

I DIRECTION AND FRAMEWORK

1.1 RATIONALE

The Veterans Health Administration (VHA) has undergone a remarkable transformation since the mid-1990s, enabled by the systematic application of information science and technologies. In a previous era, the Department of Veterans Affairs (VA) was sometimes cited by the press and others as providing substandard care. A VHA reinvention effort was initiated in 1995 with the two major goals of predictable and consistent provision of high-quality care and the optimization of the value of VA health care.¹ In the past ten years VHA has pursued a course of organizational change based on “rationalization of resource allocation, explicit measurement and accountability for quality and value, and development of an information infrastructure supporting the needs of patients, clinicians, and administrators.”² It is interesting to note that VHA’s commitment to performance measurement and information systems^{3, 4} preceded the New England Journal of Medicine’s call to use these techniques by at least eight years.⁵ The results have been impressive. In 2000 the VA outperformed the Medicare fee-for-service program on 12 of 13 indicators.⁶ This finding was confirmed and extended over a set of 348 indicators.⁷ The authors of both studies cited the importance of clinical information systems for quality improvement. Today, the VA is even recognized in lay press such as the Wall Street Journal and the Washington Post for leadership in clinical informatics and performance improvement.^{8, 9} The message is clear. Informatics and Quality Improvement complement each other as components of a powerful approach whose success is documented by VHA’s transformation into a quality frontrunner.

The Tennessee Valley Healthcare System (TVHS) is at the forefront of this movement, having an exceptional history of local and national innovation in informatics resulting in “production” systems in support of patient care, as well as an impressive array of quality improvement and educational initiatives. Two TVHS information system innovations (CAPRI and CPWM) have been adopted nationally by the Office of Information (OI) as “Class 1” software and a third is under consideration. Recent enhancements to the TVHS environment for clinical research and learning include the TVHS Geriatric Research, Education, and Clinical Center (GRECC); the TVHS Health Services Research (TREP) Center for Patient Healthcare Behavior (VA HSR&D funded); the TVHS Clinical Research Center of Excellence (CRCoE); and the TVHS VA Quality Scholars Program.

Over the past decade, our academic affiliate, Vanderbilt University Medical Center (VUMC), has built an international reputation in academic biomedical informatics and developed outstanding strength in health services and quality improvement research and training. The Vanderbilt Department of Biomedical Informatics (DBMI) is widely regarded as being among the top three informatics programs nationally and is viewed as dominant in informatics related to clinical practice. The major strength of Biomedical Informatics at Vanderbilt is the functional integration of informatics within the institution, aligned with institutional research, education, and clinical practice objectives. The Vanderbilt DBMI Training Program is uniquely positioned to simultaneously provide a strong foundation in the principles and theory of biomedical informatics, and an advanced informatics applications environment. This unique environment includes readily accessible, large-scale operational clinical information systems created and maintained by DBMI faculty, in which new scientific hypotheses can be tested and new technologies can be deployed. Supported by the National Library of Medicine (NLM), the training program draws on a faculty of over 40 distinguished biomedical informaticians and attracts exceptional students from medicine, computer science, and the biosciences. The Vanderbilt Center for Health Services Research includes over 200 faculty with a research portfolio exceeding \$130 million in all years funding, including programs in clinical epidemiology and outcomes research, clinical improvement and operations research, and clinical economics and decision sciences. Center faculty direct the Vanderbilt Clinical Research Curriculum (K30) that includes the MPH program, an AHRQ funded T32 HSR training program, the Meharry National Institutes of Health (NIH) funded Clinical Research Education and Career Development Program and the Meharry Master of Science in Clinical Investigation, the TVHS Clinical Research Center of Excellence, the TVHS Health Services Research Center for Patient Healthcare Behavior, and the TVHS VA Quality Scholars Program. Vanderbilt is an outstanding clinical research training environment with 44 NIH funded training grants.

The proposed VA TVHS Post Doctoral Fellowship in Medical Informatics will meld existing expertise in informatics and quality improvement at both the VA and through Vanderbilt’s DBMI and Center for Health Services Research into an exemplary training program designed to provide the necessary leaders for VA’s continued transformation. We will develop a cadre of highly skilled and productive medical informatics professionals with a solid foundation in quality improvement via a rigorous academic program and cross-disciplinary mentoring. This cadre will be able to design, implement, and evaluate real-world clinical informatics applications that integrate principles of quality improvement and patient safety from their inception. This synergy creates an unparalleled

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environment for informatics training that will provide the intellectual fuel required to further propel VHA's innovative leadership in the entwined disciplines of clinical informatics and quality improvement.

The program will fit into a national informatics agenda via multifaceted collaborations. We propose to lead fellowship education, recruitment, and community-building activities via pilot projects with the VA Salt Lake City (SLC) Post Doctoral Fellowship in Medical Informatics. Other training sites will be welcome to participate if the pilots are successful. We propose to collaborate with the Health Information Architects (HIA) Future Systems Group, and other HIA resources, to provide entrée to the national stage for emergent innovations. We welcome collaboration in other areas and with other sites.

1.2 OVERALL AIMS

1. Recruit and train individuals who excel in the application of principles of informatics and quality improvement and who work productively in a multidisciplinary, collaborative environment.
2. Provide rigorous formal instruction in specific disciplines essential for the practice of informatics, as well as the knowledge and skills to be a successful VA practitioner of informatics.
3. Through innovative instructional methods and role models, immerse trainees in a learning environment that emphasizes effective methods of communication, teamwork, management, and leadership.
4. Provide multidisciplinary mentorship and guidance for the development, implementation, and evaluation of applied clinical informatics projects with emphasis on the VA setting.
5. Ensure benefit to VA by providing access to appropriate projects that link to VHA "domains of value" (Quality, Access, Veteran Function, Satisfaction, Cost-effectiveness, and Healthy Communities) and by providing outlets for innovation with national informatics leaders.

1.3 SPECIFIC OBJECTIVES

2. Aggressively recruit nationally to attract outstanding informatics trainee candidates who exhibit diversity in research discipline, clinical specialty/subspecialty, race/ethnicity, and gender.
3. Provide breadth of training in the foundational informatics disciplines through the existing graduate training curricula, augmented by integrated instruction in VA-specific clinical informatics and the quality sciences.
4. Provide depth in each trainee's chosen area of informatics research through rigorous training in that discipline's epistemology, conceptual frameworks, theories, strategies, measures, techniques, publication outlets, and funding sources, as well as through demonstration of proficiency in the development, implementation, and evaluation of one or more clinical informatics projects.
5. Create and nurture a learning environment that includes formal and informal interactions that build relationships and bridges among the faculty and trainees from informatics, health services research, quality, and safety research programs.
6. Develop and support research and career mentoring relationships between each trainee and experienced faculty from informatics and quality disciplines appropriate to the trainee's research.
7. Develop, monitor, evaluate, and provide feedback on professional development plans for each trainee, which include specific objectives, milestones, and timelines for completion of curricular elements and research projects.
8. Engage the Office of Information Health Information Architects to provide a national VA perspective and an outlet for innovation, including fellows' presentations to the "Future Systems" team and seminars.
9. Continually monitor, evaluate, and improve the entire program, including recruitment, curriculum, culture/environment, mentorship, and trainees' research, using both process and outcome measures.
10. Track and evaluate the careers of program graduates and obtain feedback from graduates for continual improvement of the program.

1.4 PROGRAM STRUCTURE

The VA TVHS Post Doctoral Fellowship in Medical Informatics will provide a two-year training experience resulting in a master's degree in Medical Informatics and proficiency in quality improvement. Tuition costs will be waived. Fellows will complete an individualized program of graduate level coursework in informatics and will participate in TVHS VA Quality Scholars training activities. Trainees will complete a significant master's project with a formal thesis under the guidance of their informatics and quality mentors. Exceptionally motivated trainees will be permitted to compete for PhD training slots funded by sources outside of VA. In unique circumstances, extremely well-qualified applicants may be considered for fellowship training in a non-degree track.

1.5 ELIGIBILITY TO APPLY

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The VA Tennessee Valley Healthcare System (TVHS) and Vanderbilt University Department of Biomedical Informatics (DBMI) are eligible to apply based on the existing NLM-funded Medical Informatics Training Program at DBMI (NIH/5 T15 LM07450-04).

1.6 GOVERNANCE AND ADMINISTRATION

EXECUTIVE COMMITTEE: Dr. Brown will be the Program Director. Dr. Masys, Chair of the Vanderbilt Department of Biomedical Informatics (DBMI), will be the Program Leader for Informatics. Dr. Dittus, Director of the Geriatrics Research, Education, and Clinical Center (GRECC); Senior Quality Scholar and Director of the TVHS VA Quality Scholars Program; Chief of General Internal Medicine at TVHS and Vanderbilt; and Director of the Vanderbilt Center for Health Services Research, will be the Program Leader for Quality. Dr. Brown will have overall responsibility for program administration, financial and annual reports, and accountability for program objectives. He will rely upon and extend existing administrative infrastructure at TVHS and DBMI to accomplish these tasks. Drs. Masys and Dittus are positioned in Vanderbilt and TVHS to negotiate and bring about medical center and affiliate support that will ensure the success of the program. Through their leadership positions, they will assist Dr. Brown in building program infrastructure and meeting program objectives. The Executive Committee will have administrative oversight of all functions and will meet with the Internal Advisory Committee on a recurring basis.

STEERING COMMITTEE: The Steering Committee will consist of the Executive Committee and Drs. Miller, Gadd, Speroff, and Gregg. Drs. Gadd and Miller are experienced NLM training program directors. Dr. Speroff is Associate Director of the TVHS VA Quality Scholars Program and an experienced mentor for health services research fellows and junior faculty. Dr. Gregg is a recent graduate of the Quality Scholars Program and the DBMI training program who is currently DBMI faculty with a joint appointment in the Division of General Medicine and the Center for Health Services Research. Dr. Brown will chair the Steering Committee which will meet monthly in order to: develop, screen, and evaluate program candidates; monitor and evaluate trainee, faculty, and mentor performance; develop and implement strategies for curriculum and research monitoring, evaluation, and continuous improvement; and track program graduates. The Steering Committee will update the Program Annual Strategic Plan with review of the Program Mission, Aims, and Objectives; an environmental assessment of resources and program results; and development of the Action Plan.

EXTERNAL ADVISORY COMMITTEE: The External Advisory Committee will meet annually and will be charged with program review and strategic planning. The proposed membership is: Dr. Joseph Francis, Director for the Quality Enhancement Research Initiative (QUERI) and Acting Deputy Chief Research and Development Officer; Dr. Michael Lincoln, Program Director, VA Salt Lake City Post Doctoral Fellowship in Medical Informatics; Mr. Jim Demetriades, Chief Health Information Architect, VHA; and Dr. Bill Stead, Vanderbilt Associate Vice-Chancellor of Health Affairs and Director of the Vanderbilt Informatics Center.

INTERNAL ADVISORY COMMITTEE: The Internal Advisory Committee (IAC) will be composed of TVHS and VISN executive, clinical, quality, and informatics leadership. The Steering Committee will meet with the IAC semi-annually and as needed, to manage the intersection between the training program, TVHS, and VISN 9. IAC consultation will be sought to ensure program awareness of institutional clinical and informatics needs, and to consider appropriateness of technology transfer within regional VA facilities.

1.7 RECRUITMENT

Demand for training in clinical informatics is high. In the past 3 years Vanderbilt DBMI received 22 applications from U.S. citizens with MD degrees in a pool of over 84 total applicants who were eligible for 3-4 NLM training slots per year. The DBMI and VA TVHS Program Directors will evaluate the entire DBMI applicant pool and will match applicants with the VA-sponsored program based on previous experience and career aspirations. The VA TVHS Post Doctoral Fellowship in Medical Informatics will also share recruitment efforts with the VA SLC Post Doctoral Fellowship as a pilot initiative. Specifically, we will send program announcements jointly to medicine and surgery training program directors. We will also maintain a VA Informatics Training website thru the Silver Springs WebOps service that describes informatics training at VA in general, and provides further details and application procedures for specific programs. If successful, we would offer participation to other interested VA Post Doctoral Fellowships in Medical Informatics.

2 LEADERSHIP

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Complete VA Biographical Sketches are available in Appendix 1. Letters of commitment for the proposed director and program leaders and other letters of support can be found following Appendix 4.

2.1 PROPOSED DIRECTOR: STEVEN H. BROWN, MD, MS, FACMI (8/8 VA): Dr. Brown has extensive experience in the domains of applied and theoretical informatics; the development and implementation of nationally deployed applications and standards; quality improvement; leadership and administration; and education from both a teacher's and student's perspective. His experiences and accomplishments touch on each of the five desired fellowship outcomes noted in the RFP, making him an ideal mentor and role model based on real world experience. Dr. Brown has received numerous awards and honors for informatics and quality improvement initiatives, including a Vice-Presidential "Hammer" award, a VA Secretary's "Scissors" award, a VA National Patient Safety Award, and a VA National "Best Practices" designation. Two of Dr. Brown's initiatives have been officially adopted and nationally deployed by VHA Office of Information, and a third is under review. Dr. Brown has twice been afforded the privilege of testifying before the U.S. House of Representatives on informatics and quality improvement initiatives. Dr. Brown is a recently elected fellow of the American College of Medical Informatics based on lifetime accomplishments in the field.

Dr. Brown's career in informatics spans 24 years and 3 academic institutions. Between 1981 and 1985 he was a programmer, systems integrator, and researcher in what would now be called "Bioinformatics" in Surgical Pathology at Brown University. The lab conducted structural and ultrastructural image analysis to develop diagnostic and prognostic predictors in a variety of disease states. Between 1990 and 1994 Dr. Brown was a Senior Associate and Assistant Professor of Medicine at Emory University. While in this role, he worked to implement and evaluate an early large-scale fully-functional electronic medical record system. Dr. Brown has been affiliated with the Department of Biomedical Informatics at Vanderbilt since 1994 and the Department of Veterans Affairs since 1996. His informatics interests have focused in three major areas – terminology and knowledge representation, quality improvement and patient safety, and electronic medical records.

Dr. Brown's work in terminology and knowledge representation spans development, evaluation, delivery architectures, and implementation. His fellowship work on clinical problem representation was published in the *Annals of Internal Medicine*. While working with the VHA Health Information Architects, he helped define and establish a service-based terminology architecture for the Office of Information. He also led development of the National Drug File-Reference Terminology (NDF-RT) using techniques grounded in formal logic. Recently, portions of NDF-RT have been declared national standards by the HHS National Committee on Vital and Health Statistics and will be used Government-wide, for example, on all FDA prescription medication labeling. He has also been active in Standards within VA and on the national level. For example, he led interagency workgroups for the evaluation and selection of data standards for laboratory test names and medication data, served as Vice Chair for ASTM E 31.01 Medical Terminology standards group, and was a member of the Quality Interagency Council Information Systems Group. These examples address fellowship outcome #2, advancement of applied informatics at a national or international level, and outcome #5, regarding advisement of senior management.

Dr. Brown has extensive program management experience and leadership skills. In his role as Chief Information Officer at the Nashville VA Medical Center /Tennessee Valley Healthcare System between 1996 and 2001, Dr. Brown had budgetary line authority and supervision of a department ranging in size from 17.0 to 19.3 FTE, with total annual expenditures of \$2.02 million to \$3.80 million. In this role, Dr. Brown was responsible for tactical and strategic planning and execution for the facilities' information management and information technology programs. This included extensive and direct interaction and collaboration with facility leadership, clinical staff, and administrative staff – precisely as outlined in fellowship desired outcomes # 3, #4, and #5 on page 2 of the RFP. Relevant examples include: CPRS and BCMA deployment, Management of Information Committee and CPRS Committee chairmanships, Joint Commission reviews, facility integration, Y2K preparations, and computer hardware and network deployment. During this time, Dr. Brown was also responsible for locally developed projects that functioned in a production environment that improved patient safety and process efficiency (e.g., RADARx, PNCS, and SCAM) in line with fellowship desired outcome #1. Dr. Brown was competitively selected to the Leadership VA class of 1999.

Since 2001 Dr. Brown has served as Director of the VA Compensation and Pension Examination Program (CPEP). CPEP is a joint VBA/VHA national program office dedicated to improving the quality of veterans' disability exams via applied informatics and traditional quality improvement techniques. Program resources include ~19 FTEE with a budget of approximately \$2 million. VHA performs ~500,000 compensation and pension exams and distributes over \$30 billion per year in disability benefit payments based on the results. VHA national exam quality has improved

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70% in 18 months as the result of CPEP initiatives undertaken with the VHA Office of Information, Employee Education System, Quality Scholars Program, and other offices within VHA, VBA, and BVA. For example, CPEP has developed the Quality Enhancement Systems Technology (QuEST) system, a national scale, end-to-end computerized exam quality assurance/improvement, feedback, and appeals system. This directly addresses fellowship desired outcome #1. Other relevant projects will be described under research opportunities.

Mentorship and teaching were daily requirements of Dr. Brown's faculty position in Internal Medicine at Emory. He was responsible for the education and guidance of numerous medical students and post-graduate physicians in both inpatient and outpatient arenas via one-on-one, small group, and large group sessions. Dr. Brown has personal experience in Applied Informatics postdoctoral training. He completed a competitively awarded NLM Applied Informatics Fellowship between 1994 and 1996 based on a self-initiated research and educational agenda. Since graduation, Dr. Brown has taught and mentored a variety of trainees. He is presently mentoring one master's candidate, two PhD candidates, a non-degree track fellow, and a junior faculty member. In past years he has guided and provided opportunities for other informatics trainees, medical trainees, and engineering students. Dr. Brown serves on the Vanderbilt NLM Informatics Fellowship Internal Advisory Board and on the Vanderbilt Department of Biomedical Informatics Curriculum Committee.

Dr. Brown maintains a VA primary care practice and is recently recertified in Internal Medicine. He routinely uses VA clinical computing systems and understands their strengths and opportunities for improvement. Dr. Brown has the full support of his supervisor to act as Fellowship Program Director. A portion of the time required will come via a re-direction of current mentoring efforts to concentrate on VA fellows.

