CURRICULUM VITAE

Brent K. Stewart, PhD, DABMP

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**1. Personal Data:**

Place of Birth: Seattle, WA; Citizenship: USA

**2. Education:**

Physics, BS, 1980
Magna Cum Laude with Honors
University of Washington; Seattle, WA

Biomedical Physics, PhD, 1988
Emphasis in Medical Imaging
University of California at Los Angeles

**3. Postgraduate Training:**

None

**4. Faculty Positions Held**

Assistant Professor (tenure-track) of Radiology (1988-89)
Medical Physics Division, University of Cincinnati

Assistant Professor of Radiological Sciences (1990-93)
Medical Imaging Division, UCLA School of Medicine

Associate Professor of Radiology (1993-1999)
University of Washington School of Medicine
Adjunct Associate Professor of Bioengineering (1994-1999)
Adjunct Associate Professor of Medical Education (1997-1999)

Professor of Radiology (1999-present)
University of Washington School of Medicine
Adjunct Professor of Medical Education (1999-2006)
Adjunct Professor of Bioengineering (1999-2002)

**5. Hospital Positions Held:**

Director of Diagnostic Physics (1993-2012)
Department of Radiology, University of Washington School of Medicine
Director of Imaging Informatics (1996-2002)
University of Washington Academic Medical Centers

**6. Honors:**

Who's Who in Education, 2002
Who's Who in the World, 2000
Who's Who in Science and Engineering, 1994-97
National Science Foundation Fellow, 1984-1987
Phi Beta Kappa, Washington Alpha, 1980

**7. Board Certification:**

Medical Physics with Special Competence in Diagnostic Imaging Physics
American Board of Medical Physics Certification (1996)
Diplomat of the American Board of Medical Physics (DABMP)
American Board of Medical Physics Recertification (2006-2010)
American Board of Medical Physics Recertification (2011-2015)

Letter of Equivalence in Radiologic Physics, Diagnostic Imaging
American Board of Radiology (2001-2006)

**8. Current License(s) To Practice:**

None required or available in Washington State.

**9. Professional Organizations:**

Full Member, American Association of Physicists in Medicine (AAPM)
Full Member, American College of Radiology (ACR)
Diplomate, American Board of Medical Physics (ABMP)

**10. Teaching Responsibilities:**

University of Washington Department of Radiology (1993-present): Radiology resident instruction in the physics of diagnostic radiology and resident physics board exam review instruction (http://courses.washington.edu/radxphys/).

Full responsibility for the Bioengineering Graduate Student course RADGY 508A (Physical Aspects of Medical Imaging), 1994-present. UW Department of Bioengineering (BIOEN 508A; 1994-2003).

Quarterly Medical Student Clerkship Physics lectures as part of RADGY 693 Introduction to Diagnostic Radiology (2006-2014). Lecture topic: "Radiation Dose and Risk."

A credentialing program, "Minimizing Risks from Fluoroscopic X-rays" is required for all physicians requesting fluoroscopy credentialing privileges. The Diagnostic Physics section has produced documents for us in this process now administered by UW Medicine Office of Medical Staff Appointments (OMSA).

HMC Physics Noon Conferences (2003-2007): bi-monthly physics lectures to residents. (http://depts.washington.edu/diagphys/).

HMC Department of Radiology Fluoroscopy Credentialing Program (1997-2008): to assure adequate training of physicians who use fluoroscopy. Consists of self-study materials, an exam and hands-on practical session.

**10. Teaching Responsibilities (cont.):**

University of Washington Department of Electrical Engineering (1998-2000): EE400B (Systems Engineering and Medical Imaging Informatics). This course is sponsored by a grant from the Hewlett Packard Company.

University of Washington (1994-2005) have taught components of EE500B (Seminar on Imaging Computing), MEDED530 (Medical Informatics), MEDED535 (Clinical Topics & Informatics) and HSERV590K/MEDED510 (Selected Topics in Health Informatics).

Faculty - American Association of Physicists in Medicine 1999 Summer School on Practical Digital Imaging and PACS: "Network, Pipes and Connectivity" and "Teleradiology" (Sonoma State University, CA). Faculty - American Association of Physicists in Medicine 1993 Summer School on Digital Imaging: "Mini-PACS" (Charlottesville, VA).

RSNA Refresher Course Faculty (1991-1996): "Categorical Course on Computers in Radiology Categorical Course," "Information Systems for Radiology Clinical Practice and Research," "Clinical Practice and Research Information Systems for Radiology's Next Century," "Clinical Information Systems for Radiology: Informatics Infrastructure for Healthcare Providers," and "Diagnostic Physics Categorical Course." See also: Invited Lectures, items 6, 9, 12, 15, 17, 18 and 21.

UCLA Biomedical Physics Graduate Program (1990-1993): Digital Techniques in Radiological Sciences (RS209), Advanced Instrumentation (RS206), Medical Physics Laboratory (RS208) and Medical Imaging Seminar (RS269), Biomedical Physics Graduate Program. Radiology resident training in radiological physics, computer technology, image processing and digital radiography.

University of Cincinnati Medical Physics Graduate Program (1988-1989): Radiology resident and Medical Physics graduate student teaching in computer technology, image processing, digital radiography, CT and MRI.

