

Supplemental Information

1. Background on Guinea worm case data¹⁻⁷

The country-level annual case reports enumerate the number of individuals with Guinea worm disease in a calendar year (January-December). These individuals were typically counted as a case only once in a given year, when the first Guinea worm emerged; if that individual went on to experience subsequent cases in that calendar year those were not counted separately. To ensure that cases were attributed to the burden of Guinea worm disease in the country in which the case was detected, both indigenous and imported cases were included.

Case data in the early 1990s suggests under-reporting. To account for implausible case reports, the data were reviewed longitudinally. If there is an order of magnitude difference in the case series, the lower year was outliered from the main analysis. For example, Niger: 1991: 32,829 cases; 1992: 500 cases; 1993: 25,346 cases). Table 2 presents the year annual case searches were complete, as well as reporting rates from 1995 to justify exclusion of data points from the early 1990s.

By design, the Guinea worm eradication programmatic infrastructure covers the entire at-risk population in endemic countries. Since case containment is a key intervention designed to not only interrupt transmission but also monitor progress towards eradication, incident cases of guinea worm disease are generally considered nationally representative. Case reporting occurs at the village level on a monthly basis; case data are then aggregated within the national Guinea Worm Eradication Program and reported to the World Health Organization. In settings where annual case reports are low (suggesting no transmission) or transmission has been interrupted, cash rewards are promoted to enhance surveillance activities until national elimination is certified. Containment is defined as: detection within 24 hours of the worm's emergence; the patient did not contaminate any water source; the patient received proper wound care and health education on not entering any water source; a supervisor verified the case as dracunculiasis within seven days; and Abate® is used if there is any uncertainty about contamination of water sources or known contamination of water sources.

SI Table 1: Guinea worm case data by country or subnational division, by year

Geography	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Benin	37417	4006*	4315*	16334	4302	2273	1427	855	695	492
Burkina Faso	42187	*	11784	8281	6861	6281	3241	2477	2227	2184
Cameroon	742	393	127	72	30	15	17	19	23	8
Central African Republic	*	*	*	*	*	18	9*	5*	34	26
Chad	*	*	156*	1231	640	149	127	25	3	1
Cote d'Ivoire	1360*	12690	*	8034	5061	3801	2794	1254	1414	476
Ethiopia	2333	*	303*	1120	1252	514	371	451	366	249
Ghana	123793	66697	33464	17918	8432	8894	4877	8921	5473	9027
India										
Andhra Pradesh	207	120	26	0	0	0	0	0	0	0
Gujarat	22	0	0	0	0	0	0	0	0	0
Karnataka	634	226	167	29	10	0	0	0	0	0
Madhya Pradesh	333	120	91	179	13	0	0	0	0	0
Maharashtra	209	0	1	0	0	0	0	0	0	0
Rajasthan	3376	1712	792	547	348	60	90	0	0	0
Tamil Nadu	0	1	0	0	0	0	0	0	0	0
Telangana	17	6	4	0	0	0	0	0	0	0
Kenya										
Turkana County	6*	*	*	35	37	23	0	6	7	1
Mali	884*	16024	*	12011	5581	4218	2402	1099	650	410
Mauritania	8036	*	1557*	5882	5029	1762	562	388	379	255
Niger	*	32829	500*	25346	18562	13821	2956	3030	2700	1920
Nigeria	394082	281937	183169	75752	39774	16374	12282	12590	13420	13237
Pakistan	160	106	23	2	0	0	0	0	0	0
Senegal	38*	1341	728	815	195	76	19	4	0	0
South Sudan**	*	*	*	*	53139	60555	116844*	42944	47126	65805
Sudan	*	*	2447	2984	132*	4053	1734	652	851	292
Togo	3042*	5118*	8179	10349	5044	2073	1626	1762	2128	1589
Uganda	4704*	*	126369*	42852	10425	4810	1455	1374	1061	321
Yemen	*	*	*	*	106	82	62	7	0	0

*Years for which data were missing or considered implausible.

**Although South Sudan was not independent until 2011, the GBD estimates disease burden using current political boundaries and applies those boundaries retrospectively.

SI Table 1 (continued): Guinea worm case data by country or subnational division, by year

Geography	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Benin	186	172	181	30	3	1	0	0	0	0
Burkina Faso	1956	1032	591	203	60	30	5	3	1	0
Cameroon	5	5	3	0	0	0	0	0	0	0
Central African Republic	35	36	*	0	0	0	0	0	0	0
Chad	3	0	0	0	0	0	0	0	0	0
Cote d'Ivoire	297	231	198	42	21	10	5	0	0	0
Ethiopia	60	29	47	28	17	37	3	3	41	24
Ghana	7402	4739	5611	8290	7275	3981	4136	3358	501	242
India										
Andhra Pradesh	0	0	0	0	0	0	0	0	0	0
Gujarat	0	0	0	0	0	0	0	0	0	0
Karnataka	0	0	0	0	0	0	0	0	0	0
Madhya Pradesh	0	0	0	0	0	0	0	0	0	0
Maharashtra	0	0	0	0	0	0	0	0	0	0
Rajasthan	0	0	0	0	0	0	0	0	0	0
Tamil Nadu	0	0	0	0	0	0	0	0	0	0
Telangana	0	0	0	0	0	0	0	0	0	0
Kenya										
Turkana County	4	8	17	12	7	2	0	0	0	0
Mali	290	718	861	829	357	659	329	313	417	186
Mauritania	136	94	42	13	3	0	0	0	0	0
Niger	1166	417	248	293	240	183	110	14	3	5
Nigeria	7869	5355	3820	1459	495	120	16	73	38	0
Pakistan	0	0	0	0	0	0	0	0	0	0
Senegal	0	1	0	0	0	0	0	0	0	0
South Sudan**	54800	49339	41403	20270	7255	5569	20582	5815	3618	2733
Sudan	90	132	90	29	11	0	0	0	0	0
Togo	1354	1502	669	278	73	29	2	0	0	0
Uganda	96	55	24	26	4	9	2	4	0	0
Yemen	0	1	0	0	0	0	0	0	0	0

*Years for which data were missing or considered implausible.