2.2 PROPOSED PROGRAM LEADER FOR INFORMATICS: DAN MASYS, MD, is Professor and Chair of the Department of Biomedical Informatics at Vanderbilt University Medical Center. Prior to joining Vanderbilt in 2005, Dr. Masys was director of biomedical informatics and professor of medicine at the University of California, San Diego (UCSD). He also served as chief of the International Cancer Research Data Bank of the National Cancer Institute, and from 1986 through 1994 was director of the Lister Hill National Center for Biomedical Communications, which is a computer research and development division of the National Library of Medicine. Dr. Masys is co-director of the introductory graduate course BMIF 300 entitled "Foundations of Biomedical Informatics" that is required of all Vanderbilt biomedical informatics graduate students. At UCSD, he was a member of the faculty Steering Committee for an NIH K30 training grant which funded a Master's of Clinical Investigation degree program, and was course director for the required Data Management and Informatics of Clinical Research component of that degree program. He has mentored more than 20 medical students, PhD candidates, postdoctoral trainees, and junior faculty; and was a member of the VA San Diego Healthcare System's Research and Development (R&D) Committee from 2001-2004. A board-certified hematologist-oncologist, Dr. Masys completed 11 years of service as a U.S. Naval Medical Officer followed by 10 years as a U.S. Public Health Service Commissioned Corps Officer, and is a service-connected VA beneficiary. Dr. Masys is an elected member of the Institute of Medicine, National Academy of Sciences. He is a fellow of the American College of Physicians, a fellow and President-elect of the American College of Medical Informatics, and has received numerous awards, including the U.S. Surgeon General's Exemplary Service medal and NIH Director's award.

2.3 PROPOSED PROGRAM LEADER FOR QUALITY: ROBERT DITTUS, MD, MPH (7/8 VA), is the Albert and Bernard Werthan Professor of Medicine and Chief of the Division of General Internal Medicine at Vanderbilt and TVHS; Director, Center for Health Services Research, Vanderbilt; Director, Institute for Community Health, Vanderbilt; Director, Center for Improving Patient Safety, Vanderbilt; Director, TVHS Geriatric Research, Education, and Clinical Center; VA Senior Quality Scholar; and Director, TVHS VA Quality Scholars Program. He is the founding President of the Academy for Healthcare Improvement and is on the Board of Directors of the Association of Clinical Research Training Program Directors. Dr. Dittus is trained in systems engineering, internal medicine, and epidemiology, earning his MPH while a Robert Wood Johnson Clinical Scholar. He began his faculty career in the Division of General Internal Medicine at Indiana University and took his current positions at Vanderbilt University in 1997. He has conducted numerous clinical epidemiology and health services research studies, published over 100 scientific articles, and has been awarded over 50 grants with total research funding exceeding \$125 million (mostly federal, including NIH, AHRQ, NLM, CDC, VA). His focus of research has been to improve the methods for examining the cost-effectiveness of health care management strategies and to use these methods to identify and implement improved approaches to care. He was named Teaching and Research Scholar of the American College of Physicians, was given Vanderbilt's highest faculty award – the Branscomb Distinguished Faculty Award, and was named Industrial Engineer of the Year last year by Purdue University. In collaboration with

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the other leaders of the Quality Scholars Program, he has published "A Curriculum for Training Quality Scholars to Improve the Health and Health Care of Veterans and the Community at Large". (Quality Management in Health Care. 2002; 10:10-18) and "Exploring the Academic Context for Quality Improvement: A Scientific Discipline in Need of a Career Path". (Quality Management in Health Care. 2002; 10:65-70). Dr. Dittus also has extensive experience in providing mentorship to junior faculty. He has been the Principal Investigator of 12 federally funded fellowship training programs and has been a mentor to over 80 fellows and junior faculty, over 90% of who remain in academic medicine.

2.4 PROPOSED STEERING COMMITTEE MEMBERSHIP

THEODORE SPEROFF, PhD (7/8 VA), is a PhD graduate of the Epidemiology and Biostatistics Program of Case Western Reserve University; he has another PhD in cognitive-developmental experimental psychology and a MS in mathematical statistics. Dr. Speroff has appointments in the Vanderbilt University Departments of Medicine, Preventive Medicine, and Biostatistics. Dr. Speroff was recently awarded a Targeted Research Enhancement Program (TREP) award by the VA HSR&D to direct the VA Tennessee Valley Healthcare System (TVHS) Health Services Research Center for Patient Healthcare Behavior. He is a VA Senior Quality Scholar and Associate Director of the TVHS VA Quality Scholars Program; a member of the VA HSR&D Scientific Merit Review Board (SMRB) and Career Development Award Board; chairs the HSR&D SMRB on Quality Measurement and Effectiveness; a member of the advisory board of the Cleveland VAMC Center for Quality Improvement Research, Research Enhancement Award Program (REAP); and Director of Quality Improvement for the national office of the VA Compensation and Pension Examination Program (CPEP). Dr. Speroff co-chairs the International Scientific Symposium on Improving Quality and Value in Health Care sponsored by the Institute for Healthcare Improvement and is the founding Secretary/Treasurer of the Academy for Healthcare Improvement. Dr. Speroff has mentored over 30 postdoctoral and predoctoral students. He is currently mentoring four fellows, three faculty members with career development awards, and four junior faculty. Dr. Speroff has 20 years of professional experience in quality improvement that ranges from hospital-based firm trials of quality improvement to community-based quality improvement. Dr. Speroff bridges the disciplines of Health Services Research and Quality Improvement (QI) by helping to assure that the knowledge gained and protocols implemented in clinical research become sustained and renewed using QI strategies. His work involves development of measurement techniques employing benchmarks of quality, focusing on outcomes as well as the processes of care, and implementation throughout networks of caregivers, payers, and patients. His research interests include health services research and outcomes assessment, continuous quality improvement and patient safety in health care, assessment of patient preferences, healthcare costs and clinical decision analysis, patient healthcare behavior, and methodological reviews of the literature and meta analysis.

CYNTHIA S. GADD, PhD, MBA, MS, is Associate Professor of Biomedical Informatics and Director of Educational Programs. She recently joined the Department of Biomedical Informatics after eight years at the Center for Biomedical Informatics at the University of Pittsburgh, where she directed the NLM-funded Biomedical Informatics Training Program from 2003-2005. Dr. Gadd earned her MBA from Winthrop University in 1979, her doctorate in Information Systems from the University of Pittsburgh in 1995, and her master's in Biomedical Engineering/Informatics from Duke University in 1998, where she was an NLM Fellow. Dr. Gadd has published numerous articles in her primary area of research, implementation and evaluation of integrated clinical information systems, including electronic health records (EHR) systems, in large health care delivery networks. She has conducted evaluations of a diverse range of health information technologies, including integrated, multi-site vendor EHRs; web-based guideline-based decision support system; multimedia EHR for outpatient oncology practice; bioscience collaboratories; handheld computing use to support a residency program; and teleradiology and telepathology initiatives. Dr. Gadd directed the survey and assessment of the VISN 4 Information System Resources, a strategic initiative undertaken prior to the VISN-wide implementation of CPRS. She also directed the evaluation of the Pittsburgh IAIMS initiative. Dr. Gadd has a continued interest in promoting and conducting information system evaluations that address system functionality and effectiveness, as well as user and organizational impacts. She is also interested in graduate education in biomedical informatics in the U.S and developing countries. She taught in MBA programs at the College of William & Mary School of Business. While at the University of Pittsburgh, Dr. Gadd was director of two courses, Introduction to Biomedical Informatics and Information Technology in Health Care Organizations, and mentored five doctoral students, ten masters' students, and ten certificate students. She directed the University of Pittsburgh's Medical Informatics for Africa program, a Fogarty International Center and NLM-funded initiative to train Nigerian and Malawian biomedical scientists in information technologies with the

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potential for direct application to health care in their home countries, and has served on an NLM-Fogarty International Center study section addressing this pressing need.

RANDOLPH A. MILLER, MD (VA WOC applied for), is University Professor, Department of Biomedical Informatics, and Professor of Medicine at Vanderbilt University Medical Center. He was Professor of Medicine and Chief, Section of Medical Informatics, Department of General Internal Medicine at Pittsburgh prior to coming to Vanderbilt. He is known for his early pioneering work on medical diagnostic systems and knowledge bases, work on ethical and legal concerns related to biomedical informatics, and more recent work on integrating clinical decision support with clinician order entry. He was Principal Investigator (PI) for the University of Pittsburgh's UMLS Project (1986-94) and founding Director of its NLM-sponsored Training Program in Medical Informatics (1987-94) prior to moving to Vanderbilt. He chaired the University of Pittsburgh's IAIMS Executive Committee (1991-94), was Project Director for the Pittsburgh Phase II IAIMS Project, and was an active participant in Vanderbilt's IAIMS activities. He is a Fellow of the American College of Medical Informatics and a Fellow of the American College of Physicians. He served on the SCAMC Board of Directors (1988-90); is a former Board member and a past President of the American Medical Informatics Association (AMIA); a past President of the American College of Medical Informatics (ACMI); a past Program Chair of the USA's national meeting in medical informatics; a member of the Editorial Board of *Methods of Information in Medicine*; a past Editorial Board member of *Artificial Intelligence in Medicine*; a founding Associate Editor and current Editor-in-Chief of *JAMIA*; a member of the Editorial Board of the *Annals of Internal Medicine* 2000-2003; and he has served twice on the National Library of Medicine's (NLM) Study Section and once on the AHCPR Health Care Technology Study Section. Dr. Miller is well acquainted with VA clinical systems from the user's perspective – he served as a primary care provider at TVHS for six years.

WILLIAM GREGG, MD, is Assistant Professor of Biomedical Informatics and Medicine at Vanderbilt University Medical Center. A board certified internist, Dr. Gregg began his medical career as a staff physician at the Nashville VA Medical Center. As a trained electrical engineer with an interest in information technology, he then entered fellowship and master's level training in Biomedical Informatics at Vanderbilt University. Subsequently, Dr. Gregg completed a National VA Quality Scholars Fellowship at the Nashville VA Medical Center and a Master's of Public Health degree from Vanderbilt University. His thesis work has explored telephone (non-visit based) patient encounters as a platform for clinical decision support and improvement of patient care through customized informatics tools. This varied training experience has naturally led to a research program at the intersection of informatics applications, chronic disease care, and quality improvement.

3 PROPOSED FACULTY

Both TVHS and Vanderbilt are well endowed with excellent faculties in the core disciplines of informatics and quality improvement. This abbreviated table provides an overview of the proposed VA TVHS Post Doctoral Fellowship in Medical Informatics faculty. Brief bios for each faculty member are in Appendix 2.

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| Constantin Aliferis, MD, PhD | Assistant Professor, DBMI |
| Dominik Aronsky, MD, PhD | Assistant Professor, DBMI |
| Joseph Awad, MD (8/8 VA) | Associate Professor of Medicine & Pharmacology |
| Erik Boczko, PhD | Assistant Professor, DBMI |
| Jim Demetriades, MS, PE (8/8 VA OI) | Chief Health Information Architect, VHA |
| Elliot M. Fielstein, PhD (8/8 VA) | Assistant Professor in Psychiatry |
| Wesley Ely, MD, MPH, FACP (5/8 VA) | Associate Professor of Medicine |
| Fern FitzHenry, PhD, RN | Instructor, DBMI |
| Mark E. Frisse, MD | Professor, DBMI |
| Dario A. Giuse, Dr Ing | Associate Professor, DBMI |
| Nunzia B. Giuse, MD, MLS, AHIP | Professor, DBMI |
| Stanley Graber, MD (VA WOC) | Adjunct Assistant Professor, DBMI |
| Marie Griffin, MD, MPH (5/8 VA) | Professor of Preventive Medicine; Director, TVHS Clinical Research Center of Excellence |
| Kevin B. Johnson, MD, MS | Associate Professor & Vice Chair, DBMI |
| Shawn Levy, PhD | Assistant Professor, DBMI |
| Nancy M. Lorenzi, MLS, PhD | Professor, DBMI; Assistant Vice Chancellor |
| Harvey Murff, MD, MPH (5/8 VA) | Assistant Professor of Medicine |
| Josh Peterson, MD | Assistant Professor, DBMI |

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| Wayne Ray, PhD (5/8 VA) | Professor, Medicine & Pharmacology; Director, Master of Public Health Program |
| Trent Rosenbloom, MD, MPH (VA WOC) | Assistant Professor, DBMI |
| Christianne Roumie, MD, MPH (8/8VA) | Assistant Professor, Medicine |
| Edward K. Shultz, MD, MS | Associate Professor, DBMI |
| Walter Smalley, MD, MPH (6/8 VA) | Associate Professor of Medicine |
| Jay Snoddy, PhD | Research Associate Professor, DBMI |
| Anderson Spickard III, MD, MS | Assistant Professor, DBMI and Medicine |
| Jack Starmer, MD | Assistant Professor, DBMI |
| William W. Stead, MD | Professor, DBMI; Associate Vice Chancellor; Director of the Informatics Center |
| David L. Tabb, PhD | Assistant Professor, DBMI |
| Ioannis Tsamardinos, PhD | Assistant Professor, DBMI |
| Russell Waitman, PhD | Assistant Professor, DBMI |
| Matthew B. Weinger, MD (3/8 VA) | Professor DBMI, Anesthesiology, and Medical Education |
| Stuart T. Weinberg, MD | Assistant Professor, DBMI |

4 EDUCATIONAL RESOURCES AND CURRICULUM

The proposed VA TVHS Post Doctoral Fellowship in Medical Informatics will leverage the highly successful Vanderbilt Biomedical Informatics Training Program, which encompasses clinical informatics and bioinformatics (genomics, proteomics, and molecular medicine), with VA TVHS's excellent environment for advanced training and experiential learning opportunities in clinical informatics applications and innovative quality improvement. The Vanderbilt Biomedical Informatics Training Program has been funded by the National Library of Medicine since 2002. The major strength of biomedical informatics training at Vanderbilt is the functional integration of informatics within the institution, aligned with institutional research, education, and clinical practice objectives. Nationally, few, if any other institutions, offer such a balance and range of rigorous academic studies coupled with applied informatics in the settings of clinical practice and biomedical research; a philosophy of education that is highly compatible with the VA's objectives for this fellowship. See Appendix 4 for a table of current and past trainees.

VA TVHS Informatics Fellows will participate in the Vanderbilt Biomedical Informatics Graduate Degree Program (VU-BMIP). The interdisciplinary VU-BMIP curriculum emphasizes the integration of biomedical research, informatics, and health care processes and delivery. The program prepares future leaders in the field with a deep understanding of biomedical informatics through a combination of coursework, participation in large-scale informatics projects (development, management, and evaluation), and directed and independent scientific research. Collaboration on ongoing research projects within the program and with the diverse faculty within our basic science and clinical departments and the Schools of Engineering, Business, and Nursing will be highly encouraged and will provide an in-depth experience with cutting-edge research as well as a broad understanding of the field. Emphasis on the analysis, development, and evaluation of highly integrated biomedical informatics systems will provide trainees with a lifelong appreciation of the role of information in the health sciences, and how information will be produced, managed, and used in the 21st century.

The curriculum offers six areas of concentration: Clinical Systems; Decision-Support Systems and Medical Decision Sciences; Informatics related to Evidence-Based Practice; Informatics related to Health Policy Management and Health Administration; Bioinformatics for Molecular Medicine; and Clinical Bioinformatics. All students will take five Biomedical Informatics foundation courses. These foundation courses, described in more detail below, are: (1) Foundations of Biomedical Informatics and Evidence-Based Practice, (2) Foundations of Bioinformatics and Computational Biology, (3) Health Care Organization and Management, (4) Biomedical Artificial Intelligence, and (5) Clinical Information Systems and Databases. Students are required to complete nine additional courses, three each in three core competency areas: research methods, biomedicine, and information/computational sciences. Course requirements in each area may be waived according to student background, upon review by the faculty. While a minimum total of 27 credits are required for a thesis MS degree, students typically take more. Vanderbilt's extensive course catalog is available online.

Trainees will take advantage of the rich research and informatics environment under the guidance of their informatics and quality mentors to plan, propose, implement, manage, document, and defend a research project that

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yields a written thesis meeting Vanderbilt University requirements. Projects will be VA focused, meld informatics and quality sciences, and relate to domains of value (Section 1.2.5) in a practical manner. Thus, all fellows will guide and lead an inherently multidisciplinary process. Fellows who choose to extend or evolve aspects of ongoing R&D projects will be required to make a substantive, independent, and identifiable contribution. Presentation at local research conferences, national meetings (including standards organizations when appropriate), and with the HIA Future Systems Group are expected outcomes that will build research, communication, and teaching skills. Written communication skills are developed via authoring of project proposals, IRB applications, the master's thesis, and journal manuscripts. All students must participate in the Informatics Center research seminars and journal club, where research and communications skills are further developed. Students will also participate in aspects of the Quality Scholars curriculum (detailed below).

Exceptionally motivated trainees will be permitted to compete for PhD training slots funded by sources outside of VA. In unique circumstances, extremely well-qualified applicants for whom an additional degree would not be appropriate may be considered for fellowship training in a non-degree track based on an individualized curriculum. The non-degree program will provide students with in-depth studies in a specialized area and will expand their previous skills and knowledge through a project-related experience in an academic setting. Such a program allows a focused and concentrated opportunity to gain additional knowledge that prepares the trainee for a productive career in biomedical informatics.

4.1 DBMI FOUNDATION COURSES – OVERVIEW

FOUNDATIONS OF BIOMEDICAL INFORMATICS AND EVIDENCE-BASED PRACTICE: This introductory course addresses the nature of life sciences data and its management, and the relationship of data, information, and knowledge to improve health care. It addresses the design of information systems in clinical settings, principles of information confidentiality and security, and use of databases for outcomes management. Also included is an introduction to clinical cognitive biases, formal Medical Decision Making methods, and methods for Evidence-Based Practice. Instructors: Johnson, Masys.

FOUNDATIONS OF BIOINFORMATICS AND COMPUTATIONAL BIOLOGY: This survey course presents an outline of some of the current research topics and problem-solving approaches in the field. The topic areas covered include: methods for representing and comparing molecular sequence and structure data; mathematical and statistical issues involved in bioinformatics models; networks and their dynamics; and clinical applications of genetic, genomic, and proteomic data. Instructor: Snoddy.

HEALTH CARE ORGANIZATION AND MANAGEMENT: This course provides an overview of theoretical concepts and practical tools for understanding: (1) health care organizations, especially academic health centers; (2) the health care environment; and (3) organizational informatics, including leadership and people issues. Instructor: Lorenzi.

BIOMEDICAL ARTIFICIAL INTELLIGENCE (AI): This course addresses Decision-Support Systems, fundamentals of AI programming, search algorithms, and formal computational reasoning. Bayesian Networks and medical decision support methods are taught, along with Machine Learning programming and inductive frameworks, and mathematical foundations. Families of machine learning algorithms discussed include: Decision Tree Induction, Genetic Algorithms, Neural Networks, Clustering, K-Nearest Neighbors, Support Vector Machines, Feature Selection, and Causal Discovery methods. Instructors: Aliferis, Tsamardinos.

