Child Health Network
Perinatal Pilot Project Report

Prepared by
Sten Ardal & Paul Lee,
Central East Health Information Partnership

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Executive Summary

The Child Health Network (CHN) links providers of maternal, newborn, and paediatric care, and is dedicated to the creation of a regional health system that will improve the quality of care for mothers, infants, children and youth in the Greater Toronto Area. For newborns, gestational age has been used as the benchmark to determine optimal Levels of Care and the distribution of services, such as neonatal intensive care units. The CHN **Perinatal Pilot Working Group** initiated the Perinatal Pilot Project to monitor Levels of Care objectives and consistency with the network's Clinical Scope of Maternal and Newborn Services (2001).

CHN acute care hospitals provided records for all newborns and transfers discharged in fiscal years 1999 to 2001 who met specific criteria. This resulted in over 17,000 records, with two-thirds being born at 36 weeks or less, and the remainder being infants transferred within the first few months following birth. This represents about 10% of all births at CHN hospitals during this period.

Results show a strong relationship between hospital Level of Care and gestational age, with most births occurring at appropriately designated hospitals. However, about a quarter of neonates born under 32 weeks are delivered at Level II facilities, where Level III may be considered optimal. Patterns of movement between hospitals were considered, and show both the movement of neonates to higher levels of care, and "retro" transfers to lower levels of care. While it was not possible to track individual cases, the high level of transfer activity suggests a coordinated flow of patients within the network. Information was also analyzed on interventions and outcomes. This analysis revealed strong and consistent evidence that hospitals with different Levels of Care designations are managing clinically different patient populations.

In conclusion, the Perinatal Pilot Project has been successful in describing the distribution of CHN perinatal activity, and testing the value of identified data elements. Recommendations are provided that support continued data collection and analysis, with advice on how to enhance the quality and utility of CHN perinatal data.

Recommendations

1. ***The CHN should continue to work with the data elements collected in the Perinatal Pilot Project to monitor trends and track system performance. These elements should be reviewed and modified as necessary to ensure that they address specific quality of care, institution, and network performance objectives.***

2. ***The CHN should develop a data capture method that provides on-going feedback to submitters as a way to promote quality and completeness. Quarterly submission and reporting is suggested.***

3. ***The CHN should work to build a Perinatal data set that allows individuals to be liked across episodes of care, and allows linkage with maternal data elements.***

Background

The Child Health Network (CHN) approached the Central East Health Information Partnership in January 2001 to seek assistance with the analysis of information being captured at the network's 18 acute care hospitals. In 1999 the CHN had identified a number of data elements to be captured at each of these member institutions. It was intended that this information could be used to monitor the success of the network in meeting some key objectives. The **Perinatal Pilot Working Group** was given responsibility to oversee the resulting project.

The Child Health Network links providers of maternal, newborn, and paediatric care, and is dedicated to the creation of a regional health system that will improve the quality of care for mothers, infants, children and youth in the Greater Toronto Area. Directives from Ontario's Health Services Restructuring Commission designated the maximum level of care to be provided at hospitals in the Greater Toronto Area (GTA). For newborns, gestational age was used as the benchmark to determine the distribution of services, such as neonatal intensive care units. The following matrix shows the levels of care designation for perinatal services in the CHN. This model is more fully described in the ***Clinical Scope of Maternal and Newborn Services (2001).***

Table 1: *The Levels of Care Matrix.*

Gestational Age → (weeks) **↓ Level of Care**	<32	32-36	36+
III			
II/II+			
I			

Optimal Site for Care	
Activity Areas To Be Monitored: "Watch Zone"	

Service providers affiliated with the CHN are organized into clusters to ensure coordinated local response to patient needs within defined geographic areas. It is expected that most transfers between institutions

would be within a cluster. Transfers should also be consistent with identified characteristics, with higher needs patients being transferred to higher level of care institutions. The following table lists the 18 hospitals considered in this study, and shows their designated level and cluster affiliation.

Table 2: *Cluster Designations and Levels of Care for CHN Hospitals.*

Cluster	Hospital Corporation	Level(s)
Central	Humber River Regional Hospital	II
	St. Joseph's Health Centre	II
	St. Michael's Hospital	II
	Toronto East General Hospital	II
	Mount Sinai Hospital	III
	The Hospital For Sick Children	III
East	Lakeridge Health Corporation	I/II+
	Rouge Valley Health System	I/II+
	Markham Stouffville Hospital	II
	The Scarborough Hospital (General & Grace Sites)	II
North	Southlake Regional Health Centre	II
	York Central Hospital	II
	North York General Hospital	II+
	Sunnybrook And Womens Health Sciences Centre	III
West	William Osler Health Centre	I/II/II+
	Halton Health Services	II
	Trillium Health Centre	II
	The Credit Valley Hospital	II+

There are two main reasons for this study. In the years since the formation of the CHN there has been considerable effort expended by member organizations to improve the quality, accessibility, and coordination of care. It was felt that an evaluation was required, and the Perinatal Pilot Project was seen as a "manageable" way to start this process. The second reason stems from the need to monitor and seek opportunities for improvement in Perinatal care. The study is designed to shed some light on practice patterns and outcomes with the network. Accordingly, this report is structured to address the following questions:

1. ***Is the distribution of higher risk neonatal births consistent with hospital designations?***

2. ***Is the movement of higher risk neonates consistent with the structure of the network?***

3. ***Are the interventions provided consistent with patient characteristics and hospital designations?***

While definitive answers to these questions are unlikely, it is expected that this will frame the inquiry in a way that will create opportunities for the CHN to pursue ongoing monitoring, evaluation and interpretation of patient outcomes.

