15-Year Plan To Increase Rural Physician Distribution In Texas

Daniel M. Williams, MD

Physicians Caring For Texas

Committee On Rural Health

TMA 2012 Winter Conference

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Daniel M. Williams, MD
Department of Behavioral Health and Psychiatry
Scott & White Hospital
In c/o 316 Peanut Drive
Temple, Tx. 76502
dmwilliams@swmail.sw.org
713-822-7469

Texas Medical Association
Committee on Rural Health

January 26, 2012

Dear committee member,

Thank you for allowing me to serve on the TMA Committee for Rural Health this year. For the past 5 years, I have been conducting research that is meant to build up the physician workforce in rural areas. Health care access disparities have been a passion of mine for some time and it is a pleasure to present you with my research in this brief.

As an ambassador for the National Health Service Corps, I have seen first-hand how physicians vacate rural posts as soon as their obligation is up – often after hundreds of thousands of dollars are spent in administrative costs and loan repayments. The physicians themselves are simply not personally motivated to serve in rural locations. As this brief explains, a recent discovery has now shed light on why so many education pipeline and unconstitutional "guaranteed access" programs that get minorities into medical school don't work.

Once you've read this report and enclosed proposal, please implore your contacts at the State Legislature to support this project. Texas can become a leader in rural health access innovation with novel approaches such as this.

The long-term impact of this study is to lay the foundation for an effective recruitment tool to provide **primary care physicians and psychiatrists who desire to remain in shortage areas without external incentives** after their training is complete.

Thank you for taking the time to review this proposal and I would ask for your letter of support and funding assistance in helping bring this much-needed research into fruition.

Sincerely,

Daniel M. Williams, M.D.
Principle Investigator

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Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

INTRODUCTION

As of September 30, 2009, there were 65 million people living in Health Provider Shortage Areas, according to the U.S. Department of Health and Human Services. Currently 20% of Americans live in rural areas, but only 9% of physicians live there. The U.S. Health Resources and Services Administration estimates that it would take 16,663 primary care physicians in these locations to meet their needs[1]. Similarly, 5,338 mental health providers are needed in these areas.

This physician shortage is projected to worsen. The Association of American Medical College's (AAMC's) Center for Workforce Studies predicts a physician shortage of over 124,000 by the year 2025[2], but underestimates primary care. In 2007, they recommended a 30% increase in the number of medical school and graduate residency training positions, the largest recommendation of its kind. Considering the fact that the majority of internal medicine graduates subspecialize[105], we have a crisis in family medicine physicians – especially in rural areas. Psychiatrists are similarly in demand to help alleviate the mental health services shortages.

The disparity is worsened by physicians self-selecting specialties and urban settings. Simply *putting more physician candidates in the "pipeline" will not solve the health care disparities problem*. In fact, if the physicians in this coming surge do not willfully choose to serve in physician shortage areas, current expansion efforts could actually make the problem worse. It is, in part, a matter of individual motivation to serve in these areas. The logical question has become "how do we select candidates for medical school that will 'want' to serve in shortage areas?"

Legislation

While some state legislatures approve of "pipeline" programs that guarantee admission into medical school for minorities and the financially disadvantaged, Supreme Court Justice Sandra Day O'Connor wrote in the 2003 *Grutter vs. Bollinger* ruling that race-conscious admission decisions should be irrelevant by 2028 – roughly the same time we're expecting a 124,000 physician shortage[3,4]. So far, medical schools have not even attempted a compliant response to physician recruitment to rural areas. Providing health care access for all U.S. citizens is a national goal, but traditional methods of diversifying the physician workforce while simultaneously increasing primary care physicians in shortage areas have simply failed to yield the desired trend[4,7,8].

Fortunately, in the last few years have we been able to better understand which traits in a physician candidate actually contribute to their desire to serve in physician shortage areas[5,6]. Contrary to premedical enrichment programs that date back to the 1980's, it is now known that *race and socioeconomic status don't accurately predict the physician candidate's desire to serve the medically underserved*. It turns out that actually having come from a medically underserved area themselves statistically increases medical students' desire to serve in such environments[6]. So, while diversity does have

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

other benefits for the educational experience of future physicians, this alone does not solve our problem of health care disparities.

What we propose is a national, randomized, controlled trial that will test an existing premedical enrichment tool. This study will recruit physician candidates born and raised in medically underserved areas and provide them with the best premedical enrichment training available at little or no cost to them. This effort will help level the financial, social, and academic playing field for physician candidates from minority and disadvantaged backgrounds. This strategy will allow for a more competitive and diverse applicant pool and will naturally distribute physicians into shortage areas based on their own preferences when they enter the workforce.

The specific benchmarks we will use to track success include:

1. Increased matriculation rates into medical school.
2. Increases in Medical College Admission Test (MCAT) scores.
3. Applicants' demographic information to the general medical school applicant pool will ensure the sampling techniques are representative.
4. Undergraduate grade point averages pre- and post-intervention.
5. Personal essays on career interest pre- and post-intervention, and assess inter-rater reliability, to detect improvements in the content and quality of their writing and interest in rural medicine.
6. We will test an instrument designed to formulate numeric scores to the composite students' applications and compare them to the actual applications that get them accepted into medical school. Logistic regression and odds ratios will be calculated to determine which components have the greatest impact in preparation for validation of this instrument as a recruitment tool.
7. Student participation in the peer support community to determine if this involvement has a lasting impact on their attitude, outlook, and enthusiasm.

METHODS

Our one-year intervention uses a diverse curriculum: student-to-physician tele-mentoring and a step-wise multimedia curriculum that includes print, DVD and online training. The clinical emphasis is on the integration of primary care integration with mental health services, provided by Asim A. Shah, M.D., a multi-N.I.H. grant awardee, in cooperation with Baylor College of Medicine's Psychiatry Residency Training Program. The success strategies we teach to disadvantaged students are based on the writings and work of Napoleon Hill, with the support of his grandson, J.B. Hill, M.D. and the Napoleon Hill Foundation's World Learning Center based at Perdue University Calumet. The career mentorship curriculum was created by the primary investigator of this study, Daniel M. Williams, M.D., which incorporates a written and video tutorial-based career advising curriculum with live tele-seminars hosting a variety of physician

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

specialists. Other research arms available to a subset of our students will be Dr. Brett Ferdinand's online science training for the Medical College Admission Test (MCAT) and Test Prep New York's Verbal Reasoning Course and Test Anxiety Management training. Finally, education and training in rural practice will be administered by Robert C. Bowman, M.D. at A.T. Still School of Osteopathic Medicine.

