The Canadian Pediatric Surgery Network
Le Réseau Canadien de Chirurgie Pédiatrique

2010 Annual Report

Improving pediatric surgical care through national, collaborative research.

CAPSNet

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Introduction to the Network

The CAnadian Pediatric Surgery Network (CAPSNet) is a multi-disciplinary group of Canadian health researchers working together on research issues concerning pediatric surgical care. To date there are 28 network members, including 19 pediatric surgeons, 5 perinatologists/ maternal fetal medicine specialists and 4 neonatologists.

The main objectives of the network are to:

- Maintain a national pediatric surgical database, providing an infrastructure to facilitate and encourage collaborative national research.
- Identify variations in clinical practices across Canadian centres and identify those practices which are associated with favourable and unfavourable outcomes.
- Disseminate new knowledge through effective knowledge translation, and study impact of practice change.
- Study the economic impact of clinical practice decisions to enable identification of treatment strategies that are efficacious and cost-effective.

Currently CAPSNet is in the 5th year of data collection and we are pleased to report that the Network's total number of publications now reaches 11 with an additional 2 in press and 4 submitted manuscripts. To date, there have been 23 podium and 6 poster presentations at national and international conferences. For a complete list of all past and current CAPSNet projects, please see Appendix II.

Recent Network Activity

CIHR Renewal

Although CIHR reviewers initially recommended the grant for renewal with a sufficiently high priority score, a third attempt at a 788K 4-year CIHR renewal was ultimately not funded. Subsequently, CAPSNet did receive $100,000 of priority "bridge" funding from CIHR. A recent budget analysis suggests that CAPSNet had sufficient operating funds to continue data collection at all 16 centres (as it is currently conducted) for approximately another 2 years.

CAPS had committed $30K of funding towards data collection in 2013 in the CIHR renewal budget. For the time being, CAPSNet can continue to function without that additional money, however we wish to reserve the option of activating that request in the future.

CAPSNet-X Meeting: December 2009

In December 2009, a group of approximately 20 including the CAPSNet executive and strategic invited guests met in Montreal for a 2 day strategic planning meeting, which was supported by competitive funds obtained from CIHR (PI P. Puligandla) through the Meeting, Planning and Dissemination Program. At this meeting, discussion on the long term direction of CAPSNet was

discussed, with general agreement on the need for long term follow-up and an evidence-based practice change strategy (EPIQ model).

CAPSNet Data Audit Project

During the summer of 2009, a data audit project was launched in order to review the CAPSNet prenatal data collection, and in particular, the sonographic variables. The objective of the project was to identify, understand, and find solutions to the gaps in the CAPSNet prenatal data. The results were reviewed by the CAPSNet Steering Committee and have been used to inform the upcoming revision of the CAPSNet database.

Highlights of the results include:

- Five sites re-abstracted a total of 94 patients.
- Excluding the ultrasound screens, the re-abstracted prenatal data was the same as the original abstraction 93% of the time. However, agreement in the ultrasound screens was only 80%. This was primarily due to the fact that the abstractors did not always choose to the exact same ultrasound in each time period, and so the values changed.
- Only 37% of cases had 4 CDH ultrasounds abstracted, whereas 69% had all 4 GS ultrasounds abstracted.
- For CDH ultrasounds, the most problematic variables were: lung-head measurements ("Not measured" in 63% of ultrasounds), the cardio-ventricular index ("Not measured" in 59% of ultrasounds) and the cardio-vascular index ("Not measured" 54% of ultrasounds).
- For GS ultrasounds, the most problematic variables were: NST, (92% missing), intrabdominal calcification, (71% missing), bowel echogenicity (76% missing) and amniotic fluid echogenicity (73% missing).

CAPSNet Database Revision

Several changes to the CAPSNet data collection were made in order to become more consistent with the new CNN database (starting for babies born January 1, 2010):

- Perinatal ultrasounds: Enter the most complete ultrasound in the window indicated.
- NTISS: No longer collected. Abstractors can leave blank in the current database.
- SNAP scores for CDH patients: SNAP is required only on Day 1 of admission and 12 hours prior to the first corrective visit to the OR.
- GS Bowel Injury Score: Collect only score I at the surgeon's first assessment of the bowel. The second scoring is no longer required and abstractors can leave blank in the current database.
- CDH Size of Defect: Added to the surgical form; abstractors enter into the comments box until the database is updated.

The CAPSNet Steering Committee has since approved a further revision of the CAPSNet database. The goals are to streamline data collection wherever possible, ensure relevancy, improve accuracy and to remain consistent with the new version of the CNN. The database will be built by the programmers at the MiCare Coordinating Centre; the tentative timeline for development and roll-out is from December 2010 – May 2011.

The data elements were reviewed and changes were made based on the new CNN database, comments from abstractors, researchers and the Steering Committee. In addition to those listed above, changes will include:

- Obstetrical Screen: Delete Tocolytics, LMP, EDD, previous thrombophilia and hypertension
- Ultrasound Screen: Extensive changes, see Appendix III
- Pregnancy Outcome Screen: Delivery plan will be defined as made between 28 weeks GA and term (prior to onset of labour), lung maturity and most neonatal resuscitation variables will be deleted.
- GS screen: Vascular access and vascular site will be deleted, diameter of defect will be added.
- CDH screen: Highest pressors dose, ventilation modes will be deleted, a checkbox for thorascopic repair will be added, and an ECHO section (first and last) will be added. The cardiorespiratory targets and nitric oxide sub-screens will be deleted.

Acknowledgements

We would like to acknowledge the CAPSNet Steering Committee members for their leadership and commitment to the Network over the past year:

Dr. E. Skarsgard, Children's and Women's Health Centre of BC, Vancouver
Dr. S. Bouchard, Hôpital Ste-Justine, Montréal
Dr M. Brindle, University of Calgary, Calgary
Dr S. Himidan, Hospital for Sick Children, Toronto
Dr. J-M. Laberge, Montréal Children's Hospital, Montréal
Dr. S. K. Lee, MiCare, University of Toronto, Toronto
Dr. Aideen Moore, Mount Sinai Hospital, Toronto-Neonatology
Dr. P. Puligandla, Montréal Children's Hospital, Montréal
Dr. G. Ryan, Mount Sinai Hospital, Toronto-Perinatology
Dr. N. Yanchar, IWK Health Centre, Halifax
Dr. D. Wilson, U of Calgary, Calgary-Perinatology

Many thanks to Mr. Sonny Yeh, MiCare System Administrator at Mount Sinai Hospital for his work in compiling the national dataset which was used to produce this report. Thanks also are due to Ms. Alana Gaumont and Jennifer Claydon for their involvement in coordinating Network activities over the last year.

We also acknowledge each of our Data Abstractors, whose attention to detail and high quality work serves as the foundation for the database. Many thanks to: Alda DiBattisa, Andrea Secord, Charlene Cars, Danielle Cardiff, Debbie Arsenault, Ellen Townson, Faye Hickey, Joceylne Vallee, Kruti Patel, Lizy Kodiattu, Lola Cartier, Margaret Ruddy, MaryJo Ricci, Natalie Condron, Nathalie Fredette, Nima Mirakhur, Rashmi Raghavan, Robin Knighton, Susan Wadsworth, Tanya McKee, Ullas Kapoor, Valerie Cook and Wendy Seidlitz.

We also acknowledge the many trainees, their site sponsors and the CAPSNet Steering Committee members who have and are currently utilizing the data for analyses (for a full list of ancillary projects to date see Appendix II).

CAPSNet is grateful for the financial support received from the Canadian Institutes of Health Research (CIHR), the Executive Council of the Canadian Association of Pediatric Surgeons (CAPS), the Maternal, Infant, Child and Youth Research Network (MICYRN) and the Maternal-Infant Care team (MiCare) as well as in-kind contributions from CNN.

2010 Data Analysis

This report includes data submitted from the following list of contributing centres. Cases were abstracted on all cases of Gastroschisis (GS) or Congenital Diaphragmatic Hernia (CDH) diagnosed either prenatally or within 7 days of life.

Data from the CAPSNet database has been cleaned by the CAPSNet coordinating centre and checked with abstractors in the event of a possible discrepancy. Data from the CNN database has been cleaned by the CNN coordinating centre. CAPSNet uses CNN database from the 2004 version of the CNN database.

In terms of the centre-level analyses, cases are attributed to the centre in which the surgery took place (i.e., if a baby was admitted at CAPSNet centre A but transferred to CAPSNet centre B for surgery, the baby is included as a case for CAPSNet centre B).

Finally, information from transfers within CAPSNet or CNN have been linked wherever possible in order to provide as much data as possible on the baby's complete course of hospital care.

