PROCEEDINGS

The Second Annual Symposium on
computer application
in medical care

November 5-9, 1978
Washington, D.C.

EDITOR:
F. HELMUTH ORTHNER, Ph. D.
The George Washington University
Medical Center

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PREFACE

The Second Annual Symposium on Computer Applications in Medical Care offers physicians, health care administrators, biomedical scientists, and other health care professionals from Government and private organizations an intensive program on new developments and uses of computers in the medical field. Computer scientists and engineers may find it stimulating and informative to learn from the experiences of expert medical scientists who use and design medical information systems.

The objectives of the symposium are to disseminate information on those computer applications and ideas which increase the quality and accessibility of health care services and to aid in determining -- and ultimately contain -- the rising costs of health care with which our Nation is wrestling today. Hopefully, our efforts will also contribute to a greater understanding of this emerging and fascinating interdisciplinary field called "Medical Computing."

Medical computing advances rapidly, especially in fields such as medical decision making, information systems that "know" medicine, and computers that aid in managing research efforts or the private practice. New systems designs seem to emerge every two or three years and the high rate with which new concepts using computers appear may be attributed to the increased acceptance and attention that computers have gained as tools by the biomedical research and development community.

The rapid diffusion of computer technology into the health care delivery system rests primarily on the availability of less costly and better computer products and the increasing requirements for medical documentation. This diffusion, however, is impeded by the lack of trained personnel to design, use and operate the medical information systems. Both, more educational opportunities and easier access to and use of medical information systems need to be developed, so that the health care system can derive increased benefits from this great new tool.

We had anticipated developing this year's activity around topics which were not addressed last year. However, we received so many excellent papers that we were persuaded to include topics from last year as well. This called for an extended program. To accommodate such a program, we had to add a half day, two evening sessions, and poster sessions, the latter running parallel to regular sessions.

We would like to take this opportunity to thank the program planning committee for the time and effort expended in developing this year's symposium. We also would like to thank the sponsoring, cooperating, and contributing institutions and societies as well as the industrial sponsors for their assistance in making this event possible.

Abund O. Wist, Ph.D.  
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INTRODUCTION

The program of the SECOND ANNUAL SYMPOSIUM ON COMPUTER APPLICATIONS IN MEDICAL CARE begins with the Keynote Address in which Dr. Cesar Caceres views the computer as a component useful to automate health care processes. Experience in other industries has shown that automation should contain and even decrease costs and the effects in the health care industry should not be an exception to the rule.

The program itself is organized around seven themes:

I  RADIOLGY:  Sessions: 1,2,3
II MENTAL HEALTH:  Sessions: 4,5
III COMPUTER-PATIENT DIALOG  Session: 6
IV REPRESENTATION, STORAGE AND USE OF MEDICAL KNOWLEDGE:  Sessions: 7,8,9,10
V CLINICAL LABORATORY TESTING  Session: 11
VI MEDICAL OFFICE PRACTICE:  Session: 12
VII MEDICAL INFORMATION SYSTEMS:  Session: 13

One area of medicine in which automation has reached a high level is Radiology and its associated disciplines: Medical Imaging, Nuclear Medicine, and Radiation Therapy. In our first theme, the status, progress, and the problems encountered in each of these areas will be addressed.

One of the current pressing national issues is Mental Health Care. Within the constraints of time and space, we tried to review the role of computers in two areas: Psychiatry and Clinical Psychology, and in Mental Health Care. The first session (Plenary Session 4) is primarily a review of computers in Mental Health Care, while the second session (Plenary Session 5) deals with the role of computers in the Mental Health Care Delivery System.

Following the theme on Mental Health Care, we scheduled a session with the theme "Computer Patient Dialog" in which the experience of using computers to directly interact with the patient is explored. The primary emphasis is focused on obtaining the Medical History. Today's microcomputer technology, however, allows us to go "Beyond Data Collection" (see Dr. Greist's paper).

