Douglas R. Bish
Professor - Information Systems, Statistics, and Management Science,
Culverhouse College of Business,
University of Alabama
drbish@cba.ua.edu

Summary

I am a Professor of Operations Management in the Department of Information Systems, Statistics, and Management Science in the Culverhouse College of Business at the University of Alabama. I use operations research (e.g., optimization, simulation, stochastic models), decision science, and data analytic tools to solve complex research problems in healthcare, emergency management, and logistics. Current research projects include improving public health screening, hospital and regional evacuation management, disaster response management, and humanitarian supply chains. My objectives are to produce research that advances the fields of operations research and decision making and improves the current state of practice in the application areas studied. Towards these goals, I publish in leading operations research journals (e.g., Operations Research, Management Science, INFORMS Journal on Computing, Transportation Science, IISE Transactions, Naval Research Logistics) and application area journals, as well as cultivate external research collaborators, including collaborations with Carilion Clinics, the American Red Cross, the Los Angeles County Emergency Medical Services Agency, the New York Department of Health, and the North Carolina State Laboratory of Public Health. My research has been supported by multiple National Science Foundation grants, including the CAREER award, and by industry grants.

I teach a variety of courses, from methodological courses in optimization (e.g., linear and nonlinear optimization, network flows), to applied courses in supply chain and logistics.

Education

PhD in Civil and Environmental Engineering, Virginia Tech, Blacksburg, VA, Major: Transportation and Infrastructure Systems, Dissertation: *Staging and Routing Strategies in Evacuation Planning: Models, Insights, and Applications.* (Advisers: Antoine Hobeika and Hanif Sherali), 2006.

MS in Industrial Engineering and Management Science, Northwestern University, Evanston, IL.

MS in BioMedical Engineering, Northwestern University, Evanston, IL, Thesis: *Enzymatic reaction rate limits with constraints on equilibrium constants and experimental parameters.*

BS in Industrial and Manufacturing Engineering, California Polytechnic State University, San Luis Obispo, CA.

Work Experience

Professor of Operations Management (2020-present): Information Systems, Statistics, and Management Science, Culverhouse College of Business, The University of Alabama

Associate Professor (2013-2020): Industrial and Systems Engineering, Virginia Tech.

Assistant Professor (2006-2013): Industrial and Systems Engineering, Virginia Tech.

Instructor (2005): Department of Civil and Environmental Engineering, Virginia Tech.

Systems Analyst & Project Leader (1996-2003): United Airlines, R&D, Chicago, IL
Led a team in research and development projects in revenue management and scheduling. These projects utilized operations research and related methodologies, including optimization, network analysis, experimental design, econometric models, large-scale simulation, and algorithmic techniques suitable for large-scale problems.

Instructor (1996): Industrial Engineering and Management Science, Northwestern University, Evanston, IL.

Research and Teaching Assistant (1994-1996): Biomedical Engineering and Industrial Engineering and Management Science, Northwestern University, Evanston, IL.

Honors and Awards

- National Science Foundation **CAREER** Award Recipient for *CAREER: Decision support models for hospital and regional evacuations.* (#1055360).
- Winner of the 2019 Best Applications Paper in the IISE Transactions Focused Issue on Operations Engineering and Analytics for the paper: Aprahamian*, H.Y., Bish, E.K., and Bish, D.R. (2018). *Adaptive risk-based pooling in public health screening.* IISE Transactions 50(9):753-766.
- Runner-up for the 2017 INFORMS Pierskalla Award for the Best Paper in Healthcare Management Science for the paper: Aprahamian*, H.Y., Bish, D.R., and Bish, E.K. (2019). *Optimal risk-based group testing.* Management Science 65(9):3949-4450.
- Finalist for the 2015 INFORMS Pierskalla Award for the Best Paper in Healthcare Management Science for the paper: El-Amine*, H., Bish, E.K., and Bish, D.R. (2017). *Robust post-donation blood screening under prevalence rate uncertainty.* Operations Research 66(1):1-17.
- Winner of the Best Applications Paper in the IIE Transactions Focused Issue on Operations Engineering and Analytics for 2016 for the paper: Bish, D.R., Bish, E.K., Xie*, S.R., and Stramer, S.L., (2014). *Going beyond "same-for-all" testing of infectious agents in donated blood.* IIE Transactions 46(11):1147-1168.
- Winner of the 2011 INFORMS Pierskalla Award for the Best Paper in Healthcare Management Science for the paper: Bish, D.R., Bish, E.K., Xie*, S.R., and Slonim, A.D. (2011). *Optimal selection of screening assays for infectious agents in donated blood.* IIE Transactions on Healthcare Systems Engineering 1(2):67-90.
- Industrial & Systems Engineering Paul E. Torgersen Outstanding Teaching Award 2011.

