Report Survival Function

Data and Methodology

The dataset used in the study was obtained from CVE website (cve.org) for the year 2021, 2022 and 2023. For each vulnerability, the patch was released by the respective companies. The killed count here refers to the number of vulnerabilities whose patch was created/made where as the censored here refers to those vulnerabilities who are still alive and no patch was made for them.

The survival function was used to asses the lifetime of CVE's. Survival function graphs visually depict the estimated likelihood that a subject will survive beyond a specific time point in survival analysis. These graphs play a crucial role in comprehending the survival journey of a population or a studied group. Below is an explanation of the elements and the interpretation of survival function graphs.

Cumulative Hazard Function: The survival function provides the probability of surviving past a specific time point, while the cumulative hazard function indicates the cumulative risk or failure rate leading up to that time point. Both functions are crucial in survival analysis for understanding time-to-event data and evaluating associated risk factors.

Empirical Results (Year 2023)

The survival analysis comprises of 390 vulnerabilities, 366 of whom were killed as their patch was made available. The number of censored vulnerabilities were 24 as their patch was not available. Our analysis observed a total of 365 days. (Table 1)

Table: 1 Killed and censored counts

Time	First Seen	CVE	Release Date	Patch Details	Killed Count	censored
1	Jan 1, 2022	CVE-2022-21835	Jan 6, 2022	CVE-2022-21929	5	0
2	Dec 30, 2021	CVE-2022-21846	Jan 11, 2022	CVE-2022-21835	12	0
3	Jan 20, 2022	CVE-2022-21968	Jan 21, 2022	CVE-2022-23258	1	0
4	Jan 31, 2022	CVE-2022-21969	Feb 3, 2022	CVE-2022-23261	3	0
5	Jan 21, 2022	CVE-2022-21979	Feb 8, 2022	CVE-2022-21957	18	0
6	Feb 25, 2022	CVE-2022-23266	Mar 8, 2022	CVE-2022-23265	11	0
7	Mar 23, 2022	CVE-2022-24462	Apr 1, 2022	CVE-2022-24475	9	0
8	Apr 3, 2022	CVE-2022-24510	Apr 12, 2022	CVE-2022-23259	9	0
9	May 4, 2022	CVE-2022-26806	May 10, 2022	CVE-2022-21978	6	0
10	May 28, 2022	CVE-2022-26905	May 31, 2022	CVE-2022-26905	3	0
11	Jun 8, 2022	CVE-2022-26912	Jun 9, 2022	CVE-2022-22021	1	0
12	Jun 3, 2022	CVE-2022-29105	Jun 14, 2022	CVE-2022-29143	11	0
13	Jun 21, 2022	CVE-2022-30158	Jun 23, 2022	CVE-2022-30192	2	0
14	Jun 23, 2022	CVE-2022-30168	Jun 24, 2022	CVE-2022-33639	1	0
15	Jun 29, 2022	CVE-2022-30171	Jun 30, 2022	CVE-2022-33680	1	0
16	Jul 10, 2022	CVE-2022-30172	Jul 12, 2022	CVE-2022-33632	2	0
17	Aug 2, 2022	CVE-2022-30174	Aug 5, 2022	CVE-2022-33636	3	0