The theme on the use of computers entitled "Representation, Storage, and Use of Medical Knowledge," is the focal point of the Second Annual Symposium on Computer Applications in Medical Care. In the next four sessions (Plenary Sessions 7, 8, 9, 10) we illuminate this topic from various points of view. I believe that computers will only be effective and truly useful to the medical profession when medical knowledge is included in medical information systems. Today we don't know how much and what knowledge is useful for inclusion in these systems. Obviously, more work needs to be done both in the field of computer science and in the field of medicine.
Computerized knowledge will affect the practice and consequently the study of medicine. Computers must, of needs, be included in both graduate and undergraduate curricula. During our banquet Dr. Lawerence Weed, who is a pioneer in abstracting, selecting and using medical knowledge with computers, will address this issue.

The Clinical Laboratory has long been in the forefront using computers in medicine. Our theme entitled “Computer Directed Clinical Laboratory Testing” nicely follows the previous theme. In matter of fact, it might be considered a part of the previous theme; the use of medical knowledge to direct testing in order to obtain less but more accurate and useful information. Dr. Rubin's session is also a bridge to the next theme on the use of computers in private medical practice since computers and automation may bring laboratory testing back to the physician's office.

Considering the requirements for documentation that are imposed on the practicing physicians, automation of some clerical procedures seems practical. In our last Plenary Session, "Computers in Office Patient Care," we are looking at computers for these environments with emphasis on the 'medical' aspects.

The last theme on Medical Information Systems is quite broad. The presentations range from systems for specific research purposes to hospital management information systems; from large mainframe computer systems to small microcomputers systems that are networked into one information system. We did not structure this session since time constraints forced us to require these papers be presented individually by posters.

The papers listed in the Evening Program did not fit into the themes we have decided upon but are included since they are the basis of some evening discussions.

I hope these proceedings will be useful to you.

F. Helmuth Orthner, Ph.D
Program Chairman
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Much effort and time have been spent in organizing the scientific program of the Second Annual Symposium on Computer Applications in Medical Care. As in many endeavors of this sort a certain threshold must be overcome before a program begins to take on form and substance which are compatible with important national issues, one's own criteria for a quality program and which concurrently appeal to the medical and computer professionals. Last year the early participation of Dr. William R. Baker from the Biotechnology Resources Program of the Division of Research Resources, NIH, provided the necessary activation energy. This year the early cooperation of the Division of Computer Research and Technology (DCRT) of NIH, notably Dr. William R. Mohler, Martin N. Epstein and Dr. Pratt, provided the moral support to get the scientific program on its way.

Each member of the Advisory Committee has assisted me in assembling the program in various ways: e.g. suggesting speakers for certain topics, and advising or evaluating topics which were proposed in the abstracts. Special thanks of course to the Session Chairmen and Session Organizers, who have used their knowledge and personal contacts in inviting many authorities in the field of medical computing. The scientific program has been greatly strengthened by these invited speakers.

Without the personal efforts of Ms. Lisa Allen, Ms. Monique M. Lucas, and Mr. William F. Hurst of the Department of Clinical Engineering, this symposium may never have come about. They have assisted me with an enormous volume of correspondence and with the collating, correcting, typing, and proofreading of the advance and final program brochures, as well as some manuscripts contained in the volume you are holding in your hands now.

A grant from the Bureau of Health Manpower, HRA, DHEW, (5 R01 MB 0097-04) has enabled me to devote time to this endeavor. Their support is greatly appreciated.

Last but not least, I thank every author whose work and ideas are presented in this symposium. Thank you.

F. Helmuth Orthner, Ph.D.
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INVITED SPEAKERS

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Lawrence L. Weed, M.D., Professor, Department of Medicine; Director, PROMIS Laboratory, College of Medicine, University of Vermont, Burlington, VT 05401.

Giovanni Wiederhold, Ph.D., Assistant Professor, Department of Computer Science, Stanford University, Stanford, CA 94305.
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Chairman: H. K. Huang, Ph.D., Assistant Professor, Department of Physiology and Biophysics, Department of Anatomy, Georgetown University School of Medicine

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H. K. Huang, Ph.D., Department of Physiology and Biophysics and Department of Anatomy, Georgetown University School of Medicine

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Edward S. Sternick, Ph.D., Medical Physics Division, Department of Therapeutic Radiology, Tufts-New England Medical Center Hospital, Boston, MA
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Chairman: James H. Johnson, Ph.D., Associate Professor and Vice-chairman, Department of Psychiatry and Behavioral Sciences, Eastern Virginia Medical School

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COMPUTERS IN MENTAL HEALTH CARE