Methods

Three types of information were considered to address the questions posed by the Perinatal Pilot Working Group: Neonatal, Maternal, and Transit. The Transit information was to be provided by Criticall and the Hospital For Sick Children transit system, while the other information would be provided by the member hospitals. Information provided by the hospitals presented greater challenge than anticipated, particularly for maternal information. Given that the neonatal information was the most central to the study, it was decided that the investigation would focus only on the creation and analysis of this dataset. The transportation information was not addressed because of timing and resource limitations.

The neonatal population to be studied had to be clearly defined. Selection criteria were discussed, and the following population was identified for study:

- Newborns with gestational age between 20 and 36 weeks, or
- Newborns with birth weight between 450 and 2,500 grams, or
- Infants under 5 months of age transferred from another hospital.

Hospitals were asked to select cases based on these criteria which were intended to capture births that met gestational age criteria for Level II and Level III facilities, as well as high risk births and neonates who may have been transferred after extended hospitalization. Cases meeting any of these criteria were to be selected if they were discharged between April 1, 1999 and March 31, 2001.

Institutions were contacted to obtain two consecutive years of data, as identified in earlier communication from the CHN. It became apparent that though the information was generally available, it was not always readily accessible. In addition, definitions were questioned and greater clarity required to ensure consistent reporting. These issues were addressed by convening two meetings of hospital information specialists in the summer of 2001. This resulted in the preparation of the definitions listed in Appendix A. The following table provides a summary of the data elements requested for the project.

Table 3: *Summary of Elements Requested with Brief Definitions.*

Indicator	Definition
Hospital	Reporting institution.
Gestation at birth	Completed gestational age in weeks, rounded down.
Birthweight	Weight at birth.
Entry Code	Transfer, Emergency, Newborn or Stillborn.
DOB	Date of birth.
Multiple Births	ICD-9 V codes (specifying multiple and type of birth).
Transferred In	Sending Institution.
Transferred Out	Institution sent to.
Home	6 digit postal code of home address.
Residence code	MOHLTC geographic code.
Death	Y/N
CPAP Hours*	Hours of Continuous Positive Airway Pressure.
Vented Hours*	Hours of mechanical ventilation.
LOS	Total days of care.
Admission Date	Date of admission.
Discharge Date	Date of discharge.

**Combined into single variable.*

Hospitals submitted the requested information in excel spreadsheets in the fall of 2001. The Central East Health Information Partnership (CEHIP) received a series of these files in October 2001, and began work on the creation of master files suitable for analysis. Most of the files, however,

did not fully conform to the guidelines resulting in a significant amount of data checking, cleaning, and re-coding. In December the Perinatal Pilot Project Committee met to consider some of the more challenging issues identified in the files. It was concluded that some information be re-submitted, and that some of the issues raised needed to be discussed directly with submitting institutions. It was at this meeting that it was determined that the primary focus should be on the neonatal data, and a decision was made not to proceed with analysis of the maternal information because of data quality and interpretive concerns.

The files received were carefully scrutinized, cleaned, and re-coded. Despite efforts to ensure consistent and comparable submissions, the files received by CEHIP required considerable revision before they could be combined for analytical purposes. It is believed that the resulting analytical files accurately reflect the information as intended by the submitting institutions. Where there was any doubt, this was explored with CHN staff and individual hospitals. There were, however, no validity checks to ensure that the data extracted and submitted were in fact accurate. These cautions should be kept in mind, particularly where tabulations provide unexpected or inconsistent results.

A 500 gram lower limit was used for the analysis, rather than the 450 gram boundary adopted as the criteria for submission from hospitals. This excluded six cases, but makes the results consistent with other low birth weight studies (Joseph & Kramer, 19967, Ennis, Woodward & Ardal, 2000). Appendix B describes modifications, assumptions, and final criteria applied in creating the analytical data set.

Results

Overview

The Perinatal Pilot Project dataset totaled 17,418 cases, or separations. It is not possible to determine how many individuals this represents as newborns who are transferred and meet the selection criteria at both sites will have produced two entries in the data set. Accordingly, subsets of the total dataset are used for specific analyses. In many cases the actual numbers used in the graphs and tables presented is far fewer than the total shown in Table 4. Analyses by Level of Care may omit Level I if there is little of no activity reported by hospitals with this designation.
The following table shows how the criteria cases are distributed between the clusters and level of care designations. Note that only the Central and

North clusters have level III facilities. The great majority of cases would be captured as Level I, but the criteria applied exclude 90% of all CHN hospital births. As a result, there are very few cases reported for the level I facilities located in the East and West clusters. The following tables include ***all identified cases***, whether newborn or transferred.

Table 4: *Perinatal Dataset Cases by Network Cluster and Level of Care, 1999-2001.*

Cluster → ↓ Level of Care	Central	East	North	West	Total
I	0	87	0	312	394
II	5,796	470	364	1,818	8,448
II+	0	606	473	3,235	4,314
III	3,154	0	1,098	0	4,252
Total	8,950	1,163	1,935	5,365	17,413

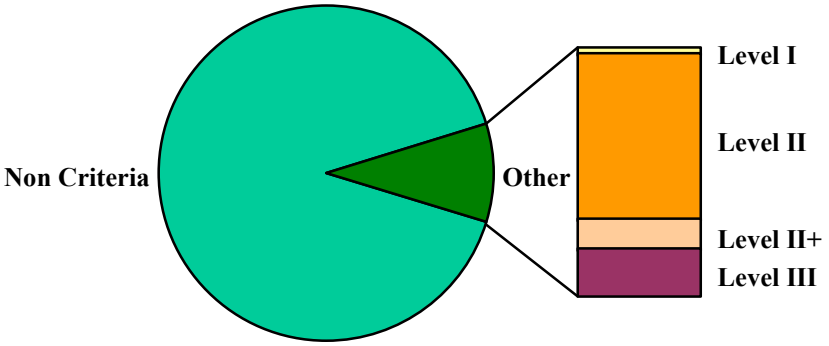
Table 5 provides a breakdown by entry code for each of the four Child Health Network clusters. Overall, about two-thirds of the cases identified were born in the reporting institution. The other cases are either direct admissions, or admitted through the emergency department. Direct admissions are about twice as common in the dataset, and in most cases these records indicate a sending institution. About one in ten admissions through Emergency are associated with a sending facility. The West cluster has the highest reported admissions through emergency departments.