CLINICAL INFORMATION SYSTEMS AND DATABASES. This course provides an introduction to distributed systems and data network computing concepts, including the OSI stack, protocols, TCP/IP, Sockets, and DNS. Computing concepts including synchronization, concurrency, and database deadlock are addressed, as well as the conceptual design of clinical databases and full-text databases. Also addressed are principles of distributed database services, architectural considerations in the design of clinical information systems, and high-availability techniques for distributed services. Instructor: D. Giuse.

PROPOSED VA INFORMATICS DIDACTIC: We plan to enhance the current “Foundations of Biomedical Informatics” course to include a significant component of VA Informatics. The course will supplement the current Vanderbilt offering by covering key VA informatics concepts such as the history of DHCP/VistA, CPRS, FileMan, BCMA, current and future architectures, and VA data resources. As a foundation course, the revised offering will be required of all Vanderbilt students, and of TVHS fellows. We also plan to make the course available to VA Informatics Fellows at other sites via distance learning techniques. See “Collaboration” section below for more details. VA introductory materials not relevant to informatics will be delivered in a seminar fashion, again in collaboration with other training sites.

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4.2 QUALITY SCHOLARS CURRICULUM INTEGRATION

TVHS Informatics Fellows will benefit from the weekly research meetings held for the Quality Scholars and the Health Services Research fellows. These weekly one hour seminars are a forum for work in progress by fellows, talks by invited junior faculty, and additional topics that may fill educational gaps. These meetings build research methodology and communication skills through guided critical analysis of project presentations, often given in preparation for national meetings. TVHS Informatics Fellows will also participate in the TVHS VA Quality Scholars curriculum. The curriculum is delivered via a course pack of readings and every other week interactive, instructional video teleconferences that address principles and practices of quality improvement, patient safety, research methods, systems thinking, leadership skills, and a practicum of applied projects.

4.3 MENTORING PLANS

MENTORING: The VA TVHS Post Doctoral Fellowship in Medical Informatics will take advantage of two of the key components of other successful mentoring programs at our institutions: (1) individualization of the career development program, and (2) cross-disciplinary mentoring. Although the VA TVHS Informatics trainees will be a diverse group, several common elements will be essential to their success: protected project and research time; an exciting and supportive environment; and availability of resources to do informatics research, including analytic support. Fellows will be located together in newly renovated VA GRECC offices with the TVHS VA Quality Scholars Program, TVHS Clinical Research Center of Excellence junior faculty, and the TVHS Health Services Research (TREP) Center for Patient Healthcare Behavior. This environment will be ideal for this program. Fellows will have access to Center resources, including a biostatistician, research nurse, an experienced VistA programmer and systems manager, and a database and survey manager.

The major mentoring objectives are to create an environment in which biomedical informatics fellows: (1) successfully complete their education and research milestones, (2) elect to continue their informatics careers at the VA, and (3) perform projects and research that improves the health of veterans. Based upon initial meetings and their DBMI Plan of Study and VA Fellowship Professional Development Plan discussed in the next section, trainees will be matched with an informatics mentor and a quality mentor. They will meet at least monthly with each mentor throughout their fellowship. Mentors will review each trainee's progress and plans with the Steering Committee. If progress is not satisfactory, the mentors and Steering Committee will work with the trainee to adjust the Professional Development Plan and Academic Plan of Study.

INDIVIDUALIZATION OF THE PROFESSIONAL DEVELOPMENT PLAN: The individualization of each trainee's program will begin at the time of application. At that time the potential trainee's informatics experience and interests will be assessed and clarification may be sought. During July of the first year in the program, each trainee will meet with Dr. Steven Brown and either Dr. Robert Dittus or Dr. Ted Speroff, to discuss program objectives. Specific objectives will be developed and examined and an explicit Professional Development Plan will be created. This plan will include specific objectives, a timeline, and measures to assess the achievement of each objective. In this fashion, each trainee will have participated in the goals to be accomplished and the selection of the criteria to be used for evaluation. Similar plans are used in other TVHS programs, such as the Clinical Research Center of Excellence. Dr. Brown will assure that these objectives fit the expectations of the VA TVHS Post Doctoral Fellowship in Medical Informatics. The trainees' Professional Development Plans and progress will be reviewed at quarterly Steering Committee meetings. Trainees are also required to create a formal, templated DBMI "Plan of Study" at the beginning of their fellowship, and update the document at the beginning of each semester. The DBMI Academic Program Committee reviews each "Plan of Study" and each subsequent update.

ROLE MODELS: Role models are very important to trainees. The informatics mentor and the quality mentor will be two role models with whom the trainee will develop a close relationship. Members of each trainee's thesis committee will also serve as role models. In addition, we will expose each trainee to many informatics and quality role models throughout their training experience. Trainees will participate in the "Careers in Clinical Research" seminar series where Vanderbilt clinical research faculty and invited investigators outside of Vanderbilt provide a review and reflection of their career and an examination of their field of clinical research and their current research activities. In addition, various seminars have been included to address issues in professional development, such as: The Mentoring Process, Promotion, and Tenure; Negotiating Your Future; and How to Get Funded.

ACADEMIC PROGRAM COMMITTEE (APC): The DBMI APC is responsible for facilitating and monitoring the progress of all DBMI trainees, including TVHS Informatics Fellows. In January of each year the APC reviews each trainee's progress and, in cases of concern, requests from the trainee's academic adviser a written statement of how

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the concerns are being addressed. In July of each year the Academic Program Committee reviews each trainee's self-evaluation of progress and the academic adviser's assessment of the trainee's progress. The committee may recommend facilitative or remedial actions to the adviser and the trainee. The committee shall determine the appropriateness of the nominated chair and members of each master's thesis committee and, when satisfied, shall authorize the constitution of each such committee.

4.4 COLLABORATION WITH OTHER VA INFORMATICS PROGRAMS

The VA TVHS Post Doctoral Fellowship in Medical Informatics is eager to collaborate with other VA Informatics training sites. We propose to facilitate collaboration by leading four initiatives. The first three will be piloted initially with the VA Salt Lake City (SLC) Post Doctoral Fellowship in Medical Informatics, and extended to other sites based on interest and success. First, as noted in Section 4.1 above, we will teach a "Foundations of Informatics" course that extends the current Vanderbilt offering with a significant component of VA Informatics. The course will be made available to trainees in Nashville in person and to other VA Informatics training sites via distance learning techniques such as Live Meeting and Video Teleconferencing. The distance learning collaboration will include shared responsibility for lectures. Second, we propose a pilot distance learning collaboration with the VA SLC program to cover "Introduction to VA" materials such as the history and mission of VA that may not be appropriate for non-VA informatics trainees. Third, we propose to pilot a shared recruiting strategy with the VA SLC program (Section 1.7) that could be extended to other VA sites based on success and interest. Finally, we propose to coordinate a one-day conference for current VA fellows and training staff, and VA Informatics graduates, to occur in association with the annual meeting of the American Medical Informatics Association. The meeting will give fellows a chance to present their research, for past graduates to speak about their career paths, and for all to network with an eye towards continued success, collaboration, and the development of a community of expertise in VA informatics. We will also attend the NLM training program meetings.

4.5 ADDITIONAL EDUCATIONAL RESOURCES

Trainees will be encouraged to take additional coursework, either at our institution or elsewhere, or through web-based courses that will contribute to their professional development. A wealth of VA focused informatics courses exist online via VistA University, VHA eHealth University, and the VA Learning University. Examples include: "CPRS Foundations," "Integrating Clinical Research into the EMR," "Internetworking Architecture and Servers," "Enterprise Java Beans," "SQL Programming: database queries," and hundreds of others. Fellow-specific educational opportunities will also be developed via collaboration with TVHS clinical and administrative leaders.

4.6 EDUCATIONAL RESOURCE DEVELOPMENT

As noted above, in the upcoming year we will work to modify the "Foundations of Informatics Course" to include a VA Informatics component and to develop techniques of distance learning. We will also work with the TVHS, the Nashville VBA Regional Office, VBA C&P Service, and the VA SLC training program to develop VA introductory materials and recruiting techniques.

5 RESEARCH RESOURCES

5.1 RESEARCH OPPORTUNITIES

Active, mentored participation in research is expected. A research project of appropriate scope will be planned, proposed, carried out, and defended according to University rules. The Vanderbilt University Medical Center and VA Tennessee Valley Healthcare System provides an ideal environment to undertake projects and informatics research in an inpatient and outpatient environment. In addition to the research opportunities with informatics and quality researchers described below, a large number of basic and clinical research groups use our existing informatics infrastructure on a routine basis, and this provides trainees with opportunities for collaboration and multidisciplinary projects. TVHS clinical leadership is supportive of participating as project sites in this Fellowship Program. See Section 7 for more details.

5.2 VA TENNESSEE VALLEY HEALTHCARE SYSTEM (TVHS)

RESEARCH ENVIRONMENT: The Nashville campus of the TVHS is located adjacent to the VUMC and connected by an enclosed aboveground walkway. The successful Nashville VAMC research program includes funding in Medical Research, Rehabilitative Research, Health Services Research and Development, and Cooperative Studies. Annual research funding for FY 2005 was \$26 million, with \$4.5 million funded from VA research. In FY 2005, 96 VA investigators had 154 ongoing projects. Recent additions to the research program at the VA are: (1) the Geriatric

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Research, Education, and Clinical Center which has 34 investigators who published over 500 articles in the past four years; (2) the Quality Scholars Program which provides training to physicians for careers in health services research and quality improvement; and (3) the TVHS Health Services Research (TREP) Center for Patient Healthcare Behavior, a newly funded HSR&D center. Over 800 trainees work at the Nashville VAMC annually.

The VA TVHS Post Doctoral Fellowship in Medical Informatics will share space with the TVHS VA Quality Scholars Program, the GRECC, the TVHS Clinical Research Center of Excellence (CRCoE), and the TREP Center for Patient Healthcare Behavior (TVHS Health Services Research Center). The space is newly renovated and includes offices, conference rooms, and a duplicating and break room. An experienced Vista programmer and systems manager is on staff and there is an outstanding library facility. The addition of a full-time statistician by the CRCoE, as well as the space renovated by the VA for the GRECC, which houses many of the listed clinical mentors, will provide a supportive environment for trainee development.

QUALITY SCHOLARS PROGRAM: The TVHS VA Quality Scholars Program was created in 1998 through the Office of Academic Affiliations (OAA) Special Fellowships Program. TVHS is one of six sites nationally. The program supports two fellows per year for a two-year fellowship program (four total fellows annually) which provides health services research training with an MPH and a focused didactic and experiential training curriculum in the quality improvement and management sciences. Nearly 90% of graduates remain in academic medicine and nearly 80% have active research programs. Fellows' projects have made significant improvements to both the effectiveness and safety of care while also reducing the costs of care, both within TVHS and Vanderbilt University Medical Center.

GERIATRIC RESEARCH, EDUCATION, AND CLINICAL CENTER (GRECC): Dr. Robert Dittus is director of this Center funded by the Department of Veterans Affairs, which provides a foundation for research in geriatrics with a focus on prevention, geropharmacology, pharmacoepidemiology/economics, and quality improvement/patient safety. Thirty-five investigators have 65 grants, with total all-year funding exceeding \$130 million.

HEALTH SERVICES RESEARCH CENTER FOR PATIENT HEALTHCARE BEHAVIOR: The TVHS Health Services Research Center for Patient Healthcare Behavior is a VA TREP whose mission is to facilitate investigations of patient healthcare behaviors and how those behaviors affect the system of care and patient-centered outcomes. The Center includes 21 core and 7 affiliate investigators. We have four Quality Scholar fellows and one VA HSR&D Career Developmental Awardee. The multidisciplinary composition includes health services research, behavioral science, medical informatics, biostatistics, pharmacoepidemiology, decision and cost-effectiveness analysis, psychometrics, quality improvement, quality of care, and knowledge translation and implementation research. Examples of research projects include computer alert intervention to clinical inertia (Roumie, Speroff, Elasy, Dittus), and informatics interface for glycemic control in the intensive care unit (Boord, Speroff, Dittus). In our pipeline of HSR&D grant submissions is "Electronically identifying adverse events in clinical narrative," which uses concept-based indexing to extract information on surgical complications (Brown, Speroff, Murff).

CLINICAL RESEARCH CENTER OF EXCELLENCE (CRCoE): The theme of the TVHS CRCoE is "Optimizing Preventive and Therapeutic Interventions." This Center takes advantage of our well-developed training program for clinical researchers and strengths in pharmacoepidemiology, clinical pharmacology, use of large administrative databases for clinical research, medical informatics, and expertise in continuous quality improvement and methods to influence patient and provider behaviors. The objectives of our CRCoE are to augment mentoring and infrastructure support for clinical research at the VA, and to develop a core group of clinical researchers who exert both a local and a national impact on the health of veterans. The Center is closely linked to the Vanderbilt Division of Pharmacoepidemiology and its AHRQ funded Center for Research and Education in Therapeutics. The leaders of these two programs (Wayne Ray, PhD, and Marie Griffin, MD, MPH) are both 5/8 VA GRECC faculty and Dr. Griffin is Director of the CRCoE.

5.3 VANDERBILT RESEARCH ENVIRONMENT

Vanderbilt University provides a rich collaborative environment for training of clinical investigators, as evidenced by the 32 current NIH Center (P award) grants and their associated 111 program projects, 52 NIH training (K) awards, 44 NIH institutional training (T32) grants (11 of which have been continually funded for at least 25 years), and publication productivity in major journals (ranked #5 in impact of publications in clinical medicine). Nearly half (48%) of our clinical faculty are a principal investigator in an active IRB protocol and participate in clinical trials and other forms of human subjects research. Federally sponsored research has increased substantially over the past ten years. From 1999-2004, the Vanderbilt School of Medicine had the highest annualized growth in NIH funding of all U.S. universities and is currently ranked 15th in NIH funding. The Department of Medicine has experienced the

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highest percentage growth in NIH funding over the past five years and is ranked #6 in NIH funding. Total research funding for the School has doubled over the past five years, from approximately \$150 million in 1999 to over \$300 million in 2004.

THE VANDERBILT INFORMATICS CENTER: The Informatics Center consists of the Department of Biomedical Informatics, the Eskind Biomedical Library, and the Department of Information Management. Information Management has responsibility for the medical center's information technology infrastructure, and supports a rich variety of faculty-developed and commercially-acquired systems. The offices of the Department of Biomedical Informatics (DBMI) are housed in 9,600 net square feet on the fourth floor of the Eskind Biomedical Library, which has a total of 78,000 net square feet. The Annette and Irwin Eskind Biomedical Library (EBL) is the hub of Vanderbilt Medical Center's information services and resources. Opened in 1994, the EBL is prominently located at the center of Vanderbilt's medical campus. Faculty members of the department have offices there. The fourth floor space also includes a large and a small conference room; offices and cubicles for administrative and support staff; and cubicles for students, fellows, and research staff (current graduate program trainees are housed in 6x7 to 10x12 foot carrels located in this area, adjacent to faculty offices). VA TVHS trainees will be given shared carrels in DBMI, in addition to space at TVHS. The infrastructure on the floor includes 61 PCs, 3 network printers, 5 color ink jet printers, and 2 high-volume copying machines. A computer laboratory on the same floor is equipped with workstations and a printer; the lab is used for teaching of students and demonstration sessions of new applications. Expansion space exists in the lower level of the library where 12 additional cubicles are available to DBMI at any time. Access to the library and the departmental space is unlimited for department faculty, trainees, and staff. The Informatics Center's hospital- and clinics-based service unit, the Department of Information Management, has 19,685 net square feet of office space (9,400 in VU Hospital, 4,580 in Oxford House, 5,705 in Medical Center North) and 10,300 net square feet devoted to a data center. Hardware platforms include an OS390 based parallel sysplex with 2 CEC (240 MIPS) and 692 Gigabytes of disk storage; an AS400; a VAX 6510; 10 RS 6000s; 7 Sun Enterprise class servers; 60 Sun Ultra Class servers; 100 NT, Novelle, and OS2 servers; and >3000 Pentium class desktops. Distributed monitoring products include HP OpenView, Optivity, and Tivoli.

CENTER FOR HEALTH SERVICES RESEARCH faculty are conducting numerous studies designed to make healthcare more timely, safe, effective, efficient, patient-centered, and equitable. Many of these projects are conducted in collaboration with DBMI faculty. Examples include the AHRQ funded Center for Improving Patient Safety (PI Dittus) that has established a culture of safety and conducted many safety improving projects, including a major effort in reducing blood stream infections among ICU patients receiving central venous catheters, and a subsequent AHRQ funded safety project (PI Speroff) that is conducting a randomized, controlled trial to improve critical care safety among the nearly 200 hospital system of the Hospital Corporation of America. The Health Behavior and Education Research Unit of the Center (PI Elasy) is conducting several NIH funded studies examining methods to improve patient self-care behavior in the setting of chronic illness, some of which use an informatics foundation to collect patient data and serve as a tool for improved care management. Ongoing studies within the Adult Primary Care Center have used the clinical information system to improve adherence to chronic care recommendations. A TVHS study improving hypertension management through CPRS has been completed and its extension throughout VISN 9 is underway and is the basis for a VA funded HSR&D Career Development Award for one of the Center's faculty (PI Roumie, a former TVHS Quality Scholar).

HUMAN FACTORS ENGINEERING LABORATORY is dedicated to a scientific approach to problems in patient safety and quality of care. Research projects include field studies, design and analysis, and validation in both real and simulated care environments. The Laboratory applies methods and tools from human factors, engineering, informatics, psychology, sociology, interaction design, computer science, statistics, and management sciences to practical problems in a variety of clinical domains.

CENTER FOR PERIOPERATIVE RESEARCH IN QUALITY (CPRQ) applies human factors, quality improvement, and health services research methods to address issues of healthcare quality. The Center engages in interdisciplinary efforts to understand why everyday medical care deviates from optimal care in terms of effectiveness, safety, efficiency, and cost. The Center evaluates and implements interventions designed to attain optimal care. While the emphasis is on perioperative care, Center faculty also engage in projects in other acute and chronic care domains. The Center works closely with a number of departments, including Biomedical Informatics.

5.4 FUNDED RESEARCH ACTIVITIES

A number of significant facility-specific research activities are ongoing and planned at TVHS and DBMI. Competitively funded projects will be listed first.

