

Validation of a Claims-Based Algorithm to Identify Major Congenital Malformations in Infants using a Linked Claims-EMR Database

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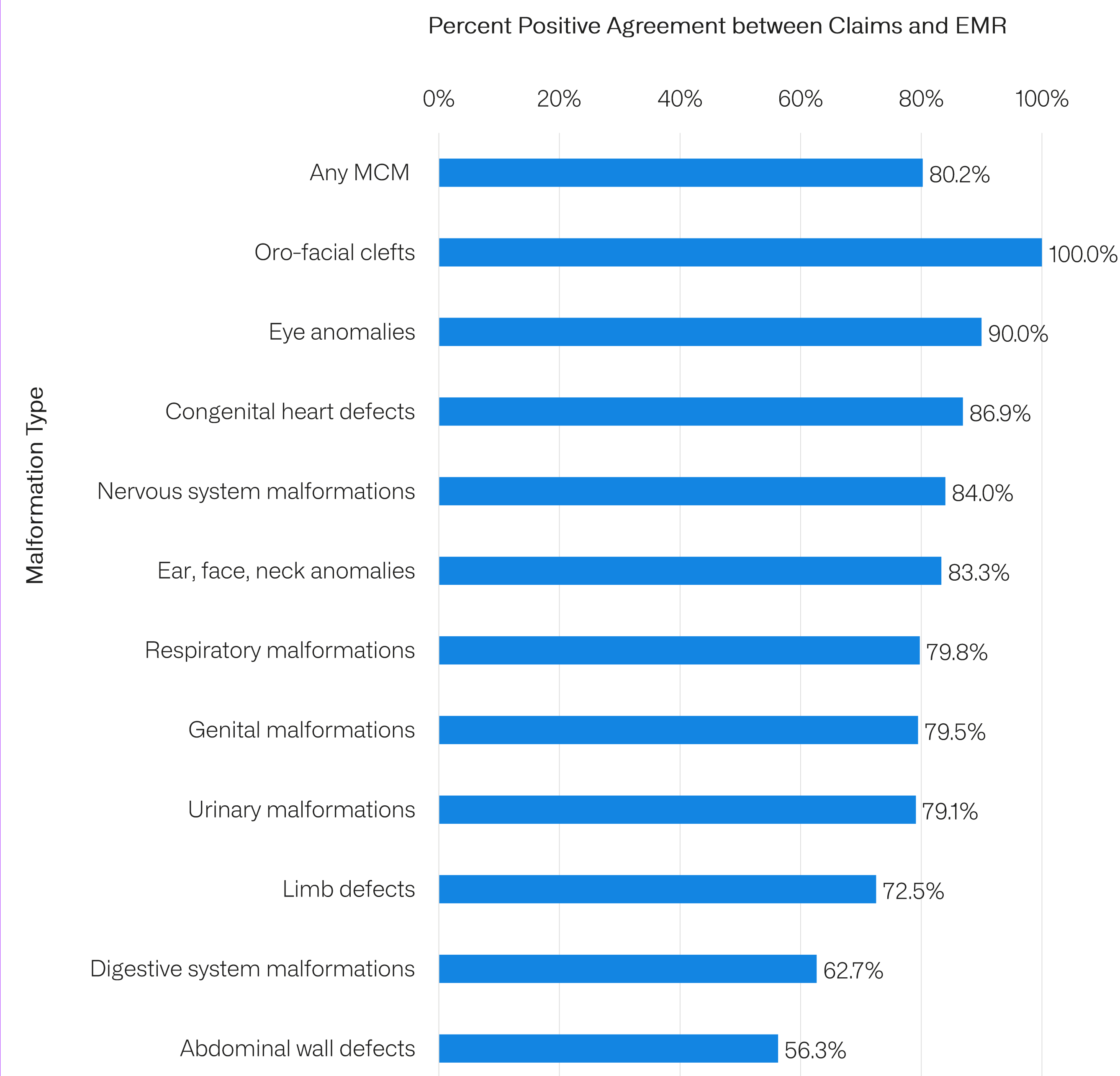


Study Summary

Study Question: Do claims-based algorithms to identify major congenital malformations (MCM) that have been validated in Medicaid databases also perform well in a commercially insured population?

Study Population: Liveborn infants with birth hospitalizations between 1/1/2016 and 12/31/2020 in the MarketScan Linked Claims-EMR Database.

Study Results



Conclusion: Agreement between the claims and EMR databases was high, indicating claims-based algorithms identify major congenital malformations in infants with a high degree of specificity.

