Abbreviated Resume

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Synopsis:

As an academic anesthesiologist and human factors engineer (HFE), I have been teaching and conducting research in HFE, human centered design (HCD), medical device development and innovation, patient safety, and decision making for more than 30 years. I have published more than 200 papers and been on nearly 70 grants & contracts (including 15 federal projects as PI). I have given more than 250 invited presentations and received recognition for my mentoring and teaching as well as several prestigious awards for contributions to HFE and safety.

In my effort to apply HFE theory and methods to health care, I seek out and disseminate cross-disciplinary learning from other industries to improve understanding, research methods, and clinical tools & processes. I have designed, evaluated, implemented, and promulgated best practices and technologies to improve care quality and safety. I was an early adopter of medical simulation and continue to be a leader in research in simulation training and assessment.

My early efforts focused on developing meaningful measures of healthcare system safety and clinician performance. For example, in the early 1990s, my colleagues and I popularized behavioral task analysis (i.e., time-motion analysis) as a tool to evaluate clinician workflow and performance. We introduced a number of HFE methods, used in military, aviation, and other domains, to measure clinician workload and situation awareness during actual patient care. These HFE tools and methods were used to evaluate clinician performance under real-world conditions, including the effects of the introduction of new technology.

I was the first to refine and apply to healthcare the concept of non-routine events (NREs). A NRE is defined as any event that deviates from optimal or expected care for a specific patient in a specific clinical situation. My team and I have captured thousands of NREs across many clinical domains. We have found that NREs are: reported reliably by both clinicians and patients; frequent (≥1 NRE in 20%–60% of all care episodes studied); capture a wide cross-section of potential system failure modes; and are associated with other measures of care quality and of clinician stress.

Clinicians often complain that health care processes, policies, and devices are designed and introduced without adequate understanding of the needs, demands, and realities of real-world clinical care. Human-centered design (HCD), a HFE method, strives to account for these contextual factors by incorporating structured end-user input in all stages of design and deployment. For 25 years, I have promulgated HCD in health care, have conducted research using HCD methods, and consulted for industry in technology user interface design and evaluation. I was also the leader of the national committee that developed two important medical device user interface design. I have also advocated for safer and more usable health information technology (HIT) for both clinicians and patients through the structured application of HCD and HFE methods.

While I have always been an innovator and entrepreneur, this has been a more prominent component of recent efforts. I have been a consultant to more than two dozen medical technology companies (including many start-ups). For two infusion pumps, I designed the user interfaces of and successfully helped to shepherd through FDA approval and commercialization.

Current Positions (oldest to most recent)

2005 – Professor of Anesthesiology, Biomedical Informatics, and Medical Education, Vanderbilt University (Nashville, TN)

2010 – 25 Director, Center for Research and Innovation in Systems Safety (CRISS), Vanderbilt University Medical Center (Nashville, TN)

2016 – Professor of Civil and Environmental Engineering, Vanderbilt University School of Engineering (Nashville, TN)

Previous Major Positions (oldest to most recent)

1987 – 93 Assistant Professor of Anesthesiology, University of California San Diego (UCSD) School of Medicine (La Jolla, CA)

1987–2004 Staff Physician, VA San Diego Medical Center (La Jolla, CA)

1990 – 95 Adjunct Assistant Member, Department of Neuropharmacology, The Research Institute of Scripps Clinic (TSRI) (La Jolla, CA)

1995–2004 Adjunct Associate Member, Department of Neuropharmacology, TSRI

1998–2004 Professor of Anesthesiology, UCSD

2005 – 10 Director, Center for Perioperative Research in Quality (CPRQ), Vanderbilt University (Nashville, TN) [Note name changed to CRISS in 2010]

2005 – 11 Director, Simulation Technologies Program, Center for Experiential Learning and Assessment (CELA), Vanderbilt University (Nashville, TN)

2005 – 20 Staff Physician, VA Tennessee Valley Healthcare System (Nashville, TN)

2008 – 20 Vice Chair for Faculty Affairs, Department of Anesthesiology, Vanderbilt University and Vanderbilt University Medical Center (VUMC)

2011 – 22 Director of Research, CELA

2022 – 23 Visiting Senior Scientist, Hospital virtual Valdecilla (HvV), Santander, Spain

Education & Training (oldest to most recent)

1974 – 78 Stanford University (Stanford, CA), BS in Electrical Engineering & MS in Biological Sciences (Neurosciences).

1978 – 82 University of California, San Diego, School of Medicine, MD degree.

