Decoding Lyme Disease: How AI is Shaping Our Understanding of Tick-borne Illnesses

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A cross-disciplinary compendium of techniques tailored to probe the intricacies of the Lyme disease bacterium *Borrelia burgdorferi*.

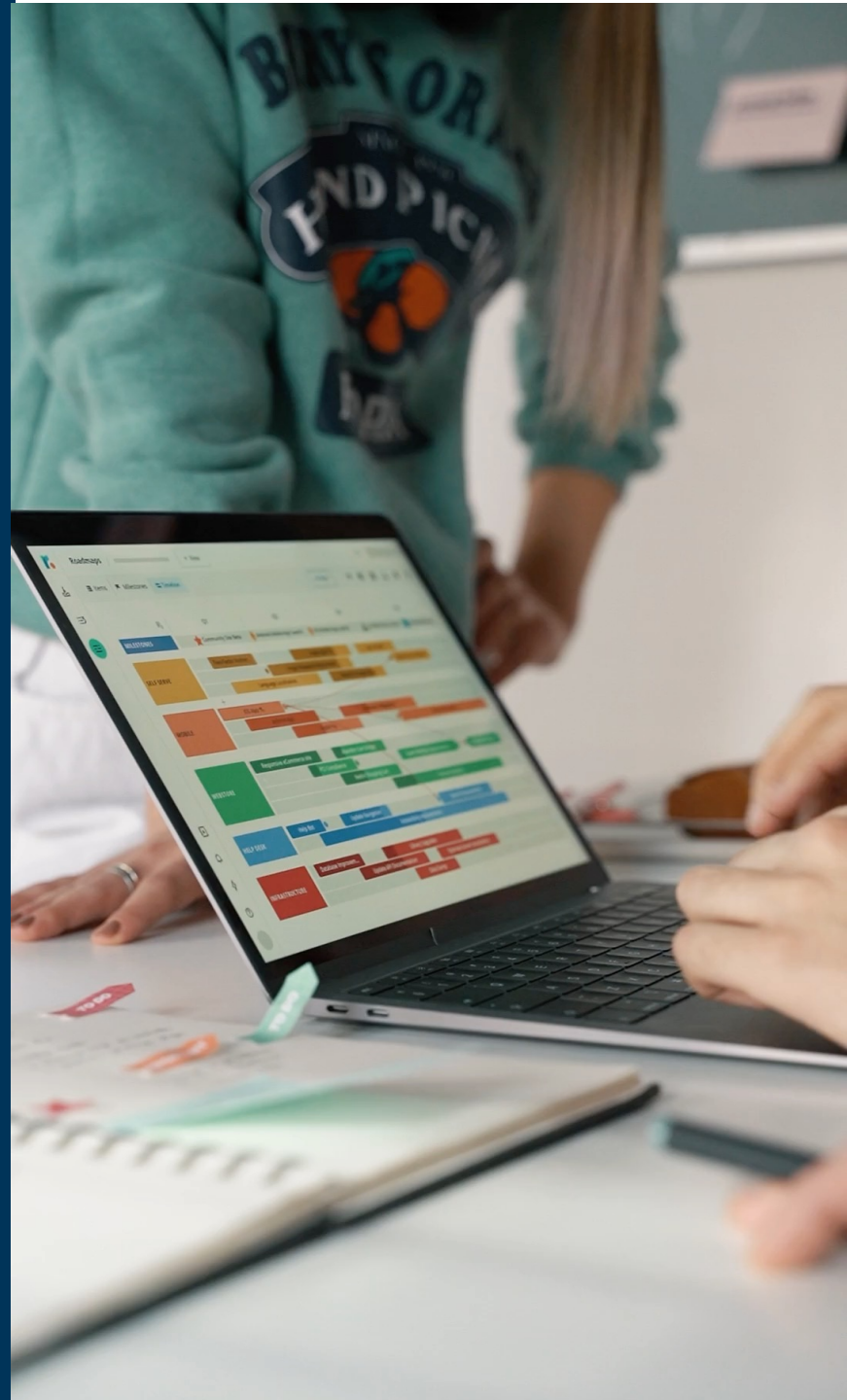
This resource meticulously compiles standard and avant-garde methods, accessible to novices and veteran scientists alike, for robust *in vitro*, *in vivo*, *in situ*, *de novo*, and clinical investigations.