Advisee Honors and Awards

- Hussein El Hajj (current PhD student)
  - Second-place, 2019 INFORMS Health Application Society Student Paper Competition.
- Hrayer Aprahamian (**Assistant Professor**, Industrial Engineering, Texas A&M)

  - Winner, 2019 IISE Pritsker Doctoral Dissertation Award.
  - Winner, 2018 Paul E. Torgersen Graduate Research Award for *Risk-based group testing, with equity and robustness considerations.*
  - Runner-up, 2017 INFORMS Pierskalla Award for the Best Paper in Healthcare.
  - Finalist, 2017 INFORMS Seth Bonder Scholarship for Applied Operations Research in Health Services, for his PhD research on public health screening.

- Hadi El-Amine (**Assistant Professor**, Systems Engineering and Operations Research, George Mason University)
  - Second-place, 2017 IISE Pritsker Doctoral Dissertation Award.
  - Finalist, 2015 INFORMS Pierskalla Award for the Best Paper in Healthcare.
  - 2015 INFORMS Seth Bonder Scholarship for Applied Operations Research in Health Services, for his PhD research on optimization of blood screening assays.
  - Finalist, 2014 WINFORMS Student Excellence Award, for his PhD research.

- Behrooz Kamali (**Research Assistant Professor**, Industrial and Management Systems Engineering, West Virginia University)
  - Second-place, 2013 IIE Doctoral Colloquium Poster Competition, for *Risk-based decision support for adult and pediatric patient triage in emergency response.*

- Shiguang Xie (Position: Senior Scientist-Analytic Science, FICO)
  - Winner, 2011 INFORMS Pierskalla Award for the Best Paper in Healthcare.
  - Winner, 2016 Best Applications Paper in the IIE Transactions Focused Issue on Operations Engineering and Analytics.

Publications (student advisees denoted with *)

Journal Publications

35. El-Hajj*, H., Bish, D.R., and Bish, E.K., *Optimal genetic screening for cystic fibrosis.* Accepted Operations Research.
Second-place, 2019 INFORMS Health Application Society Student Paper Competition.

34. El-Hajj*, H., Bish, D.R., Bish, E.K., and Aprahamian, H.Y. *Screening multi-dimensional heterogeneous populations for infectious diseases under scarce testing resources, with application to COVID-19.* Accepted Naval Research Logistics.

33. Bish, D.R., Bish, E.K., El-Hajj*, H., and Aprahamian, H.Y. (2021) *A robust pooled testing approach to expand COVID-19 screening capacity.* Accepted PLOS ONE.

32. El-Hajj*, H., Bish, D.R., and Bish, E.K. (2021). *Equity in genetic newborn screening.* Naval Research Logistics 68(1):44-64.

31. Aprahamian*, H.Y., Bish, E.K., and Bish, D.R. (2020). *Static risk-based group testing schemes under imperfectly observable risk.* Stochastic Systems 10(4):361-390.

30. Aprahamian*, H.Y., Bish, D.R., and Bish, E.K. (2020). *Optimal group testing: Structural properties and robust solutions, with application to public health screening.* INFORMS Journal on Computing 32(4):895-911.

29. Sadeghzadeh*, S., Bish, D.R. and Bish, E.K. (2020). *Optimal data-driven policies for disease screening under noisy biomarker measurement.* IISE Transactions 52(2):166-180.
Featured in the January 2019 issue of ISE magazine.

28. Aprahamian*, H.Y., Bish, D.R., and Bish, E.K. (2019). *Optimal risk-based group testing.* Management Science 65(9):3949-4450.
Runner-up for the 2017 INFORMS Pierskalla Award for the Best Paper in Healthcare.

