The role of human insight in forecasting the COVID-19 epidemic

- Results from Germany, Poland (and Europe) -

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Outline

1) Overview and aims
2) The models
3) Results
4) Current and future work

Overview and aims

Overview

- Submissions to the German / Polish Forecast Hub

- October 10 2020 - March 1 2021

- 3 Models submitted:

    a. Crowd forecast
    b. A model based on the renewal equation
    c. A convolution model

- continued submission to ECDC Hub

Aims

- Provide value to the Forecast Hub

- Disentangle the role of human influence:

  1. a completely untuned model based in epidemiological theory
  2. a completely tuned model with no theory
  3. an ensemble of semi-tuned models

The models

The renewal equation model

- based on the R package EpiNow2

- future cases
  = weighted sum of past cases * Rt

- Estimates Rt (using a gaussian process) and then just predicts a constant Rt into the future
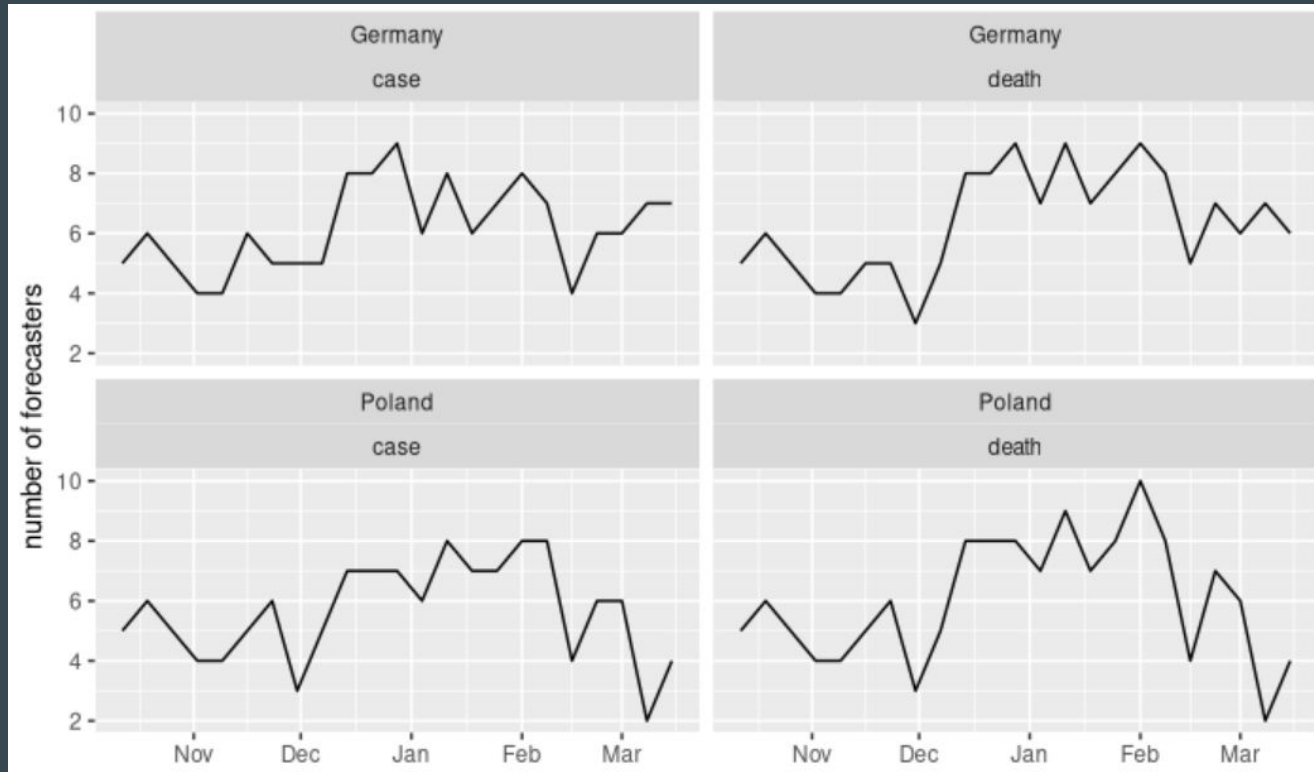
The convolution model