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| Project Title | Start Date End Date | PI | Source | Total Funding |
|---|--------------------------------|------------|---|--------------------------|
| Active Grants | | | | |
| Health Information Technology Resource Center | 9/30/2004-9/29/2009 | Frisse | National Opinion Research Center (NORC) | 588,999 |
| State and Regional Demonstrations of Health Information Technology | 10/1/2004-9/30/2004 | Frisse | State of Tennessee | 12,155,364 |
| State of TN - Planning Grant | 9/29/2004-9/28/2005 | Frisse | State of Tennessee | 1,182,577 |
| TIME: (Tools for Inpatient Monitoring using Evidence) for Safe & Appropriate Testing | 2/1/2004-1/31/2007 | Miller | NIH/5 R01 LM07995-02 | 1,019,250 |
| Vanderbilt Biomedical Informatics Training Grant | 7/1/2002-6/30/2007 | Miller | NIH/5 T15 LM07450-04 | 3,650,405 |
| Principled Methods for Very Large-scale Causal Discovery | 8/1/2003-7/30/2006 | Aliferis | NIH/5 R01 LM07948-03 | 631,180 |
| Towards Optimal Methodological Filtering of Medical Articles: Intelligent Information Retrieval vs. Pubmed Clinical Queries | 7/1/2005-6/30/2006 | Aliferis | Medical Library Association (MLA) | 50,000 |
| Collaborative Proposal: NCR-Circuit Dynamics | 5/15/2005-4/30/2008 | Boczko | NSF/DMS-0443855 | 584,704 |
| Atypical Anti-Psychotic Induced Weight Gain | 7/1/2004-6/30/2005 | Levy | NIH/5 R01 DK68261-02 | 115,990 |
| Simultaneous Profiling of Protein and RNA Expression by Mass Spectrometry in Intact Breast Tissue Samples | 7/15/2004-7/14/2005 | Levy | DOD/W81XH-04-1-0626 | 113,250 |
| Health Science Librarian Pre-Professional Integrated Learning Model | 12/31/2003-12/31/2006 | Giuse | HSRA RE-01-03-0052-03 | 126,891 |
| The Clinical Informationist: Does the Model Work? | 6/15/2005-6/14/2006 | Giuse | NIH/5R01 LM007849-03 | 1,168,781 |
| Biosurveillance Utilizing SNOMED-CT based NLP | 9/30/2005-9/29/2008 | Brown | NIH/1 R01 PH000022-01 subcontract w/ Mayo | 30,000 |
| Testing Evaluation Metrics for Interface Terminologies | 2/1/2005-1/31/2008 | Rosenbloom | NIH/1K22LM008576-01 | 604,152 |
| | | | Total Active Funding | 22,021,543 |
| Pending Grants | | | | |
| Terminological and Ontological Requirements of ePrescribing | 12/1/2005-11/30/2006 | Brown | AHRQ and CMS | 148,562 |
| Collaborative Proposal: A New Paradigm in Binary Classification and Application to Genomic and Proteomic Data | 1/1/2006-12/31/2009 | Boczko | NSF | 713,475 |
| Show Your Work: Do Prescription Annotations Impact Near Miss Medication Errors? | 1/1/2006-12/31/2006 | Johnson | AHRQ | 100,000 |
| CCASAnet: Caribbean, Central and South America Network | 3/1/2006-2/28/2011 | Masys | NIH | 3,393,766 |
| SNOMED Supported Discovery of Novel Drug Mechanisms | 4/1/2006-2/28/2011 | Aliferis | NIH | 31,537 |

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| | | | | |
|---|--------------------|-----------------------|------------------------------|------------------|
| New paradigm in binary classification for disease diagnosis from biological data | 4/1/2006-3/31/2008 | Boczko | NIH | 417,608 |
| Molecular Seismology: A Nanoscale Assay for Detecting Biopolymer Interactions | 4/1/2006-3/31/2009 | Boczko | NIH | 574,532 |
| Hijacking morphogenesis: integrated, complex microsystems (ICS) for controlling embryonic pattern formation | 7/1/2006-6/30/2009 | Boczko | NSF | 83,422 |
| Next-Generation Evidence-Based KB Construction Tools | 7/1/2006-6/30/2009 | Miller | NIH | 1,113,420 |
| Improving Laboratory Utilization via Predictive Modeling | 7/1/2006-6/30/2008 | Tsamardinos | NIH | 421,500 |
| Controlled Vocabulary Design for Clinical Applications | 3/1/2006-2/28/2009 | Brown | NIH | 30,000 |
| Post Operative Event Monitor | | Brown, Speroff, Murff | VA | 284,215 |
| Managing ED Diversion with Information Technology | 7/1/2006-6/30/2008 | Aronsky | NIH | 421,375 |
| | | | Total Pending Funding | 7,733,412 |
| Completed Grants | | | | |
| Pharmacogenetics of Phase II Drug Metabolizing Enzymes: Drug Ontology Supplement | 2002-2003 | Brown | NIH | 517,712 |
| Vanderbilt Physician Scientist Development Program | 2003-2004 | Rosenbloom | Vanderbilt | 150,000 |

5.5 PRODUCTION RESEARCH

Other research projects, particularly those surrounding locally-developed systems in production, are being conducted as part of the R&D effort without extramural funding. These projects are listed in Section 6.2 below.

CPEP AND VA: Three ongoing studies center on evaluation of the CPWM Templates. The first is an ongoing IRB approved randomized controlled study of the time costs and quality outcomes of using the CPWM templates for exam documentation versus dictation, the current standard of practice. The second is a methodology development study to create unobtrusive tools to estimate documentation entry costs. The third is an evaluation of SNOMED CT as an interface terminology and for knowledge representation of medical evaluation concepts. We are also focused on the application of natural language processing to perform automated or semi-automated quality assessments of disability exams. Our initial efforts are to develop and evaluate algorithms for Joint, Spine, and PTSD exams. The next step will be to integrate these tools into current CPEP quality review processes to determine their impact on review accuracy and time costs. We are also planning to evaluate prospectively the impact of automated expert feedback during the exam documentation process. An additional area of evaluation within CPEP is the study of how performance data use patterns vary between high performing and low performing sites.

5.6 VHA'S HEALTH INFORMATION ARCHITECTS

VHA's Health Information Architects (HIA) inform, guide, and manage information technology in support of health system goals including creating highly interoperable, non-duplicative information systems. HIA staff review VHA IT acquisitions and spending and ensure information system decisions support VA's missions, goals, and program business needs. HIA activities also involve evaluation of future systems design and clinical usability via its Future Systems Group. HIA Future Systems Group has a number of relevant projects underway that fellows can be exposed to and possibly become involved with if their skills, topics and interest match. See the "practice of informatics" Section 6.2 for a description of HIA projects.

HIA has agreed to support the VA TVHS Post Doctoral Fellowship in Medical Informatics in three ways (see letter of support following Appendix 4). First, HIA will engage fellows in a two-way dialog about their ongoing research

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projects in order for the fellows to learn about national standards, needs, and expectations; and for HIA to learn about the results of fellows' projects. Second, HIA will make available participation in its projects to interested and qualified fellows. Third, the HIA Director has agreed to serve as faculty to the fellowship. HIA is a multi-site organization that relies heavily on virtual collaboration using tools such as "Groove." Interested fellows will use the same tools to collaborate as a normal HIA team member. Also, face-to-face sessions will be conducted as needed, in keeping with HIA standard practices.

5.7 OTHER RESOURCES

DATABASES: A number of databases exist at the VISN and national level that could be relevant for fellows' education and research. Fellows will be encouraged to explore these resources during the proposed Introduction to VA Informatics Course and to use it as needed during their research projects. The VISN 9 Data Warehouse contains an extensive amount of data extracted monthly from each VistA system in the VISN and stored in 70+ relational tables. Numerous other databases, such as the National Patient Care Database, will also be explored.

LOGISTICAL RESOURCES: Computer support, e-mail, Internet and Intranet access, and telephone access will be provided by TVHS and VISN 9 per routine.

STATISTICAL SUPPORT: Statistical support will be provided by the TVHS Health Services Research (TREP) Center for Patient Healthcare Behavior and the TVHS Clinical Research Center of Excellence. Currently we have a designated biostatistician, Robert Greevy, PhD, from the Vanderbilt Department of Biostatistics and his master's level assistant. Additional biostatistical support is available thru Vanderbilt's Department of Biostatistics, via a collaboration agreement with DBMI. Under this agreement, dedicated master's and PhD level biostatisticians are assigned to DBMI to support the design and data analysis phase of research projects.

5.8 RESEARCH INFRASTRUCTURE DEVELOPMENT ACTIVITIES

FELLOWS VistA "TEST" SYSTEM: In the upcoming year we will explore and compare approaches to creating a test VistA system for the use of the fellowship. Approaches will be based on open source software, i.e., Linux and the GT.M M environment in order to avoid/minimize licensing fees. Vin Messina, the programmer and data manager for the TVHS TREP, is a trained and experienced VistA systems manager who will lead this effort.

DATABASE ACCESS: In the upcoming year we will investigate procedures and requirements to access VA databases.

6 PRACTICE OF INFORMATICS RESOURCES

The combined Practice of Informatics Resources of TVHS and Vanderbilt offer a training environment of unusual abundance that is quite possibly unsurpassed by any other VA and university affiliate pair in the country. Systems in "production," a practice of informatics metric of success specified in the RFP, are commonplace here. The environment is further enriched by large-scale funded applied informatics projects, a specified success factor in the RFP. Fellows will find a wealth of applied informatics opportunities where their involvement is encouraged and can result in real impact on healthcare.

6.1 VA TENNESSEE VALLEY HEALTHCARE SYSTEM (TVHS)

TVHS staff has an exceptional history of local and national innovation in informatics with resulting systems in "production." Two TVHS innovations have been adopted nationally by the Office of Information as "Class 1" software, and a third is under consideration. This is a remarkable achievement, given the rarity of the event. Other Class 1 adoptions include BCMA (Topeka) and VistAWeb (Ann Arbor). It is our best estimate that fewer than 10 such adoptions have occurred in the past 5 years. The informatics practice environment is further enhanced by access to an experienced VistA programmer and systems manager on the research staff.

CAPRI: The CAPRI system permits VBA users to electronically access medical data and place orders for examinations for hundreds of thousands of veteran compensation and pension (C&P) claims each year. CAPRI is analogous to CPRS in many ways, but is specifically designed to serve at the intersection of VHA and VBA business processes and information flow. CAPRI was initially developed at Nashville and is now deployed at every VA medical center and VBA regional office in the country. The CAPRI team, led by the proposed fellowship director, was awarded a Vice-Presidential "Hammer" award and a Secretary's "Scissors" award for CAPRI.

CPWM: The Compensation and Pension Worksheet Module (CPWM) is the second nationally deployed (Class 1) structured documentation system which grew out of a TVHS innovation. CPWM allows non-programmers to use a graphical design environment and re-usable object repository to create sophisticated C&P exam templates that

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integrate with VistA. To date, 57 templates are in production at all VA medical centers. The CPEP Office and OI have an ongoing collaboration to further develop the templates. A graduate of the VA Salt Lake City Post Doctoral Fellowship in Medical Informatics is the lead template developer. It is anticipated that CPWM will offer excellent project and research opportunities for fellows. Preliminary evidence (Section 5.5) indicates that the templates improve documentation, quality, and decrease exam turnaround time.

SCAM: The Service Connection Automated Monitoring (SCAM) program is a TVHS innovation that is being considered by OI for adoption as Class 1 software. It is already in use by four VISNs and several other individual sites. SCAM uses a “crosswalk” between two highly pre-coordinated compositional terminologies (ICD-9 and VBA diagnostic codes) to screen for potentially billable care improperly designated as “service connected.” VISN 23 found and corrected a 38.6% error rate in SC care determination between May and July 2005, billed an additional \$1.4 million, and collected \$593,000 as the result of using SCAM. This additional funding was used for medical care programs, a clear benefit to veterans based on SCAM process quality improvements. SCAM is under ongoing development and could serve as a platform for fellows’ projects. Planned additions will contribute to improving data quality and reducing entry costs for the Clinical Indicators Data Capture (CIDC) initiative.

RADARx: RADARx is a medication adverse event screening and documentation tool developed at TVHS. RADARx integrates computerized ADE screening, probability assessment, documentation, and reporting capabilities. RADARx improved patient safety and quality as evidenced by the more than doubled adverse event detection. Data dictionary mapping tools enabled RADARx implementation at 3 sites within VISN 9. The RADARx team, led by the proposed fellowship Program Director, won a national safety award for this initiative.

NATIONAL DRUG FILE-REFERENCE TERMINOLOGY: The National Drug File-Reference Terminology (NDF-RT) is a description logic based formal terminology for medications whose initial and ongoing development has been led by the proposed fellowship Program Director. NDF-RT is based on a rigorous, clinically-based medication reference model and structured, computer-usable formal definitions for each medication. NDF-RT is being used as a data collection and management aid by the NIH Pharmacogenomics Research Network and the Centers for Disease Control’s National Electronic Injury Surveillance System. VA is transitioning to NDF-RT. NDF-RT physiologic effect and mechanism of action hierarchies have been selected as national standards by the National Committee on Vital and Health Statistics and endorsed by the Secretary of HHS.

CPEP QUALITY ENHANCEMENT SYSTEM TECHNOLOGY (QuEST): CPEP’s evaluation of compensation and pension examination quality nationwide requires the collection, storage, and analysis of large data sets. To support this extensive information management process, infrastructure consisting of computer hardware, a data repository, and a set of specialized software tools has been built, tested, and implemented and is continuously refined. The system’s capacity includes the gathering and storage of electronic C&P examination report data from around the country; assignment and review of randomly selected examinations, recording of review scores, continuous tracking and management of reviewers and review processes, and generation of reports.

CPRS ALERTS - IMPACT ON PATIENT CARE: TVHS TREP researchers, led by Christianne Roumie, have developed technical and methodological experience with the use of CPRS alerts to modify physician behaviors and clinical outcomes. Investigators have implemented and evaluated CPRS alerts in the settings of poorly controlled hypertension and in hormone replacement therapy based on the findings of the Women’s Health Initiative. Similar studies based on or extending these methods are available for fellows’ involvement.

6.2 HEALTH INFORMATION ARCHITECTS (HIA) FUTURE SYSTEMS GROUP

HIA Future Systems Group has a number of relevant projects underway that fellows can be exposed to and possibly become involved with if skills, topics, and interest match. HIA is: (1) conducting an Radio Frequency Identification (RFID) pilot at the Minneapolis VAMC that will track assets such as infusion pumps, wheelchairs and stretchers, and portable IT equipment; (2) developing an outpatient order management demonstration application that will integrate chronic disease, order, and results management for outpatient management of diabetes as a means of demonstrating the utility of Jini, an adaptive, self-healing network framework; (3) leading an HL7 version 3 demonstration project; (4) establishing a content management system with subscription capabilities using open source tools such as Wiki and Real Simple Syndication (RSS); (5) assessing the resources required to facilitate an open source-like, multinational model for HealtheVet-VistA; and (6) developing usability evaluation methodologies for VHA applications (including clinical software). HIA is a multi-site organization that relies heavily on virtual collaboration using tools such as “Groove.” Interested fellows will use the same tools to collaborate as a normal HIA team member. Face-to-face sessions will also be conducted as needed, in keeping with HIA standard practices.

6.3 VANDERBILT UNIVERSITY

Across the United States, there are a number of academic institutions with excellent, but often insular, resources in many informatics “specialty” areas. What distinguishes Vanderbilt is the high profile and essential role that informatics and informaticians play in the daily operations of the institution – in its research, clinical care delivery, and educational initiatives. Vanderbilt University Medical Center entrusts its Informatics Center with the responsibility for: (a) providing the essential information infrastructure for patient care, management, research, and education – including the support for informatics-related research and education in clinical informatics and the emerging field of bioinformatics (including new initiatives in genomics and proteomics); and (b) fusing scholarly research in biomedical informatics with the dissemination of the resultant knowledge to individuals through its education programs and into operation through the infrastructure. The synergy between the Department of Biomedical Informatics in the medical school and the Informatics Center creates an unparalleled laboratory for informatics research, fostering multidisciplinary rapid prototyping and deployment of applied systems, and evaluation of their impact. Researchers have access to real-world problems and operational resources (the Informatics Center budget totals over \$43 million annually). Faculty members are encouraged to meld service responsibilities with research activities in a manner that leverages the clinical and research facilities of the university as an applied informatics laboratory. With an expanding faculty of outstanding investigators (including Bill Stead, Dan Masys, Randy Miller, Nancy Lorenzi, Mark Frisse, and Kevin Johnson, among others), Vanderbilt has become a national leader in biomedical informatics. The Informatics Center has developed and continuously evolves many very successful and nationally/internationally recognized products. The following are just a few:

WIZORDER: WizOrder is a computerized clinician order entry system that was developed by DBMI faculty (led by Randy Miller, see Section 2.4, Leadership) working with Informatics Center staff and trainees at Vanderbilt, and has been in operation since 1994. WizOrder is used “at the point of care” to provide patient-specific clinical decision support for more than 1500 clinicians as they make important decisions regarding a patient’s clinical course. WizOrder helps to ensure the highest quality of care for VUMC patients, while reducing medical errors. It incorporates relevant information resources to enhance and support decision-making. Over 10,000 orders are entered into WizOrder daily, with 70% directly entered by MDs and the rest by clinical staff. In addition to using WizOrder as a tool to implement quality control and patient safety measures, the institutional leadership at VUMC uses WizOrder as a means to reduce inappropriate variances in test ordering. WizOrder technology has been so successful that it has been licensed by Vanderbilt to HBO McKesson, which offers it as the Horizon Expert Orders product line.

STARPANEL: StarChart/StarPanel, the medical center’s electronic patient chart, is a web-enabled distributed system that brings together all information about a patient to provide a complete electronic patient record. It currently receives data from over 50 sources/systems and the earliest source is complete back to 1984. It uses more than 60 servers, located in 2 separate areas for maximum availability. Every word and every number is indexed, permitting full text data mining. StarChart and StarPanel were developed in 1998 and 2000 respectively by Dario Giuse, faculty on this proposal. Currently, StarChart stores more than 60 million documents in 200 GBytes (not counting images), comprising an up-to-date, comprehensive, 9-year electronic medical record for 1.3 million distinct patients. Lead: Giuse.

PATHWORX: PathworX is a computer-based tool for care management, documentation, and quality improvement, based on interdisciplinary care pathways built by clinical teams. Literature review identifies, for particular diagnoses and procedures, current best practices. Clinical and organizational knowledge then guides design of a time-specific comprehensive, care pathway extending from admission to discharge to clinic visits. The team determines the therapeutic goals for each phase of the pathway; organizes and coordinates the assessments, treatments, medications, tests, teaching, etc. done in each phase; and produces a template pathway that becomes the starting point in managing the care of individual patients. The admitting nurse uses PathworX to assign a pathway to a patient and customizes the pathway to match the patient’s needs. PathworX then produces specific “flow sheets” and other forms that nurses use to record care given and assess patient progress toward identified goals (or to record reasons for goals not achieved). In addition to promoting quality in the care of each patient, PathworX is a valuable tool for continual quality improvement (CQI). Lead: Starmer.

