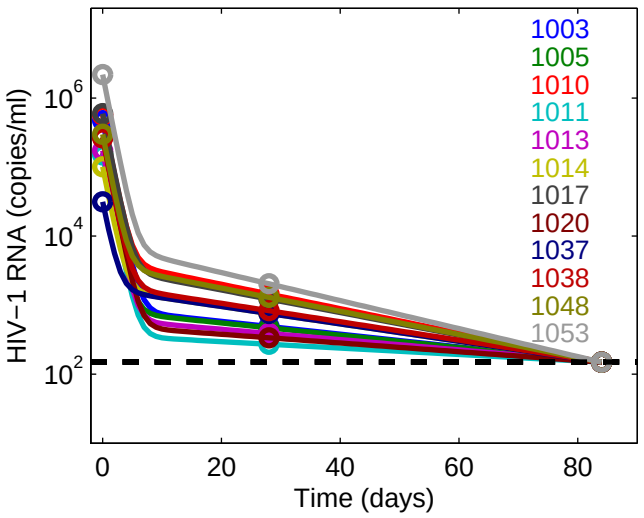
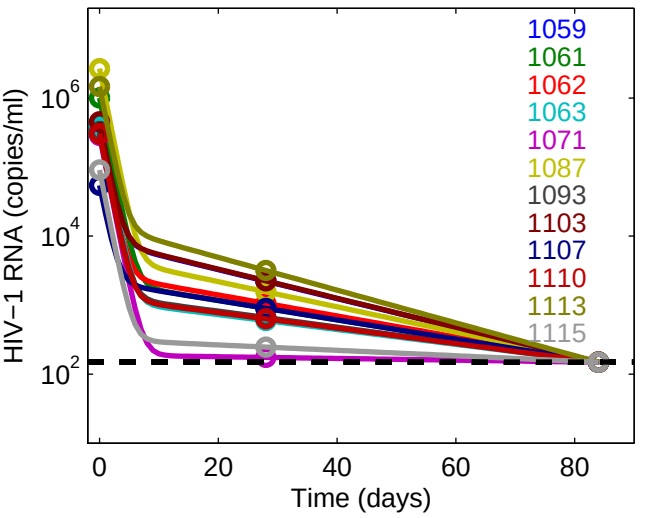
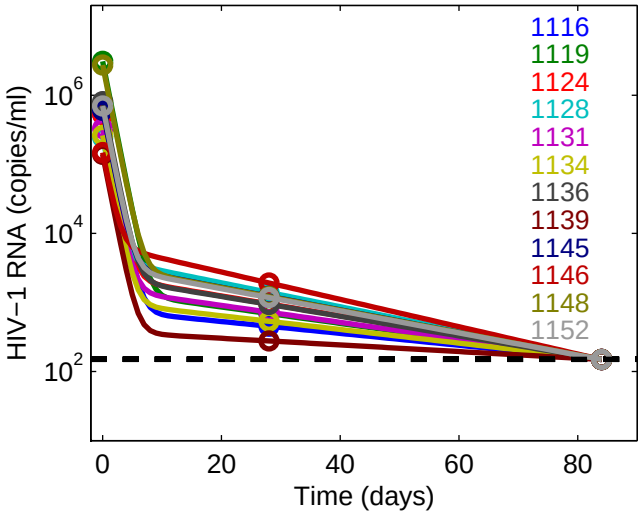
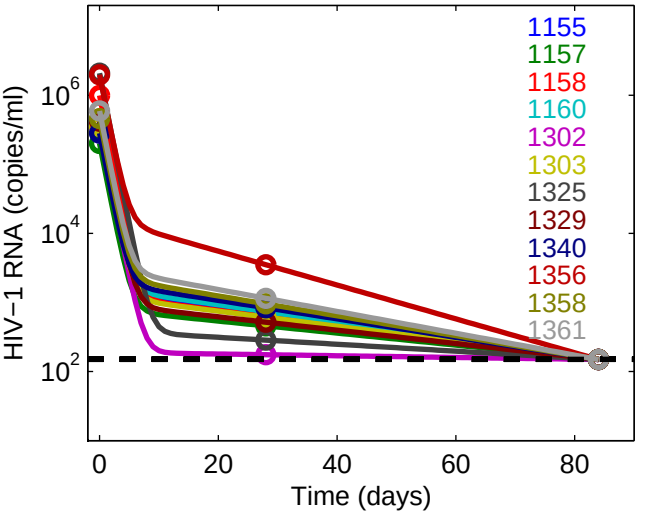
Supplemental Digital Content 1: Figure

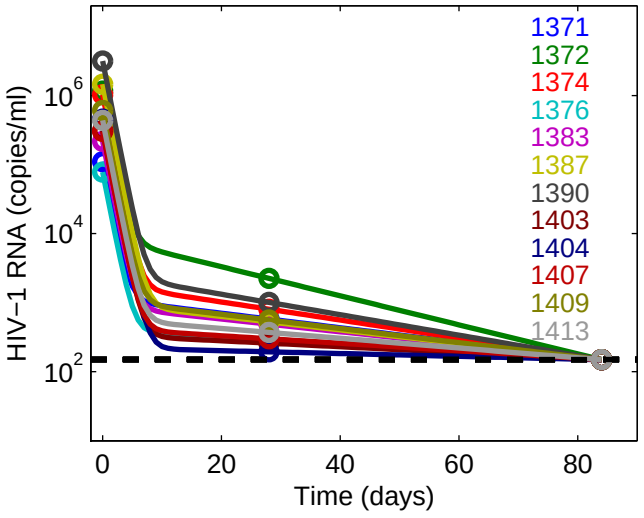
Fits (solid lines) of our model predictions (Eq. (7)) to data (symbols) from patients of plasma HIV-1 RNA levels as a function of time following the onset of treatment. Dashed lines represent the limit of detection (LOD) (150 copies/ml). The patients considered here achieved undetectable viremia by week 12. The numbers indicated identify patients and the corresponding data and fits are color-coded. The resulting best-fit parameter estimates are in Table, Supplemental Digital Content 6.

