Surveillance systems cost estimate

All numbers include a 20% +/- error bar around central point estimate

	Methodology	Annual cost per capita: Target state L/MIC	Annual cost per capita: Target state HIC	Annual cost per capita: Best-in-class state L/MIC	Annual cost per capita: Best-in-class state HIC	Start-up cost per capita: Target state	Start-up cost per capita: Best-in-class	Estimated % of target-state: L/MIC	Estimated % of target-state: HIC
Population-representative surveillance foundation	**CRVS:** Top down estimates for software, systems costs and cost per registration event from the World Bank CRVS report and CRVS Gateway. Expert interviews used to narrow in on wide range provided to $100M for HICs. Cost per registration used to derive per capita cost based on countries annual birth/death rate from the World Bank. Given other non-surveillance uses of a CRVS system, only 2/3 assumed to be for CRVS. HICs assumed to have 90% of target state CRVS systems. **SRS:** Used total costs for the COMSA program in Mozambique to estimate a per capita spend for a SRS for L/MICs – L/MICs assumed to have 20% of target state SRS systems. **Mortality:** Cost per activity (cause of death verification, verbal autopsy, autopsy) from CRVS Gateway, Sierra Leone MITS program, benchmark of published data, and expert interviews. • % undergoing autopsy/equivalent: 1% (target based on ideal MITS program) and 2% for best in class (based on WHO data for European countries of 10% current autopsy rate, of which 20% cost attributed to surveillance) •% cause of death attributed target: 80-99%; 50% of verification cost attributed to surveillance L/MICs assumed to have 10% of target state mortaility surveillance systems, HICs assumed to have 90%	$0.16 - $0.24	$1.03 - $1.54	$0.61 - $0.92	$1.20 - $1.80	$0.08 - $0.12	$0.91 - $1.36	10-20%	90%
Notifiable disease and IDSR-like surveillance	**Community based surveillance**: L/MIC: using network of CHW receiving modest incentive and salaried supervisors. No. of volunteer CHW estimated from study showing 33% sensitivity with 1000 pop per CHW. Number of volunteers increased linearly for higher sensitivity (50% for target, 80% for best-in-class). No. of surveillance managers per volunteers assumed to be 1:25, and data managers assumed to be 1:75 HIC: assumed cost of an ongoing health awareness campaign to direct population towards health system or national phone hotline L/MICs assumed to have 30% of target state indicator based surveillance systems, HICs assumed to have 60% **Indicator based surveillance**: Main cost (~80% of total) comes from FTEs related to data collection and data entry of data from health facilities and labs. Assuming ~2 FTEs per 500k population from expert interviews L/MICs assumed to have 20% of target state mortaility surveillance systems, HICs assumed to have 90% **Response**: estimated rapid response team FTEs needed (a team of 5 per 200k of population for target and 100k for best-in-class) per expert interview and IHR's Joint External Evaluation L/MICs assumed to have 30% of target response teams, HICs assumed to have 60%	$0.20 - $0.30	$0.57 - $0.85	$0.30 - $0.45	$0.69 - $1.03	<$0.01	$0 - $0.01	30%	60%
Pathogen surveillance including sequencing	**Lab costs**: Set-up cost of up to $40M per lab from APHL estimate for HIC, $20M for L/MIC, with 1 lab per 6M population in target and per 3M in best-in-class. Ongoing labor costs of 40 people per lab. 15% of total public health lab cost assumed to be for surveillance per ECDC analysis L/MICs assumed to have 30% of target lab systems, HICs assumed to have 80% **Pathogen Genomic Sequencing**: assuming sequencing platforms to be added to existing public health labs • Capacity: Weekly sequencing capacity needed is most uncertain input given recency of PGS technology. Yearly capacity (as % of total population) 0.5% for target and 2.5% for best-in-class That roughly translates to ~2% of weekly COVID-19 peak number of positive cases for target and ~10% for best-in-class, or (though COVID-19 cases and peak varies significantly by country) • Fixed costs: For a capacity of ~500k sequenced samples per year, labor and platform capital costs estimated as a blended average of different high throughput lab network set-ups – totaling ~$2.5M in HIC and ~$5M in L/MICs, with an ongoing labor cost of ~$600k/year and $200k/year respectively • Variable costs: Sample prep, logistics and sequencing cost of reagents and consumables calculated to be ~$60/sample. Total variable cost calculated based on capacity multiplied expected utilization of 50% L/MICs assumed to have 20% of target PGS systems, HICs assumed to have 50% **Sewer and septic**: Sample sites assumed to cover population of 50-100k population, with enough sites to cover 50-80% of the population, per expert interviews and ongoing Malawi waste water surveillance effort. Frequency of sample collection per site ranges from twice a month once a week L/MICs assumed to have 15% of target sewer and septic surveillance systems, HICs assumed to have 25%	$0.23 - $0.34	$0.53 - $0.80	$0.87 - $1.30	$1.29 - $1.93	$0.57 - $0.86	$1.10 - $1.65	15-30%	50-80%
Specialized surveillance programs	Main costs are program management costs of a couple of FTE per program and sample collection and analysis Costs per sample collected and analyzed multiplied by the number of samples taken as part of study or survey Total cost of ~$0.5M per study in HIC. Assuming 1-8 sero-surveillance studies per year and 1-3 vaccine effectiveness studies per year L/MICs assumed to have 10% of specialized surveillance programs, HICs assumed to have 40%	$0.01 - $0.01	$0.03 - $0.04	$0.07 - $0.11	$0.12 - $0.17	<$0.01	<$0.01	10%	40%
Data integration	For a country of 30M people, necessary cloud infrastructure costing $300k/year, with software licenses costing $100k/year (and an additional $300k in the first year) Team of 5 dedicated FTEs during set-up to lobby and push for health centers and for each surveillance program to share data and to have interoperable data with common meta-data – 2 dedicated FTEs ongoing Build team of nearly 40 FTEs ($1.5M for LIC/MIC and $3M for HIC) to set up system. Ongoing support from 20 data scientists and 10 data and IT support staff ($1.5M for LIC/MIC and $3M for HIC) L/MICs assumed to have 30% of data integration capacity, HICs assumed to have 80%	$0.05 - $0.08	$0.10 - $0.14	$0.05 - $0.08	$0.10 - $0.14	$0.05 - $0.07	$0.05 - $0.07	30%	80%
National Public Health Institute	Assuming regional hub teams responsible for local populations of ~3m each, with 1 single centralized national-level set-up per country Assuming a team of ~15 dedicated FTEs (e.g., data encoders, program officers, managers, epidemiologists) per every 3M population per expert interviews L/MICs assumed to have 30% of central NPHI capacity, HICs assumed to have 80%	$0.03 - $0.05	$0.24 - $0.37	$0.03 - $0.05	$0.24 - $0.37	$0.01 - $0.01	$0.01 - $0.01	30%	80%
TOTAL		**$0.68 - $1.03**	**$2.50 - $3.75**	**$1.94 - $2.91**	**$3.63 - $5.45**	**$0.71 - $1.07**	**$2.07 - $3.11**		