**11. Editorial Responsibilities:**

Associate Editor - Academic Radiology (1997-present)
Associate Editor – Medical Physics (2005-2012)
Editor - Academic Radiology (1995-1997)

**12. Special National Responsibilities**

American Association of Physicists in Medicine Task Group 257: Medical Physics Practice Guidelines #6, Selection of a Patient Dose Monitoring System (2014)

American Association of Physicists in Medicine Task Group 232: Clinical Use of CR/DR Exposure Indices (2013-2014)

American Association of Physicists in Medicine Task Group #10: Computed Radiographic Imaging (1995-2005).

Presiding Officer, Radiological Society of North America (2000-2002): "Physics - PACS Architecture and Algorithms" (2000), "Physics – PACS Workflow and

**12. Special National Responsibilities (cont.):**

Quality Assurance" (2001) and "Physics – PACS Various Topics" (2002).

Faculty - American Association of Physicists in Medicine 1999 Summer School on Practical Digital Imaging and PACS: "Network, Pipes and Connectivity" and "Teleradiology."

Scientific Program Committee, American Roentgen Ray Society (1996-98).

RSNA Refresher Course Faculty (1991-1996): "Categorical Course on Computers in Radiology," "Information Systems for Radiology Clinical Practice and Research," "Clinical Practice and Research Information Systems for Radiology's Next Century", "Diagnostic Physics Categorical Course" and "Clinical Information Systems for Radiology"

Moderator, "Clinical Information Systems for Radiology" Refresher Course at the 82nd Scientific Assembly and Annual Meeting of the Radiological Society of North America (4 December 1996).

RadioGraphics RSNA Physics Scientific Exhibit Review Panel (1995-98)

Moderator, "Clinical Practice and Research Information Systems for Radiology's Next Century" Refresher Course at the 81st Scientific Assembly and Annual Meeting of the Radiological Society of North America (30 November 1995).

Moderator, "Information Systems for Radiology Clinical Practice and Research" Refresher Course at the 80th Scientific Assembly and Annual Meeting of the Radiological Society of North America (2 December 1994).

Moderator, "Information Systems for Radiology Clinical Practice and Research" Refresher Course at the 79th Scientific Assembly and Annual Meeting of the Radiological Society of North America (2 December 1993).

Faculty - American Association of Physicists in Medicine 1993 Summer School on Digital Imaging: "Mini-PACS."

**13. Special Local Responsibilities**

Review Panel, Royalty Research Fund (RRF)
Basic Biological and Biomedical Sciences subcommittee (2010-2011)

UW Provost's UW Data Management Committee (2006-2008)
UW Graduate Student Representative (1993-2006)

UW President's Strategic Risk Initiative Committee (2005-2006)
UW Provost's Future of Information Systems Task Force (2006)
UW Research Advisory Board (2004-2006)

Faculty Senate Executive Committee (2004-2006)
Chair, Faculty Council on Research (2004-2006)
Vice-Chair, Faculty Council on Research (2002-2004)
Faculty Council on Research (2000-2006)

**13. Special Local Responsibilities (cont.):**

University of Washington Faculty Senate (2004-2006)

Chair, UW Radiation Safety Committee (2004-2006)
Scientific Executor, UW Radiation Safety Committee (2004-2006)

Intellectual Property Advisory Management Committee (2004-2006)
Export Control Policy and Training Polices Committee (2005-2006)
Medical Centers Information Systems Steering Committee
University of Washington Academic Medical Centers (1996-2002)

IAIMS (Integrated Advanced Information Management System) Core Group,
University of Washington School of Medicine (1996-2000)

Clinical Informatics Workgroup
Medical Centers Information Systems (1996-2000)

Chair, Telemedicine Technology Oversight Committee
University of Washington School of Medicine (1997-1998)

Chair, Electronic Radiology Imaging Committee
University of Washington Dept. of Radiology (1995-1997)

Chair, Technical Advisory Committee
Technical Director, Leadership Team and Clinical Advisory Committee
WAMI Rural Telemedicine Network (1994-97)

Managed Care Committee, UW Dept. of Radiology (1994)

Dean's Task Force on Distance Learning and Telemedicine
University of Washington School of Medicine (1994)

**14. Research Funding:**

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| (1) Status: | Active |
| Role: | Principal Investigator |
| Support Source: | GE Healthcare |
| Title: | Accurate classification of CT dose information utilized for alarm threshold selection. |
| Duration: | 3/2014-8/2015 |
| Budget: | $194,894 |
| Brief Description: | It is well known that free-text entry of the exam descriptor at the CT console causes exam descriptor count creep in DoseWatch (DW). This and protocol 'cross contamination' greatly hampers efforts to accurately set alert thresholds based on DLP, leading to false positive alerts. Determination of segmented protocol classes using the large number features resident in the DW database for each study can be effected through classification methods such as cluster analysis and/or discriminant function determination. In addition, it is posited that the in-cluster variance will lower to the point where the dose data for each segment can be segmented further into 'appropriate' and 'inappropriate' sub-clusters. Therefore, |

**14. Research Funding (cont.):**

this will find the valid high-dose cases and simultaneously lower the number of false positive alerts.