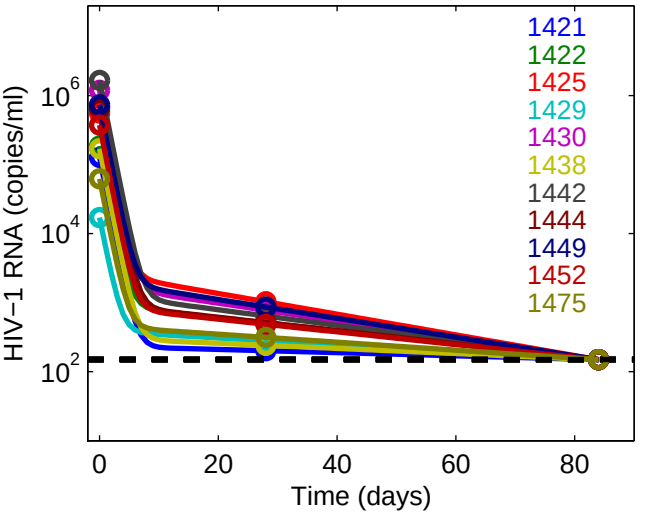

1003
1005
1010
1011
1013
1014
1017
1020
1037
1038
1048
1053
HIV−1 RNA (copies/ml)
Time (days)


1059
1061
1062
1063
1071
1087
1093
1103
1107
1110
1113
1115
HIV−1 RNA (copies/ml)
Time (days)


1116
1119
1124
1128
1131
1134
1136
1139
1145
1146
1148
1152
HIV−1 RNA (copies/ml)
Time (days)

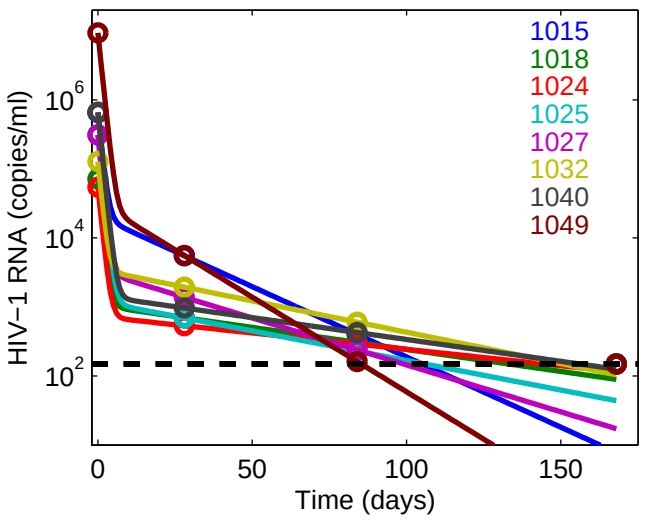

1155
1157
1158
1160
1302
1303
1325
1329
1340
1356
1358
1361
HIV−1 RNA (copies/ml)
Time (days)

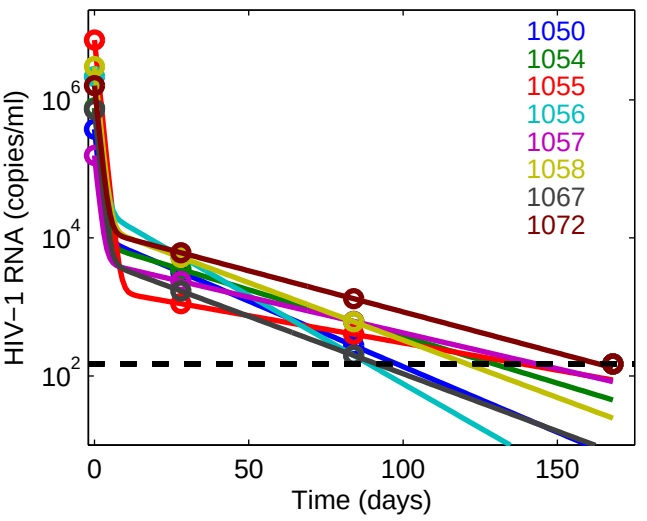

1371
1372
1374
1376
1383
1387
1390
1403
1404
1407
1409
1413
HIV−1 RNA (copies/ml)
Time (days)