Chapter 13: Content Analysis: An approach to Exploring the Depiction of Tick-borne Diseases

Dr. Stephen M Croucher

Chapter 14: Applying BERT and ChatGPT for Sentiment Analysis of Lyme Disease in Scientific Literature

Dr. Teo Susnjak



*Overview of Tick-borne Diseases:

-Tick-borne diseases, such as Lyme disease, are significant public health concerns.

*Purpose of the Presentation:

-Explore how media and scientific literature depict tick-borne diseases differently.

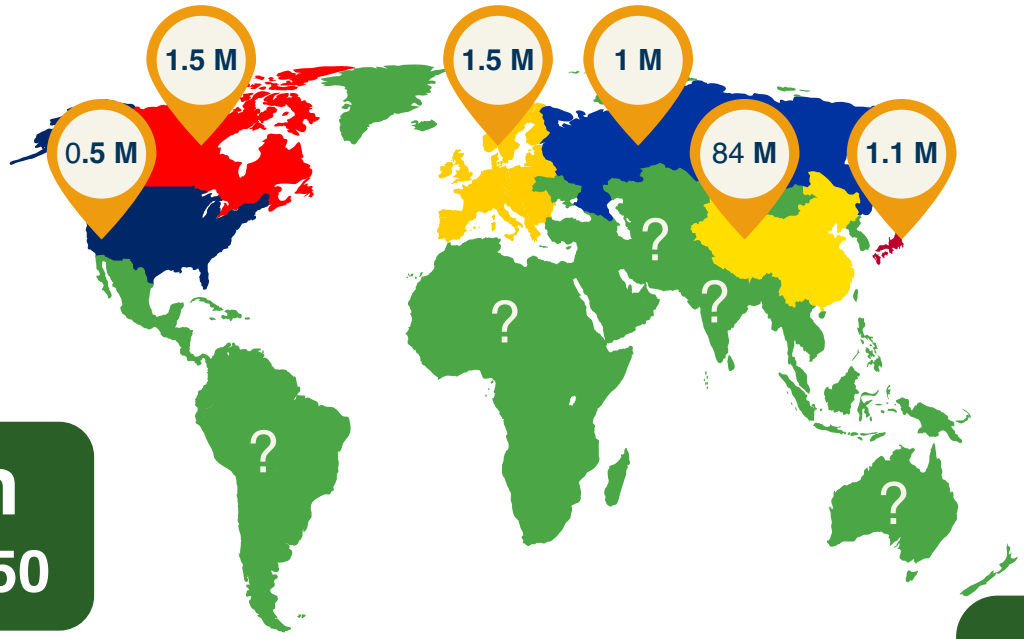
-Understand the influence of these depictions on public perception, healthcare decisions, and policy-making.

*Why It Matters:

Misinformation or biased portrayals can lead to misdiagnosis and inappropriate treatments.

Overview of Tick-borne Diseases

Yearly number of patients reported



2.8 Billion
infected by 2050

1.2 Billion infected already

2 M long haulers

Davidsson et al 2018, Dong et al 2022, Dulong et al 2019, Godfrey & Randolph et al 2011, Kugeler et al 2021, Schwartz et al 2021

Understanding Content Analysis

Definition:

-Content analysis is a systematic research method to analyze the content of texts to identify patterns and themes.