(2) Status: Inactive
Role: Principal Investigator
Support Source: Radiology Health Services Research Seed Grant Program
Title: Enhancement and Validation of a Simulation Model for the Introduction of Digital Radiography into a Radiology Department with Existing Computed Radiography
Duration: 4/04-3/05
Budget: $7,090
Brief Description: The accurate prediction of workflow throughput is a critical issue in planning for and acquisition of any new imaging modality, be it conversion of computed radiography (CR) systems to digital radiography (DR) or successful installation of a picture archiving and communication system (PACS). Workflow bottlenecks or process design flaws can render a large-scale implementation or conversion process useless. This research presents a methodology for predicting workflow throughput and cost effectiveness in converting from CR to DR in an already existing radiology department with PACS.

(3) Status: Inactive
Role: Principal Investigator (10% effort)
Support Source: General Electric Medical Systems
Title: Imaging Informatics Workflow Modeling and Simulation
Duration: 1/02 – 6/03
Budget: $75,000
Brief Description: The objective of this research is to create generic and specific workflow models of the University of Washington Department of Radiology using MedModel. Both pre and post PACS installation models will be generated. These models will then be used to run simulations that will provide key cost and time parameters for use in a cost-benefit modeling (CBM) tool.

(4) Status: Inactive
Role: Principal Investigator (50% effort)
Support Source: National Library of Medicine, Biomedical Applications of the Next Generation Internet (NGI) - Phase II
Title: Patient-centric Tools for Regional Collaborative Cancer Care Using the NGI
Duration: 10/99 - 12/02
Budget: $1,351,962
Brief Description: Phase II involves the creation of collaborative Internet tools necessary for the effective practice of oncology in the highly distributed and differentiated medical enterprise represented by the Seattle Cancer Care Alliance (SCCA) and its regional affiliates. These tools and their underlying infrastructure will be applied to three key collaborative steps in the diagnosis, management and treatment of oncology patients. Contextual inquiry and design are being used to determine user

**14. Research Funding (cont.):**

requirements for collaborative tools and in the design and evaluation of the collaborative tools developed. The Pacific Northwest Gigapop which connects all SCCA partners through 2.5 Gbps fiber-optic links and the MINDscape web-based electronic medical record developed at the University of Washington are key infrastructure components in this effort. 15 awards made.

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| (5) Status: | Inactive |
| Role: | Principal Investigator (20% effort) |
| Support Source: | National Library of Medicine, Biomedical Applications of the Next Generation Internet (NGI) - Phase I |
| Title: | Adopting the Next Generation Internet as a Tool for Healthcare Delivery and Information Access: Assessment, Selection and Planning |
| Duration: | 10/98 - 6/99 |
| Budget: | $85,470 |
| Brief Description: | In Phase I, an Assessment, Selection and Planning (ASP) team was formed to analyze the myriad of biomedical and healthcare information processes and select those which best demonstrate the application of Next Generation Internet technologies and toolsets, while simultaneously providing demonstrable benefit to healthcare practitioners and end users. Twenty-four awards made. |

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| (6) Status: | Inactive |
| Role: | Investigator (10% effort), Director of Imaging Informatics |
| Support Source: | National Library of Medicine, Health Applications for the National Information Infrastructure |
| Title: | From Bench to Bedside and Beyond: “Building and Testing an Integrated Regional Medical Information Network for the Pacific Northwest.” |
| Duration: | 10/96 - 9/99 |
| Budget: | $2,028,000 |
| Brief Description: | The UWAMC will be creating a comprehensive, integrated, information access and management telemedicine regional network that will enhance the clinical, research, educational, and administrative effectiveness of the medical center and its affiliated clinics, institutions and programs over a five state region. The goal of the network is to provide clinicians, educators, students, researchers, administrators and staff with convenient and timely access to the information they need to function optimally, regardless of physical location of the user, the technical resources of the system, or the format of the information package. |

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| (7) Status: | Inactive |
| Role: | Principal Investigator (35% effort), Telemedicine Component |
| Support Source: | Technology Re-investment Program (TRP) - Defense Advanced Research Programs Agency (DARPA) |
| Title: | Portable Ultrasound Imaging Device for Battleground Trauma |
| Duration: | 5/96 - 4/99 |
| Budget: | $2,250,049 |

**14. Research Funding (cont.):**

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| Brief Description: | Use advances in Application Specific Integrated Circuit (ASIC) design to construct a hand-held, ultrasound imaging device with telemedicine capability that would have comparable quality to that of conventional clinical systems. Specific protocols for the special application of combat casualty care will be determined. The UW is joined in this project by a number of industrial partners: Advanced Technology Laboratories (ATL), Harris Semiconductor, and VLSI Technology. |
| (8) Status: | Inactive |
| Role: | Investigator |
| Support Source: | Intel |
| Title: | Network and Resource Monitoring and Analysis with Model Simulation for Medical Informatics Infrastructures |
| Duration: | 9/97-9/98 |
| In-kind Contrib: | Dual and single processor PC servers, est. value = $22,000. |
| Brief Description: | As more and more medical information is transferred electronically, networks and computing resources have become mission-critical cornerstones of the medical enterprise, adequate capacity planning, analysis of alternative architectures and configuration optimization are vital. This is especially critical for the deployment of new information processing systems where response-times are critical and network traffic patterns (tracking with changes in workflow patterns) cannot be predicted a priori or from experience. |
| (9) Status: | Inactive |
| Role: | Co-Principal Investigator (20% effort) |
| Support Source: | Biomedical Technology - Defense Advanced Research Programs Agency (DARPA) |
| Title: | Telemedicine-Remote Portable Ultrasound |
| Duration: | 4/95 - 3/98 |
| Budget: | $445,214 |
| Brief Description: | Specify, develop, integrate and demonstrate a telemedical ultrasound system using leading edge technologies to develop a portable high resolution ultrasound imaging system, codecs tailored for real-time ultrasound image transmission, portable satellite communication links and virtual reality viewing devices. |
| (10) Status: | Inactive |
| Role: | Investigator (10% effort), Technical Director |
| Support Source: | Office of Rural Health Policy, Department of Health and Human Services |
| Title: | WAMI Rural Telemedicine Grant Program |
| Duration: | 10/94 - 9/97 |
| Ann. Direct Budget: | $227,672 |
| Brief Description: | Implementation and evaluation of a multi-state telemedicine network using the University of Washington School of Medicine WAMI (Washington-Alaska- |