Background

- Regulators are increasingly requiring retrospective studies of the safety of prenatal exposures to medication and assessment of the risk of major congenital malformations (MCM) following prenatal exposures [1].
- The accurate identification of MCM is essential to assess the safety of prenatal exposures and compare the risk of MCM in exposed and unexposed populations.
- Though claims-based algorithms identifying MCM are available [2-4], these were validated in Medicaid patients and their performance in commercially-insured populations is unknown.

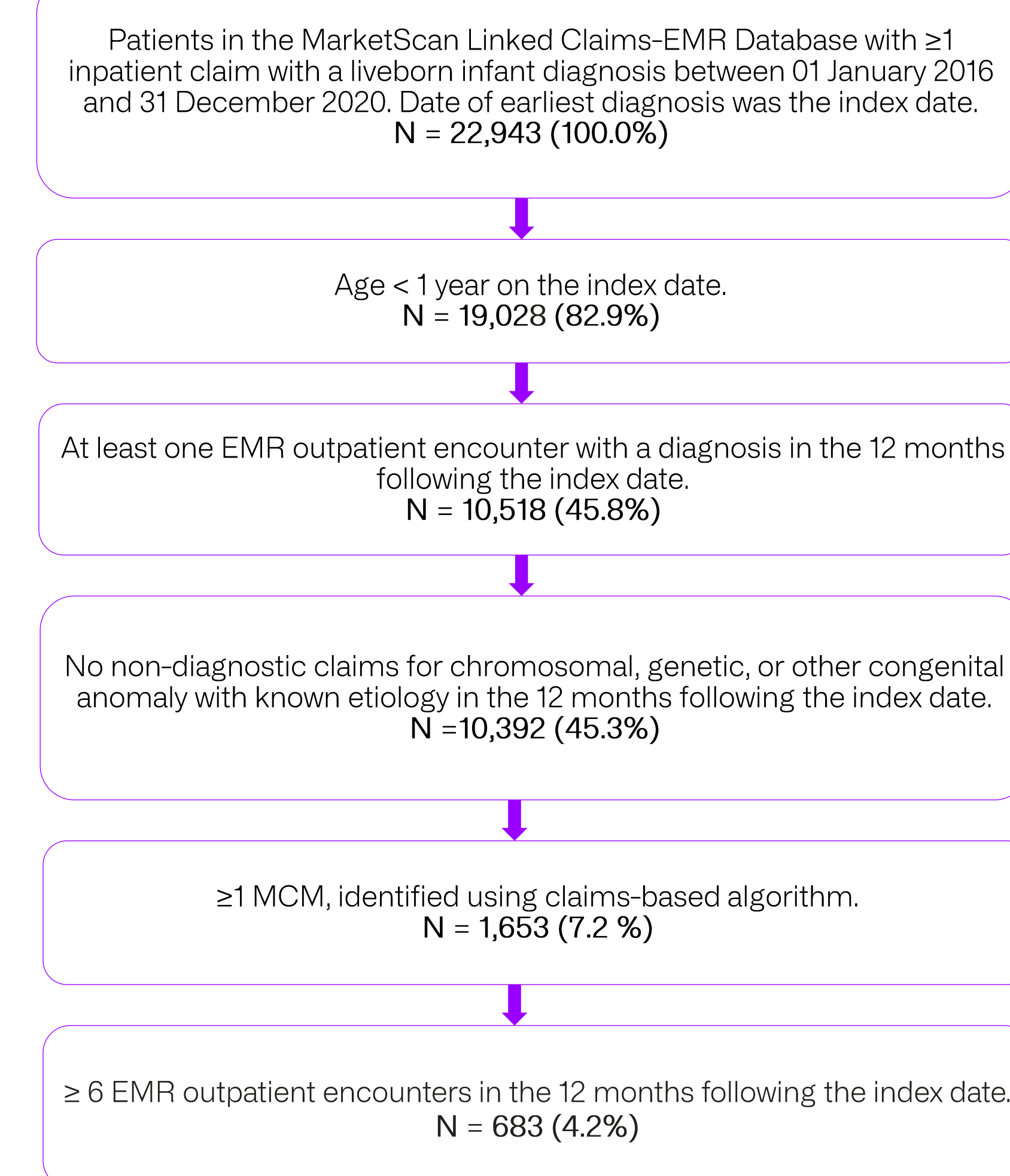
Objective

- To validate claims-based algorithms to identify MCM in a commercially-insured population using the Merative™ MarketScan® Claims-EMR Database.

Methods

- This study included liveborn infants with an MCM between 1/1/2016 and 12/31/2020, identified in the Merative MarketScan Claims-EMR Database (Figure 1).
- Evidence of MCM in the claims was identified by diagnosis and procedure codes using previously published claims-based algorithms [2-4] and was flagged overall and for 11 MCM subtypes.
- Percent positive agreement (PPA) was calculated as the percent of patients with an MCM in claims with evidence of the same MCM in EMR.
- Clinical characteristics and healthcare resource use (HCRU) were compared between infants with and without a confirmatory diagnosis in the EMR. Categorical variables were compared using chi-squared tests; continuous variables were compared using t-tests.