EMERGENCY DEPARTMENT WHITE BOARD: The Emergency Department (ED) Information System includes an advanced patient tracking system, developed and continuously refined by DBMI faculty, which provides up-to-date clinical and operational information for ED patients. The system is fully integrated with several institutional applications, such as computerized patient record system, computerized provider order entry, computerized triage,

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order tracker system, and the hospital bed board. The ED information system supports a number of ongoing research projects addressing patient safety, quality improvement, and process optimization. Lead: Aronsky.

QUILL: QUILL (Q**U**estions and Information Logically Linked) is a flexible, structured documentation tool which permits rapid entry of categorical clinical information, allows input by generalists and sub-specialists, supports multiple methods of data entry, and outputs data in both human- and machine-readable form. QUILL, a Java-based application that is a component of our electronic health record (EHR), was designed for use across multiple clinical domains and supports a collaborative workflow so that a nurse and physician can work together to create a final comprehensive document. Documentation using QUILL occurs through the use of user-customizable templates, which are collections of terms and concepts from an underlying pilot clinical interface terminology. Templates prompt documentation of particular problems or to follow specific guidelines. Leads: Shultz, Rosenbloom.

VOLUNTEER eHEALTH INITIATIVE RHIO: Vanderbilt is home to the Volunteer eHealth Initiative, a Regional Health Information Organization (RHIO) being developed to create a comprehensive and fully-operational data exchange in Tennessee. Its goal is to create an infrastructure to examine how health care delivery can be improved through a more comprehensive exchange of clinical information. The initiative addresses national standards, governance, clinical outcomes, prescription drug information, integration of clinical information systems, clinical quality, authentication, confidentiality, and other critical aspects of medical informatics research. Lead: Frisse.

AHRQ NATIONAL RESOURCE CENTER FOR HEALTH INFORMATION TECHNOLOGY: Vanderbilt is one of five partners in the AHRQ National Resource Center for Health Information Technology. Faculty from Vanderbilt University and staff from the Vanderbilt Center for Better Health play leadership positions in AHRQ's National Resource Center. They provide technical support to all state and regional demonstration contract awardees as well as support in areas as diverse as public health networks, clinical decision support, and data repositories. They also facilitate major meetings for the National Resource Center. Vanderbilt faculty has been critical in the design of the knowledge resource and has made original contributions to the support of all AHRQ awardees through white papers and reports. Lead: Frisse.

7 CLINICAL RESOURCES

7.1 VA TENNESSEE VALLEY HEALTHCARE SYSTEM (TVHS)

The VA TVHS serves the veteran populations of Middle Tennessee and portions of south-central Kentucky, northern Alabama, and northwest Georgia. The VA TVHS is a component of the Veterans Integrated Service Network (VISN 9), which covers Tennessee, Kentucky, and a portion of West Virginia. Care in the VA TVHS is provided at two hospitals (VA Medical Center Nashville and Alvin C. York VA Murfreesboro) and in several outlying outpatient clinics. These sites provide 130,000 bed-days for inpatients and 468,000 outpatient encounters per year. The demographics of this population reflect the VA population in general in that it is predominately male and has a disproportionate number of persons who are elderly and who have important medical co-morbidities. The VA TVHS provides an excellent setting for clinical studies of the large numbers of veterans.

The Nashville campus of the TVHS is located adjacent to the VUMC and the two are connected by an enclosed aboveground walkway. The Nashville campus offers primary, secondary, and tertiary care. TVHS is affiliated with Vanderbilt and Meharry, with active residency programs in all major medical and surgical specialties and sub-specialties. In addition, the Nashville campus supports a vigorous research program of over \$19 million annually. The Nashville campus serves as a VHA resource for solid organ and bone marrow transplants. Specialty programs include: Geriatric Research, Education, and Clinical Center (GRECC), Audiology/Speech Pathology, Angioplasty, Arthroscopic Surgery, Brain Stem and Auditory Evoked Response Testing, CT Scanning/MRI, Dental, Dermatology, Infectious Disease, Neurology, Post-Traumatic Stress, Neuropsychiatric Testing, Homeless Services and Outreach, Flow Cytometry, Laser Surgery, Open Heart Surgery, Ophthalmology, Retinal Screening, Diabetic Education, Otolaryngology, Pain Clinic, Photopheresis, Cardiac Catheterization, Dialysis, Head and Neck Surgery, Major Orthopedic Surgery, Organ Transplantation, and Peripheral Vascular Surgery. The Alvin C. York campus of the VA Tennessee Valley Healthcare System (TVHS) provides primary care and a subset of specialty medical and surgical care. The campus provides long-term rehabilitation and nursing home care, and serves as a VISN 9 resource for the long-term inpatient care of psychiatric patients. The TVHS clinical environment is highly affiliated and highly sophisticated. Clinical leaders offer their broad support for the proposed fellowship integrating informatics and quality at TVHS and for the fellows' direct involvement in the clinical enterprise. Opportunities are also available at the intersection of informatics with clinical support aspects of the organization: e.g., Biomedical Engineering, Health Information Management, or the Business Office. See letters of support following Appendix 4.

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7.2 VANDERBILT UNIVERSITY

The Vanderbilt University Hospital is a twin-towered, 658-bed structure. Supported by respected, research-based medical and nursing schools, Vanderbilt delivers both routine inpatient care and highly specialized medical treatment and surgical procedures. The hospital is also supported by a philosophy of patient-centered care, as well as the most up-to-date systems and technology. The hospital is home to the region's only Level I Trauma Center and the most comprehensive Neonatal Intensive Care Unit. The new Monroe Carell Jr. Children's Hospital at Vanderbilt is truly unique and offers family-centered healthcare. The \$172 million facility opened in February 2004. It has 8 floors and 616,785 square feet. The new children's hospital has 206 inpatient beds, including 36 intensive care beds, 60 neonatal intensive care beds, 25 emergency department beds, and 12 operating rooms. Construction is underway on an 11-story outpatient center. The Vanderbilt Clinic comprises more than 95 outpatient specialty practices in several campus locations, including The Vanderbilt Clinic building, Medical Arts building, and the Villages at Vanderbilt. The Vanderbilt Page Campbell Heart Institute offers a comprehensive heart program including diagnosis, medical treatment, minimally invasive therapies, surgical intervention, and disease management, tailored to each individual's unique needs. The Vanderbilt Stallworth Rehabilitation Hospital provides complete inpatient and outpatient services for pediatric and adult patients with neurological and orthopaedic injuries or disabilities, degenerative conditions, and certain chronic ailments. The Vanderbilt Sports Medicine Center is a full-service medical, surgical, and rehabilitative approach to acute and chronic musculoskeletal injuries. The Vanderbilt Transplant Center has extensive clinical experience in each of the established transplant programs, excellent clinical outcomes, and experienced leadership.

7.3 CLINICAL INFRASTRUCTURE RESOURCE DEVELOPMENT: In the upcoming year we will work to identify additional opportunities for collaborative work with clinical departments at TVHS.

8 EVALUATION STRATEGY

The Executive Committee of the VA TVHS Post Doctoral Fellowship in Medical Informatics will develop and implement process and outcome measures to guide the Fellowship Program's strategic and tactical planning and to assure that it is conducting itself as a leader in the VA national network of medical informatics fellowship sites. The measures will encompass individual and programmatic evaluation components described below.

8.1 EVALUATION OF INDIVIDUAL FELLOWSHIP EXPERIENCES: The Steering Committee will review each fellow's progress quarterly based on the individualized Professional Development Plan and the DBMI degree program Plan of Study (Section 4.3). Using these individualized planning documents, the fellow completes a self-appraisal and the fellow's mentor completes a companion evaluation of the student's program. Key assessment areas of these plans include progress towards training milestones, quality of training outcomes, and the impact potential of the specific fellowship experience relative to VA informatics and quality objectives. The Steering Committee, in coordination with the DBMI Academic Progress Committee, will provide written feedback to each fellow and mentor, in which accomplishments are acknowledged and concerns, if present, are identified for timely attention.

8.2 PROGRAMMATIC EVALUATION: The Fellowship Program's success in achieving its stated objectives will be measured using several outcome-specific methods described below. All programmatic evaluation results will be anonymized, summarized, and shared with the Steering Committee, the Internal and External Advisory Committees, and the VA OAA (if requested), as well as with fellows, instructors, and other Fellowship Program participants and stakeholders, as appropriate, to insure that continuous quality improvement of the program is pursued through the administrative and strategic planning processes.

RECRUITMENT: Summary statistics regarding applicant diversity and quality metrics, to be defined by the Steering Committee, will be with the Fellowship's stated objectives and benchmarks from other training programs.

EDUCATIONAL RESOURCES: Using formal, anonymous evaluation tools appropriate to each educational resource, fellows will evaluate their courses, instructors, other informatics and quality training resources (e.g., the Biomedical Informatics and Quality Scholars Seminar Series and multi-site collaborative learning opportunities, including interactions with the VHA's Health Information Architects); teaching opportunities; and other learning environment resources (e.g., office space, computing resources). For example, each course taught in the Biomedical Informatics degree program is assessed by an anonymous questionnaire completed at the last session.

FELLOWS' PROGRESS IN COURSEWORK AND RESEARCH: Each fellow's Individualized Professional Development Plan and the DBMI degree program Plan of Study are also important sources of program evaluation data. Additional

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data such as fellows' publications will be tracked electronically. These data will be reviewed by the Steering Committee to identify trends in fellows' progression through the program, such as the pace of completion of courses and research projects and the submission and acceptance rates for fellows' scholarly writing.

MENTORING EFFECTIVENESS: Fellows will meet individually with the Program Director each month. These meetings provide occasion for discussion of expectations, problems, and consideration of potential solutions in a variety of important fellowship areas, including mentorship.

CAREERS OF GRADUATES: Records on all program graduates' career pathways (including positions held, grants, publications, and recognitions) will be maintained and periodically assessed by the Steering Committee for their contributions to VA quality and medical informatics objectives. Graduates will be contacted periodically to obtain feedback regarding the role of the fellowship in their career development and suggestions for improving the educational benefits of the fellowship.

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APPENDIX I – LEADERSHIP BIOSKETCHES

| | | | |
|---|--|--|--|
|  Department of Veterans Affairs | RESEARCH AND DEVELOPMENT PROGRAM | INVESTIGATOR'S BIOGRAPHICAL SKETCH <i>(Not to Exceed Four Pages)</i> | |
| NAME Steven Holloway Brown | POSITION TITLE Director, Compensation and Pension Examination Program | | |
| EDUCATION / TRAINING <i>(Begin with Baccalaureate or other initial professional education, such as nursing, and include post-doctoral training. Do not include Honorary Degree.)</i> | | | |
| NAME, LOCATION OF INSTITUTION Brown University, Providence, RI Brown University, Providence, RI Residency, Emory University, Atlanta, GA Applied Informatics Fellowship, NIH/NLM Vanderbilt University, Nashville, TN | DEGREE A.B. M.D. MS | YEAR AWARDED 1981 1987 1987-90 1994-96 1998 | FIELD OF STUDY Biology Medicine Internal Medicine Informatics Biomedical Engineering |
| NOTE: The Biographical Sketch may not exceed four pages. Items A and B (together) may not exceed two of the four-pages. | | | |
| A. Positions and Honors (List in chronological order previous positions, concluding with your present position. List any honors, professional memberships or present membership on any Federal Government public advisory committee.) Positions and Employment: | | | |
| 1981-1983 1983 1983-1987 1990-1993 1993-1996 1994-1996 1996-2001 1996-2000 1999-Pres. 2000-2001 2001- Pres. | Research Assistant/Programmer, Rhode Island Hospital, Department of Pathology, Division of Surgical Pathology, Providence, RI Computer Consultant, Compydyne, Inc., Bedford, MA Computer Consultant, Rhode Island Hospital, Department of Pathology, Division of Surgical Pathology, Providence, RI Senior Associate in Medicine, Emory University School of Medicine, Atlanta, GA Assistant Professor of Medicine, Emory University School of Medicine, Atlanta, GA Visiting Assistant Professor of Biomedical Informatics, Division of Biomedical Informatics, Vanderbilt University School of Medicine, Nashville, TN Assistant Professor of Biomedical Informatics, Division of Biomedical Informatics, Vanderbilt University School of Medicine, Nashville, TN Chief Information Officer and Staff Physician, Veterans Affairs Medical Center, Nashville, TN Lead Terminology Informatician, Health Information Architecture, Office of Information, Veterans Health Administration Chief Information Officer and Staff Physician, VA Tennessee Valley Healthcare System, Nashville, TN Director, Joint VBA/VHA Compensation and Pension Examination Program Office | | |

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2001- Pres. Associate Professor of Biomedical Informatics, Department of Biomedical Informatics, Vanderbilt University Medical Center, Nashville, TN

Other Experience and Professional Memberships:

1990 American Medical Informatics Association
1999 International Medical Informatics Association
2001 Health Level 7 Vocabulary Technical Committee
2002 Quality Interagency Council Information Systems Group
2002 ASTM E 31.01 Medical Terminology – Vice Chair
2004 American Medical Informatics Association Meetings Committee
2004 Vanderbilt Department of Biomedical Informatics Curriculum Committee
2003 Federal Consolidated Health Informatics Council
2003 Interagency SNOMED CT Technical Advisory Workgroup
VA Medical Informatics WG
VA Problem List Expert Panel
VA Adverse Drug Event WG
VA Informatics Implementation Task Force (Guidelines)
VA Patient Safety Reporting, Analysis, and Feedback WG
VISN9 Medical Informatics Committee
VISN9 Computerized Medical Record Committee
VAMC Nashville Management of Information Committee - Chair
VAMC Nashville CPRS Steering Committee – Chair

Honors:

1998 Who's Who in Science and Engineering
1999 Leadership VA
2000 VHA National Best Practice - Service Connected Automated Monitoring Program
2000 VBA National Special Contribution Compensation and Pension Record Interchange Program
2000 VA Secretary's Scissors Award Compensation and Pension Record Interchange Program
2000 Vice President's Hammer Award Compensation and Pension Record Interchange Program
2001 VHA National Safety Award Recognizing, Assessing and Detective Adverse Drug Events Program
2002 VHA Special Contribution Award Compensation and Pension Examination Project
2003 National Library of Medicine Special Contribution Award SNOMED CT technical assistance
2004 VHA Special Contribution Award BCMA Presentation to Senate Staff
2005 Fellow, American College of Medical Informatics

B. Selected peer-reviewed publications (in chronological order)

(Do not include publications submitted or in preparation)

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2. Peleg II, Maibach HT, Brown S, Wilcox CM. Aspirin and nonsteroidal anti-inflammatory drug use and the subsequent risk of colorectal cancer. *Archives of Internal Medicine*. 1994;154:394-399.
3. Brown S, Coney RD. Changes in computer anxiety and attitudes in physicians related to clinical information system use. *Journal of the American Medical Informatics Association*. 1994;1(5):381-394.
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5. Brown S. No free lunch: institutional preparations for computer-based patient records. Proc AMIA Symp. 1999:486-90.
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7. Elkin PL, Harris M, Ogren PV, Buntrock JD, BrownSH, Solbrig H, Chute CG. Semantic augmentation of description logic based terminologies. International Medical Informatics Association WG6. 1999.
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14. Elkin PL, Brown SH, Ruggieri A, Bauer BA, Wahner-Roedler D, Beebe C, Dolin RH. A Systematic Review of the Health Level 7 Reference Information Model. Health Information Technology Advisory Report vol 3(7) 26-31.
15. Carter JS, Brown SH, Erlbaum MS, Gregg W, Elkin PL, Speroff T, Tuttle MS. Initializing the VA Medication Reference Terminology Using UMLS Metathesaurus Co-Occurrences. Proc AMIA Symp. 2002;;116-20.
16. Nelson SJ, Brown SH, Olson N, Erlbaum MS, Powell T, Carlsen B, Carter J, Tuttle MS, Hole WT. A Semantic Normal Form for Clinical Drugs: Early Experience with the VANDF. Journal of the American Medical Informatics Association Fall Symposium Supplement 2002. p 557-561
17. Elkin PL, Brown SH, Bauer BA, Wahner-Roedler D, Bergstrom L, Pittlekow M, Papier A, Rosse C. Guideline and Quality Indicators for Development, Purchase and Use of Controlled health vocabularies. International Journal of Medical Informatics. 2002;68/1-3:175-186.
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24. Rosenbloom ST, Awad J, Speroff T, Brown SH. Adequacy of representation of the National Drug File Reference Terminology Physiologic Effects reference hierarchy for commonly prescribed medications. AMIA Annu Symp Proc. 2003:569-78.
25. Chute CG, Carter JS, Tuttle MS, Haber M, Brown SH. Integrating Pharmacokinetics Knowledge into a Drug Ontology As an Extension to Support Pharmacogenomics. AMIA Annu Symp Proc. 2003:170-4.
26. Brown SH, Bauer BA, Wahner-Roedler DL, Elkin PL. Coverage of Oncology Drug Indication Concepts and Compositional Semantics by SNOMED-CT®. AMIA Annu Symp Proc. 2003:115-9.
27. Bauer BA, Lee M, Wahner-Roedler D, Brown SH, Pankratz S, Elkin PL. A Controlled Trial of Physicians' and Patients' Ability to Distinguish Authoritative from Misleading Complementary and Alternative Medicine Web Sites. Journal Of Cancer Integrative Medicine 2003;1(1).