**14. Research Funding (cont.):**

Montana-Idaho) medical education consortium to deliver improved rural health services access using low-bandwidth, desktop compressed televideo systems.

(11) Status: Inactive
Role: Investigator
Support Source: NASA
Title: Telemedicine Using the NASA/JPL ACTS Mobile Terminal
Duration: 6/95-6/96
Budget: In-kind from NASA, some support from General Electric ($40,000).
Brief Description: This experiment involved the transmission of static digital medical images, as well as real-time video and ultrasound imagery, between the ACTS/AMT and the Department of Radiology at the University of Washington.

(12) Status: Inactive
Support Source: National Cancer Institute
ID Number: RO1-CA51198-04
Core PI: H.K. Huang, D.Sc.
Core Title: PACS in Radiology
Core Annual Costs: $468,891
Duration: 5/90 - 4/95 (five years)
Brief Description: Research on three PACS modules in Neuroradiology, Thoracic Radiology and Intensive Care as well as Image Compression.
Project 1: PACS for ICU; Hooshang Kangarloo, M.D., PI
Project 2: PACS for Neuroradiology, Robert Lufkin, M.D., PI
Project 3: PACS for Thoracic Imaging, Denise R. Aberle, M.D., PI
Co-PI: Brent K. Stewart, Ph.D. (25% effort)
Proj. 3 Annual Costs: $95,343
Description: Project 3 deals with the definition of the minimum requirements of digital projection radiography that maintain diagnostic accuracy, the design and integration of hardware necessary for Thoracic PACS, and the demonstration of PACS in the clinical environment.

(13) Status: Inactive
Support Source: University of California Tobacco-Related Disease Research Program
ID Number: 2RT0081
Title: Advances in Lung Cancer Detection with Digital Techniques
PI: Denise R. Aberle, M.D.
Co-PI: Brent K. Stewart, Ph.D. (15% effort)
Duration: 1/92 - 12/94
Ann. Direct Costs: $88,962
Brief Description: Comparison of Digital Thoracic Imaging Modalities (laser film digitizers, dual-energy computed radiography, computer aided detection and advanced multiple-beam equalization radiography) with conventional radiography in the detection accuracy for early lung cancer.

**15. Bibliography (Refereed Journals):**

1. Stewart BK. Implementation of a magnetic resonance imaging computer simulator and preliminary results. Proc SPIE 1986; 626: 200-206.

2. Stewart BK, Lo SC, Huang HK. Gray level dynamic range in magnetic resonance imaging. Proc SPIE 1986; 626: 189-195.

3. Stewart BK. PACS at UCLA IV - picture communication. Proceedings of the Third International Symposium on PACS and PHD, 1986; 4: 84-86.

4. Mankovich NJ, Cho PS, Taira RK, Wong A, Stewart BK, Huang HK. A general purpose optical disk system with a radiological imaging application. Proc SPIE 1986; 626: 676-684.

5. Huang HK, Mankovich NJ, Cho P, Taira R, Stewart BK, Ho BK. PACS at UCLA I - a status report. Proceedings of the Third International Symposium on PACS and PHD 1986; 4: 69-79.

6. Ho BK, Mankovich NJ, Stewart BK, Takeuchi H, Huang HK. PACS at UCLA III - image acquisition. Proceedings of the Third International Symposium on PACS and PHD 1986; 4: 82-83.

7. Stewart BK, Huang HK. Dual energy radiography using a single exposure technique. Proc SPIE 1987; 767: 154-161.

8. Stewart BK, Taira RK, Cho PS, Mankovich NJ. PACS module image communication at UCLA. Proc SPIE 1987; 767: 558-563.

9. Ho BK, Morioka C, Mankovich NJ, Stewart BK, Huang HK. Image acquisition for the pediatric radiology PACS module. Proc SPIE 1987; 767: 554-557.

10. Huang HK, Mankovich NJ, Taira R, Cho P, Stewart BK, Ho BK, Kangarloo H, Boechat MI, Dietrich RB. Picture archiving and communication systems for radiology. Proceedings of the International Symposium on Computer Assisted Radiology 1987; 3: 487-492.

11. Stewart BK. Single exposure dual-energy digital radiography. Proceedings of the International Symposium on Computer Applications in Medical Care 1987; 11: 535-542.