Since not every physician candidate will choose primary care or to serve the medically underserved, the number of students needed to enroll in this study must be three to ten times the number of primary care physicians needed to meet our nation's goal. The conservative estimate of ten times the number of candidates needed, 165,850, in order to place 16,585 primary care physicians in shortage areas, puts the cost of national expansion of the University of California's pilot enrichment program at over $2.9 Billion. This cost-prohibitive delivery model has caused these valiant efforts to have little-to-no impact on the problem as a whole, especially in light of the 30% increase in medical school and residency training slots recommended by the AAMC[2]. By comparison, we estimate that two out of every three of our students will serve in a capacity that serves patients in areas that are currently medically underserved for less than 10% of the cost of traditional, on-site programs.

This study will ultimately seek 1,200 student applicants as a cohort, which will then be randomized to the intervention group. Outcomes such as matriculation into medical school and rural primary care preferences will be compared to national trends, as there is no data available on remote, computer-based premedical mentorship.

Our study design has been constructed to enable us to:

(1) Describe the demographic and other personal characteristics of potential medical students from physician shortage areas, and compare them with other potential medical students,

(2) Develop short-term indicators of our program's probable success for participating students who have not yet applied to medical school (increased likelihood of medical college admission),

(3) Compare medical school admission rates for graduates of our program with those of a comparison program,

(4) Collect formative data from program participants to enable program refinements and improvements, and

(5) Create a data file and establish a process through which the ultimate efficacy of our program (increased proportion of program medical school graduates, relative to comparable medical school graduates, who are employed as physicians in rural and other shortage areas) can be measured.

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All study procedures, protocols, data security procedures, and confidentiality procedures will be reviewed and approved by the American Institutes for Research (AIR) Institutional Review Board prior to their implementation. AIR's IRB (IRB00000436) has conducted expedited and full-board reviews of research involving human subjects for more than 14 years. AIR is registered with Office of Human Research Protection (OHRP) as a research institution (IORG0000260) and conducts research under its own Federal wide Assurance (FWA00003952).

Extensive, longitudinal surveys will allow the medical education community to better understand the premedical student landscape with increased granularity. For example, what percentage of African American women from medically underserved areas choose to practice as a specialist in an urban setting? Logistic regression analysis and odds ratios with confidence intervals will be calculated to determine which, if any, confounding factors may have contributed to the students' increased matriculation into medical school or academic failures.

Remote administration of a premedical enrichment program has never, to our knowledge, been studied. We will deliver a one-year intervention program and test its efficacy for increasing the odds that a student can matriculate into medical school. Odds ratios with confidence intervals will be calculated to determine if our premedical enrichment program can be validated as an effective intervention to increase matriculation into medical school.

Further, this grant award will allow us to test the hypothesis that physicians recruited from medically underserved areas actually return there to serve when their training is complete. This is a 10-15 year process that is not dependent on this grant award. The outcome of profound interest is identifying the effect of this recruitment model on the problem of physician shortage areas as a whole. Odds ratios with confidence intervals will be calculated to determine if our premedical enrichment program can be validated as an effective intervention to provide primary care physicians into medically underserved areas within the United States.

TIMELINE OVERVIEW

Table 2 summarizes the proposed participant data collection activities. This table is followed by discussions of our proposed instrument development activities, procedures for scoring AMCAS applications, procedures for data collection, and our analysis plan.

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

Table 2. Participant Data Collection Activities

Instrument	Timing	Uses
1. Application	Application to program	Describe the characteristics of potential medical students from physician shortage areas, and compare them with other potential medical students Baseline data for assessment of impacts of participation
2. On-line surveys	End of school year	Formative feedback on program Short-term indicators of impacts/success
3. Telephone interviews	Episodic	Formative feedback on program
4. AMCAS application	Application to medical school	Indicator of impacts/success
5. Annual on-line follow-up surveys	October	Medical college admission rate (Success indicator) Tracking data Formative feedback on program

Time – 0: Grant Award

Time - Months 1-3: Program Announcement

Pre-medical career advisers employed at junior colleges' and universities' located in federally-designated physician shortage areas will be contacted throughout the country. Information about the research study will be delivered via phone, internet, email, and physical mail. We will ask them to post flyers, forward emails, and make announcements directing students to a unique web site, www.DoctorCareer.Info. This URL will take them directly to the Research Account application, called the "Pre-Med Boot Camp". In return, participating and cooperative advisers will receive a premedical advising DVD set for their local student library. This resource will be provided at the end of the study so as not to contaminate the applicant and non-participant pool.

The qualification criteria for selecting which students will qualify will be kept confidential from both advisers and students. If the students learned that their address of origin defined them as a potentially qualifying applicant for this grant-sponsored enrichment program, they would have an incentive to provide false information.

The equal interest in premedical students from medically served and underserved communities will provide insight into intrinsic differences and needs within these groups. Therefore, the primary web site for content delivery is a commercial design. This fact contributes to the students' perception of the content's value and may result in greater appreciation and program completion.

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

Time - Months 4-5: Program Enrollment

Students interested in this program opt-in by completing a web-based informed consent document for research on human subjects. Identifying information will not be published, but aggregate data will.

A variety of outreach strategies will be used to recruit program participants. Pre-medical advisors at colleges and universities will be provided with information materials to disseminate. Recruitment will be concentrated at Minority Serving Institutions (MSIs) and those located in medically underserved rural areas.

All students will then fill out a fairly lengthy survey designed to mimic the real medical school application, including MCAT scores if available, transcripts, letters of recommendation, and personal essays.