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28. Penz JFE, Lincoln MJ, Nguyen V, Brown SH, Carter JS, Elkin PL. Evaluation of SNOMED Coverage of Veterans Health Administration Terms. *Medinfo*. 2004:540-544.
29. Brown SH, Elkin PL, Rosenbloom ST, Husser C, Bauer BA, Lincoln MJ, Carter JS, Erlbaum MS, Tuttle MS. VA National Drug File Reference Terminology: A Cross-Institutional Content Coverage Study. *Medinfo*. 2004:477-81.
30. Lincoln MJ, Brown SH, Nguyen V, Cromwell T, Carter JS, Erlbaum MS, Tuttle MS. U.S. Department of Veterans Affairs Enterprise Reference Terminology Strategic Overview. *Medinfo*. 2004:391-5.
31. Elkin PL, Brown SH, Husser CA, Wahner-Roedler D, Bailey S, Nugent, L, Porter K, Bauer BA. Using SNOMED-CT as a Reference Terminology: Mapping VA Disability Terminology to ICD-9-CM. *Medical Informatics Europe 2005*
32. Elkin PL, Brown SH, Bauer BA, Wahner-Roedler DL, Hamm R, Carruth B, Bergstrom L. A controlled trial of automated classification of negation from clinical notes *BMC Medical Informatics and Decision Making* 2005, 5:13
33. Lincoln MJ, Brown SH, Bouhaddou O, Maulden S, Cromwell T, Ferrer J, Hollinger K, Integrating legacy terminologies with enterprise reference terminologies: A VHA progress report. *TEPR* 2005

C. Research Support

List selected ongoing or completed (during the last three years) research projects (federal and non-federal support). Begin with the projects that are most relevant to the research proposed in this application. Briefly indicate the overall goals of the projects and your role (e.g. PI, Co-Investigator, Consultant) in the research project. Do not list award amounts or percent effort in projects.

Ongoing Research Support

VA TREP VA HSR&D Speroff (PI) 10/01/03 - 10/30/08. Health Services Research Center for Patient Healthcare Behavior: To characterize the contribution that patient behavior has in shaping the organizational dynamics of care and the self-management of chronic illness. Role: Collaborator

NIH/1 R01 PH000022-01 Brown, Steven. 9/30/2005-9/29/2008. Biosurveillance Utilizing SNOMED-CT based Natural Language Processing Role: Site PI

NIH/1 K22 LM008576-01 Rosenbloom, Samuel Trent. 2/1/2005-1/31/2008. Testing Evaluation Metrics for Interface Terminologies Role: Mentor

Completed Research Support:

3U01 GM61388-03S1 Weinshilboum (PI). 04/01/00 - 03/31/04. NIH/NIGMS. Pharmacogenetics of Phase II Drug Metabolizing Enzymes To identify a series of bioinformatic algorithms that can be interfaced with a focused group of drugs to allow predictions of likely drug interactions and likely important pharmacogenetic effects. Role: Sub-PI and informatician

D. Time and Effort Statement

Indicate percentage of time spent on research, clinical, teaching/mentoring, and administration. List persons mentored in last 3 years and type of mentoring awards.

Administration 60%, Teaching/mentoring 15%, Research 15% Clinical 10%

Trent Rosenbloom, M.D., M.P.H. - K Award

Elliot Fielstein, Ph.D.

Yin Aphinyanaphongs, M.D.

Alex Kazerooni, M.S.

John Carter, M.B.A.

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Significant Life Events (OPTIONAL)

List any significant life events that have interrupted the PI's research activities for a significant period of time.

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| | | | | | |
|---|--|---|---|--|--|
| Department of Veterans Affairs | | RESEARCH AND DEVELOPMENT PROGRAM | | INVESTIGATOR'S BIOGRAPHICAL SKETCH <i>(Not to Exceed Four Pages)</i> | |
| NAME <i>MASYS, DANIEL RICHARD</i> | | | POSITION TITLE Professor and Chair Department of Biomedical Informatics Vanderbilt University Medical Center | | |
| EDUCATION / TRAINING <i>(Begin with Baccalaureate or other initial professional education, such as nursing, and include post-doctoral training. Do not include Honorary Degree.)</i> | | | | | |
| NAME, LOCATION OF INSTITUTION | | DEGREE (if applicable) | YEAR AWARDED | FIELD OF STUDY | |
| Princeton University, Princeton, NJ | | | | Biochemistry | |
| Ohio State University College of Medicine, Columbus, OH | | A.B. | 1971 | Medicine | |
| Internship, UCSD University Hospital, San Diego, CA | | M.D. | 1974 | Internal Medicine | |
| Residency, Naval Regional Medicine Center, San Diego, CA | | | 1974-75 | Internal Medicine | |
| | | | 1975-77 | | |
| NOTE: The Biographical Sketch may not exceed four pages. Items A and B (together) may not exceed two of the four-pages. | | | | | |
| A. Positions and Honors (List in chronological order previous positions, concluding with your present position. List any honors, professional memberships or present membership on any Federal Government public advisory committee.) Positions and Employment: | | | | | |
| 1977-1979 | Hematology-Oncology Fellow, Naval Regional Medical Center, San Diego, CA | | | | |
| 1979-1980 | Research fellow (Hematology), University of California, San Diego, CA | | | | |
| 1980-1984 | Staff Hematologist-oncologist, Naval Regional Medical Center, San Diego, CA | | | | |
| 1983-1985 | Vice Chairman, Data Management Committee, Cancer and Leukemia Group B | | | | |
| 1984 | Computer Medical Specialist, Computer Communications Branch, International Cancer Information Center, National Cancer Institute, National Institutes of Health, Bethesda, MD | | | | |
| 1984-1986 | Chief, International Cancer Research Data Bank Branch, National Cancer Institute, National Institutes of Health, Bethesda, MD | | | | |
| 1986-1994 | Director, Lister Hill National Center for Biomedical Communications, and Associate Director, National Library of Medicine, National Institutes of Health, Bethesda, MD | | | | |
| 1986-1987 | Director, National Center for Biotechnology Information (NCBI), National Library of Medicine, Bethesda, MD | | | | |
| 1995-2003 | Associate Clinical Professor of Medicine and Family & Preventive Medicine, University of California, San Diego, CA | | | | |
| 1994-2004 | Director of Biomedical Informatics, School of Medicine, University of California, San Diego, CA | | | | |
| 2000-2001 | Director, Clinical Trials Office, UCSD Cancer Center, University of California, San Diego, CA | | | | |
| 2003-2004 | Adjunct Professor of Medicine, University of California, San Diego, CA | | | | |
| 2000-2002 | Leader, Genomics bioinformatics group, UCSD Cancer Center, San Diego, CA | | | | |

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| | |
|------------|--|
| 2001-2004 | Director, UCSD Human Research Protections Program, San Diego, CA |
| 2005-Pres. | Professor and Chair, Department of Biomedical Informatics, Vanderbilt University Medical Center, Nashville, TN |

Other Experience and Professional Memberships:

| | |
|-----------|--|
| 1993-1998 | U.S. Surgeon General's USPHS Professional Advisory Committee for Physicians (Chair, 1993) |
| 1992-1995 | Member, Board of Directors, American Medical Informatics Association |
| 1993-2004 | Founding Associate Editor, Journal of the American Medical Informatics Association (JAMIA) |
| 1998-2003 | Member, Board of Scientific Counselors, National Library of Medicine, National Institutes of Health (Chair, 2002-2003) |
| 2000-2002 | Member, BetterHealth_2010 Advisory Panel, Association of American Medical Colleges |
| 2002-2006 | Appointed Member, Health Science Policy Board, Institute of Medicine, National Academy of Sciences |

Honors:

| | |
|-----------|---|
| 1973 | Alpha Omega Alpha Honor Medical Society |
| 1977-1980 | Diplomate, American Board of Internal Medicine in Internal Medicine (1977), Hematology (1979) & Medical Oncology (1980) |
| 1979 | Fellow, American College of Physicians |
| 1983 | U.S. Navy Achievement Medal for computerization of clinical research activities |
| 1986 | NIH Director's award for directing initiatives to improve dissemination of cancer research information |
| 1986 | Fellow, American College of Medical Informatics (President, 2006) |
| 1989 | U.S. Surgeon General's Exemplary Service Medal |
| 2001 | Elected member, Institute of Medicine, National Academy of Sciences |

B. Selected peer-reviewed publications (in chronological order)

(Do not include publications submitted or in preparation)

1. Newton A, Masys DR, Leonardi E, Wygal D. Association of Frameshift Mutagenesis and DNA Replication in Escherichia Coli. *Nature (New Biology)*. 1972;236:19-22.
2. Masys DR, Bromberg PA, Balcerzak SP. Red Cells Shrink During Sickling. *Blood*. 1974;44:885-889.
3. Lea JW, Masys DR, Shackford SR. Typhlitis, a treatable complication of acute leukemia. *Cancer Clinical Trials*. 1980;3: 355-362.
4. Masys DR, Bajaj SP, Rapaport SI. Activation of Human Factor VII by Activated Factors IX and X. *Blood*. 1982;60:1143-1150.
5. Hubbard SM, Martin NB, Blankenbaker LW, Esterhay RJ, Masys DR, Tingley DE, Stram MC, DeVita VT. The Physician Data Query (PDQ) Cancer Information System. *J Cancer Education*. 1986;1:79-87.
6. Masys DR, Hubbard SM. Technical Information Programs of the National Cancer Institute. *JASIS*. 1987;38:(1)60-64.
7. Masys DR, Baker DB. Patient-Centered Access to Secure Systems Online (PCASSO): A Secure Approach to Clinical Data Access Via the World Wide Web. *J Am Med Informatics Assoc. Suppl.* Oct 1997:340-3.
8. Masys DR. Advances in Information Technology: Implications for Medical Education. *Western J Med*. 1998;168(5):341-7.
9. Baker DB, Masys DR. PCASSO: A Design for Secure Communication of Personal Health Information

via the Internet. *Int J Med Inf.* 1999;54(2):97-104.

10. Masys DR. Internet Technologies. In Carter, J, Ed., *Electronic Medical Records Systems: A Guide for Clinicians and Administrators.* American College of Physicians, Philadelphia, March 2001.
11. Masys DR, Welsh JB, Fink L, Gribskov M, Klacansky I, Corbeil J. Use of Keyword Hierarchies to Interpret Gene Expression Patterns. *Bioinformatics.* 2001;7(4):319-26.
12. Masys DR. Linking microarray data to the literature. *Nature Genetics.* 2001;28:9-10.
13. Corbeil J, Genini D, Sheeter D, Rought S, Leoni L, Du P, Ferguson M, Masys DR, Welsh JB, Fink JL, Sasik R, Huang D, Drenkow J, Richman DD, Gingeras T. Temporal gene expression during HIV-1 infection of human CD4+ T cells. *Genome Research.* 2001;11(7):1-7.
14. Masys DR. Database designs for microarray data. *Pharmacogenomics Journal.* 2001;1(4):232-233.
15. Masys DR, Baker D, Butros A, Cowles KE. Giving Patients Access to Their Medical Records via the Internet: The PCASSO Experience. *J Am Med Inform Assoc.* 2002;9(2):181-91.
16. Masys DR. Effects of current and future information technologies on the health care workforce. *Health Affairs (Millwood).* 2002;21(5):33-41.
17. Fink JL, Drewes S, Patel H, Welsh JB, Masys DR, Corbeil J, Gribskov MR. 2HAPI: A web-based microarray data analysis system. *Bioinformatics.* 2003;19(11):1443-5.
18. Stuart RO, Wachsmann W, Berry CC, Wang-Rodriguez J, Wasserman L, Klacansky I, Masys DR, Arden K, Goodison S, McClelland M, Wang Y, Sawyers A, Kalcheva I, Tarin D, Mercola D. In silico dissection of cell-type-associated patterns of gene expression in prostate cancer. *Proc Natl Acad Sci USA.* 2004;101(2):615-20.
19. Masys DR. Information Systems in Oncology. In DeVita V, Hellman S, Rosenberg S, eds. *Cancer: Principles and Practice of Oncology, 7th Ed.* Lippincott, Williams & Wilkins, Philadelphia, 2005.

C. Research Support

List selected ongoing or completed (during the last three years) research projects (federal and non-federal support). Begin with the projects that are most relevant to the research proposed in this application. Briefly indicate the overall goals of the projects and your role (e.g. PI, Co-Investigator, Consultant) in the research project. Do not list award amounts or percent effort in projects.

Ongoing Research Support

2 R24 MH59745-06 Grant (PI) 06/17/03 - 03/31/08
California NeuroAids Tissue Network - Core D Data Mgmt & Info Systems
Creation of a national research resource of tissue and data related to HIV infection of the CNS.
Role: Leader, Data Management and Information Systems core

5 P30 MH62512-03 Grant (PI) 04/24/01 - 11/30/05
HIV Neurobehavioral Research Center - 3: Data Management Unit
Characterization of the long term effects of HIV on CNS functioning, cognition and behavior.
Role: Leader, Data Management Unit

Completed Research Support:

5U01CA084998-05 Mercola (PI) 09/30/99 – 03/31/05
Molecular Characterization of Early Prostate Cancer
Role: Leader, genomics bioinformatics group

5 K30 HL04133-04 Mehta (PI) 09/30/00 - 08/31/05
Clinical Research Enhancement from Supplemental Training (CREST)

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Postgraduate training in clinical research methodologies.
Role: Course director and Executive Steering Committee member

N01 MH22005 Grant (PI) 09/01/02 - 08/31/07
CNS HIV Anti-Retroviral Therapy Effects Research (Charter) - Data Management and Information Systems Core
Characterization of the effects of HAART therapy upon CNS functioning.
Role: Leader, Data Management and Information Systems Core

N01-LM-3-3511 Lenert (PI) 09/30/03 - 09/29/06
Wireless Internet Information System for Medical Response in Disasters (WIISARD)
Creation of secure information management infrastructure for responding to mass casualty events.
Role: Technical Consultant

5 M01 RR00827-29 Holmes (PI) 12/01/99 - 11/30/04
General Clinical Research Center
Provision of institutional infrastructure for clinical research.
Role: Informatics Consultant

2 S07 RR18186-02 Holmes (PI) 09/01/03 - 08/31/04
San Diego Regional IRB Enhancements
Creation of systems and methods for improving the efficiency and effectiveness of Institutional Review Boards.
Role: Co-Principal Investigator

5 NO1 LM64537-04 Baker (PI) 10/01/96 - 09/30/02
Patient-Centered Access to Secure Systems Online (PCASSO)
Creation and evaluation of secure information technologies for transmission of clinical data over the open Internet.
Role: UCSD Principal Investigator

D. Time and Effort Statement

Indicate percentage of time spent on research, clinical, teaching/mentoring, and administration. List persons mentored in last 3 years and type of mentoring awards.

Administration 65%, Teaching/mentoring 20%, Research 15%

Jim Breaux, Ph.D. – gene expression profile analysis 1999-2004

John Melville, M.D. – development and evaluation of assistive communication device for speech impaired individuals 2001-2

Loki Natarajan, Ph.D. – Statistical methods for quantifying adherence to dietary interventions 2003-4


Matthew Allison, M.D. – Correlation of LifeScore voluntary CT findings with health outcomes

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Significant Life Events (OPTIONAL)

List any significant life events that have interrupted the PI's research activities for a significant period of time.

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| | | | | | |
|--|--|----------------------------------|--|---|--|
|  Department of Veterans Affairs | | RESEARCH AND DEVELOPMENT PROGRAM | | INVESTIGATOR'S BIOGRAPHICAL SKETCH <i>(Not to Exceed Four Pages)</i> | |
| NAME ROBERT S. DITTUS, MD, MPH | | | POSITION TITLE Director, Geriatric Research, Education, and Clinical Center | | |
| EDUCATION / TRAINING <i>(Begin with Baccalaureate or other initial professional education, such as nursing, and include post-doctoral training. Do not include Honorary Degree.)</i> | | | | | |
| NAME, LOCATION OF INSTITUTION | | DEGREE (if applicable) | YEAR AWARDED | FIELD OF STUDY | |
| Purdue University, West Lafayette, Indiana | | B.S. | 1973 | Industrial Engineering | |
| Indiana University, Indianapolis, Indiana | | MD | 1978 | Medicine | |
| Univ. Of North Carolina, Chapel Hill, North Carolina | | MPH | 1984 | Epidemiology | |
| NOTE: The Biographical Sketch may not exceed four pages. Items A and B (together) may not exceed two of the four-pages. | | | | | |
| A. Positions and Honors (List in chronological order previous positions, concluding with your present position. List any honors, professional memberships or present membership on any Federal Government public advisory committee.) Positions and Employment: | | | | | |
| 2001-Pres. Director, Institute for Community Health, Vanderbilt University and Meharry Medical College 2000-Pres. Director, Center for Health Services Research, Vanderbilt University 1999-Pres. Director, Geriatric Research, Education and Clinical Center, Nashville VAMC/TVHS 1999-2000 Director, Vanderbilt Clinical Research Curriculum (K30), Vanderbilt University 1999-2000 Physician Scientist Training Program (K23/K24) Study Section, NHLBI, NIH 1998-Pres. Senior Quality Scholar, Department of Veterans Affairs 1998-Pres. Senior Fellow, Vanderbilt Institute for Public Policy Studies, Vanderbilt University, Nashville, TN 1997-Pres. Albert and Bernard Werthan Professor of Medicine, Vanderbilt University, Nashville, TN 1997-Pres. Chief, Division of General Internal Medicine, Vanderbilt University, Nashville, TN 1995-2000 International Medical Scholars Program Study Section, ECFMG 1993-1997 Co-Director, Bowen Research Center, Indiana University, Indianapolis, IN 1993-1997 Professor of Medicine, School of Medicine, Indiana University, Indianapolis, IN 1991-1992 Vice-President, Society for Medical Decision Making 1989-1992 Editorial Board, Journal of General Internal Medicine 1989-1994 Primary Care Faculty Development Study Section, Health Resources and Services Administration 1989-1991 Ambulatory Care Research Fellowship Training Study Section, Department of Veterans Affairs 1989-1993 Associate Professor, School of Medicine, Indiana University School of Medicine, Indianapolis, IN 1988-1990 Editorial Board, Medical Decision Making 1988-1992 Health Care Technology Study Section, Agency for Health Care Policy and Research 1986-1997 Staff Physician, Veterans Administration Medical Center, Indianapolis, IN 1986-1997 Director, Clinical Practice and Health Policy Analysis Section, Regenstrief Institute for Health Care, Indiana University School of Medicine 1978-1982 Teaching and Research Scholar, American College of Physicians 1985-1997 Director, Health Services Research Fellowship Training Program; Indiana Univ. Sch. Of Medicine, Indpls, IN 1984-1989 Assistant Professor, School of Medicine, Indiana University, Indianapolis, Indiana 1982-1984 Robert Wood Johnson Clinical Scholar, Univ. of North Carolina at Chapel Hill, Chapel Hill, NC | | | | | |

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1978-1982 Intern, Resident, and Chief Resident in Medicine, Indiana University School of Medicine, Indianapolis, IN
Honors: Veterans Affairs Director's Achievement Commendation Award, 2000. Senior Quality Scholar, 1999. Central Society for Clinical Research, 1995. Delta Omega, Public Health Academic Honorary, 1984. The G.A.Ross Award, Outstanding Graduating Senior Man, Purdue University, 1974.

