Pôle de Recherche Appliquée en Parahospitalier

The Preburn Project: Preventing Burnout by Predicting Compromised Wellness in EMS workers

A Data-Driven Approach to Enhancing Mental health in EMS

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About the speaker

Thérésa J. Choisi, MSc.
Clinical Research Advisor

Research interests

- Cardiac Arrest
- Stroke
- Mental health

Academic Background:

- MSc in Experimental Health Sciences (INRS – Armand Frappier)
  INRS Armand-Frappier Santé Biotechnologie, Laval, Canada.
- BSc in Health Sciences, Specialization in Biology & Biochemistry (Paris V University)
  Université René Descartes (Paris V), Paris, France.

Professional Experience:

- Over 14 years in EMS
- Research expertise in EMS-related clinical studies
- Lead investigator of the Preburn Project

Recent Achievements:

- **Winner of the Top EMS Research Project Award (PACE 2024)**.
- Publications & Contributor to national and international conferences.

Webinar Roadmap

Context: Why Mental Health Matters in EMS

Problem Statement: Understanding burnout and compromised wellness

The Preburn Study: Methods & Key Findings

Practical Applications: How predictive models can help

Impact & Future Perspectives

Q&A Session

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Why Mental Health Matters in EMS

Definition of Mental Health (WHO)

Mental health is a state of **mental well-being** that enables people to cope with the **stresses of life**, realize their **abilities**, **learn** well and **work** well, and **contribute** to their **community**. It has instrumental value and is integral to our well-being.

Source : Organisation mondiale de la Santé (OMS), "Renforcer notre réponse en matière de santé mentale"

The Role of EMS in the Prehospital Care Chain

Emergency Medical Dispatchers (EMDs)

Paramedics

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Understanding Burnout: A Recognized Syndrome

WHO Definition (2019)

A syndrome resulting from chronic workplace stress that has not been successfully managed.

Source : World Health Organization. (n.d.). Burn-out an “occupational phenomenon”. WHO. Retrieved january 2025 from https://www.who.int/standards/classifications/frequently-asked-questions/burn-out-an-occupational-phenomenon

Key Symptoms

Emotional exhaustion

Cynicism and depersonalization

Reduced professional effectiveness

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Burnout Prevalence in EMS Professionals

Global Data on Burnout in Healthcare Professionals (Johnson et al., 2018)

65,000
Healthcare Professionals

12 Countries

54%

69%

78%

Burnout rate

Burnout in EMS Dispatchers & Paramedics

Emergency Medical Dispatchers (EMDs; Zaluski et al., 2022)

553 EMDs

14

High risk of Burnout — 34%

Professional Inefficiency — 32%

Disappointment — 32%

Paramedics & Ambulance Technicians:

- **35% Report Professional Burnout** (Amro et al., 2022)
- **37% Show Moderate Burnout Levels** (Amro et al., 2022)
- Studies estimate **burnout prevalence ranges from 16% to 56%** (Reardon et al., 2020)

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Why EMS Worker are at High Risk ?

Training

Chronic stress

Emotional burden

Long shift

Irregular schedules

High job demands

Lack of psychological support and coping mechanism

Exposure to traumatic event

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How Do We Identify Burnout?

Innovative approach

Need for proactive, data-driven solutions

Acting upstream

↓

Providing advice, tools and professional support

↓

Preventing or reducing psychological injuries

Focus: Prevention and early intervention to reduce the risk of severe mental health issues.

How Can We Proactively Prevent or Mitigate Burnout?

Early Detection & Risk Prediction

- Data-Driven Wellness Monitoring
- Screening
- Surveys & Feedback Loops

Workload Management & Organizational Support

- Reasonable Work hours & Scheduling
- Administrative Support
- Flexible Work Policies

Psychological Support & Resilience Training

- Access to Mental Health Resources
- Mindfulness & Stress Reduction Techniques
- Resilience & Coping Skills Training

Stronger Team & Leadership Support

- Encouraging Open Communication
- Supportive Leadership & Supervision
- Recognition & Appreciation Programs

Proactive Culture Shift in EMS

- Fostering a Wellness-First Workplace
- Policy Changes at the System Level
- Continuous Education & Burnout Awareness

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The Path from Well-Being to Burnout

Mental wellness exits on a continuum that moves through different stages:

Well-being – The individual functions optimally with **good mental health and resilience**.
(Prevention stage: Focus on maintaining well-being through healthy work conditions and support.)

Compromised Mental Wellness (CMW) – Emerging **stress, emotional exhaustion, and cognitive difficulties** start affecting performance.
(Intervention stage: Identifying risk factors and applying targeted strategies to prevent escalation.)

Burnout – A state of severe **mental, emotional, and physical exhaustion**, often leading to disengagement and reduced effectiveness.
(Support stage: Implementing recovery programs, counseling, and workload adjustments.)

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The Preburn Project: Predicting Mental Health Risks in EMS

Funding

Agence de la santé publique du Canada | Public Health Agency of Canada

Ethic certificate

IRB : A03-B21-23B (Université McGill)

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What We Aimed to Discover

Primary Objective

Describe the characteristics of EMS workers diagnosed with CMW.

Secondary Objectives

2. Identify the characteristics of **9-1-1 calls** and **prehospital patient encounters** associated with **compromised mental wellness** in **EMS dispatchers (RMU) and paramedics**, respectively.