18	Jul 29, 2022	CVE-2022-33631	Aug 9, 2022	CVE-2022-21979	11	0
19	Aug 31, 2022	CVE-2022-34713	Sep 1, 2022	CVE-2022-38012	1	0
20	Aug 23, 2022	CVE-2022-34717	Sep 13, 2022	CVE-2022-34700	21	0
21	Sep 19, 2022	CVE-2022-37971	Sep 20, 2022	CVE-2022-37972	1	0
22	Sep 28, 2022	CVE-2022-37972	Sep 30, 2022	CVE-2022-41040	2	0
23	Oct 2, 2022	CVE-2022-37983	Oct 3, 2022	CVE-2022-41035	1	0
24	Sep 26, 2022	CVE-2022-38001	Oct 11, 2022	CVE-2022-37968	15	0
25	Oct 19, 2022	CVE-2022-41038	Nov 8, 2022	CVE-2022-39327	20	0
26	Dec 2, 2022	CVE-2022-41115	Dec 5, 2022	CVE-2022-41115	3	0
27	Nov 27, 2022	CVE-2022-41123	Dec 13, 2022	CVE-2022-26804	16	0
28	Feb 11, 2022	CVE-2022-1539				1
29	Jul 25, 2022	CVE-2022-1794				1
30	Jul 11, 2022	CVE-2022-21606				1
31	Oct 18, 2022	CVE-2022-2170				1
32	Aug 1, 2022	CVE-2022-22304				1
33	Jul 18, 2022	CVE-2022-22516				1
34	Apr 7, 2022	CVE-2022-22765				1
35	Mar 15, 2022	CVE-2022-22771				1
36	May 17, 2022	CVE-2022-22773				1
37	Apr 28, 2022	CVE-2022-22782				1
38	Aug 25, 2022	CVE-2022-23235				1
39	Dec 9, 2022	CVE-2022-23468				1
40	Dec 9, 2022	CVE-2022-23477				1
41	Dec 9, 2022	CVE-2022-23478				1
42	Dec 9, 2022	CVE-2022-23479				1
43	Dec 9, 2022	CVE-2022-23480				1
44	Dec 9, 2022	CVE-2022-23481				1
45	Dec 9, 2022	CVE-2022-23482				1
46	Dec 9, 2022	CVE-2022-23483				1
47	Dec 9, 2022	CVE-2022-23484				1
48	Dec 9, 2022	CVE-2022-23493				1
49	Sep 6, 2022	CVE-2022-23678				1
50	Apr 19, 2022	CVE-2022-24826				1
51	Mar 4, 2022	CVE-2022-26336				1
52	Mar 9, 2022	CVE-2022-26355				1
53	Mar 17, 2022	CVE-2022-26504				1
54	May 10, 2022	CVE-2022-27167				1
55	Apr 4, 2022	CVE-2022-27608				1
56	Apr 4, 2022	CVE-2022-27609				1
57	May 9, 2022	CVE-2022-30335				1
58	Jul 14, 2022	CVE-2022-32225				1
59	Jun 19, 2022	CVE-2022-34005				1
60	Jun 19, 2022	CVE-2022-34006				1
61	Dec 22, 2022	CVE-2022-34478				1

62	Sep 6, 2022	CVE-2022-36670				1
63	Aug 12, 2022	CVE-2022-37397				1
64	Sep 6, 2022	CVE-2022-37771				1
65	Nov 4, 2022	CVE-2022-40263				1
66	Sep 19, 2022	CVE-2022-40608				1
67	Dec 13, 2022	CVE-2022-41561				1
68	Dec 13, 2022	CVE-2022-41562				1
69	Dec 13, 2022	CVE-2022-41563				1
70	Nov 14, 2022	CVE-2022-43688				1

The survival plots for the survivor, cumulative hazard and actual data are represent in the fig. 1, 2 and 3 respectively.

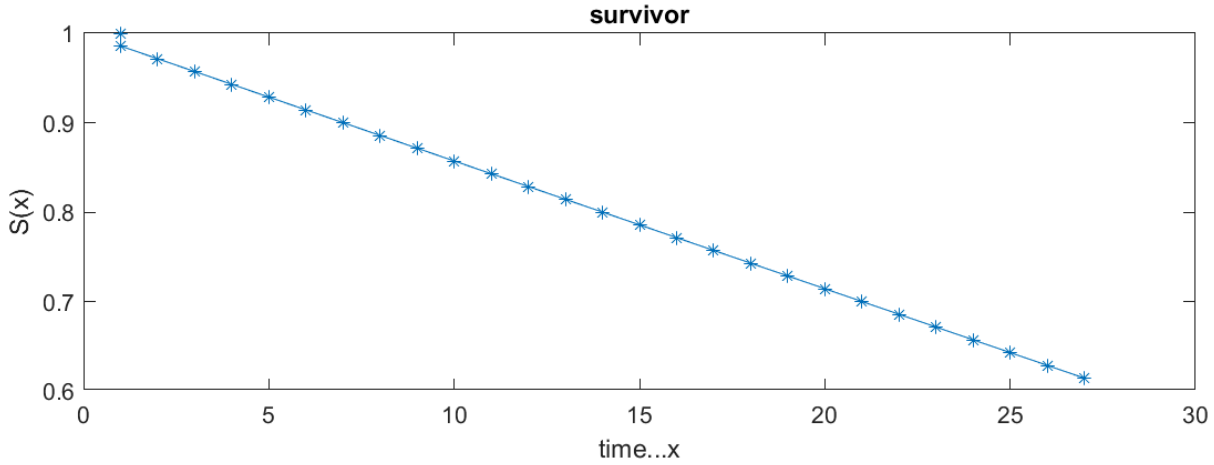

Fig. 1: Survivor Function

From the above figure it can be said that the overall trend of vulnerabilities is decreasing with respect to time. We can see that 92% of the vulnerabilities are alive for about 5 days, 85% of the vulnerabilities live for about 10 days. As the period of time increases, the number of vulnerabilities decreases as the patch was made available for them.

