational materials throughout the Rajamundry. With continued efforts, patients like Padma will benefit from greatly improved health outcomes.

Ultimately, the Sai Sudha Hospital, run by Dr. Ravi and Dr. Lalitha, along with the hospital's consultant doctors, nurses, counselors, and staff, is an encouraging example of the power of human passion. Dr. Ravi and his family took me into their home as a son, while the hospital staff welcomed me as a brother. This fundamental human connection was powerful and allowed me to adapt, grow, and help them accomplish goals, even though at the start of the summer I did not speak Telugu. For me, it is these relationships that I will especially value and carry with me throughout my future endeavors. Observing individuals like Dr. Ravi uphold equanimity in the face of adversity is a moving example of human perseverance and drive. With a healthy sense of adventure and purpose, it is exciting to consider what more can be achieved in international health.

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Cleaning Up the Streets of Venezuela

Dave Iaconangelo, Class of 2010
Writing Seminars

In the past two years (2006-2008), I have traveled alone on the road for 17 weeks - one month in the Dominican Republic, three weeks in Mexico, and ten weeks in Venezuela (minus the two nights I spent in Cúcuta, Colombia) - researching under the auspices of the Woodrow Wilson fellowship. My brother, who had embarked on similar research oriented trips to Peru and Bolivia, made sure to disabuse me of any fallacious notions of life in underdeveloped countries: "It's not all fun and games. You'll see how much you feel like Dean Moriarty when you're midway through your fourth hour in the bathroom and well into your third of praying to every major deity in hopes that one will strike you dead." Obediently, I took my Cipro and packed my Imodium AD and managed to elude the worst of Montezuma's Revenge. But what did catch me off guard was the extent to which Venezuela's cities suffered from inept garbage disposal despite its comparative affluence.

As a visitor to Venezuela, one of the things you notice immediately is a profound lack of compunction about littering. On buses, candy bar wrappers, plastic bags, bottles, and occasionally even diapers go out the window. I mentioned this to a Colombian and fellow traveler with whom I had become friends, and he insisted this was not a common practice in his country:

"Here, there's no consciousness of those things," Juan Carlos said. "In Colombia, you don't see that."

Well aware of the rivalry between these two countries, I was ready to chalk his comment up as a bit of nationalistic bluster. Besides, I was not particularly eager to suspend my critical faculties for a man who had nicknamed me "Ronald McDonald" in light of my nationality. A few weeks later, though, I realized Juan Carlos was right when I traveled with him and a French traveler named Marco, to Cúcuta, a Colombian city just across the border with Venezuela.

We left the Venezuelan border city of San Antonio by bus. After

Trash piled in front of wall reading 'Dumping Trash Prohibited'. Courtesy of Soberanía Newspaper.

Left: A wall with painted-over graffiti reading "Viva Chavez" (as in Hugo Chavez) in the city of Coro.
Right: Fellow traveler Juan Carlos and Ianonangelo crossing between Venezuela and Colombia on foot. Courtesy of Marco Reynaud.

about fifteen minutes, Juan Carlos whistled at the driver to pull over and we got off to cross the border on foot, bypassing the checkpoints that detain buses. Midway across the bridge that marked the dividing line, we stopped to take photos of the drug runners pushing their bicycles through the stream underneath, balancing enormous packages on the seats. On the outskirts of Cúcuta, we hailed a bus and sped into the center. Wandering through its streets in search of a hotel, I realized Juan Carlos had not lied—the contrast between San Antonio and Cúcuta, which are only about thirty minutes apart, was striking. The sidewalks, roadways, and even public bathrooms were all rigorously hygienic, a far cry from those of its sister city, just across the border. This is to say nothing about Venezuela's largest and most densely populated cities, like Valencia or Caracas. In fact, the accumulation of garbage in a Caracas plaza recently necessitated the use of a bulldozer to collect it.[1] Over the summer, residents of a notorious shantytown, known as Petare, complained of stacks of uncollected garbage that had grown taller than most people. Shortly after, protests blocked roads there after three weeks passed with no trash pickup.[2]

I wondered how and why these crises come about. Many Venezuelans place blame squarely on government ineptitude, specifically inconsistent or unsatisfactory garbage collection.[3] Indeed, local governments have failed to respond effectively to an urban population boom driven by immense numbers of migrants from rural areas, often settling in shantytowns plunked down on hillsides overlooking downtown. In these neighborhoods, garbage collection is especially erratic. Problems like shortages of garbage trucks or worker strikes have occasionally left entire blocks flooded with trash, having not been collected for months. For Hugo Chávez and his allies, who have established the poorest sectors as their political base, it has become a liability. In this past November's gubernatorial races, 17 of 22 states went to Chávez' supporters, but the opposition made serious inroads in areas like Petare, which were previously staunchly pro-Chávez.[4] Their shift in alliances is widely attributed to the Chavistas' inability to clean up the streets, in both senses of the word.

"It's not all fun and games. You'll see how much you feel like Dean Moriarty when you're midway through your fourth hour in the bathroom and well into your third of praying to every major deity in hopes that one will strike you dead."

Blaming this problem solely on the government, though, doesn't recognize all of the factors at work here. That most people believe it's the government's responsibility has only made it tougher for public services, as garbage tends to build up in vacant lots, beaches, and other places beyond the reach of garbage trucks.[5] Though it is one of the most prodigious producers of solid waste in the world, Venezuela has little in the way of public education regarding disposal practices. Even existing programs try to tackle the problem of trash buildup without addressing preventative measures. In one such scheme, residents of Caracas could exchange garbage for food and, in doing so, clear trash-clogged ravines that can cause devastating mudslides in hillside slums during the rainy season.[6] Sure, that's an innovative solution, but not a sustainable one for either urban hunger or waste disposal.

This unfortunate cultural facet seems unlikely to die out soon. Apathetic attitudes about littering (and corollary topics like composting food) are firmly entrenched. Public education programs need to broaden significantly in size and scope, meaning substantial funding must be wrung from an administration whose budget has already been stretched thin from social spending. But with inflation climbing to 30 percent in 2008 and homicide rates approaching those of El Salvador,[7] waste disposal seems destined to remain on the back burner of political discourse. Homeowners and business owners, trying to keep their portion of the sidewalk clean, will continue painting "no botar basura aquí" (don't throw trash here) on walls and gates across the country. And inevitably, trash will pile high enough to obscure those words wherever they appear. Some things, I guess, are not funny in any language.

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Shedding Light Upon Neonatal and Maternal Health in Pune, India

Neha Deshpande, Class of 2011
Molecular and Cellular Biology

I remember the first day I walked into the King Edward Memorial Hospital (KEMH) Neonatal Intensive Care Unit (NICU) in Pune, India. Dozens upon dozens of extended families were cramped into one small waiting room. Some sat barefoot, others slept on the ground, while others crouched on the floors. In the pediatric ward I worked at in the afternoons, I saw young children with horrific problems – cobra bites, meningitis, pneumonia, rubella, typhoid, and leukemia, among many others.

The most memorable aspect of my trip to India was speaking with these families and learning about their daily struggles. I spoke Marathi, the local dialect, with all of the families, and despite their village dialect and my Americanized pronunciations, we understood everything about each other.

One surgeon turned to me in the pitch black and said, "Neha, simply hold your place with your fingers and hope the lights turn on soon."

I saw fear in the way they lowered their eyes or never smiled in the photographs I took, but I also saw hope in the way they gazed at physicians or held my hand. Many of the families thanked me for being the only foreigner they would ever have the chance to meet. My favorite such encounter happened when a young boy asked me, "Do you see a moon from your home?" When I replied yes, he said we should tell it messages to deliver to each other. Another woman told me I would always have a home in her village, if I ever needed to escape my stressful life. One day, two other mothers I met in the nursery, 21 and 22 years old, spoke with me for more than two hours. My camera was the first they had ever seen and when I took photos of their babies, they became very emotional at the thought that an instrument could capture reality so beautifully. A mere photograph of her baby could make each woman's day. Unfortunately, many of these babies do not survive to see their own photos.

State of India's Newborns, a 2004 report released at the National Conference on Child Survival and Development in New Delhi, India claims that of the 26 million children born in India each year, about 1.2 million die during the first four weeks. This represents 30 percent of the 3.9 million global neonatal deaths. The report also states that approximately 47 percent of children under the age of five are malnourished, and 30 percent of babies are born underweight. The prevalence of infections, lack of prenatal care, and nutritional deficiencies predispose mothers from underdeveloped urban and rural areas to poor pregnancy outcomes and low birth-weight babies.[1]

Through the Johns Hopkins University Woodrow Wilson Undergraduate Research Fellowship Program, I spent the winter of 2008/2009 assessing neonatal and maternal health in Pune, India. An ancient city, home to over five million people, Pune has India's third-highest slum population, after Mumbai and Meerut. In December of 2007, The Times of India stated that Pune's slum population has grown by 176 percent since 1991. I was born in Maharashtra, India, and therefore it was of personal significance and concern to me that the first and third ranking "slum" cities were located in my birth state.[2]

During my month in Pune, I had the privilege of working at KEMH, a non-government organization (NGO) whose primary purpose is to serve the lowest income bracket (poverty line population) of the urban and rural areas of Pune. Built during the British rule of India in 1912, KEMH was once a four-bed maternity hospital and eventually expanded into a three-story, 550-bed institute with a Level III Neonatal Intensive Care Unit (NICU) comparable to that of Johns Hopkins Hospital.[3] Over the course of the month, I studied social, clinical, and economic aspects of about 75 babies born during December 2008.

Some social aspects I researched included the demographics of the babies families', parents' education levels, family income, and whether or not the baby belonged to an extended (joint) or nuclear family. The majority of the infants' parents were poor farmers and laborers who had received only a fifth or sixth grade education, and earned an average of 50 dollars a month to support their entire household. A month's salary for these families was spent for a single day's care at the NICU. Babies that needed three or four months of care could only stay for a few days because their families simply could not afford the treatments required, even though they were significantly subsidized. I remember one father whose eyes brimmed with tears as he imagined how many years it would take him to pay back the debt he incurred to pay for his daughter's medical treatments.

