EPH58

Evaluating the cost-effectiveness of wastewater-based disease surveillance

Karina Wallrafen-Sam[1], Nicole Zacharias[2], Raquel Rubio Acero[3], Andreas Walker[4], Marcus Lukas[5], Beate Schneider[5], Sophia Beyer[6], Timo Greiner[6], Jakob Schumacher[6], and Jan Hasenauer[1,7]

[1] University of Bonn, Bonn, Germany | [2] University Hospital Bonn, Bonn, Germany | [3] LMU University Hospital, Munich, Germany | [4] University Hospital Düsseldorf, Düsseldorf, Germany
[5] German Environment Agency, Berlin, Germany | [6] Robert Koch Institute, Berlin, Germany | [7] Helmholtz Center Munich, Neuherberg, Germany

I. BACKGROUND

- Interest in **wastewater-based surveillance** has grown since COVID due to advantages w.r.t. underreporting and scaleability
- A comprehensive **cost overview** is lacking
- The **context-specific cost-effectiveness** of different surveillance strategies is unknown

- We investigate wastewater surveillance **running costs at 4 laboratories** across Germany:
  - Bonn
  - Düsseldorf
  - Munich
  - Berlin
- Then we couple our cost data with different **effectiveness measures** to **compare wastewater vs. individual tests**

II. DATA

- **Investments in automatic extraction** equipment are quickly **offset by efficiency gains**
- Surveilling **multiple targets** at once exploits **economies of scale**
- **Costs vary widely** based on PCR technology, sample transport approach, etc.

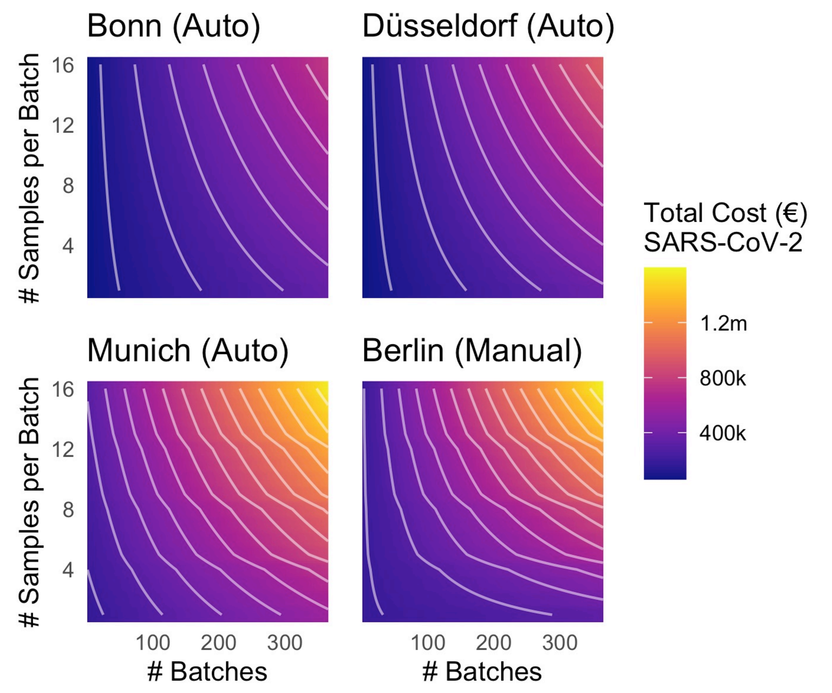


Figure 1: Total costs of wastewater sampling and analysis at 4 laboratories by the number of samples analysed per batch and the number of batches (with manual or automatic extraction)

III. COST-EFFECTIVENESS AT THE CITY LEVEL

METHODS

- *Scenario:* An **emerging infectious disease** spreads among 10'000 persons (1 catchment area)
- *Goal:* **reconstruct true case curve** using 1 year of **active surveillance data**
- *Approach 1:* **Test wastewater** every *X* days
  - Map concentrations to prevalence estimates (McMahan et al., 2021) & interpolate
- *Approach 2:* **Individually test** *N* random persons per day
  - 99% / 80% Se and €43.74 / €12.00 cost (Diel et al., 2022)

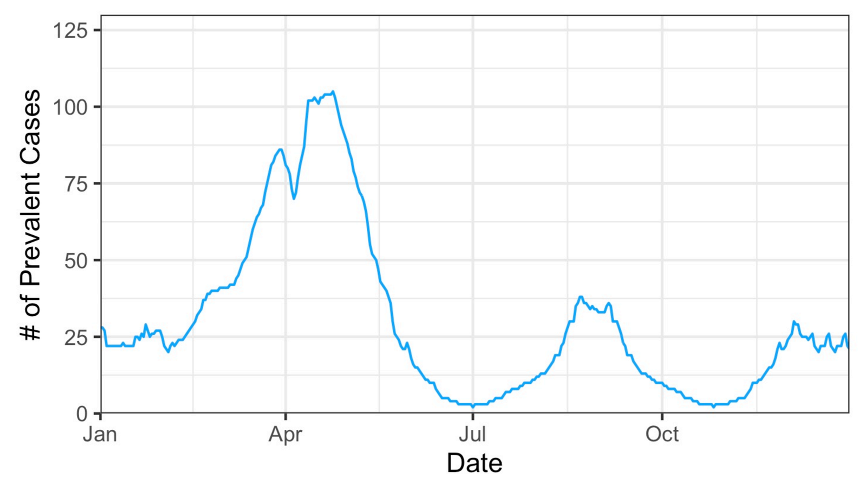


Figure 2: The true number of prevalent cases of a COVID-like illness in an example population