Contributing Centres for the 2010 Annual Report

Victoria General Hospital, Victoria, BC
Children's and Women's Health Centre of British Columbia, Vancouver, BC
Alberta Children's Hospital, Calgary, AB
University of Alberta Hospital, Edmonton, AB
Royal University Hospital, Saskatoon, SK
Winnipeg Health Sciences Centre, Winnipeg, MB
    in cooperation with St. Boniface General Hospital, Winnipeg, MB
Hospital for Sick Children, Toronto, ON
    in cooperation with Mount Sinai Hospital, Toronto, ON
McMaster Children's Hospital, Hamilton, ON
London Health Sciences Centre, London, ON
Kingston General Hospital, Kingston, ON
Children's Hospital of Eastern Ontario, Ottawa, ON
    in cooperation with The Ottawa Hospital, Ottawa, ON
Montréal Children's Hospital, Montréal, QC
    in cooperation with McGill University Health Centre, Montréal, QC
Hôpital Ste-Justine, Montréal, QC
Centre Hospitalier de L'Université Laval, Ste-Foy, QC
IWK Health Centre, Halifax, NS
Janeway Children's Health and Rehabilitation Centre, St. John's, NL

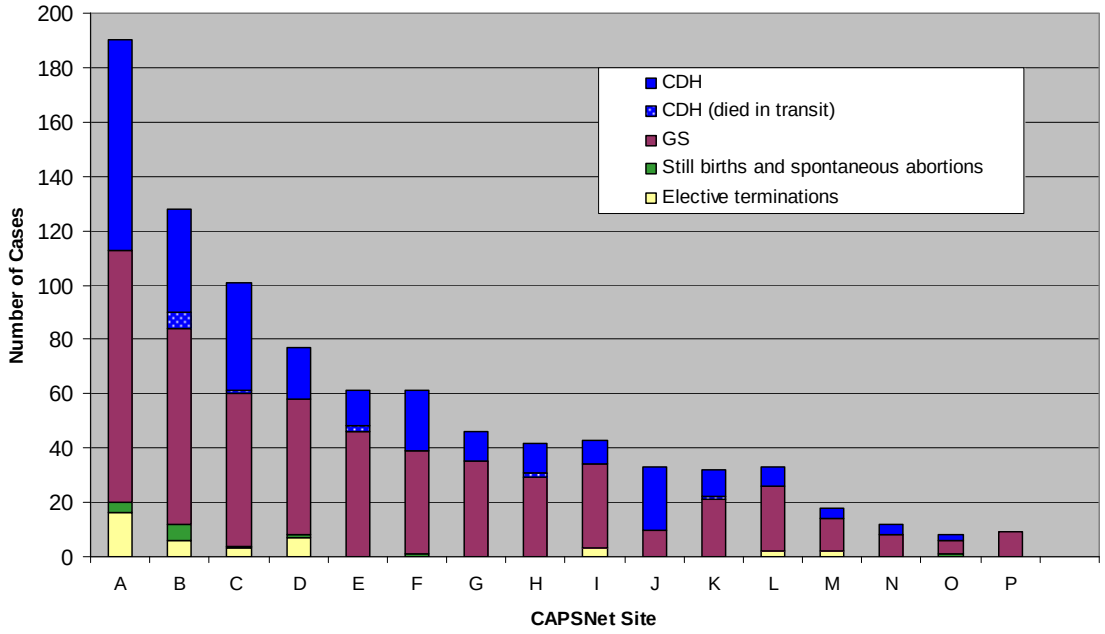
Summary of Data by Diagnosis and Birth Outcomes

	Congenital Diaphragmatic Hernia (CDH)	Gastroschisis (GS)	CAPSNet total
Complete live births	269	501	770
Incomplete live births Represents cases for which there are known live-births, but the infant was still in hospital or data entry was incomplete as of April 30, 2010. Incomplete live births are not included outside of the summary section of this report.	21	38	59
Died in Transit Represents live births at a community hospital where the infant did not survive postnatal transfer to admission at a CAPSNet tertiary pediatric centre.	12	2	14
Elective Terminations	40	11	51
Still-births and spontaneous abortions	5	9	14
Total Case Incidence	**347**	**561**	**908**

Antenatal Misdiagnoses

- 2 cases of suspected CDH were confirmed at birth as “other”.
- 5 cases of suspected GS were confirmed at birth as Omphalocele (*n*=4) or “other” (*n*=1).

Figure A: Distribution of cases by centre



Gastroschisis Descriptive Analyses

Table 1.0: Patient population

GS complete live births ***n* = 501**	
Overall survival rate	96.8%
Inborn rate	79.0%
Mean birth weight	2526.3 g
Proportion of males	53.3%
Proportion of males with undescended testis/testes	14.2%
Isolated defect	71.1%
SNAP-II* scores	
Mean – survivors (*n*=485)	8.7
Mean – non-survivors (*n*=16)	17.6
Median – survivors (*n*=485)	5
Median – non-survivors (*n*=16)	9.5

*SNAP-II: Score for Neonatal Acute Physiology, version II. See Appendix I for definitions. If more than 65% of the SNAP score data elements were missing, then a baby's SNAP-II score could be computed and thus have been excluded from any analyses of SNAP-II scores.

Table 1.1: Survival by centre volume

Table shows the survival rate grouped by centre volume. *Low volume* centres are those that see on average <3 GS cases per year, *high volume* centres see an average ≥ 9 GS cases per year; and *mid volume* centres includes all those in between.

			SNAP-II		GS Prognostic Score (GPS)**	
Centre volume	Count (*n*)	Survival (%)	Median	Range	Mean	Range
High (5centres)	296	97.6%	5	0-64	1.4	0-12
Mid (6 centres)	163	96.3%	7	0-50	1.3	0-10
Low (4 centres)	34	91.1%	6	0-53	1.2	0-6

* 1 centre has been excluded from all site-level analyses due to concerns of data accuracy.
** For a description of the GPS, see page 8.

GS Ultrasound Measurements

Bowel dilation and bowel wall thickness measurements were recorded on up to four ultrasounds taken at varying time points:

1. First ultrasound taken at the tertiary CAPSNet centre;
2. Last ultrasound taken between 23+0 and 31+6 weeks;
3. Last ultrasound taken between 32+0 and 34+6 weeks; and
4. Last ultrasound before delivery

The data presented here reflects the worst (i.e., greatest) measurement reported on any one of the above ultrasounds. *Not measured* indicates that at least one ultrasound was taken, but the specific variable interest was not measured; *no ultrasound* indicates that there were no reported ultrasounds.

Figure 1.2: Maximum bowel dilation reported on antenatal ultrasound

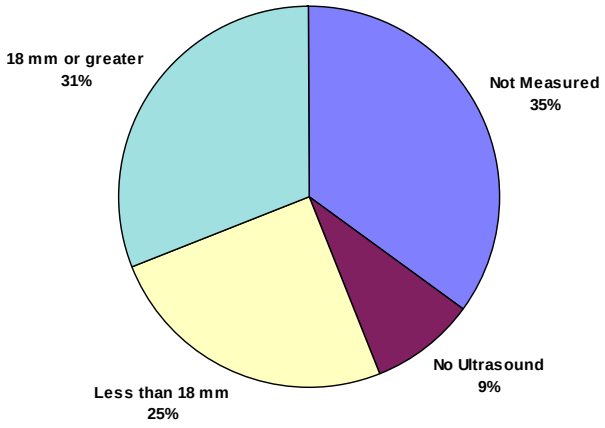


Figure 1.3: Maximum bowel wall thickening reported on antenatal ultrasound

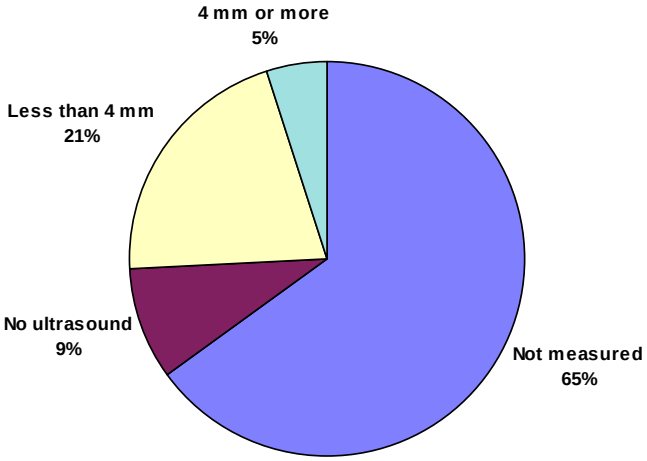


Figure 1.4: Early vs. late antenatal diagnosis

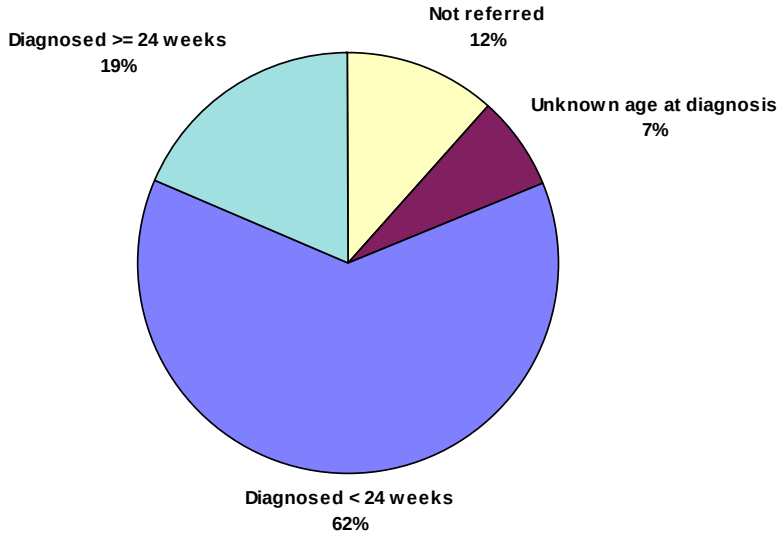


Figure 1.5: Gestational age at birth

Gestational age is in complete weeks and calculated according to the CNN algorithm, which considers both pediatric and obstetric estimates.

