Table (1): patients' characteristics.

ID	Sex	age	Age Cat.	LDL chol	LDL Cat	Homa 2-IR	Homa Cat	BMI	BMI cat	Sys pre	Sys cat	Dias pre	Dias cat
1	0	27	1	59.89	1	0.49	1	20.30	1	123.40	1	70.00	1
2	0	27	1	62.18	1	0.63	1	20.39	1	124.18	1	70.96	1
3	0	29	1	63.65	1	0.65	1	22.21	1	125.90	1	71.78	1
4	0	29	1	65.81	1	0.84	1	22.50	1	126.18	1	71.91	1
5	0	30	1	69.79	1	1.05	1	23.14	1	130.08	2	73.52	1
6	0	31	1	70.11	2	1.06	1	23.18	1	130.43	2	73.89	1
7	0	31	1	70.60	2	1.08	1	23.35	1	132.98	2	74.24	1
8	0	32	1	71.74	2	1.09	1	23.36	1	133.19	2	74.61	1
9	1	33	1	74.00	2	1.13	1	23.52	1	135.13	2	74.70	1
10	0	34	1	74.63	2	1.19	1	23.70	1	135.27	2	75.54	1
11	0	34	1	74.72	2	1.29	2	23.85	1	135.50	2	76.49	1
12	0	34	1	75.17	2	1.32	2	24.18	1	135.66	2	76.52	1
13	0	34	1	75.18	2	1.34	2	24.23	1	136.00	2	77.16	1
14	0	34	1	75.23	2	1.42	2	24.29	1	136.10	2	79.35	1
15	0	34	1	75.62	2	1.43	2	24.36	1	136.90	2	79.74	1
16	0	35	1	76.18	2	1.45	2	24.44	1	137.08	2	80.02	1
17	0	35	1	76.24	2	1.45	2	24.54	1	137.09	2	80.16	1
18	0	35	1	76.30	2	1.46	2	24.61	1	137.56	2	80.75	1
19	0	35	1	76.70	2	1.46	2	24.62	1	138.07	2	80.85	1
20	0	35	1	77.59	2	1.51	2	24.64	1	138.32	2	82.06	1
21	0	35	1	77.71	2	1.54	2	24.91	1	138.59	2	82.10	1
22	0	35	1	77.95	2	1.54	2	24.92	1	139.01	2	82.32	1
23	0	36	2	78.06	2	1.59	2	25.06	2	139.18	2	82.49	1
24	0	36	2	78.26	2	1.62	2	25.10	2	139.42	2	82.77	1
25	0	36	2	78.44	2	1.62	2	25.12	2	139.89	2	83.11	1
26	0	36	2	79.18	2	1.63	2	25.13	2	139.91	2	83.43	1
27	0	36	2	79.34	2	1.64	2	25.18	2	140.56	2	83.54	1
28	0	36	2	79.90	2	1.64	2	25.29	2	140.70	2	83.81	1
29	0	36	2	80.23	2	1.65	2	25.61	2	140.72	2	83.84	1
30	0	36	2	80.54	2	1.65	2	25.70	2	141.08	2	84.51	1
31	0	36	2	80.79	2	1.67	2	25.71	2	141.14	2	84.66	1
32	0	36	2	80.95	2	1.67	2	25.73	2	141.30	2	84.77	1
33	0	36	2	81.40	2	1.68	2	25.80	2	141.74	2	84.94	1
34	0	36	2	81.52	2	1.69	2	25.83	2	142.02	2	85.05	2
35	0	36	2	81.63	2	1.69	2	25.96	2	142.14	2	85.08	2
36	0	36	2	81.64	2	1.71	2	25.98	2	142.27	2	85.97	2
37	0	37	2	81.8	2	1.73	2	26.03	2	142.75	2	86.08	2
38	0	37	2	82.10	2	1.73	2	26.05	2	142.88	2	86.34	2
39	0	37	2	82.73	2	1.74	2	26.20	2	143.64	2	86.78	2
40	0	37	2	83.19	2	1.78	2	26.25	2	143.65	2	87.11	2
41	0	37	2	83.51	2	1.78	2	26.35	2	143.84	2	87.38	2
42	0	37	2	83.88	2	1.82	2	26.36	2	143.90	2	87.50	2
43	0	37	2	83.91	2	1.83	2	26.44	2	144.10	2	88.10	2
44	0	37	2	84.40	2	1.86	2	26.65	2	144.15	2	88.17	2
45	0	37	2	85.18	2	1.87	2	26.67	2	144.35	2	88.77	2
46	0	38	2	86.24	2	1.87	2	26.78	2	144.51	2	88.78	2
47	0	38	2	86.42	2	1.92	2	26.81	2	144.52	2	89.01	2
48	0	38	2	86.97	2	1.92	2	26.96	2	144.74	2	89.32	2
49	0	38	2	87.03	2	1.93	2	27.11	2	145.11	2	89.34	2
50	0	38	2	87.21	2	1.94	2	27.11	2	145.17	2	89.38	2
51	1	38	2	87.60	2	1.94	2	27.13	2	145.63	2	89.50	2
52	1	38	2	87.65	2	1.95	2	27.31	2	145.78	2	89.53	2

ID	Sex	age	Age Cat.	LDL-chol	LDL Cat.	HOMA2-IR	Homa Cat.	BMI	BMI Cat.	Sys. Pre.	Sys. Cat.	Dias. Pre.	Dias Cat.
53	1	38	2	88.22	2	1.95	2	27.31	2	145.84	2	89.56	2
54	1	39	2	88.34	2	1.96	2	27.34	2	145.85	2	89.82	2
55	1	39	2	88.74	2	1.96	2	27.36	2	145.95	2	89.95	2
56	1	39	2	89.00	2	1.99	2	27.42	2	146.00	2	90.18	2
57	1	39	2	89.31	2	2.03	2	27.43	2	146.44	2	90.34	2
58	1	39	2	90.06	2	2.03	2	27.45	2	146.60	2	90.87	2
59	1	39	2	90.42	2	2.05	2	27.51	2	146.73	2	90.92	2
60	1	39	2	90.67	2	2.07	2	27.54	2	146.74	2	91.06	2
61	1	39	2	90.92	2	2.08	2	27.64	2	146.88	2	91.07	2
62	1	39	2	91.45	2	2.10	2	27.76	2	146.91	2	91.12	2
63	1	39	2	91.74	2	2.12	2	27.78	2	147.31	2	91.30	2
64	1	39	2	92.51	2	2.13	2	27.79	2	147.39	2	91.32	2
65	1	39	2	92.73	2	2.15	2	27.80	2	147.39	2	91.45	2
66	1	40	2	92.90	2	2.15	2	27.85	2	147.77	2	91.50	2
67	1	40	2	92.90	2	2.16	2	27.87	2	148.11	2	91.60	2
68	1	40	2	93.15	2	2.17	2	28.02	2	148.21	2	91.61	2
69	1	40	2	93.18	2	2.19	2	28.02	2	148.23	2	91.67	2
70	1	40	2	93.54	2	2.19	2	28.11	2	148.27	2	91.70	2
71	1	40	2	93.57	2	2.20	2	28.28	2	148.37	2	92.01	2
72	1	40	2	93.97	2	2.21	2	28.32	2	148.85	2	92.04	2
73	1	40	2	94.15	2	2.23	2	28.35	2	149.01	2	92.99	2
74	1	40	2	94.27	2	2.24	2	28.36	2	149.08	2	93.62	2
75	1	40	2	94.57	2	2.25	2	28.38	2	149.38	2	93.99	2
76	1	40	2	94.68	2	2.28	2	28.42	2	149.44	2	94.15	2
77	1	40	2	94.73	2	2.29	2	28.45	2	149.69	2	94.28	2
78	1	40	2	94.81	2	2.30	2	28.45	2	149.96	2	94.65	2
79	1	40	2	95.22	2	2.31	2	28.49	2	149.98	2	94.68	2
80	1	41	2	95.32	2	2.33	2	28.61	2	150.00	2	94.95	2
81	1	41	2	95.81	2	2.33	2	28.61	2	150.03	2	95.50	2
82	1	41	2	95.88	2	2.36	2	28.62	2	150.47	2	95.68	2
83	1	41	2	96.00	2	2.36	2	28.62	2	150.63	2	95.72	2
84	1	41	2	96.11	2	2.37	2	28.67	2	150.76	2	95.92	2
85	1	41	2	96.40	2	2.39	2	28.71	2	150.84	2	96.07	2
86	1	41	2	96.77	2	2.39	2	28.76	2	150.86	2	96.34	2
87	1	41	2	96.81	2	2.40	2	28.81	2	150.91	2	96.48	2
88	1	41	2	96.90	2	2.41	2	28.92	2	150.92	2	96.52	2
89	1	41	2	96.91	2	2.42	2	28.99	2	151.06	2	96.61	2
90	1	41	2	97.55	2	2.43	2	29.10	2	151.58	2	96.78	2
91	1	41	2	97.58	2	2.46	2	29.11	2	151.69	2	97.16	2
92	1	41	2	97.82	2	2.47	2	29.14	2	152.01	2	97.39	2
93	1	41	2	98.19	2	2.51	2	29.17	2	152.49	2	97.51	2
94	1	41	2	98.65	2	2.54	2	29.18	2	152.54	2	97.58	2
95	1	42	2	98.68	2	2.56	2	29.34	2	153.38	2	98.40	2
96	1	42	2	99.00	2	2.58	2	29.37	2	153.46	2	98.42	2
97	1	42	2	99.47	2	2.58	2	29.41	2	153.50	2	98.49	2
98	1	42	2	99.57	2	2.59	2	29.41	2	153.63	2	98.93	2
99	1	42	2	100.28	3	2.61	2	29.60	2	153.91	2	99.20	2
100	1	42	2	100.57	3	2.64	2	29.72	2	153.94	2	99.39	2
101	1	42	2	100.60	3	2.65	2	29.80	2	154.46	2	99.72	2
102	1	42	2	101.85	3	2.68	2	29.94	2	154.56	2	99.74	2

ID	Sex	age	Age Cat.	LDL chol	LDL Cat.	Homa 2-IR	Homa Cat.	BMI	BMI Cat.	Sys Pre.	Sys Cat.	Dias Pre.	Dias Cat.
103	1	42	2	101.95	3	2.69	2	29.97	2	154.82	2	100.16	3
104	1	42	2	102.25	3	2.70	3	29.97	2	154.84	2	100.45	3
105	1	43	2	102.91	3	2.71	3	29.97	2	155.02	2	100.54	3
106	1	43	2	103.48	3	2.72	3	30.00	3	155.03	2	100.95	3
107	1	43	2	104.09	3	2.72	3	30.03	3	155.41	2	100.98	3
108	1	43	2	104.37	3	2.74	3	30.11	3	155.50	2	101.08	3
109	1	43	2	104.39	3	2.75	3	30.15	3	155.57	2	101.08	3
110	1	43	2	104.58	3	2.76	3	30.18	3	155.59	2	101.14	3
111	0	43	2	104.66	3	2.77	3	30.28	3	155.63	2	101.34	3
112	0	43	2	104.72	3	2.77	3	30.34	3	155.96	2	101.66	3
113	0	44	2	104.85	3	2.78	3	30.35	3	155.97	2	101.66	3
114	0	44	2	104.92	3	2.79	3	30.36	3	156.53	2	101.77	3
115	0	44	2	105.04	3	2.79	3	30.42	3	156.62	2	101.84	3
116	0	44	2	105.77	3	2.81	3	30.46	3	156.97	2	101.87	3
117	0	44	2	106.05	3	2.82	3	30.52	3	157.23	2	102.14	3
118	0	44	2	106.32	3	2.84	3	30.54	3	157.36	2	102.32	3
119	0	44	2	106.36	3	2.86	3	30.55	3	157.53	2	102.93	3
120	0	44	2	106.50	3	2.87	3	30.63	3	157.67	2	103.46	3
121	0	44	2	106.60	3	2.87	3	30.74	3	158.72	2	103.61	3
122	0	44	2	108.32	3	2.87	3	31.00	3	158.92	2	103.73	3
123	0	45	2	108.59	3	2.88	3	31.12	3	159.14	2	103.75	3
124	0	45	2	108.82	3	2.91	3	31.18	3	159.54	2	104.41	3
125	0	45	2	108.92	3	2.94	3	31.19	3	159.60	2	104.98	3
126	0	45	2	109.36	3	2.95	3	31.24	3	159.73	2	105.40	3
127	0	45	2	109.44	3	2.99	3	31.34	3	159.83	2	105.58	3
128	0	45	2	110.00	3	3.03	3	31.35	3	160.49	3	105.80	3
129	0	45	2	111.71	3	3.04	3	31.35	3	161.40	3	106.17	3
130	0	45	2	112.73	3	3.05	3	31.39	3	161.58	3	106.43	3
131	1	45	2	112.96	3	3.05	3	31.47	3	161.62	3	106.51	3
132	1	46	3	113.07	3	3.06	3	31.51	3	161.78	3	107.06	3
133	1	46	3	113.08	3	3.08	3	31.56	3	162.26	3	108.16	3
134	1	47	3	113.50	3	3.08	3	31.67	3	162.37	3	108.61	3
135	1	47	3	113.97	3	3.13	3	31.75	3	162.53	3	109.79	3
136	1	47	3	115.21	3	3.13	3	31.94	3	163.57	3	110.16	3
137	1	47	3	116.16	3	3.21	3	32.18	3	163.78	3	110.53	3
138	1	47	3	116.90	3	3.24	3	32.20	3	164.47	3	110.68	3
139	1	47	3	118.37	3	3.33	3	32.31	3	164.93	3	112.09	3
140	1	47	3	118.75	3	3.36	3	32.71	3	164.93	3	112.44	3
141	1	48	3	121.35	3	3.36	3	32.87	3	165.41	3	113.56	3
142	1	48	3	123.60	3	3.36	3	32.91	3	165.96	3	114.21	3
143	1	49	3	123.70	3	3.45	3	33.17	3	167.51	3	114.27	3
144	1	49	3	124.69	3	3.52	3	33.73	3	168.68	3	114.77	3
145	1	49	3	124.96	3	3.60	3	33.93	3	169.07	3	115.36	3
146	1	50	3	127.56	3	3.65	3	34.29	3	170.23	3	117.39	3
147	1	51	3	127.83	3	3.70	3	34.59	3	173.73	3	117.88	3
148	1	51	3	131.57	3	3.78	3	34.95	3	175.61	3	118.11	3
149	1	51	3	131.89	3	3.82	3	35.09	3	175.59	3	119.27	3
150	1	53	3	133.13	3	4.36	3	35.16	3	175.75	3	124.04	3

The following table are the actual data used in Stata 14 software, not the above rounded values. The above values are only used for the space to demonstrate all the variables and corresponding category each participant belong to.