27. Nguyen*, N., Aprahamian*, H.Y., Bish, E.K., and Bish, D.R. (2019). *A methodology for deriving the sensitivity of pooled testing, based on viral load progression and pooling dilution.* Journal of Translational Medicine 17:252.

26. Aprahamian*, H.Y., Bish, E.K., and Bish, D.R. (2018). *Adaptive risk-based pooling in public health screening.* IISE Transactions 50(9):753-766.
Winner of the Best Applications Paper in the 2019 IISE Transactions Focused Issue on Operations Engineering and Analytics and featured in the August 2018 issue of IISE magazine.

25. El-Amine*, H., Bish, E.K., and Bish, D.R. (2017). *Robust post-donation blood screening under prevalence rate uncertainty.* Operations Research 66(1):1-17.
Finalist for the 2015 INFORMS Pierskalla Award for the Best Paper in Healthcare.

24. Bish, D.R., Tarhini, H., Amara, R., Zoraster, R., Bosson, N., and Gausche-Hill, M. (2017). *Modeling to optimize hospital evacuation planning in EMS systems.* Prehospital Emergency Care 21(4):503-510.

23. Kamali*, B., Bish, D.R., and Glick, R. (2017). *Optimal service order for mass-casualty incident response.* European Journal of Operational Research 261(1):355-367.

22. El-Amine*, H., Bish, E.K., and Bish, D.R. (2017). *Optimal pooling strategies for Nucleic Acid Testing of donated blood considering viral load growth curves and donor characteristics.* IISE Transactions on Healthcare Systems Engineering 7(1):15-29.

21. Aprahamian*, H.Y., Bish, D.R., and Bish, E.K. (2016). *Residual risk and waste in donated blood with pooled Nucleic Acid Testing.* Statistics in Medicine 35(28):5283-5301.

20. Tarhini*, H. and Bish, D.R. (2016). *Routing strategies under demand uncertainty.* Networks and Spatial Economics 16(2):665-685.

19. Pereira*, V.C. and Bish, D.R. (2015). *Scheduling and routing for a bus-based evacuation with constant evacuee arrival rates.* Transportation Science 49(4):853-867.

18. Bish, E.K., Moritz, E.D., El-Amine*, H., Bish, D.R., and Stramer, S.L. (2015). *Cost effectiveness of Babesia microti antibody and nucleic acid blood donation screening using results from prospective investigational studies.* Transfusion 55(9):2256-2271.

17. Bish, D.R., Bish, E.K., Xie*, S.R., and Stramer, S.L. (2014). *Going beyond "same-for-all" testing of infectious agents in donated blood.* IIE Transactions 46(11):1147-1168.

Winner of the Best Applications Paper in the IIE Transactions Focused Issue on Operations Engineering and Analytics for 2016 and featured in the October 2014 issue of IIE's Industrial Engineer magazine.

16. Bish, D.R., Agca*, E., and Glick, R. (2014). *Decision support for hospital evacuation and emergency response.* Annals of Operations Research 221(1):89-106.

15. Bish, E.K., Ragavan*, P.K., Bish, D.R., Slonim, A.D., Stramer, S.L. (2014).*A probabilistic method for the estimation of residual risk in donated blood.* Biostatistics 15(4):620-635.

14. Bish, D.R., Sherali, H.D., and Hobeika, A.G. (2014). *Optimal evacuation planning using staging and routing.* Journal of the Operational Research Society 65:124-140.

13. Glick, R., Bish, D.R., and Agca*, E., (2013). *Optimization-based decision support to assist in logistics planning for hospital evacuations.* Journal of Emergency Management 11(4):261-270.

12. Bish, D.R., Chamberlayne*, E.P., and Rakha, H.A. (2013). *Optimizing network flows with congestion-based flow reductions.* Networks and Spatial Economics 13(3):283-306.

11. Bish, D.R. and Sherali, H.D. (2013). *Aggregate-level demand management in evacuation planning.* European Journal of Operational Research 224(1):79-92.

10. Bish, E.K., Zeng, X., Liu*, J., and Bish, D.R. (2012). *Comparative statics analysis of multi-product newsvendor networks under responsive pricing.* Operations Research 60(5):1111-1124.