RESULTS

Wastewater surveillance can achieve similar accuracy at a significantly lower cost than individual testing

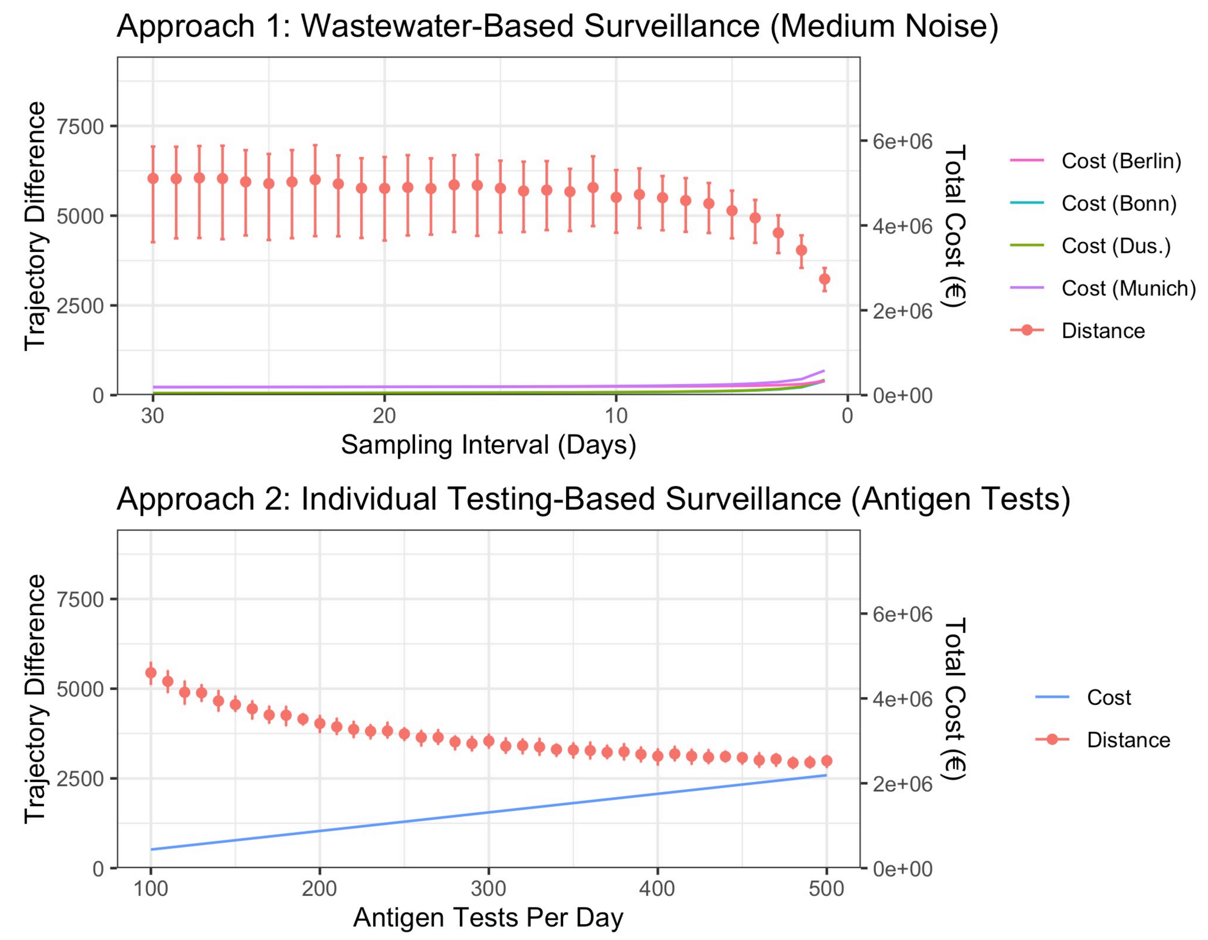


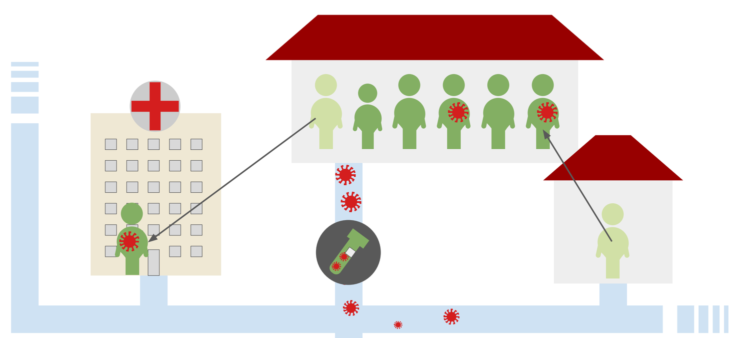
Figure 3: The lock-step Euclidean Distance between the true and reconstructed prevalence curves (in red) and the total cost for various surveillance approaches