Table 5: *Perinatal Dataset Cases by Network Cluster and Entry Code.*

Cluster → ↓ Entry Code	Central	East	North	West	Total
Direct	2,293	398	319	1,118	4,128
Emergency	198	5	<5	1,762	1,966
Newborn	6,444	759	1,589	2,382	11,174
DS & Clinic	15	<5	0	0	16
Stillborn	0	0	31	103	134
Total	8,950	1,163	1,940	5,365	17,418

It is important to understand the dataset in context. About 60,000 births occur at CHN hospitals each year. Since this study covers a two-year period, the data are in fact sampled from a pool of 116,795 births, and represent about 10% of all births at CHN hospitals. The study is only concerned with those births that may represent some level of risk, as it is these births that differentiate CHN service designations. Figure 1 shows almost no criteria births at Level I facilities. Most of the following tables only include neonates born in the reporting hospitals.

Figure 1: *Births at CHN Hospitals Showing Level Distribution for Those Fitting The Study Criteria.*



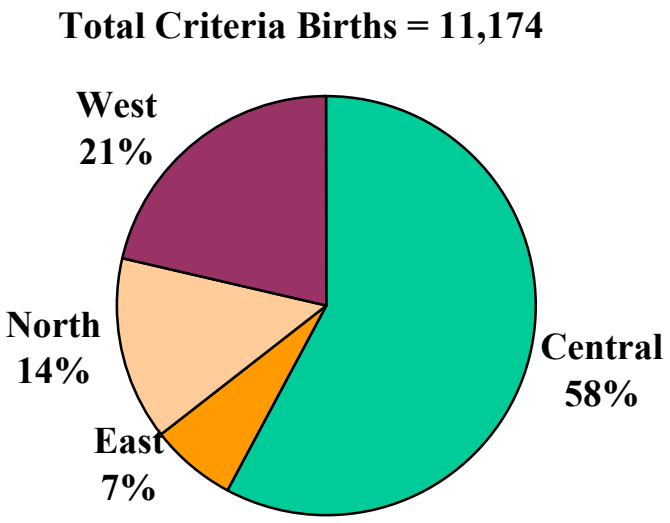
The following table provides the actual number of newborn cases identified as meeting the study criteria. Very few of the birth are credited to Level I, with most being identified with Level II facilities. The II+ designation is associated with greater capacity to intervene in complex cases, but like level III hospitals, this is not associated with the bulk of the criteria births. This distribution is likely due to higher overall births at Level II facilities, which applies to the majority of hospitals in the network. Subsequent analyses in this report will try to determine if the Level II newborns identified here present a different profile than those associated with the higher level of care facilities.

Table 6: *Level of Care distribution for Entry Code of Newborn, 1999-2001.*

Level of Care	Criteria Births	% of Criteria Total
I	372	3.3%
II	7,418	66.4%
II+	1,319	11.8%
III	2,061	18.5%
TOTAL	11,170	100.0%

Most of the newborn fitting the selection criteria were born in the Central Cluster. This cluster includes 58% of all criteria births, with the West cluster accounting for half of the remaining births.

Figure 2: *Births at CHN Hospitals Showing Percentage Identified in Each Cluster.*



Question 1:

Is the distribution of higher risk neonatal births consistent with hospital designations?

The previous section provides a description of the distribution of cases and newborns among, and within, the CHN clusters. The purpose of the Levels of Care designation is to create an efficient and effective model of service delivery that fits varying need. In this section, the dataset will be explored to see if the profile of cases is consistent with the designation of institutions.

The key designation variable is gestational age. Figure 3 shows where neonates are born according to gestational age. It is clear that there is a gradient consistent with the designation of facilities. The 32-36 week group is distributed among the three higher levels, while the 20-31 week group is almost exclusively attributed to the level three facilities. Reassuringly, level one facilities are associated with very few of these births.

Figure 3: *Births at CHN Hospitals Showing Gestational Age Groups by Level Of Care.*

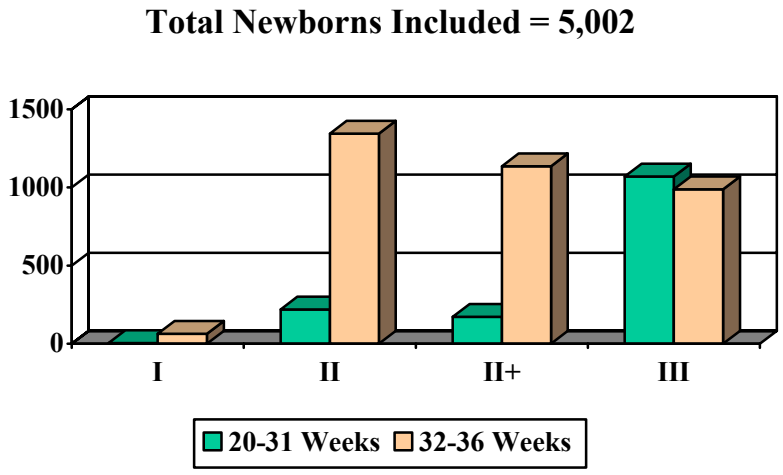


Table 1 (*Background)* illustrates the CHN "Level of Care Matrix". This matrix has been reproduced with data as Table 7. The final column would be filled in if all newborns at CHN hospitals were included, but these data are not included in this study. The remaining diagonal includes the percent of newborns for each gestational age group column. The Levels of Care Matrix predicts that newborns under 32 weeks gestational age would be concentrated at Level III facilities, while Level II facilities are most appropriate for newborns of 32-36 weeks gestational age. Clearly, the majority of cases fall in the expected cells along the diagonal. In the bottom left are the "watch zone" cells. Births falling in these cells need to be monitored since the Level of Care may not be optimal. Of the three applicable cells, only one has any appreciable volume as about one in four <32 week newborns are born at level II facilities.