**Although South Sudan was not independent until 2011, the GBD estimates disease burden using current political boundaries and applies those boundaries retrospectively.

SI Table 1 (continued): Guinea worm case data by country or subnational division, by year

Geography	2010	2011	2012	2013	2014	2015	2016
Benin	0	0	0	0	0	0	0
Burkina Faso	0	0	0	0	0	0	0
Cameroon	0	0	0	0	0	0	0
Central African Republic	0	0	0	0	0	0	0
Chad	10	10	10	14	13	9	16
Cote d'Ivoire	0	0	0	0	0	0	0
Ethiopia	21	8	4	7	3	3	3
Ghana	8	0	0	0	0	0	0
India							
Andhra Pradesh	0	0	0	0	0	0	0
Gujarat	0	0	0	0	0	0	0
Karnataka	0	0	0	0	0	0	0
Madhya Pradesh	0	0	0	0	0	0	0
Maharashtra	0	0	0	0	0	0	0
Rajasthan	0	0	0	0	0	0	0
Tamil Nadu	0	0	0	0	0	0	0
Telangana	0	0	0	0	0	0	0
Kenya							
Turkana County	0	0	0	0	0	0	0
Mali	57	12	4	11	40	5	0
Mauritania	0	0	0	0	0	0	0
Niger	3	0	3	0	0	0	0
Nigeria	0	0	0	0	0	0	0
Pakistan	0	0	0	0	0	0	0
Senegal	0	0	0	0	0	0	0
South Sudan**	1698	1028	521	113	70	5	6
Sudan	0	0	0	3	0	0	0
Togo	0	0	0	0	0	0	0
Uganda	0	0	0	0	0	0	0
Yemen	0	0	0	0	0	0	0

*Years for which data were missing or considered implausible.

**Although South Sudan was not independent until 2011, the GBD estimates disease burden using current political boundaries and applies those boundaries retrospectively.

2. Summary of country-level Guinea worm case searches and reporting

SI Table 2: National case search completion and reporting rate

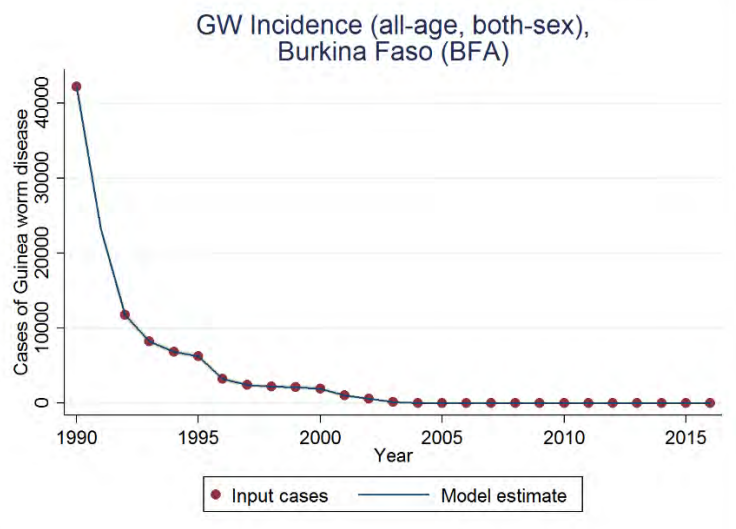
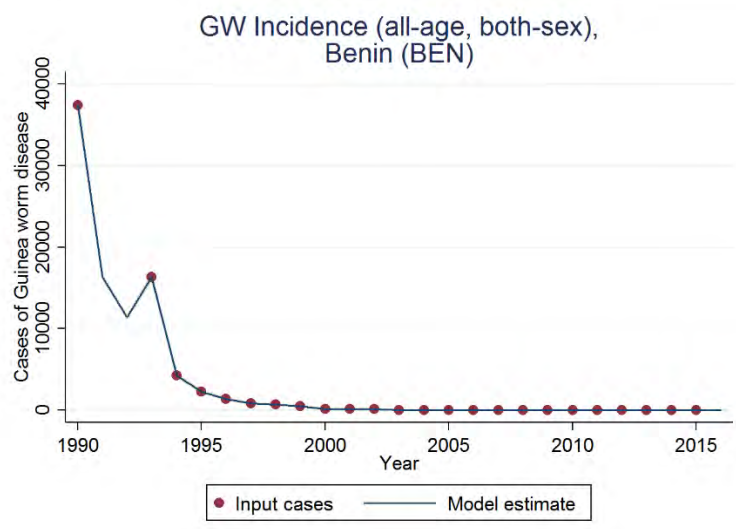
Country	National case search completed	Reporting rate 1995 ⁸ (%)
Benin	1990 ⁹	81
Burkina Faso	1990 ⁹	80
Cameroon	1990 ¹⁰	86
Central African Republic	1991 ⁹	NR*
Chad	1994 ¹¹	99
Cote d'Ivoire	1991 ⁹	95
Ethiopia	1993 ¹²	86
Ghana	1989 ¹⁰	88
India	1980 ¹³	100
Kenya	1994 ¹⁴	NR*
Mali	1992 ¹⁵	87
Mauritania	1991 ⁹	96
Niger	1991 ⁹	88
Nigeria	1990 ¹⁶	79
Pakistan	1987 ¹³	-
Senegal	1991 ⁹	100
South Sudan**	-	NR*
Sudan	1993 ¹²	NR*
Togo	1991 ⁹	94
Uganda	1992 ¹⁷	95
Yemen	1995 ¹⁸	99