patient_ID	LDL_chol	HOMA2_IR	BMI	sysBloodPr	diastBloodPressure
1	59.88626253	0.486660227	20.30083374	123.4009178	69.99634935
2	62.17804017	0.625517898	20.38539827	124.1760587	70.95836483
3	63.65385754	0.648810155	22.20504654	125.8975997	71.77720889
4	65.80681914	0.835501959	22.50371191	126.1787116	71.90626924
5	69.79260909	1.048423757	23.13687005	130.0785608	73.51626359
6	70.10500285	1.063198485	23.18066959	130.4312855	73.89087266
7	70.5951389	1.082373227	23.34615748	132.9771952	74.24442658
8	71.73608315	1.09242144	23.3553593	133.1941031	74.60984969
9	73.99519667	1.129448668	23.51913306	135.1296929	74.69569464
10	74.63244092	1.189798489	23.7000037	135.2716671	75.54314352
11	74.71785909	1.29368181	23.84731358	135.4981258	76.48721248
12	75.17096758	1.324724984	24.18061722	135.6569022	76.52476289
13	75.18235196	1.335093535	24.23270373	136.0038509	77.16186785
14	75.23138391	1.422111938	24.28506674	136.0953597	79.34849803
15	75.61753709	1.432224008	24.36230869	136.9038556	79.73530992
16	76.18401022	1.453228249	24.44359033	137.0809407	80.01683653
17	76.24358806	1.453815821	24.53815568	137.0869254	80.15864331
18	76.29881294	1.456305613	24.61359837	137.5649291	80.74565456
19	76.69659462	1.464666603	24.61722818	138.0735912	80.85114089
20	77.58989329	1.51356061	24.64186842	138.3241151	82.05654214
21	77.70521508	1.536136161	24.9131702	138.5853047	82.1038819
22	77.94998599	1.544577706	24.92131773	139.008886	82.31728002
23	78.05838748	1.586554018	25.06314382	139.181514	82.48948116
24	78.25702966	1.617951836	25.09951711	139.4240568	82.76779198
25	78.4403701	1.619881	25.11813044	139.889396	83.11299612
26	79.17897107	1.626478279	25.13316489	139.9072013	83.42940556
27	79.34469678	1.639802471	25.17546941	140.5566385	83.53598548
28	79.90002937	1.640401777	25.28627577	140.7048667	83.80597309
29	80.23286431	1.650270486	25.60867263	140.7248329	83.83555089
30	80.53759625	1.651985736	25.70466017	141.0786766	84.5109185
31	80.78692327	1.665993018	25.71210314	141.1392888	84.6618672
32	80.95179537	1.666095395	25.73388846	141.3048354	84.77066523
33	81.39997551	1.676923007	25.80137142	141.7431129	84.94485471
34	81.5230473	1.694165523	25.83013284	142.0180379	85.04737784
35	81.6333478	1.694587966	25.95726452	142.1419579	85.08232589
36	81.63910707	1.7096777	25.9830848	142.2669347	85.9701009
37	81.79551762	1.728720127	26.03356639	142.7497928	86.07727811
38	82.09730138	1.732354693	26.05377139	142.8777895	86.33759816
39	82.72673203	1.738136697	26.19980058	143.6355794	86.78184428
40	83.19282441	1.775434606	26.25343572	143.6518685	87.11256427
41	83.51015721	1.780812997	26.35494787	143.8440352	87.37727918
42	83.87801001	1.821641325	26.3591208	143.904684	87.49567067
43	83.90994145	1.831844486	26.44070213	144.0988788	88.0956395
44	84.40043839	1.862877807	26.65017692	144.1541475	88.16578459
45	85.17501733	1.86912154	26.66541993	144.3474132	88.76568544
46	86.24150134	1.872825229	26.78361722	144.509008	88.7825505
47	86.41587725	1.916601042	26.812301	144.5242085	89.0125243
48	86.96738711	1.92222757	26.96295086	144.7370245	89.31527986
49	87.02828486	1.932907728	27.11405208	145.1060697	89.33794082
50	87.21342521	1.939328867	27.11442109	145.1690792	89.38452095
51	87.59738179	1.941058513	27.12546756	145.6324734	89.5019489
52	87.65253761	1.951682018	27.30688699	145.7802001	89.5308856

53	88.21762356	1.952190865	27.30755139	145.8370062	89.55774174
54	88.34186837	1.958971905	27.34284662	145.8501257	89.81576935
55	88.7409777	1.962141305	27.36056248	145.9489973	89.95193185
56	88.99684398	1.989914501	27.42257654	145.9993347	90.17512035
57	89.31278846	2.02697825	27.43065895	146.4363352	90.33968778
58	90.05869996	2.033050053	27.45034168	146.6040765	90.86615116
59	90.42098152	2.052561065	27.50839688	146.7290227	90.91646661
60	90.66844195	2.065170296	27.54237172	146.7365686	91.06059405
61	90.91962854	2.082371342	27.63616749	146.8836997	91.07330339
62	91.45092179	2.098034701	27.75959177	146.9104233	91.12413523
63	91.73729771	2.1191684	27.78172501	147.3086787	91.29977663
64	92.51302825	2.132822463	27.79279514	147.3877559	91.32199752
65	92.73033242	2.147590744	27.7992254	147.3889239	91.44767437
66	92.90181516	2.15186423	27.84995994	147.7746667	91.49574549
67	92.90450229	2.159333468	27.86907689	148.1125105	91.60054843
68	93.15072278	2.170694946	28.01690012	148.2112376	91.61239313
69	93.18080864	2.187319216	28.01932658	148.2342406	91.66833284
70	93.53782288	2.190678916	28.11007119	148.2676521	91.69940127
71	93.5737695	2.196355685	28.28004598	148.3681924	92.00989498
72	93.96977742	2.211907172	28.31709791	148.8537684	92.04176836
73	94.14544773	2.226152678	28.34828762	149.0057149	92.99337843
74	94.26851067	2.240807892	28.36225579	149.0833154	93.62273135
75	94.57093547	2.250136361	28.37706409	149.3803847	93.98582303
76	94.68147986	2.276625971	28.42003727	149.4410218	94.14513547
77	94.73162406	2.291658478	28.44672231	149.6870214	94.28270759
78	94.8091201	2.300868336	28.45466819	149.9554549	94.64978228
79	95.22476536	2.307544036	28.4938252	149.9772856	94.67519469
80	95.31849196	2.326027215	28.6073615	150.0036963	94.95138569
81	95.80827063	2.332456523	28.60853748	150.0317356	95.504466
82	95.87960534	2.35945621	28.62039083	150.4667957	95.68060593
83	96.00168055	2.359833761	28.62136969	150.6259156	95.72396957
84	96.10649581	2.373084069	28.67169603	150.7608258	95.92103971
85	96.40483791	2.387931316	28.70849209	150.8378482	96.06573604
86	96.76889879	2.390069935	28.76101083	150.8610255	96.34116959
87	96.80646738	2.399277902	28.80966656	150.905197	96.47836375
88	96.90122271	2.411984544	28.92018631	150.9217811	96.51952908
89	96.90967787	2.4218036	28.9943167	151.0591804	96.60639678
90	97.54518517	2.425332347	29.10458361	151.5783406	96.78398633
91	97.57532315	2.464533455	29.11393665	151.6895192	97.16179582
92	97.82240849	2.472015524	29.14182311	152.0147919	97.38518017
93	98.19383152	2.512852519	29.17354849	152.4897552	97.50577044
94	98.65168935	2.538669397	29.17974603	152.5383571	97.583515
95	98.67628649	2.557198677	29.33804648	153.3760363	98.40263236
96	99.000552	2.579092668	29.37220989	153.4606462	98.42450822
97	99.47036072	2.583321929	29.40508095	153.4953371	98.4857294
98	99.56796044	2.589431917	29.40925322	153.6290617	98.93001208
99	100.2809094	2.610692002	29.60369794	153.9099293	99.20391047
100	100.5717195	2.636885226	29.71572889	153.9424972	99.38911282
101	100.6047924	2.651751393	29.79977925	154.4560393	99.71821712
102	101.8494775	2.678843061	29.93617461	154.558702	99.7448965

103	101.9492914	2.69069223	29.96661684	154.8245324	100.1596441
104	102.2515504	2.698054556	29.96835067	154.837513	100.4489565
105	102.9114573	2.708479035	29.96957974	155.019825	100.5387061
106	103.4806938	2.71543582	30.00466141	155.0302859	100.9490535
107	104.0881578	2.720640069	30.03225126	155.4068362	100.9756056
108	104.3713252	2.736640518	30.10960076	155.4976388	101.0822111
109	104.3914483	2.748266639	30.14865929	155.5674547	101.0830179
110	104.5798686	2.758139944	30.18347007	155.5914364	101.1394993
111	104.6607348	2.768605796	30.27695636	155.6261913	101.3435673
112	104.7238725	2.772175859	30.33694066	155.9660494	101.6553383
113	104.8524726	2.784769065	30.34647086	155.972805	101.6564651
114	104.9203266	2.788978027	30.35791172	156.5262548	101.7654722
115	105.0374154	2.792846389	30.42338805	156.623788	101.8369263
116	105.7708525	2.813543425	30.45991065	156.9746708	101.8745766
117	106.0526701	2.8216319	30.52013788	157.2333107	102.1438818
118	106.3224205	2.836471693	30.54321084	157.3606742	102.3191044
119	106.3588698	2.86156774	30.54610609	157.5349887	102.9303476
120	106.4972799	2.870049811	30.62901275	157.6709272	103.4613788
121	106.604525	2.870113146	30.7433647	158.7207682	103.6144469
122	108.3227542	2.874031357	30.99738238	158.9222397	103.7258609
123	108.5904841	2.87941575	31.12302385	159.1374886	103.7531646
124	108.8231986	2.906358239	31.18244663	159.5381187	104.4083546
125	108.9212838	2.944579876	31.19197902	159.599158	104.9786418
126	109.3646854	2.946595176	31.24239694	159.7268598	105.3992209
127	109.443203	2.985029147	31.34270287	159.830625	105.5849072
128	110.0035342	3.027057171	31.34638621	160.4869579	105.8003815
129	111.7142213	3.0415236	31.35100678	161.3990233	106.1653939
130	112.727007	3.045917418	31.39241181	161.5790007	106.4294163
131	112.9599582	3.054332948	31.4744049	161.620505	106.5062134
132	113.0742184	3.059351383	31.51252628	161.7783022	107.0606273
133	113.0811469	3.080270062	31.56477963	162.2555993	108.1639294
134	113.5011891	3.082093216	31.6663631	162.3732048	108.6064678
135	113.9678215	3.12902167	31.74508879	162.5259587	109.7874429
136	115.2098298	3.133993	31.93917448	163.5672102	110.1637194
137	116.1608298	3.212666172	32.18283095	163.7750487	110.5316899
138	116.8971631	3.239904042	32.19956838	164.4663885	110.6818642
139	118.3710727	3.331810851	32.31424866	164.9260434	112.0894894
140	118.750906	3.361332552	32.70754103	164.9274447	112.4385468
141	121.3539927	3.361957484	32.86909366	165.4101566	113.5642057
142	123.6046089	3.363641715	32.90902767	165.9629702	114.2073523
143	123.6953321	3.44841049	33.17015687	167.5063644	114.2730905
144	124.6863766	3.520206957	33.72790263	168.6830254	114.7742868
145	124.9633003	3.600924971	33.9273159	169.066132	115.3553829
146	127.5631494	3.652359416	34.29045674	170.229292	117.3937688
147	127.8271221	3.697602312	34.58909385	173.7274296	117.8790236
148	131.5713536	3.782653123	34.95279071	175.6065684	118.1096726
149	131.8938225	3.815486059	35.0914694	175.5867168	119.268837
150	133.1308799	4.361195597	35.16374084	175.7543407	124.037896

Table (2): statistical summary of the patients' characteristics:

Variable	Observations	mean	Std. Dev.	Min	Max
Gender:	150				
Female=0	69(0.46)				
Male=1	81(0.54)				
Age	150	40.2	4.93	27	53
LDL-chol	150	94.81	15.41	59.89	133.1
HOMA2-IR	150	2.28	.71	.49	4.36
BMI	150	28.28	2.991	20.3	35.16
Sys.Bl.Pr.	150	149.73	10.434	123.4	175.75
Dias.Bl.Pr.	150	94.25	11.39	70	124

Table (3): table summarizing the categorical groups of patients according to the previous characteristics:

Variable	Group1 (desirable)	Group2 (borderline)	Group3 (high)
Age	Age ≤ 35	35 < age ≤ 45	Age > 45
LDL-chol	LDL ≤ 70	70 < LDL < 100	LDL ≥ 100
HOMA2-IR	HOMA < 1.22	1.22 ≤ HOMA < 2.7	HOMA ≥ 2.7
BMI	BMI ≤ 25	25 < BMI < 30	BMI ≥ 30
Systolic blood pressure	Sys.Pr. ≤ 130	130 < Sys.Pr. < 160	Sys.Pr. ≥ 160
Diastolic blood pressure	Dias. Pr. ≤ 85	85 < Dias. Pr. < 100	Dias. Pr. ≥ 100

Table (4): summary of categorical groups of the patients' characteristics regarding age category, BMI category, LDL-chol category, systolic and diastolic blood pressure category:

category	Age			BMI			LDL-chol		
	Frequency	Percent	Cum.	Frequency	Percent	Cum.	Frequency	Percent	Cum.
1	22	14.67	14.67	22	14.67	14.67	5	3.33	3.33
2	109	72.67	87.33	83	55.33	70	93	62.00	65.33
3	19	12.67	100	45	30	100	52	34.67	100
total	150	100		150	100		150	100	
category	**HOMA2-IR**			**Systolic Blood Pressure**			**Systolic Blood Pressure**		
	Frequency	**Percent**	**Cum.**	**Frequency**	**Percent**	**Cum.**	**Frequency**	**Percent**	**Cum.**
1	10	6.67	6.67	4	2.67	2.67	33	22	22
2	93	62.00	68.67	123	82.00	84.67	69	46	68
3	47	31.33	100	23	15.33	100	48	32	100
total	100	100		150	100		150	100	

Table (5): correlation between continuous predictor variables

	age	LDL-chol	HOMA2-IR	BMI	Sys. Bl.Pr.	Dias. Bl.Pr.
Age	1					
LDL-chol	.9919	1				
HOMA2-IR	.9941	.9947	1			
BMI	.9938	.9948	.996	1		
Sys. Bl.Pr.	.9958	.9953	.9958	.9962	1	
Dias. Bl.Pr.	.9915	.9951	.9962	.9945	.9949	1

Table (6): transition counts for each patient.