Table 7: *Levels of Care Matrix Showing Percent of Criteria Births in Each Cell, 1999-2001.*

Gestational Age → (weeks) **↓ Level of Care**	<32	32-36	36+
III	73%	28%	Not Studied
II	27%	70%	Not Studied
I	<1%	2%	Not Studied

Optimal Site for Care	
Activity Areas To Be Monitored: "Watch Zone"	

To better understand the activity in the Level II "watch zone" an additional analysis is presented that splits both the gestational age and the level of care for this cell. Some hospitals are designed II+, as noted earlier. It may be the case that it is these "higher" designated institutions that are managing some of the early gestational age neonates. A further possibility is that the gestational age of the cases in question in this cell are comparatively higher. Table 8 provides information to address these hypotheses.

Table 8: *Number of Births, and Percentages for Gestational Age Subsets, for Level II and II+ CHN Hospitals.*

Gestational Age → (weeks) **↓ Level of Care**	20-23		24-31	
	#	%	#	%
II+	48	***23%***	124	***10%***
II	59	***28%***	160	***13%***

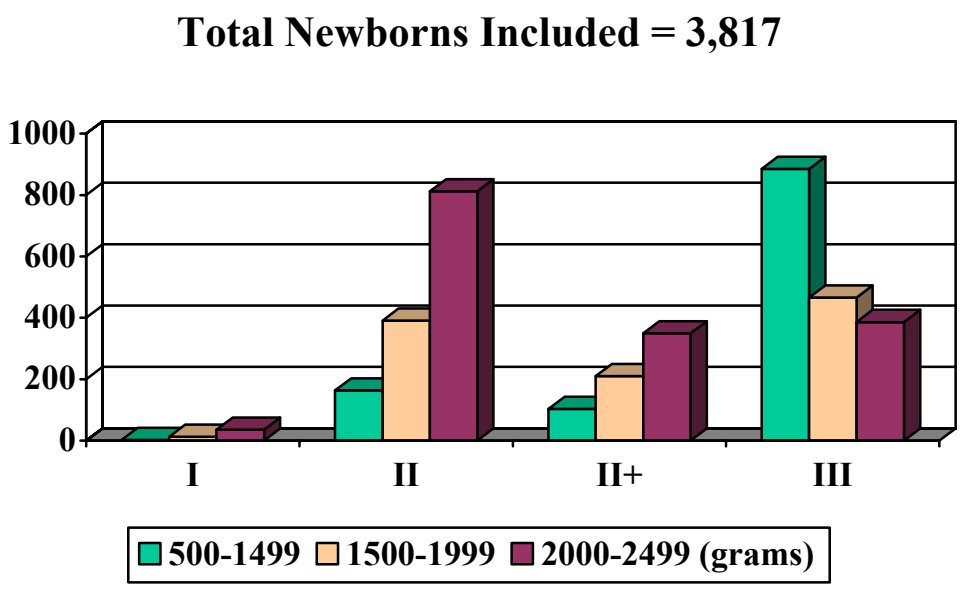
The percentages in this table indicate the proportion of births for each gestational age subset born at Level II and II+ facilities. Table 8 shows that Level II facilities were dealing with proportionately more newborns at lower gestational ages. This result is somewhat unexpected, though it should be noted that the numbers are relatively small. Furthermore, there is no evidence to suggest that the II+ facilities are involved in more of these "higher risk" births. In fact, the tendency is opposite to that expected. The presence of these cases in the "watch zone" does not necessarily imply that births at these facilities are inappropriate, or could have been avoided. In summary, only one of the three "watch zone" cells had any appreciable activity, and that activity is fairly evenly split within the Level II hospital designation.

Another way to consider the distribution of newborns is by birth weight. This variable is widely used to reflect on population health and health system performance, and tends to correlate with gestational age. There

has been a recent upward trend in low birth weight in Ontario, with a coincident increase in pre-term births (Ennis, Woodward & Ardal, 2000). This trend is also noted in the rest of Canada (Canadian Perinatal Surveillance System, 1999).

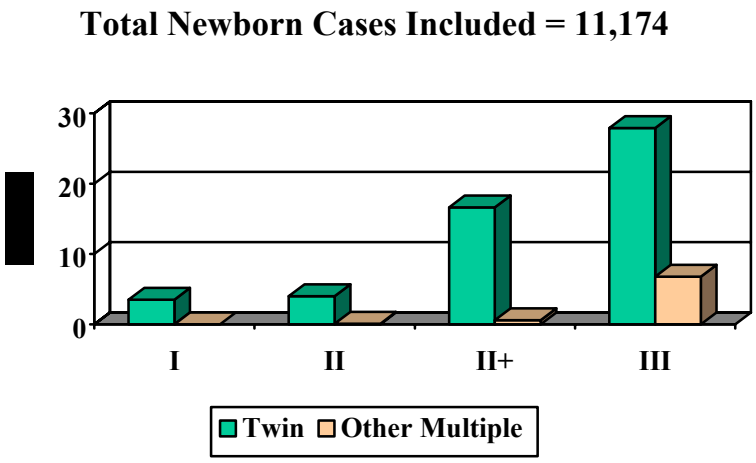
Birth weight, and Level of Care, were tabulated, yielding information for 3,817 newborns. Results are depicted in Figure 4, and show a clear and consistent pattern. Higher weight newborns are more likely to be born at Level II facilities, while a reverse pattern shows the increased role of Level III facilities in lower weight neonates. All cases depicted are between 500 and 2,500 grams.

