

Appendix

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X59/Y34 ICD Codes

Table 1. ICD codes for the (a) X59 and Y34 packages and (b) GBD injuries causes

Table 1a. ICD codes that make up the packages for X59 and Y34

Package Name	ICD-9 Codes	ICD-10 Codes
Unspecified External Factor X59	E887.01-E887.09, E928.9-E928.99, E929, E929.8-E929.9	W47, W48, W63, W71-W72, W82, W95-98, X07, X55-X56, X59
External Causes UDI, Type Unspecified Y34	E000-E000.9, E001, E001.1, E002-E002.9, E003.0-E003.3, E003.9, E004.0-E004.4, E004.9, E005.0-E005.4, E005.9, E006.0-E006.6, 006.9, E007.0-E007.9, E008.0-E008.4, E008.9, E009.0-E009.5, E009.9, E010.0-E010.3, E010.9, E011.0, E011.1, E011.9, E012.0, E012.1-E012.2, E012.9, E013.0-E013.5, E013.8, E013.9, E014.0-E014.1, E014.9, E015.0-E015.2, E015.9, E016.0-E016.2, E016.9, E017.0, E017.9, E018.0-E018.3, E019.0-E019.2, E019.9, E029.0-E029.2, E029.9, E030, E80, E88, E980.0-E980.9, E981.0-E981.1, E981.8, E982.0-E982.1, E982.8-E982.9, E983.0-E983.1, E983.8-E983.9, E984, E985.0-E985.7, E986, E987.0-E987.2, E987.9, E988.0-E988.9, E988.1-E988.9, E989	G44.3, G44.301, G44.309, G44.31, G44.311, G44.319, G44.32, G44.321, G44.329, G91.3, R58, W47, W76.0-W76.9, Y10.0-Y.10.9, Y11.0-Y11.9, Y12.0-Y12.9, Y13.0-Y13.9, Y14.0-Y14.9, Y16.0-Y16.9, Y17.0-Y17.9, Y18.0-Y18.9, Y19.0-Y19.9, Y20.0-Y20.9, Y21.0-Y21.9, Y22.0-Y22.9, Y23.0-Y23.9, Y24.0-Y24.9, Y25.0-Y25.9, Y26.0-Y26.9, Y27.0-Y27.9, Y28.0-Y28.9, Y29.0-Y29.9, Y30.0-Y30.9, Y31.0-Y31.9, Y32.0-Y32.9, Y33.0-Y33.9, Y34.0-Y34.9, Y85.0, Y85.9, Y86.0-Y86.2, Y86.9, Y87, Y87.2, Y89, Y89.2, Y90.0-Y90.9, Y91.0-Y91.3, Y91.9, Y92.000-Y92.9, Y93.0-Y93.02, Y93.1-Y93.9, Y94, Y95, Y96, Y997, Y98.0, Y99.0-Y99.2, Y99.8-Y99.9

GBD Injuries Causes ICD Codes

Table 1b. ICD codes that make up target list for X59 and Y34.

GBD Injuries Cause	ICD-9 Codes	ICD 10 Codes
Adverse effects of medical treatment	349.0-349.1, 457.0, E870-E876, E878-E879, E930-E949	Y40-Y84.9, Y88-Y88.3
Cyclist road injuries		V10-V19.9
Drowning	E910	W65-W70.9, W73-W74.9
Environmental heat and cold exposure	E900-E902, E926	L55-L55.9, L56.3, L56.8-L56.9, L58-L58.9, W88-W94.9, W97.9, W99-W99.9, X30-X32.9, X39-X39.9
Executions and police conflict*	E970-E978	Y35-Y35.9, Y89.0
Falls	E880-E886, E888	W00-W19.9
Fire, heat, and hot substances	E890-E899, E924	X00-X06.9, X08-X19.9
Foreign body in other body part	E914-E915	W44-W45, W45.3-W45.9
Motor vehicle road injuries		V30-V79.9, V87.2-V87.3
Motorcyclist road injuries		V20-V29.9
Non-venomous animal contact	E906	W52.0-W62.9, W64-W64.9
Other exposure to mechanical forces	E916-E921	W20-W31.9, W35-W38.9, W40-W43.9, W45.0-W45.2, W46-W46.2, W49-W52
Other road injuries		V80-V80.9, V82-V82.9
Other transport injuries	E800-E807, E830-E838, E840-E849	V00-V00.8, V05-V05.9, V81-V81.9, V83-V86.9, V88.2-V88.3, V90-V98.8
Pedestrian road injuries		V01-V04.9, V06-V09.9
Poisoning by carbon monoxide	E862, E868-E869	X47-X47.9
Physical violence by firearm*	E965	X93-X95.9
Physical violence by sharp object*	E966	X99-X99.9
Physical violence by other means*	E961-E964, E967-E969	X85-X92.9, X96-X98.9, Y00-Y04.9, Y06-Y08.9, Y87.1
Pulmonary aspiration and foreign body in airway	E911-E913	W75-W75.9, W78-W80.9, W83-W84.9
Self-harm by firearm*	E955	X72-X74.9
Unintentional firearm injuries	E922	W32-W34.9
Venomous animal contact	E905	X20-X29.9

*Only targets for Y34

Model Evaluation

Table 2. Range of metric values across 500 test datasets for X59 (a) and Y34 (b) models