ID	0→1	1→2	2→3	3→4	1→0	2→1	3→2	2→0	3→1
1	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0

ID	0→1	1→2	2→3	3→4	1→0	2→1	3→2	2→0	3→1
54	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0
64	1	0	0	0	0	0	0	0	0
65	1	0	0	0	0	0	0	0	0
66	1	0	0	0	0	0	0	0	0
67	1	0	0	0	0	0	0	0	0
68	1	0	0	0	0	0	0	0	0
69	1	0	0	0	0	0	0	0	0
70	1	0	0	0	0	0	0	0	0
71	1	0	0	0	0	0	0	0	0
72	1	0	0	0	0	0	0	0	0
73	1	0	0	0	0	0	0	0	0
74	1	0	0	0	0	0	0	0	0
75	1	0	0	0	0	0	0	0	0
76	1	0	0	0	0	0	0	0	0
77	1	0	0	0	0	0	0	0	0
78	1	0	0	0	0	0	0	0	0
79	1	0	0	0	0	0	0	0	0
80	1	0	0	0	0	0	0	0	0
81	1	0	0	0	0	0	0	0	0
82	1	0	0	0	0	0	0	0	0
83	1	0	0	0	0	0	0	0	0
84	1	0	0	0	0	0	0	0	0
85	1	0	0	0	0	0	0	0	0
86	1	0	0	0	0	0	0	0	0
87	1	0	0	0	0	0	0	0	0
88	1	0	0	0	0	0	0	0	0
89	1	0	0	0	0	0	0	0	0
90	1	0	0	0	0	0	0	0	0
91	1	0	0	0	0	0	0	0	0
92	1	0	0	0	0	0	0	0	0
93	1	0	0	0	0	0	0	0	0
94	1	0	0	0	0	0	0	0	0
95	1	0	0	0	0	0	0	0	0
96	1	0	0	0	0	0	0	0	0
97	1	1	0	0	0	0	0	0	0
98	1	1	0	0	0	0	0	0	0
99	1	1	0	0	0	0	0	0	0
100	1	1	0	0	0	0	0	0	0
101	1	1	0	0	0	0	0	0	0
102	1	1	0	0	0	0	0	0	0
103	1	1	0	0	0	0	0	0	0
104	1	1	0	0	0	0	0	0	0
105	1	1	0	0	0	0	0	0	0
106	1	1	0	0	0	0	0	0	0
107	1	1	0	0	0	0	0	0	0
108	1	1	0	0	0	0	0	0	0

ID	0→1	1→2	2→3	3→4	1→0	2→1	3→2	2→0	3→1
109	1	1	0	0	0	0	0	0	0
110	1	1	0	0	0	0	0	0	0
111	1	1	0	0	0	0	0	0	0
112	1	1	0	0	0	0	0	0	0
113	1	1	0	0	0	0	0	0	0
114	1	1	0	0	0	0	0	0	0
115	1	1	0	0	0	0	0	0	0
116	1	1	0	0	0	0	0	0	0
117	1	1	0	0	0	0	0	0	0
118	1	1	0	0	0	0	0	0	0
119	1	1	0	0	0	0	0	0	0
120	1	1	0	0	0	0	0	0	0
121	1	1	0	0	0	0	0	0	0
122	2	1	1	0	1	0	0	0	0
123	2	1	1	0	1	0	0	0	0
124	2	1	1	0	1	0	0	0	0
125	2	1	1	0	1	0	0	0	0
126	2	1	1	0	1	0	0	0	0
127	2	1	1	0	1	0	0	0	0
128	2	1	1	0	1	1	0	0	0
129	2	1	1	1	1	1	0	0	0
130	2	1	1	1	1	1	0	0	0
131	2	1	1	1	1	1	1	0	0
132	2	1	1	1	1	1	1	0	0
133	2	1	1	1	1	1	1	0	0
134	2	1	1	1	1	1	1	0	0
135	2	1	1	1	1	1	1	0	0
136	2	1	1	1	1	1	1	0	0
137	2	1	1	1	1	1	1	0	0
138	2	1	1	1	1	1	1	0	0
139	2	1	1	1	1	1	1	1	0
140	2	2	1	1	1	1	1	1	1
141	2	2	1	1	1	1	1	1	1
142	2	2	1	1	1	1	1	1	1
143	2	2	1	1	1	1	1	1	1
144	2	2	1	1	1	1	1	1	1
145	2	3	2	1	1	2	1	1	1
146	2	2	2	1	2	2	1	1	1
147	3	2	2	1	2	2	1	1	1
148	3	2	2	1	2	2	2	1	1
149	3	2	3	1	3	2	2	1	2
150	3	3	3	1	3	3	2	2	2

Table(8): time line for each patient. First column is the patient's ID.

1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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144	0	1	1	1	3	3	3	3	2	3	3	1	2	1	0	0	0	1	1	1	1	1	1	1	2	0	3	3	4
145	0	1	0	1	1	3	3	3	2	3	3	1	2	1	2	2	2	2	2	2	2	2	2	1	2	0	2	3	4
146	0	1	0	1	0	0	0	3	2	3	3	1	2	1	3	0	2	1	1	1	1	1	1	1	2	0	2	3	4
147	0	1	0	1	0	2	1	3	2	3	3	1	2	1	3	0	0	1	1	1	1	1	1	1	2	0	2	3	4
148	0	1	0	1	0	2	1	3	2	3	3	1	2	1	3	2	0	1	1	1	1	1	1	1	2	2	2	3	4
149	0	1	0	1	0	2	1	3	2	3	3	1	2	1	3	2	0	1	0	0	0	2	3	1	2	2	2	3	4
150	0	1	0	1	0	2	1	3	2	3	3	1	2	1	3	2	0	1	0	2	0	2	3	1	2	1	2	3	4

The first column in the above table is the ID, the next column (year index) is t=0 and the last column is t=28

The following figures show the Lowess smoother for each observed response count to each of the 7 predictors:

Figure 6: Transition 1 to 2:

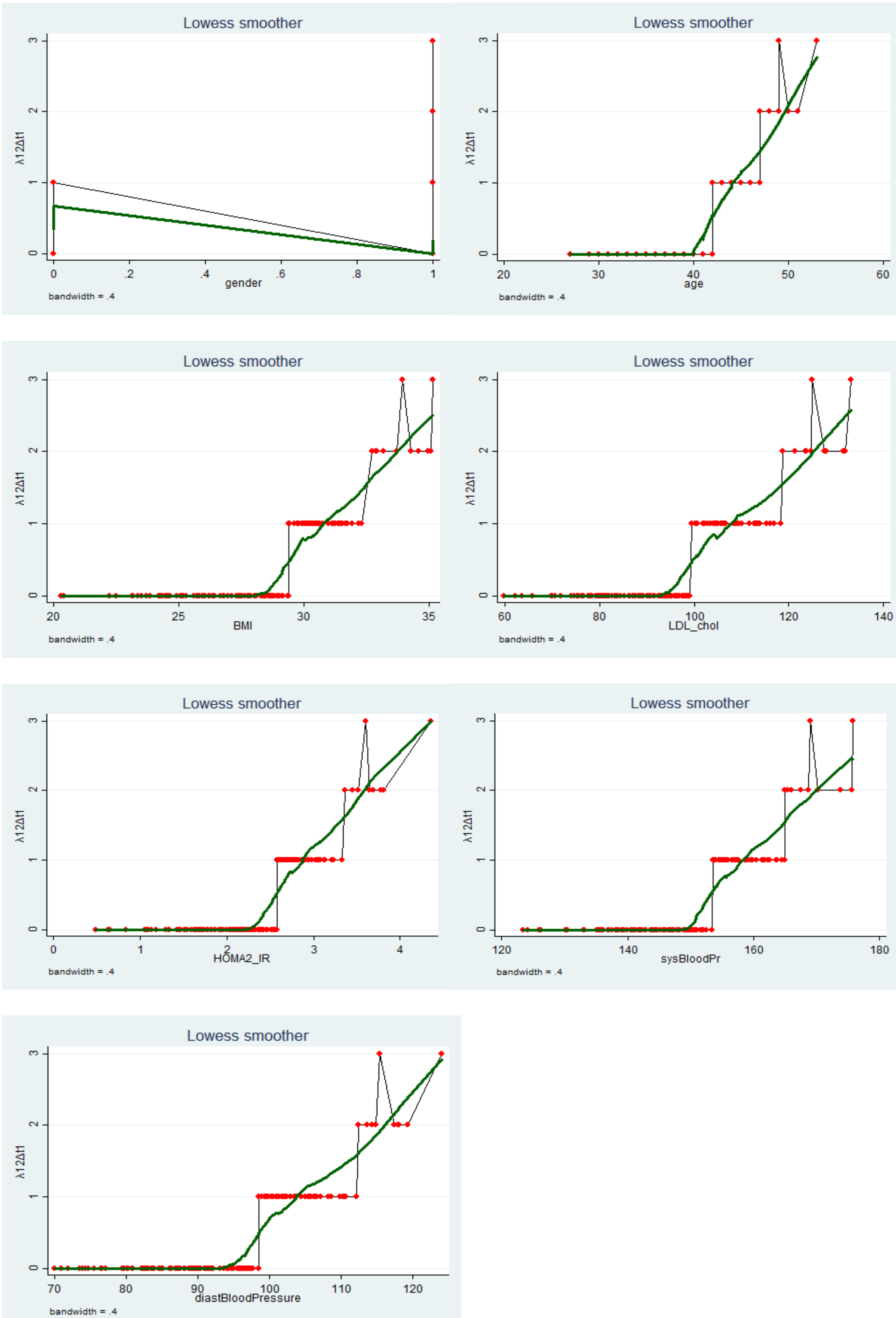


Figure 7: Transition 2 to 3:

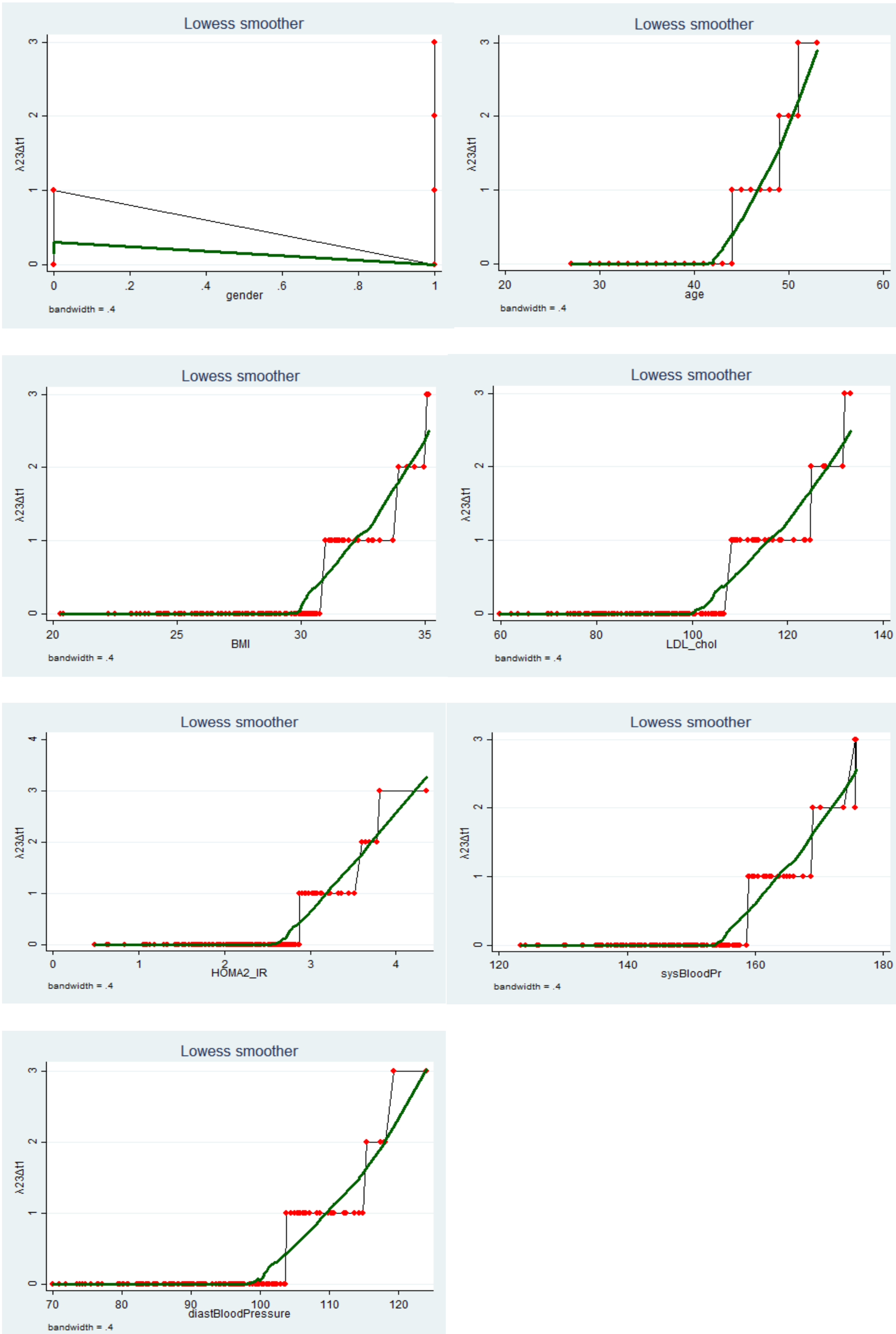


Figure 8: Transition 3 to 4:

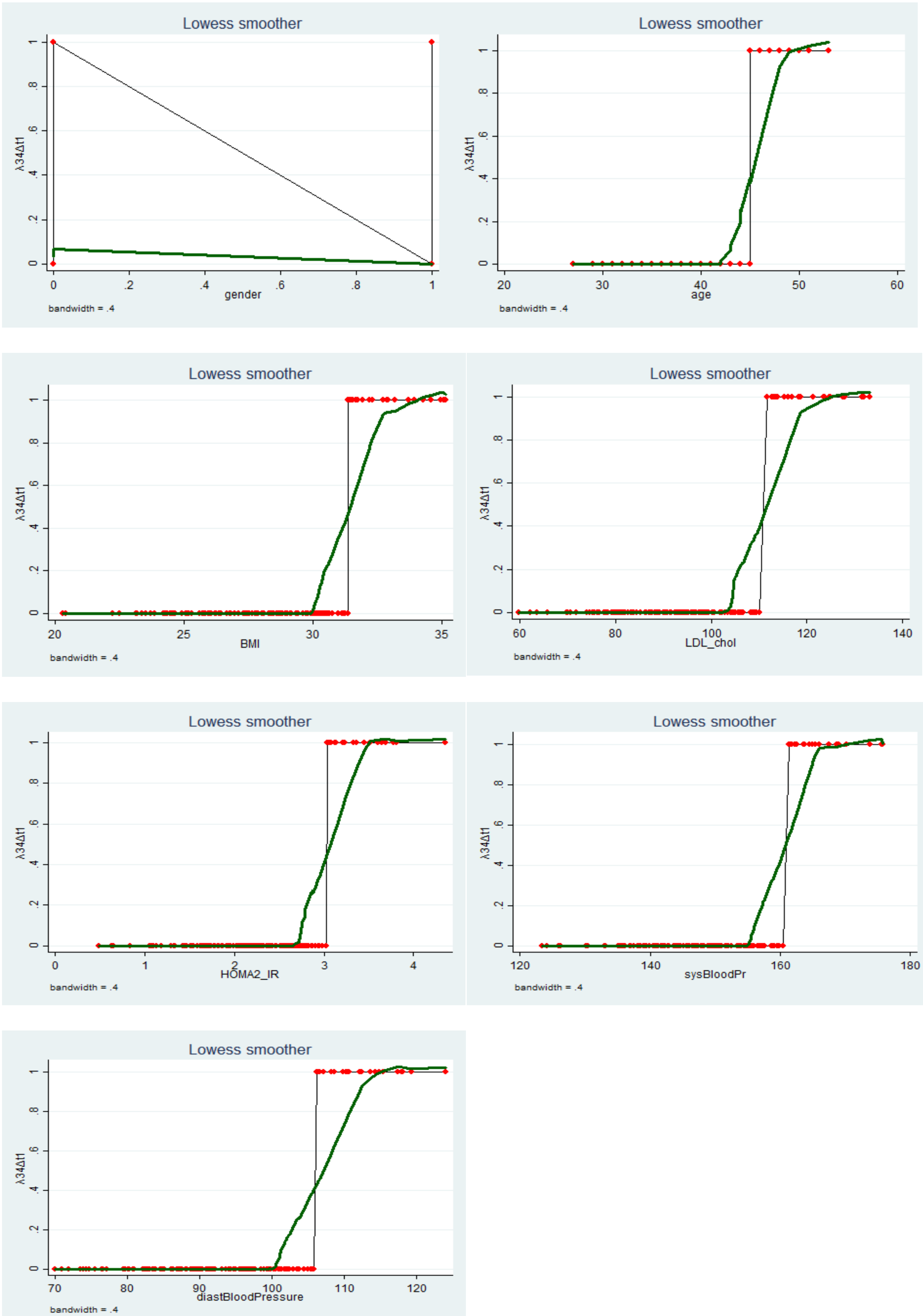


Figure 9: Transition 1 to 0:

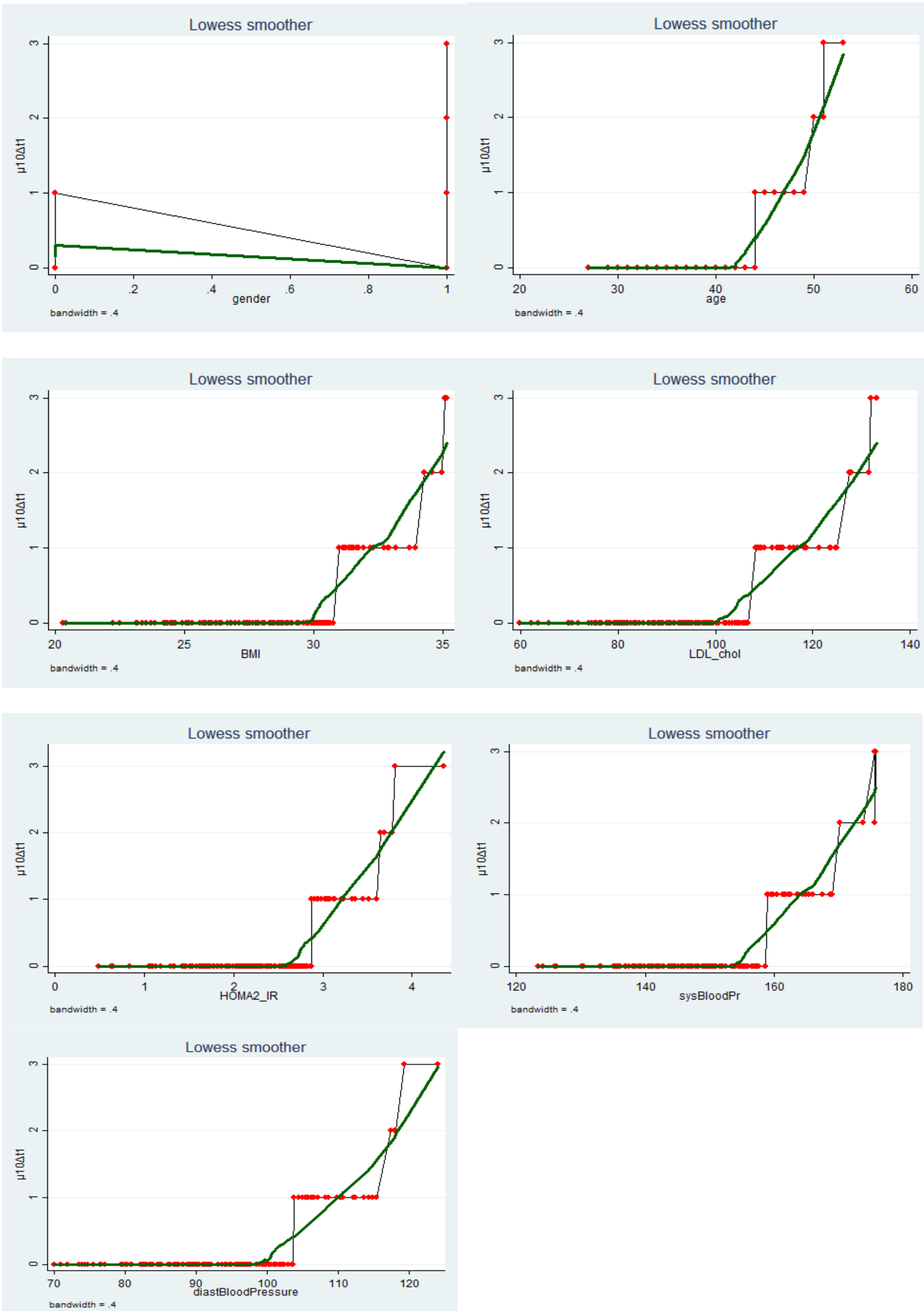


Figure 10 : Transition 2 to 1:

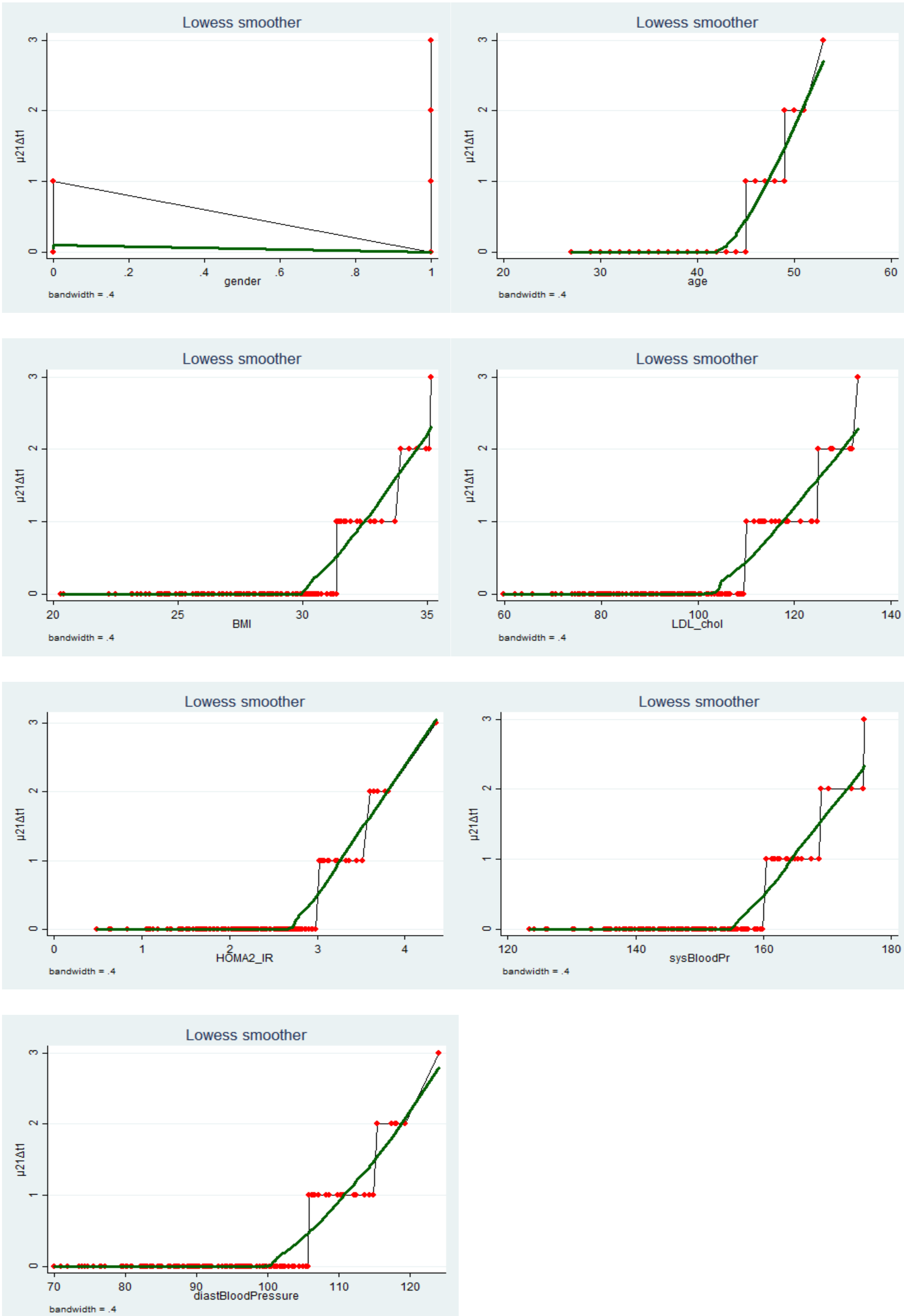


Figure 11 : Transition 3 to 2 :

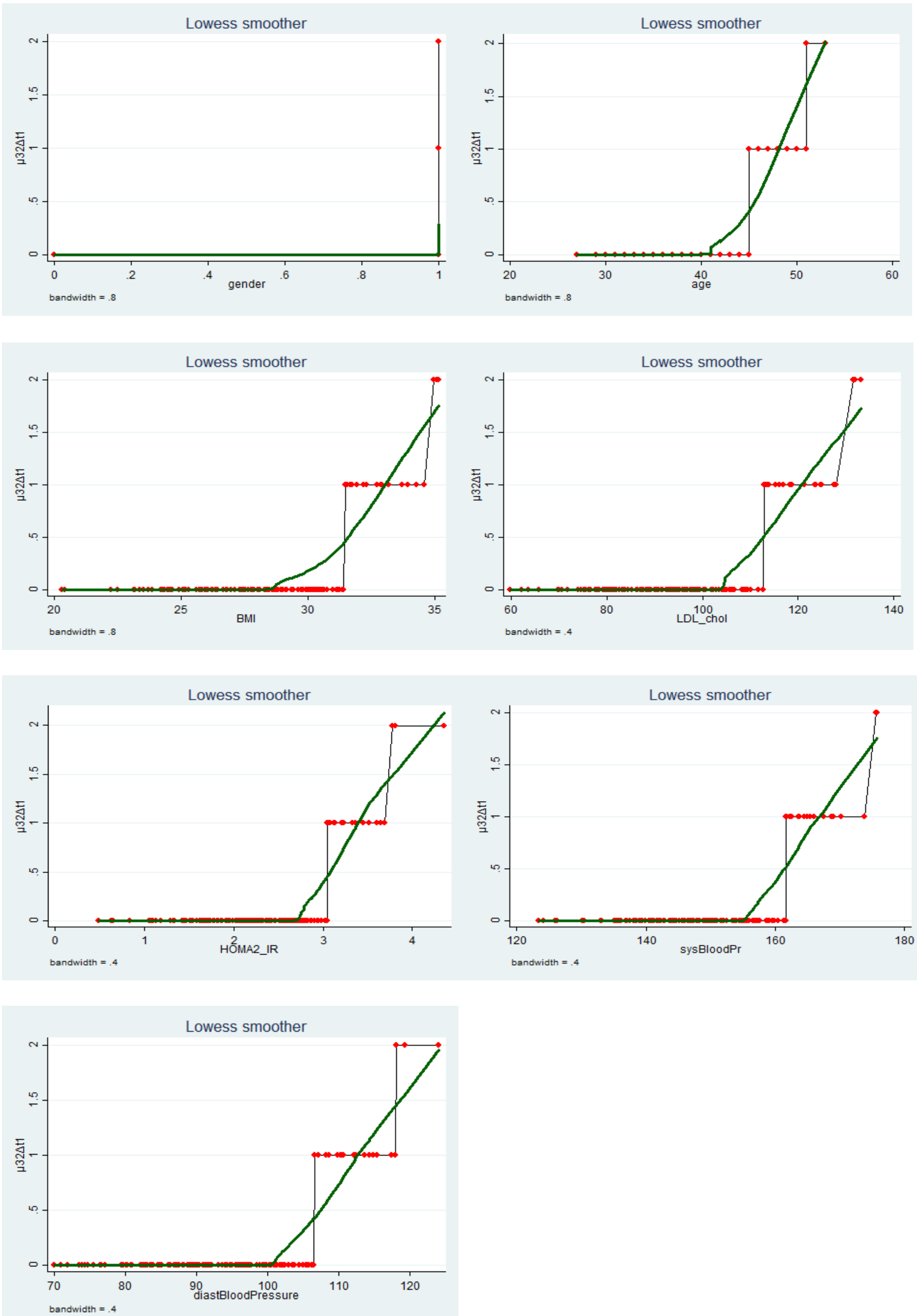


Figure 12 : Transition 2 to 0 :