Figure 4: *Births at CHN Hospitals Showing Level Distribution for Three Birth Weight Categories.*



The final view presented for births according to Levels of Care is provided in Figure 5. Twins and multiple birth events are likely to echo the results of the previous analyses. In particular, it may be expected that multiple births will be managed at Level III facilities. This pattern is clearly supported in the data, which show that a relatively small percentage of twin births meeting the criteria are reported for Levels I and II. Level II+ is intermediate, while Level III facilities report the highest proportion of reported twin and multiple births. Of 156 identified multiples only 14 were attributed to Level II facilities, and fully one-third of the Level III criteria births were twins or other multiples.

Figure 5: *Percent of Criteria Births at Each Level of Care Identified as a Twins, or Other Multiples.*



Question 2:

Is the movement of higher risk neonates consistent with the structure of the network?

This second question is difficult to address directly as there is no way to directly link cases and follow their movement between member institutions. Despite this, it is still possible to look at the extent of movement between member institutions, and identify some of the patterns by cluster and level. Overall, about one in four records in the dataset suggest a transfer. Transfer information was collected to show both sending institutions, and institutions that patients were sent to. Since the "transfer to" information was judged as more complete it forms the basis for most of the information reported in this section.

Table 9 shows the pattern of movement between, and within clusters. Rows show the location of the sending facilities, while the columns indicate the transfer destination. Note that about a third of all transfers are to non-CHN institutions. Among CHN institutions there is considerable transfer activity, with the Central Cluster being the most common cluster destination.

Table 9: *Criteria Transfers Showing Movement Between CHN Clusters for all Cases.*

TO → / ↓ FROM	Central	East	North	West	Non-CHN	Total
Central	452	274	177	257	740	1,900
East	98	72	18	0	166	354
North	279	113	90	117	196	795
West	176	0	13	18	68	275
Total	1,005	459	298	392	1,170	3,324

The percent distribution of transfers for sending facilities is given in Table 10. Because of the distribution of Level III facilities it is likely that much of the inter-cluster movement reflects transfers between levels of care. This will be explored in subsequent analyses. The following table shows very little activity between the East, North, and West Clusters. Within Cluster movement is also relatively low. The Majority of transfers for all Clusters involve Central and Non-CHN institutions.

Table 10: *Percent Distribution of Transfers Between CHN Clusters for all Cases.*

TO → / ↓ FROM	Central	East	North	West	Non-CHN	Total
Central	23.8%	14.4%	9.3%	13.5%	38.9%	100%
East	27.7%	20.3%	5.1%	0.0%	46.9%	100%
North	35.1%	14.2%	11.3%	14.7%	24.7%	100%
West	64.0%	0.0%	4.7%	6.5%	24.7%	100%

Newborns who are transferred will most likely be moved either because they require a higher level of care, or because they no longer require intensive treatment and can be transferred to a facility closer to their homes. By selecting only newborns, a Level of Care Matrix has been created to explore these hypotheses. Of the 1,789 identified newborn cases virtually all were either transferred to a higher, or lower Level of Care facility. Volumes are depicted in Table 11.

Table 11: *Number of Newborn Transfers From CHN Hospitals By Level of Care.*

TO → / ↓ FROM	I	II	II+	III	Non-CHN	Total
I	56	0	7	<5	11	76
II	0	12	12	231	42	297
II+	<5	7	<5	122	110	247
III	9	431	321	97	311	1,169
Total	69	450	344	452	474	1,789

Table 12 shows the distribution of transfers, by Level, within the CHN. Nine out of ten transfers from II and II+ facilities are to Level III hospitals. This suggests that most Newborns transferred from these facilities are being moved to address clinical needs. The Level III facilities are transferring a similar proportion of newborns to lower level of care facilities, supporting the idea that, when appropriate, neonates are being transferred closer to home. A more thorough analysis of these hypotheses is possible as the dataset includes hospital locations and patient residence information. Such detailed analysis, however, is beyond the scope of this report.

Table 12: *Percent Distribution of Newborn Transfers In the CHN By Level of Care.*

TO → / ↓ FROM	I	II	II+	III	Total
I	86.2%	0.0%	10.8%	3.1%	100%
II	0.0%	4.7%	4.7%	90.6%	100%
II+	2.9%	5.1%	2.9%	89.1%	100%
III	1.0%	50.2%	37.4%	11.3%	100%

Tables 11 and 12 provide some understanding of transfers related to newborns, but in many cases these newborn transfers are returning to the sending facility. While it is not possible to trace individuals in the data, the distribution of transfers for non-newborns can be used to describe the pattern of "retro-transfers". These volumes are depicted in Table 13.

Table 13: *Number of Direct Admissions Transferred Out From CHN Hospitals By Level of Care.*

TO → / ↓ FROM	I	II	II+	III	Non-CHN	Total
I	0	0	0	<5	<5	<5
II	0	5	<5	28	27	63
II+	<5	7	6	29	129	173
III	15	299	237	147	491	1189
Total	17	311	246	205	648	1428

Direct admissions were used to identify cases that were not born in the sending institution. In most cases these could be identified with specific sending hospitals, but since this information was not complete the Direct Entry category was preferred as a way of identifying neonates that had been born in other institutions. As may be expected, the movement between levels here shows that three out of four of the network transfers are to lower levels of care. There were 780 of these direct entry transfers identified between network institutions, with 551 of these moving from Level III to Level I and II hospitals. These are likely "retro-transfers". The remaining "within CHN" transfers are between Level III hospitals. Table 14 shows the percentage distribution of those direct entry transfers occurring between CHN hospitals.