It is in this step of the program workflow that data will be compiled for the first of our program's missions: increased granular understanding of the premedical student landscape. Questions administered after informed consent and privacy concerns are addressed include, but are not limited to the following: name, email, shipping address, address of origin: where you were born and raised [street address or county/state], spouse/significant other address of origin, age, sex, race/ethnicity, undergraduate major, highest level of education attained by each of the applicant's parents, medical school reapplication, participation in another premedical enrichment program or professional MCAT review course, county/state of high school of graduation, total number of credit hours at all schools, total credit hours at current school if that is your expected bachelor's-awarding institution, county/state they intend to practice, intent to practice medicine in a medically underserved area, and undergraduate degree obtained. In addition, the application will contain sections that will be directly comparable to the real American Medical College Application Services (AMCAS) application (to enable the detection of within-individual changes in application quality). This demographic data will be de-identified to protect anonymity and will then be incorporated into a Geographic Information System, discussed in the Data Sharing Plan.

Included in this set of demographic-type questions will be a field called "Address of Origin: where you were born and raised?" Students will have the option of typing in a street address or County/State in this required field. Research Assistants will input these address locations into the U.S. Department of Health and Human Resources website that defines Medically Underserved Areas (MUAs), Medically Underserved Populations (MUPs) and Health Professional Shortage Areas (PSAs): http://bhpr.hrsa.gov/shortage/index.htm. This web site is maintained by the Health Resources and Services Administration (HRSA).

Students that were born and raised in one of these HRSA-qualified areas will be pre-qualified for our program and put into the qualified applicant pool. A sample size of 1,200 will be sought through a multimedia campaign and directly through undergraduate

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

campuses located in MUPs and PSAs. Students will then be randomized to participate in the research study.

When participants enroll in the study, they will complete a consent form that describes the study and the responsibilities (i.e., completion of periodic questionnaires; transmission of a copy of their AMCAS application; provision of information to enable long-term follow-up) and rights of program participants. Although future data collection activities will always be voluntary, sensitizing participants to planned data collection activities should predispose them to favorably respond to these requests.

Time – Months 6-18: Program Administration

Applicants from shortage areas will be systematically assigned to class (freshman, sophomore, junior) strata based upon the number of completed semester hours. The stratification of assignment by class will insure equal numbers of underserved area freshman, sophomores and juniors. That is, completed applications will be alternated among the two programs, within class strata, based on time of receipt of the application. Assuming outcome data are provided by 60% of the participants, a sample of this size will permit the detection of an enhancement in medical college acceptance rates from 20% to 28%, with statistical power of 81% (one-tailed test, $p < .05$). This statistical power is comparable to Grumbach and Chen's demonstration of the efficacy of the University of California's Postbaccalaureate Premedical Program in increasing medical school matriculation for minority and disadvantaged students.[87]

Students randomized to the test cohort will be stratified according to need and receive multiple program modalities:

1. Science of Personal Achievement from the Napoleon Hill Foundation's World Learning Center at Perdue University Calumet

2. Medical Career Training from the Medical Mastermind Community's Daniel Williams, M.D.

3. Gold Standard prerequisite science courses from Brett Ferdinand, M.D.

4. Verbal Reasoning for the Medical College Admission Test (MCAT) from Test Prep New York

5. Test Anxiety Management Training from Test Prep New York

6. Coaching sessions with physicians via teleconference hosted by the Medical Mastermind Community

7. Rural Practice Primer Course from A.T. School of Osteopathic Medicine's Robert Bowman, M.D.

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8. Integration of Psychiatry and Primary Care Primer Course from Asim A. Shah, M.D. at Baylor College of Medicine

The curricula chosen for this program come from successful programs and peer-reviewed literature and include, but are not limited to the following: basic science and verbal reasoning study preparation (emphasis on the MCAT), importance of primary care, test taking, test anxiety management, writing personal statements, interviewing, opportunities for research, health care disparities, diversity training, lifestyle balance, life success strategies, career paths in medicine, peer-support teleconferencing, emotional intelligence development and assessment, burnout prevention, and stress management and assessment. In essence, this curriculum encapsulates the elusive, and often tacit, "discourse of medicine" that is often inaccessible among disadvantaged undergraduate students.

Practically speaking, recent technological advances have enabled mass distribution of content both cost-effectively and conveniently. The training we will deliver uses printed workbooks, internet-based forums and tutorials, teleconferences over the telephone, and accompanying CD's and DVD's shipped directly to their home. Physician-student teleconferencing will happen live on a monthly basis and student-student teleconferencing biweekly, each for one calendar year. The "Pre-Med Consult" kit includes DVD's, manuals, semester calendars and Pre-Med mindmap software, which organizes the entire medical education pathway on one DVD-ROM.

One-on-one, structured interviews and formative data will be used to provide accountability for the students to insure they actually consume the course material. To further increase the likelihood of compliance with follow-up surveys, we plan to provide incentives such as valuable study tools at relevant times throughout the medical licensing process.

Time – Years 2-6: Follow-Up Surveys

The primary outcomes we are studying in this phase are matriculation into medical school or other health care professions and the intent to serve in a physician shortage area when the students are in their 4th year of medical school. Matriculation will be compared to the control and test cohorts as well as the national statistics according to the Association of American Medical Colleges (AAMC).[88] This will answer the billion-dollar question: Will this affordable delivery method be as effective as an in-house program?

We will use HRSA-qualified shortage areas as the specific outcome and, for the first time in history, be able to substantiate the claim that an affordable premedical enrichment program can target students in physician shortage areas and that its delivery mechanism is scalable.

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The fourth year of medical school was chosen as a benchmark reference so as to provide a comparison to the 2003 AAMC Graduation Questionnaire.[89] More recent questionnaires now lack sufficient power and are possess substantially less power for predicting a students' desire to serve in a physician shortage area.

Due to a complaint filed by the U.S. Department of Health and Human Services' Office for Human Research Protections against the AAMC's mandatory nature of this survey, participation has greatly decreased in recent years from 89% in 2003 to 33% in 2005. Furthermore, the AAMC simply asked these students "Do you plan to locate your practice in an underserved area?" These students likely have no idea if the regions within the county they plan to work in, if they even know, are deemed official physician shortage areas or medically underserved areas by the U.S. Department of Health and Human Services (HRSA).

Therefore, our end goal for this project will be to prospectively follow these students through their medical education and ask them a more refined question in their 4th year of medical school; "In what county/state or at what street address do you intend to practice medicine?" Their answers will be, again, put into the HRSA database to see if their practice setting officially qualifies as a physician shortage area.

