Gastroschisis in Queensland, 2008 to 2017

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Gastroschisis is a congenital anomaly of the abdominal wall characterised by herniation of the gut and other organs where the herniated organs lack a protective membrane[1]. Numerous reports have identified an increasing birth prevalence of gastroschisis internationally and in Australia over the past few decades[1-4], including a previous Queensland Health StatBite[5]. The previous Queensland Health Statbite included statistics on the rising incidence of gastroschisis in Queensland, place of birth for babies born with gastroschisis, outcomes (length of stay and mortality) and identified the key risk factors among mothers who gave birth to a baby with gastroschisis. This report updates and expands upon that work, by including more recent data (up to 2017, with an emphasis on the decade from 2008 to 2017) and information on labour onset type, delivery mode, and babies' gestational age and birthweight.

Data were extracted from the Queensland Perinatal Data Collection (PDC) for babies born between 1988 and 2017. While most cases of gastroschisis are identified within the PDC, some additional cases (an average of 3 per year) were identified from the Congenital Anomaly Linked File (CALF; available from 2008 onwards)[†]. This report includes additional cases from the CALF where available, unless otherwise noted.

Trend

In Queensland, the aggregated rate of gastroschisis over the three years from 2015 to 2017 was 5.5 per 10,000 births. Over the entire period 1988 to 2017, the proportion of babies born with gastroschisis increased significantly with an average annual increase of 4.5% (95% CI: 3.4%-5.5%) (Figure 1, Table 1), although the rate has plateaued in recent years. When limited to the

Figure 1 Gastroschisis rate per 10,000 births, Queensland, 1988 to 2017
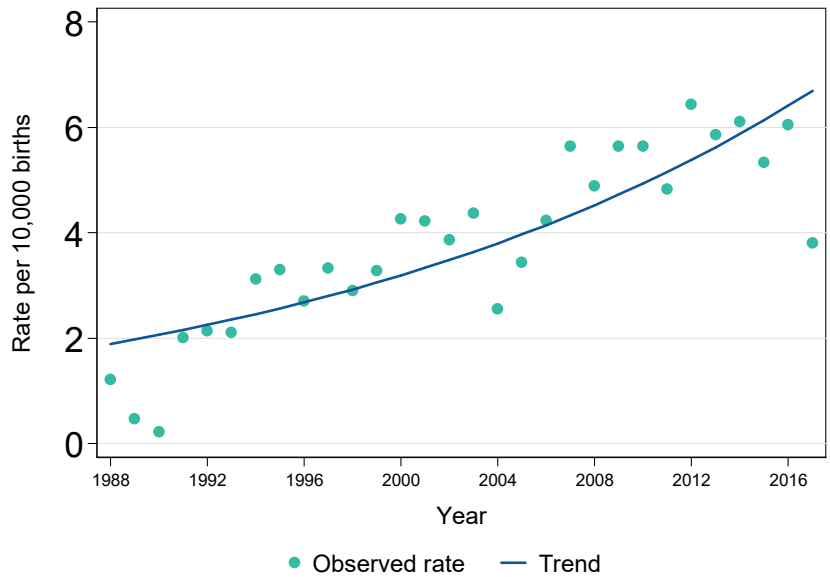
Does not include additional gastroschisis cases from the Congenital Anomaly Linked File.
Source: Queensland Perinatal Data Collection