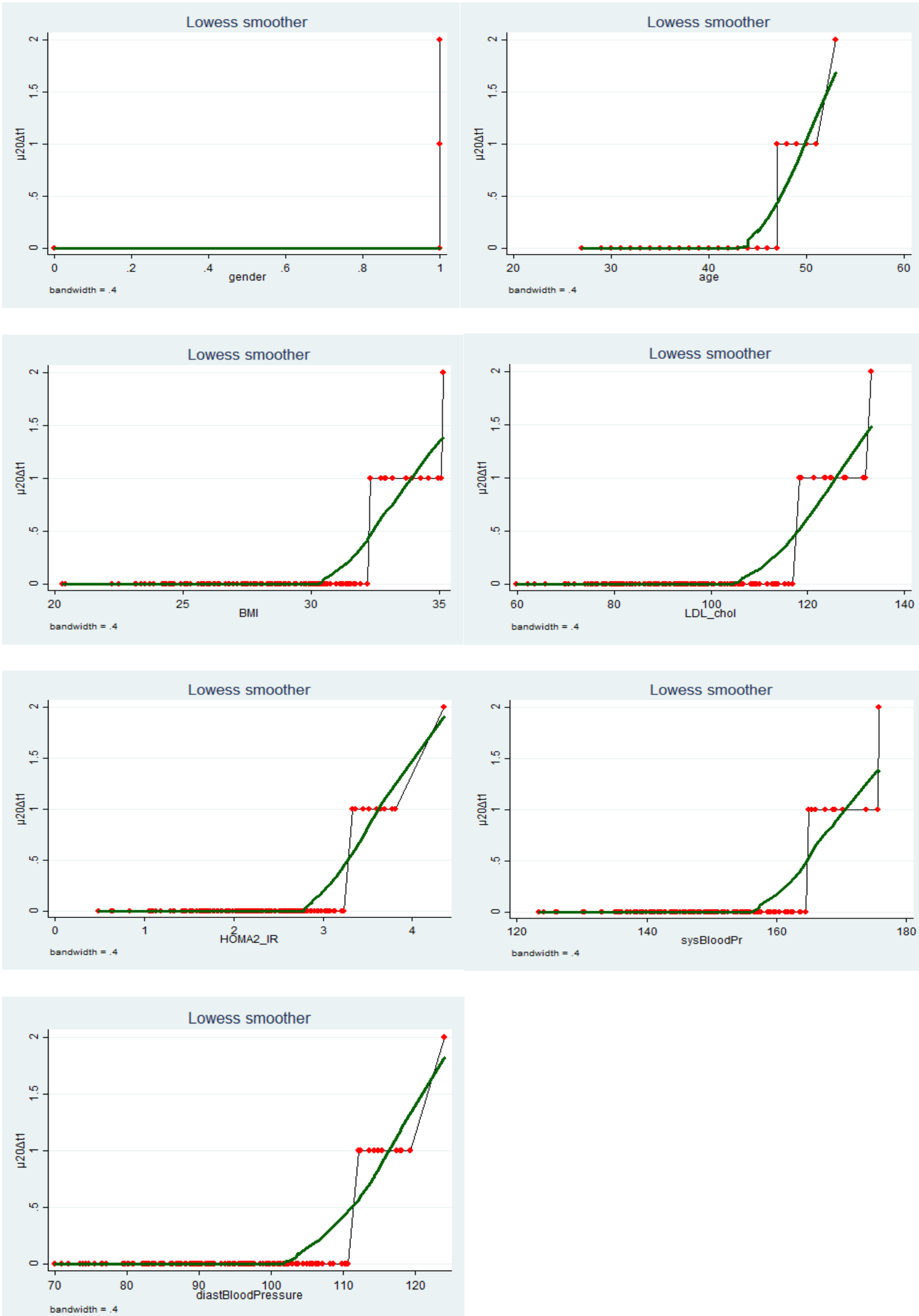
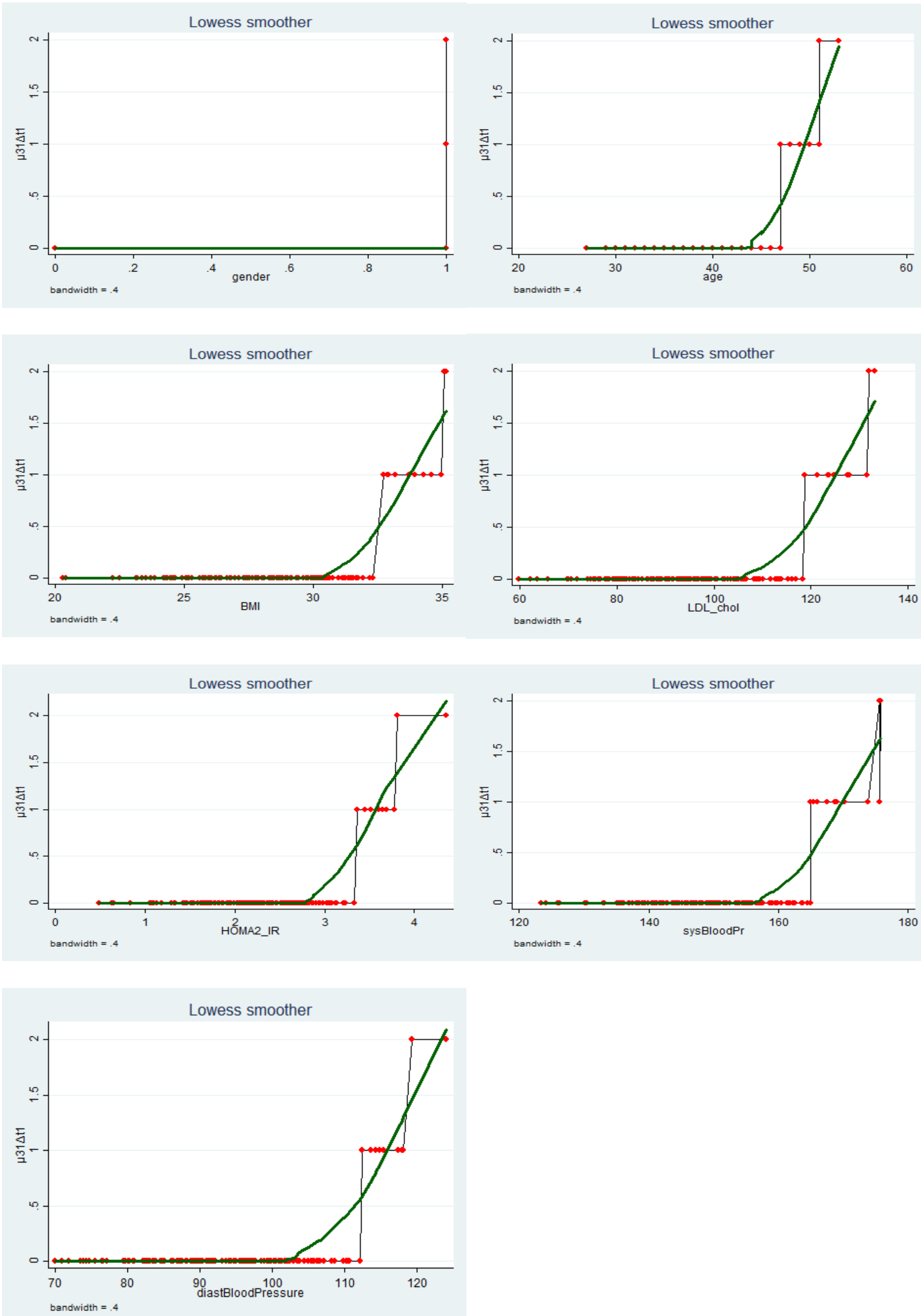


Figure 13: Transition 3 to 1:



In the following output results of running Poisson regression in stata, the estimated counts of transition from state 1 to state 2 are discussed as shown below :

```
. poisson λ12Δt1 LDLsp2 HOMAsp1 sysPS2   c.LDLsp2#c.HOMAsp1   c.sysPS2#c.HOMAsp1, vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3
> f)

Iteration 0:   log pseudolikelihood = -110.19868
Iteration 1:   log pseudolikelihood = -76.739509
Iteration 2:   log pseudolikelihood = -68.155535
Iteration 3:   log pseudolikelihood =  -67.88722
Iteration 4:   log pseudolikelihood = -67.886656
Iteration 5:   log pseudolikelihood = -67.886656

Poisson regression                              Number of obs     =        150
                                                Wald chi2(5)      =     284.30
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -67.886656               Pseudo R2         =     0.4811

------------------------------------------------------------------------------------
                   |               Robust
            λ12Δt1 |      Coef.   Std. Err.        z    P>|z|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
            LDLsp2 |      0.311      0.396     0.785    0.432      -0.465       1.086
           HOMAsp1 |      5.486      0.571     9.599    0.000       4.366       6.606
            sysPS2 |     -0.314      0.545    -0.577    0.564      -1.383       0.754
                   |
c.LDLsp2#c.HOMAsp1 |     -0.105      0.116    -0.902    0.367      -0.332       0.123
                   |
c.sysPS2#c.HOMAsp1 |      0.079      0.158     0.502    0.616      -0.231       0.389
                   |
             _cons |    -14.884      1.363   -10.923    0.000     -17.555     -12.213
------------------------------------------------------------------------------------
```

The above Stata command is used for regression of the count of transition from state 1 to state 2 on the transformed predictors using robust standard error, the same command is used with the addition of irr to estimate the incidence rate ratio for this transition as shown below:

```
.
. poisson λ12Δt1 LDLsp2 HOMAsp1 sysPS2   c.LDLsp2#c.HOMAsp1   c.sysPS2#c.HOMAsp1, vce(robust) irr cformat(%9.3f) pformat(%5.3f) sformat(
> %8.3f)

Iteration 0:   log pseudolikelihood = -110.19868
Iteration 1:   log pseudolikelihood = -76.739509
Iteration 2:   log pseudolikelihood = -68.155535
Iteration 3:   log pseudolikelihood =  -67.88722
Iteration 4:   log pseudolikelihood = -67.886656
Iteration 5:   log pseudolikelihood = -67.886656

Poisson regression                              Number of obs     =        150
                                                Wald chi2(5)      =     284.30
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -67.886656               Pseudo R2         =     0.4811

------------------------------------------------------------------------------------
                   |               Robust
            λ12Δt1 |        IRR   Std. Err.        z    P>|z|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
            LDLsp2 |      1.364      0.540     0.785    0.432       0.628       2.962
           HOMAsp1 |    241.179    137.821     9.599    0.000      78.690     739.192
            sysPS2 |      0.730      0.398    -0.577    0.564       0.251       2.126
                   |
c.LDLsp2#c.HOMAsp1 |      0.901      0.105    -0.902    0.367       0.717       1.131
                   |
c.sysPS2#c.HOMAsp1 |      1.083      0.171     0.502    0.616       0.794       1.476
                   |
             _cons |      0.000      0.000   -10.923    0.000       0.000       0.000
------------------------------------------------------------------------------------
```

The above results shows that the expected increase in log count for one-unit increase in transformed LDL cholesterol is (0.311), which is not highly statistically significant (P=0.432), and for one-unit increase in transformed HOMA is (5.486), which is highly statistically significant (P=0.000), as both are considered risk factors for NAFLD to progress from F1 to F2. The expected decrease in log count for one-unit increase in transformed systolic blood pressure is (0.314), which is not statistically significant (P= 0.564). For every unit increase in transformed LDL the incident rate ratio is increased (increase in transition counts) by 36.4%; while, for transformed HOMA it is increased by 24017.9%, with 95% confidence that this increase is between 7769% and 73819.2%. The expected decrease in log count for one unit increase in interaction between the transformed LDL and transformed HOMA is (0.105) with no statistical significance (P=0.367), in other word, the rise in one predictor variable decreases the rising effect of the other on the response variable (expected log count) but not reverse it. While, the expected increase in log count for one unit increase in interaction between the transformed systolic blood pressure and transformed HOMA is (0.079) with no statistical significance (P=0.616).

To assess the fitness of the model, the output results in the Stata revealed the following goodness of fit, the AIC, and the BIC as shown below:

```
. estat gof

         Deviance goodness-of-fit =  20.26627
         Prob > chi2(144)         =    1.0000

         Pearson goodness-of-fit  =  18.12217
         Prob > chi2(144)         =    1.0000

.
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-130.82	-67.88666	6	147.7733	165.8371

Poisson model fits the data as goodness of fit is not statistically significant (P=1), and when compared to null model as shown in the output results of stata below, there is marked decreased in the deviance goodness of fit. Also the AIC and BIC are less than their values in the null model, which signifies the improvement in the full model. In addition there is increased in the pseudo R^2 indicating the ability of the model to predict the outcome better than the null model. The output results of the null model are shown below:

```
. poisson λ12Δt1, vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood =     -130.82
Iteration 1:   log pseudolikelihood =     -130.82

Poisson regression                              Number of obs     =        150
                                                Wald chi2(0)      =          .
                                                Prob > chi2       =          .
Log pseudolikelihood =    -130.82               Pseudo R2         =    -0.0000
```

λ12Δt1	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
_cons	-0.806	0.123	-6.571	0.000	-1.046	-0.566

```
. estat gof

         Deviance goodness-of-fit =   146.133
         Prob > chi2(149)         =    0.5511

         Pearson goodness-of-fit  =  150.1642
         Prob > chi2(149)         =    0.4578

. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-130.82	-130.82	1	263.64	266.6506

The first command in the below output results obtained from Stata is used to predict the $\ln \lambda_{12} = x_i' B$ and the second command is used to estimate the $E[y_i|x_i] = \lambda_{12} = e^{x_i' B}$, then rounding the previous result for the appropriate integer to obtain the estimated count of transition from state 1 to state 2. The forth command is used to obtain the frequency for each count made by the patients in the whole period of the study. The estimated number of transitions made in the person-year interval is 64 transitions while the observed count is 67 transitions.

```
. predict est12,xb

.
. gen est12count=exp(est12)

.
. gen est12countround=round( est12count )

.
. tab est12countround
```

est12countround	Freq.	Percent	Cum.
0	102	68.00	68.00
1	35	23.33	91.33
2	11	7.33	98.67
3	1	0.67	99.33
4	1	0.67	100.00
Total	150	100.00	

In the following output results of running Poisson regression in stata, the estimated count of transition from state 2 to state 3 are discussed as shown below :

```
. poisson λ23Δt1 LDLsp2 HOMAsp1 sysPS2   c.LDLsp2#c.HOMAsp1   c.LDLsp2#c.sysPS2   c.sysPS2#c.HOMAsp1, vce(robust) cformat(%9.3f) pforma
> t(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -160.12839
Iteration 1:   log pseudolikelihood = -107.21927  (backed up)
Iteration 2:   log pseudolikelihood = -81.300112
Iteration 3:   log pseudolikelihood = -39.228241
Iteration 4:   log pseudolikelihood =  -37.90122
Iteration 5:   log pseudolikelihood = -37.865806
Iteration 6:   log pseudolikelihood =  -37.86568
Iteration 7:   log pseudolikelihood =  -37.86568

Poisson regression                              Number of obs     =        150
                                                Wald chi2(6)      =     191.48
                                                Prob > chi2       =     0.0000
Log pseudolikelihood =  -37.86568               Pseudo R2         =     0.6020
```

λ23Δt1	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
LDLsp2	-1.480	0.685	-2.159	0.031	-2.823	-0.137
HOMAsp1	6.174	3.093	1.996	0.046	0.112	12.237
sysPS2	2.497	0.967	2.583	0.010	0.602	4.391
c.LDLsp2#c.HOMAsp1	0.390	0.192	2.032	0.042	0.014	0.766
c.LDLsp2#c.sysPS2	-0.001	0.002	-0.403	0.687	-0.005	0.004
c.sysPS2#c.HOMAsp1	-0.655	0.274	-2.392	0.017	-1.191	-0.118
_cons	-20.866	7.293	-2.861	0.004	-35.160	-6.572

The above Stata command is used for regression of the count of transition from state 2 to state 3 on the transformed predictors using robust standard error, the same command is used with the addition of irr to estimate the incidence rate ratio for this transition as shown below:

```
.
. poisson λ23Δt1 LDLsp2 HOMAsp1 sysPS2   c.LDLsp2#c.HOMAsp1    c.LDLsp2#c.sysPS2   c.sysPS2#c.HOMAsp1, vce(robust) irr cformat(%9.3f) pf
> ormat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -160.12839
Iteration 1:   log pseudolikelihood = -107.21927  (backed up)
Iteration 2:   log pseudolikelihood = -81.300112
Iteration 3:   log pseudolikelihood = -39.228241
Iteration 4:   log pseudolikelihood =  -37.90122
Iteration 5:   log pseudolikelihood = -37.865806
Iteration 6:   log pseudolikelihood =  -37.86568
Iteration 7:   log pseudolikelihood =  -37.86568

Poisson regression                              Number of obs     =        150
                                                Wald chi2(6)      =     191.48
                                                Prob > chi2       =     0.0000
Log pseudolikelihood =  -37.86568               Pseudo R2         =     0.6020
```

λ23Δt1	IRR	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
LDLsp2	0.228	0.156	-2.159	0.031	0.059	0.872
HOMAsp1	480.318	1485.815	1.996	0.046	1.118	2.06e+05
sysPS2	12.143	11.738	2.583	0.010	1.826	80.754
c.LDLsp2#c.HOMAsp1	1.477	0.283	2.032	0.042	1.014	2.151
c.LDLsp2#c.sysPS2	0.999	0.002	-0.403	0.687	0.995	1.004
c.sysPS2#c.HOMAsp1	0.520	0.142	-2.392	0.017	0.304	0.889
_cons	0.000	0.000	-2.861	0.004	0.000	0.001

The above results shows that the expected decrease in log count for one-unit increase in transformed LDL cholesterol is (1.48) which is not highly statistically significant (P=0.031). This effect is not explainable. The expected increase in log count for one-unit increase in transformed HOMA is (6.174) which is not highly statistically significant (P=0.046), and for one-unit increase in transformed systolic blood pressure is (2.497) which is statistically significant (P=0.01), as both are considered risk factors for NAFLD to progress from F2 to F3. For every unit increase in transformed systolic blood pressure, the incident rate ratio is increased (increase in transition counts) by 1114.3%, with 95% confidence that this increase is between 82.6% and 7975.4%. The expected increase in log count for one unit increase in interaction between the transformed LDL and transformed HOMA is (0.39) with no high statistical significance (P=0.042), in other word, the rise in one predictor variable increases the rising effect of the other on the response variable (expected log count). While, the expected decrease in log count for one unit increase in interaction between the transformed systolic blood pressure and transformed LDL is (0.001) with no statistical significance (P=0.687), and this decrease in log count for one unit increase in interaction between transformed systolic blood pressure and transformed HOMA is (0.655) which is highly statistically significant (P=0.017), in other word, the rise in one predictor variable decreases the rising effect of the other on the response variable (expected log count) but not reverse it. However, for every unit increase in the first interaction, the incident rate ratio is only decreased (i.e. decrease in transition counts) by 0.1%, and for the second interaction; the IRR is decreased by 48%, with 95% confidence that this decrease is between 11.1% and 69.6%.