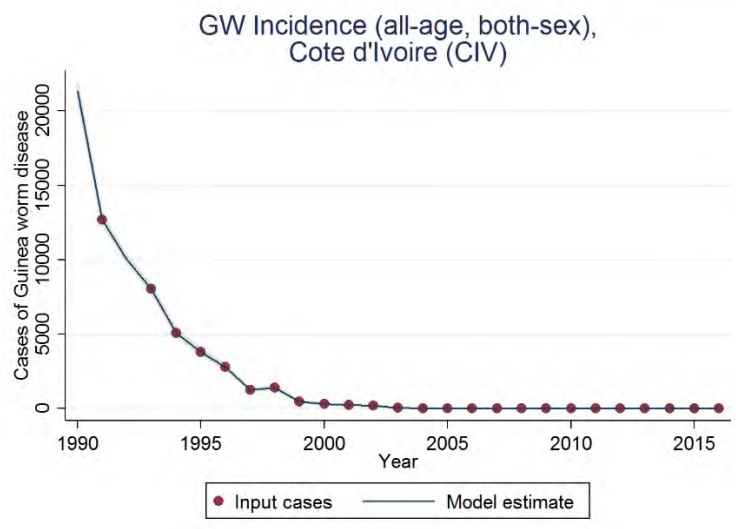
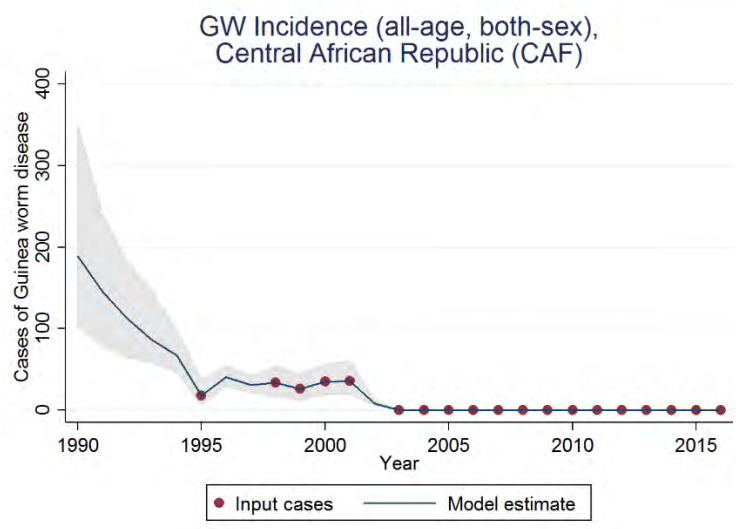
*NR: Not reported.

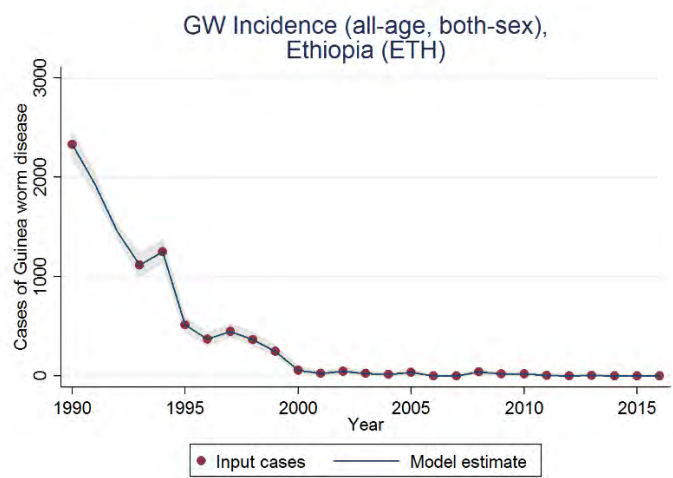
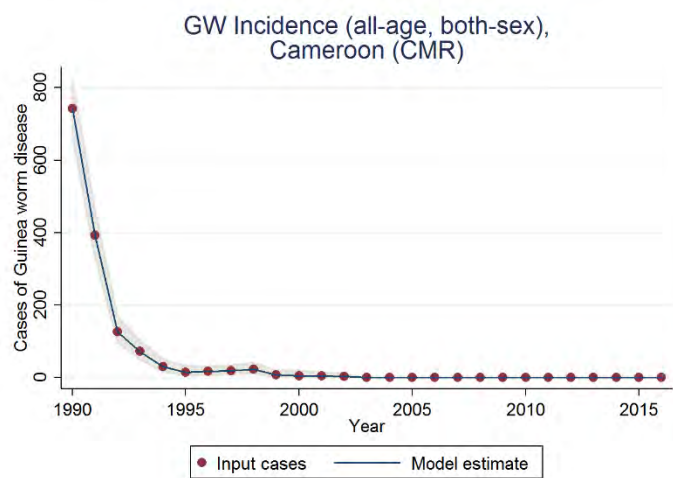
**South Sudan and Sudan Guinea worm eradication program data were reported under one national program until 2006. Case searches and annual reporting in the 1990s was limited to accessible areas.

