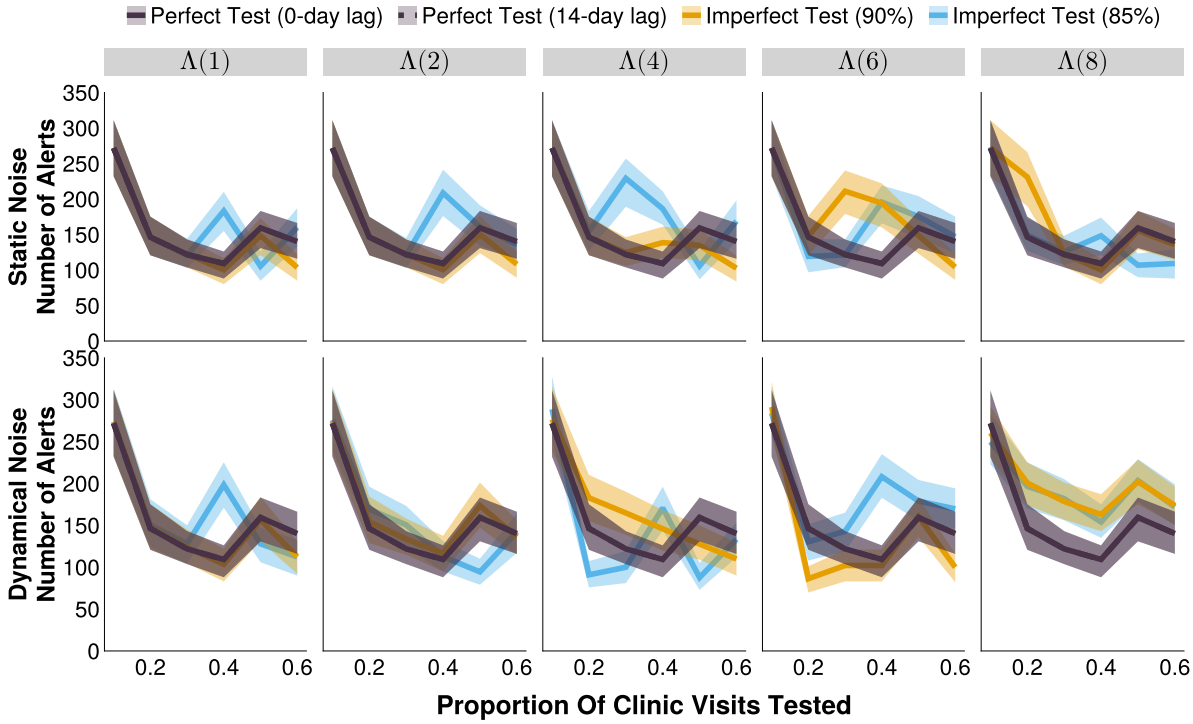
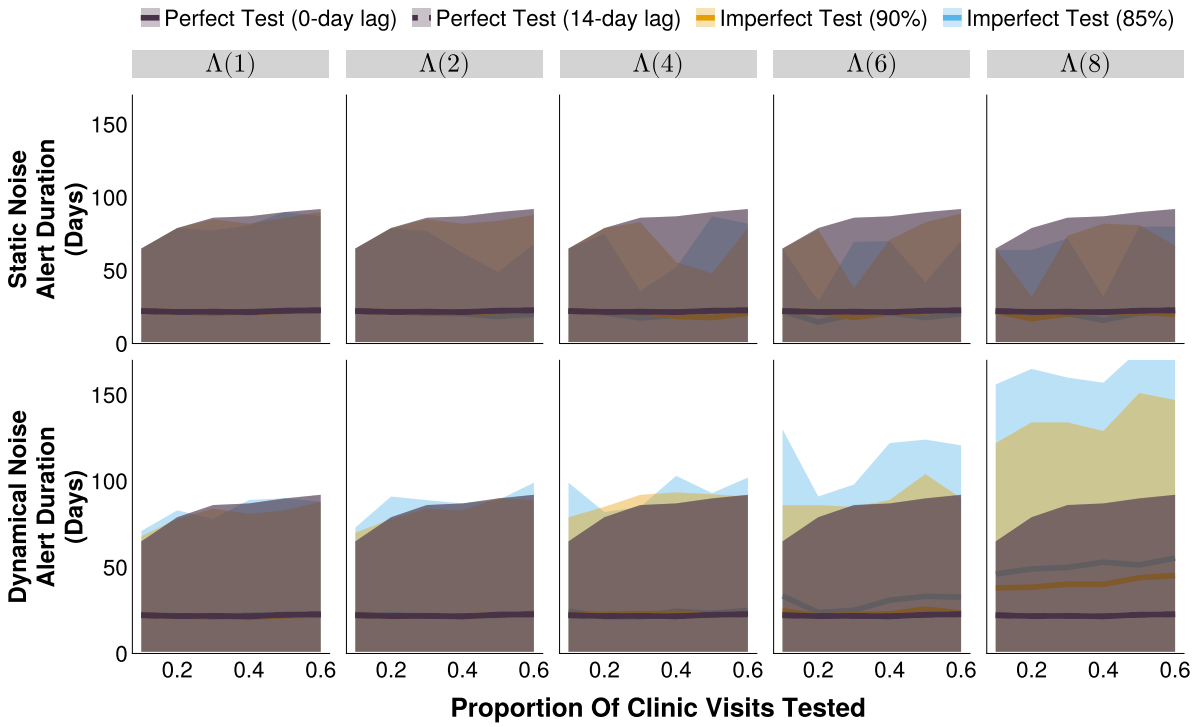
Supplementary Material for Chapter 4