12. Huang HK, Mankovich NJ, Cho PS, Taira R, Stewart BK, Ho BK. Picture archiving and communication systems in Japan. AJR 1987; 148: 427-429.

13. Stewart BK. Single exposure dual-energy digital radiography. Computer Methods and Programs in Biomedicine 1989; 30:127-135.

14. Stewart BK, Huang HK. Single-exposure dual-energy computed radiography. Medical Physics 1990; 17: 866-875.

**15. Bibliography (Refereed Journals, cont.):**

15. Wong A, Lou SL, Stewart BK, Chan KK, Valentino DJ, Huang HK. Performance comparisons of image communication networks. Proc SPIE 1990; 1234: 461-470.

16. Huang HK, Lou SL, Cho PS, Valentino DJ, Wong AWK, Chan KK, Stewart BK. Radiologic image communication methods. AJR 1990; 155: 183-186.

17. Stewart BK, Lou SL, Wong WK, Huang HK. An ultrafast network for communication of radiologic images. AJR 1991; 156: 835-839.

18. Stewart BK, Honeyman JC, Dwyer SJ. Picture archiving and communication system (PACS) networking: Three implementation strategies. Computerized Medical Imaging and Graphics 1991; 15: 161-169.

19. Taira RK, Stewart BK, Sinha U. PACS database architecture and design. Computerized Medical Imaging and Graphics 1991; 15: 171-176.

20. Stewart BK, Pratt RG, Thomas SR, Dieckman SL, Ridgway TH. Software and hardware integration of a microprogrammable state machine for NMR imaging. Magnetic Resonance Imaging 1991; 9: 627-634.

21. Stewart BK, Lou SL, Wong A, Chan KK, Huang HK. Performance characteristics of an ultrafast network for PACS. Proc SPIE 1991; 1446: 141-153.

22. Taira RK, Chan KK, Stewart BK, Weinberg WS. Reliability issues in PACS. Proc SPIE 1991; 1446: 451-458.

23. Wong WK, Stewart BK, Lou SL, Chan KK, Huang HK. Multiple communication networks for a radiological PACS. Proc SPIE 1991; 1446: 73-80.

24. Stewart BK. Local area network topologies, media and routing. Radiographics 1992; 12: 549-566.

25. Dwyer SJ, Stewart BK, Sayre JW, Honeyman JC. Wide area network strategies for teleradiology systems. Radiographics, 1992; 12: 567-576.

26. Dwyer SJ, Stewart BK, Sayre JW, Aberle DR, Boechat MI, Honeyman JC, Boehme JM, Roehrig H, Ji TL, Blaine GJ. Performance characteristics and image fidelity of gray-scale monitors. Radiographics 1992; 12: 765-772.

27. Stewart BK, Dwyer SJ, Kangarloo H. Design of a high-speed, high-resolution teleradiology network. Journal of Digital Imaging 1992; 5: 144-155.

**15. Bibliography (Refereed Journals, cont.):**

28. Dwyer SJ, Templeton AW, Anderson WH, Hensley KS, McFadden MA, Stewart BK, Honeyman JC, Cook LT, Baxter KG, Wingard RY, Hall CL. Teleradiology using switched dialup networks. IEEE Journal on Selected Areas in Communications 1992; 10: 1161-1172.

29. Stewart BK, Dwyer SJ. Teleradiology system analysis using a discrete event driven block oriented network simulator. Proc SPIE 1992; 1654: 2-13.

30. Stewart BK, Taira RK, Dwyer SJ, Huang HK. Acquisition and analysis of throughput rates for an operational, department-wide PACS. Proc SPIE 1992; 1654: 24-38.

31. Stewart BK, Dwyer SJ, Huang HK, Kangarloo H. Design of a high-speed, high-resolution teleradiology system. Proc SPIE 1992; 1654: 66-80.

32. Stewart BK, Taira RK, Dwyer SJ, Huang HK. Development and implementation of a PACS network and resource manager. Proc SPIE 1992; 1654: 530-535.

33. Dwyer SJ, Templeton AW, Stewart BK, Honeyman JC. Dial-up switched 56,000 bits-per-second teleradiology system. Proc SPIE 1992; 1654: 97-102.

34. Taira RK, Wong AWK, Stewart BK, Huang HK. Design of a PACS cluster controller. Proc SPIE 1992; 1654: 203-207.

35. Huang HK, Wong WK, Lou SL, Stewart BK. Architecture of a comprehensive radiologic imaging network. IEEE Journal on Selected Areas in Communications 1992; 10: 1188-1196.

36. Stewart BK, Dwyer SJ. Prediction of teleradiology system throughput by discrete event-driven, block-oriented network simulation. Investigative Radiology 1993; 28: 162-168.

37. Huang HK, Taira RK, Lou SL, Wong AW, Breant C, Ho BK, Chuang KS, Stewart BK, Andriole K, Tecotzky R, Bazzill T, Eldredge SL, Tagawa J, Barbaric Z, Boechat MI, Hall T, Bentson J, Kangarloo H. Implementation of a large-scale picture archiving and communication system. Computerized Medical Imaging and Graphics 1993; 17: 1-11.