3. Develop models to **predict compromised mental wellness** in EMS dispatchers and paramedics.

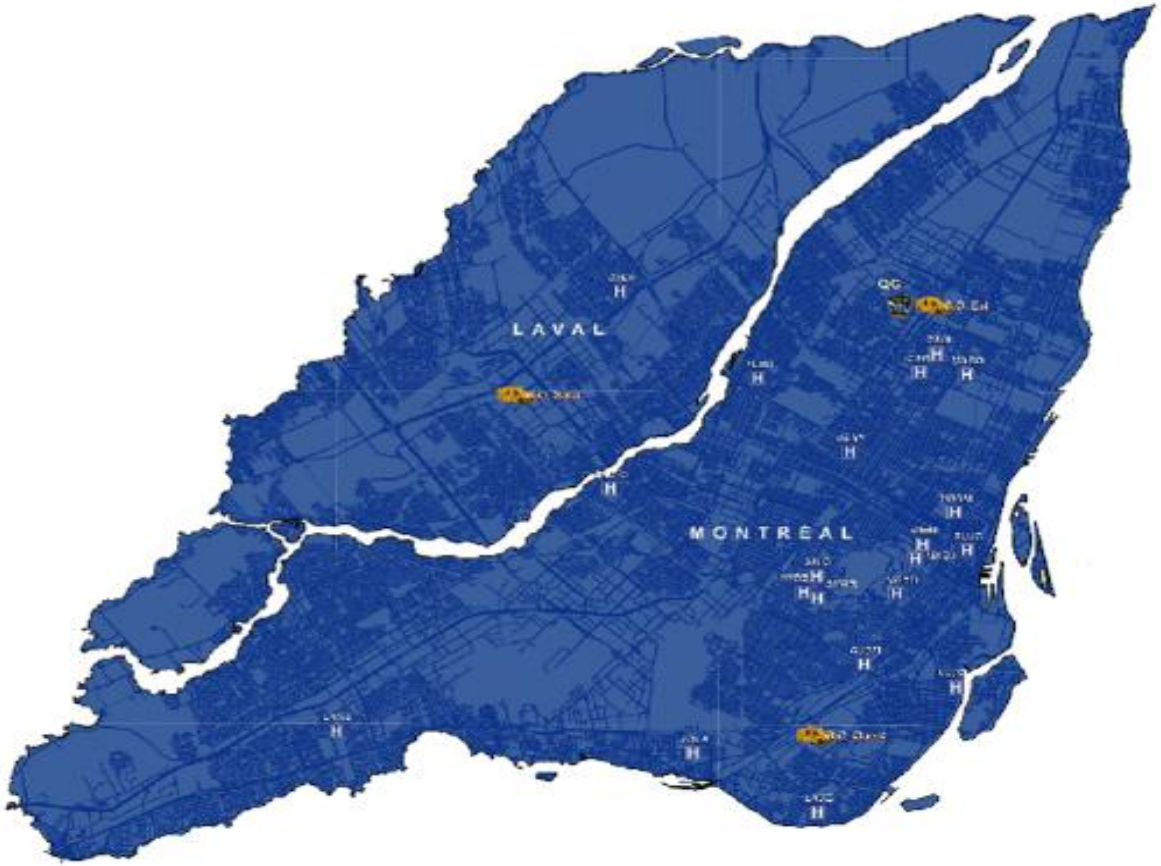
4. Based on these predictive models, develop a **monitoring tool** to identify EMS dispatchers and paramedics who may be at **higher risk of compromised mental wellness**.

5. Compare the performance of the **risk prediction tool** with the **Maslach Burnout Inventory (MBI) scale**.

How Was the Study Conducted?

Metropolitan Ambulance Service

- Area: 744 km²
- Population: 2.5 million
- 1,000 paramedics
- 112 EMS dispatchers (RMU)
- > 275,000 calls per year



Methods

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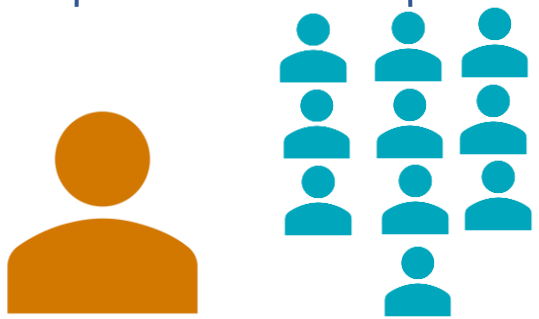
Phase 1
Nested Case-control study (2015-2022 data)

Matching based on the diagnosis date



Case
(Diagnosis made by a doctor)

Control
(No diagnosis received in the last 6 months)

Database of insurance claims

Data extraction

- HR
- Insurances
- CAD
- Patient care report

Predictive models

Evaluations

Phase 2

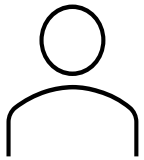
Wellness department

Tool development

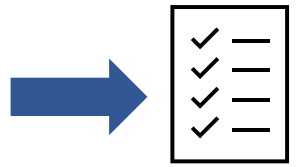
Risk prediction tool

vs

Recruitment



EMD | Paramedic



MBI

Preliminary results

Final Results

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Methods

For Each Frontline Worker
Age
Sex
Years of experience
Call history (last 6 months)
Total number of previous diagnoses
Total number of sick days
Total number of overtime hours
Total number of lateness (in minutes)