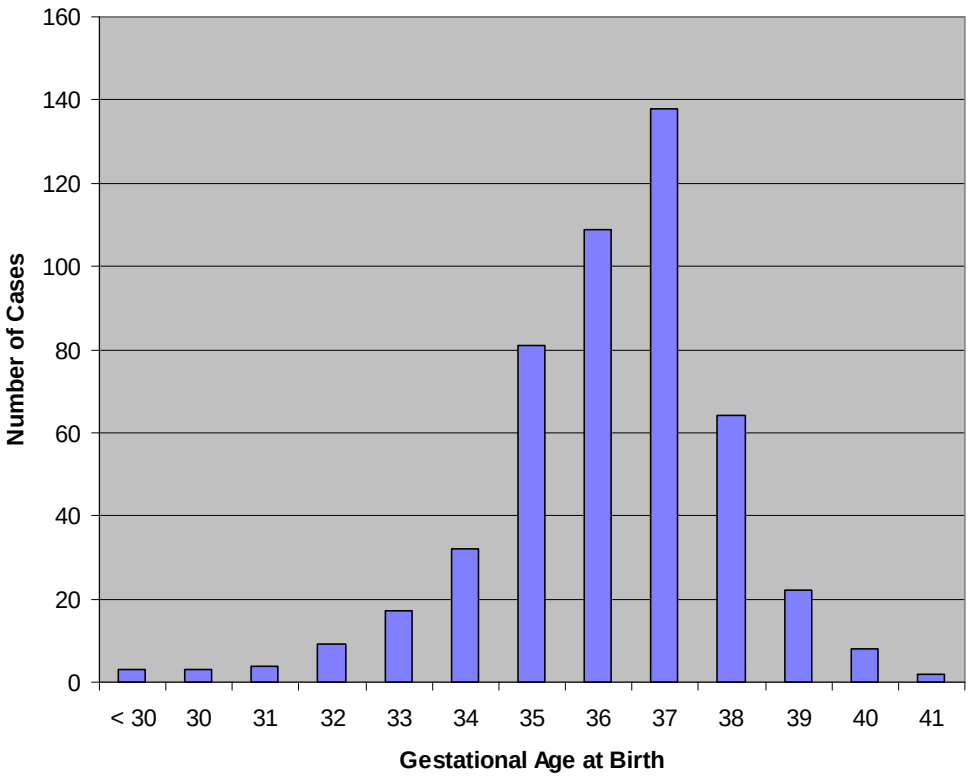


Table 1.6: Antenatal plan for delivery as of 32 weeks GA

	n	%
No pre-determined plan	106	21%
Spontaneous vaginal delivery	155	31%
Elective caesarean-section	32	6%
Induction	171	34%
Other	5	1%
Unknown	32	6%

Figure 1.7: Actual mode of delivery by centre

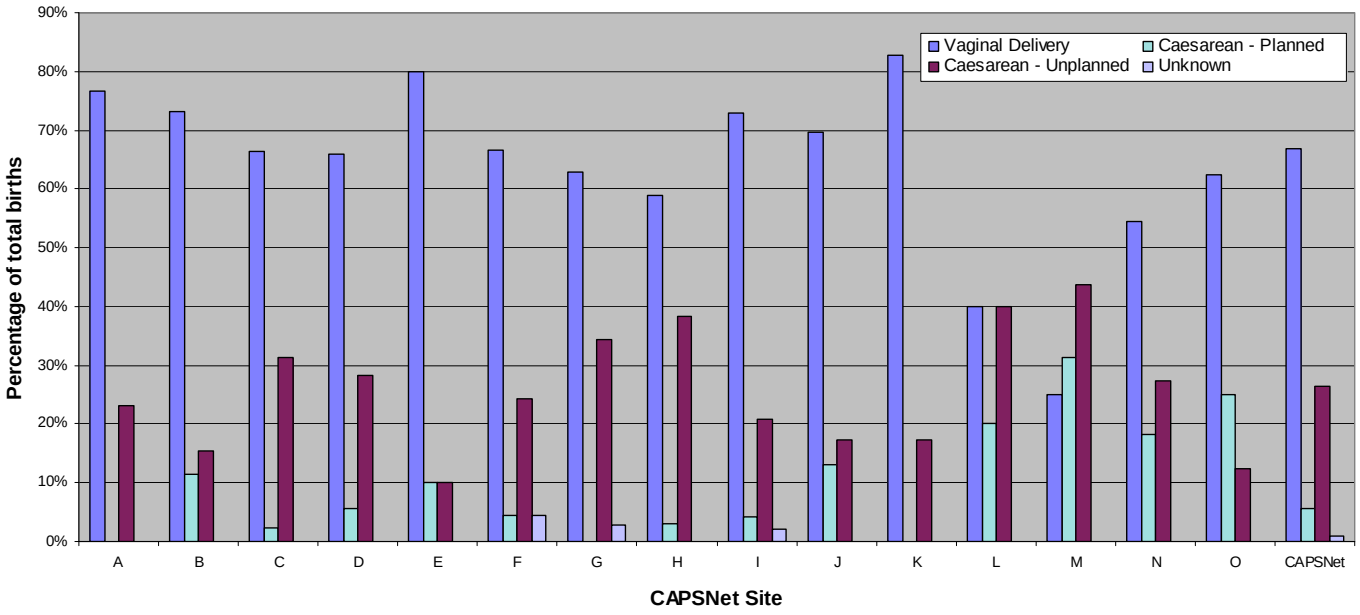


Figure 1.8a: Pre-operative bowel protection

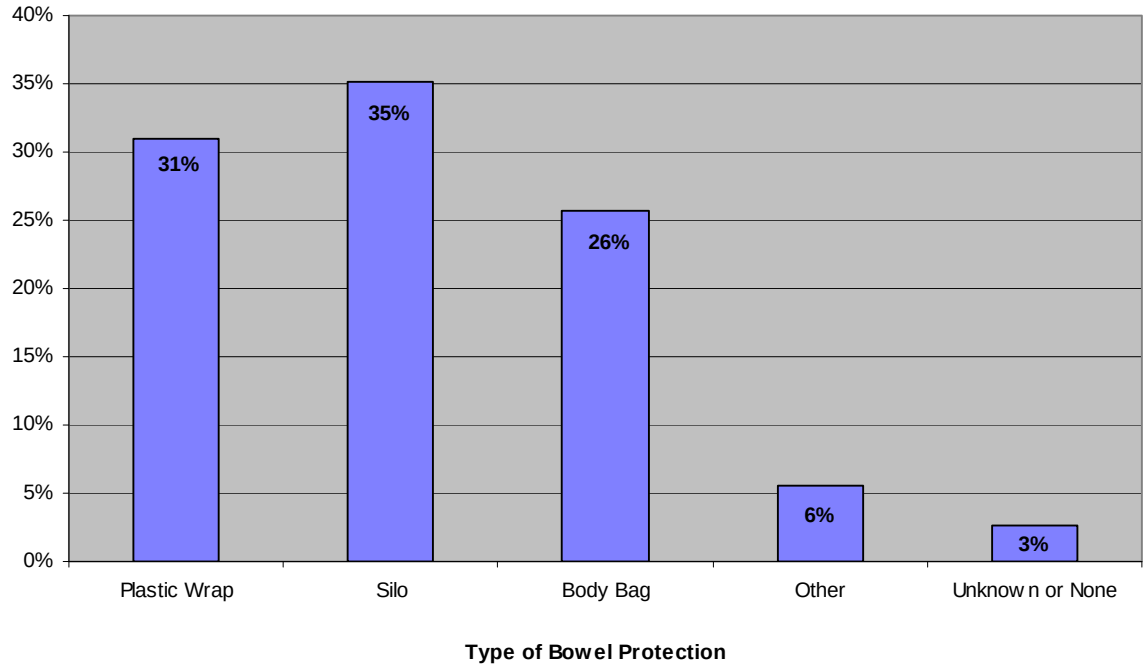


Figure 1.8b: Time elapsed until pre-operative bowel protection

	n	%
≤ 1 hour	356	71%
1-4 hours	92	18%
> 4 hours	32	6%
Unknown	19	4%
No bowel protection	2	1%

Figure 1.9a: Timing of gastroschisis closure

The denominator in this figure is the number of cases in which surgery was performed (i.e., *n*=497).

	n	%
< 6 hours	251	51%
6-12 hours	51	10%
12-24 hours	16	3%
> 24 hours	173	35%
Unknown	6	1%

Figure 1.9b: Surgeon's treatment intent by centre

The denominator in this figure is the number of cases in which surgery was performed (i.e., *n*= 497). Across all centres, the surgeon's treatment intent was to perform an urgent primary closure in 58% (*n*=292) of cases, and elective primary closure (enabled by a silo) in 39 % (*n*= 97). In the remaining 2% (*n*=8) of cases, the surgeon's treatment intent is unknown.

The following figure provides a breakdown of treatment intent by site.