38. Stewart BK, Aberle DR, Boechat MI, Barbaric Z, Taira RK, Sayre JW, Dwyer SJ. Clinical utilization of grayscale workstations. IEEE Engineering in Medicine and Biology 1993; 11: 86-102.

39. Dwyer SJ, Vannier MW, Wilson CR, Stewart BK, Spraggins TA. Computer applications and digital imaging. 78th scientific assembly and annual meeting: Radiological Society of North America--meeting notes Part 2. Chicago, November 29-December 4, 1992. Radiology 1993; 186: 939-940.

**15. Bibliography (Refereed Journals, cont.):**

40. Aberle DR, Gleeson F, Sayre JW, Brown K, Batra P, Young DA, Stewart BK, Ho BKT, Huang HK. The effect of irreversible image compression on diagnostic accuracy in thoracic imaging. Investigative Radiology 1993; 28: 398-403.

41. Stewart BK. Operational departmentwide picture archiving communication system analysis using discrete event-driven block-oriented network simulation. Journal of Digital Imaging 1993; 6: 126-139.

42. Gold RH, Kangarloo H, Grant EG, Yaghmai I, Stewart BK, Mankovich NJ, Sayre JW, Dwyer SJ. Teleconferencing for cost-effective sharing of radiology educational resources: Potential and technical development. AJR 1993; 160: 1309-1311.

43. Dwyer SJ, Stewart BK, Aberle DR, Boechat MI, Yao L, Marciano D. Electronic archiving for radiology image management systems. Proceedings of the Twelfth IEEE Symposium on Mass Storage Systems, April 26-29, 1993; Monterey, CA: 9-18.

44. Stewart BK, Mankovich NJ, Sayre JW, Dwyer SJ, Gold RH, Grant EG, Kangarloo H, Yaghmai I. Technical development of shared radiology educational resources via teleconferencing. Proc SPIE 1993; 1899: 284-295.

45. Dwyer SJ, Stewart BK, Spraggins TA, Aberle DR, Boechat MI, Sayre JW, Yao L, Marciano DM, Johnson SL. Modeling of radiographic retrievals: a Markov chain analysis. Proc SPIE 1993; 1899: 117-123.

46. Sayre JW, Lee JS, Stewart BK, Liu M, Dwyer SJ, McNitt-Gray MF, Huang HK, Cox GG, Cook LT. Techniques for multiple-signal multiple-reader evaluations. Proc SPIE 1993; 1899: 638-651.

47. Stewart BK, Dwyer SJ. Electronic archiving system analysis using mean value analysis, Jackson queuing models and block oriented network simulation. Proc SPIE 1993; 1899: 511-517.

48. Duerinckx A, Stewart BK. Overview of PACS and their impact on network evolution. Proc SPIE 1993; 1977: 4-11.

49. Dwyer SJ, Stewart BK, Spraggins TA. Modeling of analog film-file radiographic retrievals: a Markov chain. Investigative Radiology 1993; 28: 1144-1147.

50. Stewart BK, Kimme-Smith C, Johnson SL, Johnson T, Aberle DR. Simultaneous acquisition of storage phosphor and asymmetric screen-film chest images using a hybrid cassette. Proc SPIE 1994; 2163: 81-88.

51. Collins CA, Lane D, Frank M, Hardy ME, Smith DV, Haynor DR, Stewart BK, Parker JES, Bender GN, Kim Y. Design of a receiver operating characteristic (ROC) study of 10:1 lossy image compression. Proc SPIE 1994; 2166: 149-158.

**15. Bibliography (Refereed Journals, cont.):**

52. Gillespy T, Stewart, BK. Interactive display of computed radiographic images on personal computers. Proceedings of the Symposium for Computer Assisted Radiology (SCAR) 1994; 126.

53. Vannier MW, Combs MJ**,** Dwyer SJ, Stewart BK, Wilson CR. Computer applications and digital imaging. 79th scientific assembly and annual meeting: Radiological Society of North America--meeting notes Part 2. Radiology 1994; 190(3): 951-952.

54. Stewart BK, Gillespy T, Spraggins TA, Dwyer SJ. Functionality of Grayscale Display Workstation Hardware and Software in Clinical Radiology. Radiographics 1994; 14: 657-669.

55. Stewart BK. Adding Intelligence to PACS. Diagnostic Imaging 1994; 16(6): 81-84.

56. Stewart BK, Carter SJ, Rowberg AH. Application of the Advanced Communications Technology Satellite for Teleradiology and Telemedicine. Proc SPIE 1995; 2435: 210-219.

57. Dwyer SJ, Vannier MW, Cox GG, William MB, Huynh PT, Stewart BK, Boehme JM, Karellas A.. Computer applications and digital imaging. 80th scientific assembly and annual meeting: Radiological Society of North America--meeting notes Part 2. Radiology 1995; 194(2):616-618.

58. Stewart BK. PACS: A Phased Implementation Strategy. Administrative Radiology, 1995; 14(11): 10-16.

59. Frank MS, Stewart BK, Rowberg AH. Use of Data in a Radiology Information System for Labeling Computed Radiographs: An Interface to Connect the Two Systems. AJR 1995; 164:745-747.

60. Stewart BK, Carter SJ, Rowberg AH, Cook J, Abbe B, Pinck D. Real-time Compressed Video Ultrasound Using the Advanced Communications Technology Satellite. Proc. SPIE 1996; 2711: 194-204.