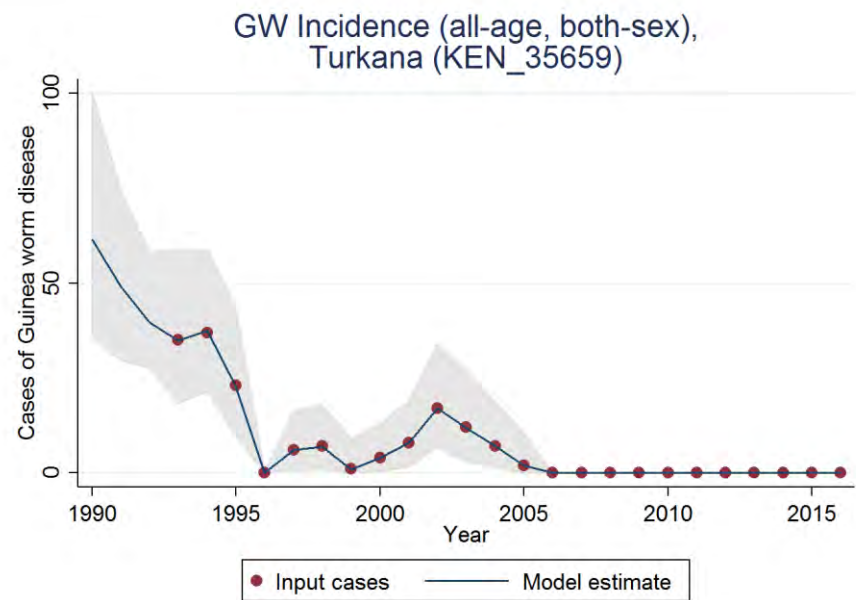
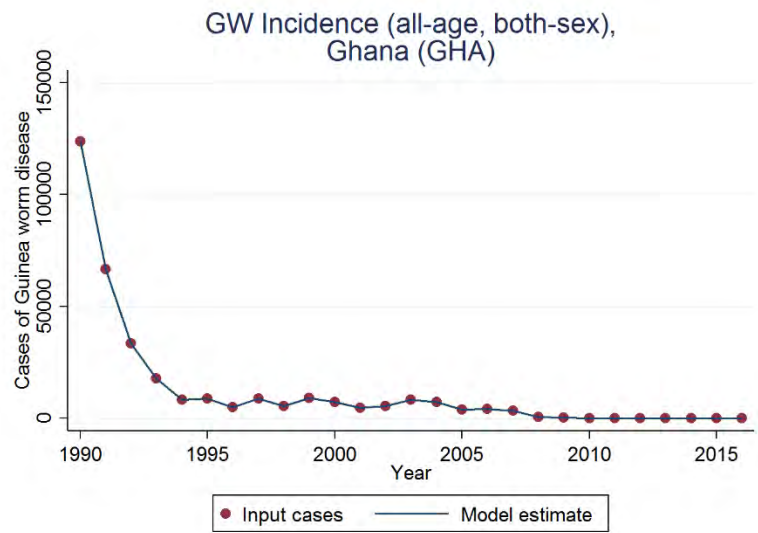
3. Country-specific model results

The countries with the starkest difference between reported cases and cases predicted by the model were Uganda and South Sudan, largely due to either the high case burden or sequential years of missing data. In the case of Uganda, the 1992 case data were set to missing because their inclusion resulted in over 1 million cases predicted in 1990, which upon review of preliminary results was considered a gross over-prediction. For South Sudan, inclusion of the 1996 data point of 116,844 cases also resulted in vast over-prediction of cases in the early 1990s. While we do not dispute the case burden in these two countries was likely quite high, in order to generate stable model estimates overall, these points were treated as outliers in the analysis. In contrast, Central African Republic (CAR) and Kenya model predictions did not fit the data well due to the extremely low numbers (<30 cases) as well as several years of missing data.

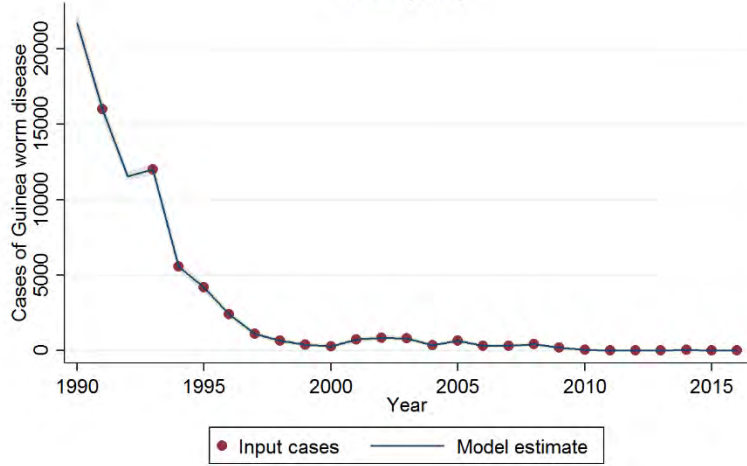




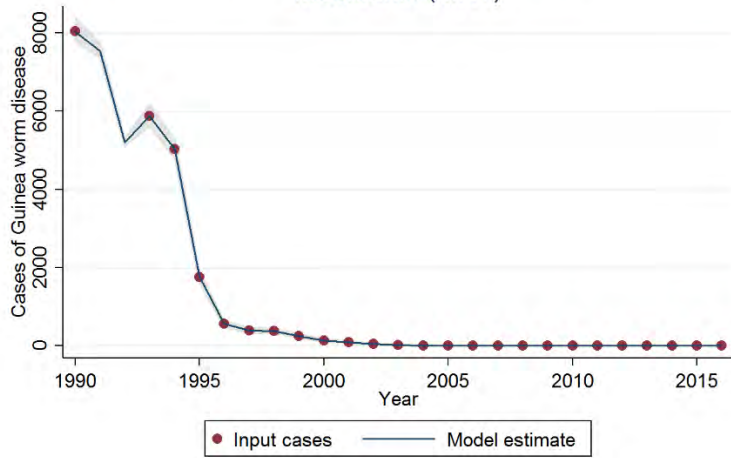




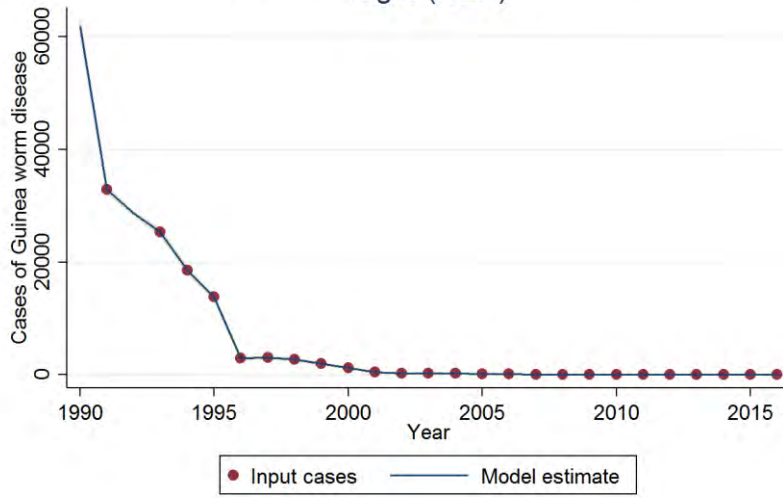
GW Incidence (all-age, both-sex),
Mali (MLI)