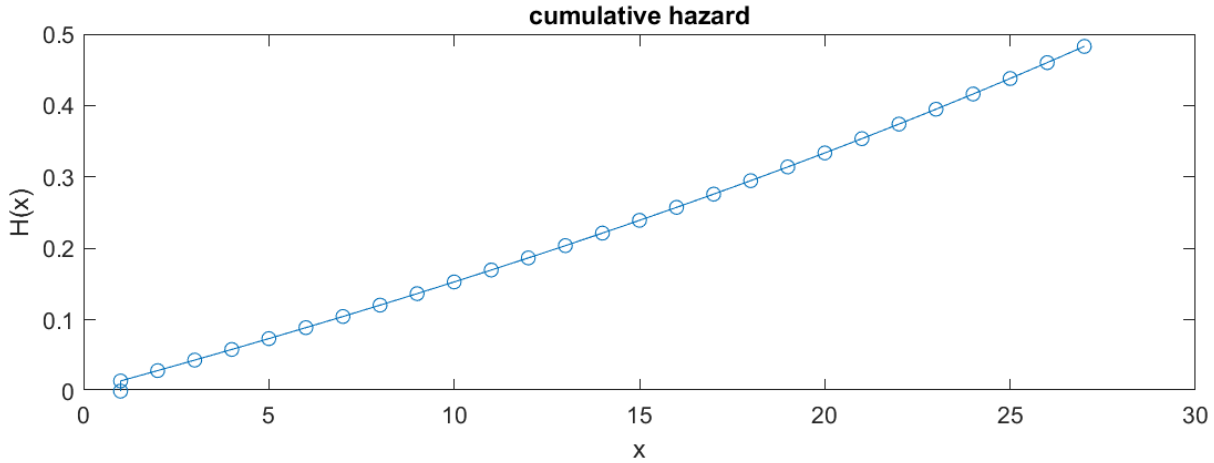

Fig. 2: Cumulative Hazard Function

From the above figure, it can be said that, at any given time, t, the value of H(x) signifies the cumulative risk of experiencing the vulnerability up to that particular date. A higher H(x) value indicates a greater cumulative risk or failure rate up to time t.

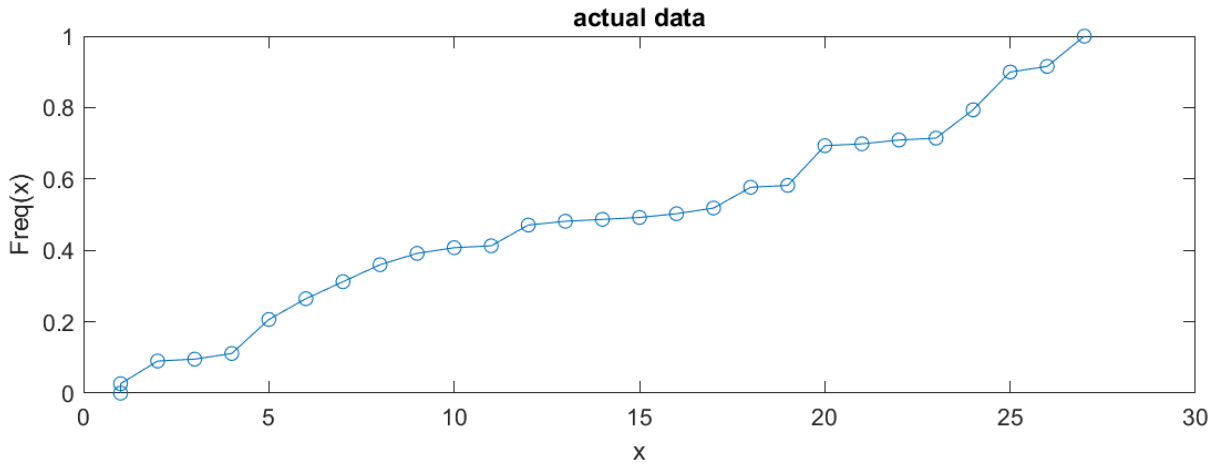

Fig. 3: Actual Data

From the above figure, the overall trend of vulnerabilities is increasing day by day. The increasing trend in the curve can be seen from the actual data.