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79. Zamora D, Kanal KM, Dickinson R, Shuman WP, Stewart BK. Clinical Implementation of the NEMA (MITA) XR-25 CT dose-check standard. RSNA Annual Meeting, Chicago, Illinois November 2012 (*Oral Presentation*).

80. Zamora D, Kanal KM, Dickinson R, Shuman WP, Stewart BK. Clinical Implementation of the NEMA (MITA) XR-25 CT dose-check standard. RSNA Annual Meeting, Chicago, Illinois November 2012 (*Scientific Electronic Education Exhibit*).

81. Stewart BK, Kanal KM, Dickinson RL, Zamora D. Implementation of a Radiation Exposure Monitoring System for Surveillance of Multi-Modality Radiation Dose Data. The American Association of Physicists in Medicine, Annual Meeting, Austin, Texas, July 2014.

**15. Bibliography (Abstracts, *RSNA Scientific and Educational Exhibits* noted, cont.):**

82. Kanal KM, Hoff MN, Dickinson RL, Zamora D, Stewart BK. ABR Diagnostic Radiology Core Exam: Was Our Redesigned Physics Course Successful in Teaching Physics to Radiology Residents? American Association of Physicists in Medicine, Annual Meeting, Austin, TX, July 2014.

**16. Other (Invited Lectures, in addition to 108 other lectures at various scientific meetings):**

1. The Third International Symposium on PACS and PHD (Tokyo, Japan), "Keynote Lecture - System Description and Implementation of PACS at UCLA: Image Communication" (July 9, 1986). Invited by the President of the Japan Society of PACS - M. Onoe, M.D.

2. NATO Advanced Study Institute - Picture Archiving and Communication System (PACS) in Medicine (Evian, France), "Database Architecture and Design for PACS" (October 23, 1990). Invited by the NATO Advanced Study Institute on Picture Archiving and Communication Systems (PACS) in Medicine Program Committee - H.K. Huang, D.Sc.; Osman Ratib, M.D., Ph.D.; Albert Bakker, Ph.D.; Gerd Witte, Ph.D.

3. NATO Advanced Study Institute - Picture Archiving and Communication System (PACS) in Medicine (Evian, France), "Three Tiered Network Architecture for PACS Clusters" (October 24, 1990). Invited by the NATO Advanced Study Institute on Picture Archiving and Communication Systems (PACS) in Medicine Program Committee - H.K. Huang, D.Sc.; Osman Ratib, M.D., Ph.D.; Albert Bakker, Ph.D.; Gerd Witte, Ph.D.

4. American Association of Physicists in Medicine - Workshop on Computer Networks for the Medical Physicist (Los Angeles), "High-speed Communication Networks for Diagnostic Imaging" (1 February 1991). Invited by the Southern California Chapter of the American Association of Physicists in Medicine Education Committee - Bruce Liming, Chairman.

5. American Hospital Association MediTrends Education Series - Radiology Networks: Advantages in Diagnostic Imaging (Los Angeles), "Imaging Network Reliability: What Does It Mean?" (25 April 1991). Invited by the American Hospital Association.

6. Radiological Society of North America - Refresher Course 725 (Chicago, IL), "Mini Course PACS: Communications" (5 December 1991). Invited by the RSNA Refresher Course Committee - Donald R. Kirks, M.D., Chairman.

7. International Conference on Computers in Clinical Dentistry (Los Angeles, CA), "Networking for the Dental Office, an Examination of Interconnectivity Solutions Appropriate for the Clinical Environment" (17 September 1992). Invited by the International Conference on Computers in Clinical Dentistry Conference Committee.

8. International Conference on Computers in Clinical Dentistry (Los Angeles, CA), "IMACS, PACS, DICOM - Communication Standards - What are they and why does Dentistry Need Them?" (17 September 1992). Invited by the International Conference on Computers in Clinical Dentistry Conference Committee.

**16. Other (Invited Lectures, in addition to 108 other lectures at various scientific meetings, cont.):**

9. Radiological Society of North America - Special Course on Computers in Radiology (Chicago, IL), "PACS Communications: Network Topologies, Media and Routing" (2 December 1992). Invited by the RSNA Refresher Course Committee - Donald R. Kirks, M.D., Chairman.

10. Radiological Society of North America - *info*RAD (Chicago, IL), "Electronic Archiving" (3 December 1992). Invited by the RSNA Electronic Communications Committee - Laurens V. Ackerman, M.D., Ph.D., Chairman.

11. 1993 AAPM Summer School on Digital Radiology (Charlottesville, VA), "Mini-PACS" (1 August 1993). Invited by the AAPM Summer School Program Directors - William R. Hendee, Ph.D. and Jon Trueblood, Ph.D.

12. Radiological Society of North America - Refresher Course (Chicago, IL), "Information Systems for Radiology Clinical Practice and Research: Adding Intelligence to PACS" (28 November 1993). Invited by the RSNA Refresher Course Committee - Donald R. Kirks, M.D., Chairman.

13. Radiological Society of North America - *info*RAD (Chicago, IL), "Digital Communications in Radiology: The University of Washington Experience" (29 November and 1 December 1993). Invited by the RSNA Electronic Communications Committee - Laurens V. Ackerman, M.D., Ph.D., Chairman.