Total incremental global spend for target state (in USD millions)

	Incremental funding notes	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	10 year total
Population-representative surveillance foundation	For CRVS/SRS, L/MIC assumes target state SRS, HIC assumes best-in-class CRVS For incremental spending for mortality assumes average of target and best-in-class	$1,994 - $2,991	$1,994 - $2,991	$1,357 - $2,036	$1,357 - $2,036	$1,357 - $2,036	$1,357 - $2,036	$1,357 - $2,036	$1,357 - $2,036	$1,357 - $2,036	$1,357 - $2,036	$14,845 - $22,268
Notifiable disease and IDSR-like surveillance	Incremental spending estimate assumes mid-point average between target and best-in-class spending	$1,552 - $2,328	$1,552 - $2,328	$1,532 - $2,297	$1,532 - $2,297	$1,532 - $2,297	$1,532 - $2,297	$1,532 - $2,297	$1,532 - $2,297	$1,532 - $2,297	$1,532 - $2,297	$15,356 - $23,034
Pathogen surveillance including sequencing	For PGS, given recency of technology use, with lower existing baseline, therefore assume less progress towards best-in-class (only 25% of best-in-class) For lab based, and sewer and septic surveillance, assumes average of target and best-in-class	$7,826 - $11,738	$7,826 - $11,738	$2,849 - $4,273	$2,849 - $4,273	$2,849 - $4,273	$2,849 - $4,273	$2,849 - $4,273	$2,849 - $4,273	$2,849 - $4,273	$2,849 - $4,273	$38,440 - $57,660
Specialized surveillance programs	Assumes mid-point average between target and best-in-class spending	$328 - $492	$328 - $492	$321 - $482	$321 - $482	$321 - $482	$321 - $482	$321 - $482	$321 - $482	$321 - $482	$321 - $482	$3,227 - $4,841
Data integration	Assumes mid-point average between target and best-in-class spending	$491 - $736	$491 - $736	$255 - $383	$255 - $383	$255 - $383	$255 - $383	$255 - $383	$255 - $383	$255 - $383	$255 - $383	$3,023 - $4,535
National Public Health Institute	Assumes mid-point average between target and best-in-class spending	$260 - $390	$260 - $390	$200 - $300	$200 - $300	$200 - $300	$200 - $300	$200 - $300	$200 - $300	$200 - $300	$200 - $300	$2,121 - $3,182
TOTAL		**$12,451 - $18,676**	**$12,451 - $18,676**	**$6,514 - $9,771**	**$6,514 - $9,771**	**$6,514 - $9,771**	**$6,514 - $9,771**	**$6,514 - $9,771**	**$6,514 - $9,771**	**$6,514 - $9,771**	**$6,514 - $9,771**	**$77,013 - $115,520**