INSTRUMENT DEVELOPMENT PROCESS

For each data collection instrument, a variables list will be prepared. This variables list will be tied to a conceptual framework linking specific factors to the outcomes of interest. For example, the variables list for the application (baseline data collection) will include factors that have been shown to be associated with medical practice location choice (such as rural upbringing and specialty preference). We also anticipate the development of measures of a student's medical college application self-efficacy. Although self-efficacy is not a requisite for medical college admission, one of the program's proximal goals is to increase a student's belief in his or her ability to succeed in the medical college application process. This enhancement in self-efficacy can serve as an indicator of program success for students who have not yet applied to medical college. One of the program's proximal goals is to increase a student's belief in his or her ability to succeed in the medical college application process.

The self-efficacy measure is critical for underclassmen for whom we don't get American Medical College Application Service® (AMCAS) scores, such as the sophomores and juniors who haven't yet applied. We can validate our self-efficacy measures with either logistic regression or, if we lack acceptance data, through regular multivariate regression (assuming that our AMCAS measures are continuous).

Survey development is an iterative process. Draft items, linked to specific constructs on the variables list, will be developed (or taken from items used in our previous research efforts). These items will be circulated, reviewed, and revised by team members. After the review and revision process concludes, a draft version will be

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prepared for pilot testing. We anticipate the use of cognitive testing procedures for pilot testing the instrument. Cognitive testing allows potential problems to be detected and avoided, obviating the need for "damage-control" procedures after the survey has been fielded, or the need for rejection of data because of concerns regarding validity.

Our approach to cognitive testing is based on a specific model of the questionnaire response process.[89,90,91] This model decomposes the process of responding to an item into four stages: 1) comprehension; 2) retrieval of information; 3) judgment formation; and 4) response production/selection. With the tools available to the cognitive survey researcher (including think-aloud interviews, probes, paraphrasing requests, confidence ratings, and debriefing protocols), it is possible to systematically develop, investigate, and evaluate survey items. The process informs survey changes based on a rational model rather than on intuition.

DATA COLLECTION PROCESS

Interested participants will complete an application for admission. This application will consist of a detailed background survey as well as a version of the AMCAS application. In addition, as part of the informed consent process, participants will be provided with a description of the proposed study, describing their rights and responsibilities, prior to completing the application. These data collection procedures will be conducted on-line.

Near the end of the school year, all participants will be sent an invitation to participate in an on-line survey. Embedded in the invitation will be a hypertext link to the survey web site. The link will also contain a unique identifier, allowing identification of the respondent. This survey will re-administer some of the items from the application survey (such as medical college admission self-efficacy items) to allow assessment of changes in self-efficacy. It will also contain items about the respondent's medical school plans, the estimated amount of time the student engaged in program related activities, involvement with other medical college admission activities and strategies, and items intended to provide formative feedback about the program. Up to three reminder e-mails will be sent to non-respondents, at approximately weekly intervals.

Approximately 30 students will be selected for follow-up telephone interviews, to obtain more detailed formative information about the program. Half of these will be selected from individuals who did not respond to the e-mail survey request; the other half will be individuals whose electronic survey responses indicated problems or issues that might require follow-up. It should be noted that the purpose of these interviews is to identify program components and procedures that are in need of modification. These data will not be used to calculate problem rates.

AMCAS applications will be requested of all students. AMCAS deadlines reflect medical school deadlines (ranging from October 1 – December 15). We anticipate

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sending out e-mail requests for copies of AMCAS applications on October 1. Reminder requests (for individuals not providing copies) will be sent on November 1, December 1, and January 1.

In years 2 and 3 of the study, e-mail survey invitations will be sent to all participants. We recognize that many participants' e-mail addresses will change after their graduation. Individuals identified in the application as people who will know how to contact the student will be contacted, as needed, to obtain updated contact information for the participant. These periodic surveys will enable determination of medical school application success and career plans. We anticipate administering these surveys in the spring, using the same procedures as employed in our other electronic surveys. The enclosed budget for this budget will cover the first 2-3 years of this multi-year study, following our first cohort through their matriculation into medical school. Subsequent funding will be identified beyond the third year (see commercialization plan for revenue sources).

We anticipate continued follow-up of participants subsequent to the end of Phase II of SBIR funding. Such follow-up will be invaluable for assessing the true impacts of participation in the program and both medical college admission success and practice location choice. We refrain from a discussion of these activities since they are outside of the temporal scope of this SBIR.

DATA ANALYSIS

Comparisons of potential medical students from physician shortage areas with other potential medical students. Program applications will provide extensive data on potential medical students' demographics and other personal characteristics known or believe to be associated with medical career choice. Both parametric and non-parametric tests will be employed, depending on the types of data being analyzed. We anticipate numerous bivariate analyses (such as comparing females from underserved areas with other female students; minority students from underserved areas with other minority students) in addition to comparisons of the gender and racial/ethnic balance of shortage area applicants with applicants from other areas.

Short-term indicators of success. We anticipate the development of measures, which may be associated with medical school application success, to provide indicators of probable program effectiveness. These include medical school application self-efficacy, occupational commitment, AMCAS application 'scores' (see next section) and other characteristics that may be influenced through program participation. Participant changes on these measures during the study period will be calculated using appropriate parametric and non-parametric statistical tests.

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We will ultimately attempt to validate these measures against actual outcomes after true outcome data (i.e., admission success rates, practice location data) become available.

AMCAS Application scoring. Rubrics for scoring the AMCAS application will be developed based on our understanding of the criteria employed by medical colleges. These scoring rubrics will focus on specific components of the application, to reduce the amount of time required and to also promote scoring reliability. Raters will be trained in the application of these rubrics. At least 10 percent of each rater's work will be duplicate-coded. Discrepancies will be discussed and resolved. The discrepancy resolution process will also be part of the quality control process, to identify raters in need of further training. When applications are scored, raters will be blind to whether the student is in the program or the comparison group.