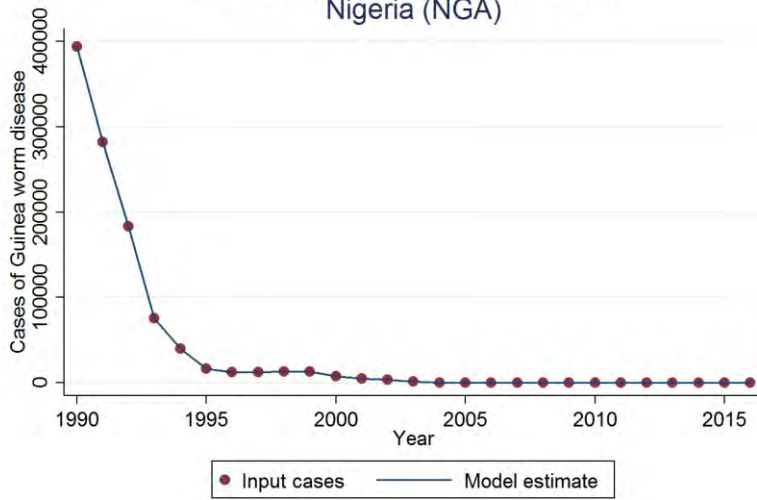
GW Incidence (all-age, both-sex),
Mauritania (MRT)



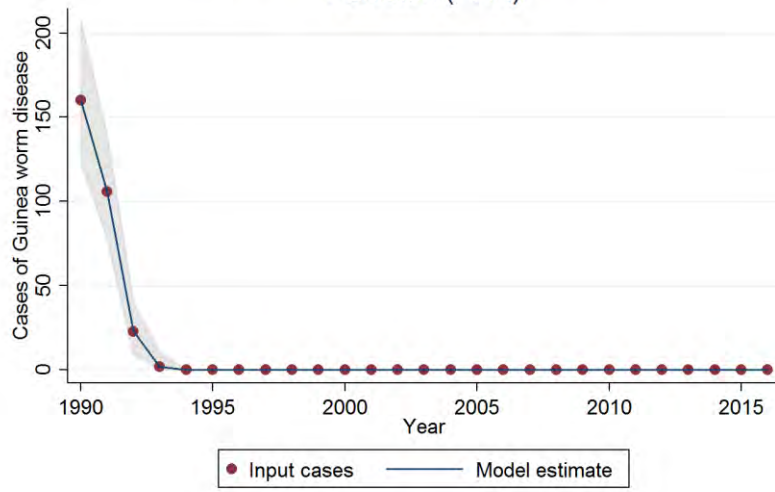
GW Incidence (all-age, both-sex),
Niger (NER)



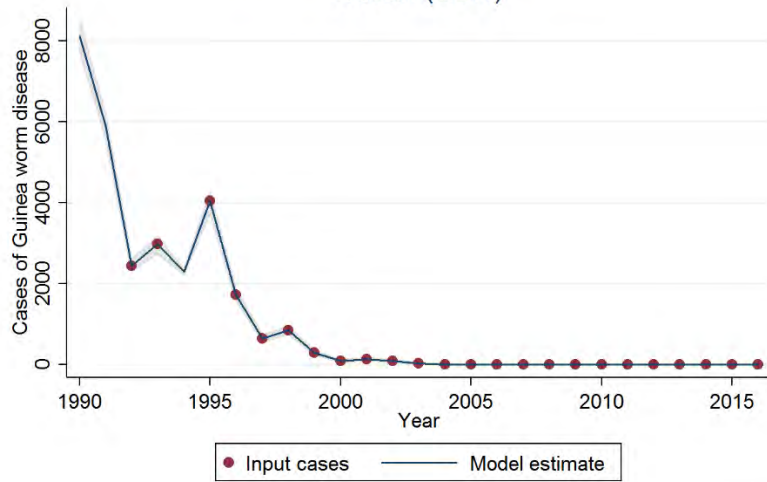
GW Incidence (all-age, both-sex),
Nigeria (NGA)



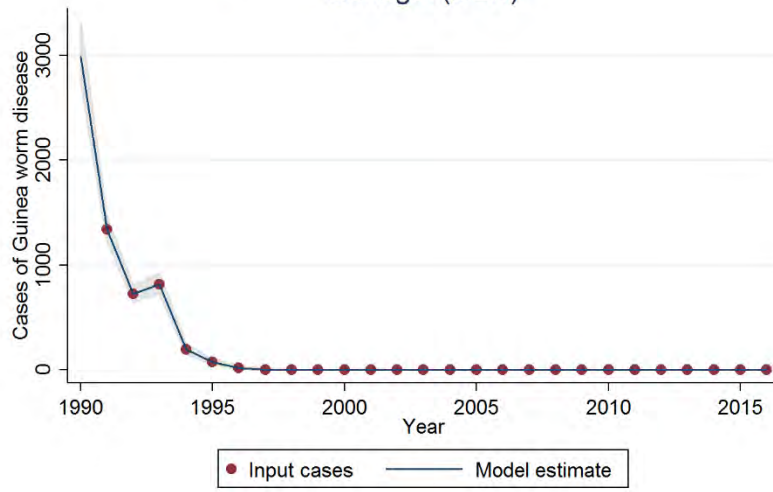
GW Incidence (all-age, both-sex),
Pakistan (PAK)



