

SETTING  
THE STAGE

# CHILDREN & CRITICAL CARE SERVICES

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# Children & Critical Care Services: Setting the Stage for Tiers Development

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### HOW TO CITE CHILDREN & CRITICAL CARE SERVICES MODULE:

We encourage you to share these documents with others and we welcome their use as a reference. Please cite each document in the module in keeping with the citation on the table of contents of both of the documents. If referencing the full module, please cite as:

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## Critical Care Services for Children: Setting the Stage for Tiers Development

The Children & Critical Care (CC) Tiers module is made up of two components:

1. Setting the Stage for Tiers Development (provides the context - **this document**)
2. Tiers to Support System and Operational Planning (provides a description of the tiers and the corresponding responsibilities and requirements)

The Children & Critical Care Tiers module focuses on services provided by *specialist* and *subspecialist* health care providers to children up to 17 years old (16.9 years) who have *highly acute* and often *highly complex* illnesses, injuries and complications. It builds on and is intended to be used in conjunction with the *Children's Emergency Department, General Medicine* and *Surgery Tiers* modules.

All facilities providing pediatric services (T1-T6) should have capacity to provide resuscitation and initial stabilization of critically ill children while awaiting transport to a higher tier (in ED, on an inpatient unit &/or in ICU). This module focuses on critical care services which are provided **beyond** the resuscitation and initial stabilization period.

"Critical care services" refer to services which are **above and beyond those usually available on a pediatric inpatient unit** (refer to children's medical and surgical modules for details of what is usually provided on a pediatric inpatient unit). Provision of these services requires **specialized skills** and **enhanced staffing levels**. In BC, such services are usually provided in a pediatric-specific or a general intensive care unit.

### 1.0 Providers of Critical Care Services for Children

Critical care services for children are provided by a range of physician specialists and subspecialists, in partnership with nurses, allied health and other members of the health care team. In many cases, the physicians have specific training in critical care medicine (CCM).

CCM is a relatively new Royal College of Physicians and Surgeons-recognized subspecialty. CCM has multiple different base specialties that serve as a route for entry including pediatrics, anesthesiology, cardiac surgery, emergency medicine and general surgery. Within CCM, there is an adult and a pediatric stream. In Canada, there are 21 Royal College accredited CCM training programs - 13 adult and 8 pediatric (source: Royal College website). There are 9 pediatric CCM physicians in BC, 6 at BCCH and 3 in Victoria.

### 2.0 Utilization of Intensive Care Units by Children

Highlights of the data used to inform the development of this module are provided in this section. Data is for 2017/18 and children ages 0 - 16.9 years unless otherwise stated.

Refer to Appendices 1 - 3 for detailed tables. Appendix 4 provides a summary of designated pediatric beds in BC, including pediatric ICU (PICU) beds. BCCH has 22 PICU beds and Victoria General has 5 beds. Additionally, the University Hospital of Northern BC (UHNBC) has 4 beds with the capacity for more intensive monitoring, up to and including continuous cardiorespiratory monitoring.

## 2.1 ICU Visits & Days

### 2.1.1 2018/19, 2017/18, 2016/17 and 2015/16 Visits and Days

In 2018/19, 1,643 children were discharged from an ICU in BC (4.5 admissions per day). These children occupied 5,474 ICU bed days (15 beds per day) and had an average length of stay (ALOS) of 3.3 days. See Table 1 (Appendix 1 for details).

**Table 1: ICU Visits & Days, Children 0 - 16.9 Yrs, 2018/19, 2017/18, 2016/17 and 2015/16 (CIHI)**

Activity	2018/19	2017/18	2016/17	2015/16	Difference, 2018/19 - 2015/16
ICU Visits	1,643	1,630	1,851	1,850	-207
ICU Days	5,474	5,715	6,742	5,927	-453
ALOS	3.3	3.5	3.6	3.2	+0.1

### 2.1.2 Ages of Children Treated in ICU

The highest proportion of ICU visits for children were between 2 and 13.9 years of age: 46% of total visits, while the highest proportion of ICU days for children were less than 2 years of age: 46% of total days. 11% of BC's children were in the less than 2 years age group, while 71% were in the 2 - 13.9 years age group. See Table 2 (Appendix 1 for details).