IV. COST-EFFECTIVENESS IN A HIGH-RISK SETTING

METHODS

- Agent-based, **network-based model** of a **nursing home** using EpiModel (Jenness et al., 2018):
  - 150 residents + 150 staff (closed population)
  - 4 contact network layers
  - COVID-like illness introduced via outside visitors
  - Frequent asymptomatic infections
  - Co-circulating generic cold/flu
  - No vaccinations; waning natural immunity
  - 1-year simulation period
  - Isolation of detected cases

- Model used to **compare testing strategies**:
  - For symptomatic cases: Daily PCR testing
  - For others:
    - Daily PCR testing OR
    - Daily antigen testing + PCR follow-up OR
    - Wastewater testing + PCR follow-up



RESULTS

Neither the wastewater- nor the individual testing-based approach consistently outperforms the other

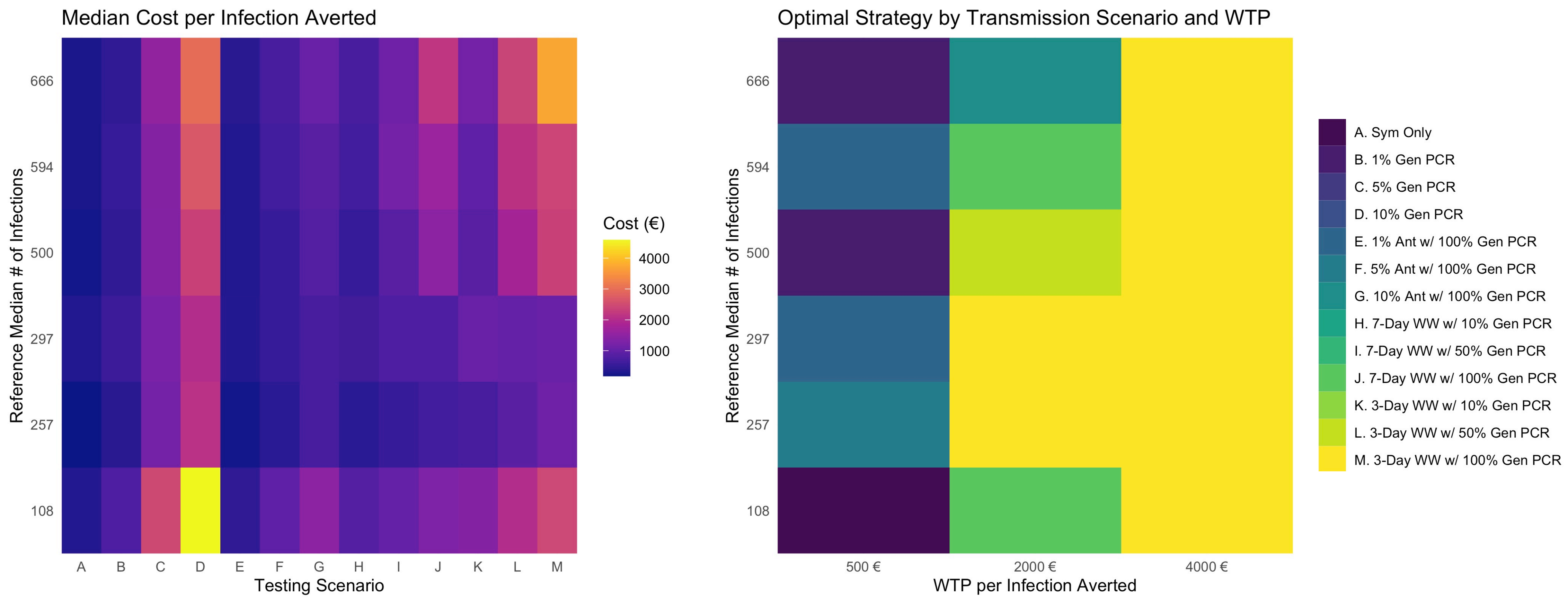


Figure 4: The median surveillance cost per infection averted by transmission and testing scenario (left); the strategy with the lowest number of median infections by transmission scenario and willingness-to-pay for surveillance per infection averted (right).

V. CONCLUSIONS

- **Wastewater-based surveillance** has clear **cost-related advantages** over active individual testing-based surveillance **in larger, heterogeneous populations**

- **Modelling** can guide public health officials in choosing a **suitable surveillance** approach for a given context

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