1982 – 83 Internal Medicine Internship, Cedars-Sinai Medical Center (Los Angeles, CA)

1983 – 85 Anesthesia Residency at the University of California, San Francisco

1986 – 87 Postdoctoral Research Fellowship, Department of Anesthesiology, UCSD and Department of Neuropharmacology, TSRI (Drs. N. Ty Smith & George F. Koob, mentors)

1996 – 97 Fellowship in the Management of Perioperative Services, Department of Anesthesia, Stanford University (Stanford, CA)

Publication Summary

	Publications Considered	Citing Articles	Times Cited	Average per cite	H-index	Date last accessed
Web of Science	205	4,514	5,329	26	39	August 1, 2024

Google Scholar	335	n/a	11,731	34.8	55	August 1, 2024

Grant and Contract Summary

Total Awards Received	69	37 federal, 17 foundation, & 15 other
Roles in Awarded Projects	35 as PI (15 federal), 16 as Mentor, & 18 as Co-Investigator	
Funding Awarded	Actual $ Awarded	Adjusted to 2023 Dollars
All	$24,969,000	$33,722,000
Federal (overall)	$20,565,000	$27,096,000
Federal (as PI)	$7,801,853	$10,964,000
Allocated effort	Total 14.25 own FTE	Average of over 40% annually

Invited Presentation Summary

- 5 named lectureships
- 32 international invited presentations (including 5 Keynote speakers and 26 Visiting Professorships)
- 218 National invited presentations (including 5 Keynote speakers and 29 Visiting Professorships)

Academic Service

Leadership and substantive service:

- National Academies of Sciences, Engineering, and Medicine – 4 years on the Board on Human Systems Integration (BOHSI), servedon the Clinician well-being report panel.
- Anesthesia Patient Safety Foundation (APSF) – 21 years on the Board of Directors incl. 12 years as the Secretary
- Association for the Advancement of Medical Instrumentation (AAMI) – 6 years on the Board of Directors incl. as Vice Chair for Research and 5 years on the AAMI Foundation Board of Directors
- Society for Technology in Anesthesia (STA) – 14 years incl. as President
- American Society of Anesthesiologists (ASA) – 13 years developing and overseeing simulation-based education
- American Board of Anesthesiology (ABA) – 25 years as an Examiner, 7 years as a member of the OSCE Committee
- Anesthesia Quality Instituted (AQI) of the ASA – 3 years on the Board of Directors incl. as Vice Chair

Grant reviewing: AHRQ (Special emphasis panel on patient safety), NIH/HSOD and NIH Challenge Grants, Swiss National Science Foundation, McArthur Fellows Program, Anesthesia Patient Safety Foundation (11 years)

Editorial boards: *Human Factors* (11 years incl. 6 years as Associate Editor for Health and Healthcare Systems), *Simulation in Healthcare* (10 years), AHRQ *WebM&M* (6 years), *Pharmacology, Biochemistry and Behavior* (6 years).

Advisory Boards: The United States Pharmacopeia (USP) (11 years), Agency for Healthcare Research and Quality (AHRQ) Technical Expert Panel, FAER Advisory Council, and for several research project entities funded by AHRQ and the VA.

Member, *Academy of Research Mentors in Anesthesiology* of the Foundation for Anesthesia Education and Research (FAER, 8 yrs, current).

Industry Consulting and Service

Consultant to the Food and Drug Administration (FDA): Advisory Panel on Gastroenterology and Urological Devices, Center for Devices and Radiological Health (CDRH) (10 yrs) and Anesthesiology and Critical Care Section, Center for Drug Evaluation (CDE) (1 yr)

Medical Director of Alaris-Cardinal (3 yrs), Ivenix (11 yrs, sold to Fresenius-Kabi), Fluidnet (7 yrs), & Fluidsense (7 yrs)

Corporate Scientific Advisory Boards (n=7): Fresenius-Kabi/Ivenix (current), Covidien, DocuSys (3 yrs), Fluidsense (3 yrs), iAC LLC, MedVis (2 yrs), Novatelligence (3 yrs)

Consulting engagements on medical technology design, development, and clinical use with a focus on human factors and user experience:

- Pharmaceutical companies (n=4): Astra, Glaxo, Janssen (9 yrs), & Organon
- Major medical device companies (n=11): Alaris-Cardinal (3 yrs), BD-CRISI (3 yrs), Covidien (3 yrs), Criticon, Diatek/Arkive (3 yrs), Drager, Fresenius-Kabi (current), Guidant (3 yrs), Hewlett-Packard, LMA NA, Ohmeda (6 yrs), & Puritan Bennett
- Medical device *startup* companies (n=14): Covalent Materials, Docusys (4 yrs), Emtek, Fluidnet (7 yrs), Fluidsense (7 yrs), iAC LLC (3 yrs, New Zealand), Ivenix (11 yrs), MedVis (3 yrs), Novatelligence (4 yrs, Sweden), Philometron, Trevena, Vapotronics, ViaMedical, & Woodside Biomedical

Reviewer for *Medical Design Excellence Awards*, Canon Communications (3 yrs)

National and International *standards work*:

- AAMI/ANSI Human Engineering Committee (23 yrs incl. 13 as user Co-Chairman). Developed HE-74 and HE-75 which became IEC 62366.
- AAMI/ANSI Health Information Technology Committee (8 years, current), focused on national standards for safety and risk of HIT.
- American Society for Testing and Measurement (ASTM) Committee F-29 on Anesthetic and Respiratory Equipment (13 yrs).
- Member, ISO/IEC Joint Working Group 4 (Medical devices: General requirements for safety and essential performance – usability) of Technical Committee 210 *and* Working Group 5 (Ergonomics and Symbols) of Subcommittee 62A of IEC Technical Committee 62 (Electrical equipment in medical practice – 8 years.