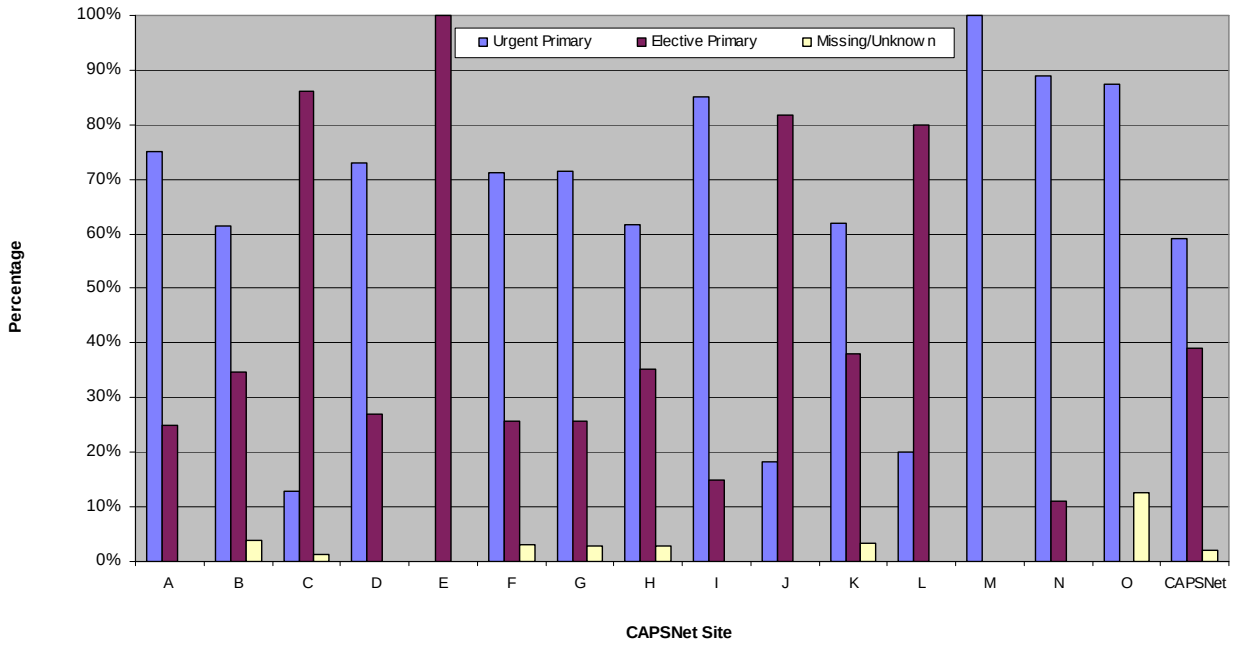


Figure 1.10a: Method of surgical closure

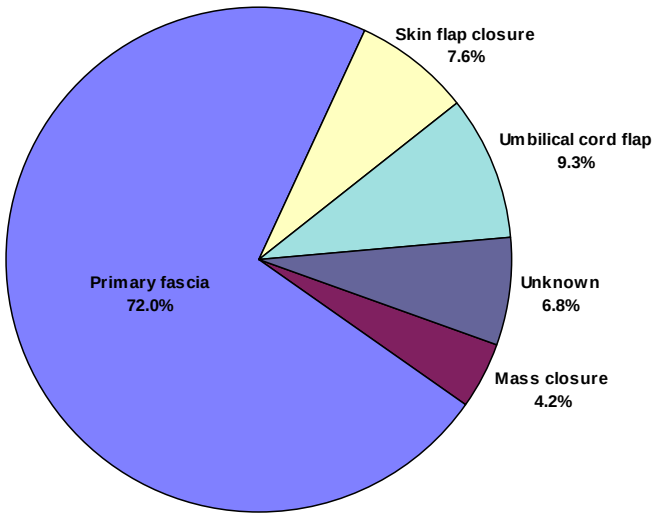


Figure 1.10b: Operative success

Of 497 primary operations, 80.3% were recorded as successful. 19.7% were reported as failed initial closures for the following reasons:

	n	%
Bowel not reducible	10	10.2%
Bowel would reduce, but IPP or PIP too high to close	62	63.3%
Bowel would reduce, but seemed too tight to close	18	18.4%
Unknown	8	8.2%

Figure 1.11a: Proportion and severity of bowel injury

The following variables are collected by the consulting surgeon for all GS patients at two periods of time: a) at the time of the surgeon's first assessment of the patient's bowel following birth, and b) during the first surgical attempt to correct the defect.

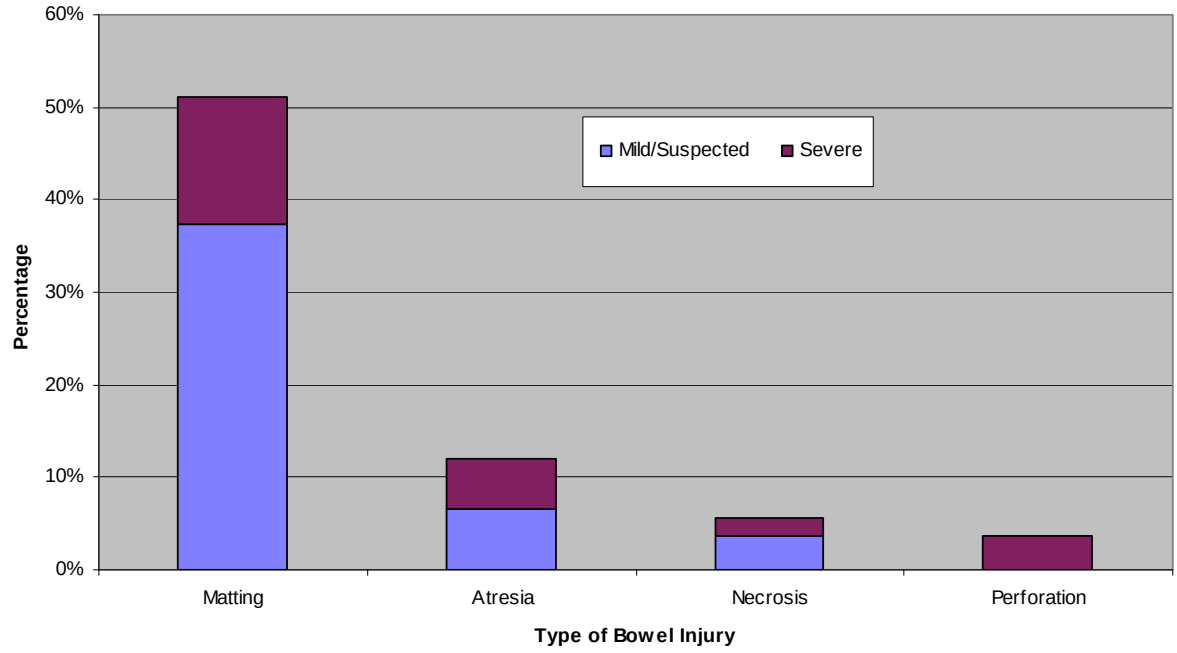


Figure 1.11b: Gastroschisis Prognostic Score (GPS) risk group by centre volume

The Gastroschisis Prognostic Score (GPS) was developed by Cowan et al[1] using CAPSNet data collected at the time of the surgeon's first visual assessment of the bowel. The bowel injury variables (matting, atresia, necrosis, perforation) were weighted based on a regression analysis, thus creating the GPS, which was validated using the CAPSNet database (patients born May 2005 – May 2009; see Table 1.11b).

[1] Cowan KN, Puligandla PS, Laberge JM, Skarsgard ED, Bouchard S, Yanchar N, Kim P, Lee SK, McMillan D, von Dadelszen P, and the Canadian Pediatric Surgery Network. The Gastroschisis Prognostic Score: Outcome prediction in Gastroschisis. *Pediatr* (submitted).

Table 1.11b	High Risk (GPS ≥ 2)	Low Risk	P Value
Cohort 1 (n=225):	(n=51)	(n=174)	
Length of stay (median days)	63	36	0.001
Days to 1st Enteral Feed (median)	19	14	0.002
Days on TPN (median)	41	27	0.0001
Complications	0.8 ± 1.1	0.5 ± 0.7	0.489
Cohort 2 (n=97):	(n=29)	(n=68)	
Length of stay (median days)	73	31	0.001
Days to 1st Enteral Feed (median)	19	12	0.001
Days on TPN (median)	50	26	0.0001
Complications	1.0 ± 0.8	0.5 ± 0.8	0.001
Cohort 3 (n=322):	(n=80)	(n=242)	
Length of stay (median days)	63	34	0.0001
Days to 1st Enteral Feed (median)	19	13	0.0001
Days on TPN (median)	47	27	0.0001
Complications	0.9 ± 1.0	0.5 ± 0.7	0.006

Risk stratified non-mortality outcome prediction by the Gastroschisis Prognostic Score in the derivation (Cohort 1) and validation (Cohorts 2, 3) patient groups. Table provided courtesy of Cowan et al (submitted manuscript).

The GPS risk group is assigned based on the composite GPS score. For scores of <2, the patient is considered low risk. Patients are considered at high risk if the score is ≥ 2; scores of 2 or 3 indicate a high risk of morbidity, whereas scores ≥ 4 indicate a high risk of mortality. The following table uses the current GS dataset to demonstrate the proportion of GS cases assigned to each risk category grouped by centre volume.