**Table 2: ICU Visits & Days by Facility & Age of Child, Children 0 - 16.9 Yrs (CIHI, 2018/19)**

Treating Hospital	ICU Visits				ICU Days			
	< 2 yrs	2 - 13.9 Yrs	14 - 16.9 Yrs	Total	< 2 yrs	2 - 13.9 Yrs	14 - 16.9 Yrs	Total
BCCH	329	414	105	848	1,331	1,522	358	3,211
Victoria General	162	153	28	343	629	506	62	1,197
UHNBC (Prince George)	119	97	13	229	315	195	17	527
Other BC Hospitals	81	93	49	223	220	161	158	539
<b>Total</b>	<b>691</b>	<b>757</b>	<b>195</b>	<b>1,643</b>	<b>2,495</b>	<b>2,384</b>	<b>595</b>	<b>5,474</b>
<b>% Visits/Days</b>	<b>42%</b>	<b>46%</b>	<b>12%</b>	<b>100%</b>	<b>46%</b>	<b>44%</b>	<b>11%</b>	<b>100%</b>
<b>% BC's Child Population</b>	<b>11%</b>	<b>71%</b>	<b>18%</b>	<b>100%</b>	<b>11%</b>	<b>71%</b>	<b>18%</b>	<b>100%</b>

### 2.1.3 Visits and Days by Treating Hospital

The highest number of ICU visits and days for children were at BC Children's Hospital (BCCH), Victoria General Hospital (Vic Gen) and University Hospital of Northern BC (UHNBC). Combined, these represented 86% of total ICU visits and 90% of total ICU days. See Table 3 (Appendix 1 for details).

**Table 3: ICU Visits & Days by Facility, Children 0 - 16.9 Yrs, (CIHI, 2018/19)**

Treating Hospital	ICU Visits		ICU Days	
	#	% Prov Total	#	% Prov Total
BCCH	848	52%	3,211	59%
Victoria General	343	21%	1197	22%
UHNBC (Prince George)	229	14%	527	10%
Other BC Hospitals	223	14%	539	10%
<b>Total</b>	<b>1,643</b>	<b>100%</b>	<b>5,474</b>	<b>100%</b>

### 2.1.4 Visits and Days by Location of Child's Home Residence

The highest proportion of visits and days were by children living in the Vancouver Island Health Authority (VIHA): 28% of total visits and 29% of total days. FHA has more children than any other HA.

On a per capita basis, children living in Interior, Fraser and Vancouver Coastal HAs utilized an ICU less often than children living in Vancouver Island and Northern Health Authorities.

See Table 4 (Appendix 2 for details).

**Table 4: ICU Visits & Days by HA of Child's Home Residence, Children 0 - 16.9 Yrs (CIHI, 2018/19)**

HA of Child's Home Residence	ICU Visits		ICU Days		% BC Child Pop'n
	#	% Prov Visits	#	% Prov Days	
IHA	213	13%	715	13%	15%
FHA	354	22%	1245	23%	42%
VCH	246	15%	967	18%	20%
VIHA	440	28%	1558	29%	15%
NHA	346	22%	925	17%	7%
<b>Total, BC as Home Residence</b>	<b>1,599</b>	<b>100%</b>	<b>5,410</b>	<b>100%</b>	<b>100%</b>
<b>Out of Prov/Unknown</b>	<b>44</b>		<b>64</b>		
<b>Total, All</b>	<b>1,643</b>		<b>5,474</b>		

## 2.2 Reasons for ICU Visits

### 2.2.1 Mode of Entry

The most common routes of entry to ICU by children were direct entry or via emergency. A small number were admitted via a clinic or day care surgery from within the same hospital.