- only death forecasts

- models deaths as a convolution of cases with a delay distribution and a scaling parameter
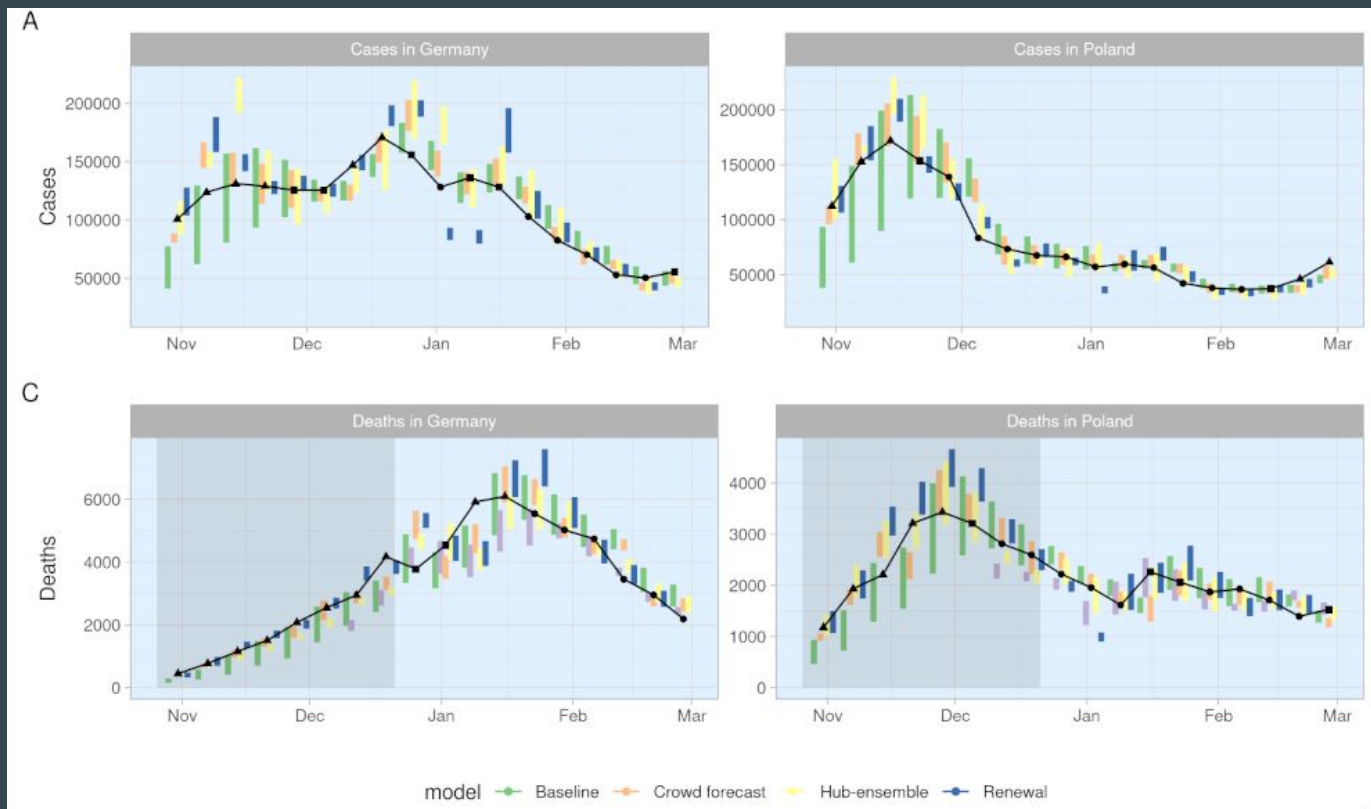
The crowd forecasts