For Each Call in the 6-Month History
MPDS protocol
MPDS priority
Call priority
Treatment time
Time on scene
Transport time
Time spent at the hospital
Patient's age
Patient's sex
Mode of transport
Shift type (Night/Day/Evening)
Number of ambulances available during the shift
Number of paramedics on duty during the shift
Number of RMUs on duty during the shift
Number of calls received during the shift

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For Each Call in the 6-Month History
+ 21 variables

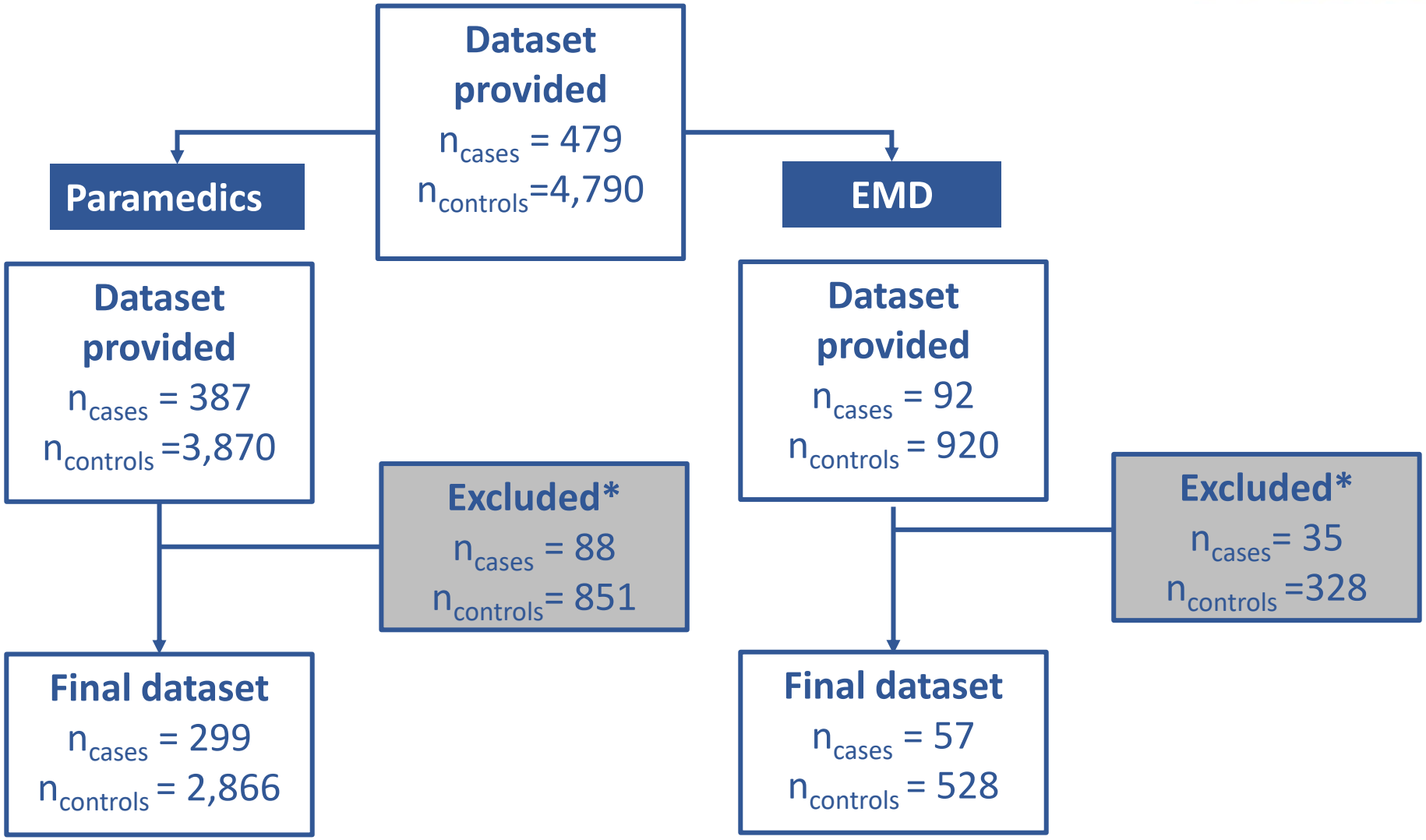
Legend
Paramedic & RMU
Paramedic only
RMU only

Statistical Analysis

Continuous variables: Mean difference tested using a t-test (pooled standard deviation if variances are approximately equal, otherwise Welch's t-test for unequal variances).

