



**Institute of Industrial and Systems Engineers  
Quality Control & Reliability Engineering (QCRE) Division  
and  
Data Analytics and Information Systems (DAIS) Division  
2022-2023 Webinar Series**

IISE Quality Control & Reliability Engineering (QCRE) division and Data Analytics and Information Systems (DAIS) Division would like to invite you to attend our webinar on Thursday, November 17, 12 p.m.-1 p.m., Eastern Time.

**Webinar Registration:** [https://us06web.zoom.us/webinar/register/WN\\_GLzGvI6XS-q1OcW105n8OQ](https://us06web.zoom.us/webinar/register/WN_GLzGvI6XS-q1OcW105n8OQ)

**Time:** Dec. 6, Tuesday, 1-2 p.m., Eastern Time.

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**Title: Dynamic Characterization and Optimal Self-Management of the Emergence  
Trajectories of Multiple Chronic Conditions**

**Presenter:** Dr. Adel Alaeddini, Associate Professor, Department of Mechanical Engineering, The University of Texas at San Antonio (UTSA)

**Abstract:** More than a quarter of all Americans and two out of three older Americans are estimated to have at least two chronic health problems. Treatment for people living with multiple chronic conditions (MCC) consume an estimated 66 percent of U.S. healthcare costs, and as the population ages, the number of MCC patients will increase. This mounting challenge is a major public health issue linked to suboptimal health outcomes and rising healthcare costs. However, fundamental knowledge gaps remain in our understanding of how MCC evolves at the individual and population levels. It is known that shared modifiable lifestyle behaviors, such as poor diet and physical inactivity, account for a large proportion of common MCC, and the progression of those conditions is associated with the development of additional comorbidities. What is not known is the dynamic effect of an individual's behavioral lifestyle changes on the trajectories of MCC emergence. This presentation introduces functional and deep continuous time Bayesian networks to model the relationship among MCC and non/modifiable risk factors to characterize major patterns of MCC emergence in individuals based on a dataset from the US Department of Veteran Affairs. It also presents the extension of the presented methodology to nonlinear state-space models and tensor-based control charting to capture the dynamics of modifiable risk factors and their impact on the timing of the emergence of new chronic conditions using a live dataset from the Cameron County Hispanic Cohort (CCHC). Finally, it demonstrates the application





of optimal control and reinforcement learning to identify the changes in modifiable behavioral lifestyle factors to reduce the risk of new chronic conditions. The findings aim to give healthcare professionals and patients the ability to identify effective preventive policies, including self-management strategies, to decelerate the evolution of new chronic conditions.

**Biography:** Dr. Adel Alaeddini is an Associate Professor of Mechanical Engineering at the University of Texas at San Antonio (UTSA). He is also the Director of the Center for Advanced Manufacturing and Lean Systems (CAMLs) at UTSA. Before joining UTSA, he was a Postdoctoral Scholar at the University of Michigan. He received his Ph.D. in Industrial and Systems Engineering from Wayne State University. Dr. Alaeddini's research interests involve both theoretical and applied aspects of machine learning integrated with engineering knowledge with applications in healthcare and manufacturing. His research has been mainly supported by AFOSR (including Young Investigator Award), AFRL, NIH, DHS, and VA among others. Dr. Alaeddini is an associate editor of the Journal of Applied Statistics, Healthcare Management Science, and IIE Transactions on Healthcare Systems Engineering. He is the past chair of the Quality, Statistics, and Reliability (QSR) Section of INFORMS, and Past-President of the Quality Control & Reliability Engineering (QCRE) Division of the Institute for Industrial & Systems Engineers (IIE).

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