- R shiny app

- Data stored in a google sheet

- app.crowdforecastr.org

Number of forecasts

Results

Observed values and 2 week ahead predictions

Evaluation metrics

WIS = sharpness + overprediction + underprediction

Calibration
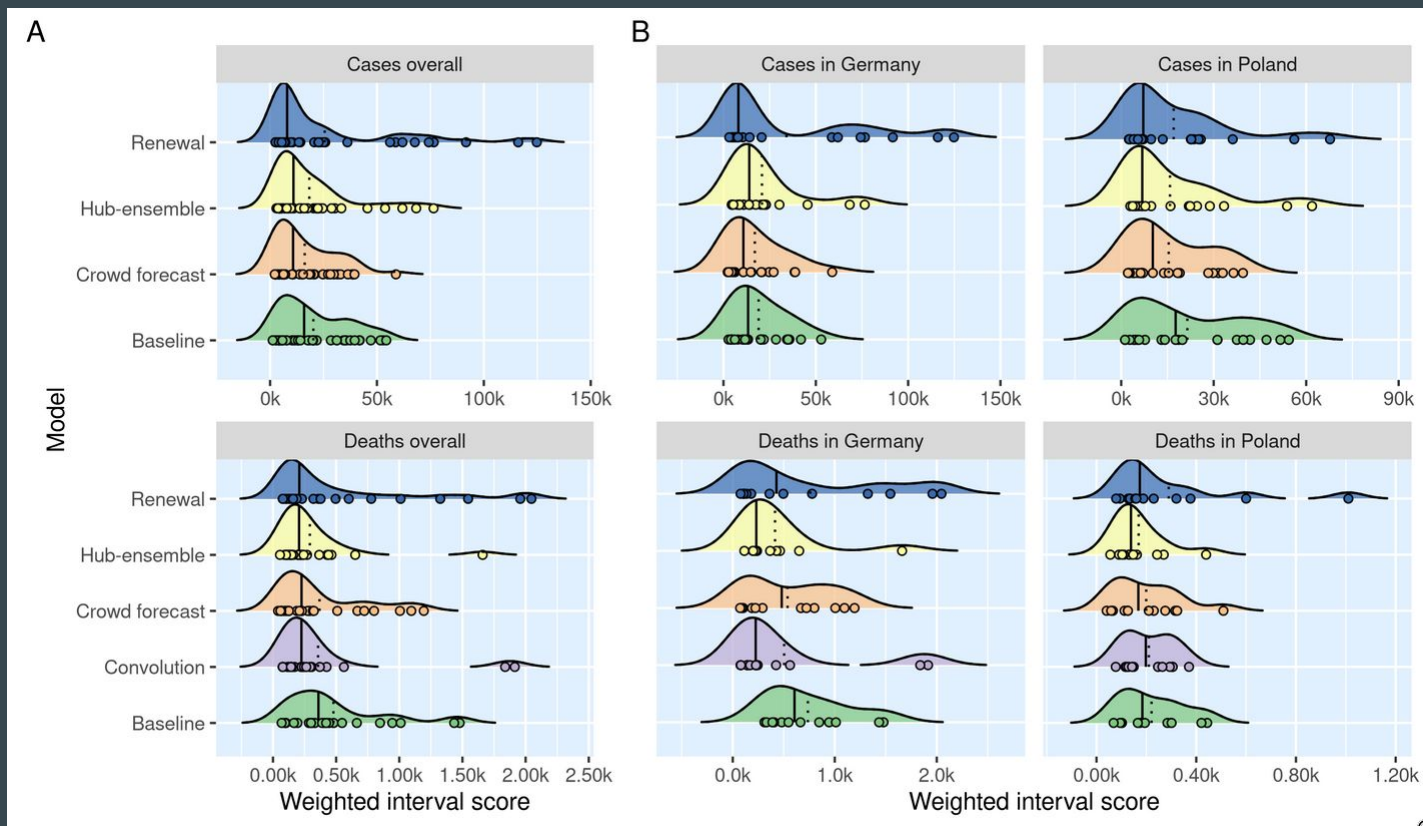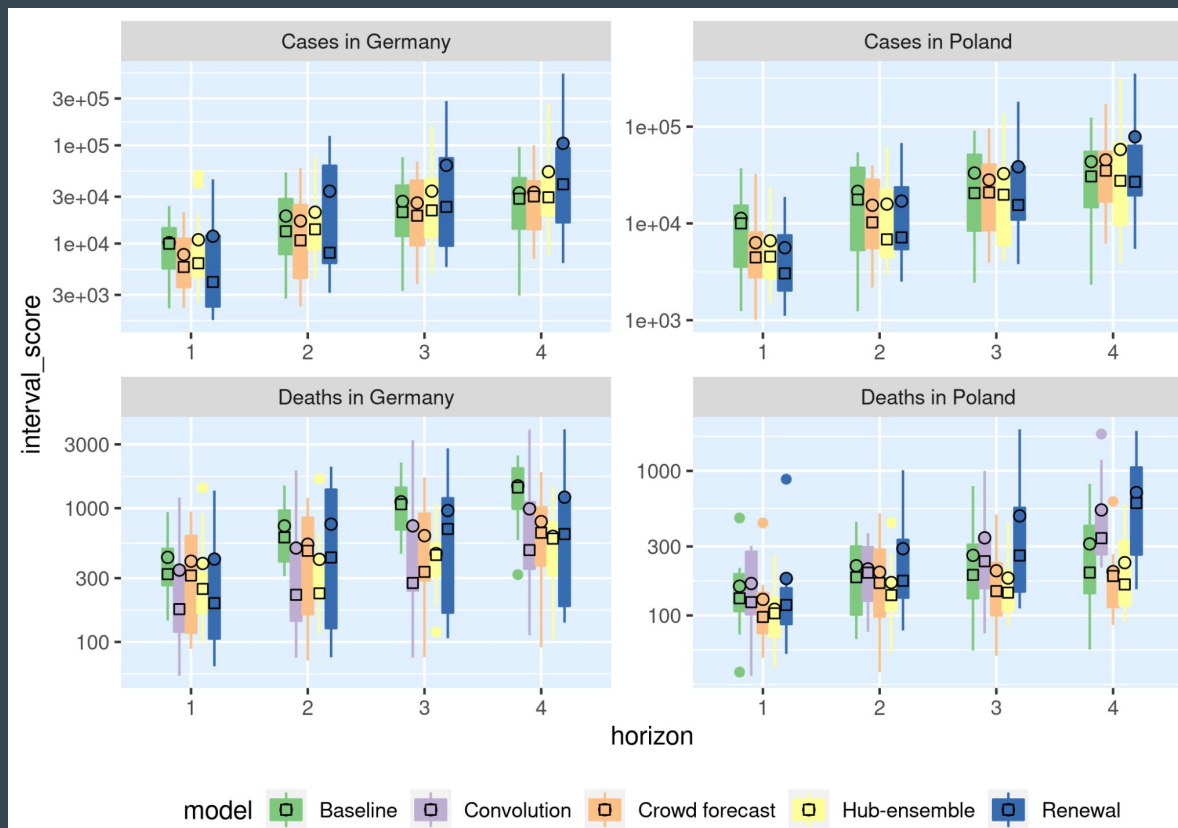- bias (between -1 and 1)
- coverage