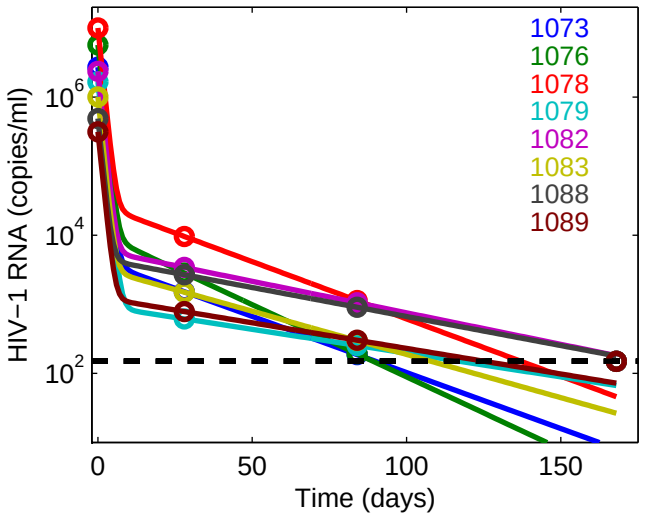

1421
1422
1425
1429
1430
1438
1442
1444
1449
1452
1475
HIV−1 RNA (copies/ml)
Time (days)

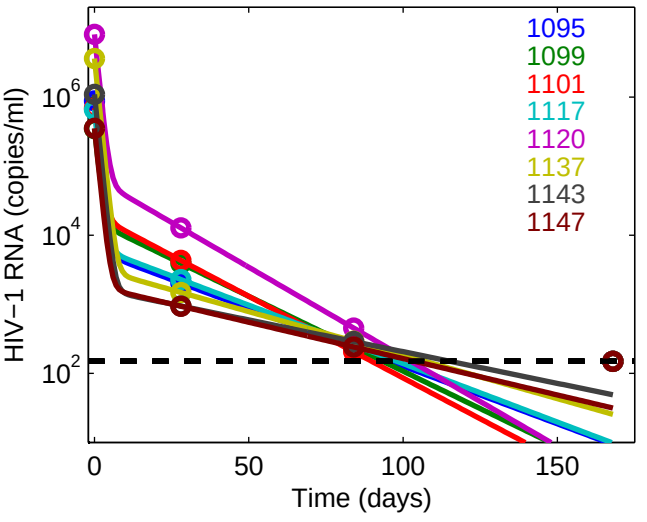
Supplemental Digital Content 2: Figure

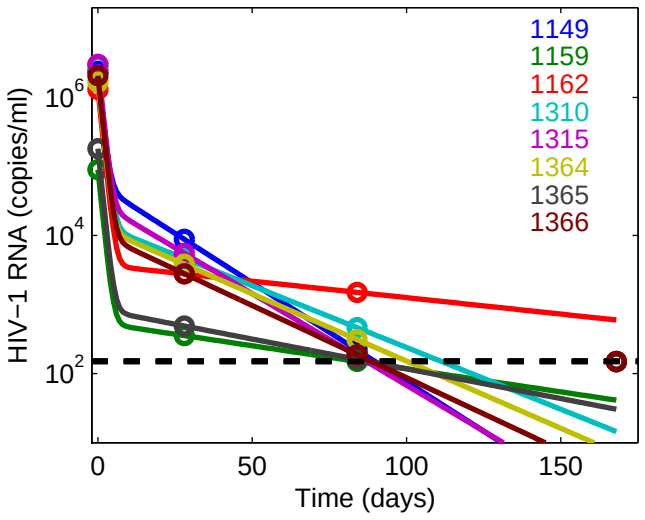
Fits (solid lines) of our model predictions (Eq. (7)) to data (symbols) from patients of plasma HIV-1 RNA levels as a function of time following the onset of treatment. Dashed lines represent the limit of detection (LOD) (150 copies/ml). The patients considered here had detectable viremia at week 12. The numbers indicated identify patients and the corresponding data and fits are color-coded. The resulting best-fit parameter estimates are in Table, Supplemental Digital Content 6.

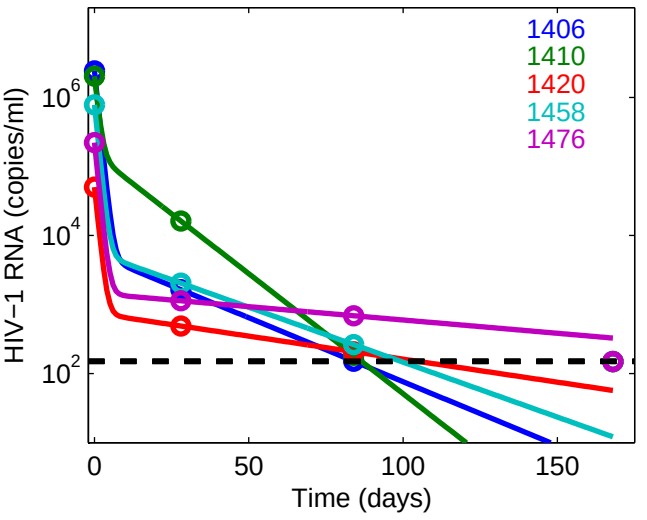

1015
1018
1024
1025
1027
1032
1040
1049
HIV−1 RNA (copies/ml)
10^6
10^4
10^2
0
50
100
150
Time (days)


1050
1054
1055
1056
1057
1058
1067
1072
HIV−1 RNA (copies/ml)
10^6
10^4
10^2
0
50
100
150
Time (days)


1073
1076
1078
1079
1082
1083
1088
1089
HIV−1 RNA (copies/ml)
10^6
10^4
10^2
0
50
100
150
Time (days)