Chairman: James L. Hedlund, Ph.D., Professor of Psychiatry (Medical Psychology), Department of Psychiatry and Director, Mental Health Systems Research Unit, Missouri Institute of Psychiatry, School of Medicine, University of Missouri-Columbia; Director, Mental Health Information Systems Project, Health Services Research Center/Health Care Technology Center, University of Missouri-Columbia

Co-Organizers: Cecil R. Wurster, Chief, Statistical Program Development Branch, Division of Biometry and Epidemiology, NIMH, ADAMHA, DHEW, and Eugene M. Laska, Ph.D., Director, Information Sciences Division, Rockland Research Institute, Orangeburg, NY

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Chairman: Warner V. Slack, M.D., Associate Professor of Medicine, Thorndike Laboratory, Department of Medicine, Harvard Medical School, Division of Computer Medicine, Beth Israel Hospital

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Chairman: William S. Yamamoto, M.D., Professor and Chairman, Department of Clinical Engineering, The George Washington University Medical Center

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Chairman: S. K. Chang, Ph.D., Associate Professor, Department of Information Engineering, Director, Knowledge Systems Laboratory, University of Illinois at Chicago Circle

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Inferring Knowledge from Clinical Data Banks: Utilizing Techniques from Artificial Intelligence, Robert L. Blum, M.D., and Gio Wiederhold, Ph.D., Department of Computer Science, Stanford University

The Application of a Pattern Matching Algorithm to Searching Medical Record Text, Peter Nicholas Yianilos, Robert A. Harbort, Jr., Samuel R. Buss, and Elbert P. Tuttle, Jr., Emory University Medical Center

Experience on a Surgical Pathology Database and a Lexicon Compiled from Locally Derived Medical English, Ruth L. Wong, M.D., Robert Platt, J.D., Alan Baldwin, and Timothy Hain, M.D., Pathology Department, College of Medicine, University of Illinois
LANGUAGE PROCESSING AND REPRESENTATION

Chairman: Martin N. Epstein, Division of Computer Research and Technology, National Institutes of Health, DHEW

Natural Language Access to a Melanoma Data Base, Martin N. Epstein, Division of Computer Research and Technology, National Institutes of Health, and Donald E. Walker, SRI International, Menlo Park, CA


Computerized Language Processing for Multiple Use of Narrative Discharge Summaries, Naomi Sage, Ph.D., Lynette Hirschman, Linguistic String Project, New York University, and Margaret Lyman, M.D., Department of Pediatrics, New York University Medical Center

Medikas—An Interactive Knowledge Acquisition System, A. B. Baskin, Allan H. Levy, M.D., University of Illinois College of Medicine and Department of Computer Science, Urbana-Champaign

Competing Models for Intelligent Systems Analysis of Client-Therapist Transactions, Sally Yeates Sedelow, Ph.D., Department of Computer Science and Linguistics, and Walter A. Sedelow, Ph.D., Departments of Computer Science and Sociology, University of Kansas and Interdisciplinary Studies Program, The Menninger Foundation, Topeka, KA

REPRESENTATION OF MEDICAL KNOWLEDGE

Chairman: William C. Mohler, M.D., Associate Director, Division of Computer Research and Technology, National Institutes of Health, DHEW

Introduction to 'Representation of Medical Knowledge', William C. Mohler, M.D., Division of Computer Research and Technology, National Institutes of Health, DHEW

The Hepatitis Knowledge Base Prototype, Lionel M. Bernstein, M.D., Ph.D., Elliot R. Siegel, Ph.D., and William H. Ford, Lister Hill National Center for Biomedical Communications, National Library of Medicine, NIH, DHEW

'Representation of Medical Knowledge' and PROMIS, Staff, PROMIS Laboratory, College of Medicine, University of Vermont

Knowledge Sectors for Logical Processing of Patient Data in the Help System, Homer R. Warner, M.D., Ph.D., Department of Medical Biophysics and Computing, College of Medicine, University of Utah

COMPUTER DIRECTED CLINICAL LABORATORY TESTING

Chairman: Martin Rubin, Ph.D., Professor, Department of Biochemistry, Georgetown University Medical Center, Director, Division of Clinical Chemistry, Georgetown University Hospital

QUO VADIS? Martin Rubin, Ph.D., Department of Biochemistry, Schools of Medicine and Dentistry, Georgetown University