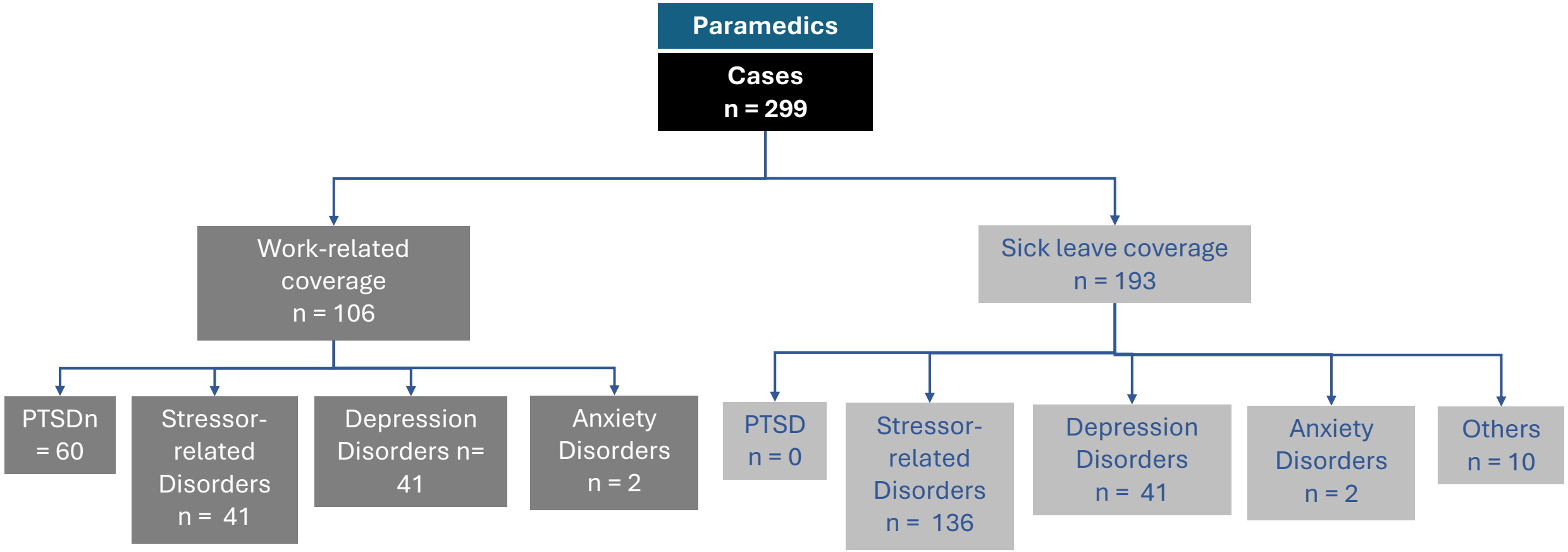
Categorical variables: Pearson's chi-square test with Yates' correction for continuity.

Results



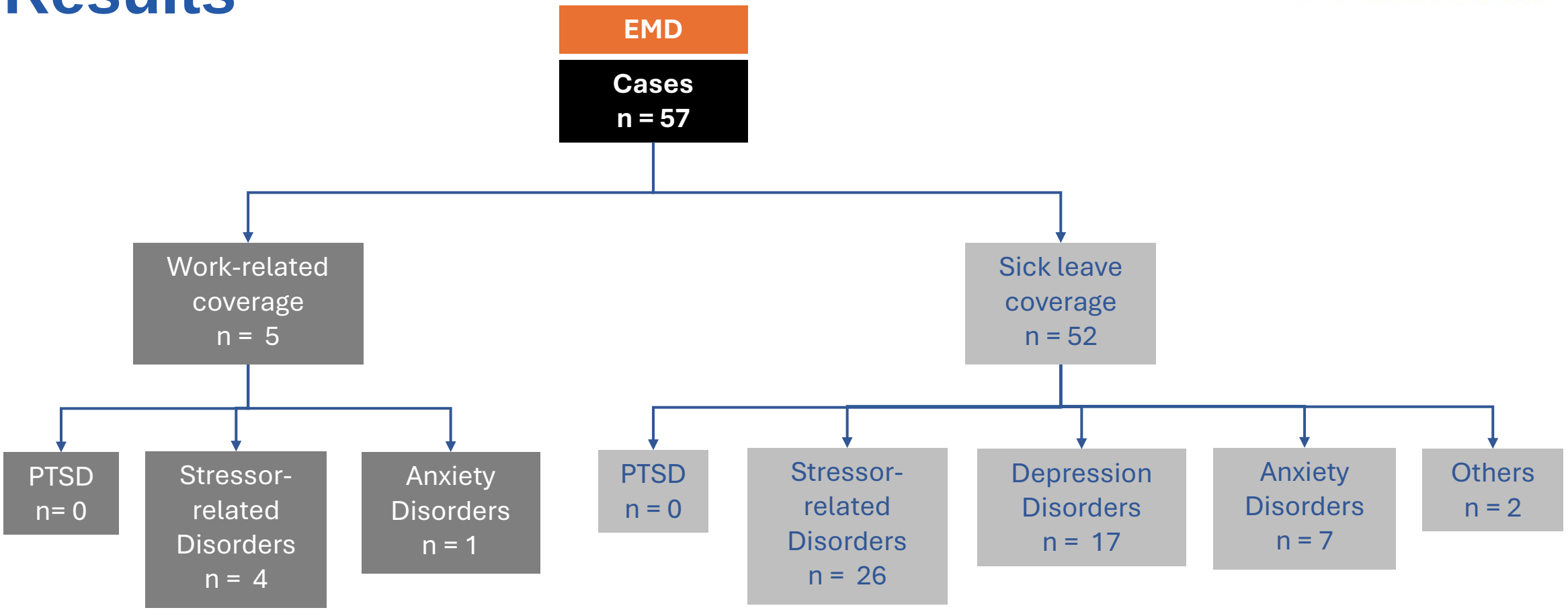
*Exclusion criteria: Non valid diagnostics, no call history, duplicates.

Results



Post-traumatic stress disorder = 20% of all cases
Stress-related disorders = 59% of all cases

Results



Stress-related disorders = 53 % of all cases

Who is Most at Risk?