Success rates. Medical college admission success rates will be calculated for applicants in the treatment and control conditions. We anticipate comparing success rates for students from medically underserved areas through chi-squared tests. We also anticipate the use of multivariate logistic regression analyses to enable us to both assess and control for the impacts of characteristics that might be associated with application success (family members in medicine; GPA; MCAT scores, use of specific program materials, amount of tele-mentoring, use of other programs or strategies to increase the likelihood of medical college admission, etc.) and which might be unevenly distributed among participants in the treatment and control groups. Success rates will be calculated on a yearly basis, using information obtained through the annual on-line follow-up surveys.

Should resources permit, we will also compare success rates for comparison group participants from underserved areas and from other areas. Similar analytic procedures will be employed, allowing determination of the impact of living in underserved areas on admission success.

Formative data. Telephone interviews with a small number of program participants and on-line survey items will be analyzed to inform about problems with program materials, logistics, tele-mentoring, and program operational characteristics. Initially, these data will be primarily open-ended data, to facilitate the identification of areas in need of improvement. The data will be coded, to allow the detection of the prevalence of specific themes indicating areas of weakness. Problem areas – and potential problem areas – will lead to probable program refinements, as well as the development of specific survey and interview items to permit monitoring of these problems over the duration of the program.

Create a data file and process to allow long-term follow-up. Medical practice location data cannot be collected from medical school applicants in the 2.5 years allotted to phases I and II of the SBIR. Nonetheless, such information is essential in demonstrating the ultimate impacts of the program in ameliorating the physician shortage area problem. At the end of initial funding, we will have a longitudinal data file on

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

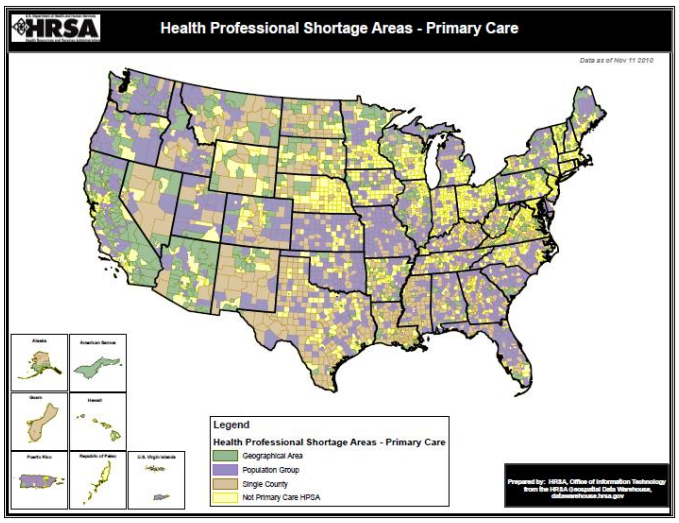
program (and control) participants. A substantial proportion of these participants are expected to have enrolled in medical school.

We will continue to collect data from these students – and continue to share information and make available resources to them, to encourage their retention as study participants. This cadre of medical school students from underserved areas can be an invaluable resource for researchers interested in developing ancillary programs to enhance the probability of ultimate medical practice in underserved areas. As previously noted, the original application/participation agreement collects information about people who will probably know how to contact these participants in the future. In addition, the detailed information (including date of birth and home address) can be used to track individuals in an effective and cost-efficient manner.

DATA SHARING PLAN

One of the largest innovations of this project is the integration of our data with the Geospatial Data Warehouse, maintained by the U.S. Health Resources and Services Administration (H.R.S.A.). This will make it possible to view, for the first time, a visual overlay of highly detailed demographic and social support data from future physicians on the backdrop of the very physician shortage areas in which they were reared.

http://datawarehouse.hrsa.gov/mapgallery.aspx



This will enable organizations such as the National Association of Community Health Centers, representing the physician employers in many of these shortage areas, to create custom maps and study trends in physician career preferences to better inform their recruitment efforts and, perhaps, increase retention in shortage areas.

Additional target audiences include conferences and journals that are attended and read by premedical advisors at community colleges, colleges, and universities. Within one year of our enrollment of students into our program, aggregate data will be put on the web free of charge.

Trends in demographics of future physicians will be submitted to peer-reviewed, scientific journals for data sharing with the general public. Data on the matriculation of students into medicals school will not be available for approximately 2.5 years after our project start date. This data will also be submitted to peer-reviewed, scientific journals for data sharing with the general public. In the event that sharing data will affect the

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

proprietary nature of our product development under this S.B.I.R., the data will be made public 4 years after the project end date in accordance with the Small Business Act.

LIMITATIONS

The definition of medically underserved areas/populations and physician shortage area changes over time and is currently under review by the Health Resources and Services Administration (HRSA). To alleviate this problem, all efforts will be made to obtain a copy of the 2012 database of the HRSA for the express purpose of carrying out this study on the same dataset 6 years from now. Our survey data will also be compared to future definitions of physician shortages areas in 6 years to discover if changes to the HRSA database are confounding our results. While this may seem somewhat arbitrary, the procedural due diligence of the U.S. Health Resources and Services Administration to accurately represent our country's health care needs provides the most robust solution available and is carefully guarded.

Second, ensuring that we stay in contact with these students on an optional, ongoing basis for 5-6 years will require regular, beneficial contact. That is why we have integrated the follow-up surveys as a strategy to conduct a 30-minute, structured telephone interview per year with each participant. The focus of the interview is two-fold: to further see what challenges they face and understand them better; as well as make them feel appreciated for taking part in this national study by providing them with updates on exactly how their participation is benefiting our country as a whole. They will then be reminded about the next follow-up interview and updated contact information.

This phase of the study will allow us to validate a number of important theories used as attempts to remedy health care disparities in the United States. The most important data this prospective, randomized study will yield are increased understanding of the premedical student landscape so that we can better target subpopulations for a career in medicine, determination of remote multimedia delivery of the "discourse of medicine" as a viable intervention for increased matriculation into medical school, and whether selection of physician candidates from medically underserved areas can truly contribute to solving our nationwide health care disparities problem.

SUMMARY

This study contributes to a diverse physician workforce, evening physician distribution to physician shortage areas, is scalable, complies with the Supreme Court's guidance by mentoring students who then compete in the free market for medical school matriculation, and tests the possibility of selecting future physicians more likely to want to serve in underserved areas when their training is complete. The multimedia approach is currently being published and is submitted for presentation at the Southwest Teaching and Learning Conference.