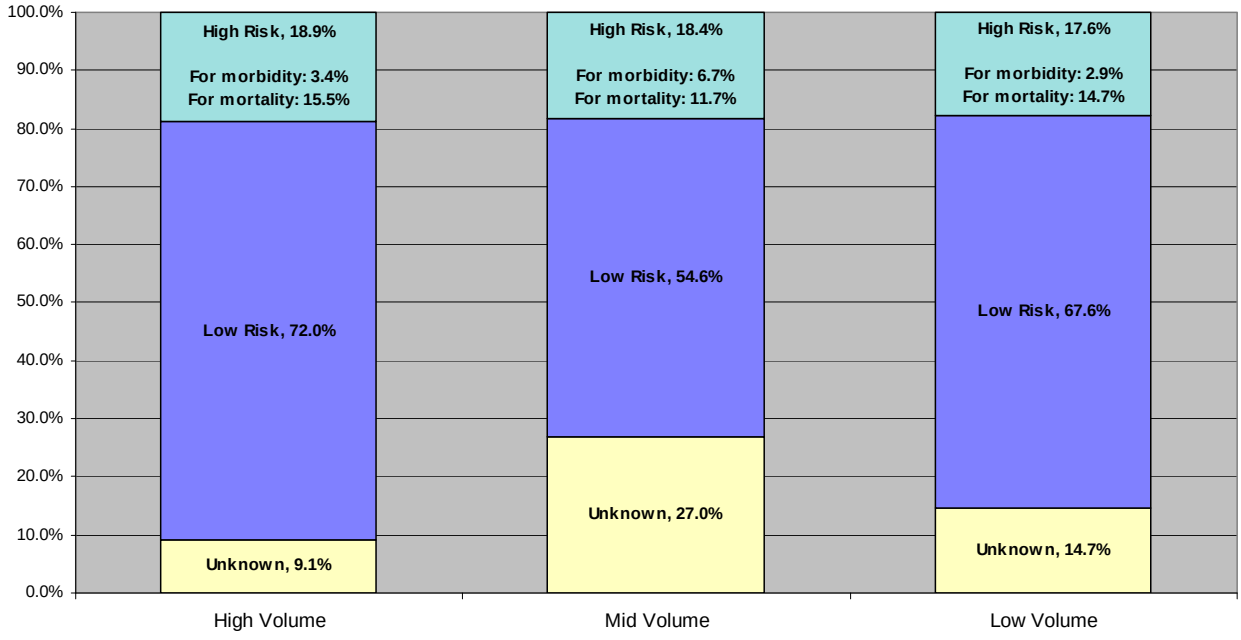


Figure 1.12: Selected neonatal complications

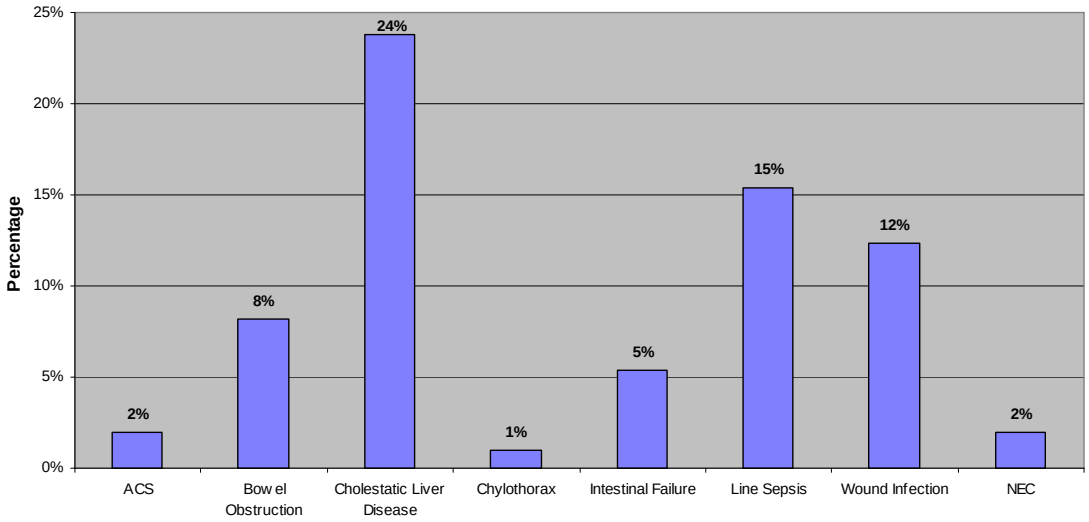


Figure 1.13a: Selected neonatal outcomes

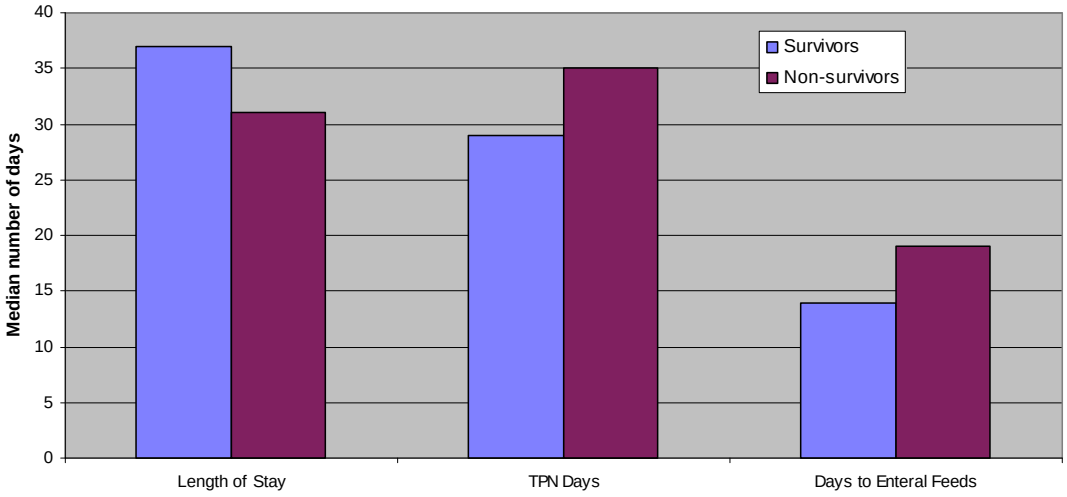


Table 1.13b: Selected neonatal outcomes

	Survivors (*n* = 486)			Non-survivors (*n* =16)		
	Median	Mean	Range	Median	Mean	Range
Length of stay (days)	37	56.4	1*-604	31	70	1-272
TPN days	29	43.4	6-604	35	62.7	2-207
Days to enteral feeds	14	17.3	2-97	19	32.5	1-86

*Five infants have a length of stay of 1 day because they were discharged to another hospital for ongoing care and no further data was available.

Congenital Diaphragmatic Hernia Descriptive Analyses

Table 2.0: Patient population

CDH complete live births ***n* = 269**	
Overall survival rate	81.4%
Inborn rate	57.6 %
No prenatal diagnosis	32.3%
Mean birth weight	3071.2 g
Proportion of males	56.9%
Isolated defect	61.7%
Proportion requiring ECMO	6.7%
Proportion with left-sided defect	71.0%
SNAP-II* scores	
Mean – survivors (*n*= 219)	13.2
Mean – non-survivors (*n*= 50)	32.6
Median – survivors (*n*=219)	12
Median – non-survivors (*n*=50)	32

* If more than 65% of the SNAP score data elements were missing, then a baby's SNAP-II score could be computed and thus have been excluded from any analyses of SNAP-II scores.

Table 2.1: Survival by centre volume

Table shows the survival rate grouped by centre volume. *Low volume* centres are those that see on average <1 CDH cases per year, *high volume* centres see an average ≥ 5 CDH cases per year; and *mid volume* centres includes all those in between.

	Count (*n*)	Survival (%)	SNAP-II Median	SNAP-II Range
High volume (4 centres)	172	81.3%	14	0-77
Mid volume (6 centres)	74	83.8%	16	0-44
Low volume (4centres)	20	70.0%	16	0-59
CAPSNet	269	81.4%	16	0-77

* Two centres have been excluded from site-level analyses for CDH: one due to concerns of data accuracy, and another because there have been no cases of CDH at that centre.

Figure 2.2: Maximum lung-head ratio reported on antenatal ultrasound of fetuses with an antenatal diagnosis

Measurements are recorded on up to four ultrasounds taken at varying time points:

1. First ultrasound taken at the tertiary CAPSNet centre;
2. Last ultrasound taken between 23+0 and 27+6 weeks;
3. Last ultrasound taken between 28+0 and 32+6 weeks; and
4. Last ultrasound before delivery

The data presented here reflects the worst (i.e., greatest) measurement reported on any one of the above ultrasounds. *Not measured* indicates that at least one ultrasound was taken, but the specific variable interest was not measured; *No ultrasound* indicates that there were no reported ultrasounds.

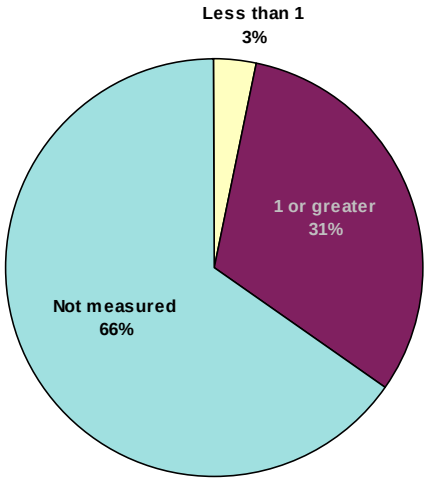


Figure 2.3: Early vs. late antenatal diagnosis

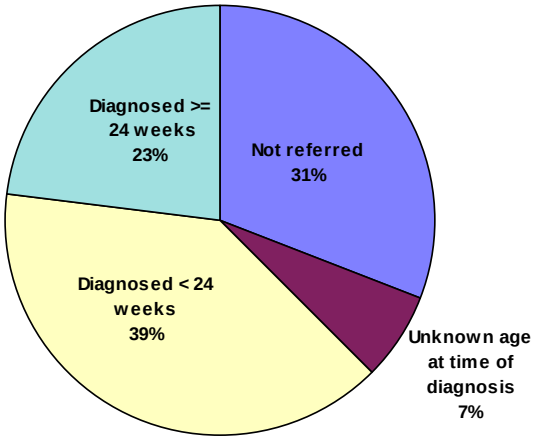


Figure 2.4: Gestational age at birth

Gestational age is in complete weeks and calculated according to the CNN algorithm, which considers both pediatric and obstetric estimates.