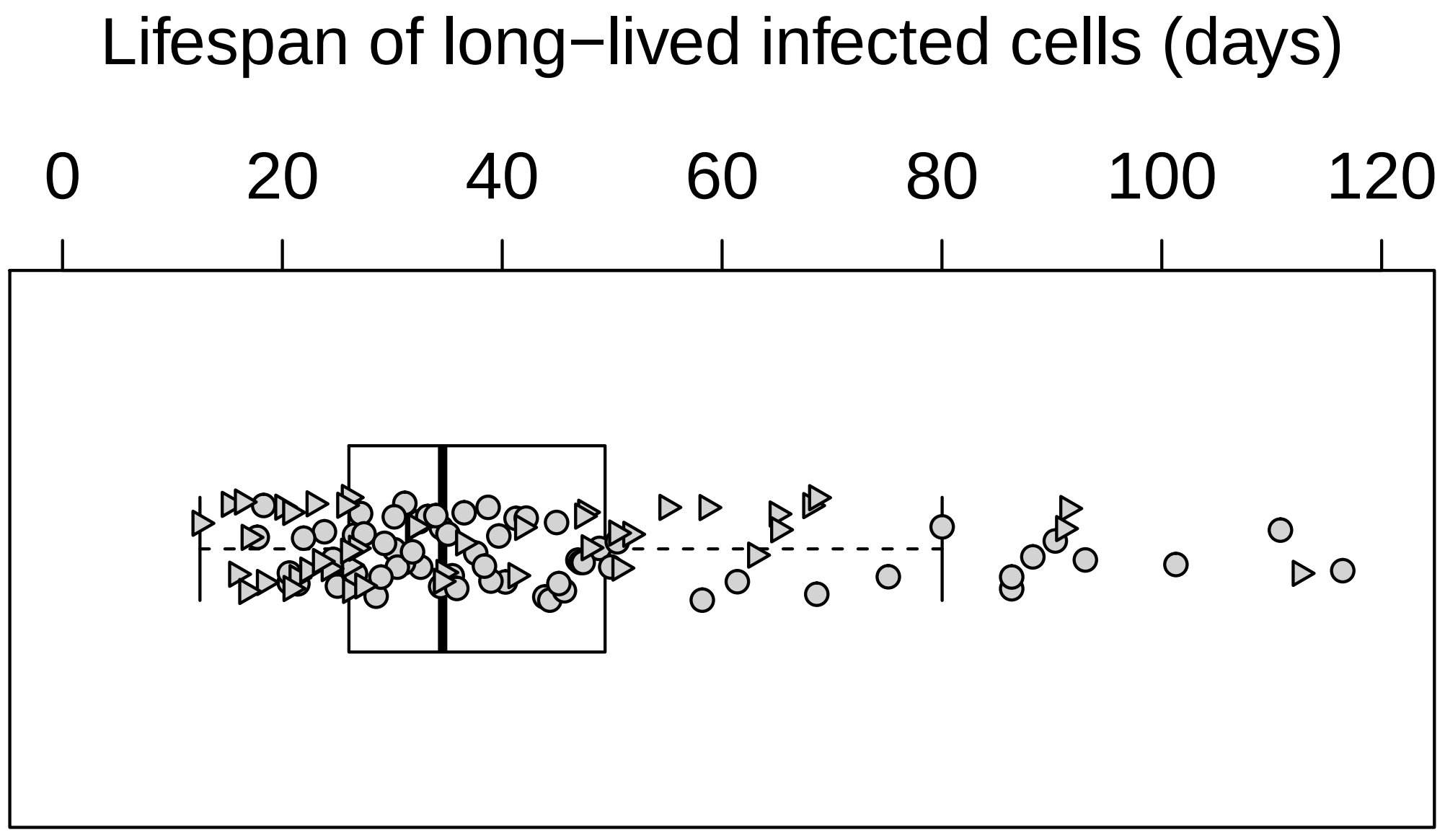

1095
1099
1101
1117
1120
1137
1143
1147
HIV−1 RNA (copies/ml)
10^6
10^4
10^2
0
50
100
150
Time (days)


1149
1159
1162
1310
1315
1364
1365
1366
HIV−1 RNA (copies/ml)
10^6
10^4
10^2
0
50
100
150
Time (days)


1406
1410
1420
1458
1476
HIV−1 RNA (copies/ml)
10^6
10^4
10^2
0
50
100
150
Time (days)