	Naïve Bayes			DNN			Random Forest			GBT		
Metric	Median	Max	Min	Median	Max	Min	Median	Max	Min	Median	Max	Min
Concordance	0.7875	0.8653	0.7087	0.8086	0.8837	0.7251	0.7635	0.8491	0.6223	0.809	0.884	0.7088
CCCSMFA	0.7532	0.9529	0.3575	0.8267	0.9791	0.4422	0.8191	0.9657	0.4533	0.8266	0.9756	0.4555
Macro Sensitivity	0.6113	0.801	0.5083	0.6236	0.8147	0.5195	0.6027	0.733	0.4611	0.6236	0.814	0.5222
Macro Precision	0.5436	0.7055	0.3563	0.6037	0.7942	0.4305	0.5542	0.7266	0.3834	0.5891	0.7691	0.4086
Accuracy	0.8078	0.9079	0.651	0.8486	0.9405	0.6866	0.8304	0.9197	0.6746	0.8474	0.9384	0.6878

Table 2a. Metric values for X59 model

	Naïve Bayes			DNN			Random Forest			GBT		
Metric	Median	Max	Min	Median	Max	Min	Median	Max	Min	Median	Max	Min
Concordance	0.7498	0.8329	0.6657	0.8099	0.8739	0.7287	0.7700	0.8445	0.6819	0.8065	0.8661	0.7261
CCCSMFA	0.7752	0.916	0.4548	0.8725	0.9709	0.5309	0.8499	0.9612	0.5242	0.8607	0.9691	0.5311
Macro Sensitivity	0.6095	0.7317	0.4684	0.6560	0.7942	0.5081	0.6309	0.7400	0.4999	0.6518	0.7921	0.5065
Macro Precision	0.5560	0.7229	0.4250	0.6105	0.7741	0.4700	0.5711	0.7342	0.4434	0.5931	0.7455	0.4579
Accuracy	0.8473	0.9241	0.7163	0.8879	0.9526	0.7625	0.8725	0.9388	0.7493	0.8878	0.9541	0.7613

Table 2a. Metric values for Y34 model

Redistribution by Cause

Table 3. Redistribution numbers and fractions by GBD injuries cause in the DNN vs GBD 2019 in the X59 (a) and Y34 (b) models

Table 3a. Redistribution numbers and fractions for X59

Cause Name	X59 DNN Deaths	DNN by cause proportion	X59 GBD2019 Deaths	GBD2019 by cause proportion
Adverse effects of medical treatment	75536	16.16%	2512	1.01%
Cyclist road injuries	1040	0.22%	2116	0.85%
Drowning	583	0.13%	292	0.12%
Environmental heat and cold exposure	1362	0.29%	245	0.10%
Falls	55033	11.77%	183643	73.96%
Fire, heat, and hot substances	376	0.08%	479	0.19%
Foreign body in other body part	38	0.01%	28	0.01%
Motor vehicle road injuries	200204	42.83%	19694	7.93%
Motorcyclist road injuries	13141	2.81%	6958	2.80%
Non-venomous animal contact	395	0.08%	398	0.16%
Other exposure to mechanical forces	648	0.14%	2340	0.94%
Other road injuries	1676	0.36%	588	0.24%
Other transport injuries	4803	1.03%	1973	0.80%
Other unintentional injuries	237	0.05%	8044	3.24%
Pedestrian road injuries	106907	22.87%	17249	6.95%
Poisoning by carbon monoxide	48	0.01%	36	0.01%
Poisoning by other means	243	0.05%	71	0.03%
Pulmonary aspiration and foreign body in airway	4509	0.97%	1004	0.40%
Unintentional firearm injuries	266	0.06%	555	0.22%
Venomous animal contact	425	0.09%	70	0.03%

Table 3b. Redistribution numbers and fractions for Y34

Cause Name	Y34 DNN Deaths	DNN by cause proportion	Y34 GBD2019 Deaths	GBD2019 by cause proportion
Adverse effects of medical treatment	123565	20.97%	1759	0.52%
Cyclist road injuries	1037	0.18%	2706	0.80%
Drowning	9418	1.60%	12849	3.77%
Environmental heat and cold exposure	450	0.08%	173	0.05%
Falls	36854	6.26%	49223	14.45%
Fire, heat, and hot substances	3878	0.66%	12515	3.68%
Foreign body in other body part	28	0.01%	46	0.01%
Motor vehicle road injuries	106505	18.08%	18572	5.45%
Motorcyclist road injuries	50293	8.54%	11155	3.28%
Non-venomous animal contact	244	0.04%	327	0.10%
Other exposure to mechanical forces	415	0.07%	2376	0.70%
Other road injuries	103	0.02%	715	0.21%
Other transport injuries	34697	5.89%	1766	0.52%
Other unintentional injuries	664	0.11%	1440	0.42%
Pedestrian road injuries	71091	12.07%	17956	5.27%
Physical violence by firearm	33115	5.62%	68274	20.05%
Physical violence by other means	19353	3.29%	39589	11.62%
Physical violence by sharp object	2043	0.35%	11154	3.28%
Poisoning by carbon monoxide	2819	0.48%	3866	1.14%
Poisoning by other means	3541	0.60%	2493	0.73%
Police conflict and executions	26586	4.51%	2482	0.73%
Pulmonary aspiration and foreign body in airway	8719	1.48%	5290	1.55%

Self-harm by firearm	1795	0.31%	5000	1.47%
Self-harm by other specified means	51546	8.75%	66482	19.52%
Unintentional firearm injuries	259	0.04%	738	0.22%
Venomous animal contact	166	0.03%	1640	0.48%