Figure 2 Gastroschisis rate per 10,000 births, Queensland, 2008 to 2017
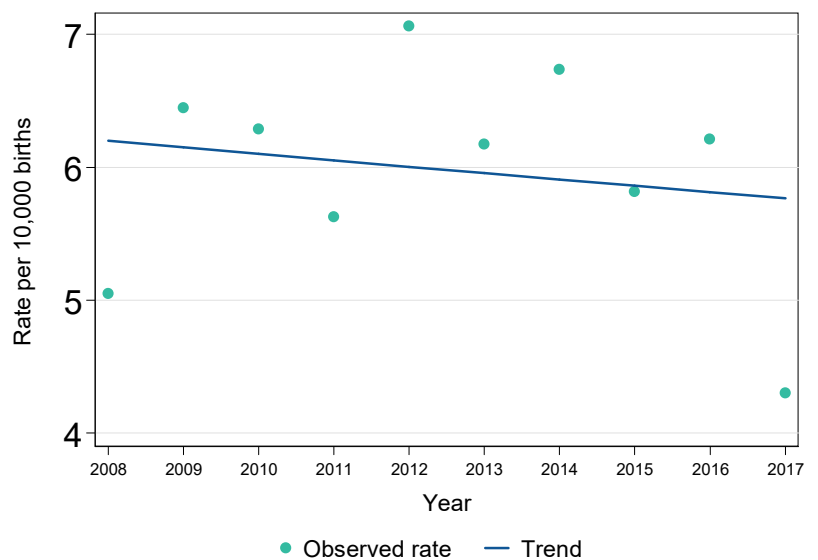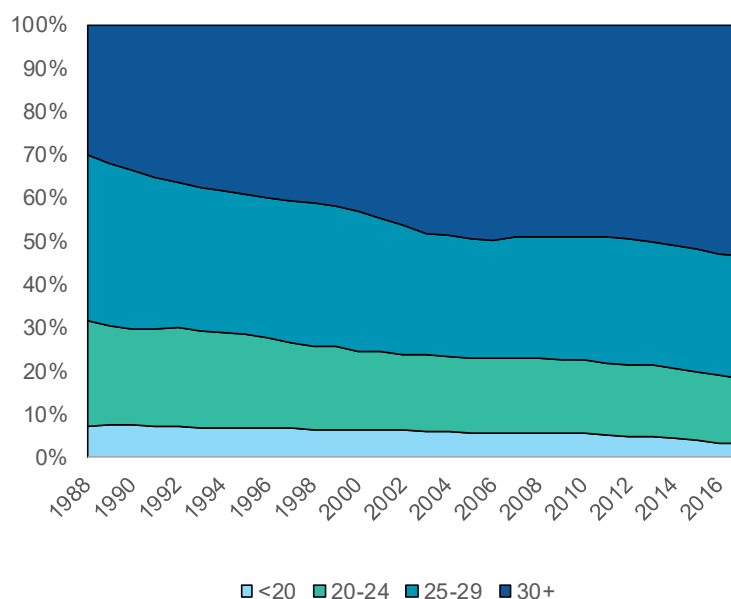

Source: Queensland Perinatal Data Collection, Congenital Anomaly Linked File

† A linked data resource that combines records from the Queensland Perinatal Data Collection, the Queensland Hospital Admitted Patient Data Collection (QHAPDC) (including terminations of pregnancy prior to 20 weeks gestation) and Queensland Death Registration Data where a congenital anomaly has been recorded.

latest decade (2008 to 2017) (Figure 2, Table 1), there is a slight, though non-significant, decrease in the proportion of babies born with gastroschisis (annual percent change: -0.8% (95% CI: -4.3%-2.8%)). A slight decline in incidence has also been observed in China from 2006 to 2015[6].

The risk of gastroschisis has been shown to vary by maternal age, with risk being highest for younger mothers[5]. The age distribution of mothers has changed over the last three decades (Figure 3) and may confound the observed trends. Table 1 shows the annual percentage change (APC) before and after adjusting for maternal age. Removal of the effect of maternal age results in higher APCs for all epochs. Notably, the trend for the latest decade (2008 to 2017) reverses, showing a slight, non-significant, increase.

Figure 3 Distribution of maternal age, Queensland, 1988 to 2017

Legend: □ <20 ■ 20-24 ■ 25-29 ■ 30+

Source: Queensland Perinatal Data Collection

Table 1 Annual percentage change (APC) of gastroschisis rate per 10,000 births, crude and adjusted for maternal age, Queensland, 1988-2017

Epoch	APC (95% Confidence Interval), crude	APC (95% Confidence Interval), adjusted for maternal age
1988-2007	6.74 (4.56, 8.97)	8.22 (6.00, 10.48)
2008-2017	-0.80 (-4.27, 2.79)	1.14 (-2.42, 4.83)
1988-2017^	4.45 (3.45, 5.47)	5.80 (4.77, 6.83)

^Does not include additional gastroschisis cases from the Congenital Anomaly Linked File.
Source: Queensland Perinatal Data Collection, Congenital Anomaly Linked File

Place of birth

Gastroschisis is usually detectable in antenatal morphology ultrasound screening, and an optimal outcome requires early intervention with fluid resuscitation, bowel protective measures, mitigation of infection and surgical management. Therefore, antenatal detection and tertiary delivery is recommended. Between 2008 and 2017, approximately 88.6% of babies born with gastroschisis were born at one of the tertiary perinatal centres in Queensland[‡]. When limited to livebirths, 92.9% were born in a tertiary centre. These rates have slightly increased since the period 1988 to 2007 (85.0% overall; 89.0% livebirths only) and suggest a high rate of antenatal detection and referral for planned tertiary delivery and optimal neonatal management.