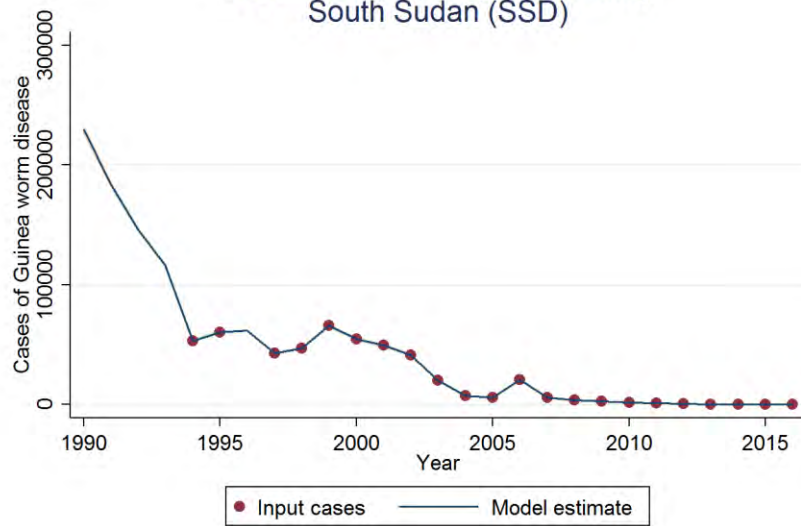
GW Incidence (all-age, both-sex),
Sudan (SDN)

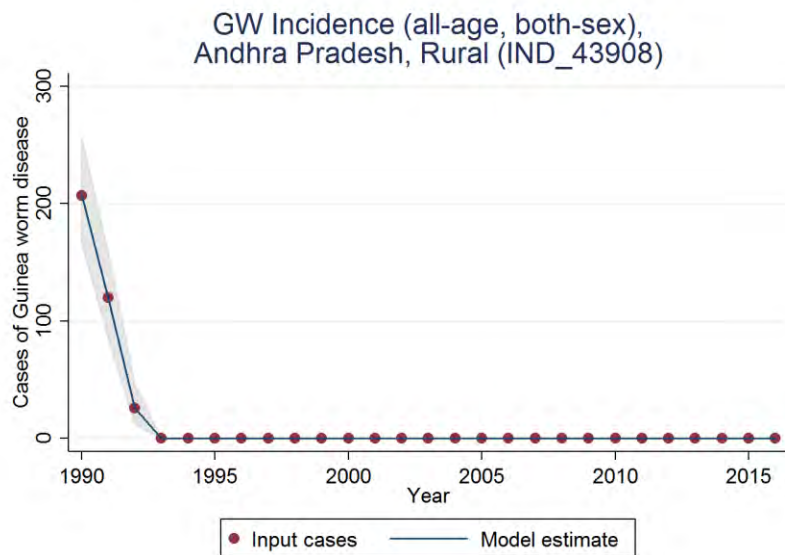
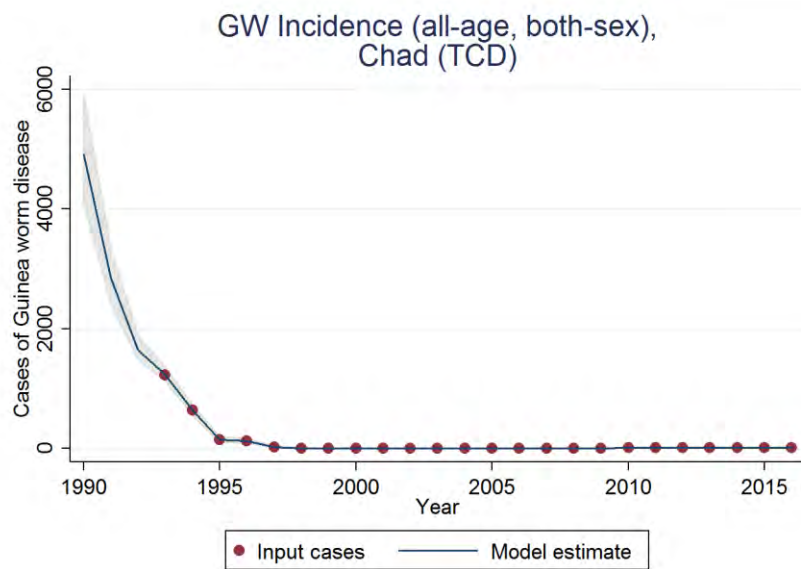


GW Incidence (all-age, both-sex),
Senegal (SEN)

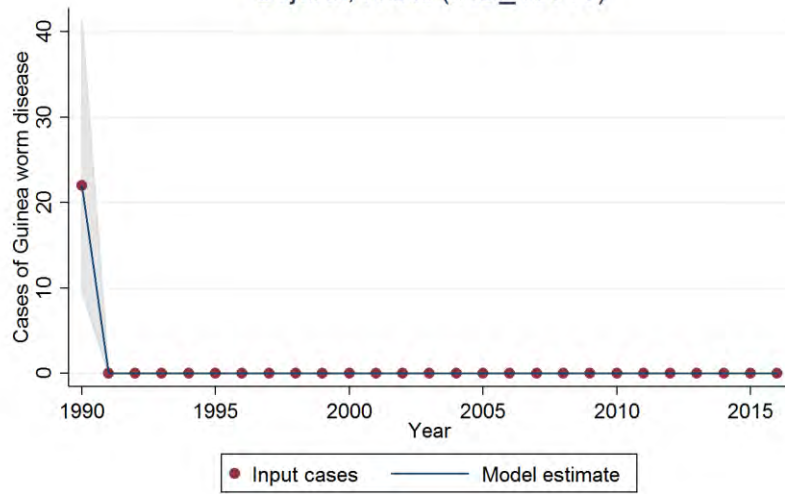


GW Incidence (all-age, both-sex),
South Sudan (SSD)