Table 14: *Percent Distribution of Direct Admissions Transferred Out Among CHN Hospitals By Level of Care.*

TO → / ↓ FROM	I	II	II+	III	Total
I*	-	-	-	-	-
II	0.0%	13.9%	8.3%	77.8%	100%
II+	4.5%	15.9%	13.6%	65.9%	100%
III	2.1%	42.8%	34.0%	21.1%	100%

*Percentages suppressed because total is <5.

The above analyses show a high number of transfers to non-CHN facilities, attesting to the role of the CHN as a provider of care well beyond immediate catchment areas. They also show patterns of movement within and between clusters and Levels of Care. While not definitive, these patterns are consistent with expectations of a network that moves neonates to ensure that they are in the most appropriate facility to meet their specific needs.

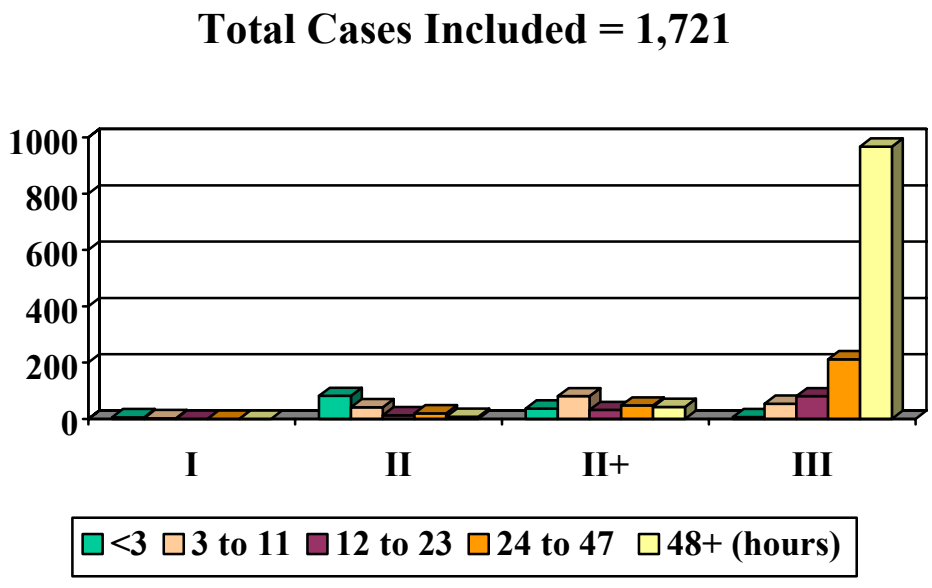
Question 3:

Are the interventions provided consistent with patient characteristics and hospital designations?

The dataset provides information that suggests relative needs of the population studied. Three data elements are shown that describe resource use, and outcome. The resource indicators presented include assistance with breathing, and length of stay. The outcome indicators considered are the number and location of neonatal deaths.

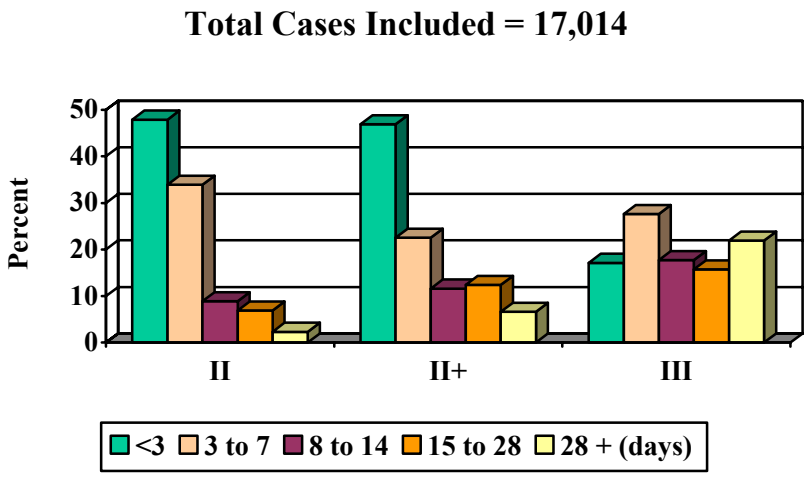
Two measures were included to determine the level of support required to support lung function. Continuous Positive Airway Pressure (CPAP) was to be reported, as was the time patients were mechanically ventilated. Many institutions were not able to provide separate statistics, and so these measures were combined to create one indicator representing the total hours of assisted respiration. The results were collapsed into five groups for the 1,721 cases where CPAP or mechanical ventilation were reported. Figure 6 shows that there are few cases receiving these interventions at Level I, II and II+ facilities. Furthermore, such cases fall primarily in <3 and 3 to 11 hour categories. The Level III hospitals provide most of these interventions, and almost all interventions for extended periods of time.

Figure 6: *Number of Cases Receiving Assistance with Respiration by Hours of Assistance and Level of Care.*



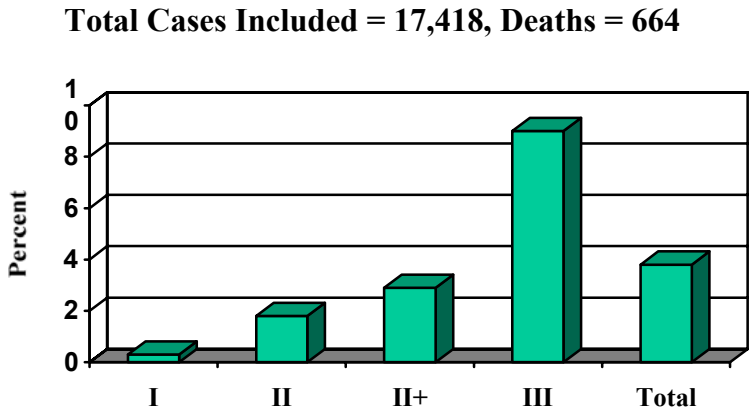
Length of stay can be expected to be longer for cases with higher needs. It would be expected that the average length of stay would, therefore, be progressively longer as the Level of Care increases. This would suggest that the cases that meet the criteria that have higher needs are treated at the higher designated institutions. Five length of stay groups were created, and the proportion of cases falling into each category was determined for each level. The result is Figure 7, which shows that Level II and II+ hospitals have relatively shorter lengths of stay than Level III institutions, where one in five cases have lengths of stay greater than a month. This table includes all cases, so some of the shorter lengths of stay in Level II and II+ facilities may be contributed by neonates who are subsequently transferred.