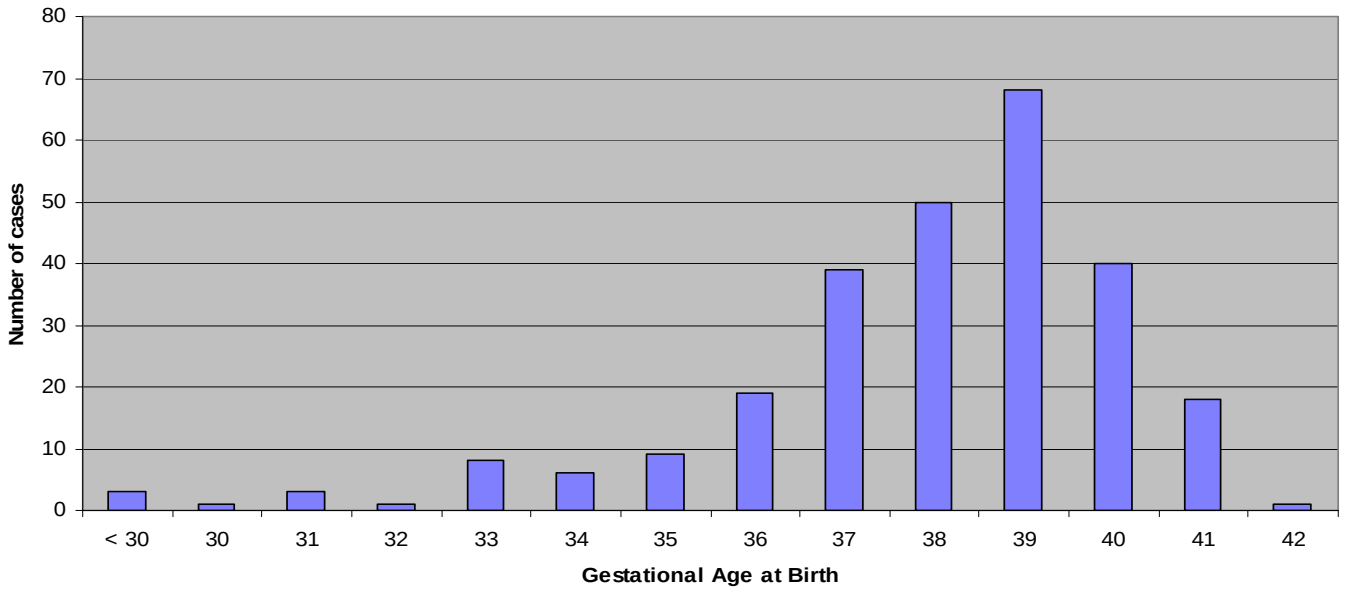


Figure 2.5: Mode of delivery by centre

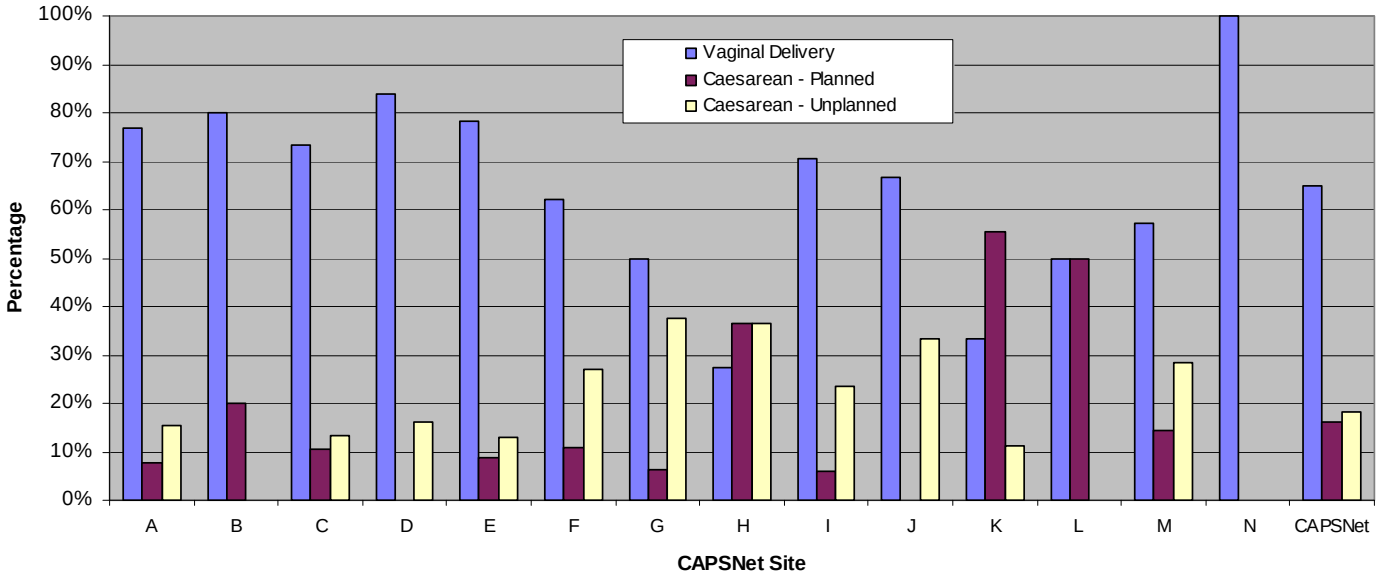


Figure 2.6: Mean age at surgical repair by centre

The denominator in this figure indicates only those cases in which surgery was performed (i.e., *n* =237).