Mortality

Between 2008 and 2017, 45 babies (12.5%) born with gastroschisis died during the perinatal period compared with 40 babies (13.3%) between 1988 and 2007. 24 (53.3%) of the 45 perinatal deaths were stillbirths, emphasising the importance of antenatal monitoring and timing of delivery if overall mortality is to be reduced. Overall perinatal mortality of babies born with gastroschisis in a recent New Zealand report was 15% with 67% of these deaths in stillborn infants[7].

Termination of pregnancy for isolated gastroschisis[§] is rare. The mortality rate decreases to 10.2% when terminations of pregnancy are excluded.

[‡] Tertiary perinatal centres include Royal Brisbane and Women's Hospital (until 2003: Royal Women's Hospital), Mater Mothers' Hospital, Mater Women's & Children's Private Health Services, Mater Misercordiae Women's & Children's Private Health Service (Women's Campus) (until June 2008), and The Townsville Hospital (until 2001: Kirwan Hospital for Women)
[§] Gastroschisis occurring without any other unrelated major congenital anomalies.

Length of stay

Between 2008 and 2017, the average length of stay** for babies with gastroschisis, excluding babies who died, was 47.9 days, with a median of 33 days and a maximum of 505 days (Figure 4). This reduces to 36.5 days (median 31; maximum 172) when restricted to babies who had isolated gastroschisis.

Labour Onset, Delivery Method and Preterm Birth

There is debate regarding clinical management strategies for pregnancies complicated by

Figure 4 Length of stay for babies born with gastroschisis, Queensland, 2008 to 2017

Length of stay (days)
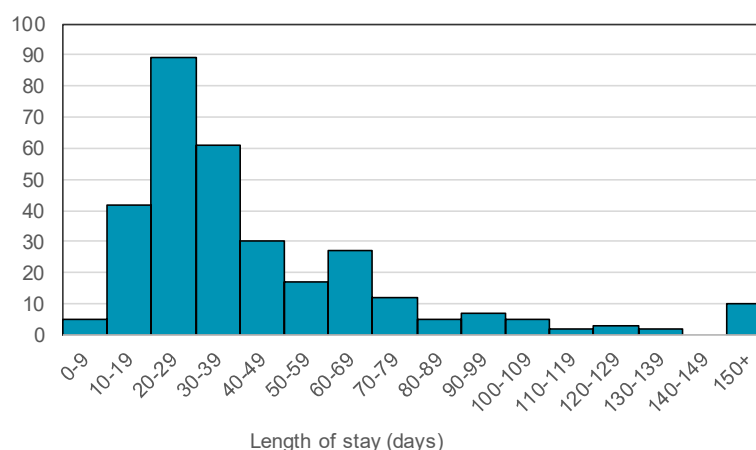
Source: Queensland Perinatal Data Collection, Congenital Anomaly Linked File, Master Linkage File

gastroschisis, particularly in relation to delivery method (caesarean vs vaginal) and timing of delivery (preterm vs term)[8-12].

In pregnancies complicated by gastroschisis in Queensland, the distribution of labour onset has shifted in the latest decade (2008 to 2017) compared with 1995[††] to 2007, with more mothers being induced (44.6% vs 30.2%) and a higher proportion of babies born via caesarean section without labour (27.4% vs 16.5%) (Table 2). However, the overall proportion of caesarean section deliveries is comparable (41.8% vs 38.7%).

Table 2 Gastroschisis cases and preterm (<37 weeks gestation) birth rate and median gestational age by labour onset type, Queensland, 1995[††] to 2007 and 2008 to 2017

Period	Labour Onset	Gastroschisis Cases	Proportion of cases	Preterm (<37 weeks) Rate	Gestational Weeks			
					Median	Q1	Q3	IQR
1995** to 2007	Induced	75	30.2%	45.3%	37	36	38	2
	No labour (CS)	41	16.5%	48.8%	37	35	38	3
	Spontaneous	132	53.2%	62.9%	36	34	37	3
2008 to 2017	Induced	161	44.6%	50.3%	36	34	37	3
	No labour (CS)	99	27.4%	73.7%	36	35	37	2
	Spontaneous	101	28.0%	81.2%	35	34	36	2

Source: Queensland Perinatal Data Collection, Congenital Anomaly Linked File

Babies with gastroschisis are highly likely to be born preterm (<37 weeks gestation; 64.5%) and with a low birthweight (<2,500g; 56.7%), with 29.7% being small for gestational age (birthweight <10th percentile[13]). Current recommendations include close monitoring of fetal growth and planned delivery at 37-38 weeks directed at reducing late gestation fetal death. Delivery prior to 37 weeks largely reflects obstetric management to improve outcome. Table 2 shows that between 2008 and 2017, half of induced labours and 73.7% of caesarean sections without labour were preterm. This is a large increase in the preterm rate of caesarean sections, compared with 48.8% prior to 2008. However, the corresponding median gestational age has only slightly decreased. These data suggest that Queensland has tended toward earlier delivery in pregnancies complicated by gastroschisis.