In terms of clinical aspects, I examined the birth weight of the the infants to determine whether they were small, average, or large for their gestational age (SGA, AGA, LGA). It was disconcerting to find that a baby born at KEMH who was considered AGA or LGA on the Indian growth chart, fell under a significantly smaller percentile if plotted on an American growth chart. Other clinical factors I researched in cluded the mother's number of prenatal visits and maternal risk factors. At the NICU in Baltimore City, the most common maternal risk factors I observed were drug use, tobacco smoke, and alcohol consumption. Surprisingly, none of the 75 Indian mothers used any of these substances.

Rather, common maternal risk factors were toxemias, previous abortions, stillbirths, neonatal deaths, and antepartum hemorrhages. Other clinical factors I researched included the mother's obstetric history, her mode of delivery, and her previous children's Apgar scores, which provide a uniform measure of neuromuscular, physical, and overall maturity of the baby after birth. Economic aspects I researched included the medical, physician, and laboratory fees for each baby, and how the amount of money spent correlated to the final outcome of the infant. The outcome for nearly half of the infants was death.

In addition to my research, another unforgettable experience was working in the operation theater, where I shadowed KEMH's pediatric surgeon and assisted in numerous pediatric surgeries. With the sheer number of patients who need operations, young first year or second year surgery residents handle tedious and lengthy operations. It is hard to believe, but having the lights go off several times in the middle of a surgery was a common ordeal. One surgeon turned to me in the pitch black and said, "Neha, simply hold your place with your fingers and hope the lights turn on soon."

My experience at KEMH was inexpressibly eye opening and life-changing. The doctors I worked with were the most honorable and selfless individuals I have ever encountered. An average day for a physician went from 9 A.M. to 11 P.M., seven days a week, and a medical Fellow who worked 60 to 70 hours per week was paid only 30 dollars per month. Though they receive little monetary compensation, it is the desire of these physicians to help others and to better humanity, which fuels their persistence at work. At KEMH, I witnessed the spirit of a physician in the truest sense, and for their hard work and devotion to human health, the respect and admiration these physicians received was unparalleled. Perhaps what struck me most was the humility and sense of satisfaction the patients and physicians had with their lives, despite many obstacles and limitations.

As Robert Frost said in A Road Less Traveled: "I took the one less traveled by, and that has made all the difference."

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Deshpande with King Edward Memorial Hospital's NICU Director

View of King Edward Memorial Hospital in Pune, India

An infant baby born at 29 weeks gestation in the King Edward Memorial Hospital Neonatal Intensive Care Unit

Restoring Faith and Community

An Account of a Public Health Practice Transforming West Baltimore

Natalie Draisin and Meredith Mirrer, Class of 2010
Public Health Studies

Three miles from the Johns Hopkins Homewood campus, brightly colored rowhouses provide a glimpse of the vibrant neighborhood that Sandtown once was. Every Saturday, Habitat for Humanity volunteers from Baltimore City and the surrounding county crowd into these homes with saws, drills, and hammers to demolish and rebuild them. As Habitat volunteers, our involvement in the neighborhood inspired us to take a deeper look into the community and the evolution it has undergone. Our findings may seem startling, or perhaps may mirror the image that outsiders paint of a typical, rough city neighborhood. What we found, however, only broadens our appreciation for Sandtown, and keeps us coming back.

This thriving West Baltimore community housed about 40,000 residents until the assassination of Martin Luther King Jr. wreaked havoc on the neighborhood in 1968. Riots ravaged the city, driving away businesses and forcing people into financial insecurity and unemployment. Wealthier African Americans moved out of Sandtown, while families that were left behind faced many challenges. Due to the nonexistant job market, crack cocaine and heroin use became commonplace. With only less than half of its population remaining, a rampant drug problem, and widespread despair, Sandtown was declared one of Baltimore City's worst neighborhoods.[1] The rowhouses still stand, but their emptiness greets visitors in stark, eerie contrast to the colorful facades.

In an effort to revive the area, the city of Baltimore joined with Enterprise Community Partners, a nonprofit organization focused on housing developments, to invest in the neighborhood and foster community redevelopment. Unfortunately, these investment efforts did not last. Sandtown needed more support, according to the co-executive director of New Song Urban Ministries, Patty Prasada-Rao. "You would think that if you throw enough money into a problem, you can fix it. Investors believed that with the help of millions of dollars, Sandtown would be transformed in ten years. But it's not that easy to change public health indicators and address neighborhood factors. The revival was deemed a failure," she said.

New Song had a different method of investing in the area. They approached the situation from a new angle: build a trusting relationship with the community. Allan Tibbels, the founder of New Song, adopted the belief that relocating to a problem area is a crucial part of community redevelopment, since it forces you to take on your neighbors' problems as your own. Even after breaking his neck and becoming a quadriplegic, Tibbels pursued his calling, and moved into Sandtown with his wife and two daughters as the neighborhood's only white family. Though it is easy to view Tibbels' choice as altruistic, he believes that it is just a case of "faith, conviction, and calling." Tibbels said, "I know a lot of people see what I did as self-sacrificial because they see it in the urban context of a jungle or war zone. But I get more from living here than I left behind. I think living in the midst of people who we love is not only very important, but also essential. This is a place of tremendous community and extended networks, where everyone really cares about each other. It's not a sacrifice, it's a commitment." Tibbels' spirit was the essential factor in Sandtown's rehabilitation.

After Sandtown's community association granted Tibbels permission to move in, he still faced some resistance from parts of the neighborhood. Some residents suspected that he was an undercover police officer or a drug dealer, but others were very welcoming. Overall, it took Tibbels two years to gain the trust and respect of his neighbors that were needed to begin transforming the neighborhood.

Tibbels came in without an agenda. By partnering with community members, Tibbels started the first of seven New Song organizations, the New Song Community Church. Other organizations soon followed, with the intention of addressing every aspect of the public's health: New Song Community Learning Center, New Song Family Health Center, Eden Jobs, New Song Arts, and New Born Holistic Ministries Sandtown Habitat for Humanity, which partners with the Johns Hopkins University chapter of Habitat for Humanity.

Each of these New Song organizations addresses a different aspect of life in Sandtown. The Family Health Center, for example, aids in the support of teen pregnancies, which accounted for about eight percent of Sandtown births in 2004. Statistics indicate that these organizations are effective. The majority of birth weights in 2004, for example lie within the acceptable range, with 83.64 percent of infants delivered at term.[2]

However, Tibbels believes that there is still much work to be done. "There is a lack of jobs and vital economy. The educational system is still below standards, so kids will not have a great future. There's still lead paint in all of the houses that have not been restored. Homicide rates persist, which are largely fueled by the drug market," he said, showing that change does not happen overnight.

The prevalence of intravenous drug use and HIV are major concerns for the community. Prasada-Rao said that in 2004, 2,435 residents enrolled in drug treatment programs. This reveals an effort to combat health issues such as untreated HIV, which continues to persist largely due to inadequate education and the lack of affordable and decent health care. Most residents have minimal to no health care coverage, according to Prasada-Rao.

The desire to protect his neighbors and fellow churchgoers drove Johns Hopkins infectious disease specialist Dr. David Thomas to address this issue. He volunteered once a week, but when lines grew to wrap around the block, it became clear that there was a dire need for increased medical care. Soon thereafter, a health center for both uninsured and insured patients was developed, which resulted in 6,000

Above: Co-executive directors of New Song Urban Ministries, Patty Prasada-Rao and Allan Tibbels.

Left: Rao and Darryl Jordan of the New Song Community Church, singing with Johns Hopkins University acapella group, Adoremus, at the Habitat for Humanity house dedication on October 10, 2009.

visits annually. Prasada-Rao said that a partnership with Mercy Health Center downtown provided one paid doctor and hundreds of volunteers. Unfortunately, insurance changes forced Mercy to scale back its participation, and the clinic eventually closed due to financial difficulties. However, the many people who previously received care from Mercy were now armed with the knowledge of how to access health care and obtain regular medication. Additionally, a partnership with People's Health, a nonprofit organization which provides health care, resulted in an additional clinic for the community. Such partnerships can help change the fact that many Sandtown residents rely on hospital emergency rooms as their primary resource for health care, according to Tibbels.

Sandtown continues to improve most notably in the increased rates of homeownership and in the residents' educational aspirations. Prasada-Rao, who spends much of her day speaking with the locals, has noticed a dramatic difference in attitudes about education. "In Sandtown," she recalled, "you didn't use to hear people talk about going to college or finishing high school. That was just not a reality." Now, some adults express the desire to go back to school, and more of their children anticipate attending college in the future. In addition, by returning to Sandtown, student volunteers from local high schools and universities can also inspire the children to stay in school and pursue higher education

Tibbels has also noticed the residents' positive outlooks on the future. "One of the intangible positive changes in Sandtown is the tremendous amount of hopes that have been raised," he said. "We want to see an empowered community. Every individual within these 72 square blocks should have access to housing; we want to eradicate vacant housing. Every child should have access to education and opportunities like going to college. We really need economic development, and businesses in the community." Echoing his aspirations, Prasada-Rao strives to sustain the community's success and growth. She hopes to continue the rebuilding process by completing the remaining Habitat homes and to keep the local school funded. When volunteering with Sandtown Habitat for Humanity, we worked alongside new homeowners who expressed their goals for their families and children to grow and prosper. We, too, have elevated hopes for the future of the community.

Nonetheless, economic progress is still needed in the community. Currently, most jobs are located outside of the neighborhood, and little money comes into Sandtown. To correct this financial deficiency, Sandtown hopes to institute more employment opportunities and stores within its bounds to offer continual investment in the area.

New Song will help to facilitate the creation of new businesses. The first new business, Gary's Goods, will serve as a coffee shop and convenience store. The opening of the store brings opportunity to change some of the food preferences in the community. Gary's Goods could begin by selling wheat bread, instead of white bread, for example. To improve residents' diets, the store may be able to introduce healthier foods, lower sugar, and lower fat products. Consumers may not buy these products at first, but over time they may adopt healthier eating habits that will benefit the community's health for the future.