Aggregate results (2 weeks ahead)

	Model	WIS	WIS - rel.	WIS - median	WIS - sd	Sharpness	Underpred.	Overpred.	Bias	Abs. error	50%- Cov.	90%- Cov.
Cases												
2 wk ahead	Baseline	20200	1.00	14400	19600	4750.0	10000.0	5490.0	-0.06	28400	0.31	0.55
	Crowd forecast	16200	0.80	8330	16600	3660.0	5930.0	6600.0	-0.01	23300	0.36	0.55
	Hub-ensemble	18300	0.91	9940	21900	6140.0	3800.0	8410.0	-0.03	26800	0.43	0.64
	Renewal	25600	1.26	9020	33800	5420.0	5920.0	14200.0	0.17	34600	0.43	0.67
Deaths												
2 wk ahead	Baseline	479	1.00	317	488	123.0	122.0	233.0	0.23	735	0.17	0.67
	Convolution	357	0.74	176	573	104.0	204.0	48.8	-0.10	565	0.33	0.79
	Crowd forecast	368	0.77	164	442	107.0	102.0	160.0	0.14	576	0.38	0.75
	Hub-ensemble	292	0.61	168	385	132.0	108.0	51.9	0.01	429	0.62	0.96
	Renewal	524	1.10	206	671	155.0	133.0	236.0	-0.02	750	0.50	0.71

Distribution of weighted interval scores (2 weeks ahead)

# Scores for different forecast horizons

Contribution to the Hub ensemble (2 weeks ahead)

	Model	WIS	WIS - median	WIS - sd	Sharpness	Underpred.	Overpred.	Bias	Abs. error	50%- Cov.	90%- Cov.
Cases											
2 wk ahead	Hub-ensemble	18300	9940	21900	6140.0	3800.0	8410.0	-0.03	26800	0.43	0.64
	Hub-ensemble-all	16500	8490	19600	5450.0	3290.0	7710.0	0.02	24300	0.43	0.69
	Hub-ensemble-with-crowd	16900	9250	19600	5230.0	4310.0	7370.0	0.00	24600	0.38	0.64
	Hub-ensemble-with-renewal	17500	9250	21400	5830.0	2880.0	8770.0	0.00	25500	0.45	0.71
Deaths											
2 wk ahead	Hub-ensemble	292	168	385	132.0	108.0	51.9	0.01	429	0.62	0.96
	Hub-ensemble-all	296	151	398	125.0	91.0	80.2	0.05	486	0.58	0.92
	Hub-ensemble-with-crowd	303	161	392	122.0	106.0	74.6	0.03	499	0.58	0.92
	Hub-ensemble-with-renewal	296	144	397	128.0	97.1	71.2	-0.01	462	0.67	0.92