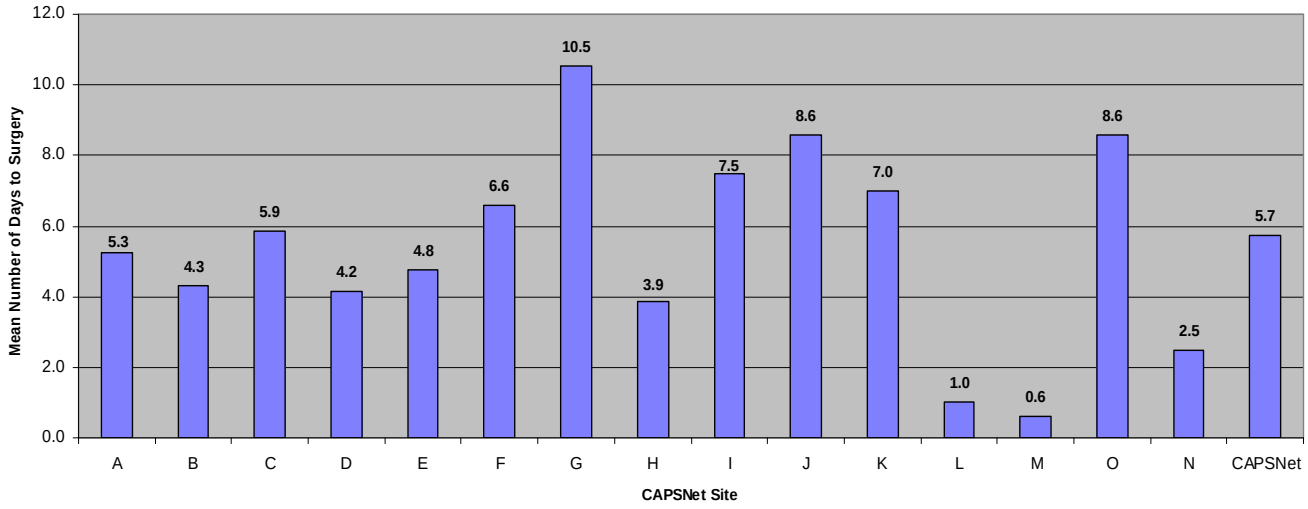


Figure 2.7: Method of surgical closure

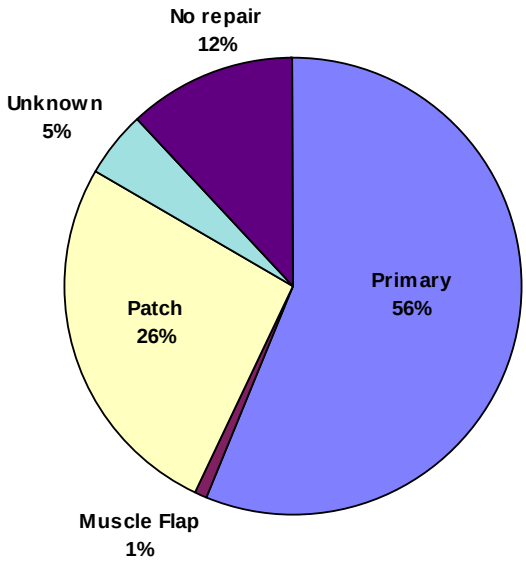


Figure 2.8: Selected neonatal complications

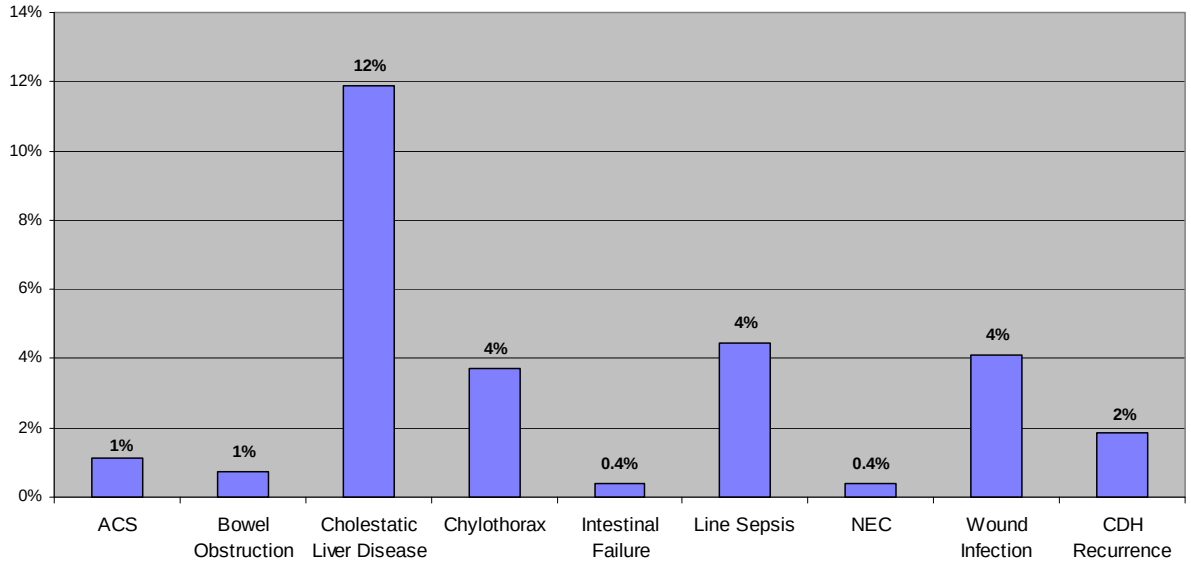


Figure 2.9a: Selected neonatal outcomes

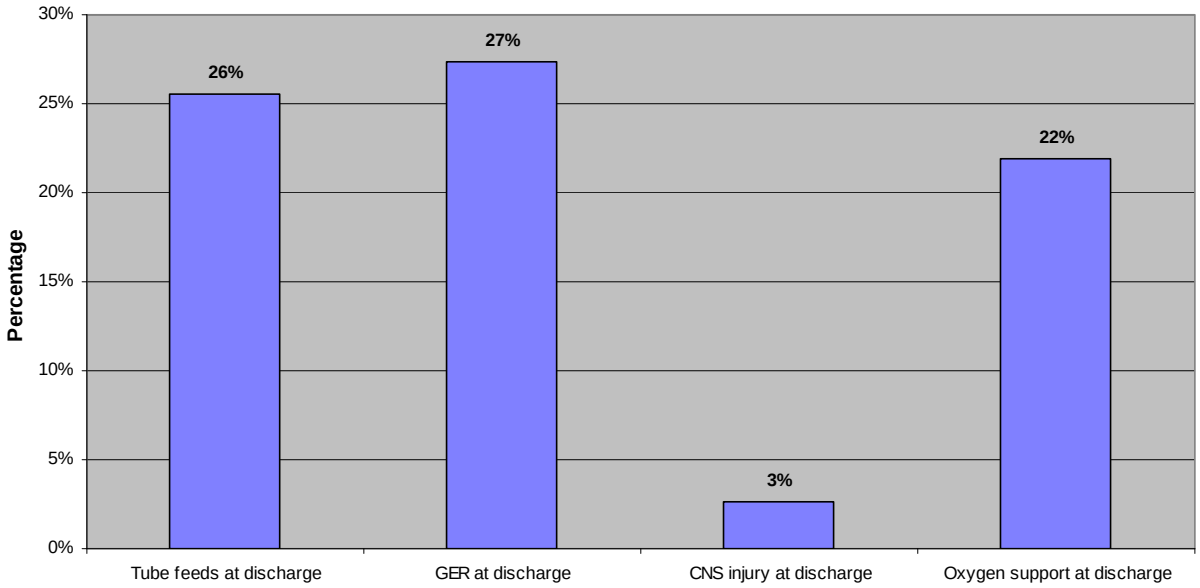


Table 2.9b: Selected neonatal outcomes

	Survivors (*n* = 219)			Non-survivors (*n* = 50)		
	Median	Mean	Range	Median	Mean	Range
Length of stay (days)	29	39.6	5-341	10	18.8	1-125
TPN days	17	21.8	3-126	19	23.1	2-59
Days to enteral feeds	10	11.5	1-64	18	20.7	4-33
Ventilation days (if required)	9.5	12.6	1-87	9	16.9	1-86
ECMO days (if required)	10	12.4	2-31	14	11.9	1-29
Supplemental O_2 days (if required)	4	7.5	1-341			

Appendix I: Definitions

CAPSNet Population Definition: The CAPSNet database captures:

- All cases of confirmed or suspect Congenital Diaphragmatic Hernia (CDH) and Gastroschisis (GS) diagnosed antenatally and referred to one of the participating tertiary perinatal centres for ongoing prenatal care of the fetus, regardless of the final outcome of pregnancy; and
- All cases of CDH and GS diagnosed postnatally up to 7 days of life who were either born at or transferred after birth to one of the participating centres.

***SNAP-II (Score for Neonatal Acute Physiology*)**: is an illness severity scoring system which stratifies patients according to cumulative severity of physiologic derangement in several organ systems within the first 12 hrs of admission to the intensive care unit. This scoring system has been shown to be highly predictive of neonatal mortality and to be correlated with other indicators of illness severity including therapeutic intensity, physician estimates of mortality risk, length of stay, and nursing workload. SNAP provides a numeric score that reflects how sick each infant is. The scoring system is modeled after similar adult and pediatric scores, which are already widely in use. For more information, see: D K. Richardson et al . SNAP-II and SNAPPE-II: Simplified newborn illness severity and mortality risk scores. *J Pediatr* 2001; 138: 92-100

Gastroschisis Bowel Dilation: refers to the maximum internal (i.e. endoluminal) diameter measured from inner wall to inner wall along the short axis of the bowel loop at the most dilated segment of the extruded bowel in millimeters (mm).

Gastroschisis Bowel Wall Thickening: refers to the maximum bowel wall thickness measured from the inner wall to the outer wall of the thickest portion of the small bowel in millimeters (mm).

CDH Lung-Head Ratio: refers to the maximum recorded lung to head ratio measured from a transverse axial image through the chest demonstrating the four-chamber view of the heart with associated shift to the contralateral side. The contralateral lung is observed and the longest diameter measured (in millimeters). A line perpendicular to the first is then drawn and measured again in millimeters (mm).

Appendix II: List of Publications, Presentations and Ongoing Projects

Publications

2010

Brindle ME, Ma IWY, Skarsgard ED. Impact of target blood gases on outcome in congenital diaphragmatic hernia (CDH). *Eur J Pediatr Surg.* DOI: 10.1055/s-0030-1253405

Mills JA, Lin Y, MacNab YC, Skarsgard ED and the Canadian Pediatric Surgery Network. Does overnight birth influence treatment or outcome in Congenital Diaphragmatic Hernia? *Am J of Perinatol*. 2010; 27 (1): 91-95.

Mills J, Lin Y, MacNab Y, Skarsgard ED JM and the Canadian Pediatric Surgery Network. Perinatal predictors of outcome in gastroschisis. *J Perinatol*. DOI: 10.1038/jp.2010.43

2009

Boutros J, Regier M, Skarsgard ED and the Canadian Pediatric Surgery Network. Is timing everything? The influence of gestational age and intended and actual route of delivery on treatment and outcome in Gastroschisis. *J Pediatr Surg.* 2009; 44:912-7.

Grushka JR, Laberge JM, Puligandla P, Skarsgard ED and the Canadian Pediatric Surgery Network. The effect of hospital case volume on outcome in Congenital Diaphragmatic Hernia. *J Pediatr Surg*. 2009; 44:873-6.

2008

Skarsgard ED, Claydon J, Bouchard S, Kim P, Lee SK, Laberge JM, McMillan D, von Dadelszen P, Yanchar N and the Canadian Pediatric Surgery Network. Canadian Pediatric Surgical Network: a population-based pediatric surgery network and database for analyzing surgical birth defects: The first 100 cases of gastroschisis. *J Pediatr Surg*. 2008; 43(1):30-4.

Baird R, MacNab YC, Skarsgard ED, and the Canadian Pediatric Surgery Network. Mortality prediction in congenital diaphragmatic hernia. *J Pediatr Surg*. 2008;43(5):783-7.

Weinsheimer RL, Yanchar NL, Bouchard S, Kim P, Laberge JM, Skarsgard ED, Lee SK, McMillan D, von Dadelszen P, and the Canadian Pediatric Surgery Network. Gastroschisis closure – does method really matter? *J Pediatr Surg*. 2008;43(5):874-8.

Weinsheimer RL, Yanchar NL and the Canadian Pediatric Surgical Network. Impact of maternal substance abuse and smoking on children with Gastroschisis. *J Pediatr Surg*. 2008; 43(5):879-83.

2006

Skarsgard E. Networks in Canadian pediatric surgery: Time to get connected. *Paediatr Child Health*. 2006; 11(1):15-18.

Publications in Press

Brindle M, Oddone E, Skarsgard ED and the Canadian Pediatric Surgery Network. Need for patch repair influences outcome in Congenital Diaphragmatic Hernia. *J Pediatr Surg* (in press).

Safavi A, Lin Y, Skarsgard ED and the Canadian Pediatric Surgery Network. Perinatal management of congenital diaphragmatic hernia: When and how should babies be delivered? *J Pediatr Surg* (in press).

Manuscripts Submitted

Baird R, Puligandla P, Skarsgard ED, Laberge JM, and the Canadian Pediatric Surgery Network. The use of antibiotics in the management of Gastroschisis- Canadian practice patterns. *J Pediatr Surg* (submitted).

Cowan KN, Puligandla PS, Laberge JM, Skarsgard ED, Bouchard S, Yanchar N, Kim P, Lee SK, McMillan D, von Dadelszen P, and the Canadian Pediatric Surgery Network. The Gastroschisis Prognostic Score: Outcome prediction in Gastroschisis. *Pediatr* (submitted).

Jansen LA, Lin Y, MacNab YC, Skarsgard ED and the Canadian Pediatric Surgery Network. Pre-closure fluid resuscitation influences outcome in Gastroschisis. *J Perinatol (submitted).*

Baird R, Eeson G, Safavi A, Puligandla P, Laberge JM, Skarsgard ED and the Canadian Pediatric Surgery Network. Institutional Practice and Outcome Variation in the Management Of Congenital Diaphragmatic Hernia and Gastroschisis in Canada: A report from the Canadian Pediatric Surgery Network (CAPSNet) (submitted).

Podium Presentations:

2010

Laberge JM and the Canadian Pediatric Surgery Network. Congenital Diaphragmatic Hernia: Results and factors affecting outcomes in the Canadian Pediatric Surgery Network. To be presented at the 3rd World Congress of Pediatric Surgery; New Delhi, India. October 21-24, 2010.

Eeson G, Safavi A, Skarsgard E, and the Canadian Pediatric Surgery Network. Practice and outcome variation in CDH in Canada. To be presented at the 42nd annual meeting of the Canadian Pediatric Surgery Association; Saskatoon, Saskatchewan. September 23-28, 2010.

Nasr A, Langer JC and the Canadian Pediatric Surgery Network. Influence of location of delivery on outcome in neonates with congenital diaphragmatic hernia. To be presented at the 42nd annual meeting of the Canadian Pediatric Surgery Association; Saskatoon, Saskatchewan. September 23-28, 2010.

Baird R, Puligandla, Laberge JM and the Canadian Pediatric Surgery Network. Practice and outcome variation in Gastroschisis in Canada. To be presented at the 42nd annual meeting of the Canadian Pediatric Surgery Association; Saskatoon, Saskatchewan. September 23-28, 2010.