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

BIBLIOGRAPHY

[1] Shortage Designation: HPSAs, MUAs & MUPs. United Stated Department of Health and Human Services, Health Resources and Services Administration. April 20, 2009. <http://bhpr.hrsa.gov/shortage/index.htm>.
[2] The Complexities of Physician Supply and Demand: Projections through 2025. Association of American Medical Colleges, Center for Workforce Studies. November 2008. <http://www.aamc.org/workforce>
[3] Joint Admission Medical Program. < http://www.texasjamp.org/>
[4] *Grutter v Bollinger*, 539 US 306 (2003).
[5] Race-neutral versus race-conscious workforce policy to improve access to care. Saha S, Shipman SA. *Health Aff (Millwood).* 2008:27(1):234-245.
[6] Student Body Racial and Ethnic Composition and Diversity-Related Outcomes in US Medical Schools. Saha S *et.al*. *JAMA*. 2008:300(10):1135-1145.
[7] *Gratz v Bollinger*, 539 US 244 (2003).
[8] Race-Neutral Admission Approaches: Challenges and Opportunities for Medical Schools. Steinecke A *et.al. Acad. Med.* 2007(82):117-126.
[9] Summer Medical and Dental Program. Association of American Medical Colleges. <http://www.smdep.org/>
[10] Effectiveness of University of California Postbaccalaureate Premedical Programs in Increasing Medical School Matriculation for Minority and Disadvantaged Students. Grumbach K, Chen E. *JAMA*. 2006(296)9:1079-1085.
[11] Effects of Affirmative Action in Medical Schools: A Study of the Class of 1975. Keith SN *et.al. NEJM.* 1986:313(24):1519-1525.
[12] Student Body Racial and Ethnic Composition and Diversity-Related Outcomes in US Medical Schools. Saha S *et.al*. *JAMA*. 2008:300(10):1135-1145.
[13] Race-Neutral Versus Race-Conscious Workforce Policy to Improve Access to Care. Health Affairs. Saha S, Shipman SA. 2008:27(1):234-245
[14] Poll Analysis: U.S. Nowhere Near Eliminating Racism, but Race-Based Affirmative Action Not The Answer. Richardson JD. *Los Angeles Times*, 26 February 2003.
[15] *Grutter v Bollinger*, 539 US 306 (2003).
[16] Health Resources and Services Administration. Fiscal Year 2007 Justification of Estimates for Appropriations Committees: Health Professions.
[17] The Consequences of Premature Abandonment of Affirmative Action in Medical School Admissions. Cohen, JJ. *JAMA*. 2003:289(9):1143-1149.
[18] Health Resources and Services Administration. http://bhpr.hrsa.gov/shortage/index.htm
[19] MEDPREP – 30 Years of Making a Difference. Jackson EW *et.al*. *Acad. Med*. 2003(78):448–453.
[20] Effectiveness of University of California Postbaccalaureate Premedical Programs in Increasing Medical School Matriculation for Minority and Disadvantaged Students. Grumbach K, Chen E. *JAMA*. 2006:296(9):1079-1085.
[21] Effect of an Intensive Educational Program for Minority College Students and Recent Graduates on the Probability of Acceptance to Medical School. Cantor *et.al*. *JAMA*. 1998:280(9):772-776.
[22] Measuring and predicting academic generalists' work satisfaction: implications for retaining faculty, Yvonne M Coyle, Lu Ann Aday, Academic Medicine 1999;74:1021-1027
[23] The impact of the changing health care environment on the health and well-being of faculty at four medical schools, Barbar A. Schindler, Dennis H. Novack, Academic Medicine, 2006;81:27-34
[24] Konrad T, Williams E, Linzer M, et al. Measuring physician job satisfaction in a changing workplace and a challenging environment. Med Care. 999;37:1174-82.
[25] Viewpoint: Enhancing the professional fulfillment of physicians, Shanaree Brown, Richard B. Gunderman, Academic Medicine 2006;81:577-582
[26] Premed survival: understanding the culling process in premedical undergraduate education, Karen Lovecchio, Lauren Dundes, Academic Medicine 2002;77:719-724
[27] A survey on the 'premedical syndrome'. Sade, R M, Fleming, G A, Ross, G R. Journal of Medical Education. 59(5):386-91, May 1984
[28] The premed stereotype, Judith D Hackman et. al. http://journals.lww.com/academicmedicine/Abstract/1979/04000/The_premed_stereotype.5.aspx
[29] Correlation of student' characteristics with their learning styles as they begin medical school, Stephen Aaron, Ernest Skakun, Academic Medicine, 1999;74:260-262
[30] Application of Bloom's Taxonomy debunks the "MCAT Myth", Alex H Zheng, Janess K Lawhorn, Science (magazine), Vol 319, 25 Jan. 2008
[31] America's best medical schools: a critique of the US News & World Report Rankings, William C McGaghie, Jason A Thompson, Academic Medicine, 2001;76:985-992.
[32] Premedical and medical school performance in predicting first-year residency performance. Linda K Gunzburger, Robert G Franzier, Journal of Medical Education, Vol 62, May 1987
[33] Does the medical college admission test predict global academic performance in osteopathic medical school? Paul Evans, Frances K Wen, Journal of American Osteopathic Assoc. 2007;107:157-162
[34] Application of Bloom's Taxonomy Debunks the "MCAT Myth", Alex Y. Zheng, Janessa K. Lawhorn, Thomas Lumley, Scott Freeman. Science. 25 Jan 2008, vol 319, pp 414-415.
[35] Is medical school the right place to choose a specialty? Sean Schafer, William Shore, Norman Hearst, JAMA 2001;285(21):2782-2783
[36] Teaching professionalism in undergraduate medical education, Herbert M Swick, Philip Szenas, Deborah Danoff, JAMA 1999;282(9):830-832