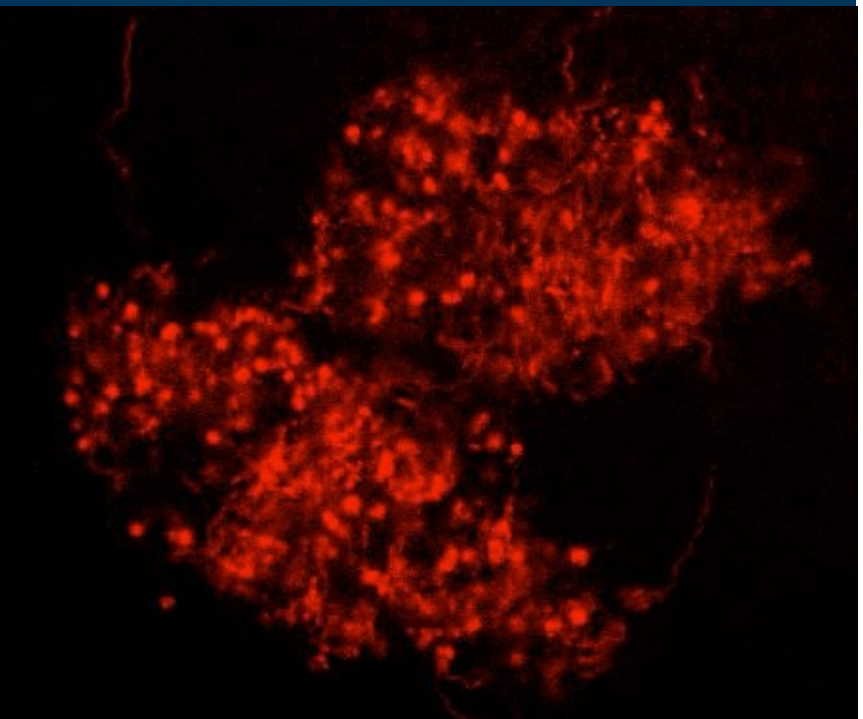
Applications in Tick-borne Diseases:

-Applied to media sources to understand public sentiment and biases.

Importance:

-Uncovers how diseases like Lyme disease are represented and the impact on public perception.

Media Depictions of Tick-borne Diseases

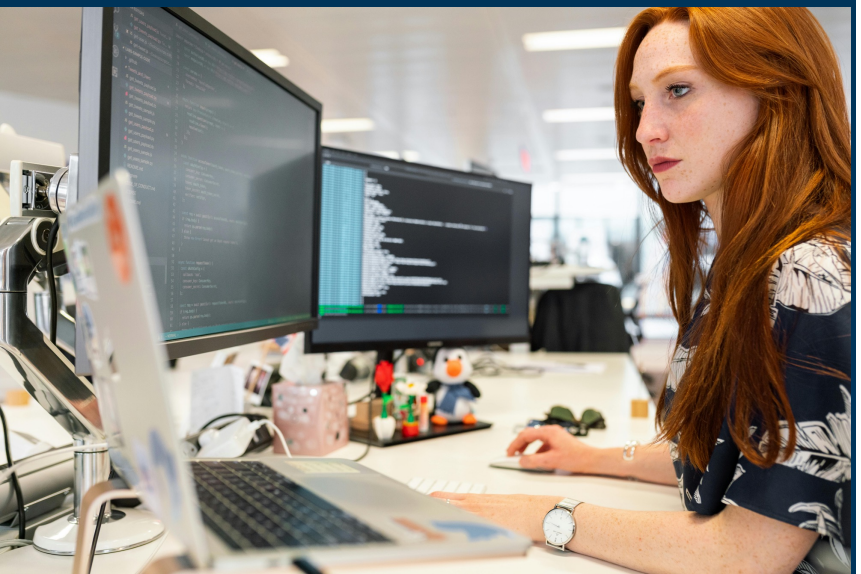


Media Platforms:
-Focus on platforms like X, Facebook, news outlets, and forums.

Common Themes Identified:
-Sensationalism, misinformation, celebrity, and emotional appeals.

Impact on Public Perception:
-Media often skews understanding, amplifying fear and misconceptions

Methodology of Content Analysis



Steps Involved:

1. **Data Collection: Gather texts from social media and news outlets.**

2. **Categorization: Themes identified (e.g., government response, medical advice)**

3. **Analysis: Use qualitative and quantitative methods to interpret data.**

Example Studies:
Studies highlight different emphases in media coverage.