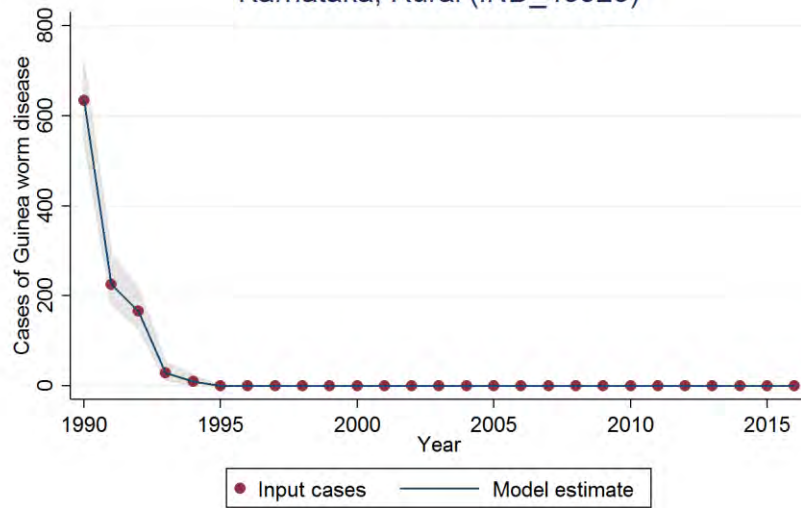




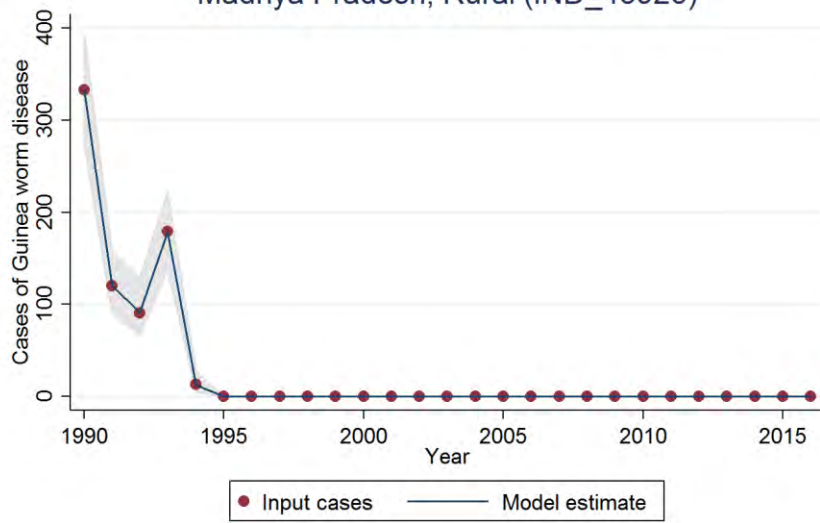
GW Incidence (all-age, both-sex),
Gujarat, Rural (IND_43918)



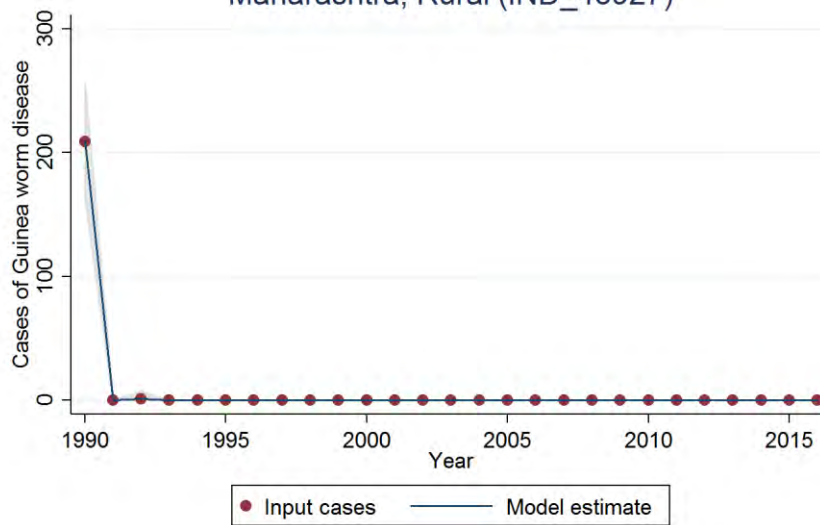
GW Incidence (all-age, both-sex),
Karnataka, Rural (IND_43923)

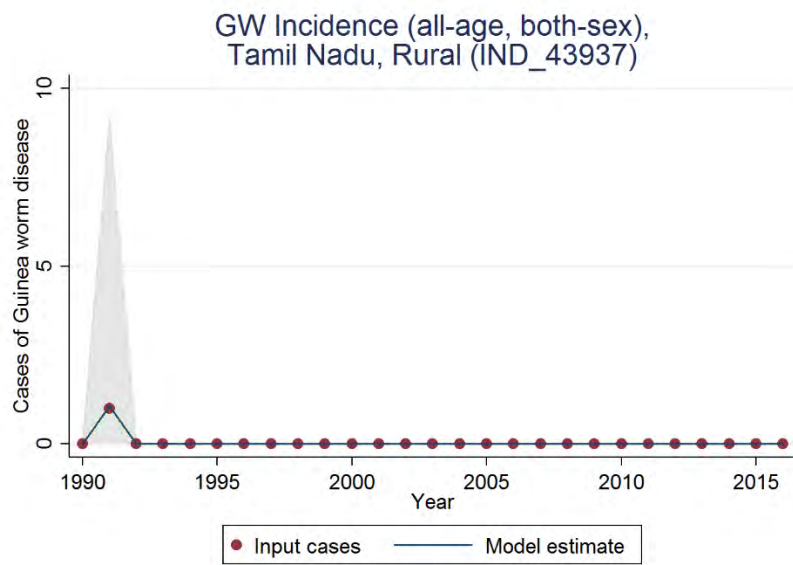
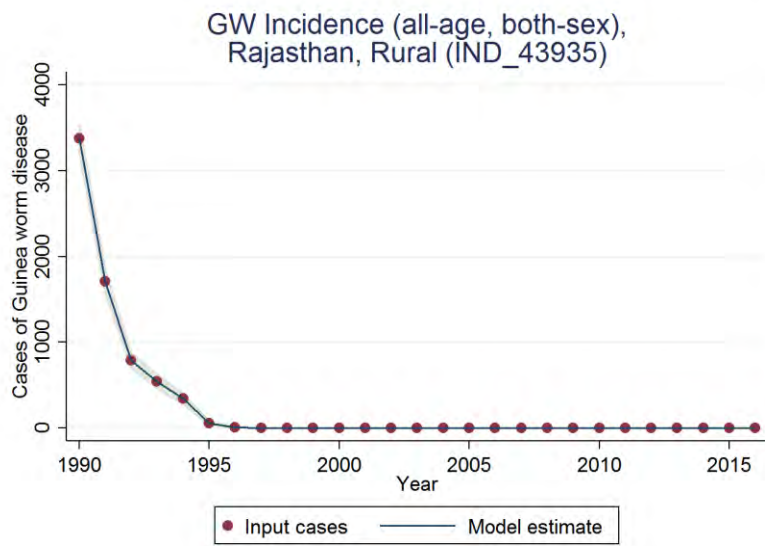