To assess the fitness of the model, the output results in the Stata revealed the following goodness of fit, the AIC, and the BIC as shown below:

```
.
. estat gof

         Deviance goodness-of-fit =  13.29285
         Prob > chi2(143)         =    1.0000

         Pearson goodness-of-fit  =  12.42161
         Prob > chi2(143)         =    1.0000

.
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-95.14565	-37.86568	7	89.73136	110.8058

Poisson model fits the data as goodness of fit is not statistically significant (P=1), and when compared to null model as shown in the output results of stata below, there is marked decreased in the deviance goodness of fit. Also the AIC and BIC are less than their values in the null model, which signifies the improvement in the full model. In addition there is increased in the pseudo R^2 indicating the ability of the model to predict the outcome better than the null model. The output results of the null model are shown below :

```
. poisson λ23Δt1, vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -95.145651
Iteration 1:   log pseudolikelihood = -95.145651

Poisson regression                              Number of obs     =        150
                                                Wald chi2(0)      =          .
                                                Prob > chi2       =          .
Log pseudolikelihood = -95.145651               Pseudo R2         =     0.0000

------------------------------------------------------------------------------
             |               Robust
      λ23Δt1 |      Coef.  Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _cons |     -1.400      0.188   -7.460  0.000       -1.767      -1.032
------------------------------------------------------------------------------

. estat gof

         Deviance goodness-of-fit =  127.8528
         Prob > chi2(149)         =    0.8942

         Pearson goodness-of-fit  =  194.0811
         Prob > chi2(149)         =    0.0077

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        150 -95.14565  -95.14565       1    192.2913   195.3019
-----------------------------------------------------------------------------
```

The first command in the below output results obtained from Stata is used to predict the $\ln \lambda_{23} = x_i'B$ and the second command is used to estimate the $E[y_i|x_i] = \lambda_{23} = e^{x_i'B}$, then rounding the previous result for the appropriate integer to obtain the estimated count of transition from state 2 to state 3. The forth command is used to obtain the frequency for each count made by the patients in the whole period of the study. The estimated number of transitions made in the person-year interval is 35 transitions while the observed count is 37 transitions.

```
. predict est23,xb

.
. gen est23count=exp(est23)

.
. gen est23countround=round( est23count )

.
. tab est23countround

est23countr |
      ound |      Freq.     Percent        Cum.
------------+-----------------------------------
          0 |        125       83.33       83.33
          1 |         18       12.00       95.33
          2 |          4        2.67       98.00
          3 |          3        2.00      100.00
------------+-----------------------------------
      Total |        150      100.00
```

In the following output results of running Poisson regression in stata, the estimated count of transition from state 3 to state 4 are discussed as shown below :

```
. poisson λ34Δt1 LDLsp2 HOMAsp1 sysPS2   c.LDLsp2#c.HOMAsp1, vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -51.459148
Iteration 1:   log pseudolikelihood = -33.399587
Iteration 2:   log pseudolikelihood = -28.375528
Iteration 3:   log pseudolikelihood = -27.031648
Iteration 4:   log pseudolikelihood = -26.968757
Iteration 5:   log pseudolikelihood = -26.968505
Iteration 6:   log pseudolikelihood = -26.968505

Poisson regression                              Number of obs     =        150
                                                Wald chi2(4)      =     122.33
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -26.968505               Pseudo R2         =     0.5801
```

λ34Δt1	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
LDLsp2	0.452	0.055	8.278	0.000	0.345	0.559
HOMAsp1	10.866	1.402	7.753	0.000	8.119	13.613
sysPS2	0.073	0.050	1.472	0.141	-0.024	0.171
c.LDLsp2#c.HOMAsp1	-0.166	0.018	-9.320	0.000	-0.201	-0.131
_cons	-34.034	3.865	-8.806	0.000	-41.608	-26.459

The above Stata command is used for regression of the count of transition from state 3 to state 4 on the transformed predictors using robust standard error, the same command is used with the addition of irr to estimate the incidence rate ratio for this transition as shown below:

```
. poisson λ34Δt1 LDLsp2 HOMAsp1 sysPS2   c.LDLsp2#c.HOMAsp1, vce(robust) irr cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -51.459148
Iteration 1:   log pseudolikelihood = -33.399587
Iteration 2:   log pseudolikelihood = -28.375528
Iteration 3:   log pseudolikelihood = -27.031648
Iteration 4:   log pseudolikelihood = -26.968757
Iteration 5:   log pseudolikelihood = -26.968505
Iteration 6:   log pseudolikelihood = -26.968505

Poisson regression                              Number of obs     =        150
                                                Wald chi2(4)      =     122.33
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -26.968505               Pseudo R2         =     0.5801
```

λ34Δt1	IRR	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
LDLsp2	1.571	0.086	8.278	0.000	1.412	1.748
HOMAsp1	52375.984	73411.343	7.753	0.000	3357.911	8.17e+05
sysPS2	1.076	0.054	1.472	0.141	0.976	1.187
c.LDLsp2#c.HOMAsp1	0.847	0.015	-9.320	0.000	0.818	0.877
_cons	0.000	0.000	-8.806	0.000	0.000	0.000

The above results shows that the expected increase in log count for one-unit increase in transformed LDL cholesterol is (0.452) which is highly statistically significant (P=0.000), this expected increase in log count for one-unit increase in transformed HOMA is (10.866) which is also highly statistically significant (P=0.000), and it is for one-unit increase in transformed systolic blood pressure is (0.073) which is not statistically significant (P=0.141), as all are considered risk factors for NAFLD to progress from F3 to F4. For every unit increase in transformed LDL, the incident rate ratio is increased (increase in transition counts) by 57.1%, with 95% confidence that this increase is between 41.2% and 74.8%. Furthermore, for every unit increase in transformed HOMA, the incident rate ratio is increased (increase in transition counts) by 5237498.4%, with 95% confidence that this increase is between 335691.1% and 81.7e+6%. For every unit increase in this interaction, the incident rate ratio is decreased (i.e. decrease in transition counts) by 15.3%, with 95% confidence that this decrease is between 12.3% and 18.2%.

To assess the fitness of the model, the output results in the Stata revealed the following goodness of fit, the AIC, and the BIC as shown below:

```
. estat gof

         Deviance goodness-of-fit =   9.93701
         Prob > chi2(145)         =    1.0000

         Pearson goodness-of-fit  =  8.963525
         Prob > chi2(145)         =    1.0000

.
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-64.23104	-26.9685	5	63.93701	78.99019

Poisson model fits the data as goodness of fit is not statistically significant (P=1), and when compared to null model as shown in the output results of stata below, there is marked decreased in the deviance goodness of fit. Also the AIC and BIC are less than their values in the null model, which signifies the improvement in the full model. In addition there is increased in the pseudo R^2 indicating the ability of the model to predict the outcome better than the null model. The output results of the null model are shown below :

```
. poisson λ34Δt1, vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -64.231042
Iteration 1:   log pseudolikelihood = -64.231042

Poisson regression                              Number of obs     =        150
                                                Wald chi2(0)      =          .
                                                Prob > chi2       =          .
Log pseudolikelihood = -64.231042               Pseudo R2         =     0.0000
```

λ34Δt1	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
_cons	-1.920	0.198	-9.714	0.000	-2.307	-1.532

```
. estat gof

         Deviance goodness-of-fit =  84.46208
         Prob > chi2(149)         =    1.0000

         Pearson goodness-of-fit  =       128
         Prob > chi2(149)         =    0.8925

. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-64.23104	-64.23104	1	130.4621	133.4727

The first command in the below output results obtained from Stata is used to predict the $\ln \lambda_{34} = x_i' B$ and the second command is used to estimate the $E[y_i|x_i] = \lambda_{34} = e^{x_i' B}$, then rounding the previous result for the appropriate integer to obtain the estimated count of transition from state 3 to state 4. The forth command is used to obtain the frequency for each count made by the patients in the whole period of the study. The estimated number of transitions made in the person-year interval is 20 transitions while the observed count is 22 transitions.

```
.
. predict est34,xb

.
. gen est34count=exp(est34)

.
. gen est34countround=round( est34count )

.
. tab est34countround

est34countr |
      ound |      Freq.     Percent        Cum.
------------+-----------------------------------
         0 |        133       88.67       88.67
         1 |         14        9.33       98.00
         2 |          3        2.00      100.00
------------+-----------------------------------
     Total |        150      100.00
```

In the following output results of running Poisson regression in stata, the estimated count of transition from state 1 to state 0 are discussed as shown below :

```
.
. poisson µ10Δt1 LDLsp2 HOMAsp2  sysPS2   c.LDLsp2#c.HOMAsp2    c.LDLsp2#c.sysPS2 c.sysPS2#c.HOMAsp2, vce(robust) cformat(%9.3f) pformat
> (%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -156.14216
Iteration 1:   log pseudolikelihood = -98.267306
Iteration 2:   log pseudolikelihood = -63.346557
Iteration 3:   log pseudolikelihood = -39.002967
Iteration 4:   log pseudolikelihood = -38.151225
Iteration 5:   log pseudolikelihood =  -38.14473
Iteration 6:   log pseudolikelihood = -38.144729

Poisson regression                              Number of obs     =        150
                                                Wald chi2(6)      =     331.08
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -38.144729               Pseudo R2         =     0.5900

------------------------------------------------------------------------------------
                   |               Robust
            µ10Δt1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
            LDLsp2 |     -0.454      0.244   -1.862   0.063       -0.932       0.024
           HOMAsp2 |     -4.489      2.962   -1.515   0.130      -10.294       1.316
            sysPS2 |      1.340      0.312    4.301   0.000        0.729       1.951
                   |
c.LDLsp2#c.HOMAsp2 |      0.290      0.096    3.029   0.002        0.102       0.478
                   |
 c.LDLsp2#c.sysPS2 |     -0.010      0.004   -2.789   0.005       -0.017      -0.003
                   |
c.sysPS2#c.HOMAsp2 |     -0.286      0.145   -1.974   0.048       -0.571      -0.002
                   |
             _cons |     -5.916      0.508  -11.651   0.000       -6.912      -4.921
------------------------------------------------------------------------------------
```

The above Stata command is used for regression of the count of transition from state 1 to state 0 on the transformed predictors using robust standard error, the same command is used with the addition of irr to estimate the incidence rate ratio for this transition as shown below:

```
.
. poisson µ10Δt1 LDLsp2 HOMAsp2  sysPS2  c.LDLsp2#c.HOMAsp2   c.LDLsp2#c.sysPS2 c.sysPS2#c.HOMAsp2, vce(robust) irr cformat(%9.3f) pfo
> rmat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -156.14216
Iteration 1:   log pseudolikelihood = -98.267306
Iteration 2:   log pseudolikelihood = -63.346557
Iteration 3:   log pseudolikelihood = -39.002967
Iteration 4:   log pseudolikelihood = -38.151225
Iteration 5:   log pseudolikelihood =  -38.14473
Iteration 6:   log pseudolikelihood = -38.144729

Poisson regression                              Number of obs     =        150
                                                Wald chi2(6)      =     331.08
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -38.144729               Pseudo R2         =     0.5900
```

µ10Δt1	IRR	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
LDLsp2	0.635	0.155	-1.862	0.063	0.394	1.024
HOMAsp2	0.011	0.033	-1.515	0.130	0.000	3.730
sysPS2	3.820	1.190	4.301	0.000	2.074	7.034
c.LDLsp2#c.HOMAsp2	1.337	0.128	3.029	0.002	1.108	1.612
c.LDLsp2#c.sysPS2	0.990	0.004	-2.789	0.005	0.983	0.997
c.sysPS2#c.HOMAsp2	0.751	0.109	-1.974	0.048	0.565	0.998
_cons	0.003	0.001	-11.651	0.000	0.001	0.007

The above results shows that the expected decrease in log count for one-unit increase in transformed LDL cholesterol is (0.454), which is not highly statistically significant (P= 0.063), and the expected decrease in log count for one-unit increase in transformed HOMA is (4.489), which is not statistically significant (P= 0.13). As better management for both of these risk factors enhance the transition from F1 to F0. While the expected increase in log count for one-unit increase in transformed systolic blood pressure is (1.34), which is highly statistically significant (p=0.000). For every unit increase in transformed systolic blood pressure, the incident rate ratio is increased (increase in transition counts) by 282%, with 95% confidence that this increase is between 107.4% and 603.4%. This effect is not really explainable and further studies are needed to evaluate such effect as there may be some confounder substances that could induce such effect. The expected increase in log count for one unit increase in interaction between the transformed LDL and transformed HOMA is (0.29) with high statistical significance (p=0.002), in other word, the rise in one predictor variable increases the effect of the other on the response variable (expected log count). For every unit increase of this interaction, the incident rate ratio is increased (increase in transition counts) by 33.7%, with 95% confidence that this increase is between 10.8% and 61.2%. While, the expected decrease in log count for one unit increase in interaction between the transformed systolic blood pressure and transformed LDL is (0.01) with high statistical significance (p=0.005), and this decrease in log count for one unit increase in interaction between transformed systolic blood pressure and transformed HOMA is (0.286) which is not highly statistically significant (p=0.048), in other word, the rise in one predictor variable decreases the effect of the other on the response variable (expected log count). However, for every unit increase in the first interaction, the incident rate ratio is only decreased (i.e. decrease in transition counts) by 1%, with 95% confidence that this decrease is between 0.3% and 1.7%. Moreover, for the second interaction; the IRR is decreased by 24.9%.

To assess the fitness of the model, the output results in the Stata revealed the following goodness of fit, the AIC, and the BIC as shown below:

```
. estat gof

         Deviance goodness-of-fit =  14.46465
         Prob > chi2(143)         =    1.0000

         Pearson goodness-of-fit  =  13.54881
         Prob > chi2(143)         =    1.0000

.
. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        150 -93.03915  -38.14473       7    90.28946   111.3639
-----------------------------------------------------------------------------
```

Poisson model fits the data as goodness of fit is not statistically significant (P=1), and when compared to null model as shown in the output results of stata below, there is marked decreased in the deviance goodness of fit. Also the AIC and BIC are less than their values in the null model, which signifies the improvement in the full model. In addition there is increased in the pseudo R^2 indicating the ability of the model to predict the outcome better than the null model. The output results of the null model are shown below:

```
. poisson μ10Δt1 , vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -93.039149
Iteration 1:   log pseudolikelihood = -93.039149

Poisson regression                              Number of obs     =        150
                                                Wald chi2(0)      =          .
                                                Prob > chi2       =          .
Log pseudolikelihood = -93.039149               Pseudo R2         =     0.0000

----------------------------------------------------------------------------
             |               Robust
      μ10Δt1 |      Coef.  Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+--------------------------------------------------------------
       _cons |     -1.427      0.188   -7.603  0.000       -1.795      -1.059
----------------------------------------------------------------------------

. estat gof

         Deviance goodness-of-fit =  124.2535
         Prob > chi2(149)         =    0.9309

         Pearson goodness-of-fit  =       189
         Prob > chi2(149)         =    0.0148

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        150 -93.03915  -93.03915       1    188.0783   191.0889
-----------------------------------------------------------------------------
```

The first command in the below output results obtained from Stata is used to predict the $\ln \lambda_{10} = x_i' B$ and the second command is used to estimate the $E[y_i|x_i] = \lambda_{10} = e^{x_i' B}$, then rounding the previous result for the appropriate integer to obtain the estimated count of transition from state 1 to state 0. The forth command is used to obtain the frequency for each count made by the patients in the whole period of the study. The estimated number of transitions made in the person-year interval is 36 transitions and it is equal to observed count.