New Song's unique commitment to the community distinguishes it from other organizations. "It's a place of love, and fun, and being able to share with people. It's very relational. We have about 10,000 volunteers a year. Almost everyone that comes here returns. That says something; there must be some kind of draw. It's really a great place to be a part of," says Tibbels. He believes that an essential part of life is to learn from our neighbors. "Reach out from your comfort zone, across the walls and barriers, across the racial, ethnic, economic divides. There's a rich blessing in doing that, and you learn so much." Ultimately, the union of different backgrounds will rebuild this community in need, and offer an invaluable experience to those involved. "All of us have the responsibility to rebuild. Sandtown was devastated, and we all have the responsibility to rebuild."

After digging into Sandtown's history and talking to the individuals responsible for some of its greatest changes, we now appreciate the neighborhood more. When we visit the community, only three miles from our Homewood campus, we are blessed to witness how the Sandtown community rebuilds itself, from the inside out, and we are extremely grateful to be a part of the transformation.

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Perspectives

The Three C's of Healthcare

The Challenges Facing Our Healthcare System

William R. Brody, M.D., Ph.D.
President, The Johns Hopkins University (1996-2009)

American health care is the world's most expensive by far, measured both in costs per person and as a percentage of gross domestic product. Yet, when the World Health Organization (WHO) ranked all the national health systems by performance, the U.S. placed 37th among 191 countries, behind countries such as Morocco, Cyprus, and Costa Rica.

When the World Health Organization (WHO) ranked all the national health systems by performance, the U.S. placed 37th among 191 countries, behind countries such as Morocco, Cyprus, and Costa Rica.

Why do we spend so much on health care, and why aren't we getting our money's worth? One of the greatest challenges facing public health today is helping societies figure out the best, most effective use of limited health care resources. Here in the U.S., we've largely taken the position of "give patients (who have insurance and can afford to pay) whatever they want, and don't worry about the cost." Clearly, this approach has not worked well. That's because while the nature of human illness has changed, in many ways our health policies have not. In wealthy and developed countries, the 21st century is going to be the age of the three C's – Consistency, Complexity, and Chronic illness.

Consistency

Consistency—which is often just another measure of quality—is the immediate challenge we face. For instance, anyone who has had a heart attack and is being discharged from the hospital should be prescribed aspirin, beta-blocking drugs, and, if they have high cholesterol, lipid-lowering drugs. This is the holy trinity of prevention of further heart attacks confirmed by NIH research and all doctors know this. Yet, a Rand Corporation study of American hospitals found that only six out of ten patients being discharged after heart attacks were going home with these prescriptions in hand. Those numbers varied tremendously by hospital. Some get close to 100 percent; others are far less than half. Public health experts can help us figure out how to make sure everyone treated for any condition receives the best possible care consistently.

Complexity

In America, inefficiency in our medical delivery system costs billions of dollars a year. Billing, collection, and payment administration represent, by conservative estimates, 20 percent of health care costs. In nations with single-payer systems, these costs are much lower, but even here, every Euro or Yen spent on bureaucracy represents a health care opportunity wasted. We must ask: How can we eliminate unnecessary complexity from health care systems? Again, we need some smart public health experts to help us out.

Chronic Illness

Part of the miracle of modern medicine has been its ability to turn killer diseases into manageable lifelong chronic conditions. American medical research, funded by the federal government through the National Institutes of Health, has revolutionized our ability to treat the sick. Our nation has been very well served by that investment. Diabetes and HIV infection are examples of this, as is the significant decline in deaths from heart attacks over the past two decades. Formerly, diabetes, HIV, and heart attacks were death sentences. Now they are typically managed conditions that require daily medication and regular medical attention.

However, chronic conditions are both difficult and expensive to manage. Eighty percent of all health care costs in America involve patients with one or more chronic illnesses, such as hypertension, diabetes, chronic obstructive pulmonary disease, arthritis, asthma, or depression. If we begin to focus on disease management – in part through sound public health policy -- there are big gains to be made, both for better patient care as well as reducing costs.

Too many people think that public health is a discipline devoted exclusively to managing external threats to the health of our community. In the years ahead, some of our best thinking is going to have to be devoted to problems of our own creation, problems like the three C's. This is the challenge before us, and this is why I am so pleased that every year, many of Johns Hopkins' best and brightest students focus their energies on issues in public health.

Changing the Environment One Step at a Time

An Interview with Dr. Cindy Parker, M.D., MPH
Co-Director of the Program on Global Sustainability and Health
Department of Environmental Health Sciences
Johns Hopkins Bloomberg School of Public Health

Dr. Parker sat down with *Epidemic Proportions* (EP) Perspectives Editor Annie Fehrenbacher to discuss the release of her book "Climate Chaos: Your Health at Risk" and the formation of the new undergraduate major, Global Environmental Change and Sustainability.

EP: What led you into a career in environmental health?

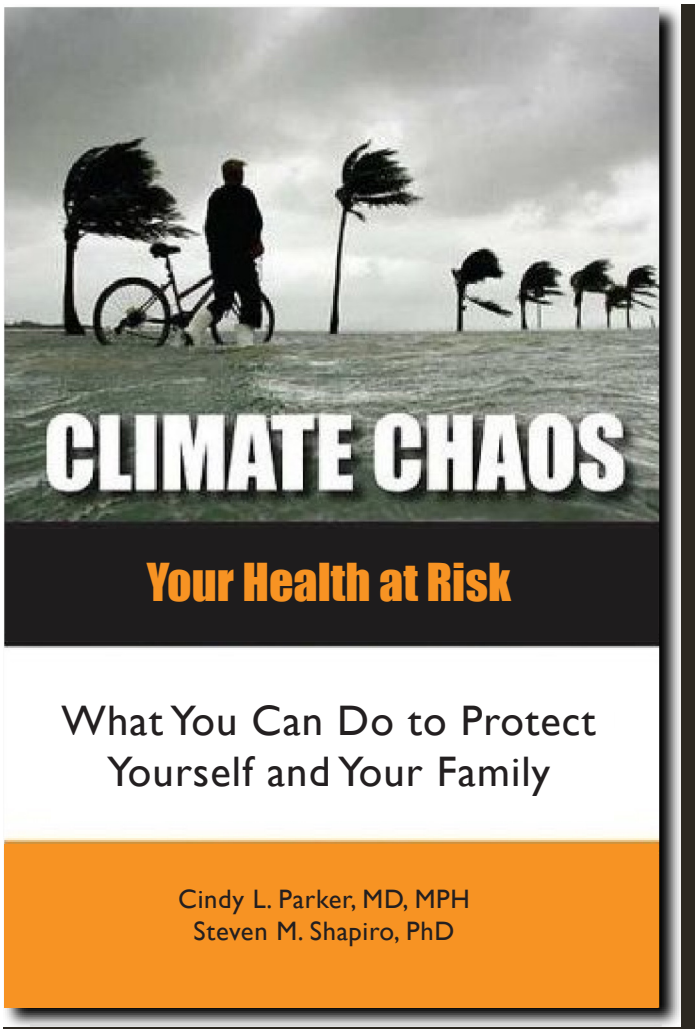
Parker: I had been a lifelong environmentalist, but it never really occurred to me that I could combine that with health into a career. I was a practicing family physician for 10 years, mostly in rural New Mexico and Alaska. When I decided public health probably made better sense for me, I came to Hopkins because it's the best school for public health. After I got here, I discovered there were actually people who were crossing environmentalism and health and making a career of it. I thought it was a wonderful idea, so that's what I did. I focused on climate change and health predominately, and global environmental issues.

EP: Could you tell me a little bit about your new book?

Parker: Sure! It's called "Climate Chaos: Your Health at Risk" and then the subtitle is "What you can do to protect yourself and your family." This book is written for a lay audience in a way that we're hoping that they would find it appealing and easy to understand. We wrote this book because much of the literature about climate change is very discipline-specific. Climatologists publish in their climatology journals and they use climatology vocabulary and they assume everybody knows about climatology. And the hydrologists publish in hydrology journals, etc. There are 15 to 30 different disciplines all working on climate change but that information is generally not accessible to the public. So what I did and what I continue to do is to find what's meaningful in all of the literature and translate it into plain English. I try to put it into some format that regular people can read and understand and make sense of and hopefully make use of in their lives. Also every chapter [of this book] has a whole list of solutions about what individuals can do as part of their community, and then what they can do on the national or international level.

EP: What are some of the solutions proposed in the book?

Parker: Well, it depends on which aspect of the problem you're talking about. For example, if you're thinking about more severe weather, which is something we expect with climate change in this part of the world, one of the things that individuals can do is be prepared to deal with a hurricane or natural disaster when it comes. Certainly an individual can't keep a hurricane from coming, but there are things you can do with your community like looking for particularly vulnerable people. This might include somebody with mobility problems, a single mom, or somebody who doesn't have transportation to evacuate when the order



Parker's useful and practical guide to the public health implications of climate change.

arrives. It is also important to look for vulnerabilities that might apply to the community more greatly. For example, we know flood plains are apt to expand. If you already have people living in or close to a flood plain in your community then working to change zoning laws to not allow further development in identified high-risk zones makes some sense. So there's sort of a combination of what you do individually, what you do for your community members, and what you can do more on a policy level.

EP: What would you say is the most pressing environmental issue right now?

Parker: I think it's actually a combination of things that we're facing. Climate change is a high priority, but the fact that we are running out of inexpensive petroleum is also important. This is sometimes referred to as "peak petroleum" or "peak oil." I think that we need to address both of those issues simultaneously because solutions to one actually could make the other far worse.

EP: Could you give an example of how changing one of the issues could make the other issue worse?