Paramedics

Variables	Mean cases (SD)	Mean controls (SD)	p-value
Age (years)	38.13 (11.94)	39.89 (11.03)	$p < 0.05$
Length of service (years)	12.79 (10.57)	14.21 (11.20)	$p < 0.05$
Total number of interventions in the last 6 months (number)	459.33 (191.08)	498.05 (188.49)	$p < 0.001$
Number of interventions during the shift	5.46 (1.30)	5.43 (1.00)	$p < 0.001$

Variable	p-value
Sex, Female	$p < 0.001$
Length of service (years) by category	$p < 0.05$
Call priority, n(%)	$p < 0.001$
Shift, n (%)	$p < 0.001$
Patient age (years) by category	$p < 0.001$

Paramedics

Paramedic at high risk of CMW

- Female
- Young
- Inexperienced
- Risk factors:
  - High workload
  - Night shift
  - Pediatric patient

Who is Most at Risk? (suite)

Preburn

EMD

Variables	Mean cases (SD)	Mean controls (SD)	p-value
Age (years)	34.67 (11.87)	38.85 (12.60)	$p < 0.05$
Length of service (years)	8.26 (11.47)	11.66 (12.04)	$p < 0.05$
Treatment times (minutes)	1.43 (1.10)	1.36 (1.17)	$p < 0.001$
Calls during shift (number)	36.37 (9.05)	39.20 (15.34)	$p < 0.001$

Variables	p-value
Sex, Female	$p < 0.01$
Shift, n (%)	$p < 0.001$
Patient Age (years) by category	$p < 0.001$

EMD

EMD at high risk of CMW

- Female
- Young
- Inexperienced
- Risk factors:
  - High workload
  - Night shift
  - Pediatric patient

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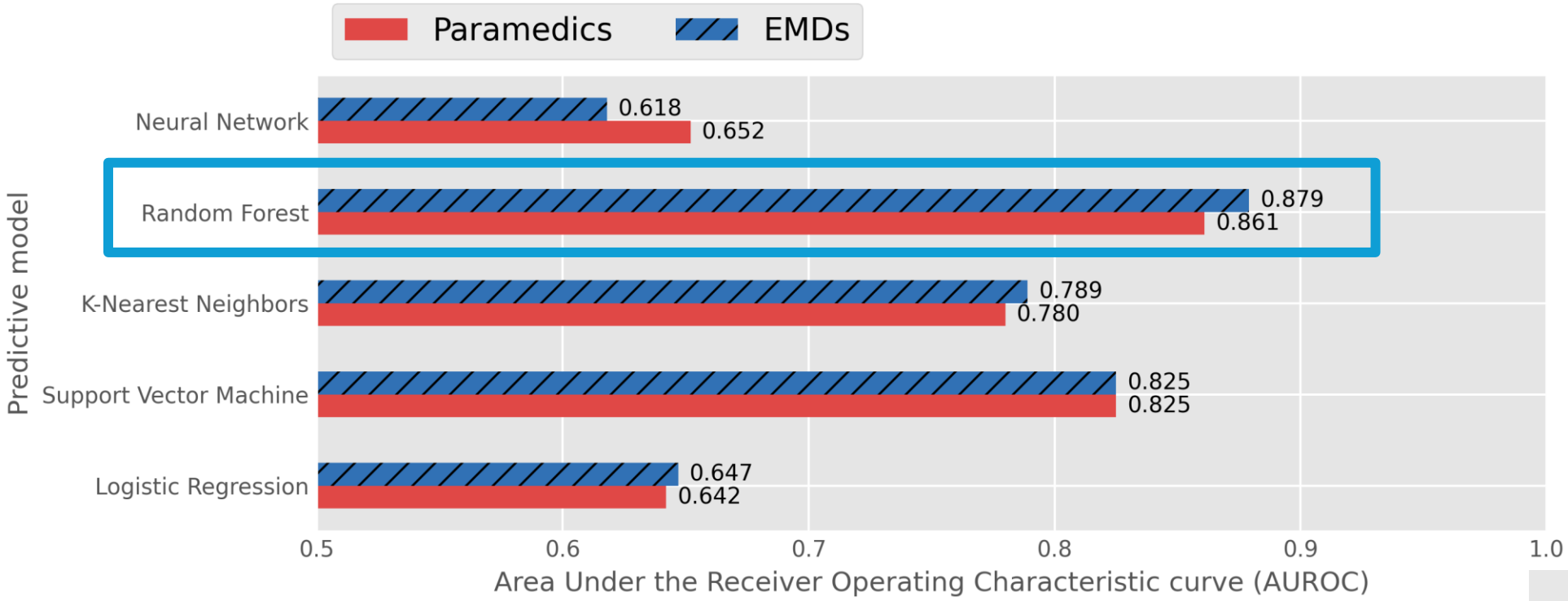
How Can We Predict Burnout Before It Happens?

Machine Learning Approach



AUC	Interpretation
0,5 - 0,6	**Weak:** Result close to chance.
0,6 - 0,7	**Fair:** Slight ability to discriminate.
0,7 - 0,8	**Good:** Reasonable reliability.
0,8 - 0,9	**Very good:** Strong ability to discriminate.
0,9 - 1,0	**Excellent** : Near perfect accuracy.