Figure 7: *Percent of Criteria Cases in Each Level of Care by Length of Stay Category.*



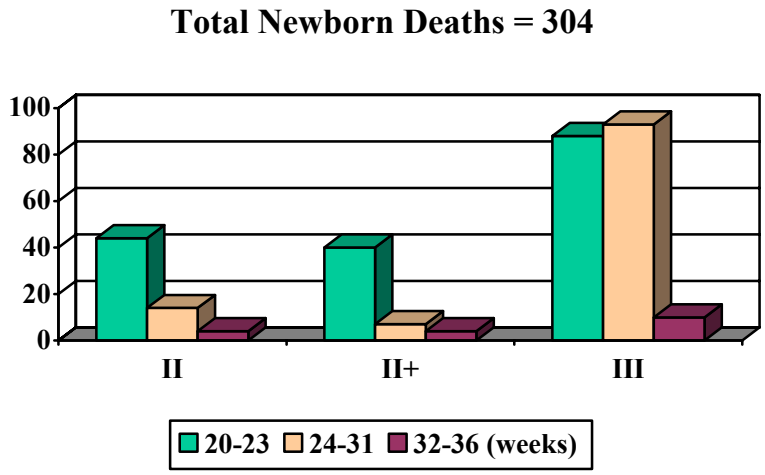
Deaths are often used to construct outcome measures, and are also indicative of system performance. A total of 664 deaths were recorded. This number does not include stillbirths, and represents less that 6% of all criteria births, and less than .6% of all births at network hospitals. This is consistent with Ontario's infant and perinatal mortality rates of 5.5 and 7.0 per thousand (1997). The number of deaths is greatest at higher Level of Care hospitals.

Figure 8: *Deaths Reported Showing the Percentage of Total Occurring at Each Level of Care.*



It may be expected that many of the deaths are associated with lower gestational age. Three gestational age groupings were created to explore the relationship between gestational age and the location where newborn deaths were reported. Figure 9 shows that there is a clear tendency for increased deaths among the lowest gestational age group at lower Level of Care hospitals. Level III facilities, however, had by far the greatest number of deaths in the middle gestational age group studied. This analysis may indicate that Level III facilities are managing more high risk neonates, and many more of the higher risk neonates born at gestational ages exceeding 23 weeks.

Figure 9: *Newborn Deaths Reported Showing the Number Occurring by Gestational Age Category at Each Level of Care.*



Conclusions and Recommendations

The Perinatal Pilot Project has resulted in the creation of a dataset that provides a rich description of an identified neonate population, revealing their interaction with the Child Health Network acute care hospitals. The data are unequivocal in describing an interrelated network that differentiates along the Level of Care continuum. The figures and tables presented in this report provide views from many angles that converge to describe an organized system of care.

Is the distribution of higher risk neonatal births consistent with hospital designations?

The core of the CHN Level of Care designation is the distribution by gestational age. The first question asked whether this designation is apparent in the distribution of neonate populations. The data clearly describe the expected distribution, reinforced by similar patterns evident in distributions by birth weight, and multiple births. Level of Care therefore reflects markers of risk in the distribution of neonates.

Is the movement of higher risk neonates consistent with the structure of the network?

Movement between hospitals in the network is anticipated and expected. Such movement should reflect the structure of the system. There are two considerations here. Ideally high risk births occur at higher designated facilities, but since this can not always be anticipated it is expected that the analysis would show movement from lower to higher Levels of Care where needs warrant, and a reverse pattern where needs abate. This would suggest a coordinated and rational flow, and is exactly the kind of pattern suggested by the data. Furthermore, analysis of neonates moving from institutions other than those they were born in show a flow of "retro-transfers" from higher to lower Levels of Care. The second question is answered, and indicates patterns of movement that are consistent with the structure of the network.

Are the interventions provided consistent with patient characteristics and hospital designations?

The final question focused on clinical dimensions to try and validate whether the location of care was warranted according to measures other than gestational age. By looking at assisted respiration, length of stay, and deaths, it is apparent that the intended institutions manage the more complex and challenging cases.

Though the data analysis provides a consistent portrait there are a number of concerns about the quality of the submitted information. The report is deliberate in keeping the analysis at the network level since there are inconsistencies and missing values that make individual institution analysis somewhat tenuous. Questions raised by such analysis would involve extensive consultation to ensure that conclusions are warranted. It is felt that the analyses presented here are less problematic because of the level of aggregation. However, the actual numbers provided herein will in many cases underestimate actual volumes as many variables were missing entries. The actual level of missing information is not calculable.

In conclusion, the Perinatal Pilot Project has been successful in describing CHN perinatal activity, and testing the value of identified data elements. The following recommendations suggest that this type of activity be continued, and provide advice on how to enhance the quality and utility of CHN perinatal data.

The **first recommendation** emphasizes the value of the Perinatal Pilot Project analysis, and promotes continued development of this dataset.