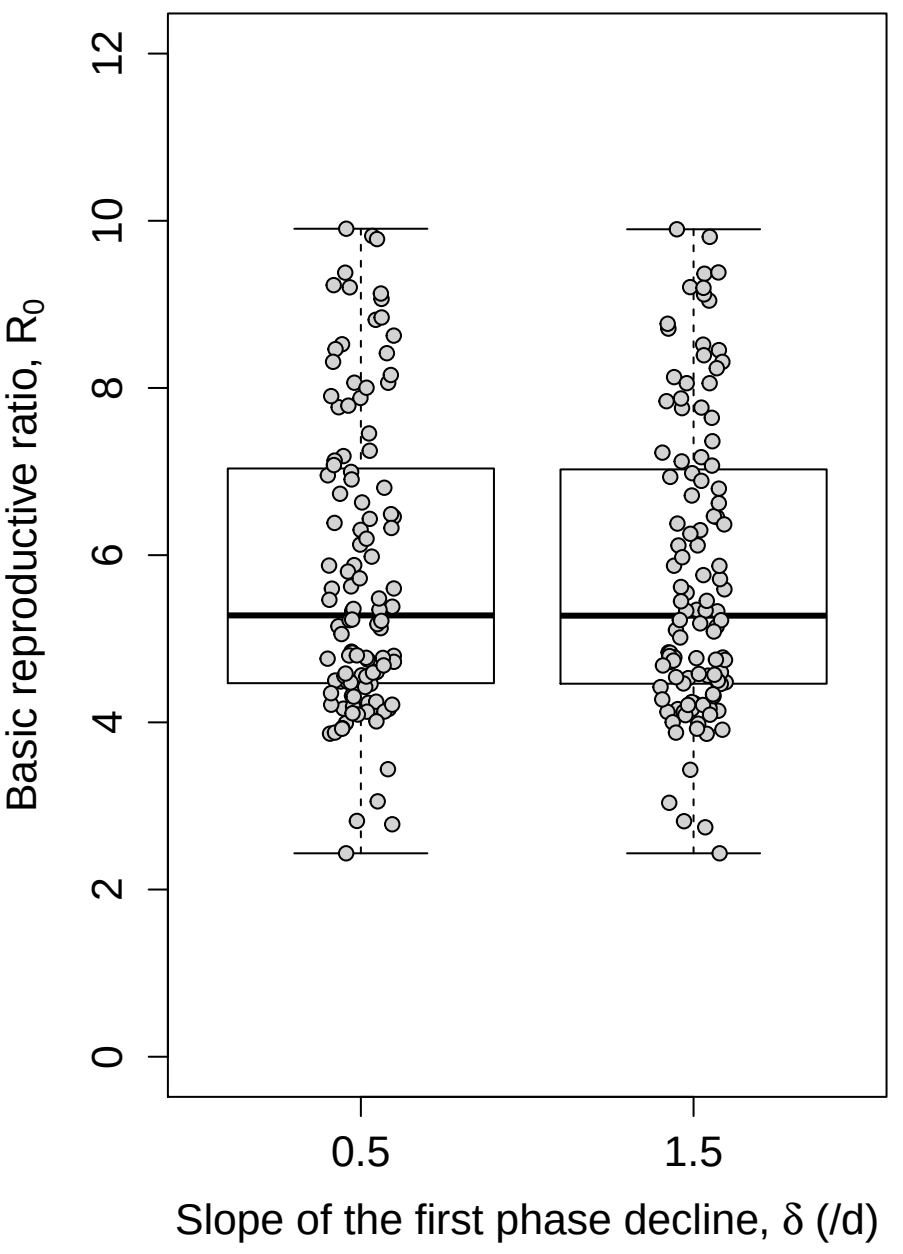
Supplemental Digital Content 3: Figure

Estimates of the lifespans of long-lived infected cells obtained from analysis of viral load data of HIV-1C patients under treatment using our mathematical model (see Figures, Supplemental Digital Content 1 and Supplemental Digital Content 2, and Table, Supplemental Digital Content 6). Symbols represent estimates for individual patients from Supplemental Digital Content 1 (circles) and Supplemental Digital Content 2 (triangles). The horizontal line within the box indicates the median, and the boundaries of the box indicate the first and third quartiles. In four patients (all with viremia undetectable by week 12; PID - 1071, 1302, 1404 and 1421), lifespans of long-lived infected cells exceeded 180 d, and were treated as outliers (not shown).