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

[37] The threatened role of the premedical advisor, Barbara Y Stewart, Academic Medicine, Vol 63, Number 7, July 1993
[38] Comparison of medical school performances and career plans of students with broad and with science-focused premedical preparation, Judith Anderson Koenig, Academic Medicine, 67(1992):191-196
[39] Medical humanities and their discontents: definitions, critiques, and implications, Johanna Shapiro, Jack Coulehan, Academic Medicine, 2009;84:192-198
[40] Perspective: After a century of criticizing premedical education, are we missing the point? Jeffry P Gross, Corina Mommaerts, Academic Medicine, 2008;83:516-520
[41] Building a diverse physician workforce, Jordan J Cohen, Ann Steinecke, JAMA 2006;296(9):1135-1137
[42] Diversity in medical school: perceptions of first-year students at four southeastern US medical schools, Carol L Elam, Mitzi M S Johnson, et al. Academic Medicine 2001;76:60-65
[43] Understanding poverty and physician workforce, Robert C. Bowman, http://www.unmc.edu/Community/ruralmeded/underserved/understanding_poverty_docs.htm
[44] The effect of a class in medical ethics on first-year medical students, Andrew F Shorr, Risa Hayes, James Finnerty, Academic Medicine, 69(1994):998-1000
[45] Mid-career burnout in generalist and specialist physicians, Anderson Spickard, Steven Gabbe, John Christensen, JAMA 2002;288(12):1447-1450
[46] A hazard model of probability of medical school dropout in the United Kingdom, Wiji Arulampalam, Robin A Naylor, Jeremy P Smith, Forschungsinstitut zur Zukunft der Arbeit, Institute for the Study of Labor, IZA Discussion Paper No. 333, July 2001
[47] Attrition Rates, Robert C. Bowman, http://www.unmc.edu/Community/ruralmeded/attrition_rates.htm
[48] A conceptual model of medical student well-being: promoting resilience and preventing burnout, Laura B. Dunn, Alana, Iglewicz, Christine Moutier, Academic Psychiatry 2008; 32:44-53
[49] Disclosure of sexual orientation by medical students and residency applicants, Robert C Merchant, Artemio M Jongco, Academic Medicine 2005;80:786
[50] Harassment of lesbians as medical students and physicians, Donna Brogan, Erica Frank, Lisa Elon, JAMA 1999;282(13):1290-1292
[51] Coping with a learning disability in medical school, Kevin M Takakuwa, JAMA 1998;279(1):81
[52] Attrition Rates, Robert C. Bowman, M.D. http://www.unmc.edu/Community/ruralmeded/attrition_rates.htm
[53] A Hazard Model of the Probability of Medical School Dropout in the United Kingdom, Wiji Arulampalam, Robin A. Naylor, Jeremy P. Smith. Iza, July 2001. DP No. 333
[54] Burnout and Serious Thoughts of Dropping Out of Medical School: A Multi-Institutional Study. Lisolette N. Dyrbe, *et. al*. Acad. Med. 2010; 85:94-102.
[55] Career satisfaction of US women physicians, Erica Frank, Julia McMurray, Archives on Internal Medicine, Vol 159, No 13, July 12, 1999
[56] A Conceptual Model of Medical Student Well-Being: Promoting Resilience and Preventing Burnout. Laura B. Dunn, Alana Iglewicz, Christing Moutier. Academic Psychiatry, 32:1, January-February 2008
[57] The U.S. Health Care system is in crisis: implications for academic medical centers and their missions, Richard Lorgren, Michael Karpf, Academic medicine, 2006;81:713-720
[58] Physician stress: results from the physician worklife study, Society of General Internal Medicine Career Satisfaction Study Group, Mark Linzer, Martha Gerrity, Jeffrey Douglas, et. al. , Stress and Health, 2002, vol 18, No 1, pp. 37-42
[59] Preventing occupational stress in healthcare workers. Marine A, Ruotsalainen J, Serra C, Verbeek J. Cochrane Database of Systematic Reviews 2006, Issue 4. Art. No.: CD002892. DOI: 10.1002/14651858.CD002892.pub2.
[60] Commentary: Impared physicians and the new politics of accountability, Daniel M. Fox, Academic Medicine, 2009;84:692-694
[61] The path to professionalism: cultivating humanistic values and attitudes in residency training, Kathryn M Markakis, Howard B Beckman, et. al., Academic Medicine, 2000;75:141-150
[62] Strong leadership and teamwork drive culture and performance change: Ohio State University Medical Center 2000-2006, Fred Sanfilippo, Neeli Bendapudi, et. al., Academic Medicine, 2008;83:845-854
[63] Effect of the 'Preresidency Syndrome' on students' selection of fourth-year courses, Stephen R. Smith, Journal of Medical Education, Vol. 63, April 1988
[64] Premed Survival: Understanding the Culling Process in Premedical Undergraduate Education. Karen Lovecchio and Lauren Dundes, MHS, ScD. Acad. Med. 2002;77:719-724
[65] The Premed Stereotype, Judith D. Hackman, John R. Low-Beer, *et. al*. Journal of Medical Education, Vol. 54, April 1979
[66] Harassment of Lesbians as Medical Students and Physicians, Donna J. Brogan, Erica Frank, Lisa Elon, *et. al*. JAMA. 1999;282 (13):1290-1292
[67] Is Medical School the Right Place to Choose a Specialty? Sean Schafer, Williams Shore, Norman Hearst. JAMA. 2001;285(21):2782-2783
[68] Cheating in Medical School: a survey of second-year students at 31 schools, DeWitt C. Baldwin, Steven R. Daugherty, et al, Academic Medicine 1996; 71:267-273
[69] Making fun of patients: medical students' perceptions and use of derogatory and cynical humor in clinical settings, Delese Wear, Julie M Aultman, et. al., Academic Medicine 2006;81:454-462
[70] Medical students' perceptions of unethical conduct at one medical school, William Satterwhite, Robert Satterwhite, cam Enarson, Academic Medicine, 1998; 73:529-331
[71] 2006-2007 Annual Report, Accreditation Council for Graduate Medical Education, http://www.acgme.org/acWebsite/annRep/an_index.asp
[72] Strong Leadership and Teamwork Drive Culture and Performance Change: Ohio State University Medical Center 2000-2006. Fred Sanfilippo, Neeli Bendapudi, Anthony Rucci, Leonard Schlesinger. Acad. Med. 2008; 83:845-854
[73] Medical Students' Perceptions of Unethical Conduct at One Medical School. Williams M. Satterwhite, III, Robert C. Satterwhite, cam E. Enarson. Acad. Med. 1998; 73:529-531
[74] The Challenge of Problem Residents, David C. Yao, Scott M. Wright, J. General Internal Medicine, 2001; 16:486-492
[75] The U.S. Health Care System Is in Crisis: Implications for Academic Medical Centers and Their Missions. Richard Lofgren, Michael Karpf, Jay Perman, Courtney M. Higdon. Acad. Med. 2006; 81:713-720
[76] Vanquishing virtue: the impact of medical education, Jack Couleham, Peter Williams, Academic Medicine 2001; 76:598-605