Parker: Sure. Two summers ago when gas prices went up, we saw that that was actually fairly effective at changing behavior of individuals in a good way – people tended to drive less. But it also encouraged people to look elsewhere to get petroleum. The "elsewhere" is looking for nontraditional petroleum reserves, so for example, tar sands and shale oil [which] are far more environmentally devastating. They require more energy to harvest, which doesn't make a lot of sense. The greenhouse gas emissions are much worse than just burning liquid petroleum, so if you're going to solve the peak oil problem by trying to get oil from those nontraditional sources, then the climate has no hope. As the price of oil goes up, it costs more to get oil from tar sands or from shale. But as the price of oil goes up then people can sell oil for enough to warrant the added expenditure. However, that's not including the cost to the environment. That's not including the cost to our health. That's not including the cost to the climate. That's just what people would pay at the pump, for example, and that doesn't reflect all these other very important issues.

EP: What type of model do you favor for restructuring our national energy policy?

Parker: Well, in an ideal world if we could figure how to make this politically feasible, I would like the idea of an individual carbon cap. If we're all given a little credit card, for example, with 100 carbon credits that we can spend however we want during the year, people who have made changes in their lives to require less carbon would use fewer of their carbon credits. They could sell those to someone who wants to use more carbon credits. I think that's kind of a good way of evening out some of the poverty issues, as well. People who are socioeconomically disadvantaged typically use a whole lot less carbon than people who are wealthy, so they could sell their carbon credits to the wealthy and make extra money. Every year, the number of carbon credits everyone starts with would be reduced, motivating us all to use less carbon. This approach could actually help on a variety of fronts.

EP: What strategies do you think need to be employed in order to make these ideas politically feasible?

Parker: I don't know if it's possible, but I like to think it is because otherwise we're all doomed (laughs). I continue leading my life thinking that it is possible and am working hard toward that. We need to provide better public education, but education is not all that it will take. We also need to change how we do things in this country. Even if the people understand some of the consequences, they may or may not be willing to change their lives enough to make a difference. When you really think of it, an individual doesn't necessarily have control. For example, I can't take public transportation if it doesn't exist in a very usable form where I live. I think there are many, many things we need to do, and we need to do them all at once. There isn't any silver bullet that is going to save us. We need to make huge changes in a lot of different things we do, and we need to do it fairly soon.

EP: What sort of communication strategies do you find are most effective for mobilizing politicians or lobbyists around these issues?

Parker: Well, one way is to talk about health. A lot of policy makers have not really made the connection between how climate change or global warming will have tremendous health impacts. They think of it as purely an environmental issue. However, the idea of having a population that is healthy that's living in an unhealthy environment doesn't make any sense. You need to have a healthy environment for the people living in that environment to be healthy. Climate change means an unstable climate; there will be lots of bad things that happen as a result of climate change and those bad things will affect our health in a variety of ways. Educating policy makers about that health connection is something I have found to be very helpful.

EP: On the topic of education, could you speak about the new major you will be implementing on the Homewood Campus?

Parker: It's called Global Environmental Change and Sustainability (GECS). I've heard some students already referring to it as "geeks," which is fine, whatever works! It allows students to major in an area where they can get the science component, understanding how the earth works, its living and nonliving systems, and how they interact with each other. But they can also get the humanities component, understanding how humans interact with their environment and how humans interact with each other. Finally, they can learn what we need to do to get these things changed.

EP: Fantastic. Will this major be in the Public Health Studies Department?

Parker: No, it will be an interdisciplinary major and will be housed in Earth and Planetary Sciences. We will have two different concentrations, a science concentration and a social science concentration. Both concentrations will require some environmental science and some social science–but the relative proportions will change depending on the concentration.

EP: Have you gotten positive feedback from the students in the Introduction to Sustainability course about the new major?

Parker: Overwhelmingly positive feedback! It was a bit of a surprise. It's a brand new course with a brand new instructor. I thought that if I could get 25 to 30 students to take this course it would keep me from being embarrassed as a new instructor, but apparently the class was automatically capped at 110 students because that's how many seats are in the auditorium. It filled up very quickly, there was an extensive waiting list, and I had students constantly emailing me trying to get in. That says to me that this kind of content is in high demand with students.

A Roadmap for Encouraging a Healthier Environment

Sara N. Bleich, Ph.D.
Assistant Professor of Health Policy and Management
Johns Hopkins Bloomberg School of Public Health

My decision to pursue a research career focused on obesity policy was both personal and professional. My grandfather was a corn farmer in Maryland without much formal education. When it came time to for me to pick a dissertation topic, I wanted something he could understand. All too often, health policy research is riddled with complicated jargon and acronyms which make it difficult for the general public to grasp. The study of obesity was a natural choice for me due to its potential to stimulate creative policy solutions, its need to draw from multiple disciplines, my general interest in adverse health conditions disproportionately impacting disadvantaged communities, and its topical accessibility to the public. My grandfather approved.

Since beginning down this path, I have conducted several projects broadly focusing on the intersection between public policy and obesity prevention. Recently, my research has focused on two main areas: disparities in practice patterns of obesity care in the health care system and – the focus of this commentary – environmental strategies to reduce caloric consumption or increase physical activity.

Understanding the Problem of Obesity

Although the root cause of obesity is simple – too many calories and/or too little exercise – it represents one of the most complex and challenging public health problems in the United States. Obesity affects more than a third of U.S adults and a fifth of children and adolescents,[1] is associated with several adverse health conditions such as type 2 diabetes and hypertension,[2] and is estimated to account for approximately 100 billion dollars in medical expenses annually.[3] While experts do not entirely agree on the complex interaction of factors which drive the obesity epidemic, the environment is increasingly recognized as a critical piece of the puzzle.[4] In particular, experts point to of the 'built environment' – the man-made or modified aspects of our surroundings. So, what is it about our environment that is causing us to gain weight, and what steps can we take to make it healthier?

Generally speaking, our environment contributes to obesity by increasing opportunities for consumption and reducing opportunities for exercise. Consider a lower income person and a higher income person. Chances are the lower income person lives in a neighborhood where there is more fast food, fewer fresh fruits and vegetables, and fewer safe spaces for exercise. Just imagine the differences between the Johns Hopkins Homewood campus and the Johns Hopkins East Baltimore Medical Institutions. In the neighborhood where Homewood is located, roughly three-fourths of adults (72.9 percent) completed a high school degree compared to half (56.5 percent) in the medical campus zip code, according to the 2000 Census (The U.S. average is 80.4 percent). These two campuses are separated by less than four miles, yet their landscapes are vastly different. Neighborhood characteristics have enormous implications for eating and exercise patterns; they may also contribute to disparities in obesity prevalence. In fact, when it comes to food choices and taste preferences, the environment is thought to be a more immediate determinant than families.[5]

In the literature, a host of food-related environmental factors have been positively associated with body mass index (BMI) –– a person's weight in kilograms divided by their height in meters squared -- such as distance to fast food restaurants, presence of convenience stores, density of food outlets, and higher prices of fruits and vegetables.[6-9] Similarly, several environmental factors related to physical activity have been negatively associated with BMI, including distance to the nearest recreational facility, number of recreational facilities, use of motorized transportation (e.g., car), number of safe sidewalks in neighborhoods, urban sprawl, and mixed land use (multiple kinds of land use in a single geographic area, distinct from areas zoned exclusively for single purposes).[10-14] Not surprisingly, the presence or absence of various obesity-promoting environmental factors, among other individual-level and neighborhood-level characteristics, is closely tied to socioeconomic status (SES).

Neighborhood characteristics have enormous implications for eating and exercise patterns; they may also contribute to disparities in obesity prevalence.

Legislative Efforts to Encourage Healthier Environments

Policy makers are increasingly looking for environmental-level solutions to the obesity epidemic. More recent legislation contrasts with earlier policy recommendations by focusing on societal and environmental contributors to obesity rather than individual-based solutions to reduce weight gain.[15] In 2007, for example, 20 states considered legislation to promote physical activity by providing safe pedestrian and bicycle transportation.[16] In that same year, 25 states launched efforts to improve the

	Active Living	Healthy Eating
Financial Incentives	- Tax incentives for mixed land use developments or for the creation of parks, biking trails	- Tax incentives for supermarkets to open outlets on low socioeconomic status areas
	- Reduce one-time impact fees levied against new developments incorporating mixed land use	- Price healthier foods lower than less healthy foods
Non-Monetary Incentives	- Expedited processing for mixed land use zoning permits	- Mandate calorie labeling alongside the food item in chain restaurants
	- Prioritize investment in public transportation in those areas that already support urban or mixed land use environments	- Limit access to foods and beverages which constitute a large portion of empty calories in the daily diet; promote low-calorie options

Table 1: Possible environmental-level strategies to encourage healthier environments

nutrition and physical activity environments for children to prevent obesity. Recently, caloric posting next to prices on menus in chain restaurants has received growing attention as a potential policy lever to reduce caloric intake. In 2008, California became the first state to pass a mandatory menu labeling law.[17] Menu labeling legislation has also passed in New York City and Seattle, and is currently under consideration in more than 20 states, including Maryland.[16] In 2009, a Maryland supermarket chain called "Giant", launched a product labeling system ("Healthy Ideas") which will be used on more than 3,000 food items (10 percent of inventory) to help consumers identify healthier foods based on guidelines from the U.S. Department of Agriculture and other federal agencies.[18]

Developing Effective Environmental Incentives to Promote Healthier Lifestyles

In general, environmental strategies aimed at encouraging healthier lifestyles will be more effective and sustainable if they include so-called 'push' approaches, where the healthier choice is the default or preferred option and the less healthy choice is more difficult or less desirable. Some potential environmental strategies to encourage healthier eating and/or increased physical activity include both financial and non-monetary incentives. Table 1 lists possible approaches.