9. Chamberlayne*, E.P., Rakha, H.A., and Bish, D.R. (2012).*Modeling the capacity drop phenomenon at freeway bottlenecks using the INTEGRATION software.* Transportation Letters: The International Journal of Transportation Research 4(4):227-242.

8. Xie*, S.R., Bish, D.R., Bish, E.K., Slonim, A.D., and Stramer, S.L. (2012). *Safety and waste considerations in donated blood screening.* European Journal of Operational Research 217(3):619-632.

7. Bish, D.R. (2011).*Planning for a bus-based evacuation.* OR Spectrum 33(3):629-654.

6. Bish, D.R., Bish, E.K., Xie*, S.R., and Slonim, A.D. (2011). *Optimal selection of screening assays for infectious agents in donated blood.* IIE Transactions on Healthcare Systems Engineering 1(2):67-90.
Winner of the 2011 INFORMS Pierskalla Award for the Best Paper in Healthcare.

5. Bish, D.R., Bish, E.K., Liu*, J., and Liao, L. (2011). *Revenue management with aircraft re-assignment flexibility.* Naval Research Logistics 58(2):136-152.

4. de la Garza, J.M., Akyildiz, S., Bish, D.R., and Krueger, D.A. (2011). *Network-level optimization of pavement maintenance renewal strategies.* Advanced Engineering Informatics 25(4):699-712.

3. Bish, E.K., Liu*, J., and Bish, D.R. (2010). *A note on resource flexibility with responsive pricing.* Naval Research Logistics 57(2):119-126.

2. Bish, E.K., Suwandechochai, R., and Bish, D.R. (2004). *Strategies for managing the flexible capacity in the airline industry.* Naval Research Logistics 51(5):654-685.

1. Bish, D.R. and Mavrovouniotis, M.L. (1998). *Enzymatic reaction rate limits with constraints on equilibrium constants and experimental parameters.* BioSystems 47(1):37-60.

Journal Manuscripts - In Process

- El-Hajj*, H., Bish, D.R., Bish, E.K., and and Kay, D., *Novel pooling strategies for genetic testing, with application to newborn screening.* Under revision, Management Science.
- Nguyen*, N., Bish, E. K. and Bish, D.R., *Optimal pooled testing design for prevalence estimation.*
- Bish, D.R., Tarhini*, H., and Agca*, E., *Hospital evacuation planning; efficiency and fairness.*
- Bish, D.R. and Tarhini*, H., *Traffic management under congestion-based flow reductions.*
- Bartholomew*, P. and Bish, D.R., *Coordinating the response to a mass-casualty incident.*
- Sadeghzadeh*, S., Bish, D.R., and Bish, E.K., *The effect of seasonality on the Immunoreactive Trypsinogen test in newborn screening for cystic fibrosis.*
- Sadeghzadeh*, S., Bish, D.R., and Bish, E.K., *Immunoreactive Trypsinogen testing with data-driven policies for cystic fibrosis screening in newborns.*

Other Publications

- Bish, E.K., Moritz, E.D., El-Amine*, H., Bish, D.R., and Stramer, S.L. (2016). Letter to the editor: *Cost-effectiveness of Babesia microti antibody and nucleic acid blood donation screening using results from prospective investigational studies.* Transfusion 56(3):775-777 (peer-reviewed).
- Bish, E.K., H. El-Amine*, D.R. Bish, S.L. Stramer, and A.D. Slonim, *Optimal selection of assays for detecting infectious agents in donated blood.* Chapter to appear in Disease Prevention and Treatment, Eds. N. Kong and S. Zhang, Wiley.
- Bish, D.R.,Bish, E.K. , and Maddah, B. (2008). *Capacity planning and yield management.* Handbook of Logistics Engineering, Ed. G.D. Taylor, CRC Press.