Key Findings from Media Analysis

Findings:

-Media often portrays Lyme disease as a severe, urgent health crisis.

-High prevalence of negative sentiments and fear-mongering.

Examples of Media Narratives:
Lyme is newsworthy when a celebrity has it, focus on deer spreading Lyme, and limited coverage outside the US and Canada

Introduction to Sentiment Analysis

Definition of Sentiment Analysis:

- **Algorithmic process of determining and categorising the emotional tone or opinion expressed in a piece of text.**

Tools and Models Used:

- **BERT and ChatGPT models to analyze scientific literature.**

Relevance:

- **Detects emotive subjectivity and potential biases in academic writing, particularly on controversial topics.**

Sentiment Analysis of Scientific Literature

Data Source:

- 5,643 abstracts from scientific journals on Lyme disease.
- Ranging from 2010 to 2021
- Abstracts filtered for PTLDS relevance

Objectives:

- Assess existence of predispositions in academic writing towards sentiments and specific viewpoints.

Challenges:

- Scientific texts often aim for neutrality, complicating sentiment detection.

Methodology of Sentiment Analysis

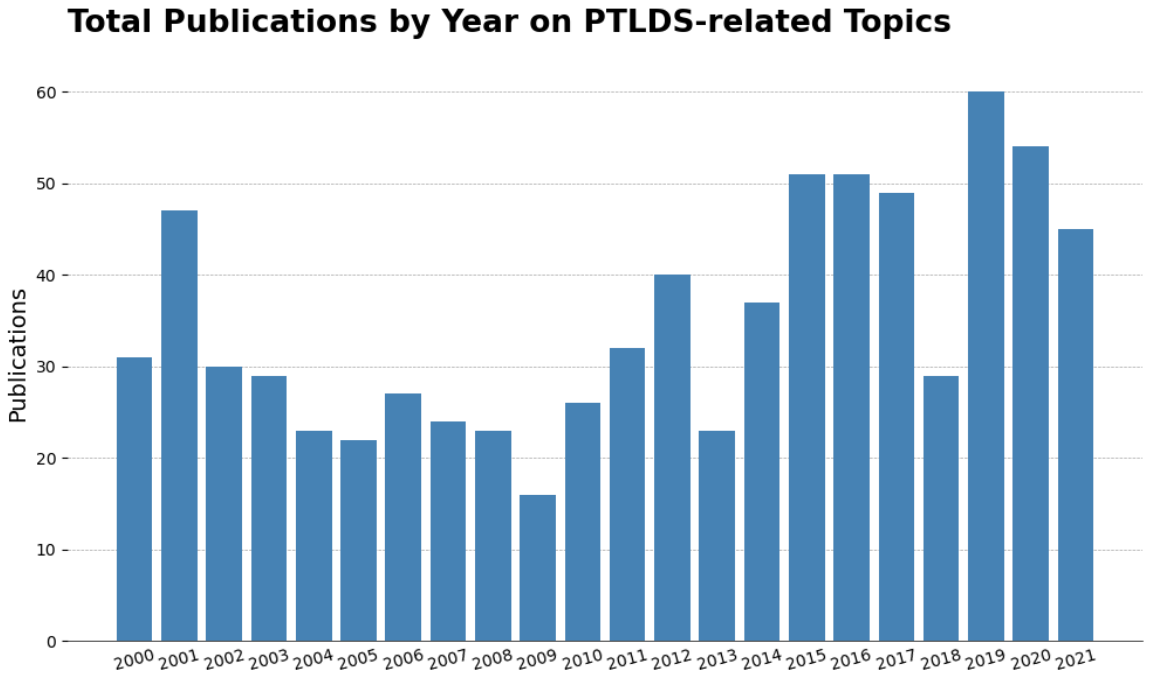
Steps:

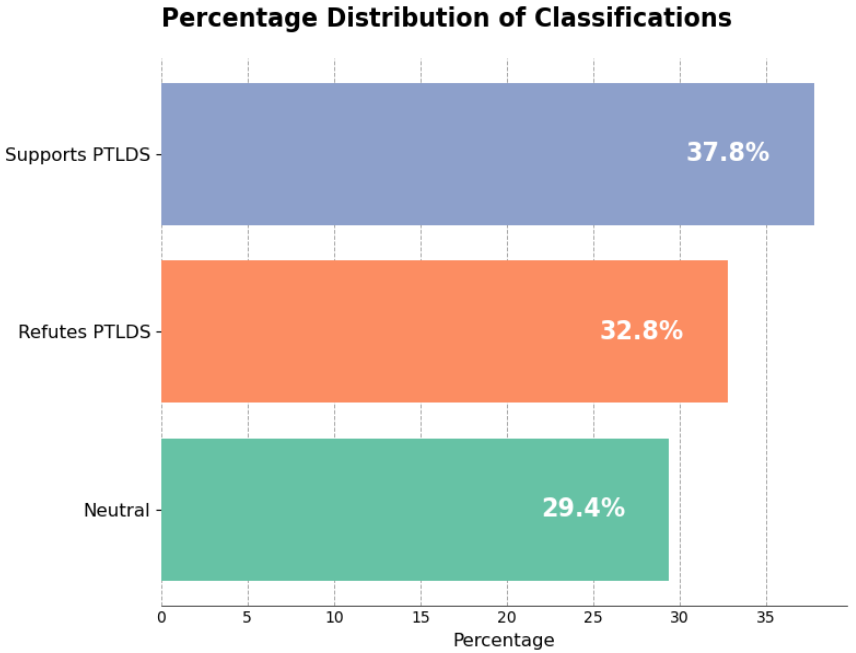
1. **Data Collection and Cleaning: Extract and prepare abstracts.**
2. **Model Application: Use BERT (or variants) for sentiment scoring.**
3. **Validation with SHAP: Ensure transparency in model predictions.**

Outputs:

Sentiment scores revealing patterns of positive, negative, or neutral emotional disposition (also: joy, fear, anger or disgust - Plutchik's Wheel of Emotions or Ekman’s Basic Emotions Model)