Lifespan of long−lived infected cells (days)
0
20
40
60
80
100
120

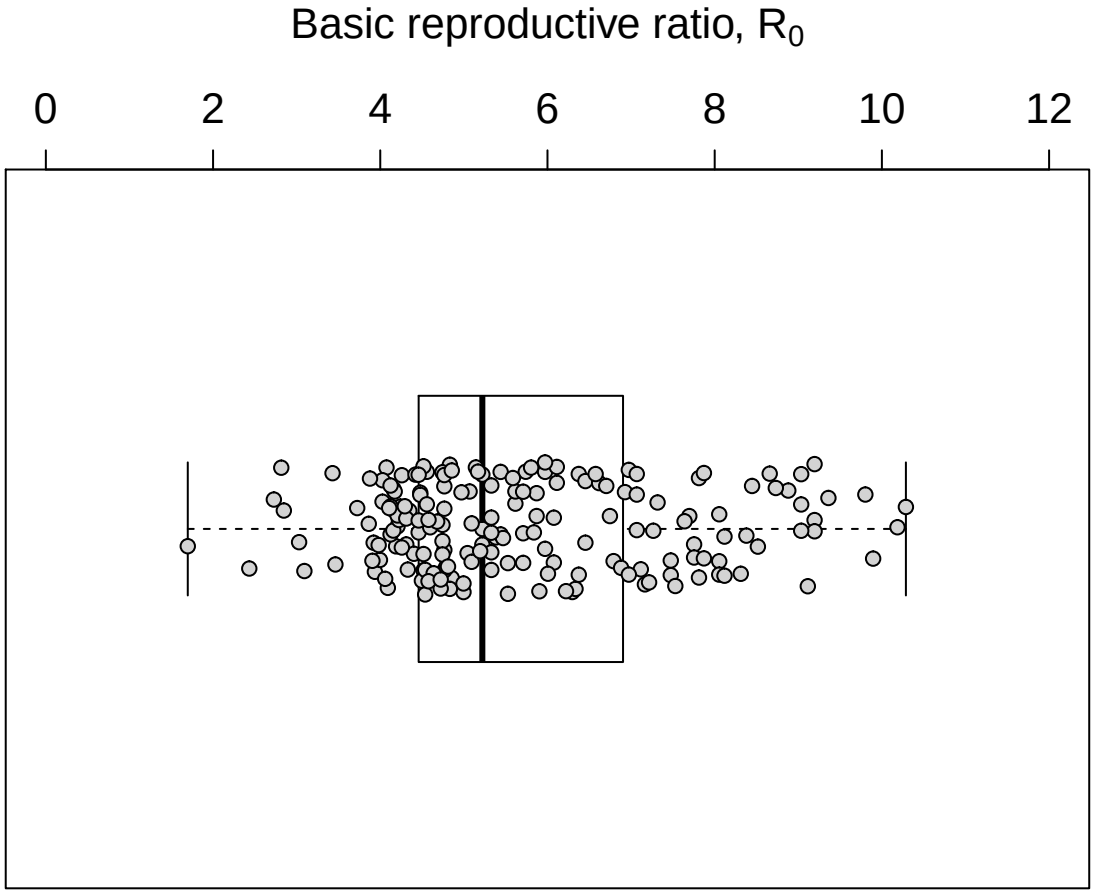
Supplemental Digital Content 4: Figure

Estimates of the basic reproductive ratio obtained from analysis of viral load data of HIV-1C patients under treatment as in Fig. 2 but using different values of the slope of the first phase viral load decline, δ, indicated. Symbols represent estimates for individual patients. The horizontal line within the box indicates the median, the boundaries of the box indicate the first and third quartiles, and the whiskers mark the minimum and maximum values.


Basic reproductive ratio, R_0
0
2
4
6
8
10
12
0.5
1.5
Slope of the first phase decline, δ (/d)

Supplemental Digital Content 5: Figure

Estimates of the basic reproductive ratio obtained as the ratio of the $CD4^+$ T cell count in uninfected individuals and that in infected individuals at baseline. Symbols represent estimates for individual patients. The horizontal line within the box indicates the median, the boundaries of the box indicate the first and third quartiles, and the whiskers mark the minimum and maximum values.


Basic reproductive ratio, R_0
0
2
4
6
8
10
12

Supplemental Digital Content 6: Table

Parameter estimates for patients with >95% adherence and baseline CD4 count >100 cells/uL (see text for details). (Outliers are indicated by an asterisk (*) next to their PIDs.)

PID	δ_M (δ)	Lifespan (days)	A	B	T_0* (cells/ul)	M_0* (cells/ul)	Baseline CD4 (cells/ul)	R_0	ε_c	$T_0^*/(T_0^*+M_0^*)$	Adherence (%)	Cells infected (%)
	(best fit)	(=1/d_M)	(best fit)	(best fit)	(=A/(Nd/c))	(=B/(Nd_M/c))			(=1-1/R_0)			
1003	0.0213	46.9	469714	894	0.216	0.019	113	9.2	0.89	0.92	98.1	0.191
1005	0.0205	48.8	159042	832	0.073	0.019	165	6.3	0.84	0.8	99.2	0.044
1010	0.0406	24.6	558222	4519	0.257	0.051	232	4.5	0.78	0.83	98.73	0.111
1011	0.0107	93	149911	368	0.069	0.016	161	6.5	0.85	0.81	96.63	0.043
1013	0.0172	58.2	172995	631	0.08	0.017	269	3.9	0.74	0.82	97.57	0.03
1014	0.0291	34.4	99138	1713	0.046	0.027	122	8.5	0.88	0.63	100	0.038
1015	0.0469	21.3	634126	20528	0.292	0.201	215	4.8	0.79	0.59	98.17	0.136
1017	0.0376	26.6	590258	3512	0.272	0.043	124	8.4	0.88	0.86	99.6	0.219
1018	0.0147	68.1	70453	1055	0.032	0.033	215	4.8	0.79	0.5	99.17	0.015
1020	0.0146	68.6	270973	507	0.125	0.016	123	8.5	0.88	0.89	98.37	0.102
1024	0.0109	91.4	53585	727	0.025	0.031	199	5.2	0.81	0.45	96.98	0.013
1025	0.0197	50.7	310301	1206	0.143	0.028	163	6.4	0.84	0.84	100	0.088
1027	0.0313	31.9	306052	3320	0.141	0.049	218	4.8	0.79	0.74	100	0.065
1032	0.0209	47.9	124427	3477	0.057	0.077	113	9.2	0.89	0.43	97.9	0.05
1037	0.029	34.5	29644	1706	0.014	0.027	195	5.3	0.81	0.34	100	0.007
1038	0.0307	32.6	262010	1962	0.121	0.029	202	5.1	0.81	0.8	100	0.06
1040	0.0146	68.6	659776	1453	0.303	0.046	150	6.9	0.86	0.87	99.22	0.202
1048	0.0386	25.9	294383	3827	0.135	0.046	134	7.8	0.87	0.75	100	0.101
1049	0.0632	15.8	9299935	32608	4.278	0.238	129	8.3	0.88	0.95	95.07	3.316
1050	0.0437	22.9	364350	10814	0.168	0.114	199	5.2	0.81	0.6	100	0.084
1053	0.0467	21.4	2183518	7537	1.004	0.074	195	5.4	0.81	0.93	98.83	0.515
1054	0.0311	32.1	754841	8403	0.347	0.124	265	3.9	0.75	0.74	99.43	0.131
1055	0.0182	55	7363366	1857	3.387	0.047	113	9.5	0.89	0.99	99.03	2.997
1056	0.0589	17	2147443	27950	0.988	0.218	181	5.8	0.83	0.82	99.35	0.546
1057	0.0239	41.8	151766	4592	0.07	0.088	129	8.1	0.88	0.44	99.45	0.054
1058	0.0383	26.1	3010658	15240	1.385	0.183	244	4.3	0.77	0.88	99.7	0.568