Benefits

- Reduced workload burden for HR
- Early intervention & targeted mental health support

Results

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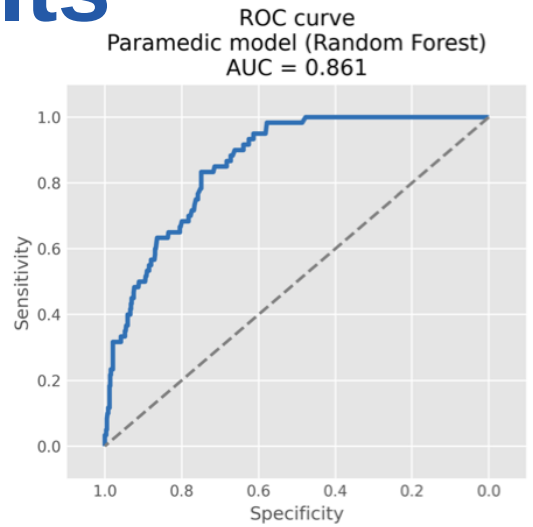
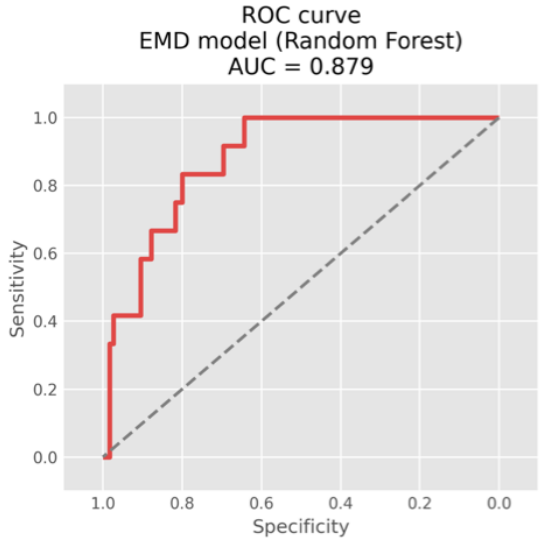
Paramedics

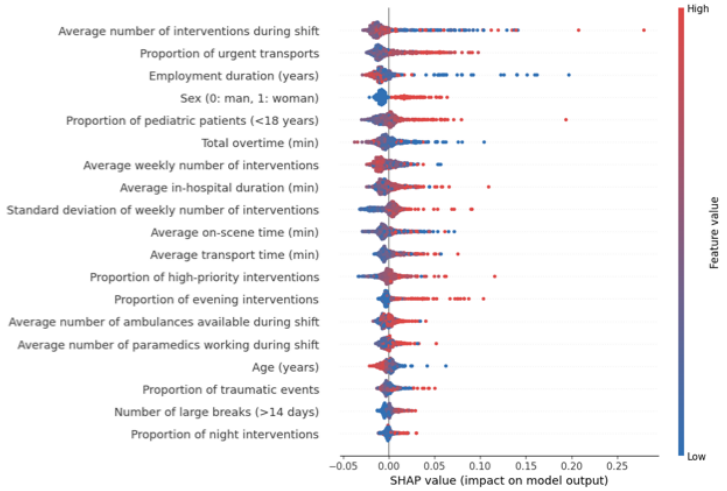


EMD

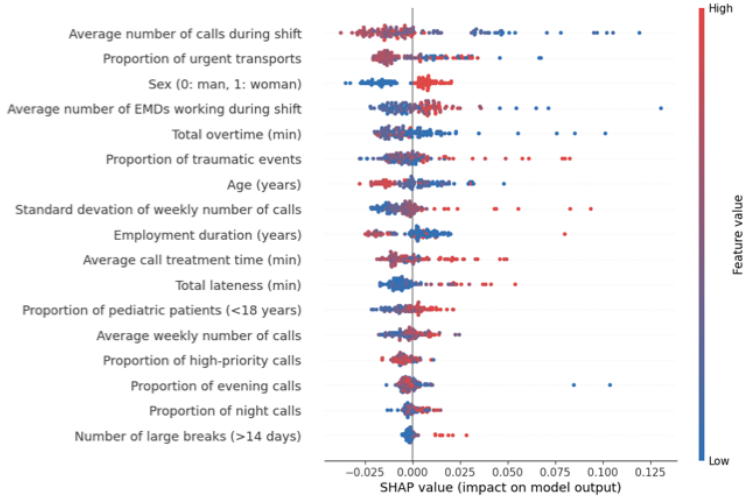


The ROC curve shows the strong predictive performance of the models.

Beeswarm plot diagram built from SHAP values for the paramedics model.



Beeswarm plot diagram built from SHAP values for the EMD model.



SHAP values are useful for predicting risk by showing how traits contribute at the individual level.

SHAP values

SHAP (SHapley Additive exPlanations) visualization shows each feature's impact on a machine learning model's predictions, with dots representing data points and their influence direction.

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Pilot Risk Prediction Tool: Early Detection

Preburn

Overview of the Tool

- The **Preburn risk prediction tool** analyzes **mental wellness indicators** to detect **early signs of CMW** among EMS workers.
- It integrates **historical data, workload indicators, and predictive analytics** to assess **risk levels** in real time.

The overview could be made accessible to HR and management.