Key Findings from Literature Analysis





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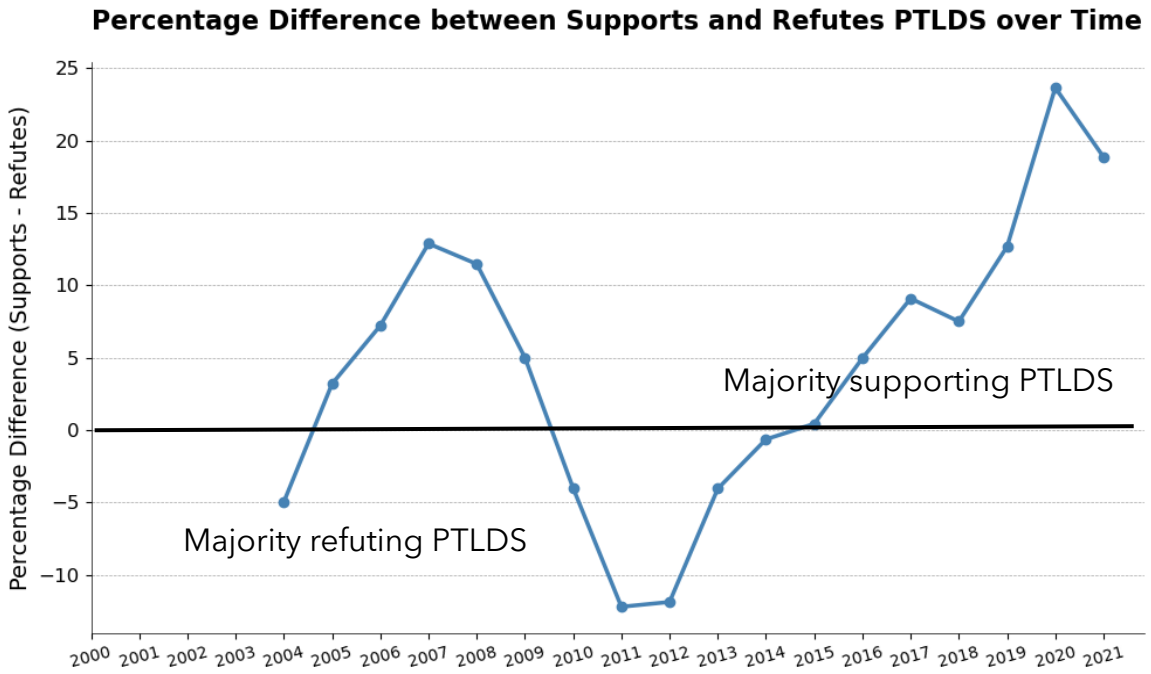
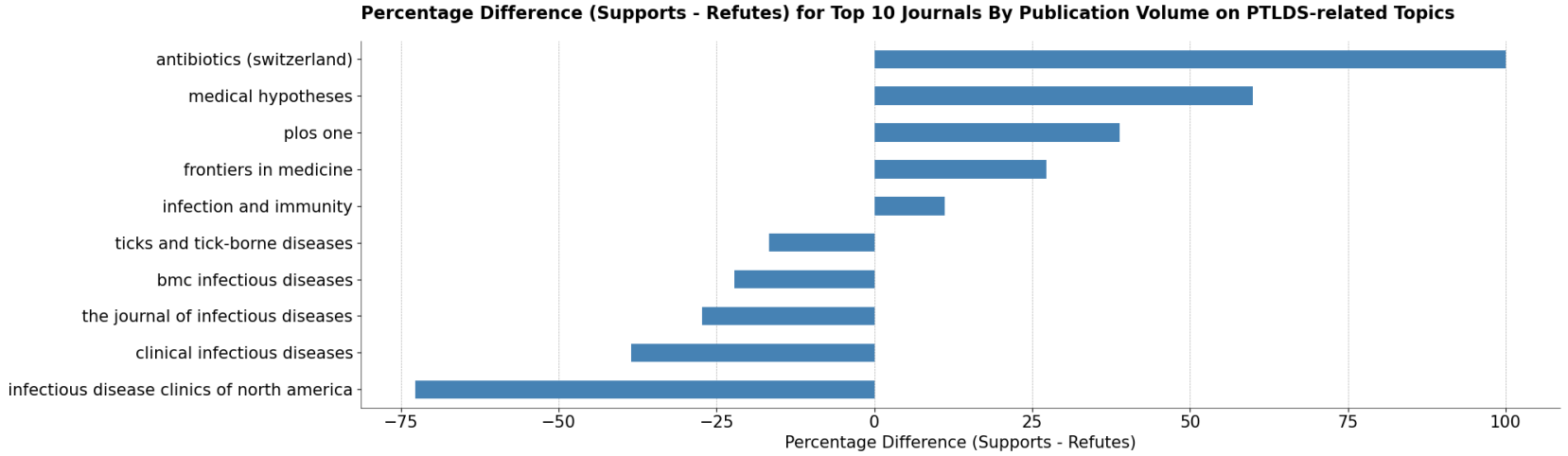




Key Findings from Literature Analysis

- Initial research shows that literature is divided on the topic of chronic Lyme disease (PTLDS).
- Trends are appearing indicating an increasing acceptance of chronic Lyme disease in literature.
- Some evidence exists of certain journals being more '*favourable*' outlets for specific positions on chronic Lyme disease.