1059	0.0482	20.7	424470	8575	0.195	0.082	115	9.1	0.89	0.7	99.5	0.17
1061	0.0322	31	1000199	2234	0.46	0.032	161	6.5	0.85	0.94	99.57	0.286
1062	0.0351	28.5	353958	2831	0.163	0.037	177	5.9	0.83	0.81	100	0.092
1063	0.0248	40.3	384887	1198	0.177	0.022	153	6.8	0.85	0.89	100	0.116
1067	0.0383	26.1	720880	4982	0.332	0.06	369	2.8	0.65	0.85	96.4	0.09
1071*	0.0029	348.2	287513	190	0.132	0.03	174	6	0.83	0.81	98.87	0.076
1072	0.0274	36.5	1596313	13159	0.734	0.221	191	5.5	0.82	0.77	99.5	0.384
1073	0.0374	26.7	2712865	4329	1.248	0.053	208	5	0.8	0.96	97.85	0.6
1076	0.0481	20.8	5677924	10934	2.612	0.105	206	5.1	0.8	0.96	97.07	1.268
1078	0.0382	26.2	9972053	27948	4.587	0.337	139	7.7	0.87	0.93	99.82	3.3
1079	0.0159	63	1655367	959	0.761	0.028	218	4.8	0.79	0.96	96.3	0.349
1082	0.021	47.6	2347861	6153	1.08	0.135	255	4.1	0.76	0.89	95.18	0.424
1083	0.0288	34.7	999078	3355	0.46	0.054	191	5.5	0.82	0.9	96.52	0.241
1087	0.042	23.8	2654278	5062	1.221	0.055	188	5.6	0.82	0.96	97.67	0.649
1088	0.0193	51.7	484611	4602	0.223	0.109	182	5.7	0.83	0.67	98.83	0.123
1089	0.0171	58.6	312302	1266	0.144	0.034	247	4.2	0.76	0.81	96.33	0.058
1093	0.0266	37.6	325968	1392	0.15	0.024	232	4.5	0.78	0.86	99.6	0.065
1095	0.0384	26	875063	5936	0.403	0.071	219	4.8	0.79	0.85	95.78	0.184
1099	0.0499	20	333348	15845	0.153	0.146	146	7.1	0.86	0.51	98.38	0.105
1101	0.0545	18.4	670426	19886	0.308	0.168	217	4.8	0.79	0.65	98.38	0.142
1103	0.0485	20.6	443330	8761	0.204	0.083	170	6.1	0.84	0.71	98.73	0.12
1107	0.0321	31.1	52255	2212	0.024	0.032	233	4.5	0.78	0.43	100	0.01
1110	0.0258	38.7	301215	1305	0.139	0.023	228	4.6	0.78	0.86	100	0.061
1113	0.0547	18.3	1451467	14691	0.668	0.124	204	5.1	0.8	0.84	99.03	0.327
1115	0.009	110.8	90326	318	0.042	0.016	235	4.4	0.77	0.72	100	0.018
1116	0.0198	50.5	528595	787	0.243	0.018	149	7	0.86	0.93	100	0.163
1117	0.039	25.7	649697	6805	0.299	0.08	134	7.8	0.87	0.79	98.28	0.223
1119	0.0274	36.5	3090241	1485	1.422	0.025	252	4.1	0.76	0.98	98.9	0.564
1120	0.0597	16.8	8017148	68012	3.688	0.524	381	2.8	0.64	0.88	99.76	0.968
1124	0.0331	30.2	523187	2410	0.241	0.033	250	4.2	0.76	0.88	100	0.096
1128	0.04	25	239655	4287	0.11	0.049	111	9.4	0.89	0.69	95.47	0.099