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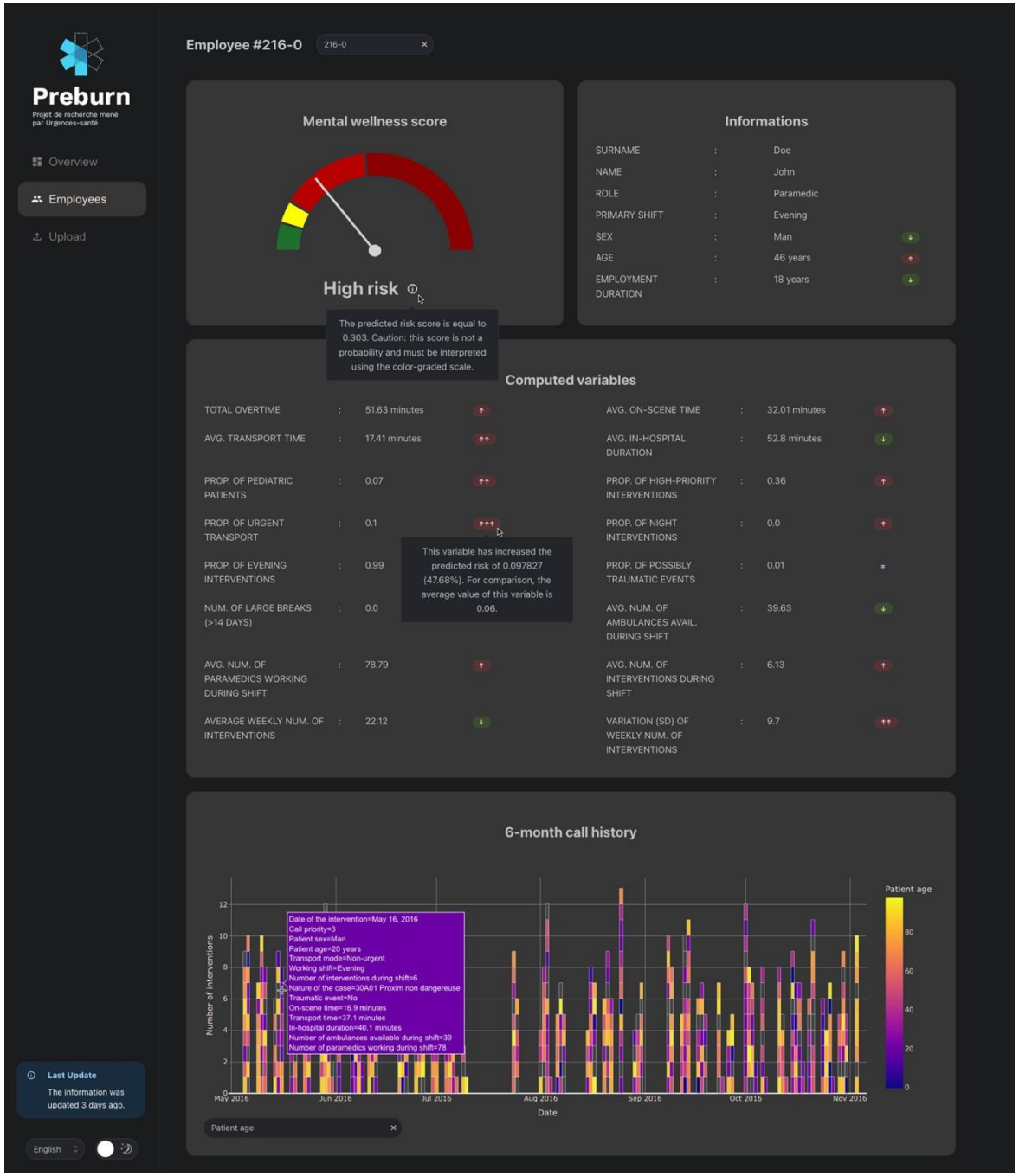
Dashboard overview

- Displays **real-time burnout risk** levels among employees;
- Track **evolution of risk over time;**
- Helps Wellness program **identify high-risk employees early**

The dashboard should be accessible only to employees from the wellness program.