Comparative Insights: Media vs. Literature

Media vs. Literature:

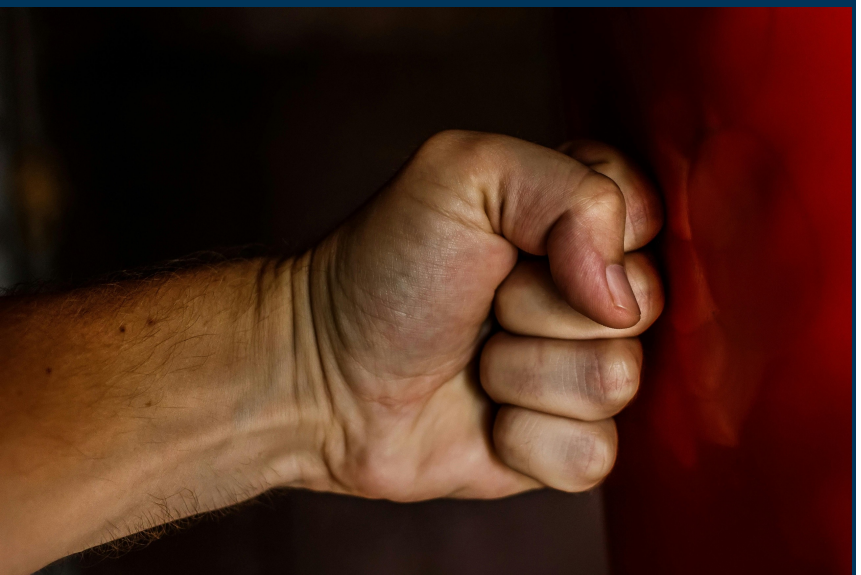
-Media often sensationalizes; literature presents cautious perspectives.

Public Perception and Policy Impact:

-Media's emotive style may drive fear and misinterpretation.

-Literature reflects complex scientific debates.

Implications of Findings



Impact on Public Health:
-Media narratives can shape patient behaviors, influencing treatment choices.

Challenges in Scientific Communication:
-Disconnect between media and literature affects public trust.

Policy Implications:
-Need for accurate, balanced information to guide effective health strategies.

Future Directions

Advances in AI and NLP:

-Development of specialized sentiment models for medical texts.

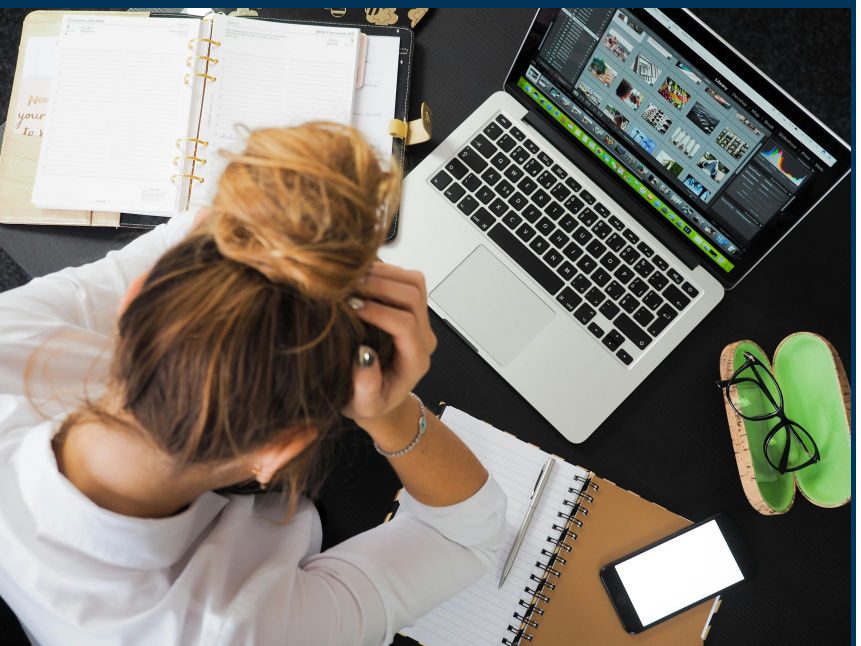
Bridging Media and Science:

-Better collaboration for accurate reporting.

Further Research Opportunities:

-Explore the impact of narratives on patient outcomes.

Conclusion



Summary:

-Media and literature offer contrasting views on tick-borne diseases.

-Understanding these depictions helps inform better public communication strategies.