```
.
. predict est10,xb

.
. gen est10count=exp(est10)

.
. gen est10countround=round( est10count )

.
. tab est10countround

est10countr |
      ound |      Freq.     Percent        Cum.
-----------+-----------------------------------
         0 |        126       84.00       84.00
         1 |         15       10.00       94.00
         2 |          7        4.67       98.67
         3 |          1        0.67       99.33
         4 |          1        0.67      100.00
-----------+-----------------------------------
     Total |        150      100.00
```

In the following output results of running Poisson regression in stata, the estimated count of transition from state 2 to state 1 are discussed as shown below :

```
.
. poisson µ21Δt1 LDLsp2 HOMAsp2  sysPS2   c.LDLsp2#c.HOMAsp2    c.LDLsp2#c.sysPS2 c.sysPS2#c.HOMAsp2, vce(robust) cformat(%9.3f) pformat
> (%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -189.11152
Iteration 1:   log pseudolikelihood = -135.76136  (backed up)
Iteration 2:   log pseudolikelihood = -72.824996
Iteration 3:   log pseudolikelihood = -46.875924
Iteration 4:   log pseudolikelihood = -33.535715
Iteration 5:   log pseudolikelihood =  -30.03631
Iteration 6:   log pseudolikelihood = -29.958911
Iteration 7:   log pseudolikelihood = -29.958555
Iteration 8:   log pseudolikelihood = -29.958555

Poisson regression                              Number of obs     =        150
                                                Wald chi2(6)      =     304.94
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -29.958555               Pseudo R2         =     0.6414

-------------------------------------------------------------------------------
                   |               Robust
            µ21Δt1 |      Coef.  Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------------+-----------------------------------------------------------
            LDLsp2 |     -0.128      0.189   -0.675  0.499     -0.499       0.243
           HOMAsp2 |     -3.288      2.812   -1.169  0.242     -8.800       2.224
            sysPS2 |      0.913      0.201    4.546  0.000      0.519       1.307
                   |
c.LDLsp2#c.HOMAsp2 |      0.152      0.066    2.288  0.022      0.022       0.282
                   |
 c.LDLsp2#c.sysPS2 |     -0.010      0.003   -2.950  0.003     -0.017      -0.003
                   |
c.sysPS2#c.HOMAsp2 |     -0.114      0.114   -1.001  0.317     -0.338       0.109
                   |
             _cons |     -7.666      0.617  -12.426  0.000     -8.875      -6.457
-------------------------------------------------------------------------------
```

The above Stata command is used for regression of the count of transition from state 2 to state 1 on the transformed predictors using robust standard error, the same command is used with the addition of irr to estimate the incidence rate ratio for this transition as shown below:

```
.
. poisson µ21Δt1 LDLsp2 HOMAsp2  sysPS2  c.LDLsp2#c.HOMAsp2   c.LDLsp2#c.sysPS2 c.sysPS2#c.HOMAsp2, vce(robust) irr cformat(%9.3f) pfo
> rmat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -189.11152
Iteration 1:   log pseudolikelihood = -135.76136  (backed up)
Iteration 2:   log pseudolikelihood = -72.824996
Iteration 3:   log pseudolikelihood = -46.875924
Iteration 4:   log pseudolikelihood = -33.535715
Iteration 5:   log pseudolikelihood =  -30.03631
Iteration 6:   log pseudolikelihood = -29.958911
Iteration 7:   log pseudolikelihood = -29.958555
Iteration 8:   log pseudolikelihood = -29.958555

Poisson regression                              Number of obs     =        150
                                                Wald chi2(6)      =     304.94
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -29.958555               Pseudo R2         =     0.6414
```

µ21Δt1	IRR	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
LDLsp2	0.880	0.167	-0.675	0.499	0.607	1.275
HOMAsp2	0.037	0.105	-1.169	0.242	0.000	9.244
sysPS2	2.492	0.501	4.546	0.000	1.681	3.694
c.LDLsp2#c.HOMAsp2	1.164	0.077	2.288	0.022	1.022	1.326
c.LDLsp2#c.sysPS2	0.990	0.003	-2.950	0.003	0.983	0.997
c.sysPS2#c.HOMAsp2	0.892	0.102	-1.001	0.317	0.713	1.116
_cons	0.000	0.000	-12.426	0.000	0.000	0.002

The above results shows that the expected decrease in log count for one-unit increase in transformed LDL cholesterol is (0.128) which is not statistically significant(P=0.499), and the expected decrease in log count for one-unit increase in transformed HOMA is (3.288) which is not statistically significant (P=0.242). As better management of both of these risk factors, enhances the transition from F2 to F1. While the expected increase in log count for one-unit increase in transformed systolic blood pressure is (0.913) which is highly statistically significant (P=0.000). For every unit increase in transformed systolic blood pressure, the incident rate ratio is increased (increase in transition counts) by 149.2%, with 95% confidence that this increase is between 68.1% and 269.4%. This effect is not really explainable and further studies are needed to evaluate such effect as there may be some confounder substances that could induce such effect. The expected increase in log count for one unit increase in interaction between the transformed LDL and transformed HOMA is (0.152) with high statistical significance (P=0.022), in other word, the rise in one predictor variable increases the effect of the other on the response variable (expected log count). For every unit increase of this interaction, the incident rate ratio is increased (increase in transition counts) by 16.4%, with 95% confidence that this increase is between 2.2% and 32.6%. While, the expected decrease in log count for one unit increase in interaction between the transformed systolic blood pressure and transformed LDL is (0.01) with high statistical significance (P=0.003), and this decrease in log count for one unit increase in interaction between transformed systolic blood pressure and transformed HOMA is (0.114) which is not statistically significant (P=0.317), in other word, the rise in one predictor variable decreases the effect of the other on the response variable (expected log count) but not reverse it. However, for every unit increase in the first interaction, the incident rate ratio is only decreased (i.e. decrease in transition counts) by 1%, with 95% confidence that this decrease is between 0.3% and 1.7%. Moreover, for the second interaction; the IRR is decreased by 10.8%.

To assess the fitness of the model, the output results in the Stata revealed the following goodness of fit, the AIC, and the BIC as shown below:

```
.
. estat gof

         Deviance goodness-of-fit =  9.856737
         Prob > chi2(143)         =    1.0000

         Pearson goodness-of-fit  =  8.967082
         Prob > chi2(143)         =    1.0000

.
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-83.54063	-29.95856	7	73.91711	94.99156

Poisson model fits the data as goodness of fit is not statistically significant (P=1), and when compared to null model as shown in the output results of stata below, there is marked decreased in the deviance goodness of fit. Also the AIC and BIC are less than their values in the null model, which signifies the improvement in the full model. In addition there is increased in the pseudo R^2 indicating the ability of the model to predict the outcome better than the null model. The output results of the null model are shown below:

```
. poisson µ21Δt1 , vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -83.540633
Iteration 1:   log pseudolikelihood = -83.540633

Poisson regression                              Number of obs     =        150
                                                Wald chi2(0)      =          .
                                                Prob > chi2       =          .
Log pseudolikelihood = -83.540633               Pseudo R2         =     0.0000
```

µ21Δt1	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
_cons	-1.609	0.212	-7.609	0.000	-2.024	-1.195

```
. estat gof

         Deviance goodness-of-fit =  117.0209
         Prob > chi2(149)         =    0.9753

         Pearson goodness-of-fit  =       200
         Prob > chi2(149)         =    0.0034

. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-83.54063	-83.54063	1	169.0813	172.0919

The first command in the below output results obtained from Stata is used to predict the $\ln \lambda_{21} = x_i' B$ and the second command is used to estimate the $E[y_i|x_i] = \lambda_{21} = e^{x_i' B}$, then rounding the previous result for the appropriate integer to obtain the estimated count of transition from state 2 to state 1. The forth command is used to obtain the frequency for each count made by the patients in the whole period of the study. The estimated number of transitions made in the person-year interval is 36 transitions and it is equal to observed count.

```
.
. predict est21,xb

.
. gen est21count=exp(est21)

.
. gen est21countround=round( est21count )

.
. tab est21countround

est21countr |
      ound |      Freq.     Percent        Cum.
------------+-----------------------------------
         0 |        132       88.00       88.00
         1 |         12        8.00       96.00
         2 |          4        2.67       98.67
         3 |          2        1.33      100.00
------------+-----------------------------------
     Total |        150      100.00
```

In the following output results of running Poisson regression in stata, the estimated count of transition from state 3 to state 2 are discussed as shown below :

```
. poisson µ32Δt1 LDLsp2 HOMAsp2  sysPS2   c.LDLsp2#c.HOMAsp2    c.LDLsp2#c.sysPS2 c.sysPS2#c.HOMAsp2, vce(robust) cformat(%9.3f) pformat
> (%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -92.482782
Iteration 1:   log pseudolikelihood = -68.161589  (backed up)
Iteration 2:   log pseudolikelihood = -40.839603
Iteration 3:   log pseudolikelihood = -26.643171
Iteration 4:   log pseudolikelihood = -26.370176
Iteration 5:   log pseudolikelihood =   -26.3679
Iteration 6:   log pseudolikelihood =   -26.3679

Poisson regression                              Number of obs     =        150
                                                Wald chi2(6)      =     175.47
                                                Prob > chi2       =     0.0000
Log pseudolikelihood =   -26.3679               Pseudo R2         =     0.6134

------------------------------------------------------------------------------------
                   |               Robust
            µ32Δt1 |     Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
            LDLsp2 |     0.302      0.211    1.427   0.154       -0.113       0.716
           HOMAsp2 |    -5.214      3.196   -1.631   0.103      -11.478       1.050
            sysPS2 |     0.422      0.288    1.467   0.142       -0.142       0.987
                   |
c.LDLsp2#c.HOMAsp2 |     0.002      0.102    0.019   0.984       -0.198       0.202
                   |
 c.LDLsp2#c.sysPS2 |    -0.012      0.004   -2.749   0.006       -0.020      -0.003
                   |
c.sysPS2#c.HOMAsp2 |     0.132      0.149    0.888   0.375       -0.160       0.425
                   |
             _cons |    -7.363      0.761   -9.671   0.000       -8.855      -5.871
------------------------------------------------------------------------------------
```

The above Stata command is used for regression of the count of transition from state 3 to state 2 on the transformed predictors using robust standard error, the same command is used with the addition of irr to estimate the incidence rate ratio for this transition as shown below:

```
.
. poisson µ32Δt1 LDLsp2 HOMAsp2  sysPS2   c.LDLsp2#c.HOMAsp2    c.LDLsp2#c.sysPS2 c.sysPS2#c.HOMAsp2, vce(robust) irr cformat(%9.3f) pfo
> rmat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -92.482782
Iteration 1:   log pseudolikelihood = -68.161589  (backed up)
Iteration 2:   log pseudolikelihood = -40.839603
Iteration 3:   log pseudolikelihood = -26.643171
Iteration 4:   log pseudolikelihood = -26.370176
Iteration 5:   log pseudolikelihood =   -26.3679
Iteration 6:   log pseudolikelihood =   -26.3679

Poisson regression                              Number of obs     =        150
                                                Wald chi2(6)      =     175.47
                                                Prob > chi2       =     0.0000
Log pseudolikelihood =   -26.3679               Pseudo R2         =     0.6134
```

µ32Δt1	IRR	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
LDLsp2	1.352	0.286	1.427	0.154	0.893	2.047
HOMAsp2	0.005	0.017	-1.631	0.103	0.000	2.859
sysPS2	1.526	0.439	1.467	0.142	0.868	2.683
c.LDLsp2#c.HOMAsp2	1.002	0.102	0.019	0.984	0.821	1.223
c.LDLsp2#c.sysPS2	0.988	0.004	-2.749	0.006	0.980	0.997
c.sysPS2#c.HOMAsp2	1.142	0.170	0.888	0.375	0.852	1.529
_cons	0.001	0.000	-9.671	0.000	0.000	0.003

The above results shows that the expected increase in log count for one-unit increase in transformed LDL cholesterol is (0.302) which is not statistically significant (P=0.154), and the expected increase in log count for one-unit increase in transformed systolic blood pressure is (0.422) which is not statistically significant (P=0.142). These effects are not really explainable and further studies are needed to evaluate such effects as there may be some confounder substances that could induce such effects. While the expected decrease in log count for one-unit increase in transformed HOMA is (5.214) which is not statistically significant (P=0.103). As better management of HOMA, enhances the transition from F3 to F2. The expected increase in log count for one unit increase in interaction between the transformed LDL and transformed HOMA is (0.002) with no high statistical significance (P=0.984), and this expected increase for one unit increase in interaction between transformed HOMA and transformed systolic blood pressure is (0.132), which is not statistically significant (P=0.375), in other word, the rise in one predictor variable increases the effect of the other on the response variable (expected log count). While, the expected decrease in log count for one unit increase in interaction between the transformed systolic blood pressure and transformed LDL is (.012) with high statistical significance (P=0.006), in other word, the rise in one predictor variable decreases the effect of the other on the response variable (expected log count) but not reverse it. For every unit increase in this interaction, the incident rate ratio is deceased (decrease in transition counts) by 1.2%, with 95% confidence that this decrease is between 0.3% and 2%.

To assess the fitness of the model, the output results in the Stata revealed the following goodness of fit, the AIC, and the BIC as shown below:

```
. estat gof

         Deviance goodness-of-fit =  10.89468
         Prob > chi2(143)         =    1.0000

         Pearson goodness-of-fit  =  9.765011
         Prob > chi2(143)         =    1.0000

.
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-68.20769	-26.3679	7	66.7358	87.81025

Poisson model fits the data as goodness of fit is not statistically significant (P=1), and when compared to null model as shown in the output results of stata below, there is marked decreased in the deviance goodness of fit.

