Smart T-Shirts Can Monitor Cardiac Function among Rural Volunteer Firefighters in New York

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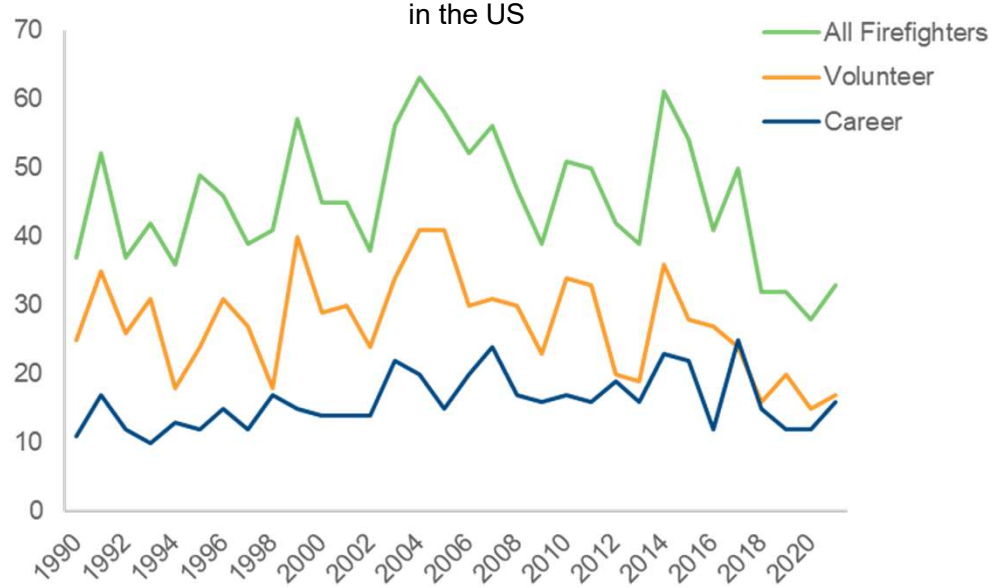
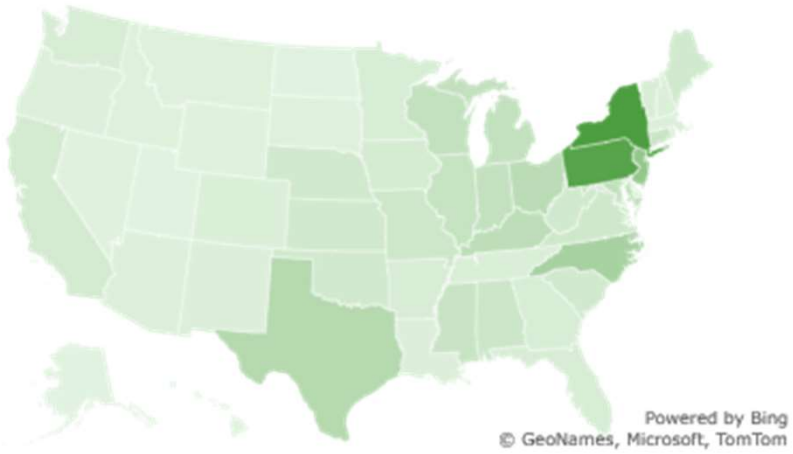
Sudden Cardiac Death Disproportionately Affects Volunteer Firefighters

- 94.2% of Firefighters in New York are Volunteer
- New York has the most cases of Sudden Cardiac Death among Volunteer Firefighters in the US

Sudden Cardiac Death Fatalities among Firefighters in the US



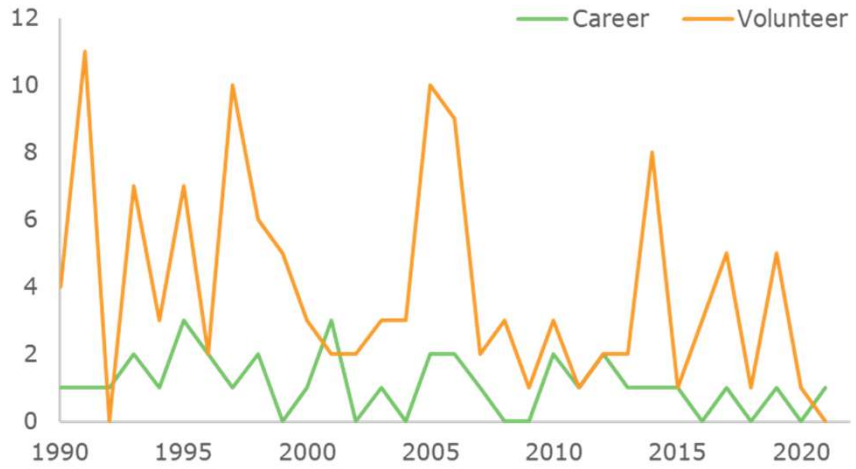
Map of Sudden Cardiac Death Fatalities among Volunteer Firefighters in the US