A key consideration for the promotion of more active living is modifying the environment in which we live. Currently, suburban housing developments, for example, are largely car-dependent and characterized by low walkability. Individuals living in neighborhoods with more mixed land use tend to walk and ride their bicycles more for transportation.[13] To promote the development of communities which include multiple types of land use, tax incentives could be used to encourage suburban housing developments to locate in areas with existing or planned shopping centers, parks, or recreation centers nearby.[19] To further incentivize the expansion of these communities, the one-time impact fees levied against new developments using mixed land use designs should also be reduced. Impact fees are designed to recover a proportionate share of the capital cost for the infrastructure needed to serve new developments (e.g., water, sewage, roads). Reducing these fees is estimated to lower the cost of building new developments by roughly 25 percent.[20]

Non-monetary incentives to encourage the development of communities which facilitate active living might include local and state government support for expedited processing of mixed land use zoning permits. Evidence suggests that regulations which lengthen the development process significantly reduce the volume of new construction.[21, 22] Another approach could be to prioritize investment in public transportation in those areas that already support urban environments or mixed land use developments. According to the 2007 American Housing Survey, just a third of Americans (32 percent) reported being satisfied with the public transportation in their neighborhood, and only a fraction (5 percent) reported that someone in their household used public transportation at least once a week.[23]

Another critical determinant contributing to whether or not individuals engage in physical activity or make healthy food choices is access.[9,24, 25] Tax incentives could also be used to promote the development of parks and public spaces across the country as well as to encourage increased penetration of supermarket outlets in communities with low SES. Recent research in Baltimore has demonstrated that availability of healthy foods is associated with the quality of an individuals' diet and that about half of lower income neighborhoods have low availability of healthy foods.[26]

Non-monetary strategies to encourage healthier eating might seek to limit access to energy-dense foods and beverages which comprise a large portion of total daily intake. One promising approach would be to reduce consumption of sugar-sweetened beverages, which represent roughly 12 percent of total per capita caloric consumption among children and adults.[27,28] To this end, vending machines in schools and work places could stock water and low-calorie beverages rather than beverages with added sugar. Those vending machines in schools and work places which do stock sugar-sweetened beverages could be located in less convenient areas. Similarly, supermarkets and convenience stores could place water and low-calorie beverages in high traffic and high profile areas and make sugar-sweetened beverages more difficult to find. To encourage stores, schools and work-site vendors to participate in these strategies, large increases in sales volume might be necessary to offset the potential decreases in profit from reduced convenience of sugar-sweetened beverages.

Non-monetary efforts to encourage healthier eating should also address the low nutritional literacy in the United States. Most Americans

(including nutritionists) greatly miscalculate the caloric content of food, and nutritional knowledge is lower among several groups at higher risk for obesity (e.g., minorities, communities with low SES).[29,30] To begin addressing this knowledge deficiency, local and state governments should mandate that all chain restaurants report caloric information on their menus and menu boards alongside the price for the food item. Such education efforts would need to be coupled with other incentives (such as lower prices for lower-calorie food options), given that interventions which have relied primarily on education have mostly failed to achieve substantial and sustainable behavior modification.[31]

When developing environmental strategies to combat obesity, it is important to consider the real-world application as well as the temporal relationship to other efforts. For example, what if local governments decided to increase funding for public parks and recreation centers? On the surface, this seems like a promising solution to encourage physical activity. However, a significant impediment to increased exercise in public spaces is perceived safety.[32] In fact, racial and ethnic minorities, who are most likely to view their neighborhood as unsafe, are also at highest risk for physical inactivity.[33-36] So, absent systematic efforts to improve safety in high crime areas, increasing the number of parks and recreation centers may have little impact on physical activity levels. The evidence is mixed, however; some research has shown that proximity is a key determinant of park utilization, not residents' concerns about park safety.[37] More generally, understanding how various environmental strategies fit with the existing neighborhood characteristics or policies will be important for increasing the effectiveness of future anti-obesity efforts.

Ingredients for a Healthier Environment

Efforts to effectively combat obesity must address the environmental component of the epidemic. To this end, a variety of financial and non-monetary strategies can be used to modify our environment and encourage healthier lifestyles. These strategies include promoting the development of communities which encourage active living and reducing accessibility to foods and beverages which constitute a large portion of empty calories in the daily diet. A key ingredient for the success of these anti-obesity approaches is to align incentives so that individuals prefer to make the healthier choice. Such environmental modifications may go a long way in promoting healthier lifestyles and, potentially, reducing obesity prevalence.

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PERSPECTIVES

Vitamin A:
From Discovery to Saving Lives, "Millions at a Time"

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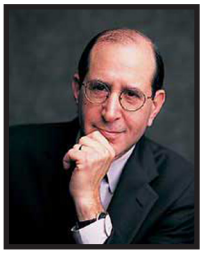

What happens when an epidemiologist, who also happens to be an ophthalmologist, gets interested in a problem related to nutrition? It all depends upon where you look and what you see (pun intended), the ability to find clues within data gathered with other end-points in mind, and a commitment to moving from science to action in the face of controversy and confusion.

Vitamin A was one of the first of a new class of "essential" nutritional elements (hence, "vitamin" and "A") first described at the turn of the last century. One of the seminal early reports was by E.V. McCollum, who soon after became the founding professor of the Department of Chemical Hygiene (now Biochemistry and Molecular Biology) at the Johns Hopkins School of Hygiene and Public Health (now the Bloomberg School of Public Health). Everything evolves: our knowledge about vitamins as well as the names of departments and schools!

McCollum and others recognized that this important constituent of dairy products was needed in small amounts, and when absent, caused newborn rats to grow poorly, fail to thrive, and die young. But most uniquely, deficiency resulted in a series of eye changes ("xerophthalmia"), beginning with night blindness and culminating with melting of the cornea ("keratomalacia") and loss of the eye. It was not long afterward that good epidemiologic detective work, primarily in Europe, associated similar conditions in young children to the deprivation of this single nutrient.[1] Vitamin A is a product of animal metabolism. Certain colored vegetables (most notably spinach and other dark greens, carrots, papaya, and mango) are rich in beta-carotene, which the human gut is able to convert to vitamin A before absorbing it from the intestines and storing it in the liver.

By the 1930s, scientists were able to synthesize vitamin A in the laboratory. Despite intriguing clinical reports, particularly a hospital-based randomized trial in London suggesting that large doses of vitamin A given to children with severe measles reduced their risk of death, most clinical interest continued to focus on the ocular signs of deficiency.[2] In the early 1970s, a small group of nutritionists and others were concerned that vitamin A deficiency might be widespread throughout the developing world and possibly responsible for a significant proportion of preventable childhood blindness; they urged that further studies of the deficiency's distribution and prevention be conducted, and where deficiency was already known to be endemic, that it be addressed by programs which improved vitamin A status, either by changing dietary practices or (on a "short-term" basis) by providing large-dose supplements of vitamin A periodically to all children at risk.[3] Few countries responded to these concerns with intervention programs, largely because their meager health budgets were targeted towards child survival programs (e.g., immunization, alleviation of protein-energy malnutrition) rather than the prevention of disabilities.

Between 1976 and 1980, a series of clinical, biochemical, and epidemiologic investigations in Indonesia highlighted the widespread nature of vitamin A deficiency among young children and their mothers,[4] and provided a basis for estimating the numbers of children suffering from xerophthalmia and blindness each year in South Asia (500,000 and 250,000, respectively).[5] The numbers were large, but most ministries of health would still not make prevention of childhood blindness a priority, or divert funding from other programs for its prevention.

How could vitamin A deficiency be so widespread if simply eating available vegetables could make a major difference?

In 1983, further analysis of the data from Indonesia revealed a startling association between mild forms of deficiency and related increases in the risk of childhood mortality.[6] The data did not definitively prove that vitamin A deficiency directly increased childhood mortality, because it was possible that some factors, not studied at the time, might have accounted for this apparent association. Despite evidence from the early work on rats, and the human epidemiologic and clinical evidence of 50 years before, few nutritional scientists or public health leaders seriously believed vitamin A deficiency could be responsible for large numbers of childhood deaths.

That left it to our group to conduct the first randomized field trial of the impact of vitamin A supplements, given twice a year, on subsequent childhood mortality.[7] Unlike our earlier, observational studies, this would be a definitive test of their relationship, because the only variable that would distinguish children in one group from another was the receipt of a vitamin A supplement at baseline, and again six months later. The result -- 34 percent fewer deaths among children randomized to receive vitamin A -- proved the relationship, at least to us.

Most experts remained skeptical, because they could not envision that two cents' worth of a single vitamin, taken once every six months, could so powerfully reduce the mortality of children living in situations of serious deprivation (e.g., recurrent infections from unsanitary environments, consumption of diets deficient in calories, protein, and many other "nutrients").

Over the next six years, additional randomized trials in Indonesia,

India, Nepal, Tanzania, and Ghana confirmed that twice-yearly supplements of vitamin A dramatically reduced child mortality, primarily by increasing immune resistance to the severe complications of measles and diarrhea.[1] Additional trials further demonstrated that administering high-dose vitamin A to children newly hospitalized with severe measles reduced their risk of dying by at least 50 percent.[8,9]

Children deficient in vitamin A were at increased risk of infection-related death, particularly from measles and diarrhea, and programs to reduce or eliminate this deficiency were urgently needed.

Despite the accumulated evidence, not everyone agreed that vitamin A could have so profound an impact; a few studies purported to have found no benefit. Differences in study design and the quality of field work explained to many of us these discordant results, but confusion over the interpretation of available data withheld the consensus needed to establish global policy. At a meeting convened at the Rockefeller Foundation's retreat in Bellagio, Italy, an open, deep discussion of all available data involving all relevant researchers, finally allowed them to reach the consensus needed for a global policy.[10] Children deficient in vitamin A were at increased risk of infection-related death, particularly from measles and diarrhea, and programs to reduce or eliminate this deficiency were urgently needed.