Also the AIC and BIC are less than their values in the null model, which signifies the improvement in the full model. In addition there is increased in the pseudo R^2 indicating the ability of the model to predict the outcome better than the null model. The output results of the null model are shown below:

```
. poisson µ32Δt1 , vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -68.207686
Iteration 1:   log pseudolikelihood = -68.207686  (backed up)

Poisson regression                              Number of obs     =        150
                                                Wald chi2(0)      =          .
                                                Prob > chi2       =          .
Log pseudolikelihood = -68.207686               Pseudo R2         =     0.0000
```

µ32Δt1	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
_cons	-1.875	0.220	-8.517	0.000	-2.307	-1.444

```
. estat gof

         Deviance goodness-of-fit =  94.57426
         Prob > chi2(149)         =    0.9998

         Pearson goodness-of-fit  =  166.1304
         Prob > chi2(149)         =    0.1599

. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-68.20769	-68.20769	1	138.4154	141.426

The first command in the below output results obtained from Stata is used to predict the $\ln \lambda_{32} = x_i' B$ and the second command is used to estimate the $E[y_i|x_i] = \lambda_{32} = e^{x_i' B}$, then rounding the previous result for the appropriate integer to obtain the estimated count of transition from state 3 to state 2. The forth command is used to obtain the frequency for each count made by the patients in the whole period of the study. The estimated number of transitions made in the person-year interval is 19 transitions while the observed count is 23 transitions.

```
.
. predict est32,xb

.
. gen est32count=exp(est32)

.
. gen est32countround=round( est32count )

.
. tab est32countround
```

est32countround	Freq.	Percent	Cum.
0	135	90.00	90.00
1	12	8.00	98.00
2	2	1.33	99.33
3	1	0.67	100.00
Total	150	100.00	

In the following output results of running Poisson regression in stata, the estimated count of transition from state 2 to state 0 are discussed as shown below :

```
. poisson µ20Δt1 LDLsp2 HOMAsp2  sysPS2   DiasPS2, vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -58.363157
Iteration 1:   log pseudolikelihood = -39.187617  (backed up)
Iteration 2:   log pseudolikelihood = -32.366721
Iteration 3:   log pseudolikelihood = -16.111028
Iteration 4:   log pseudolikelihood =  -15.65286
Iteration 5:   log pseudolikelihood = -15.630393
Iteration 6:   log pseudolikelihood = -15.630329
Iteration 7:   log pseudolikelihood = -15.630329

Poisson regression                              Number of obs     =        150
                                                Wald chi2(4)      =     263.12
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -15.630329               Pseudo R2         =     0.6564

------------------------------------------------------------------------------
             |               Robust
      µ20Δt1 |      Coef.   Std. Err.        z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      LDLsp2 |      0.076      0.079     0.965    0.335       -0.079       0.231
     HOMAsp2 |     -2.713      0.709    -3.829    0.000       -4.102      -1.324
      sysPS2 |     -0.123      0.047    -2.593    0.010       -0.216      -0.030
     DiasPS2 |      0.358      0.110     3.266    0.001        0.143       0.573
       _cons |     -7.034      0.501   -14.052    0.000       -8.015      -6.053
------------------------------------------------------------------------------
```

The above Stata command is used for regression of the count of transition from state 2 to state 0 on the transformed predictors using robust standard error, the same command is used with the addition of irr to estimate the incidence rate ratio for this transition as shown below:

```
. poisson µ20Δt1 LDLsp2 HOMAsp2  sysPS2   DiasPS2, vce(robust) irr cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -58.363157
Iteration 1:   log pseudolikelihood = -39.187617  (backed up)
Iteration 2:   log pseudolikelihood = -32.366721
Iteration 3:   log pseudolikelihood = -16.111028
Iteration 4:   log pseudolikelihood =  -15.65286
Iteration 5:   log pseudolikelihood = -15.630393
Iteration 6:   log pseudolikelihood = -15.630329
Iteration 7:   log pseudolikelihood = -15.630329

Poisson regression                              Number of obs     =        150
                                                Wald chi2(4)      =     263.12
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -15.630329               Pseudo R2         =     0.6564

------------------------------------------------------------------------------
             |               Robust
      µ20Δt1 |        IRR   Std. Err.        z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      LDLsp2 |      1.079      0.085     0.965    0.335        0.924       1.260
     HOMAsp2 |      0.066      0.047    -3.829    0.000        0.017       0.266
      sysPS2 |      0.884      0.042    -2.593    0.010        0.806       0.970
     DiasPS2 |      1.430      0.157     3.266    0.001        1.154       1.773
       _cons |      0.001      0.000   -14.052    0.000        0.000       0.002
------------------------------------------------------------------------------
```

The above results shows that the expected increase in log count for one-unit increase in transformed LDL cholesterol is (0.076) which is not statistically significant (P=0.335), and the expected increase in log count for one-unit increase in transformed diastolic blood pressure is (0.358) which is highly statistically significant (P=0.001). These effects are not really explainable and further studies are needed to evaluate such effects as there may be some confounder substances that could induce such effects. For every unit increase of diastolic blood pressure, the incident rate ratio is increased (increase in transition counts) by 43%, with 95% confidence that this increase is between 15.4% and 77.3%. While the expected decrease in log count for one-unit increase in transformed HOMA is (2.713) which is highly statistically significant (P=0.000), and the expected decrease in log count for one-unit increase in transformed systolic blood pressure is (0.123) which is highly statistically significant (P=0.01). As better management of these risk factors, enhances the transition from F2 to F0. For every unit increase of transformed HOMA, the incident rate ratio is decreased (decrease in transition counts) by 93.4%, with 95% confidence that this decrease is between 73.4% and 98.3%. For every unit increase of transformed systolic blood pressure, the incident rate ratio is decreased (decrease in transition counts) by 11.6%, with 95% confidence that this decrease is between 3% and 19.4%.

To assess the fitness of the model, the output results in the Stata revealed the following goodness of fit, the AIC, and the BIC as shown below:

```
. estat gof

         Deviance goodness-of-fit =  6.646953
         Prob > chi2(145)         =    1.0000

         Pearson goodness-of-fit  =  7.358672
         Prob > chi2(145)         =    1.0000

.
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-45.48706	-15.63033	5	41.26066	56.31384

Poisson model fits the data as goodness of fit is not statistically significant (P=1), and when compared to null model as shown in the output results of stata below, there is marked decreased in the deviance goodness of fit. Also the AIC and BIC are less than their values in the null model, which signifies the improvement in the full model. In addition there is increased in the pseudo R^2 indicating the ability of the model to predict the outcome better than the null model. The output results of the null model are shown below:

```
. poisson µ20Δt1 , vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -45.487064
Iteration 1:   log pseudolikelihood = -45.487064

Poisson regression                              Number of obs     =        150
                                                Wald chi2(0)      =          .
                                                Prob > chi2       =          .
Log pseudolikelihood = -45.487064               Pseudo R2         =     0.0000
```

µ20Δt1	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
_cons	-2.446	0.287	-8.507	0.000	-3.009	-1.882

```
. estat gof

         Deviance goodness-of-fit =  66.36042
         Prob > chi2(149)         =    1.0000

         Pearson goodness-of-fit  =  160.0769
         Prob > chi2(149)         =    0.2531

. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-45.48706	-45.48706	1	92.97413	95.98476

The first command in the below output results obtained from Stata is used to predict the $\ln \lambda_{20} = x_i'B$ and the second command is used to estimate the $E[y_i|x_i] = \lambda_{20} = e^{x_i'B}$, then rounding the previous result for the appropriate integer to obtain the estimated count of transition from state 2 to state 0. The forth command is used to obtain the frequency for each count made by the patients in the whole period of the study. The estimated number of transitions made in the person-year interval is 12 transitions while the observed count is 13 transitions.

```
. predict est20,xb

. gen est20count=exp(est20)

. gen est20countround=round( est20count )

. tab est20countround
```

est20countround	Freq.	Percent	Cum.
0	140	93.33	93.33
1	8	5.33	98.67
2	2	1.33	100.00
Total	150	100.00	

In the following output results of running Poisson regression in stata, the estimated count of transition from state 3 to state 1 are discussed as shown below :

```
. poisson µ31Δt1 LDLsp2 HOMAsp2  sysPS2   DiasPS2, vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -42.819959
Iteration 1:   log pseudolikelihood = -31.034271
Iteration 2:   log pseudolikelihood = -17.167014
Iteration 3:   log pseudolikelihood = -14.391228
Iteration 4:   log pseudolikelihood =  -14.18184
Iteration 5:   log pseudolikelihood = -14.181524
Iteration 6:   log pseudolikelihood = -14.181524

Poisson regression                              Number of obs     =        150
                                                Wald chi2(4)      =     202.29
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -14.181524               Pseudo R2         =     0.6929
```

µ31Δt1	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
LDLsp2	0.145	0.070	2.079	0.038	0.008	0.282
HOMAsp2	-2.476	0.660	-3.754	0.000	-3.769	-1.183
sysPS2	-0.129	0.045	-2.899	0.004	-0.216	-0.042
DiasPS2	0.276	0.093	2.962	0.003	0.093	0.459
_cons	-7.584	0.688	-11.017	0.000	-8.934	-6.235

The above Stata command is used for regression of the count of transition from state 3 to state 1 on the transformed predictors using robust standard error, the same command is used with the addition of irr to estimate the incidence rate ratio for this transition as shown below:

```
.
. poisson μ31Δt1 LDLsp2 HOMAsp2  sysPS2  DiasPS2, vce(robust) irr cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -42.819959
Iteration 1:   log pseudolikelihood = -31.034271
Iteration 2:   log pseudolikelihood = -17.167014
Iteration 3:   log pseudolikelihood = -14.391228
Iteration 4:   log pseudolikelihood =  -14.18184
Iteration 5:   log pseudolikelihood = -14.181524
Iteration 6:   log pseudolikelihood = -14.181524

Poisson regression                              Number of obs     =        150
                                                Wald chi2(4)      =     202.29
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -14.181524               Pseudo R2         =     0.6929
```

μ31Δt1	IRR	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
LDLsp2	1.156	0.081	2.079	0.038	1.008	1.326
HOMAsp2	0.084	0.055	-3.754	0.000	0.023	0.306
sysPS2	0.879	0.039	-2.899	0.004	0.805	0.959
DiasPS2	1.318	0.123	2.962	0.003	1.098	1.582
_cons	0.001	0.000	-11.017	0.000	0.000	0.002

The above results shows that the expected increase in log count for one-unit increase in transformed LDL cholesterol is (0.145) which is not highly statistically significant (P=.038), and the expected increase in log count for one-unit increase of transformed diastolic blood pressure is (0.276) which is highly statistically significant (P=0.003). These effects are not really explainable and further studies are needed to evaluate such effects as there may be some confounder substances that could induce such effects. For every unit increase in diastolic blood pressure, the incident rate ratio is increased (increase in transition counts) by 31.8%, with 95% confidence that this increase is between 9.8% and 58.2%. While the expected decrease in log count for one-unit increase in transformed HOMA is (2.476) which is highly statistically significant (P= 0.000), and the expected decrease in log count for one-unit increase in transformed systolic blood pressure is (0.129) which is highly statistically significant (P=0.004). As better management of these risk factors, enhances the transition from F3 to F1. For every unit increase of transformed HOMA, the incident rate ratio is decreased (decrease in transition counts) by 91.6%, with 95% confidence that this decrease is between 69.4% and 97.7%. Furthermore, for every unit increase in transformed systolic blood pressure, the incident rate ratio is decreased (decrease in transition counts) by 12.1%, with 95% confidence that this decrease is between 4.1% and 19.5%.

To assess the fitness of the model, the output results in the Stata revealed the following goodness of fit, the AIC, and the BIC as shown below:

```
.
. estat gof

         Deviance goodness-of-fit =  5.135637
         Prob > chi2(145)         =    1.0000

         Pearson goodness-of-fit  =  6.094638
         Prob > chi2(145)         =    1.0000

.
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	150	-46.18021	-14.18152	5	38.36305	53.41622

Poisson model fits the data as goodness of fit is not statistically significant (P=1), and when compared to null model as shown in the output results of stata below, there is marked decreased in the deviance goodness of fit. Also the AIC and BIC are less than their values in the null model, which signifies the improvement in the full model.

In addition there is increased in the pseudo R^2 indicating the ability of the model to predict the outcome better than the null model. The output results of the null model are shown below:

```
. poisson µ31Δt1 , vce(robust) cformat(%9.3f) pformat(%5.3f) sformat(%8.3f)

Iteration 0:   log pseudolikelihood = -46.180212
Iteration 1:   log pseudolikelihood = -46.180212

Poisson regression                              Number of obs     =        150
                                                Wald chi2(0)      =          .
                                                Prob > chi2       =          .
Log pseudolikelihood = -46.180212               Pseudo R2         =     0.0000

------------------------------------------------------------------------------
             |               Robust
      µ31Δt1 |      Coef.  Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _cons |     -2.446      0.307   -7.953   0.000       -3.048      -1.843
------------------------------------------------------------------------------

. estat gof

         Deviance goodness-of-fit =  69.13301
         Prob > chi2(149)         =    1.0000

         Pearson goodness-of-fit  =  183.1538
         Prob > chi2(149)         =    0.0299

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        150 -46.18021  -46.18021       1    94.36042   97.37106
-----------------------------------------------------------------------------
```

The first command in the below output results obtained from Stata is used to predict the $\ln \lambda_{31} = x_i' B$ and the second command is used to estimate the $E[y_i|x_i] = \lambda_{31} = e^{x_i' B}$, then rounding the previous result for the appropriate integer to obtain the estimated count of transition from state 3 to state 1. The forth command is used to obtain the frequency for each count made by the patients in the whole period of the study. The estimated number of transitions made in the person-year interval is 13 transitions while the observed count is 14 transitions.

```
.
. predict est31,xb

.
. gen est31count=exp(est31)

.
. gen est31countround=round( est31count )

.
. tab est31countround

est31countr |
      ound |      Freq.     Percent        Cum.
------------+-----------------------------------
          0 |        140       93.33       93.33
          1 |          7        4.67       98.00
          2 |          3        2.00      100.00
------------+-----------------------------------
      Total |        150      100.00
```

Table (11) : comparison of the summary between the distribution of the response counts and estimated mean response counts.

		Observed response count	Estimated mean response count
0→1	Mean	.8	.8
	Variance	.658	.619
	Std.dev.	.811	.787
1→2	Mean	.45	.45
	Variance	.45	.45
	Std.dev.	.671	.671
2→3	Mean	.25	.25
	Variance	.32	.318
	Std.dev.	.567	.564
3→4	Mean	.15	.15
	Variance	.126	.126
	Std.dev.	.355	.355
1→0	Mean	.24	.24
	Variance	.305	.314
	Std.dev.	.552	.56
2→1	Mean	.2	.2
	Variance	.268	.284
	Std.dev.	.518	.533
3→2	Mean	.15	.15
	Variance	.171	.173
	Std.dev.	.413	.416
2→0	Mean	.09	.09
	Variance	.093	.101
	Std.dev.	.305	.318
3→1	Mean	.09	.09
	Variance	.106	.11
	Std.dev.	.326	.336