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469

[77] Managed care, professional autonomy, and income: Effects on physician career satisfaction, Jeffrey, Stoddard, J. Lee Hargraves, Marie Reed, et al, J. General Internal Medicine 2001; 16:675-684
[78] Work-life balance is priority for younger physicians: survey, Alice Hohl, April 27, 2009, http://www.modernhealthcare.com/article/20090427/MODERNPHYSICIAN/304199976
[79] Mid-Career Burnout in Generalist and Specialist Physicians. Anderson Spickard, Jr., Steven G. gabbe, John F. Christensen. JAMA. 2002;288(12):1447-1450
[80] Physician Stress: Results From the Physician Worklife Study, Society of General Internal Medicine Career Satisfaction Study Group. Mark Linzer, Martha Gerrity, *et. al*. Stress and Health. 2002, vol 18, no 1, pp 37-42
[81] Why do residents fail to answer their clinical questions? A qualitative study of barriers to practicing evidence-based medicine, Michael Green, Tanya Ruff, Academic Medicine 2005;80:176-182
[82] Academic Anxiety, Locus of Control, and Achievement in Medical School. Paul L. Grover, Douglas U. Smith. J. of Medical Education, Vol. 56, September 1981
[83] Sources of Stress for Residents and Recommendations for Programs to Assist Them, Robert E. Levy, PhD, MPH. Acad. Med. 2001;76:142-150
[84] Accuracy of physician self-assessment compared with observed measures of competence: a systematic review, David Davis, Paul Mazmanian, Michael Fordis, JAMA 2006;296(9):1094-1102
[85] Report of the council on medical education, CME Report 3-A-08, Richard J.D. Pan, Chair, http://www.ama-assn.org/ama/pub/about-ama/our-people/ama-councils/council-medical-education/reports.shtml
[86] Self-assessment in lifelong learning and improving performance in practice: physician know thyself, F. Daniel Duffy, Eric S. Holmboe, JAMA, 2006; 296(9):1137-1139
[87] Effectiveness of University of California Postbaccalaureate Premedical Programs in Increasing Medical School Matriculation for Minority and Disadvantaged Students. Grumbach K, Chen E. *JAMA*. 2006(296)9:1079-1085.
[88] Facts: Applicants, Matriculates, Enrollment, Graduates, MD/PhD, and Residency Applicants Data, Association of American Medical Colleges. https://www.aamc.org/data/facts/
[89] Medical School Graduation Questionaire, 2003. All Schools Report. Association of American Medical Colleges. https://www.aamc.org/data/gq/allschoolsreports/
[89] Role of Cognitive Testing in the Development of the CHAPS© Hospital Survey, Roger E. Levine, Floyd J. Fowler, Julie A. Brown. Health Services Research. Vol. 40, Issue 6p2:2037-2056. December 2005
[90] Cognitive Science and Survey Methods, in T. Jabine, M. Straf, J.Tanur, and R. Tourangeau, Cognitive Aspects of Survey Design: Building a Bridge Between Disciplines. Tourangeau, R. Washington, DC, National Academy Press, 1984 pp. 73-100.
[91] Thinking about answers: The application of cognitive processes to survey methodology. Sudman,S., Bradburn, N. M., & Schwarz, N. 1996. San Francisco: Jossey-Bass.
[92] Table 31: Total Active Enrollment by U.S. Medical School and Race and Ethnicity, 2010, in AAMC Data Warehouse Student File. 10/26/2010. http://www.aamc.org/publications
[93] U.S. Medical School Applicants and Students 1982-83 to 2010-2011, Association of American Medical Colleges. 2010. http://www.aamc.org/publications
[94] The Association Between Parental Socioeconomic Status and Medical Students' Personal and Professional Development, Fan AP, Chen CH, *et. al*. Annals of Academic Medicine Sep; 36(9):735-42.
[95] The Entry of Underrepresented Minority Students Into U.S. Medical Schools: An Evaluation of Recent Trends, Carlisle D., *et. al*. American Journal of Public Health. 1998:88(9)1314-1318.
[97] Making Education Equitable in Rural China through Distance Learning, McQuaide, Shiling. The International Review of Research in Open and Distance Learning. Vol 10, No 1 (2009), ISSN: 1492-3831.
[98] Medical Education in Modern China, Reynolds, Teri A., Lawrence, Tierney M. JAMA. 2004;291:2141.
[99] Summer Medical and Dental Program. Association of American Medical Colleges. <http://www.smdep.org/>
[100] Shortage Designation: HPSAs, MUAs & MUPs. United Stated Department of Health and Human Services, Health Resources and Services Administration. April 20, 2009. <http://bhpr.hrsa.gov/shortage/index.htm>.
[101] Effectiveness of University of California Postbaccalaureate Premedical Programs in Increasing Medical School Matriculation for Minority and Disadvantaged Students. Grumbach K, Chen E. *JAMA*. 2006(296)9:1079-1085.
[102] AMSA Mastermind Project: A Confidential, Long-Term Approach To Student Wellness, Williams, Daniel M., *et al*. 3rd Place, 2011 American Medical Student Association National Conference, Washington, D.C.
[103] Physician Race and Care of Minority and Medically Indigent Patients. Moy E, Bartman B. JAMA. 1995:273(19):1515-1520.
[104] United Stated Department of Health and Human Services. "Shortage Designation: HPSAs, MUAs & MUPs." Health Resources and Services Administration. April 20, 2009. <http://bhpr.hrsa.gov/shortage/index.htm>.
[105] US Residency Training Before and After the 1997 Balanced Budget Act. Salsberg, Edward, *et. al*. JAMA. 2008;300(10):1174-1180

Daniel M. Williams, MD | Scott & White Dept. of Psychiatry | dmwilliams@swmail.org | 713.822.7469