The randomized trials had utilized varied supplementation schemes: some weekly, some every four or six months. All proved effective in reducing the mortality of children who received the supplements between six months and five years of age. However, these supplements did nothing for children who received them at one through four months of life. Thus the World Health Organization and Unicef urged that all children in populations deemed to be vitamin A-deficient receive appropriate-sized supplements every six months, from age six months through five years of age.[11]

Vitamin A "supplementation" was generally considered "a short-term" strategy, until such time as people could improve their vitamin A intake more "naturally," by increasing their consumption of foods rich in vitamin A. To some of us, this seemed an unnecessary detraction from the importance of providing supplements! There seemed something wrong about the conviction held by many in the nutrition community that only a change to a diet richer in vitamin A would provide a "natural" solution to the problem. In the first place, most children in poor countries have access to little beyond their starchy staples of rice, corn, or cassava. There was little green leafy vegetable to be had, but where it was available, the disease didn't appear to be any less prevalent. How could vitamin A deficiency be so widespread if simply eating available vegetables could make a major difference?

This remained a philosophical controversy until it was proved that humans, who consumed an average mixed vegetable-fruit diet, required nearly 21 molecules of beta-carotene to obtain a single molecule of vitamin A, not the six molecules of beta-carotene as had previously been thought. It was now readily apparent the amount of vitamin A (in all its forms: animal-derived active vitamin found in calf, chicken, and cod liver; the yolk of eggs; breast milk and other dairy products; plus whatever was derived from fruits and vegetable sources of beta-carotene at the newly recognized ratio of 21:1) produced in Asia or Africa was less than half of the amount the population required, even if everyone received their fair-share (e.g., per capita consumption). Since some people will always get more than their "fair share," others will inevitably get less, making the situation even worse.[12]

It is now widely accepted that as "ideal" as it would be for everyone to obtain all the vitamin A they needed from the food in their diet, this is not likely to happen anytime soon. Indeed, vitamin A sufficiency in the U.S. and other market economies largely depends on the small amounts of synthetic vitamin A added to margarine, milk, and other processed foods. Vitamin A supplementation programs will be required over the long term if we are to prevent needless loss of sight and lives among the poorest populations of the world.

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Editorials

Prescription Drugs: Can a Pill Help You Achieve an A+?

Addressing the Abuse of Prescription Drugs on College Campuses

Jae Kim and Karthik Rao, Class of 2011
Public Health Studies

Within the past decade there has been a dramatic increase in attention-disorder diagnoses and stimulant prescriptions by medical professionals. However, across college campuses, these drugs have become ubiquitous because of students increasing demand for a quick and easy way to study large amounts of material in a short period of time in hopes of achieving that elusive "A". Although numerous articles about such misuse can be found in mainstream news, many fail to explain the severe side effects that can result.

"Everyone else does it, so it's just a way for me to stay in the game. An increasing number of students on my campus are resorting to Adderall to do well academically. Why should I put myself at a disadvantage when many of my peers are taking drugs to get better grades?" a college student from the University of Florida said. If you knew that the student sitting next to you during a final exam had this view, would you gulp a pill too? The reality is that in the United States, one in five college students has reported using prescription drugs for non-medical reasons, including academic enhancement and recreational purposes.[1]

Adderall and Ritalin are two common medications used to treat attention disorders such as attention-deficit disorder (ADD) and attention-deficit hyperactivity disorder (ADHD). In recent years, taking these drugs has become trendy among college students. ADD and ADHD are chronic, neurobiological conditions that frequently continue into adulthood.[2] In 2006, the Centers for Disease Control and Prevention (CDC) reported that 7.4 percent of children in the United States are affected by attention-deficit disorders.[3] ADD and ADHD have become major public health issues because these conditions are difficult to diagnose.[4] The complexity of the disorder and the need for effective treatment has led to extensive drug studies. Over 150 clinical trials have reported positive results in patients who used stimulant drugs such as mixed amphetamine salts (Adderall) and methylphenidate (Ritalin) to treat attention disorders. Observed benefits include reduced symptoms of ADHD such as hyperactivity, impulsivity, and inattention; as well as improvements in social relationships with parents and peers.[5]

Dr. Una McCann, who says that serious side-effects can result from the misuse of amphetamines. Courtesy of Keith Weller

Unfortunately, every drug has the potential to cause unpredicted health problems. During an interview (March 2009) with director of the Johns Hopkins Anxiety Disorders Clinic, Dr. Una McCann, said, "Every drug has its risks. Reports on the side effects of amphetamines are based on patients with abnormal cognitive function and abilities. It is difficult to predict how a normal person will react to amphetamines because there are great inter-individual differences in drug metabolism." Like most prescription drugs, stimulants can produce a wide range of short-term side effects such as increased blood pressure, insomnia, anorexia, vomiting, reduced appetite, anxiety, and headache. Patients predisposed to heart conditions and mental illnesses are at risk of developing more serious side effects such as psychosis, behavior tics, stroke, and sudden death.[6,7] In total, the U.S. Food and Drug Administration (FDA) reported 12 cases of sudden death in patients who used Adderall XR. The FDA did not ban the drug because of insufficient evidence linking the cause of death to Adderall. In response to FDA reports, Health Canada (Canada's equivalent agency) temporarily banned the drug from markets, but rescinded the ban after several independent committee reviews. The side effects listed on Adderall XR labels now include myocardial infarction, sudden death, and stroke.[8,9] Relatively new clinical data has also shown that stimulant use can produce short-lived psychotic reactions in healthy adults which are more pronounced in users with pre-existing conditions.[10]

Due to the increasing concern for the safety of patients using stimulants, several rigorous studies have been done using animal models.[11] In one study, controlled increments of amphetamines were given to healthy rhesus monkeys, followed by a sudden removal of the drug.[9] The results suggested that long-term amphetamine abuse could lead to heightened sensitization and psychosis. Although it is unknown how closely the reactions of the monkeys might mirror those of human beings, these findings are worrisome.

Several factors can be attributed to the rising trend of prescription drug abuse. Since the introduction of mixed amphetamine salts in 1996 to the pharmaceutical arena, the use of stimulants has increased dramatically.[8] Zito and colleagues reported that the incidence of amphetamine prescriptions increased seven to 14 times between 1990

Adderall, one example of a stimulant abused by college students.

and 1995.[12,13] When asked for a possible explanation of this increasing trend, Dean Dorothy Sheppard (Office of Student Life, Johns Hopkins University) said, "The recent generation of students faces tremendous pressure to get into the best schools and maintain the best grades. Students are no longer in a society where just getting into college is

"Attitude is everything. Work as hard as you can... go to work early and stay late, and be scrupulously honest at all costs. You are ultimately responsible for your success or failure."[14]

- Mayor Michael Bloomberg
Whiting Engineering School, Class of 1964

enough. The mindset is that we have to be the best." In highly-charged settings like universities, students sometimes revert to swallowing stimulants out of fear of not meeting competitive expectations.

It is crucial to remember that we students are surrounded by communities dedicated to helping us succeed. Dean James Fry (Office of Academic Advising, Johns Hopkins University) said, "Neither I nor anyone in [this] office would be censorious of students who came in and asked for help. We encourage them to seek help so that they can manage their stress and do well academically. Asking for help is the first step." He advised that sleeping more, eating better, and managing time more wisely are far superior to taking the shortcut of using artificial means to acquire better grades. College is only the beginning of the habits that people form to achieve lifelong success. We must stay strong and continue to make good decisions as a community for the integrity of academics, and, more important, for a healthy future.

"Attitude is everything. Work as hard as you can... go to work early and stay late, and be scrupulously honest at all costs. You are ultimately responsible for your success or failure."[14]

- Mayor Michael Bloomberg
Whiting Engineering School, Class of 1964

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The Price of Gold:
Mercury Use in Small-Scale Mining

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On a frigid day in the northern Mongolian steppes, Erdentugs wakes up before the sun rises, cooks a meager meal that will have to sustain her and her numerous children for the day, and heads for the mines. During the day, Erdentugs and her children will most likely be directly exposed to liquid mercury, will breathe in mercury vapor, and will climb through dangerous, freezing shafts to make, as a family, less than two dollars a day.[1]

It is estimated that in the global south, at least 10 million people are directly engaged in small-scale mining activities, with another 80 to 100 million people directly or indirectly dependent on the small-scale mining sector. Mongolia, a nation with a relatively small population, contains a significantly large small-scale mining sector with more than 100,000 individuals, or one fifth of the rural population, engaged in artisanal mining. One of the most common features of global artisanal gold mining includes the use of large amounts of mercury, one of the most toxic chemicals known to man, in the amalgamation process to separate gold from ore. Mercury poses a severe public health threat to Mongolian gold miners, many of whom are women and children. The element also takes a toll on the environment, contaminating watersheds and polluting the fragile ecosystem of the Mongolian steppes. The lack of education concerning the dangers of mercury and protective equipment in mining centers, combined with widespread mercury availability and use presents a significant public health dilemma that demands appropriate and effective interventions.[2]

In 1998, Mongolia had almost zero artisanal miners, yet today, the number surpasses 100,000 and is estimated to attract thousands of more individuals each year as a result of rich gold and mineral deposits throughout the Mongolian steppe.[3] Known as "ninjas" due to the green plastic tubs they wear on their backs which resemble the cartoon "Ninja Turtles," thousands flock to remote rural mining camps where they can earn five to ten times the amount they earn in the nation's capital city, Ulan Bator.[1] Though artisanal mining presents an unquestionable economic opportunity for impoverished Mongolians, this work sector remains unregulated and extremely labor intensive with tremendous physical and chemical threats to overall well-being.

Rural mining camps resemble the stereotypical shantytown: unhygienic and overcrowded, with a lack of access to health services, clean water, or physical security. Most of the people working in these camps are traditional nomadic herders, driven to take up informal labor as a result of extreme weather conditions in the steppes as well as the government's privatization of livestock herds. Mongolia's ailing economy, matched with its desolate and expansive lands, provide the majority of rural Mongolians with simply no other employment option.

The mining activities themselves, however, pose the greatest overall threat to human health. In the amalgamation process to separate gold from ore, large amounts of mercury are used on a daily basis and can harm humans either through direct exposure through the skin, inhalation of mercury vapors, or introduction into the food chain via waterways. Without proper protective gear, exposure to mercury remains an inherent part of the daily life of Mongolian workers. In addition, without proper education concerning the dangers of mercury, many miners will continue to be ignorant of the severe threat that has become a part of their existence.