B. Selected peer-reviewed publications (in chronological order)

(Do not include publications submitted or in preparation)

1. Fitzgerald JR, Fagan LF, Tierney WM, **Dittus RS**. Changing patterns of hip fracture care before and after implementation of the prospective payment system. *JAMA*, 253:218-221, 1987.
2. Fitzgerald JF, Moore PS, **Dittus RS**. The care of elderly patients with hip fracture changes since implementation of the prospective payment system. *N Engl J Med*, 319:1392-1397, 1988.
3. **Dittus RS**. Navigating through the uncertainty in health care. *Medical Decision Making*, 1989;9:155-156
4. **Dittus RS**, Roberts SD, Wilson JR. Quantifying uncertainty in medical decisions. *J Am Coll Cardiol*, 14:23A-28A, 1989.
5. **Dittus RS**, Fitzgerald JF. The missing link: person-based quality assessment. *J Gen Intern Med*, 1989; 4:459-460.
6. **Dittus RS**, Knoebel SB, eds. Quality and cost-conscious cardiovascular care: role of decision modeling. *J Am Coll Cardiol*, 14:1A-76A, 1989.
7. Callahan CM, **Dittus RS**, Katz BP. Oral corticosteroid therapy for patients with stable chronic obstructive pulmonary disease; a meta-analysis. *Ann Intern Med*, 114:216-223, 1991.
8. Callahan CM, Drake B, Heck DA, **Dittus RS**. Patient outcomes following total knee arthroplasty: a meta-analysis. *JAMA*, 271:1349-1357, 1994.
9. Coyte PC, Wright JG, Ho E, Hawker G, Paul J, **Dittus RS**, Freund DA. Duration, acceptability, and determination of waiting times for orthopaedic consultations and knee replacement surgery in the United States and Ontario, Canada. *N Engl J Med*, 331:1068-1071, 1994.
10. Bates AS, Fitzgerald JF, **Dittus RS**, Wolinsky FD. Risk factors for under-immunization in poor urban children. *JAMA*, 272:1105-1110, 1994.
11. **Dittus RS**, Klein RW, DeBrotta DJ, Dame M, Fitzgerald JF. Medical resident work schedules: design and evaluation by simulation modeling. *Management Science*, 42:891-906, 1996.
12. Zhou XH, Katz B, Holleman E, Melfi C, **Dittus RS**. An empirical bayes method for studying variation in knee replacement rates. *Statistics in Medicine*, 15:1875-1884, 1996.
13. Eisenhut RD, **Dittus RS**, Roberts SD, Wilson JR. Comparing averaged-out utilities of probability trees with random parameters. *SJAM, Journal of Scientific and Statistical Computing*, 1991;12:1140-1161.
14. Callahan CM, Hendrie HC, **Dittus RS**, Brater DC, Hui SL, Tierney WM. "Improving Treatment of Late Life Depression in Primary Care: A Randomized Controlled Clinical Trial" *J Am Geriatric Soc* 1994;42:839-46.
15. Lubitz RM, Litzelman DK, **Dittus RS**, Tierney WM. Is obesity a barrier to physician screening for cervical cancer? *Am J Med*, 1995;98:491-496.
16. Callahan CM, Drake B, Heck DA, **Dittus RS**. Patient outcomes following uni-compartmental or bi-compartmental knee replacement. *J Arthroplasty*, 1995;10:141-150.
17. Freund D, Evans D, Henry D, **Dittus RS**. The Australian guidelines: how they came about and implications for the United States. *Health Affairs*, Winter:202-206, 1992.
18. Litzelman DK, **Dittus RS**, Miller ME, Tierney WM. Requiring physicians to respond to computerized reminders improves their compliance with preventive care protocols. *J Gen Intern Med*, 8:311-317, 1993.
19. Sullivan LM, Kaplan SH, Greenfield S, **Dittus RS**, Harris L, Dukes KA. A comparison of various methods of collecting self-reported health outcomes data among low-income and minority patients. *Med Care*, 1995;33(4):AS183-94.
20. Katz BP, Heck DA, Fitzgerald JF, **Dittus RS**, Paul JE, Joyce DZ, Young WW, Coyte PC, Freund DA. Demographic variation in counts and the rate of knee replacement in the US: a multi-year analysis. *Health Services Research*, 31:126-140, 1996.
21. Callahan CM, Tierney WM, **Dittus RS**. Primary care physicians' medical decision making for late-life depression. *J Gen Intern Med*, 1996;11(4):218-25.
22. Scholer SJ, **Dittus RS**, Orr DP, Pituch K. Clinical outcomes of children with acute abdominal pain. *Pediatrics*, 1996;98:680-5.
23. Ness RM, Holmes A, Klein R, Green J, **Dittus RS**. Outcomes states of colorectal cancer: Identification and description using patient focus groups. *Am J Gastroenterol*, 1998;93:1491-1497.
24. Mamlin LA, Melfi CA, Parchman ML, Gutierrez B, Allen DI, Katz BP, **Dittus RS**, Heck DA, Freund DA. Management of osterarthritis of the knee by primary care physicians. *Arch Fam Med*, 1998;7:563-567.
25. Hawker G, Freund D, Heck D, Bombardier C, Katz B, Croxford R, **Dittus RS**, Paul J, Coyte P, Wright J. Health-related

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- quality of life after knee replacement. *J Bone Joint Surg Am*, 1998;80(2):163-73.
26. Freund DA, **Dittus RS**. Principles of pharmacoeconomic analysis of drug therapy. *Pharmacoeconomics*, 1(1):20-32, 1992.
 27. Norton EC, Garfinkel SA, McQuay LJ, Heck D, Wright J, **Dittus RS**, Lubitz R. The effect of hospital volume on the complication rate in knee replacement patients. *Health Service Research*, 1998;33:1191-1210.
 28. Heck DA, Freund DA, **Dittus RS**, Arthur DS, Katz BP, Mamlin LA, Melfi CA. Revision rates after knee replacement in the United States. *Med Care*, 1998;36(5):661-9.
 29. Scholer SJ, Pituch K, Orr DP, **Dittus RS**. Test ordering on children with acute abdominal pain. *Clin Pediatr*, 1999;38:493-497.
 30. Ness RM, Holmes A, Klein R, **Dittus R**. An assessment of patient utilities for outcome states of colorectal cancer. *Am J Gastroenterology*, 1999;84:165-167.
 31. Wright JG, Hawker GA, Bombardier C, Croxford R, **Dittus RS**, Freund DA, Coyte PC. Physician enthusiasm as an explanation for area variation in the utilization of knee replacement surgery. *Medical Care*, 1999;37:946-956.
 32. Ness RM, Holmes A, Klein R, Green J, **Dittus RS**. Cost-utility of one-time colonoscopic screening for colorectal cancer at various ages. *Am J Gastroenterol*, 2000;95:1800-1811.
 33. Ely, E.W., Gautam, S., Margolin, R., Francis, J., May, L., Speroff, T., Truman, B., **Dittus R.**, Bernard, G.R., Innouye, S.K. The impact of delirium in the intensive care unit on hospital length of stay. *Intensive Care Medicine*, 27:1892-1900, 2001.
 34. Kallianpur AR, Poehling KA, **Dittus RS**. High time for action. *N Engl J Med*, 2001;344:48-51.
 35. Ely EW, Inouye SK, Bernard GR, Gordon S, Francis J, May L, Truman B, Speroff T, Gautam S, Margolin R, Hart RP, **Dittus RS**. Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit. *JAMA*, 2001;286:2703-2710.
 36. Weeks WB, Mills PD, **Dittus RS**, Aron DC, Batalden PB. Using an improvement model to reduce adverse drug events in va facilities. *Journal on Quality Improvement*, 2001; 27; 243-254.
 37. Wall RJ, **Dittus RS**, Ely EW: Protocol-driven care in the ICU: a tool for quality. *Critical Care*, 2001, 5:283-285.
 38. Poehling KA, Speroff T, **Dittus RS**, Griffin MR, Hickson GB, Edwards KM. Predictors of influenza virus vaccination status in hospitalized children. *Pediatrics*, 2001; 108:e99. Ely, E.W., Margolin, R., May, F.J., Truman, B., Wheeler, A., **Dittus, RS**, Speroff, T., Gautam, S., Bernard, G., Inouye, S. Delirium in the ICU: Validation of the confusion assessment method for the ICU (CAM-ICU). *Critical Care Medicine*, 2001;29:1370-1379.
 39. Poehling KA, Griffin MR, **Dittus RS**, Tang Y, Holland K, Li H, Edwards KM. Bedside diagnosis of influenza virus infections in hospitalized children. *Pediatrics*, 2002; 110:83-88.
 40. Hartert TV, Speroff T, Toghias A, Mitchel EF, Snowden MS, **Dittus RS**, Griffin MR. Risk factors for recurrent asthma hospital visits and death among a population of indigent older adults with asthma. *Ann Allergy Asthma Immunol*, 2002; 89(5):467-73.
 41. Splaine ME, Aron DC, **Dittus RS**, Kiefe CI, Landefeld CS, Rosenthal GE. A curriculum for training quality scholars to improve the health and health care of veterans and the community at large. *Quality Management in Health Care*, 2002;10:10-18.
 42. Aron DC, **Dittus RS**, Rosenthal GE. Exploring the Academic Context for Quality Improvement: A Scientific Discipline in Need of a Career Path. *Quality Management in Health Care*, 2002;10:65-70.
 43. Ely, E.W., Truman B, Shintani A, Thomason J, Wheeler A, Gordon S, Francis J, Speroff T, Gautam S, Margolin R, Sessler C, **Dittus RS**, Bernard G. Monitoring sedation status over time in the ICU: a two-part investigation of the Richmond Agitation Sedation Scale (RASS). *JAMA* 2003;289:2983-2991.
 44. Ellis SE, Mitchel E, **Dittus RS**, Griffin M. Influenza and Respiratory Syncytial Virus- Associated Morbidity and Mortality in the Nursing Home Population. *Journal of the American Geriatrics Society*; 2003; 51(6):761-7.
 45. Tarquinio GT, **Dittus RS**, Byrne DW, Kaiser A, Neilson EG. Effects of performance-based compensation and faculty track on the clinical activity, research portfolio, and teaching mission of a large academic department of medicine. *Acad Med*. 2003 Jul;78(7):690-701.
 46. Butler J, Khadim G, Belue R, Chomsky D, **Dittus RS**, Griffin M, Wilson JR. Tolerability to beta-blocker therapy among heart failure patients in clinical practice. *J Card Fail*. 2003;9(3):203-9.
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regarding the importance, diagnosis, and management of delirium in the intensive care unit: a survey of 912 healthcare professionals. *Crit Care Med* 2004;32:106-12.

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54. Milbrandt EB, Deppen S, Harrison PL, Shintani AK, Speroff T, Stiles RA, Truman B, Bernard GR, **Dittus RS**, and Ely EW. Costs associated with delirium in mechanically ventilated patients. *Crit Care Med* 2004 (in press)

C. Research Support

List selected ongoing or completed (during the last three years) research projects (federal and non-federal support). Begin with the projects that are most relevant to the research proposed in this application. Briefly indicate the overall goals of the projects and your role (e.g. PI, Co-Investigator, Consultant) in the research project. Do not list award amounts or percent effort in projects.

1K30 HI04128-02 (Dittus) NIH/NHLBI 7/1/99- 06/30/2004 Vanderbilt Clinical Research Training Curriculum

The goal of this project is to provide a clinical research curriculum for physician trainees interested in careers in clinical research.

RFA-CA-001-002 (Moses) NIH/NCI 3/1/01-2/28/06 Comprehensive MMC/VICC Cancer Research Partnership

The purpose of this grant is to establish an interdisciplinary cancer research and training program between Meharry Medical College and the Vanderbilt-Ingram Cancer Center. Dr. Dittus will be conducting clinical research related to the prevention of colon cancer.

AHRQ (Dittus) 10/1/01-9/30/04 The Center for Improving Patient Safety

The purpose of this grant is to develop Center for Improving Patient Safety. The Center will be a collaboration with Vanderbilt University, Meharry Medical College, the VA Tennessee Valley Healthcare System and the National Patient Safety Foundation. Research will be conducted to study the epidemiology of medical errors and develop strategies to reduce errors and improve patient safety.

NIH/NCI (Blot) Southern Community Cohort Study

The purpose of this grant is to develop a prospective cohort study of African-Americans and a control group of non African-American to examine the effect of race and its interaction with other risk factors for the incidence of cancer, the process of care for cancer and the outcomes from cancer.

1 R01 CA92653-01A1 (Dittus) NIH/AHRQ 4/1/02-3/31/05 Simulation Modeling of Colorectal Cancer

The purpose of this grant is to enhance an existing computer model of the national history of colorectal cancer in order to expand its abilities to analyze questions concerning the cost effectiveness of different cancer control interventions.

P20 MD 00516-01 NIH/NCMHD (Coney) 9/30/03 – 9/29/08 Meharry EXPORT Center for Health Disparities

The purpose of this grant is to develop a collaborative research and training center between Meharry Medical College and Vanderbilt University with a focus on reducing health and healthcare disparities. Dr. Dittus is the overall Co-PI of this project and the PI of the Vanderbilt site. NCI (Zheng) 7/01/02-6/30/07 Tumor Markers and Recurrent Adenomas: A Follow-up Study

The purpose of this grant is to recruit and follow 2000 patients with incident multiple or advanced adenomas to evaluate the utility of a panel of promising tumor markers in predicting the risk of adenoma recurrence. Dr. Dittus is co-investigator.

D. Time and Effort Statement

Indicate percentage of time spent on research, clinical, teaching/mentoring, and administration. List persons mentored in last 3 years and type of mentoring awards.

VA Quality Scholars Fellowship Program Mentor: Kathleen Poehling, M.D. 1999-2000; Asha Kallianpur, M.D. 1999-2000; Denise Brown, M.D. 2000-2001; Shelly Ellis, M.D. 2000-2002; Eric Milbrandt, M.D. 2001-2003; Rick Walls, M.D. 2001-2003; Eric Grogan, M.D. 2002-2004; Christianne Roumie, M.D. 2002-2004; William Gregg, M.D. 2003-2005; Jenny Shuberth, M.D. 2004-2006; Jeff Boord, M.D. 2004-2006; Mary Huizinga 2005-2007.

Faculty: Wes Ely, M.D. 2001-present; T. Hartert, M.D., M.P.H. 1999-2003; T. Elasy, M.D., M.P.H. 1998-2004; Kathleen Figuro, M.D. 2002-present.

Significant Life Events (OPTIONAL)

List any significant life events that have interrupted the PI's research activities for a significant period of time.

APPENDIX 2 – SHORT FACULTY BIOGRAPHICAL SKETCHES

CONSTANTIN ALIFERIS, MD, PhD, is a DBMI Assistant Professor and Director of the Discovery Systems Laboratory. His research interests include the development and evaluation of machine learning algorithms for large-scale computational causal discovery, feature selection and construction for classification, and text categorization; medical decision support systems for molecular prognostic, diagnostic, and treatment selection models and normative and evidence-based medicine; and temporal representation and reasoning in biomedicine. Dr. Aliferis is co-director of the graduate course BMIF 330 Biomedical Artificial Intelligence.

DOMINIK ARONSKY, MD, PhD, is a DBMI Assistant Professor. His research focuses on developing, implementing, and evaluating decision support systems for real world clinical problems, automatic, real time identification of patients likely to have pneumonia, the application of natural language processing systems for the interpretation of chest x-ray reports and the application of continuous quality improvement methods for coded data entry. He directed the development and integration of an Emergency Department information system that includes an advanced patient tracking “White Board”, computerized order entry and tracking, and triage.

JOSEPH AWAD, MD (8/8 VA), is Associate Professor of Medicine and Pharmacology. He is Chief of the TVHS Transplant Service, and Chair of the TVHS P&T. committee. Dr. Awad was a primary contributor to National Drug File Reference Terminology development. Two of the resulting products, the Mechanism of Action and Physiologic Effect Reference Hierarchies, have been named national data representation standards in the U.S.

ERIK BOCZKO, PhD, is Assistant Professor of Biomedical Informatics. Dr. Boczko’s research interests include: Mathematical Biology, Dynamical Systems, The Conley Index, Algebraic Topology, Protein Folding, and The Dynamics of Genetic Regulatory Networks.

JIM DEMETRIADES, MS, PE (8/8 VA OI), is Chief Health Information Architect of the Veterans Health Administration’s Office of Information. In this role he is responsible for ensuring the health architecture aligns VHA’s 1.4 billion dollar per year information technology program to support the nation’s largest integrated healthcare system in maximizing health services to veterans. He has held a variety of technical and management positions including Senior Biomedical Engineer, Deputy Information Systems Center Director, Director Technical Integration, and Deputy Chief Information Technology Architecture. He received his Bachelor of Science degree in Electrical and Computer Engineering from Clarkson College of Technology (1975) and his Master’s degree in Biomedical Engineering from Rensselaer Polytechnic Institute (1976). He is a licensed Professional Engineer. He has a special interest in architectural issues associated with Electronic Health Records, particularly the complex problems of secure interoperability and shared meaning. He recently edited a textbook on Person-Centered Health Records. He is a strong advocate of open systems, standards and principle-based design.

WESLEY ELY, MD, MPH, FACP, FCCP (5/8 VA), is Co-Director, TVHS Health Services Research (TREP) Center for Patient Healthcare Behavior. Dr. Ely is an associate professor and an outcomes researcher with the Center for Health Services Research. He has recently developed a strong interest in aspects of critical care as they relate to the elderly, resulting in the investigation concerning cognitive impairment in the ICU.

ELLIOT M. FIELSTEIN, PhD (8/8 VA), is Assistant Professor in Psychiatry and a Research Fellow in DBMI a Clinical Neuropsychologist who is currently completing an applied medical informatics fellowship at Vanderbilt University. The fellowship project involves implementing an electronic cancer staging system and evaluating its effect on staging compliance. His informatics interests are in large systems information management, informatics-supported quality improvement, and HIPPA compliant de-identification algorithms. Currently, he is the information manager for the Compensation and Pension Examination Program (CPEP), a national VA quality improvement initiative.

FERN FITZHENRY, PhD, RN, is Instructor in the Department of Biomedical Informatics and an Information Services Consultant in Information Management at Vanderbilt University Medical Center. Dr. FitzHenry's research interests are in the adoption of biomedical information innovations, the impact of payment systems on biomedical

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informatics, health risk assessment in defined patient populations, and biomedical informatics to support disease-specific patient registries.