14. American Association of Physicists in Medicine, 36th Annual Meeting (Anaheim, CA), "PACS versus Teleradiology Requirements" (25 July 1994). Invited by the AAPM Educational Program Committee Chair - Perry Sprawls, Ph.D.

15. Radiological Society of North America - Refresher Course (Chicago, IL), "Information Systems for Radiology Clinical Practice and Research: Adding Intelligence to PACS" (December 1994). Invited by the RSNA Refresher Course Committee - Donald R. Kirks, M.D., Chairman.

16. Radiological Society of North America - *info*RAD (Chicago, IL), "PACS and Teleradiology System Performance Modeling and Simulation" (1 and 2 December 1994). Invited by the RSNA Electronic Communications Committee - Laurens V. Ackerman, M.D., Ph.D., Chairman.

17. Joint Engineering in Medicine & Biology and Communications Society Conference (Bellevue, WA), "Electronic Imaging in Medicine - A Decade of Change and the Future" (23 February 1995). Invited by the IEEE Engineering in Medicine & Biology Society - Ming Li, Ph.D., Chairman.

18. State of Washington Governor's Telecommunications Policy Coordination Task Force, "Telecommunications Infrastructure Deployment to Facilitate Health Care Services" (22 June 1995). Invited by the Governor's Telecommunications Policy Coordination Task Force, Len McComb, Chairman.

19. Radiological Society of North America - Refresher Course (Chicago, IL), "Diagnostic Physics Categorical Course - Digital Image Processing: Exchange Media and Networks for Digital Fluoroscopy and Cineangiography Applications" (29 November 1995). Invited by the RSNA Refresher Course Committee - Donald R. Kirks, M.D., Chairman.

**16. Other (Invited Lectures, in addition to 108 other lectures at various scientific meetings, cont.):**

20. Radiological Society of North America - Refresher Course (Chicago, IL), "Clinical Practice and Research Information Systems for Radiology's Next Century: Intelligent Display Systems" (30 November 1995). Invited by the RSNA Refresher Course Committee - Donald R. Kirks, M.D., Chairman.

21. Joint Engineering in Medicine & Biology and Communications Society Conference (Bellevue, WA), "Real-time Compressed Video Ultrasound Using the Advanced Communications Technology Satellite" (14 May 1996). Invited by the IEEE Engineering in Medicine & Biology Society - Tat-Jin Teo, Ph.D., Chairman.

22. Radiological Society of North America - Refresher Course (Chicago, IL), "Clinical Information Systems for Radiology: Informatics Infrastructure for Healthcare Providers" (4 December 1996). Invited by the RSNA Refresher Course Committee - Carol B. Stelling, M.D., Chairman.

23. Radiological Society of North America - *info*RAD (Chicago, IL), "Is there a Place for Digitized Video in Radiological PACS?" (1 December 1996). Invited by the RSNA Electronic Communications Committee - C. Carl Jaffe, M.D., Chairman.

24. Telemedicine West Conference, "The Search for Common Ground: Balancing Telemedical Clinical Requirements, Cost-effectiveness and Platform and Network Options" (11 December 1996). Invited by the Telemedicine West Advisory Board - Jay Sanders, M.D., Chairman.

25. Washington State Board of Health Telemedicine Discussion, "Telemedicine: An Interim Report" (8 January 1997). Invited by the Washington State Board of Heath - Warren Featherstone Reid, Chairman.

26. Tribal Healthcare Building Blocks: Telecommunications and Information Technology, "Clinical Requirements" (16 July 1997). Invited by the Conference Manager - Paulette Hansen.

27. Radiological Society of North America - *info*RAD (Chicago, IL), "Is there a Place for Digitized Video in Radiological PACS?" (3 December 1997). Invited by the RSNA Electronic Communications Committee - C. Carl Jaffe, M.D., Chairman.

28. IEEE Signal Processing Society International Conference on Image Processing, Special Session on Medical Imaging (Chicago, IL), "Medical Imaging Databases and Informatics" (7 October 1998). Invited by Zhi-Pei Liang, Ph.D., Organizing Committee.

29. 1999 AAPM Summer School on Practical Digital Imaging and PACS (Sonoma State University, CA), "Network, Pipes and Connectivity" (29 June 1999) and "Teleradiology" (30 June 1999). Invited by the AAPM Summer School Program Director – J. Anthony Seibert, Ph.D.

30. Toward an Electronic Patient Record Conference 2002 (Seattle, WA), "Linking Laboratories and Radiology to EMRs" (12 May 2002). Invited by the Program Director of the American Academy of Family Physicians Spring Technology Conference – Tom E. Norris, MD.

**16. Other (Invited Lectures, in addition to 108 other lectures at various scientific meetings, cont.):**

31. Northwest American Association of Physicists in Medicine 2010 Spring Meeting (Portland, OR), "CT Dose and Perceived Risk" (30 April 2010). Invited by the Northwest American Association of Physicists in Medicine Chapter President – M. Miron Zaini, PhD.

32. Washington State Radiological Society 2011 Annual Meeting (Kirkland, WA), "X-ray Dose QA Program" (5 November 2011). Invited by the WSRS President, Justin Smith, MD.