GW Incidence (all-age, both-sex),
Madhya Pradesh, Rural (IND_43926)

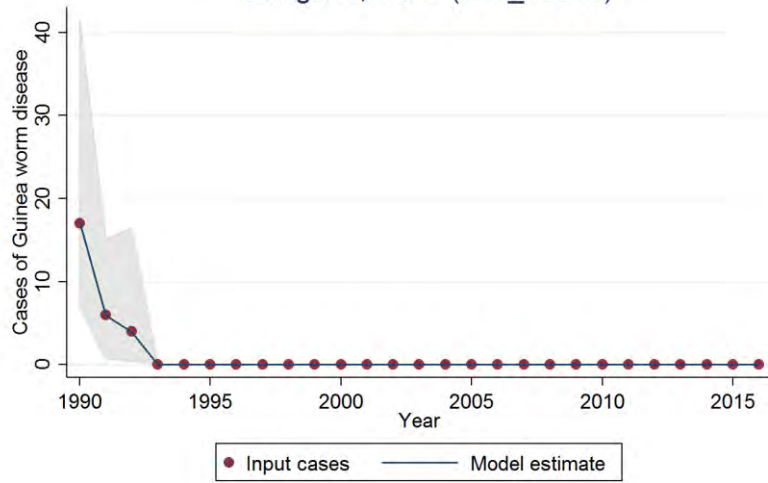


GW Incidence (all-age, both-sex),
Maharashtra, Rural (IND_43927)

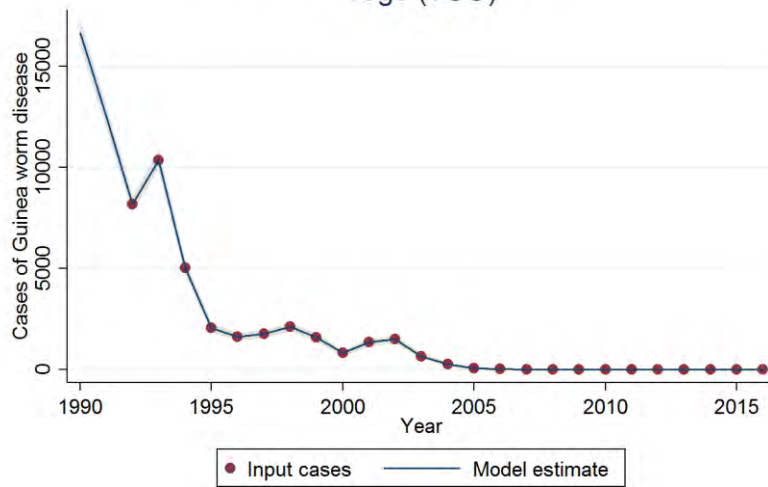


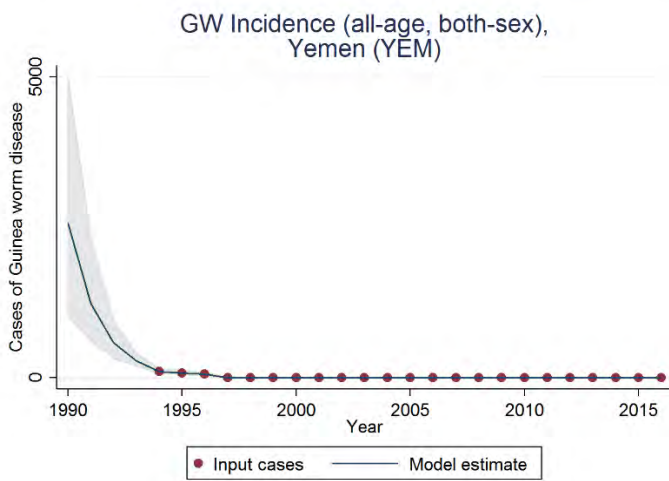
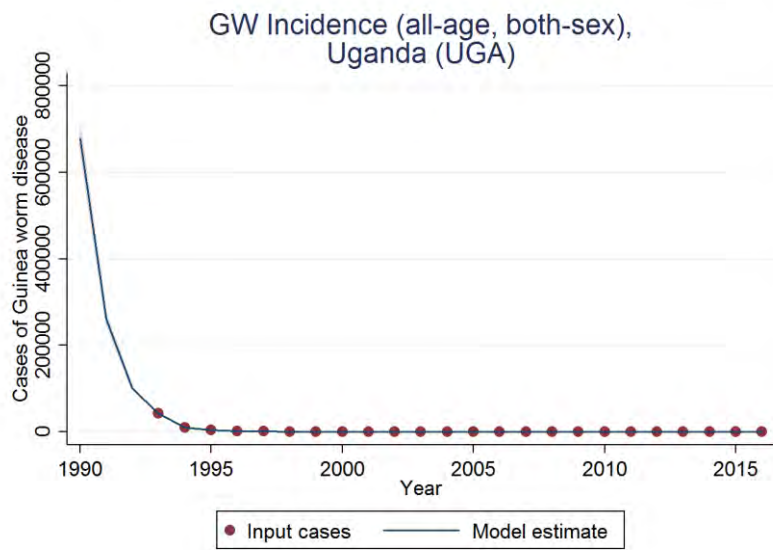


GW Incidence (all-age, both-sex),
Telangana, Rural (IND_43938)



GW Incidence (all-age, both-sex),
Togo (TGO)





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