MARK E. FRISSE, MD, serves as Director of Regional Informatics Programs through the Vanderbilt Center for Better Health and as Professor in the Vanderbilt Department of Biomedical Informatics. He is responsible for coordinating regional, state, and national projects aimed at the application of information technology to advance patient care, including development of a state-wide health information RHIO to support TennCare patients with a regional demonstration in the Memphis area. Dr Frisse is the Vanderbilt PI for the AHRQ National Resource Center. Dr. Frisse has held executive positions in the health care IT consulting and service industry, working to advance quality and safety through the application of technology and process redesign and applying integrated medical and pharmaceutical claims data to reduce practice variation.

DARIO A. GIUSE, Dr Ing, is Associate Professor of Biomedical Informatics, and Associate Director of the Informatics Center, Vanderbilt University Medical Center; and Associate Professor of Computer Science in the Vanderbilt University School of Engineering. He has long-standing research interests in the application of computer systems to facilitate real-world work processes. After joining the faculty of the School of Medicine at Vanderbilt University, he spearheaded the effort to implement the StarChart electronic patient record system. He is the course director for BMIF 340 Clinical Information Systems and Databases.

NUNZIA B. GIUSE, MD, MLS, AHIP, is Professor of Biomedical Informatics and Director of the Eskin Biomedical Library at Vanderbilt University Medical Center. Dr. Giuse has conducted NLM-funded research in medical knowledge base technologies and the application of models from the adult learning research literature to continuing professional education within the library, as well as information access for public health professionals and the active involvement of the biomedical library in clinical activities.

STANLEY GRABER, MD (VA WOC), formerly TVHS ACOS for EDUCATION, is Adjunct Assistant Professor of Biomedical Informatics. Dr. Graber has considerable experience with development and management of large clinical data sets using relational systems. While Associate Chief of Staff for Education, Dr. Graber's medication database was instrumental in decision support, quality improvement and patient safety initiatives at TVHS. Dr. Graber also managed the Vanderbilt bone marrow transplant database, a resource used for case tracking, and quality improvement. Dr. Graber is clinically active as a hematologist at TVHS.

MARIE GRIFFIN, MD, MPH (5/8 VA), is Professor of Preventive Medicine and Director, TVHS Clinical Research Center of Excellence. Dr. Griffin is an internist and epidemiologist, whose research area has been pharmacoepidemiology. She was a Burroughs Wellcome Scholar in Pharmacoepidemiology and is a co-principal investigator in Vanderbilt's CERT. Two major areas of interest include safety of immunizations and nonsteroidal anti-inflammatory drugs (NSAIDs). Current work includes safety evaluation of the new COX2 inhibitors.

KEVIN B. JOHNSON, MD, MS is Associate Professor and Vice Chair of Biomedical Informatics, with a joint appointment in the Department of Pediatrics. Dr. Johnson is involved in three main research areas: clinical information systems development; the uses of advanced computer technologies, including the Worldwide Web, personal digital assistants, and pen-based computers in medicine; and the development of computer-based documentation systems for the point of care. Dr. Johnson is co-director of BMIF 300 Foundations of Biomedical Informatics, required of all Vanderbilt biomedical informatics graduate students.

SHAWN LEVY, PhD., is Assistant Professor in Biomedical Informatics and Molecular Physiology and Biophysics and Director of the Vanderbilt Microarray Shared Resource at Vanderbilt University Medical Center. His research interests include technology and methods development in high-density gene expression profiling, structural and functional genomics, and the development of bioinformatics tools for the integration of molecular profiles of protein and gene expression with genotype information with an emphasis on colorectal cancer.

NANCY M. LORENZI, MLS, PhD, is Professor of Biomedical Informatics, Assistant Vice Chancellor for Health Affairs, and Clinical Professor of Nursing. In her role as Assistant Vice Chancellor, she is leading informatics-centric organizational change and knowledge management initiatives. Dr. Lorenzi is internationally recognized as a top expert in change management related to information technology - more specifically, with respect to organizational and personnel issues related to automation in the health care industry. She has served as the President of the Medical Library Association, was one of the first Principal Investigators of a National Library of Medicine sponsored IAIMS grant, and is currently the President of the International Medical Informatics Association. Dr. Lorenzi is the course director for BMIF 320 Healthcare Organization and Management.

HARVEY MURFF, MD, MPH (5/8 VA), is an assistant professor and the Director of Research Subject Safety for the Vanderbilt University General Clinical Research Center. He completed a General Medicine Fellowship at Harvard Medical School under the mentorship of Dr. David Bates, where he investigated methods for increasing

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adverse event detection and reducing medical errors. He is an investigator on the POEMS grant which proposes to use NLP techniques to discover adverse events associated with surgery.

JOSH PETERSON, MD, is an Assistant Professor of Medicine and Biomedical Informatics with research interests in drug safety and computerized prescribing. He designs and evaluates clinical decision support systems for drug therapy; several of his recent projects are guided dosing for geriatric patients, drug protocols for sedation and analgesia of intensive care patients, and safety alert systems to identify high-risk prescribing for hospital inpatients. He is the current co-PI on an NLM-funded projects to develop decision support addressing the immediate lab effects of commonly prescribed medications (e.g., hypokalemia following diuretics). Additionally, he has been funded with a career development award in Geriatric Clinical Pharmacology.

WAYNE RAY, PhD (5/8 VA), is Director, Division of Pharmacoepidemiology, Director, Master of Public Health Program, Department of Preventive Medicine. He has an extensive research track record in pharmacoepidemiology and health services research with essentially all of his work addressing issues related to quality of care and patient safety. Dr Ray is co-principal investigator of the AHRQ-funded Center for Education in Research and Therapeutics.

SAMUEL TRENT ROSENBLOOM, MD, MPH (VA WOC), is Assistant Professor of Biomedical Informatics with experience evaluating clinical decision support systems and structured documentation systems (QUILL). He is also interested in knowledge representation and terminology and is currently funded by the NLM to develop evaluation criteria for Clinical Interface terminologies. He has also participated in the development of NDF-RT reference hierarchies. Dr. Rosenbloom's clinical duties include attending at a community-based clinic that serves patients for the VA Tennessee Valley Healthcare System.

CHRISTIANNE L. ROUMIE, MD, MPH (8/8 VA), is an assistant professor in Internal Medicine and Pediatrics. She completed the VA Quality Scholars Fellowship along with the formal MPH coursework in 2002 working under the mentorship of Drs. Elasy, Speroff and Griffin to expand skills in clinical epidemiology and quality improvement. She has conducted VA trials to improve medication prescribing for veterans with essential hypertension and to evaluate the contribution of provider and patient interventions to improve BP control.

EDWARD K. SHULTZ, MD, MS, is Associate Professor of Biomedical Informatics, Associate Professor of Pathology and Director of Technology Integration at Vanderbilt University Medical Center. In those capacities he defines an informatics technical architecture that will scale up to support our evolving enterprise, for directing technical support for the server and application development infrastructure and for enterprise level decision support databases. He provides a bridge between the basic research activities within the Department and the units that support operational systems in the hospital, clinics, and affiliated sites. QUILL, a structured documentation system is one of many examples of Dr. Schultz's work with production systems. He served as Director of the NIH/NLM-sponsored Dartmouth Medical School Training Program in Medical Informatics from 1989-1994, and Director of the Dartmouth Program in Medical Information Science from 1988-1996. He chaired the national Department of Veteran Affairs Expert panel on Inter-application communication from 1992-1996, and served as a member of the Department of Veteran Affairs Integration and Technology Applications Requirements Group from 1991-1996.

JAY SNODDY, PhD, is Research Associate Professor of Biomedical Informatics. Dr. Snoddy recently joined Vanderbilt from the Genome Analysis and Systems Modeling Group at Oak Ridge National Lab where he led development of a set of web-based data mining and visualization tools for analysis of genes, proteins, and control mechanisms for biological networks. His research interests include understanding the complex molecular and cellular networks that create phenotype from genotype and, particularly, developing new computer-based approaches to study fundamental questions associated with this general problem. He is the director of the graduate course BMIF 310 Foundations of Bioinformatics and Computational Biology.

WALTER SMALLEY, MD, MPH (6/8 VA), is the Section Chief of Gastroenterology at the Nashville VA TVHS Medical Center and is partially funded by the Vanderbilt CERT. Clinical research includes two studies of novel cancer markers in the stool and in serum are underway in the Nashville VA clinic. His health services research activities include a population-based study of colon cancer survival and an observational study of prescription NSAID use (IIR is in preparation for re-submission).

ANDERSON SPICKARD III, MD, MS, is Assistant Professor of Medicine in the Departments of Medicine and Biomedical Informatics. He is currently the Director of the Medical Student Clerkship Program for the Department of Medicine, the Director of Programs for Technological Innovations in Medical Education for the Medical Center, and appointed to Master Teacher in the School of Medicine. Dr. Spickard's research interests include all aspects of medical education with a special focus on the design and application of innovative informatics approaches to medical education.

JACK STARMER, MD, is Assistant Professor in the Department of Biomedical Informatics. An internist and former clinical fellow in Biomedical Informatics at Vanderbilt, Dr. Starmer has considerable expertise in nursing

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and physician informatics for system design, computer-human interface, and integrating software tools into clinical workflow. He has served as a leader in the development of a clinical documentation and reimbursement coding system from an innovative medical software firm. Current research interests include clinical software adoption and integrating evidence-based decision support at the point-of-care.

WILLIAM W. STEAD, MD, is Professor of Medicine and Biomedical Informatics, Director of the Informatics Center and Associate Vice Chancellor for Health Affairs at Vanderbilt University Medical Center. The Informatics Center brings together research and education in biomedical informatics with provision of the Medical Center's operation and decision support infrastructure. Dr. Stead is also Chief Information Architect for Vanderbilt University and Chairman of the Vanderbilt Center for Better Health, established in 2002 to help accelerate change in health care through optimal use of information technology. He was co-developer of Duke University's The Medical Record (TMR), one of the first practical computer-based patient record systems and led two prominent academic health centers' IAIMS projects.

DAVID L. TABB, PhD, Assistant Professor of Biomedical Informatics. Dr. Tabb's research interests include improving our understanding of proteomic mass spectra. He created the DTASelect and Contrast tools for data mining and comparing proteomic data sets and GutenTag, an automated sequence tag inference algorithm. He also created the DBDigger database search engine and the MS2Grouper algorithm for recognizing and compacting duplications among tandem mass spectra. At Vanderbilt, he continues to work with proteomic data and is beginning studies of tandem mass spectra from lipids.

IOANNIS TSAMARDINOS, PhD, is Assistant Professor of Biomedical Informatics. His research has included development of efficient algorithms for solving disjunctive temporal problems and since coming to Vanderbilt, machine learning algorithms for feature selection and causal discovery from data and their application and evaluation on biomedical data, such as clinical data and mass throughput microarray gene expression data. Dr. Tsamardinos is co-director of the graduate course BMIF 330 Biomedical Artificial Intelligence.

RUSSELL WAITMAN, PhD, is Assistant Professor of Biomedical Informatics. His main responsibility is the continued maintenance, development, and commercialization of WizOrder, the Computerized Physician Order Entry (CPOE) system at VUMC. Prior to graduate school, he was an officer in the United States Air Force where he served as a hospital administrator and clinical engineer at the 74th Medical Group (Wright-Patterson Medical Center), Wright Patterson AFB, Dayton, Ohio. Dr. Waitman's research interests include: knowledge discovery in databases, the stability of rule induction, physiologic data collection, and biomedical signal processing.

STUART T. WEINBERG, MD, is Assistant Professor in Biomedical Informatics. He is a pediatrician and was an NLM Medical Informatics Fellow in Pittsburgh under Dr. Randy Miller from 1990 thru 1993. Dr. Weinberg's research interests include clinical reminders, immunization registries, personal health records, barcoding, intuitive user interfaces, and pediatric-specific applications.

MATTHEW B. WEINGER, MD (3/8 VA), is Professor of Anesthesiology, Biomedical Informatics, and Medical Education at Vanderbilt University and a Staff Physician in the TVHS GRECC. He was recently awarded the Norman Tyson Smith Chair in Medical Simulation and Patient Safety. Dr. Weinger is the Director of the Vanderbilt Center for Medical Simulation, Director of the Vanderbilt Center for Perioperative Research in Quality, and the Co-Director (with Dittus) of the Middle Tennessee Center for Improving Patient Safety. Dr. Weinger has been teaching and conducting research in patient safety, human factors engineering, informatics, and clinical decision making for almost two decades. He has received over \$3 million in direct research support for and published extensively on topics relevant to medical informatics including use error, user interface design and evaluation, data visualization, performance evaluation, workload, alarms and vigilance, the nature of clinical experience, automation, clinician fatigue, and clinical decision support systems. He has directly mentored nearly 100 students in his academic career.

APPENDIX 3 - REFERENCES

1. Kizer KW, Demakis JG, Feussner JR. Reinventing VA health care: systematizing quality improvement and quality innovation. *Med Care* 2000;38(6 Suppl 1):I7-16.
2. Perlin JB, Kolodner RM, Roswell RH. The Veterans Health Administration: quality, value, accountability, and information as transforming strategies for patient-centered care. *Am J Manag Care* 2004;10(11 Pt 2):828-36.
3. Brown SH, Lincoln MJ, Groen P, Kolodner RM. VistA: The U.S. Department of Veterans Affairs National Scale Hospital Information System. *International Journal of Medical Informatics* 2003;vol 69(2-3):135 - 56.
4. Hynes DM, Perrin RA, Rappaport S, Stevens JM, Demakis JG. Informatics resources to support health care quality improvement in the veterans health administration. *J Am Med Inform Assoc* 2004;11(5):344-50.
5. Steinberg EP. Improving the quality of care-can we practice what we preach? *N Engl J Med* 2003;348(26):2681-3.

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6. Jha AK, Perlin JB, Kizer KW, Dudley RA. Effect of the transformation of the Veterans Affairs Health Care System on the quality of care. *N Engl J Med* 2003;348(22):2218-27.
7. Asch SM, McGlynn EA, Hogan MM, et al. Comparison of quality of care for patients in the Veterans Health Administration and patients in a national sample. *Ann Intern Med* 2004;141(12):938-45.
8. Rundle R. In the Drive to Mine Medical Data, VHA is the Unlikely Leader. *The Wall Street Journal* 2001 December 10, 2001;Sect. 1.
9. Boodman S. No End to Errors. *Washington Post* 2003 Tuesday, December 3, 2002;Sect. HE01.

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APPENDIX 4 – DEPARTMENT OF BIOMEDICAL INFORMATICS TRAINEES

| | DBMI CURRENT STUDENTS |
|---------------------------|--|
| Aphinyanaphongs, Yindalon | Text Categorization for retrieval of high quality articles in internal medicine. 1st Prize in 2003 AMIA Student Competition, 2005 Winner, Lindberg Research Fellowship, MLA. |
| Aronoff, Joel | Classification scheme for order entry system medication warnings and clinician responses. |
| Berutti, Tyler | Evaluations of information technology in the ICU environment. |
| Brown, Laura | Algorithms for scalable and accurate Bayesian network learning. |
| Campion, Thomas | Organizational informatics. |
| Carnevale, Randy | Intelligent reporting of microbiology data within a CPR. |
| Chen, Shuo | Bioinformatics (MALDI/TOF). |
| Denny, Josua | Identifying UMLS concepts from ECG impressions using KnowledgeMap. |
| Dexheimer, Judith | Implementation of a Pneumococcal vaccination reminder system in the ER. |
| Duda, Stephany | Extracting drug-drug interaction articles from MEDLINE. |
| Fananapazir, Nafeh | Machine learning techniques applied to proteomics (mass spectrometry). |
| Fu, Lawrence | Developing Bayesian network algorithms from continuous data. |
| Hoot, Nathan | Models to predict liver transplant survival. 2nd Prize 2005 AMIA Student Competition. |
| Jerome, Rebecca | Facilitating clinician use of an evidence-based consultation service via the EMR. |
| Kazerooni, Alex | A framework for the development of pediatric growth curve. |
| Pratap, Siddharth | Dynamics of <i>Saccharomyces cerevisiae</i> (yeast) nitrogen starvation response. |
| Raggio, Chris | Clinical decision support systems. |
| Sanders, David | Identification of asthma encounters for triggering guidelines in a pediatric ER. |
| Statnikov, Alex | Automated development and evaluation of cancer diagnosis models in gene expression data. |
| Thornton, Tricia | 3 clustering methods for dissecting trait heterogeneity in simulated genotypic data. |
| Unertl, Kim | Information needs in chronic disease care. |
| Wehbe, Firas | Investigating existing and novel reasoning formalisms about temporal constraints in complex multi-step clinical protocols. |
| Weiss, Jacob | Online communication and support for cancer patients. 2005 AMIA Forsythe Award Finalist |
| White, Steven | Decision support system for the Emergency Department. |
| Xie, Charlie | Human factor design to improve signal detection for e-Rx writer w/decision support. |
| | DBMI PAST STUDENTS |
| Gregg, William | Effects of an integrated, just-in-time disease management tool. Asst. Prof, DBMI. |
| Frey, Lewis | Identifying Markov Blankets with decision tree induction. |
| Parker, Joel | Dynamics based pattern recognition for gene expression data. Bioinformatics Scientist. |
| Ozdaz, Asli | Integrating evidence-based best of care protocols into clinicians' workflow via care provider order entry. Asst. Prof, DBMI and Surgery. |
| Ritchie, Marylyn | Genetic programming optimized neural networks to identify gene-gene interactions. Asst. Prof, Genetics. |
| Geissbuhler, Antoine | WizOrder, an interface for direct patient care provider order entry with decision support capabilities. Professor & Director, Informatics Unit, University Hospital of Geneva. |
| Zakaria, Aamir | LabTalk/2, a middleware program to facilitate order entry into a legacy laboratory system. Finalist in the SCAMC Student Paper Competition in 1995. Private practice in Surgery. |
| Brown, Steven | Derivation of a canonical set of problem statements. Director, CPEP; Assoc. Prof, DBMI. |
| Rassinoux, Anne-Marie | Representation of clinical vocabularies in a combined frame-based and semantic-net based paradigm for NLP. Informatics Faculty, University Hospital of Geneva. |
| Westberg, Ed | New models for telemedicine/teleconsultation/distance learning. Dot-Com employee. |
| Starmer, John | Models for integrating decision support into clinical order entry. Asst. Prof, DBMI. |
| Sheshelidze, David | VGR scripting for WizOrder. Department of Pharmacology, Vanderbilt University. |
| Rosenbloom, Trent | QUILL project clinical developer. Asst. Prof, DBMI. |
| Sanders, David | New models for telemedicine/teleconsultation/distance learning. |
| Hamilton, Rodney | Develop and evaluate functional problem list application. Asst. Prof, DBMI/Pediatrics. |