Appropriate Use of Population and Individual Reference Data in Patient Care, Eugene K. Harris, Ph.D., Laboratory of Applied Studies, Division of Computer Research and Technology, NIH, DHEW

Strategies for Improving the Use of the Clinical Laboratory: Computer Applications, Ellis S. Benson, Department of Laboratory Medicine and Pathology, School of Medicine, University of Minnesota


Use of a Clinical Laboratory Computer to Warn of Possible Drug Interference with Test Results, William E. Groves, Ph.D., and Walter H. Gajewski, Departments of Laboratory Medicine and Biometry, Medical University of South Carolina

COMPUTERS IN OFFICE PATIENT CARE

Chairman: William E. Hammond, Ph.D., Associate Professor of Community and Family Medicine, Director, Division of Information Sciences, Duke University Medical Center

Physical Examination Reporting System, B. A. Rowley, Ph.D., J. M. Cameron, Ph.D., D. E. Anderson, Ph.D., Department of Biomedical Engineering and Computer Medicine, and T. A. Nicholas, M.D., R. L. Hogue, M.D., J. L. Hutcheson, M.D., Department of Family Practice, Texas Tech University, School of Medicine, and V. H. Peralta, M.D., B. Johansen, M.D., D. Walston, South Plains Health Providers, Inc., Plainview and Floydata, TX

Cost-Justification of Computers in General Practice in Canada, Neil H. McAlister, M.D., H. Dominic Covvey, and Nazlin K. McAlister, M.D., Cardiovascular Unit, Toronto General Hospital, Toronto, Canada
Marco (Medical Record Communications)—System Concept, Design and Evaluation, P. H. Moffatt, M.D., J. J. Alpert, M.D., Department of Pediatrics, Boston City Hospital and Boston University School of Medicine, and W. D. Mela, B. D. Heisler, H. M. Goldstein, Ph.D., Center for Medical Manpower Studies Northeastern University

Distributed Computer Networks in Support of Complex Group Practices, Bernard P. Wess, Jr., Computer Center, University of Maryland, Baltimore County

Computerized Patient Scheduling in a Clinic, Lawrence L. Rose, The Ohio State University, and Malcolm H. Gotterer, Ph.D., Florida International University

Costar—A Computer-Based Medical Information System for Ambulatory Care, G. Octo Barnett, M.D., Norma S. Justice, Michael E. Somand, M.D., J. Barclay Adams, M.D., Jacqueline K. Greenlie, Peter D. Beaman, Samuel Penchas, M.D., and Monica S. Parent, Laboratory of Computer Science, MGH, Harvard Medical School

‘My Girl Sends Out My Bills’—Doctors and Computers, Norman Ronis, M.D., Reston, VA

MEDICAL INFORMATION SYSTEMS

Chairwoman: Ruth E. Dayhoff, M.D., Department of Pathology, The George Washington University Medical Center; National Biomedical Research Foundation, Gerogergett University Medical School

Privacy and Security in an Oncology Information System, Bruce I. Blum and Raymond E. Lenhard, Jr., M.D., Johns Hopkins Oncology Center, Johns Hopkins University

An Interactive Patient Record System and its Transfer from a Mainframe to Microcomputers, Grace M. Huuko, Ph.D., and W. D. Hageman, M.D., The Laboratory of Computer Science, Cornell University Medical College

An Intelligent Terminal for Access to a Medical Database, M. E. Womble, Ph.D., S. D. Wilson, M.D., H. N. Keiser and M. L. Tworek, Clinical Sciences Division, USAF School of Aerospace Medicine, Brooks Air Force Base, TX

A Medical Genetics Data Base Management System, K. W. Kang, Ph.D., A. D. Merritt, M.D., P. M. Conneally, Ph.D., J. M. Gersting, Ph.D., and T. Rigo, Ph.D., Department of Medical Genetics and Mathematical Sciences, Indiana University

Computer Support for Muscular Subaortic Stenosis Research, Neil H. McAlister, M.D., H. Dominic Covvey, Charles Pollick, Ann M. Sheppard, and E. Douglas Wigle, M.D., Cardiovascular Unit, Toronto General Hospital, Toronto, Canada