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Data Upload

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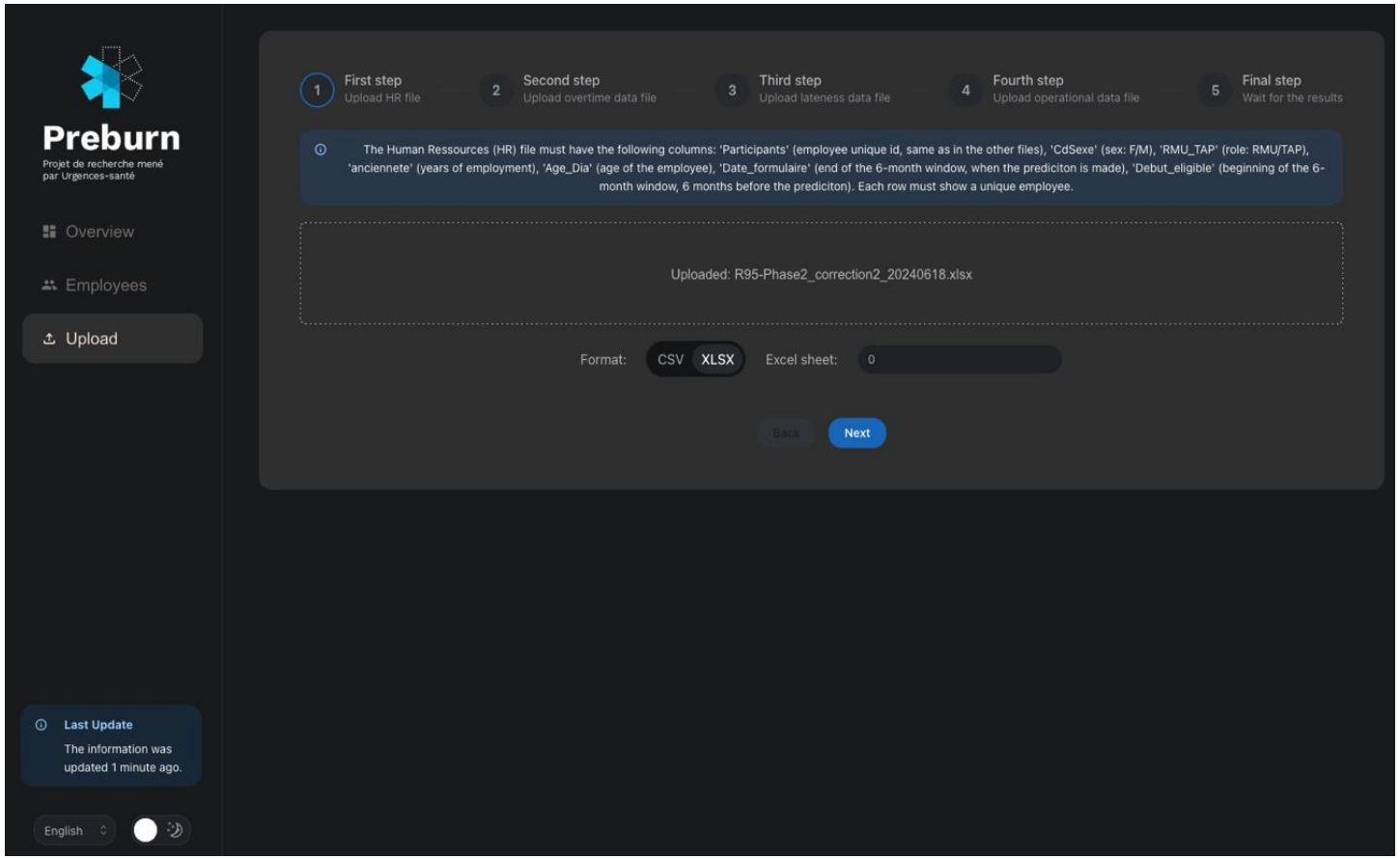
Organizations can **upload workforce data** for real-time monitoring



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From Research to Real-World Impact

How organisations can use these insights:

- Early detection of high-risk employees
- Integrating predictive tools with HR wellness programs
- Creating proactive support structures
- Foster a workplace culture that prioritizes mental well-being—because healthy minds build stronger teams

Benefits for EMS Agencies:

- Lower psychological injuries and burnout rates
- Increased staff retention
- Improved patient care quality

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Barriers to Implementing Predictive Mental Health Strategies

- **Data Availability**
- **Stigma Around Psychological Health in EMS**
- **Personal history**
- **Ethical Considerations:**
  - Privacy and confidentiality concerns
  - Acceptance of predictive tools by EMS workers.

What’s Next for EMS Mental Health?

A Comprehensive EMS Wellness Program

Scaling Predictive Models Across Different EMS Services

Integrating Mental Health Monitoring into Workforce Management

Encouraging Policy Changes to Support EMS Mental Health

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PROTECT- A Wellness Program for EMS Mental Health

P – Predict Risk using data-driven analytics

R – Recognize Early Signs of compromised mental wellness

O – Offer Support through a structured intervention plan

T – Train & Educate EMS workers on mental health resilience

E – Engage Professionals (psychologists, therapists, wellness experts)

C – Customize Action Plans based on individual risk levels

T – Track Progress & Adjust strategies for long-term impact

Proactive approach

Wellness Program Structure Based on Risk Levels

5-steps Implementation Strategy

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What We Learned Today

Preburn

- EMS workers face **mental health risks** due to trauma, workload, and stress as experimented by several public safety personnel (police, firefighter, military, etc).
- **Chronic stress-related disorders represent the vast majority of diagnoses in the dataset;**
- The **Preburn Project uses predictive modeling** to identify at-risk employees.
- **Early intervention, powered by the Preburn risk-prediction tool and organizational support,** could **reduce burnout** and **improve EMS workforce resilience**.

Thank you for your time

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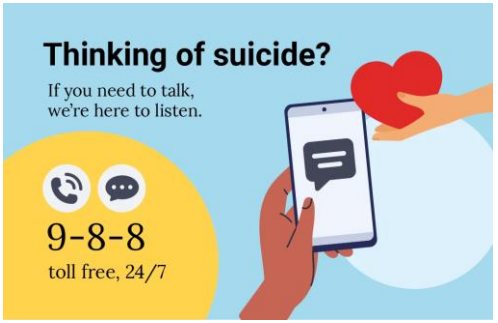

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Équipe de recherche

- Gabriel Potvin
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- Hélène Brouillet
- Marine Tessier
- Luc de Montigny
- Mathieu Campbell

Acknoledgment

Some illustrations and visual elements in this presentation were **partially created using OpenAI's generative tools**. These AI-assisted visuals were used to enhance clarity and engagement while maintaining accuracy in the content.

References

Illustrations

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