** These data are not comparable to figures from Statbite#57, as data from 2008 onwards utilises linked hospital data (Statistical Services Branch Master Linkage File) which enables length of stay to include transfers between hospitals. This has resulted in an increase in length of stay statistics.
†† Labour onset only available from 1995 onwards.

Risk factors

The association between maternal characteristics that are reported in the Queensland Perinatal Data Collection and risk of giving birth to a baby with gastroschisis was assessed using multivariate logistic regression analysis The strongest associations were consistent with those identified previously[5]: young maternal age, not being married or in a de-facto relationship (an indicator of poor social support) and being a first-time mother (Table 3). Being underweight, a smoker or Indigenous also was associated with higher risk at the univariate level but these factors were not significant when adjusted for other variables. As gastroschisis occurs early in the first trimester (approximately 10 weeks gestation) exposures occurring in this early stage of pregnancy have been of interest.

Acknowledgements

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Table 3 Frequency and odds ratios of mothers giving birth to babies with gastroschisis for selected risk factors, Queensland, 2008 to 2017

Risk factors	Frequency			Univariate association			Multivariate association		
	Cases	Total	Cases per 10,000	Odds Ratio	95% CI		Odds Ratio	95% CI	
Smoking									
No	269	518,829	5.2		-			-	
Yes	86	91,868	9.4	1.81	1.42	2.30	1.12	0.85	1.47
Unknown	6	2,775	21.6	Excluded from model			Excluded from model		
Indigenous status									
Non-Indigenous/Not stated	325	575,847	5.6		-			-	
Indigenous	36	37,625	9.6	1.70	1.20	2.39	0.74	0.48	1.12
Marital status									
Married/De-facto	195	522,994	3.7		-			-	
Other	166	90,478	18.3	4.93	4.01	6.06	2.53	1.96	3.26
ARIA+[‡‡]									
Major city – Queensland	192	373,938	5.1		-			-	
Inner Regional – Queensland	68	119,080	5.7	1.11	0.84	1.47	0.81	0.59	1.10
Outer Regional – Queensland	66	95,754	6.9	1.34	1.02	1.78	1.17	0.86	1.58
Remote/Very remote – Queensland	11	18,652	5.9	1.15	0.63	2.11	0.67	0.32	1.42
Interstate	24	6,048	39.7	Excluded from model			Excluded from model		
SEIFA[§§]									
Most disadvantaged	76	131,275	5.8		-			-	
Quintile 2	81	122,889	6.6	1.14	0.83	1.56	1.35	0.97	1.88
Quintile 3	75	117,536	6.4	1.10	0.80	1.52	1.60	1.14	2.27
Quintile 4	66	125,139	5.3	0.91	0.66	1.27	1.42	0.98	2.05
Most advantaged	39	110,563	3.5	0.61	0.41	0.90	1.18	0.77	1.83
Interstate	24	6,070	39.5	Excluded from model			Excluded from model		
Body Mass Index									
Underweight (<18.5kg/m^2)	34	31,677	10.7	1.54	1.07	2.21	1.02	0.69	1.49
Normal weight (18.5 - <25kg/m^2)	214	305,746	7.0		-			-	
Overweight (≥25kg/m^2)	81	262,182	3.1	0.44	0.34	0.57	0.49	0.37	0.63
Missing/Unknown	32	13,867	23.1	Excluded from model			Excluded from model		
Maternal age									
<20 years old	91	28,580	31.8		-			-	
20-24 years old	138	101,271	13.6	0.43	0.33	0.56	0.57	0.42	0.77
25-29 years old	83	175,141	4.7	0.15	0.11	0.20	0.23	0.16	0.33
30+ years old	49	308,480	1.6	0.05	0.04	0.07	0.09	0.06	0.14
Parity									
No previous births	235	250,916	9.4		-			-	
1 or more previous births	126	362,553	3.5	0.37	0.30	0.46	0.73	0.57	0.94
Unknown	0	3	-	Excluded from model			Excluded from model		

Source: Perinatal Data Collection

[‡‡] Australian Remoteness Index of Area.
[§§] Socioeconomic Index of Relative Advantage-Disadvantage.