Research Projects

Emergency Management Research: This project studies planning for, and operation management of, emergency responses such as hospital evacuations, regional evacuations (including both automobile and bus based evacuations), and mass casualty incidents. Such emergency responses are complex problems, e.g., hospital evacuations require hundreds of interrelated resource allocation and scheduling decisions, which must be made to minimize the risk to patients, which stems from both the threat (e.g., an earthquake or hurricane) and the evacuation process itself (medically, it is less than ideal to transfer many hospital patients). The regional evacuation research studies how to manage automobile based evacuations, given the limited roadway resources, using both supply and demand techniques. The bus-based evacuation research studies

evacuation planning for those without reliable access to an automobile. The research uses network modeling and deterministic and stochastic optimization. *Collaborators* include Carilion Clinics and the Los Angeles County Emergency Medical Services Agency. The following grants have partially supported this research:

- *CAREER: Decision support models for hospital and regional evacuations.* National Science Foundation (#1055360); Role: PI (100% Responsibility).
- *Planning decision support tools for large-scale pediatric emergencies.* Carilion Clinic; Role: PI (100% Responsibility).
- *Optimization-based decision support tools for hospital evacuations.* Carilion Clinic; Role: PI (100% Responsibility).
- *Review of hospital evacuation best practices.* Carilion Clinic; Role: PI (100% Responsibility).
- *Evacuation planning with demand management.* National Science Foundation (#0825611); Role: PI (100% Responsibility).
- *Evacuation planning with demand management.* National Science Foundation (#0825611); Role: PI (100% Responsibility).

Public Health Research: This project studies optimal screening strategies for public health applications, from reducing pathogen transmission through the blood supply to newborn screening. Mathematical models are developed to design screening strategies that maximize classification accuracy will considering testing budgets and imperfect tests. *Collaborators* include Carilion Clinics, American Red Cross, and the New York and North Carolina Laboratories of Public Health. The following grants have partially supported this research:

- *GOALI: Pooled screening design for disease biomarkers.* National Science Foundation (#1761842); Role: PI (50% Responsibility).
- *Optimal blood screening strategies for infectious agents: Mathematical models and decision support tools.* National Science Foundation (#1129688); Role: Co-PI (50% Responsibility).

Federal Grant Support:

- National Science Foundation (CMMI). *GOALI: Pooled screening design for disease biomarkers.* NSF #1761842, Role: PI, Period: 6/15/2018 - 5/31/2021, Funding Level: $479,489, with E. Bish (Virginia Tech) and S.J. Zimmerman (North Carolina State Laboratory of Public Health).
- National Science Foundation (CMMI). *Optimal blood screening strategies for infectious agents: Mathematical models and decision support tools.* NSF #1129688, Role: co-PI, Period: 8/15/2011 - 8/14/2015, Funding Level: $340,000, with E. Bish (Virginia Tech), S. Stramer (American Red Cross), and A. Slonim (Renown Healthh/Carilion Clinic). Featured on NSF's Science, Engineering & Education (SEE) Innovation site.
- National Science Foundation (CMMI). *CAREER: Decision support models for hospital and regional evacuations.* NSF #1055360, Role: PI, Period: 8/15/2011-8/14/2017, Funding Level: $400,000.

- National Science Foundation (CMMI). *Evacuation planning with demand management.* NSF #0825611, Role: PI, Period: 8/15/2008-8/14/2012, Funding Level: $254,783.

Federal Grants Pending or in Development:

- National Science Foundation LEAP HI Program. *Mathematical models for mitigating emerging vector-borne diseases.* Submitted and under review.with E. Bish (University of Alabama), M. Diuk-Wasser (Columbia University, Dept. of Ecology, Evolution and Environmental Biology).
- National Institutes of Health (R21). *Optimal newborn screening algorithms for cystic fibrosis.* Under development (was submitted to National Institutes of Health, but was not funded, scored 42th percentile), with E. Bish (University of Alabama) and D. Kay (New York State Laboratory of Public Health).
- *Operations management and planning for large scale emergencies.* Under development with M. Gausche-Hill and N. Bosson (both from Los Angeles County Emergency Medical Services).

Teaching and Advising

PhD Advisees

Manfei Xie (Expected graduation 2023, Co-Chair with E.K. Bish), her dissertation focuses on population-level infectious disease screening.

Hussein El-Hajj (Expected graduation 2021, Co-Chair with E.K. Bish), his dissertation studies improving newborn screening.

Paul Bartholomew (Expected graduation 2021), his dissertation studies emergency operations management.

Saloumeh Seyedehsaloumeh (Graduated 2019, Co-Chair with E.K. Bish), Dissertation: *Optimal data-driven methods for subject classification in public health screening.*
Assistant Professor, School of Management, Binghamton University, NY.