Contribution to the Hub ensemble median (2 weeks ahead)
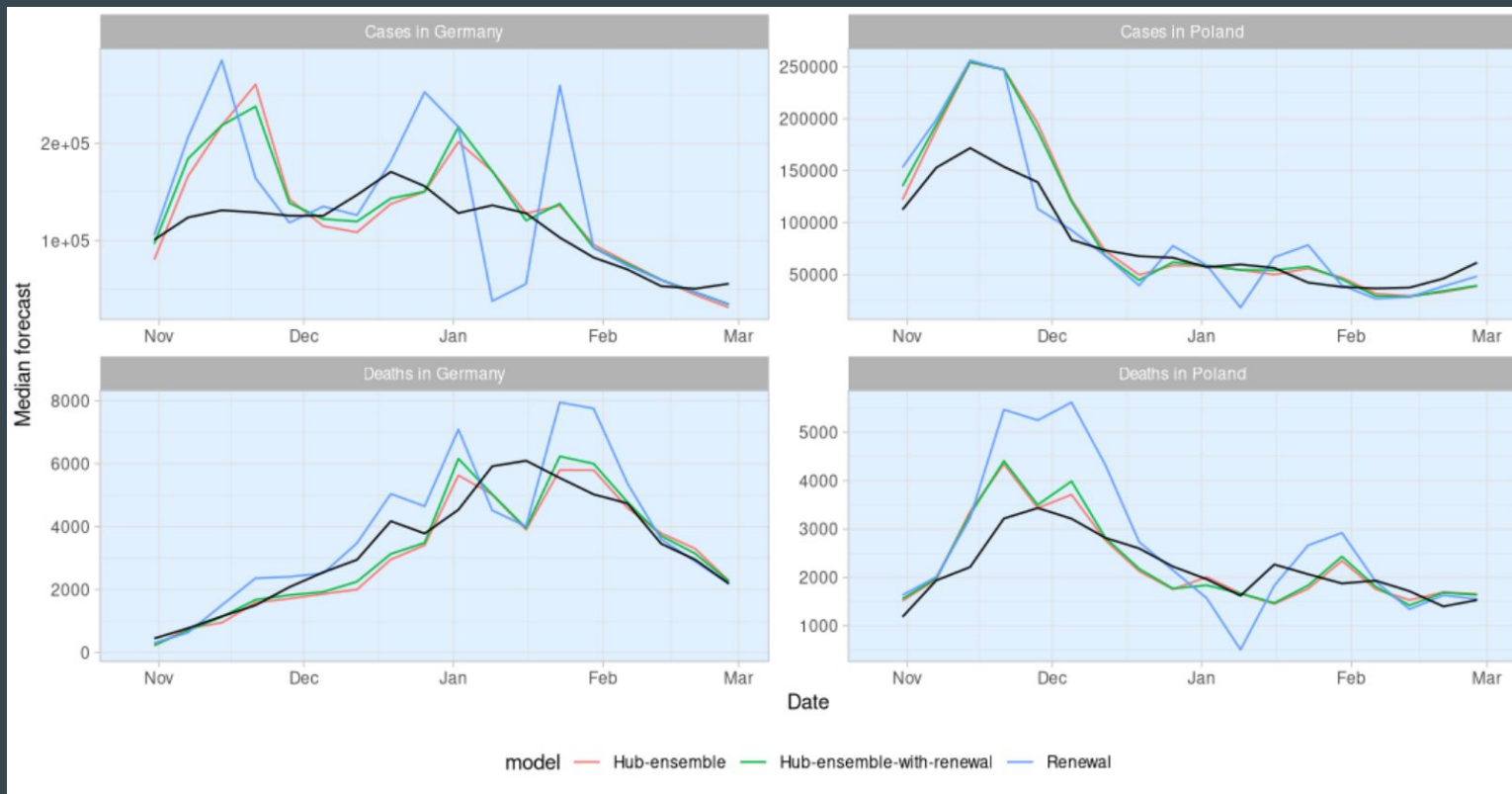
Takeaways

- Ensembles are stable, but rarely brilliant
- Even 'bad' models can make a positive contribution
- humans are
    - good at predicting cases
    - worse at deaths
    - overconfident

Current and future work

Crowd Rt forecasts

- humans forecast Rt
- renewal equation maps Rt to cases and deaths
- rt-app.crowdforecastr.org

ECDC Hub

- regular submissions to the hub
- few participants in many countries

UK COVID-19 Crowd Forecasting Challenge

- 12 weeks
- started May 24th
- users can use both apps

Tell your friends about it!

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UK Covid-19 Crowd Forecasting Challenge

May 24th - August 16th 2021

Use your insights to make a real difference! Anyone is welcome to join.

**To participate, submit your weekly forecast between
Sunday 12am and Monday 8pm UK Time.**

**1. prize: 100 GBP
2. prize: 50 GBP
3. prize: 25 GBP**

more information: crowdforecastr.org

UK crowdforecasting challenge - Rt vs. non-Rt

Leaderboard

CSV | Excel

Search: [_____]

	forecaster	interval score (lower = better)	ranking
1	anonymous_Stingray	0.19	1
2	seb (Rt)	0.27	2
3	seabbs (Rt)	0.28	3
4	EpiExpert-ensemble	0.33	4
5	Layperson_21 (Rt)	0.35	5
6	habakuk (Rt)	0.38	6
7	anonymous_Rail	0.39	7
8	curlykale	0.44	8
9	aurelwu	0.44	9
10	aen	0.47	10

Thank you for your attention