Computer Support of Cardiovascular Surgical Registries, H. Dominic Covvey, D. C. MacGregor, M.D., S. Smardon, and E. D. Wigle, M.D., Division of Cardiology and Cardiovascular Surgery, Toronto General Hospital, Toronto, Canada

A Reporting System for Non-Invasive Cardiovascular Investigations, H. Dominic Covvey, M. Van Horik, J. Hum, M. J. Sole, M.D., L. Schwartz, M.D., H. Rakowski, M.D., and E. D. Wigle, M.D., Division of Cardiology, Toronto General Hospital, Toronto, Canada

Health Care Systems—An Integrated Approach, John W. Hamilton, Sisters of Saint Mary Data Center, St. Louis, MO

Experiencing Using Standard Software to Provide a Comprehensive Information Processing System for a Large and Complex Clinical Study, John M. Long and Joseph R. Brashear, Hyperlipidemia Program, University of Minnesota


The Clinical Pathology Laboratory and its Relationship to a Hospital Information System, Marion J. Ball, Ed.D., Computer Systems and Management, Temple Medical Center

Laboratory Reports for the Physician, Samuel Raymond, M.D., Ph.D., Division of Laboratory Medicine, Department of Pathology, Hospital of the University of Pennsylvania Medical School

Adaptation of a Computer-Assisted Diagnosis Program for use by Hospital Corpsmen Abroad Nuclear Submarines, J. V. Henderson, M.D., G. M. Moeller, Ph.D., B. M. Ryack, Ph.D., G. M. Shumaik, M.D., Naval Submarine Medical Research Laboratory, Groton, CT, and Naval Medical Center, San Diego, CA

Using a Medical Information System to Improve the Quality of Patient Care, Richard M. Snieder, Technicon Medical Information Systems Corporation, Santa Clara, CA
EVENING SESSION

Chairwoman: Betty J. Andrews, Department Manager, Systems Integration, Computer Sciences Corporation, Vienna, VA

Testing of Updated Program for ECG Analysis, James J. Bailey, M.D., Martha R. Horton and Alan P. Goldman, Division of Computer Research and Technology, National Institutes of Health, DHEW

Clinical Usefulness of ECG Frequency Spectrum Analysis, Vrudhula K. Murthy, Ph.D., Thomas M. Grove, Ph.D., George A. Harvey, and L. Julian Haywood, M.D., Los Angeles County-University of Southern California Medical Center


Application of Computer Analysis to Immunological Monitoring Assays, F. Thomas, J. Thomas, M. Carver, H. M. Lee, and R. R. Lower, Medical College of Virginia, Richmond, VA

An Adaptable System for Keeping Intake/Output Records for Fluid Management in the Critically Ill, John E. Brimm, M.D., Michael R. O'Hara, and Richard M. Peters, M.D., Division of Cardio-Thoracic Surgery, University of California Medical Center, San Diego, CA

The Role of Computer Assisted Fluid Balance in Critical Care, Sergio A. Ciccolella and Mark J. Halloran, Hewlett-Packard Company, Waltham, MA

Computerized Patient Monitoring—An Update, Mark J. Halloran, Hewlett Packard Company, Waltham, MA

A Micro-Computer Based System for the Management of the Critically Ill, Harry Comerchero, Gregory Thomas, Gaby Shapiro, Mennen Greatbatch Inc., Clarence, NY, and Dr. John W. Hoyt, Naval Regional Medical Center, Portsmouth, VA

Cardiovascular Modelling to Study Effects of Pressure Regulation: Hypertension, Fred J. Ricci, Ph.D., Arlington, VA

Analog Computer in Anticoagulant Therapy, J. R. Howell, Department of Pharmacy and Pharmaceutics, Medical College of Virginia, Richmond, VA

A Conceptual Model for Health Care Information Systems, Avrom P. Nadell and Norman Ronis, M.D., Health Affairs Data Element Standardization Task Force, OASD (HA), John E. Murphy Colonel, USAF, MSC Pentagon, Washington, DC

A Model for Evaluation of Data in Health Care Systems, Samuel W. McDowell, Technicon Instruments Corporation

Performance Requirements for Data Processing Systems in Health Care Delivery, David N. Reps, Ph.D., New York Institute of Technology

A Planning Framework for Management Information Systems in the Hospital Industry, David N. Reps, Ph.D., New York Institute of Technology