- Epi side of things/standard models (File 1)
  - Problem – The Standard we are using for heat-health is DLNM and curve-fitting. We are counting bodies and matching them to thermometers and not predicting mechanical failure. We are also relying on static thresholds (IMD definition). Triggers are arbitrary. We know that association ells us extreme heat effects were higher for rural areas than urban areas (our model explains this, rural areas have lower K capacity, so they hit asymptote faster).
  - Extreme heat effects were higher for the rural areas than urban areas." (Zeng et al.)
    - Our model explains this, rural areas have lower capacity (K value) so they hit the asymptote faster.
  - With every single model, we are calculating relative risk for things, not calculating system collapse.
    - RR (or OR, if applicable) fundamentally assumes systems stretch indefinitely (for instance, as heat goes up 10%, death goes up 10% or maybe 12% if it is curved). We are blind to a hypothetical wall, which we know exists.
- Hospital congestion side (File 2)
  - Paganini seems like a recurring figure for hospital congestion.
    - None of the retrieved full-texts analyzed... the factors predisposing to emergency medical care overload
    - He is explicitly telling us nobody has done what we are doing.
  - We also seem to know it is a flow problem (the traditional input-throughput-output model … can be helpful (Paganini et al.,).
  - We are FREAKING doing surveys!!! “Do we think heat is bad? Yes/No”. We need physics.
  - Also, it does seem like we are using tipping points (McKinsey) as “lots of data”, when it can be (at least, that’s what I am trying to show) a mathematical phase transition).
  - The gap seems to be that we are identifying overload (like yes, it exists) but we treat the overload issue as a management problem (hey, we need better staffing) rather than a physics/math problem (we are running into an asymptote).
- Physics / Complexity Science
  - We are viewing pathogenic emergence as a critical transition, and we are using concepts like dynamic bifurcation, which is good to see, but it seems like it is aimed at the wrong target.
    - Drake et al.,
    - Terminology is there, like bifurcation, critical transitions, etc
  - We are also applying it to… sentiment? (anti-vaxxers), see quote below
    - Critical dynamics in population vaccinating behavior... near the disease elimination threshold." (Pananos et al.)
    - Very interesting study, so we are modelling anti-vaxxers as a phase transition.
      - **Why is nobody modelling the hospital bed as a phase transition?? (this is actually very cool)**

- § EWS and motions of perturbations slows as the system approaches the transition (Drake et al.)
  - · That.. kinda what happens to a queue before it jams.
- o My takeaway from this cohort (physics side of things) is that we seem to be hung up on the start of a disease, the outbreak, but not the end of the line (treatment/collapse). So basically, I am already taking their math and pointing it to hospitals.

- File 4: BC heat dome data
  - o Chillers for MRI and CT equipment were not able to provide sufficient cooling... scanners... were inoperable (Canadian Climate Instititute)
    - § This is Tc!! Absolutely fascinating to see.. though I might be crazy and hallucinating.. wouldn't be surprised tbh
  - o Helicopters were unable to land... because the hot air was too thin.
    - § DA/dt went to zero. The Air itself is failing.
  - o Ambulances waited hours with deceased patients
    - § This is L (queue length) going to infinity.
  - o The Death Toll: "619 deaths... 98 per cent... inside buildings."
    - § The system failed the people inside their buildings.
  - o So, my takeaway here is the report is recommending we cool and we add greenery, but we are not recommending evacuation measures, or the calculation of threshold of collapse of hospitals, and evacuating before we hit.
    - § This is typical of a reactive system, not a predictive one, because we are so scared of predicting.

Current epidemiology (File 1) models heat death as a smooth curve. Hospital managers (File 2) know this is false and that systems overload, but they lack the mathematical framework to predict it, relying instead on qualitative surveys. Meanwhile, complexity physicists (File 3) have developed robust tools for detecting critical transitions and tipping points, but have only applied them to disease outbreaks, not health system capacity. The 2021 BC Heat Dome (File 4) provided the empirical proof that health systems do not bend but break.

We propose a thermodynamic-congestion model that mathematically defines a hospital's/neighbourhoods/city's (whatever, pick one) tipping point. We define a point of critical temperature, Tc, as an infrastructure limit where dA/dt hits zero.

- Notes
  - o Notice the "a" not "the" – technically It is the first to my understanding, but good to be humble
  - o Emphasize that we are NOT curve fitting, but calculating the friction of the queue

Notes for answering:

- We need a structure for the paper
- What is the outcome? Wait times I suppose
- For evidence searching in a better
- Do we have a mathematical definition for what tipping points actually are? Or is it a buzzword (more likely a buzz word).
- Ask – have we covered a comprehensive/deep enough lit review?

- We can robustize the thesis by using queueing theory. That remains something.
- For all the keywords, buzzwords, see the google doc where I have all keywords
  - Bifurcation
  - phase transition
  - “tipping point”
  - but a mathematical definition
  - vertical asymptote
  - … singularity? (idk, division by 0). Sounds sci-fi
  - Critical transition
  - Elasticity
  - DLNM
  - Regression
  - Thermodynamic limit of the human body, measured by WBGT. Same for infrastructure too.
  - Cascade effect (AC Failing, MRi, Triage)
  - Hysteresis (state of system depends on its history).
  - Queueing theory jargon
    - Service rate decay
    - Queue
    - Utilization factor (rho, the input to capacity)
    - L
    - Whatever
  - Non-linear
  - Feedback loop
  - Control & Order parameter
    - Control is a knob you turn (temp), order is the state (mortality)