Ngoc Nguyen (Graduated 2019, Co-Chair with E.K. Bish): Dissertation: *Efficient prevalence estimation for emerging and seasonal diseases under limited resources.*
Prevention Effectiveness Fellow, Centers for Disease Control and Prevention (CDC).

Hrayer Aprahamian (Graduated 2018, Co-Chair with E.K. Bish), Dissertation: *Optimal risk-based pooled testing in public health screening.*
Assistant Professor, Industrial Engineering, Texas A&M, TX.

Hadi El-Amine (Graduated 2016, Co-Chair with E.K. Bish), Dissertation: *Optimal blood screening tests with robust performance under prevalence uncertainty.*
Assistant Professor, Systems Engineering and Operations Research, George Mason University, VA.

Behrooz Kamali (Graduated 2015), Dissertation: *Decision support for casualty triage in emergency response.*
Research Assistant Professor, Industrial and Management Systems Engineering, West Virginia University, WV.

Hussein Tarhini (Graduated 2014), Dissertation: *Network models in evacuation planning.*
Assistant Professor, Industrial Engineering and Management, American University of Beirut, Beirut, Lebanon.

Victor Pereira (Graduated 2013), Dissertation title: *Vehicle routing for emergency evacuations.*
Managing Consultant - Advanced Analytics at IBM.

Esra Agca (Graduated 2013), Dissertation: *Optimization-based logistics planning and performance measurement for hospital evacuation and emergency management.*
Assistant Professor, Industrial Engineering, Kadir Has University, Istanbul Turkey.

Ryan Shiguang Xie (Graduated 2011, Co-Chair with E.K. Bish), Dissertation: *Optimal allocation of resources for screening of donated blood.*
Analytic Science/Senior Scientist, FICO, San Francisco Bay Area, CA.

Edward Chamberlayne (Graduated 2011), Dissertation: *Optimal evacuation plans for network flows over time considering congestion.*
U.S. Army Corps of Engineers - District Commander and District Engineer at Baltimore District.

Juqi Liu (Graduated 2009, Co-Chair with E.K. Bish), Dissertation: *Managing uncertainty in capacity investment, revenue management, and supply chain coordination.*
Team Lead Manager, Unity Technologies, San Francisco Bay Area, CA.

Current PhD Advisees

Hussein El-Hajj (Co-Chair with E.K. Bish): Expected graduation 2021; the dissertation studies improving newborn screening.

Paul Bartholomew: Expected graduation 2021; the dissertation studies improving emergency management.

Courses Taught

- ISE 6404 Graph Theory and Network Flows (graduate)
- ISE 5984 Strategic and Operational Decision Support Models for Logistics Systems (graduate)
- ISE 5984 Logistics Systems (graduate)
- ISE 5404 Optimization 1 (graduate)
- ISE 4424 Logistics Engineering (undergraduate)
- ISE 2404 Deterministic Operations Research (undergraduate)

Professional Service Activities

- Reviewer for the following journals: Annals of Operations Research; Computers & Industrial Engineering; Computers & Operations Research; Disaster Medicine and Public Health Preparedness; European Journal of Operational Research; Health Care Management Science;

IISE Transactions; IEEE Transactions on Intelligent Transportation Systems; JAMA; Journal of Computer Aided Civil and Infrastructure Engineering; Journal of Operational Research Society (JORS); Journal of Scheduling; Journal of Waterway, Port, Coastal, and Ocean Engineering; Management Science; Naval Research Logistics; Networks; Omega; Operations Research; OR Spectrum; Stochastic Environmental Research and Risk Assessment; Transportation Research-B; Transportation Research-E; Transportation Science;

- Proposal reviewer for the National Science Foundation (multiple times) and National Institutes of Health.
- Associate Editor for Omega
- Virginia Tech representative for Smarter Care Virginia.
- Reviewer for INFORMS JFIG (Junior Faculty Interest Group) paper competition
- Session Chair - INFORMS Annual Meeting (multiple times)
- Committee Co-chair, INFORMS Pierskalla Best Paper Award Committee, 2012
- **Departmental Service**: Chair-Website Committee, Graduate Admissions Committee, Graduate Policy Committee, Strategic Vision Committee, Undergraduate Curriculum Committee
- Member INFORMS, IISE