Safavi A, Lin Y, Skarsgard ED and the Canadian Pediatric Surgery Network. Perinatal management of congenital diaphragmatic hernia: When and how should babies be delivered? Presented at the 43rd Annual Meeting of the Pacific Association of Pediatric Surgeons; Kobe, Japan. May 23-27, 2010.

Wilson D and the Canadian Pediatric Surgery Network. The Canadian Pediatric Surgery Network (CAPSNet): Targeting national outcome improvement for structural birth defects through collaborative knowledge synthesis and evidence-based practice change. Presented at the 18th Annual Western Perinatal Research Meeting; Banff, Alberta. February 11-14, 2010.

2009

Cowan KN, Puligandla PS, Bütter A, Skarsgard ED, Laberge JM and the Canadian Pediatric Surgery Network. The Gastroschisis Bowel Score Predicts Outcome in Gastroschisis. Presented at the 4th Annual Academic Surgical Congress; Fort Myers, Florida. Feb 2009.

Baird R, Skarsgard ED, Laberge J-M, Puligandla PS, and the Canadian Pediatric Surgical Network. The Use of Antibiotics in the Management of Gastroschisis-Canadian Practice Patterns. Presented at the 40th Annual Meeting of the American Pediatric Surgical Association; Fajardo, Puerto Rico. May 28-30, 2009

Brindle M, Ma IW, Skarsgard ED and The Canadian Pediatric Surgery Network. Impact of Target Blood Gases on Outcome in Congenital Diaphragmatic Hernia (CDH). Presented at the 40th Annual Meeting of the American Pediatric Surgical Association; Fajardo, Puerto Rico. May 28-30, 2009

Brindle M, Oddone E, Skarsgard ED and The Canadian Pediatric Surgery Network. Need for Patch Repair Influences Outcome in Congenital Diaphragmatic Hernia (CDH). Presented at the 40th Annual Meeting of the American Pediatric Surgical Association; Fajardo, Puerto Rico. May 28-30, 2009

Mills J, Lin Y, MacNab Y, Skarsgard ED JM and the Canadian Pediatric Surgery Network. Perinatal Predictors of Outcome in Gastroschisis. Presented at the 40th Annual Meeting of the American Pediatric Surgical Association; Fajardo, Puerto Rico. May 28-30, 2009

2008

Mills J, MacNab Y, Skarsgard ED and the Canadian Pediatric Surgery Network. Does Overnight Birth Time Influence Surgical Management of Outcome in Neonates with Gastroschisis? Presented at the 79th Annual Meeting of the Pacific Coast Surgical Association; San Diego, California. Feb 16, 2008.

Brindle M, Mills J,Lin Y, MacNab Y, Skarsgard ED and the Canadian Pediatric Surgery Network. Influence of Birth Time on Surgical Management and Outcomes of Neonates with Gastroschisis. Presented at the 2008 Joint Meeting of the Pediatric Academic Societies and the Asian Society for Pediatric Research. May 2008.

Pressey TP, Skarsgard ED, Claydon J, von Dadelszen P, and the Canadian Pediatric Surgery Network. Antenatal Ultrasound Detection of Abnormal Amniotic Fluid Volume Predicts Adverse Perinatal Outcomes. Presented at the 14th International Conference on Prenatal Diagnosis and Therapy. June 2008.

Laberge JM, Skarsgard ED and the Canadian Pediatric Surgical Network. CAPSNET: The Canadian Pediatric Surgical Network. Presented at the Pan-African Pediatric Surgical Association Meeting; Ghana, Africa: August 14-22, 2008.

Laberge JM and the Canadian Pediatric Surgery Network. Contemporary outcome of CDH: Results from the Canadian Pediatric Surgery Network (CAPSNet). Presented at the International Fetal Medical and Surgical Society (IFMSS), Athens, Greece, September 11-14, 2008.

Boutros J, Regier M, Skarsgard ED and the Canadian Pediatric Surgery Network. Is timing everything? The influence of gestational age and intended and actual route of delivery on treatment & outcome in Gastroschisis. Presented at the 2008 Annual Meeting of the Canadian Association of Pediatric Surgeons. September 2008.

Grushka JR, Laberge JM, Puligandla P, Skarsgard ED and the Canadian Pediatric Surgery Network. The effect of hospital case volume on outcome in Congenital Diaphragmatic Hernia. Presented at the 2008 Annual Meeting of the Canadian Association of Pediatric Surgeons. September 2008.

2007

Baird R, MacNab YC, Skarsgard ED, and the Canadian Pediatric Surgery Network. Mortality prediction in congenital diaphragmatic hernia. Presented at the 2007 Annual Canadian Association of Pediatric Surgeons Meeting; St. John's, Newfoundland. Aug 25, 2007.

Skarsgard ED, Claydon J, Bouchard S, Kim P, Lee SK, Laberge JM, McMillan D, von Dadelszen P, Yanchar N and the Canadian Pediatric Surgery Network. Canadian Pediatric Surgical Network: a population-based pediatric surgery network and database for analyzing surgical birth defects: The first 100 cases of gastroschisis. Presented at the 38th Annual Meeting of the American Pediatric Surgical Association. May 2007. Also presented at the 26th Annual Meeting of the International Fetal Medicine and Surgery Society. Apr 30, 2007.

Pressey TP, Skarsgard ED, Claydon J, von Dadelszen P and the Canadian Pediatric Surgery Network. Ultrasound Predictors of Outcome in Antenatally Diagnosed Gastroschisis. Presented at the 26th Annual Meeting of the International Fetal Medicine and Surgery Society. Apr 30, 2007.

Weinsheimer RL, Yanchar NL, Bouchard S, Kim P, Laberge JM, Skarsgard ED, Lee SK, McMillan D, von Dadelszen P, and the Canadian Pediatric Surgery Network. Gastroschisis Closure – Does Method Really Matter? Presented at the 2007 Annual Canadian Association of Pediatric Surgeons Meeting; St. John's, Newfoundland. Aug 25, 2007.

Weinsheimer RL, Yanchar NL and the Canadian Pediatric Surgical Network. Impact of Maternal Substance Abuse and Smoking on Children with Gastroschisis. Presented at the 2007 Annual Canadian Association of Pediatric Surgeons Meeting; St. John's, Newfoundland. Aug 25, 2007.

Poster Presentations:

2010

Jansen L, Lin Y, MacNab Y, Skarsgard ED, Puligandla PS and the Canadian Pediatric Surgery Network. Pre-closure fluid resuscitation influences outcome in gastroschisis. Presented at the 41st Annual Meeting of the American Pediatric Surgical Association; Orlando, Florida. May 16-19, 2010.

Cowan KN, Puligandla PS, Laberge JM, Skarsgard ED, Butter A, Bouchard S, Yanchar N, Kim P, Lee SK, McMillan D, von Dadelszen P and the Canadian Pediatric Surgery Network. The gastroschisis bowel score predicts outcome in gastroschisis. Poster presented at the 2010 Annual Meeting of the Pediatric Academic Societies; Vancouver BC. May 1-4, 2010.

Gover A, Albersheim S, Sherlock R, Claydon J, Butterworth S, Kuzeljevic B and the Canadian Pediatric Surgery Network. Does a multidisciplinary team improve outcome of gastroschisis patients? Poster presented at the 2010 Annual Meeting of the Pediatric Academic Societies; Vancouver BC. May 1-4, 2010.

Gover A, Albersheim S, Sherlock R, Claydon J, Butterworth S, Kuzeljevic B and the Canadian Pediatric Surgery Network. Early stratification of gastroschisis patients: Are we there yet? Poster presented at the 2010 Annual Meeting of the Pediatric Academic Societies; Vancouver BC. May 1-4, 2010.

2009

Grushka JR, Laberge JM, Puligandla P, Skarsgard ED and the Canadian Pediatric Surgery Network. The Effect of Prenatal Diagnosis on the Contemporary Outcome of CDH. To be presented at the 40th Annual Meeting of the American Pediatric Surgical Association; Fajardo, Puerto Rico. May 28-30, 2009

Butterworth SA, Brant R, Skarsgard ED and the Canadian Pediatric Surgery Network. Is the need for fascial defect extension a predictor of adverse outcome in gastroschisis? Presented at the 41st Annual meeting of the Canadian Pediatric Surgery Association; Halifax, Nova Scotia. October 1-4, 2009.

Additional ongoing projects

Dr. Javed Akthar and Dr. David Price: *Analysis of atypical perinatal events in gastroschisis*

Dr. Ravi Bhargava, Dr Radha Chari and Dr. Gordon Lees: *Predication of outcome of fetal CDH by lung to liver signal intensity ratios by fetal MRI*

Dr. Ioana Bratu: *The use and outcome of paralysis for management of gastroschisis with silo*

Dr. Mary Brindle, Dr Helene Flageole and Dr Paul Wales: *Maternal features associated with the development of gastroschisis and its outcome in the Canadian population*

Dr. Sonia Butterworth and Dr. Erik Skarsgard: *Preoperative predictors of unfavourable outcome in CDH-comparing the utility of delta SNAP-II, ventilation mode and persistent ductal saturation gradient*.

Dr. Oisin Coll and Dr. Erik Skarsgard: *Antenatal predictors of bowel injury in gastroschisis*

Dr. Aideen Moore, Dr Greg Ryan, Dr. Malikah Al-Farak, Dr. Ahmed Nasr and Dr. Sharifa Himidan: *Are we really population-based? Comparison of CAPSNet and FAN data.*

Dr. Arash Safavi, Dr Anne Synnes and Dr Erik Skarsgard: *Long-term follow-up and outcomes of infants born with CDH in Canada.*

Dr. Rebecca Sherlock, Dr Phillippe Chessex, and Dr Erik Skarsgard: *Does TPN photoprotection reduce TPN cholestatsis in gastroschisis patients?*

Appendix III: Database Revision: Ultrasound Screens