1. ***The CHN should continue to work with the data elements collected in the Perinatal Pilot Project to monitor trends and track system performance. These elements should be reviewed and modified as necessary to ensure that they address specific quality of care, institution, and network performance objectives.***

The **second recommendation** reflects the challenges faced in the project, and suggests a process to ensure high quality and complete data compilation. CHN should be actively engaged in ongoing data collection to build data repositories that can be analyzed as needed.

2. ***The CHN should develop a data capture method that provides on-going feedback to submitters as a way to promote quality and completeness. Quarterly submission and reporting is suggested.***

The **third recommendation** calls on the creation of data that can describe episodes of family centered care, rather than only discrete encounters. This will require use of unique identifiers, and attention to applicable privacy and confidentiality rules and regulations.

3. ***The CHN should work to build a Perinatal data set that allows individuals to be liked across episodes of care, and allows linkage with maternal data elements.***

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APPENDIX A

Indicator	Definition	Comment
Patient ID	Unique Hospital Identifier (must be consistent)	Will be dropped from analysis following determination that data is unique.
Hospital	Hospital reporting (separate for each site): number assigned by CIHI to hospital; use a, b, c for more than one site and submit meaning of code with data	It is understood that one hospital cannot add a letter to the institution number field to distinguish sites. Therefore for that hospital, the site designation will rely on the institution number only.
Gestation at birth	Completed gestational age in weeks at birth; rounded down (e.g. 31 wks 5 days = 31 weeks)	Recognizing that gestational age can be captured from different sources, hospitals are asked to pull the gestational age from the labour and delivery summary or any other appropriate source
Birthweight	Weight at birth in delivery room in grams for babies born at hospital. For transfers-in, weight at admission.	
Entry Code	D = direct E = emergency N = newborn S = stillborn	
DOB	Date of birth – yr/month/day	
Multiple Births	V codes as per CIHI guidelines (specifying multiple and type of birth)	
Transferred In (transferred from other hospitals to your hospital, including inter-site transfers for multi-site corporations.	Institution ID (as per MoHLTC listing table) Use "a, b, c" for multi-site organizations as above re Hospital	
Transferred Out	Institution ID (as per MoHLTC listing table) – institution number to which baby was sent (including home care)	
Home	6 digit postal code of home address	
Residence code	As per MoHLTC guidelines	
Death	Y/N	

CPAP Hours **TBD**	***Beyond initial resuscitation period of x minutes, hours baby received*** **Nasal** ***CPAP ventilation rounded to nearest whole number.***	< 1 hour, round to 1 hour; if exactly 30 minute interval, round to nearest even number.
Vented Hours	All infants who received assisted, mechanical ventilation (not including just oxygen therapy). Mechanical ventilation via ventilator (via ETT or NPT) in hours rounded to nearest whole number.	
LOS	Total days of care provided by hospital as per CIHI guidelines.	
Admission Date	Date of admission – year/month/day	
Discharge Date	Date of discharge - year/month/day	

APPENDIX B

NEONATAL DATA PROCESS

MSEXCEL files originally from individual hospitals:

- organize original excel files sent by catherine wang by hospital
- organize neonatal data into one excel file by hospital
- arrange according to variable order
- convert to proper formats

Convert to SPSS files:
join 18 individual hospital neonatal data files:

- outfile = 1 - merged neonatal data.sav

For several variables, additional values not on initial lists were recoded:

- for entry code: D=direct, E=emergency, N=newborn, S=stillborn, C=from clinic, P=from day surgery
- for death: Y=yes, N=no, D=discharge, E=expire, S=stillbirth

Rounded values to whole numbers:

- gestational age to integers in weeks
- birth and admission weights into integers in grams
- ventcap into integers in hours
- length of stay in days

Substituted for missing values using existing values:

- where there was no value for birth weight, birth weight = admission weight for newborns
- where there was no value for admission weight, admission weight = birth weight for newborns

Created new variables from existing variables and values:

- hospital level and cluster variables
- new multiple births variable by recoding multiple births to valid vcodes (V30 to V39), other or missing
- created 3 character FSA variable
- new death variable: 1=yes/stillborn/expire, 2=no/discharge/blank
- created transfer in and transfer out variables: network hospitals labelled as such
- created levels and clusters for transfer in/out network hospitals
- created LOS groups: 1=<3 days, 2=>=3 to <=7 days, 3=>=8 to <=14 days, 4=>=15 to <=28 days, 5=>28 days'

Created new file with new and converted variables:

- outfile = 2 - neonatal data with extra variables.sav

Reduce data set using specific criteria – select only with valid not out of range values:

- discharge date: first discharge date = April 1, 1999; last discharge date = March 31, 2001
- gestational age: lowest = 20 weeks; highest = 49 weeks
- birth weight: lowest = 500 grams; highest = 9000 grams
- admission weight: lowest = 500 grams; highest = 9000 grams
- vent hours valid: maximum 4000 hours
- gestational age group: 1=<20 weeks, 2=20 to 31 weeks, 3=32 to 36 weeks, 4=>36 weeks
- birth and admission weight groups as per CMGs: 1=<750g, 2=750 to 999 g, 3=1000 to 1499g, 4=1500 to 1999g, 5=2000 to 2499g, 6=ge 2500g
- vent cpap group variable (assume blank or missing = 0 hours): 1=0/missing/blankhrs, 2=>0to<3hrs, 3=>=3to<12hrs, 4=>=12to<24hrs, 5=>=24to<48hrs, 6=>=48hrs, 7=missing or blank

Save reduced data set with 23 variables:

- outfile =3 - reduced neonatal data.sav

Initial analyses:

- frequencies: all variables; mean, standard deviation, maximum, minimum
- crosstabs: hospital, level, cluster, gestational age group, birth weight group, admission weight group, v codes, transfer in, transfer out, level in, level out, cluster in, cluster out, death, ventilation group, los group
    - frequencies and crosstabs by each entry code: C, D, E, N, P, S