Mercury, as toxic and lethal as it is, remains the most afforable, accessible, and effective method of gold extraction in the Mongolian steppes. The use of mercury in small-scale mining occurs, and will occur, as long as rural unemployment and poverty exist.

At rural mining sites in Mongolia, women and children are much more likely to participate in the mercury amalgamation process as they are perceived to be less suited for more labor intensive practices, such as digging and explosive work.[3] The mercury vapors released during the process disproportionately come into contact with women and result in respiratory problems and psycho-pathological symptoms; and at acute exposure levels, dysfunction of kidneys and urinary tracts, and even death. Furthermore, as Mongolian women remain responsible for the preparation and provision of food, they are at an additional risk of exposure to methyl mercury in the food chain and drinking water supply. Methyl mercury, a developmental toxicant, readily crosses placental barriers and can result in neurological symptoms, sterility and/or spontaneous abortion, thereby posing a severe health threat to pregnant women and women of child-bearing age.[4] Due to the lack of education concerning mercury hazards, female miners in Mongolia have reported that they almost always store mercury within their homes, barely keep their children away from mercury, and attempt not to mix mercury with kitchen utensils. Shockingly, among female miners who handle mercury, 41.7 percent do not take any protective measures when handling the toxic metal.[3]

In addition to mercury's harmful health effects, its toxicity to the environment presents significant contamination problems, desperately in need of remediation. The United Nations Industrial Development Organization (UNIDO) has recently estimated that two to five grams of

mercury are released into the environment for every gram of gold recovered in small-scale mining practices. Environmental contamination of mercury poses a direct threat to the unique and fragile ecosystem of Mongolia, threatening the destruction of natural habitats and an irrevocable loss of biodiversity. Furthermore, because mining communities are usually situated around a water source, the link between environmental contamination and mercury exposure presents an additional health threat to miners utilizing water, and organizations which use the local rivers as their source for water.[3]

If mercury causes such deplorable human health effects, why not just completely ban the use of mercury in the small-scale mining sector? The reason is simple: economics. Economic mobility and the freedom to labor remain human rights, just as much as health, clean air, and clean water. The profits from gold mining account for 50 percent of Mongolia's industrial output and more than 60 percent of the country's export revenues, while offering an uncommon economic hope for vulnerable nomadic populations, particularly women.[1] Mercury, as toxic and lethal as it is, remains the most affordable, accessible, and effective method of gold extraction in the Mongolian steppes. The use of mercury in small-scale mining occurs, and will occur, as long as rural unemployment and poverty exist. The creation of stable jobs in the formal sector would drastically diminish the impetus for small-scale mining operations, while the creation of larger, well-governed, and well-regulated mining facilities could provide chances for investment and prosperity. Such mining facilities would present potential for more advanced amalgamation technologies, which do not include mercury. In the short run, community oriented educational interventions, which teach safe handling and storage practices of mercury and distribute basic protective gear such as aprons and masks could lead to an immediate decrease in mercury poisonings and unnecessary deaths.

In 2007, gold sales from jewelry generated a record $53.5 billion worldwide, proving that as a collective society, we have not lost our historic allure to the precious, shining metal.[5] Erdentugs, well aware of her hunger as well as her children's, has not lost the allure either. Though the ultimate goal of public health interventions is to protect individuals from health hazards, we must always take into account the unique sociocultural traditions and standards that exist in minority and vulnerable populations. For this reason, the first step for small-scale gold mining operations in Mongolia must be community focused interventions that will aim to protect each individual from a necessary evil that is intrinsic to their immediate survival. Perhaps, one day, greater levels of foreign investment and government assstance will transform the Mongolian small-scale mining sector into a large-scale, well-regulated industry that will create safe and effective gold refining methodologies while still providing the local communities with an appropriate economic gain. However, until that day, the most powerful weapon we can provide is education: not only to Mongolian miners, but also to the gold consumers of our interconnected, global society.

An artisanal gold miner in Bornuur, Central Mongolia, waits for gold-laden ore to be brought up from a deep shaft.

Young (ninja) miners wash the tailings of a formal gold mine, trying their luck for some much needed income in Zaamar, Mongolia.

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The Government and Your Waistline:
Weighing In on the Issue

Natalie Draisin, Class of 2010 and Kevin Brown, Class of 2011
Public Health Studies

Given America's affinity for McMansions, oversized cars, and supersized meals, it is no surprise that obesity is a growing public health problem. The government has started to intervene by banning *trans*-fats in certain areas, but is that enough? Is the government obligated to fix the obesity problem, and how far should it go?

In the United States, one third of the population is considered obese and one fifth of all children living in the United States are considered obese.[1] Obesity is by no means a benign concept; it yields fatal diseases including numerous forms of cancer, liver disease, and heart disease helping to kill 112,000 every year.[2] Furthermore, the financial costs to society are great. As our waistlines are expanding, our wallets are shrinking. In 2004, obesity-related costs amounted to an estimated total of $98 to $129 billion to society.[3] According to the Centers for Disease Control (CDC), if all physically inactive became active, $77 billion would be saved in medical costs annually.[4]

Recently, in large metropolitan areas like New York City, Los Angeles, Seattle and Philadelphia, the U.S. government has mandated that all major restaurant corporations post calorie amounts for each individual item on their menus as one of many public health efforts to reduce national obesity rates. However, the level of implementation varies with each city. New York City, for example, requires restaurants to list only calorie amounts, whereas Seattle requires restaurants to post calorie amounts, sodium amounts, saturated fat amounts and carbohydrate amounts.[6] In Los Angeles, restaurants are expected to offer brochures providing the amount of calories and grams of saturated fat for each item offered. Beginning in 2010, restaurants in Philadelphia will be required to post the amount of calories, saturated fat, transitive fat, carbohydrates, and sodium for each item on their menus.[7] However, the solution is not so simple and the complexity of the issue stems from the fact that obesity is largely a behavioral disease. At what point is government intervention appropriate in consideration of the people's autonomy over their own bodies and eating lifestyles?

Government Intervention: The Road to a Lighter Future

Natalie Draisin

In a country where we value the freedom to make choices, it should be the government's responsibility to provide us with the tools necessary to also make informed choices. When approximately a third of the population is obese and the average American eats approximately 200 meals at a restaurant per year, the choices we make when dining out are integral to the conservation of our waistlines.[8,9] However, we cannot make informed choices if menus do not include nutritional information, and we are forced to merely guess at the amount of calories in menu items. Therefore, it should be the government's obligation to provide consumers with information to make educated choices, and help defend the public's health in the fight against obesity. By the government defending the public's health against obesity, less money would be devoted to chronic illnes caused by obesity.

Given the popularity of dining out, the amount by which people underestimate the number of calories in their meals bears even more weight than it has in the past, further necessitating government intervention. For example, a poll of 500 Washington, D.C. voters showed that only

An Epidemic Exchange: When a Nation Emaciates

Kevin Brown

If we are able to eliminate a major cause of death and disease, it is our duty to do so provided that the means by which we choose to do so are ethical. It is the latter portion of the previous sentence upon which I wish to shed light. Obesity has numerous determinants that are ubiquitous in today's society, including complex environmental determinants. Bioethicists around the world concur that with regards to implementing any sort of public health policy, respect for those who will be most affected by the policy must be considered.[18] Put more succinctly, while a particular behavior, such as engaging in unhealthy eating, may indeed be harmful to one's health, not everyone is necessarily interested in adopting alternative lifestyles. Furthermore, the effects of a particular policy do not exclusively reach those at whom the policy is aimed; they affect entire populations equally. While the policy could perhaps be quite efficient and effective, it has the potential to produce many sizeable and potentially harmful consequences.

Anorexia and bulimia nervosa are both characterized by a heightened focus on not only one's body image, but also on food content. Anorexia

ten percent of participants could accurately guess the lowest and highest calorie items on the menu at popular chain restaurants.[10] Diners who made misinformed decisions consumed about 600 more calories per restaurant meal per week, translating into the consumption of a whopping 30,000 extra calories per year. The result of this simple underestimation of calories? A nine pound weight gain over the course of one year.[11] If diners would rather not know the amount of calories in the food they are ingesting, they could simply choose to ignore the calorie facts or ask for a menu without them. However, that information should be available to those who desire to be informed consumers.

Not surprisingly, studies show that consumers are in favor of making informed decisions. The same study which reported on consumers' inabilities to accurately estimate calories showed that 60 percent of those surveyed supported legislation which would require restaurants to label menus.[12] A four day study proved that menu labeling works as a method of behavior modification, showing that the presence of calorie information influences what 82 percent of New York City residents order at restaurants, and affects the restaurant choices of 60 percent of those surveyed. Additionally, 90 percent of those surveyed claimed that the number of calories in menu items were higher than expected.[13] Therefore, menu labeling can influence consumers, allowing them to reevaluate their choices, essentially acting as a form of behavior modification to prevent obesity.

Subway was one of the first restaurant chains to voluntarily provide nutritional information, and serves as a prime example of the importance of menu labeling. Jared, Subway's nationally known icon, is living proof that providing nutritional information can help fight obesity. At 425 pounds, Jared suffered from poor health and was told that he might not live past age 35. Obesity had a profound effect on his life, even forcing him to choose his college courses by the size of the chairs in the classroom in order to ensure he could fit into them. He made the decision to change his diet and used Subway's nutrition facts to help him reduce his 10,000 calorie daily intake to a more reasonable amount, eventually losing over half of his body weight, 240 pounds. According to Subway spokesman Kevin Kane, Jared's determination to change his diet is an example of the catalyst needed to make menu labeling so impactful. Like many Americans, Jared wanted information to make healthy decisions, and Subway was able to provide this nutritional information.[14]

Kane also noted that menu labeling did not result in the neglect of higher calorie options, which are still some of their best sellers. Americans are not fasting because of menu labeling; they are only making more informed decisions. Kane says that customers want the information, and they are thankful that it is there. Menu labeling legislation can also force restaurants to have healthier options by expanding the options for health-conscious consumers. As long as those consumers are concerned about the food with which they are fueling their bodies, restaurants with nutritionally labeled menus can help them fight obesity. According to Kane, menu labeling in restaurants is not the silver bullet, but it can certainly help in the fight against obesity.

