

Algorithms to identify major congenital malformations in routinely collected healthcare data: A systematic review

Drug Safety

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Supplemental Table 3. Algorithms for MCM among hospital discharge databases, 2010-2015

Author, Year	Country	Data source name	Case ascertainment denominator	Timing of MCM assessment	Algorithm rules	Coding system	Code location in manuscript	Prevalence of the MCM in unexposed or general population
Steurer, 2017 [1]	USA	California Office of Statewide Health Planning and Development database	Live births	Birth through first year of life	Searched for ICD9 codes	ICD-9-CM	Appendix Table 1	Not reported
Kelley-Quon, 2013 [2]	USA	California Patient Discharge Linked Birth Cohort Database	Singleton live births	Pregnancy through first year of life	Not specified	ICD-9	Methods	Not reported
Cai, 2021 [3]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS)	Live births	At birth or delivery	Not specified	ICD-9	Methods	1.4%
Sebastian, 2021 [4]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS)	Live births	At birth or delivery	Not specified	ICD-9	Methods	1.4%

Rosen, 2020 [5]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS)	Births	At birth or delivery	Not specified	ICD-9	Methods	1.4%
Bourjeily, 2020 [6]	USA	National Perinatal Information Center (NPIC) data	Live births	≤28 days	Not specified	ICD-9	Supplemental Table 1	10.6%
Salemi, 2019 [7]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS)	Infants with inpatient hospitalizations	Birth through first year of life	Not specified	ICD-9, ICD 10	Table 1	Not reported
Zhong, 2018 [8]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS)	Delivering pregnancies	Pregnancy	Not specified	ICD-9-CM	Methods, Supplemental Table 1	1.5%
Ghazali, 2017 [9]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS)	Delivering pregnancies	At birth or delivery	Not specified	ICD-9	Methods	0.4%
Egbe, 2015 [10]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS)	Live births	At birth or delivery	≥1 code of birth defects recorded during birth hospitalization	ICD-9	Methods	2.9%
Egbe, 2015 [11]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS)	Live births	At birth or delivery	Not specified	ICD-9	Methods	2.8%
Egbe, 2015 [12]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS)	Live births	At birth or delivery	Not specified	ICD-9	Methods	2.9%
Egbe, 2015 [13]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS)	Not specified	At birth or delivery	Not specified	ICD-9	Methods	2.9%
Hutcheon, 2015 [14]	USA	Healthcare Cost and Utilization Project (HCUP) - National Inpatient Sample (NIS) linked with vital records	Anomaly-related infant deaths (<365 days of life)	Birth through first year of life	Not specified	ICD-9	Methods	Not reported
Nelson, 2024 [15]	Canada	Hospital Discharge Abstract Database	Live and stillbirths	Birth	≥1 code	ICD-10-CA	Supplemental Table 1	1.2%
Bowie, 2022 [16]	Canada	Hospital Discharge Abstract Database, the Same Day Surgery Database and the National Ambulatory Care Reporting System Database	Singleton live and stillbirths	Birth through first year of life	≥1 code	ICD-10-CA	Supplemental Table 2	2.0%
Zylbersztejn, 2020 [17]	UK	Hospital Episode Statistics (HES) (England) and Scottish Birth Records (SBR), Scottish Morbidity Records for inpatients (SMR01) and Scottish Mortality Records (SMR99) (Scotland)	Singleton live births	Birth through 2 years of life	≥1 code recorded as primary or subsidiary diagnosis at birth, during any hospital admission, or as any cause of death on the death record	ICD-10	Supplemental Table 1 and Table 3	3.7%-4.1%
Gianicolo, 2012 [18]*	Italy	Hospital discharge data - Brindisi local health unit	Live births	Birth through 28 days of life	Recorded code in any of the diagnostic fields	ICD-9-CM	Methods	2.3%
Cacciani, 2011 [19]	Italy	Hospital discharge database that records perinatal information - Lazio region	Singleton live births	At birth or delivery	Search for codes in principal or secondary diagnosis of congenital malformations	ICD-9-CM	Methods	4.7%

Bunn, 2016 [20]	USA	Inpatient hospitalization discharge records from the Kentucky Cabinet for Health and Family Services	Hospitalized infants ≤30 days old	Birth through 1 month of life	Not specified	ICD-9	Methods	8.5%
Cantarutti, 2018 [21]	Italy	Lombardy (Italy) healthcare utilization databases	Singleton live births	Birth through 3 months of life	Recorded code on maternal or live birth discharge	ICD-9	Supplemental Table 1 and Table 3	5.2%
Yamamoto, 2022 [22]	Canada	Manitoba Hospital abstracts database	Singleton live and stillbirths	At birth or delivery	Not specified	ICD-10-CM	Supplemental Table 1	2.0%
Coo, 2017 [23]	Canada	Manitoba Population Research Data Repository	Singleton live and stillbirths	Birth through first year of life	≥1 code	ICD-9-CM, ICD-10-CA	Methods	5.2%
Zanetti, 2022 [24]	Italy	Record Linkage of Rheumatic Disease (RECORD) study - Administrative Health Database (AHD)	Live births	At birth or delivery	Codes recorded in maternal hospital discharge forms	ICD-9	Methods, Supplemental S1	0.3%
Phibbs, 2022 [25]	USA	Vital records linked with patient hospital discharge data from US states	Neonatal deaths	Birth through 28 days except for infants with continuous hospitalization (i.e., advanced NICU care) in whom death could be after the 28-day definition of neonatal death	Both need to be fulfilled: 1) ICD-9 code for a congenital anomaly recorded that had it 2) Listed as the immediate or underlying cause of death on the death certificate	ICD-9	Methods	Not reported
Kwon, 2012 [26]	USA	Washington State birth certificates, Washington State Comprehensive Hospital Abstract Reporting System (CHARS)	Singleton second-born live births	At birth or delivery	Check-box information recorded on their birth certificate and through ICD-9 codes on hospital discharge record	ICD-9	Methods	Not reported

*Denotes a validation study, also described in Table 2.

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