Figures



Supplemental Figure 1: The number of alerts of outbreak detection systems under different testing rates and noise structures, at their respective optimal alert thresholds. The shaded bands illustrate the 80% central interval, and the solid/dashed lines represent the mean estimate. Imperfect tests have the same values for sensitivity and specificity. Solid lines represent tests with 0-day turnaround times, and dashed lines represent tests with result delays. $\Lambda(4)$ indicates the mean noise incidence is 4 times higher than the mean measles incidence, for example.



Supplemental Figure 2: The duration of alerts of outbreak detection systems under different testing rates and noise structures, at their respective optimal alert thresholds. The shaded bands illustrate the 80% central interval, and the solid/dashed lines represent the mean estimate. Imperfect tests have the same values for sensitivity and specificity. Solid lines represent tests with 0-day turnaround times, and dashed lines represent tests with result delays. $\Lambda(4)$ indicates the mean noise incidence is 4 times higher than the mean measles incidence, for example.

Tables

	Test Characteristic		Testing Rate					
Noise Type	Test Type	Test Lag	10%	20%	30%	40%	50%	60%
Dynamical noise	Imperfect Test (85%)	0	0.64	0.72	0.71	0.68	0.7	0.73
Dynamical noise	Imperfect Test (90%)	0	0.64	0.73	0.72	0.71	0.72	0.71
Static noise	Imperfect Test (85%)	0	0.66	0.93	0.92	0.93	0.88	0.88
Static noise	Imperfect Test (90%)	0	0.66	0.85	0.91	0.87	0.92	0.93
All noise structures	Perfect Test	0	0.66	0.93	0.91	0.89	0.91	0.93
All noise structures	Perfect Test	14	0.67	0.9	0.89	0.88	0.88	0.91

Supplemental Table 1: Mean outbreak detection accuracy for imperfect and perfect diagnostic tests, at their respective optimal alert thresholds, under dynamical and Poisson noise structures where the average daily noise incidence is 8 times the average daily measles incidence $\Lambda(8)$. The test sensitivity equals the test specificity for all diagnostic tests.

	Test Characteristic		Testing Rate					
Noise Type	Test Type	Test Lag	10%	20%	30%	40%	50%	60%
Dynamical noise	Imperfect Test (85%)	0	-24.82	-12.79	-9.15	-3.21	-16.22	-10.77
Dynamical noise	Imperfect Test (90%)	0	-17.21	-5.34	-0.55	3.03	-10.55	-3.66
Static noise	Imperfect Test (85%)	0	-3.75	24.49	31.45	31.85	38.17	37.87
Static noise	Imperfect Test (90%)	0	-3.69	12.94	32.92	40.14	20.26	28.74
All noise structures	Perfect Test	0	-3.69	22.61	30.64	36.08	17.92	23.05
All noise structures	Perfect Test	14	3.69	33.64	42.38	48.18	28.21	34.07

Supplemental Table 2: Mean outbreak detection delays (days) for imperfect and perfect diagnostic tests, at their respective optimal alert thresholds, under dynamical and Poisson noise structures where the average daily noise incidence is 8 times the average daily measles incidence $\Lambda(8)$. The test sensitivity equals the test specificity for all diagnostic tests.

	Test Characteristic		Testing Rate					
Noise Type	Test Type	Test Lag	10%	20%	30%	40%	50%	60%
Dynamical noise	Imperfect Test (85%)	0	452	3053	4424	7728	3406	4361
Dynamical noise	Imperfect Test (90%)	0	515	3289	4650	6417	2578	4933
Static noise	Imperfect Test (85%)	0	766	6592	9111	9107	11865	11765
Static noise	Imperfect Test (90%)	0	770	3178	9736	12808	5205	8111
All noise structures	Perfect Test	0	770	5980	8893	11172	4529	6144
All noise structures	Perfect Test	14	2015	9277	12363	14643	7641	9495

Supplemental Table 3: Mean unavoidable cases per annum (scaled to Ghana's 2022 population) for imperfect and perfect diagnostic tests, at their respective optimal alert thresholds, under dynamical and Poisson noise structures where the average daily noise incidence is 8 times the average daily measles incidence $\Lambda(8)$. The test sensitivity equals the test specificity for all diagnostic tests.