Currently, only ten percent of restaurants in New York City label their menus with calories.[15] This is such a minute percentage of restaurants in the city that current statewide legislation is clearly inadequate and farther reaching legislation is required for menu labeling to make an impact on the obesity epidemic. Although the Labeling, Education,

nervosa ranks as the third leading chronic illness among adolescent American females. Eating disorders among men often go undiagnosed, and there is thus, an extreme lack of statistical data.[19] Nonetheless, if society is constantly and unwillingly exposed to calorie and fat content in food, there could very well be a rise in eating disorder behavior.

The average age at onset for anorexia nervosa is seventeen years, and the average age at onset for bulimia nervosa is middle to late teens or early twenties. It is logical to assume that by constantly exposing children to food statistics, the average age at onset for eating disorders could vastly decrease. The Center for Consumer Freedom recently stated that in 2007, incidences of eating disorders nearly tripled.[20] The not-for-profit organization, which promotes individual responsibility, emphasizes that "a growing chorus of researchers is cautioning regulators about the collateral damage of programs similar to menu labeling.[17] Why is it that we do not focus on an epidemic until it is in existence? Hilary Clinton once stated, "Many adolescents misinterpret the fight against obesity as a message that they should eat to achieve the body of a runway model. Anorexia and bulimia are increasingly common among our nation's youth".[20] A short time ago, I conducted an interview with an eating disorder psychotherapist at the Johns Hopkins Hospital, Janice Walker, during which I asked about the possible risks of posting food content on restaurant menus. Walker stated that she sees great danger in imposing constant exposure to food statistics, particularly on individuals who are predisposed to developing any sort of eating disorder.[21] Walker emphasized that eating disorders are not exclusive. The development of an eating disorder can take place in essentially anyone if properly stimulated.

Obesity is by no means a benign concept; it yields fatal diseases including numerous forms of cancer, liver disease, and heart disease helping to kill 112,000 people every year.

Just before I left, I asked Ms. Walker if she believed the obesity epidemic to be problematic, and if so, what her solution might be. She quickly replied that she of course thought the obesity epidemic to be extremely severe, and she subsequently provided me with a long-forgotten solution: the provision of proper portion sizes. She insisted that if people can somehow control portion sizes, whether it be via restaurant adjustments or simple education, there will no doubt be a decrease in rates of obesity. Walker wants people to understand that any type of food is acceptable to eat if consumed in proper portion and moderation. The body actually uses fat for energy and cholesterol for production of hormones and vitamin D. Chances are, however, that most menus will not come with any sort of explanation. Without explaining to individuals the significance of the numbers and the terminology therein, we risk the chance of misinterpretation and obsession, both of which promote disordered eating. Her solution makes perfect sense: Why not place our focus on portion size, so that the content of the food is not so significant? Why not avoid an eating disorder epidemic, which would require us to retrace our steps and reverse the policies we made to reduce obesity rates? I have absolutely no distrust in the positive outcomes that posting food content on restaurant menus could have, and perhaps will have. But, I cannot help but fear the consequences of such a method. When emaciation becomes as commonplace as obesity is today, will we unwittingly encourage obesity?

and Nutrition (LEAN) Act, a proposal recently re-introduced in both the House and Senate, would mandate national menu labeling complete with nutrition information beyond just calories, it will not require chains with less than 20 locations to label menus.[16,17] Therefore, most of the restaurants in New York City and other major cities will not be affected. This loophole must be addressed through national legislation that also targets smaller franchises.

It is imperative to begin implementing policy measures now in order to provide future consumers with educated choices. Menu labeling indubitably provides hope in the fight against the obesity epidemic, but it must first be mandated in nationwide franchises of all sizes. As consumers, we can choose to accept or reject the nuritional inofrmation provided by the government, but it is imperative that we are at least provided with the opportunity to do so. Consumers have the right to make educated choices, and the government should have the obligation to provide consumers with the information to do so.

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EDITORIALS

The Fountain of Youth as a Way of Life:
How to Slow Down the Aging Process

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In 1900, approximately one in every 100,000 Americans was expected to lived to be 100 years old.[1] Today, ten times as many live to celebrate their 100th birthdays.[1] With the advent of vaccinations, clean drinking water, and effective measures against maternal and childhood mortality, these figures do not come as a surprise. However, even as the average life expectancy for Americans has increased, how can we explain why only a select few are able to live to such an old age? The answer is complicated.

Starting at the molecular level, the process of aging involves the gradual accumulation of damage to our cells as they undergo metabolic processes. Such damage is created by reactive oxygen species started by free radicals, which are the byproducts of ATP production in the mitochondria.[1] Free radicals are molecules missing an electron pair that consequently take an electron pair from the neighboring molecule, which would then take an electron pair from the next molecule, and so on. This chain reaction often leads to the oxidation of proteins and damages the

DNA that produces those proteins.[2] Over the years, this internal breakdown is accelerated by external factors like ionizing radiation, toxic chemicals in the air and water, and certain ingredients in food.[1] In 1825, Benjamin Gompertz observed a linear increase in death rates as species age past sexual maturity. The theoretical maximum number of years that a human can live, 120 years, is determined by the Hayflick Limit, which states that the maximum number of times a human cell can divide is around 70.[1] The Hayflick Limit is determined by the length of telomeres on the ends of chromosomal DNA, which are shortened with each division until the cell can no longer divide. Understanding the molecular basis of aging is essential to understanding how the human lifespan can be prolonged.

Yet, if the recently discovered formula for living longer lies in diet restriction alone, how did the centenarians of today reach their ages without the benefit of this knowledge?

Researchers are trying to slow the aging process by finding ways to slow down cell metabolism by reducing the oxidation of proteins and the division of cells. Current research findings indicate that calorie restriction is the most dependable way of doing this. One experiment showed that mice that consumed 40 percent less calories than the mice in the control group lived 25 percent longer than the control group.[3] In humans, researchers predict that a calorie reduction of 20 percent is enough to decrease risk for heart disease and Type 2 diabetes mellitus, as well as add 3 to 13 years in life expectancy.[3]

According to the established theory on oxidation, calorie restriction is accompanied by lower oxygen consumption and formation of hydrogen peroxide, reducing damage to proteins and DNA within cells.[1] Recently, it has also been shown by MIT researcher Dr. Lenny Guarente that calorie restriction is linked to the activation of the SIR2 protein, a key player in the regulation of cellular metabolic rates. When food is scarce, the sirtuin group (present in different forms in organisms ranging from yeast to rats) ensures the survival of the organism by slowing down cellular processes.[4] Guarente's colleague, David Sinclair, has shown that SIR2 can not only be activated through calorie restriction, but also artificially through a chemical extracted from red wine called resveratrol.[4] However, even now, it has not been proven that high intake of resveratrol can match the benefits of calorie restriction.[5]

Yet, if the recently discovered formula for living longer lies in diet restriction alone, how did the centenarians of today reach their ages without the benefit of this knowledge? The answer points to the other factors in aging which many scientists have overlooked.

Undeniably, genes, gender, exercise, and personality are just as important as diet. Howard Hughes Medical Institute (HHMI) investigator Louis M. Kunkel's search for the single-nucleotide polymorphism (SNP), a nucleotide base within a single gene common to a pool of centenarians, led him to discover a built-in "Lipitor" gene, which encodes for the microsomal transfer protein.[6] Centenarians who had this SNP had increased levels of more effective HDL cholesterol, which decreased their risk of heart disease by lowering the amounts of LDL in their bloodstream. Gender also plays a role in favoring women over men for longevity. Because of testosterone, which increases risky behavior and raises LDL levels, men aged 55 to 65 are twice as likely as women to die from heart disease and accidents, and four times as likely to commit suicide.[1] In addition, women benefit from estrogen, which increases HDL while also acting as an antioxidant, helping to negate the effects of oxidation before further damages result.[1] Personality is also important in determining the likelihood for someone to live to 100: centenarian women scored significantly lower in neuroticism on the NEO Five-Factor Inventory Personality evaluation than the control group.[1] The absence of negative feelings like anger, fear, guilt, and sadness help centenarians to overcome stressful situations and increase their longevity.

Despite advances in longevity research, which tell us what we need to do to live longer, some scorn the addition of 13 years to the average lifespan of human beings on the basis that those years are debased due to a low quality of life and poor health. However, studies have shown that people who live to be 100 show relatively low levels of cognitive degeneration. Along with their slow rate of aging, centenarians display physical and cognitive abilities comparable to those of people up to 30 years younger.

Given the research proving that we can live longer and still benefit from good health, why is it that more people are not living to 100? Calorie restriction, coupled with increased consumption of antioxidants and many behavioral alterations seem necessary for a healthy long life. However, more temptations surround us today than 100 years ago. Fast-food restaurants and mainstream products high in trans-fatty acids ease their way into our diets. This brings up another point: simply eating less might not even be the right answer. For calorie restriction to be beneficial without side-effects, a lower calorie diet must still contain enough essential vitamins, minerals, and other nutrients to support health and longevity.

For taste, comfort, or cultural reasons, people are reluctant to give up their current diets. For people without an ideal set of genes, calorie restriction may seem to offer a lower quality of life than what they deem tolerable, even though it has been shown to preserve cognitive and physical well-being. Living in the 21st century, we are equipped with the knowledge for an elixir of life. Now, we must decide what we are willing to sacrifice to work toward potential longevity. We can choose to live as we do now or to live longer and healthier if we make the necessary dietary, behavioral, and personality modifications. A productive, long life is appealing, but giving up the pleasure of food would make life essentially tasteless. The secret to blowing our the candles on your 100th birthday cake? As the English proverb goes: one cannot eat cake and have it too.

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