Figure 1. Patient Selection



EMR: Electronic Medical Records; MCM: Major Congenital Malformation

Figure 2. Malformation Type in Study Population (N=683)

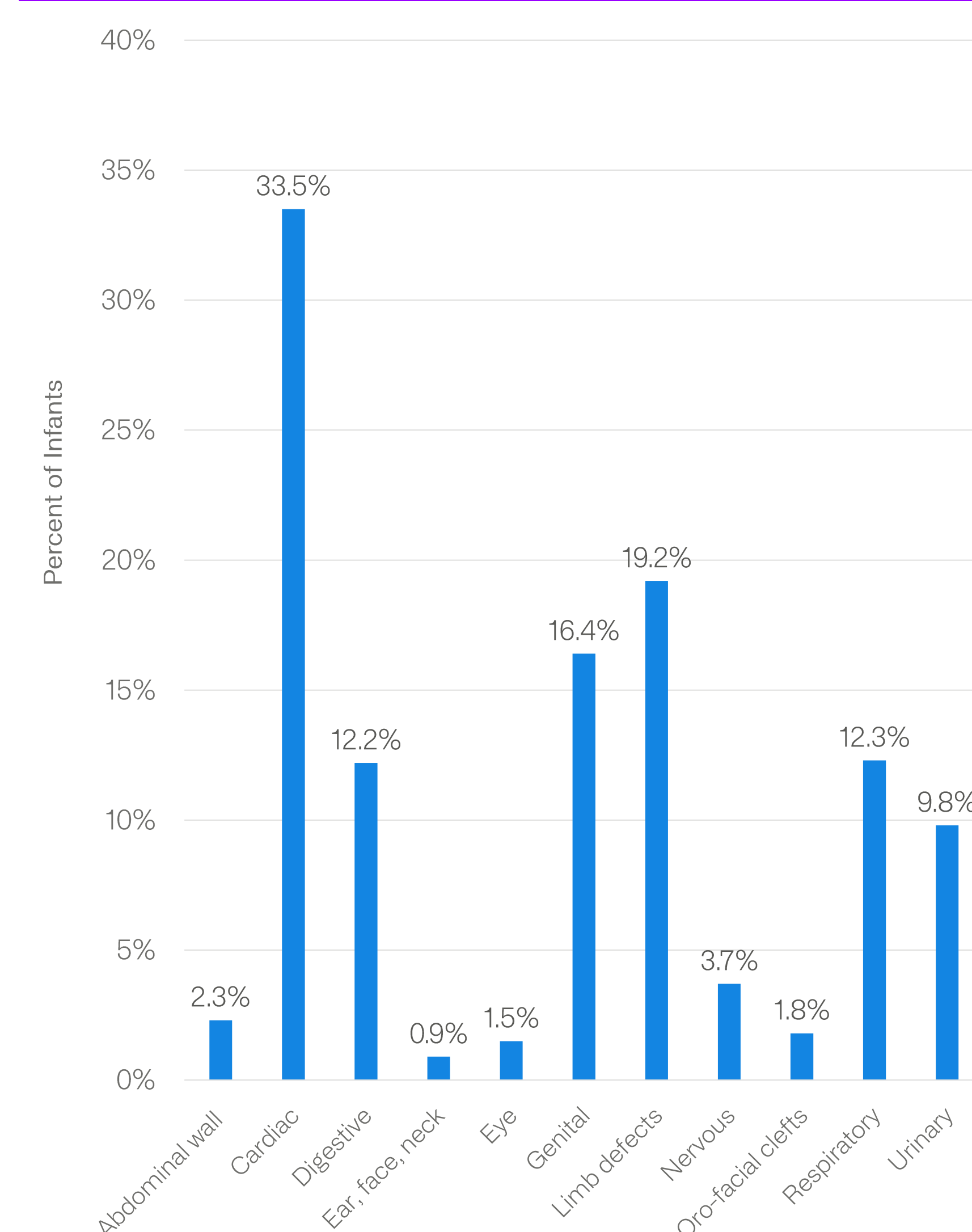


Table 1. Demographic Characteristics of the Study Population (N=683)

	N/Mean	%/SD
Age in days at MCM diagnosis (Mean, SD)	16	29
Sex (N, %)		
Female	293	42.9%
Male	390	57.1%
Health Plan Type (N,%)		
Comprehensive/Indemnity	1	0.2%
EPO/PPO	368	53.9%
POS/POS with capitation	32	4.7%
HMO	122	17.9%
CDHP/HDHP	111	16.3%
Missing/Unknown	49	7.2%
Length of follow-up in days (Mean, SD)	1,031	647
Median	955	
Number of MCM during follow-up (Mean, SD)	1.18	0.52