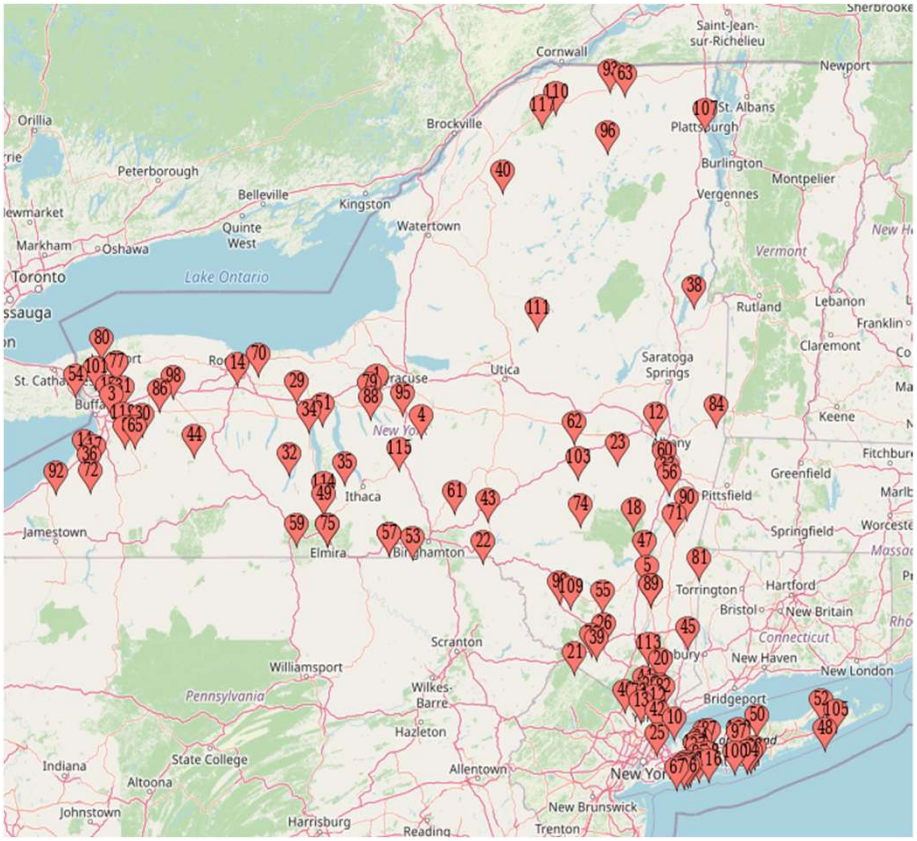
Sudden Cardiac Death Disproportionately Affects Rural Volunteer Firefighters

- Of the 160 Sudden Cardiac Deaths in NY, 78% were among volunteer firefighters
  - 80% of rural volunteer firefighters deaths were from rural areas