1131	0.0282	35.5	328124	1593	0.151	0.026	157	6.6	0.85	0.85	100	0.096
1134	0.0228	43.9	261074	1011	0.12	0.02	226	4.6	0.78	0.85	100	0.053
1136	0.0328	30.5	805979	2350	0.371	0.033	195	5.3	0.81	0.92	100	0.19
1137	0.029	34.5	3616951	3342	1.664	0.053	171	6.1	0.84	0.97	95.57	0.973
1139	0.0111	90.3	139025	378	0.064	0.016	231	4.5	0.78	0.8	99.4	0.028
1143	0.0211	47.3	1090780	1706	0.502	0.037	260	4	0.75	0.93	99.63	0.193
1145	0.0376	26.6	601355	3521	0.277	0.043	246	4.2	0.76	0.87	99.43	0.113
1146	0.0456	21.9	141166	6865	0.065	0.069	129	8.1	0.88	0.48	100	0.05
1147	0.0242	41.2	351525	1848	0.162	0.035	174	6	0.83	0.82	97.02	0.093
1148	0.0375	26.7	2735558	3482	1.258	0.043	164	6.4	0.84	0.97	96.9	0.767
1149	0.0659	15.2	2321887	55745	1.068	0.389	120	8.7	0.89	0.73	100	0.89
1152	0.0369	27.1	696801	3300	0.321	0.041	261	4	0.75	0.89	100	0.123
1155	0.0279	35.9	358915	1550	0.165	0.026	185	5.6	0.82	0.87	100	0.089
1157	0.0201	49.9	200298	803	0.092	0.018	106	9.8	0.9	0.83	100	0.087
1158	0.0257	39	992357	1286	0.456	0.023	303	3.4	0.71	0.95	100	0.15
1159	0.0154	65	89595	546	0.041	0.016	268	3.9	0.74	0.72	97.25	0.015
1160	0.0285	35.1	415449	1636	0.191	0.026	245	4.2	0.76	0.88	97.9	0.078
1162	0.011	91.1	1297742	3778	0.597	0.158	266	3.9	0.74	0.79	98.18	0.224
1302*	0.0029	348.2	352703	190	0.162	0.03	219	4.7	0.79	0.84	97.53	0.074
1303	0.0252	39.7	354533	1237	0.163	0.023	250	4.2	0.76	0.88	95.13	0.065
1310	0.0412	24.3	2882144	14752	1.326	0.165	142	7.4	0.86	0.89	99.12	0.934
1315	0.0611	16.4	2977961	30602	1.37	0.23	167	6.3	0.84	0.86	98.15	0.82
1325	0.0116	86.3	2083349	394	0.958	0.016	250	4.2	0.76	0.98	99.13	0.383
1329	0.0223	44.9	419829	966	0.193	0.02	252	4.1	0.76	0.91	97.73	0.077
1340	0.0308	32.4	279594	1984	0.129	0.03	247	4.2	0.76	0.81	95.93	0.052
1356	0.0564	17.7	1964616	17072	0.904	0.139	230	4.5	0.78	0.87	98.8	0.393
1358	0.0331	30.2	456215	2410	0.21	0.033	241	4.3	0.77	0.86	99.4	0.087
1361	0.0365	27.4	590583	3187	0.272	0.04	151	6.9	0.85	0.87	96.17	0.18
1364	0.0448	22.3	1642881	13446	0.756	0.138	119	8.8	0.89	0.85	99.13	0.635
1365	0.0198	50.4	179629	852	0.083	0.02	177	5.9	0.83	0.81	98.66	0.047
1366	0.0482	20.8	2058077	10771	0.947	0.103	228	4.6	0.78	0.9	98.13	0.415

1371	0.0242	41.3	108875	1141	0.05	0.022	105	9.9	0.9	0.7	97.77	0.048
1372	0.0485	20.6	1148357	8732	0.528	0.083	195	5.3	0.81	0.86	96.9	0.271
1374	0.0301	33.2	1029747	1868	0.474	0.029	233	4.5	0.78	0.94	99.43	0.203
1376	0.0116	86.3	77573	394	0.036	0.016	427	2.4	0.59	0.7	96.63	0.008
1383	0.0212	47.1	216603	886	0.1	0.019	114	9.1	0.89	0.84	96.33	0.088
1387	0.0226	44.3	1454687	991	0.669	0.02	218	4.8	0.79	0.97	97.63	0.307
1390	0.0341	29.3	3156364	2622	1.452	0.035	343	3	0.67	0.98	99.63	0.423
1403	0.0099	101.3	310985	341	0.143	0.016	219	4.7	0.79	0.9	99.47	0.065
1404*	0.0047	212.2	455125	221	0.209	0.022	218	4.8	0.79	0.91	99.6	0.096
1406	0.0426	23.5	2417122	5420	1.112	0.058	220	4.7	0.79	0.95	97.07	0.505
1407	0.0125	80	302145	426	0.139	0.016	252	4.1	0.76	0.9	98.47	0.055
1409	0.0237	42.2	605596	1091	0.279	0.021	229	4.5	0.78	0.93	100	0.122
1410	0.08	12.5	1878494	152486	0.864	0.877	201	5.2	0.81	0.5	99.58	0.43
1413	0.0163	61.4	435577	585	0.2	0.017	145	7.2	0.86	0.92	99.47	0.138
1420	0.0154	65.1	49537	752	0.023	0.023	222	4.7	0.79	0.5	98.58	0.01
1421*	0.0053	187.1	126772	233	0.058	0.02	195	5.3	0.81	0.74	100	0.03
1422	0.0219	45.7	184656	938	0.085	0.02	254	4.1	0.76	0.81	100	0.033
1425	0.0345	29	555697	2708	0.256	0.036	186	5.6	0.82	0.88	99.4	0.138
1429	0.0113	88.3	16698	386	0.008	0.016	125	8.3	0.88	0.33	99.6	0.006
1430	0.0294	34	1190664	1767	0.548	0.028	240	4.3	0.77	0.95	95.43	0.228
1438	0.0086	116.5	169731	307	0.078	0.016	132	7.9	0.87	0.83	100	0.059
1442	0.0261	38.4	1654434	1330	0.761	0.023	133	7.9	0.87	0.97	100	0.572
1444	0.0221	45.2	649891	957	0.299	0.02	128	8.1	0.88	0.94	98.9	0.234
1449	0.0314	31.8	729341	2084	0.335	0.031	144	7.2	0.86	0.92	96.77	0.233
1452	0.0211	47.4	372977	878	0.172	0.019	227	4.6	0.78	0.9	97.8	0.076
1458	0.0366	27.3	775355	5702	0.357	0.072	155	6.7	0.85	0.83	96.05	0.23
1475	0.0133	75.1	61681	456	0.028	0.016	220	4.7	0.79	0.64	99.37	0.013
1476	0.0089	112.6	219652	1453	0.101	0.075	147	7.1	0.86	0.57	99.72	0.069