CDHP: Consumer Driven Health Plan; EPO: Exclusive Provider Organization; HDHP: High Deductible Health Plan; HMO: Health Management Organization; MCM: Major Congenital Malformation; POS: Point of Service; PPO: Preferred Provider Organization; SD: Standard Deviation

Table 2. Clinical Characteristics and HCRU in Infants with and without Confirmatory Diagnosis in EMR

	EMR DX (N=548)		No EMR DX (N=135)	
	N/ Mean	%/SD	N/ Mean	%/SD
Number of MCM (Mean, SD)	1.22	0.56	1.05	0.25
Clinical characteristics (N,%)				
Low birthweight	108	19.7%	22	16.3%
Feeding problems	296	54.0%	65	48.2%
Abnormal weight gain	33	6.0%	7	5.2%
Fussiness/excessive crying	66	12.0%	19	14.1%
Vomiting	118	21.5%	23	17.0%
Delayed milestones	14	2.6%	2	1.5%
Physical retardation	36	6.6%	3	2.2%
Healthcare Resource Utilization				
IP admission (N, %)	548	100%	135	100%
PPPM admissions (Mean, SD)	1.85	6.40	1.21	6.07
Physician specialist admission (N, %)	354	64.6%	73	54.1%
ER visit (N, %)	255	46.5%	55	40.7%
PPPM ER visits (Mean, SD)	0.08	0.16	0.06	0.14
Physician office visit (N, %)	541	98.7%	134	99.3%
PPPM visits (Mean, SD)	1.06	1.18	1.01	1.30
Pharmacy claim (N, %)	423	77.2%	91	67.4%
PPPM claims (Mean, SD)	0.50	1.48	0.28	0.49

p<.05 when comparing infants with and without confirmatory diagnosis shown in bold.
DX: Diagnosis; EMR: Electronic Medical Records; ER: Emergency Room; HCRU: Healthcare Resource Utilization; IP: Inpatient; MCM: Major Congenital Malformation; PPPM: Per Patient Per Month; SD: Standard Deviation

Results

- In total, 683 infants with MCM were included in this study; 42.9% were female with mean age of 16 days (SD: 29) at MCM diagnosis. On average, infants included in the study had 1.18 (SD: 0.52) different MCM during the follow-up period (Table 1).
- The most common malformation types in the study population were cardiac malformations (33.5%), limb defects (19.2%), and genital malformations (16.4%) (Figure 2).
- Overall agreement between claims and EMR for any MCM was 80.4%
 - Highest agreement was found in infants with oro-facial clefts (100%), eye anomalies (90%), and congenital heart defects (86.9%).
 - Lowest agreement was found in infants with abdominal wall defects (56.3%) and digestive system malformations (62.7%).
 - Agreement for all other MCM types exceeded 70% (Summary Figure).
- On average, infants with a confirmatory diagnosis in the EMR had more MCM (1.22; SD: 0.56) than infants without a confirmatory diagnosis (1.05; SD: 0.25); other clinical characteristics were also more common in infants with a confirmatory diagnosis. However, these differences were not statistically significant (Table 2).
- HCRU was higher in infants with a confirmatory diagnosis in the EMR; however, with the exception of the percent of infants with a physician specialist inpatient admission and percent of infants with a pharmacy claim, these differences were not statistically significant (Table 2).

Limitations

- This study was based on patients with commercial health coverage, and results may not be generalizable to infants with MCM with other types of insurance or without health insurance coverage.
- Utilization included in the EMR database was limited to utilization within the integrated delivery networks that contribute to the EMR. Utilization outside of these networks was not captured and agreement between claims and EMR may be underestimated as a result.

Conclusions

- This study showed high levels of agreement between MCM identified by a claims-based algorithm and the diagnosis of MCM in the EMR database in a population of commercially-insured infants, indicating that claims-based algorithms can be reliably used to identify MCM in commercially-insured and Medicaid-insured infants.
- The algorithm to identify MCM performed well using only infant claims indicating that use of maternal claims may not be necessary to reliably identify MCM in infants.
- Significant differences in the proportion of patients with a physician specialist admission and proportion of patients with an outpatient pharmacy claim were observed when comparing infants with and without a confirmatory diagnosis; however, clinical characteristics and HCRU were otherwise similar between infants with and without a confirmatory diagnosis in the EMR.

References

- FDA. Postapproval Pregnancy Safety Studies Guidance for Industry. May 2019.
- Pharmacoepidemiol Drug Saf. 2014 Jun; 23(6):846-55.
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Disclosure

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