Sudden Cardiac Death Fatalities among Firefighters in NY

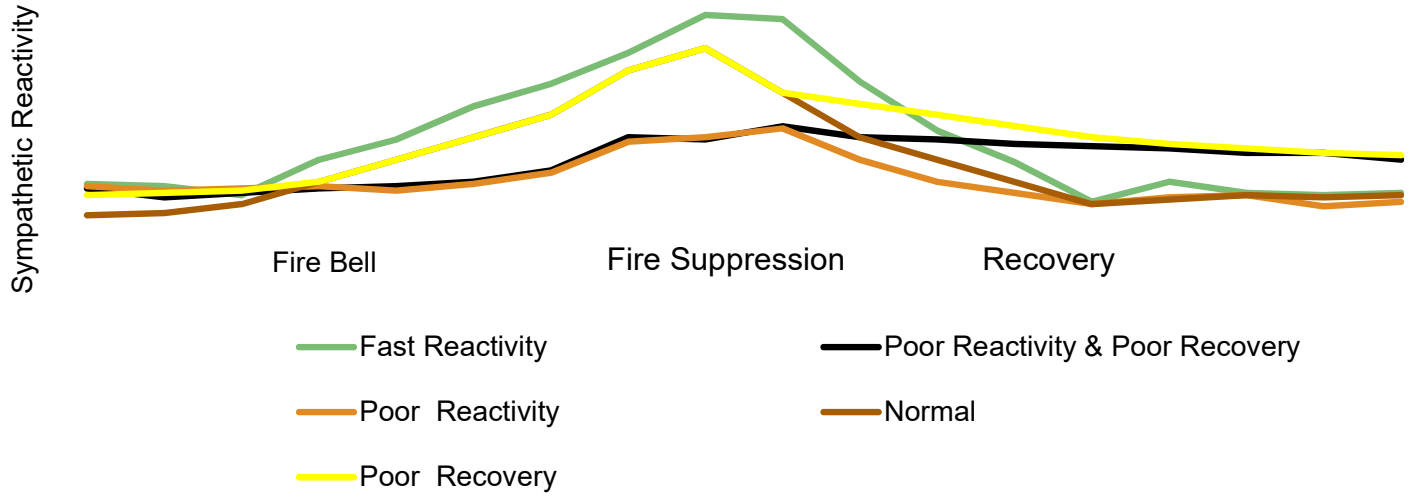


Location of Volunteer Firefighter Sudden Cardiac Deaths



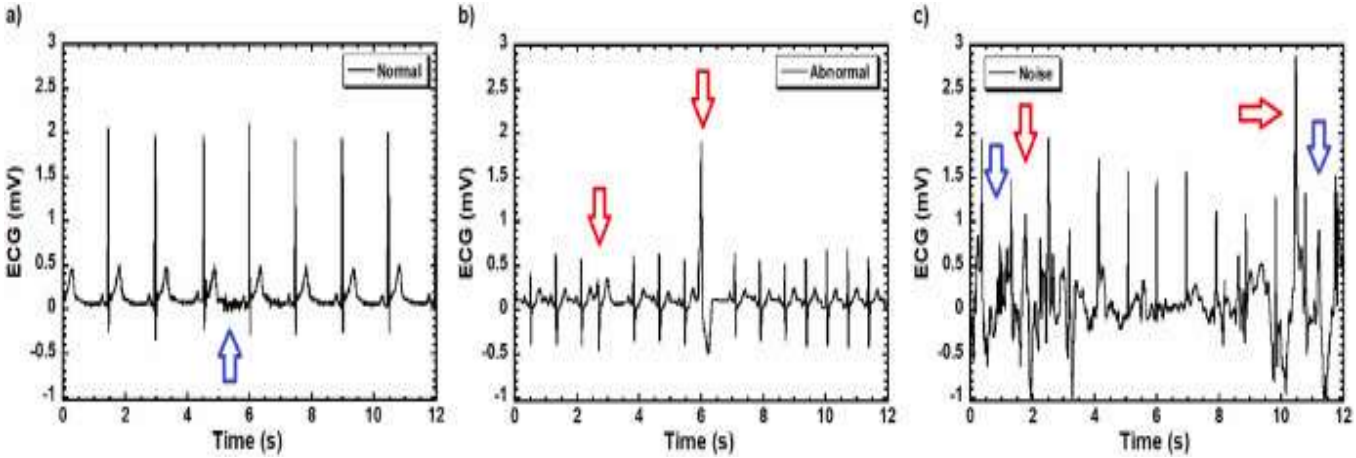
Recording Cardiovascular Physiology During Fire Suppression Activities

- During Fire Suppression Activities, the body's sympathetic nervous system naturally rises heart rate and blood pressure



Artificial Intelligence to Remotely Monitoring Volunteer Firefighters

	Accuracy	Precision	Recall	Testing Time	Parameters
H2M Neural Network Performance at Classifying Heart Beats	96.3%	94.5%	94.4%	6.2 seconds	31,298



Correct prediction of a) normal, b) abnormal, and c) noisy ECGs with the confidence level of approximately 0.99, 1.00, 0.99, respectively

Support: R21NR011077

Smart T-Shirts Can Monitor Cardiac Function Among Firefighters

Multi-parameter physiological monitoring

Current Project: Integrating AI into Smart T-Shirts to Monitor Cardiac Function among Volunteer Firefighters

Research Aims

- Validate H2M Neural Network using ECG from Smart T-shirts
  - Explore the effect of additional parameters on model neural network
    - Improve Recall (benchmark 94%)
    - Reduce Testing Time (benchmark 6.2 seconds)
- Integrate H2M Neural Network into Smart T-shirt existing infrastructure

Research Methods

- Step 1:
  - Deploy Smart T-Shirts among Rural Volunteer Firefighters during live fire trainings
  - Validate H2M Neural Network using ECG from Smart T-shirts
    - Explore potential benefits of other parameters
- Step 2:
  - Integrate H2M Neural Network into Smart T-shirt existing infrastructure
  - Re-deploy Smart T-Shirts and test it during live fire trainings

Transdisciplinary Collaboration through the UNYTE Network

University of Buffalo

Emergency First Responder Lab

(Exercise Physiology)

University of Rochester

Data Science Institute

UR Medical Center

(Nursing/Cardiology)

Bassett Healthcare Network

HealthWorks Occupational Health Services

(Epidemiology/Rural Health)

Access to Population

Feasibility

Abundant Resources

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Transdisciplinary Collaboration through the UNYTE Network

- According to Choi & Pak (2006):
  - Multidisciplinary: Draws on knowledge from different disciplines but stays within their individual disciplinary boundaries
  - Interdisciplinarity: Analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole
  - Transdisciplinary: Integrates the natural, social and health sciences in a humanities context, and transcends their traditional boundaries

Building a Transdisciplinary Collaboration through the UNYTE Network

A few comments based on my experience:

- Identify team members with *common interests*
  - Start conversations early!

- In addition to *common interests*, identify strategic strengths
  - Multiple disciplines
  - Access to unique populations
  - Access to existing data
  - Grantsmanship

- Align research roles to fit with the strengths of team members

- Practice collaboration through abstracts, manuscripts, and grant submissions

- Establish expectations early and stick to them