Key Takeaway:

-Balanced narratives are essential for public understanding and health outcomes.

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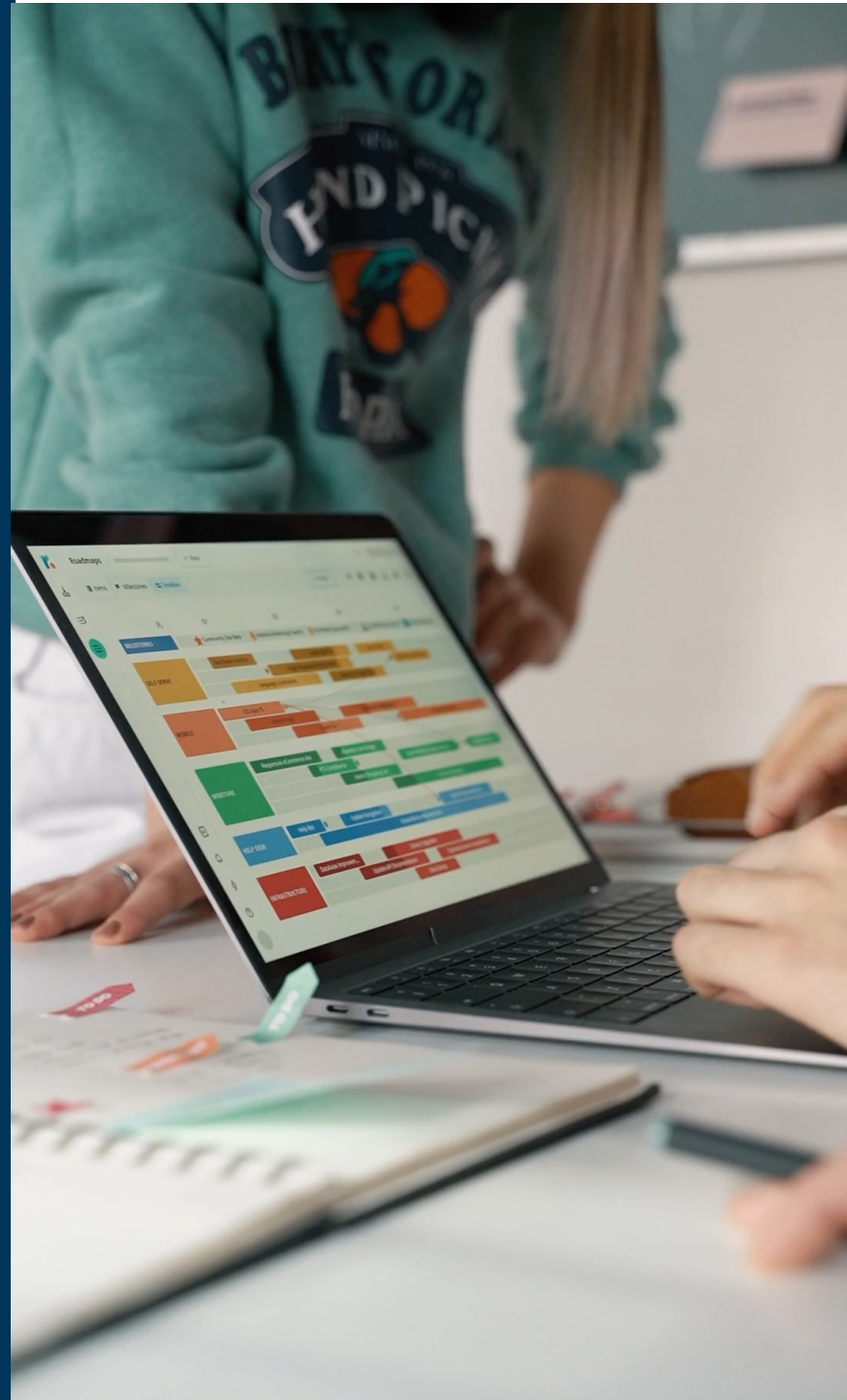

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