**Table 5: Mode of Entry of ICU Visits, Children 0 - 16.9 Yrs (CIHI, 2018/19)**

Treating Hospital	ICU Visits					Total
	Direct <sup>(1)</sup>	ED	Clinic	Day Surgery	Other	
BCCH	522	314	12	0	0	848
Victoria General	178	157	0	8	0	343
UHNBC (Prince George)	113	54	62	0	0	229
Other BC Hospitals	23	189	1	10	0	223
<b>Total</b>	<b>836</b>	<b>714</b>	<b>75</b>	<b>18</b>	<b>0</b>	<b>1,643</b>
<b>% Prov Visits</b>	<b>51%</b>	<b>43%</b>	<b>5%</b>	<b>1%</b>	<b>0%</b>	<b>100%</b>

<sup>(1)</sup> Direct entry includes:

- Children admitted to ICU from another area within the same hospital (e.g., medical unit, OR, etc), excluding the Emergency Department or a clinic; and
- Children admitted to ICU from another hospital.

### 2.2.2 Major clinical categories/case mix groups

The most common clinical categories for admission to ICU were: respiratory (26%), circulatory (12%) and nervous system (10%). See Table 6. The most common case mix groups were upper/lower respiratory infection (10%), cardiothoracic intervention with pump (7%), asthma (5%), viral/unspecified pneumonia (3%) and poisoning/toxic effect of drug (3%). See Appendix 3.

**Table 6: Visits by Major Clinical Category, Children 0 - 16.9 Yrs (CIHI, 2018/19)**

Major Clinical Category (MCC)	ICU Visits		ICU Days	
	#	% Total ICU D/C'es	#	% Total ICU Days
Diseases & Disorders of the Respiratory System	419	26%	1,773	32%
Diseases & Disorders of the Circulatory System	193	12%	464	8%
Diseases & Disorders of the Nervous System	166	10%	459	8%
Diseases & Disorders of Ear, Nose, Mouth & Throat	166	10%	399	7%
Significant Trauma, Injury, Poisoning & Toxic Effects of Drugs	151	9%	412	8%
Newborns & Neonates with Conditions Originating in Perinatal Period	149	9%	656	12%
Diseases & Disorders of the Digestive System	81	5%	270	5%
Diseases & Disorders of the Endocrine System, Nutrition & Metabolism	79	5%	233	4%
Diseases & Disorders of the MS System & Connective Tissue	57	3%	150	3%
Diseases & Disorders of the Blood & Lymphatic System	42	3%	151	3%
Diseases & Disorders of the Kidney, Urinary Tract & Male Repro System	40	2%	112	2%
Multisystemic or Unspecified Site Infections	37	2%	190	3%
Other Reasons for Hospitalization	24	1%	98	2%
Diseases & Disorders of the Skin, Subcutaneous Tissue & Breast	17	1%	77	1%
Miscellaneous CMG & Ungroupable Data	8	0%	8	0%
Diseases & Disorders of the Hepatobiliary System & Pancreas	6	0%	13	0%

Major Clinical Category (MCC)	ICU Visits		ICU Days	
	#	% Total ICU D/C'es	#	% Total ICU Days
Burns	4	0%	4	0%
Diseases & Disorders of the Eye	3	0%	3	0%
Diseases & Disorders of the Female Reproductive System	1	0%	2	0%
<b>Total, All MCCs</b>	<b>1,643</b>	<b>100%</b>	<b>5,474</b>	<b>100%</b>

### 2.3 HA of Treating Hospital versus Location of Child's Home Residence

62% of children accessed ICU services in a hospital in their home HA. This ranged from 1% of children living in Fraser to 98% living in Vancouver Coastal. See Table 7.

Table 7: HA of Treating Hospital versus Location of Child's Home Residence (CIHI, 2018/19)

HA of Treating Hospital	Child's Home Residence					Total Visits, excl Other	Other	Total Visits, incl Other	% Prov Visits
	Interior	Fraser	Van Coastal	Van Island	Northern				
<b>Interior</b>	<b>111</b>	<b>3</b>	<b>4</b>		<b>1</b>	<b>119</b>		<b>119</b>	<b>7%</b>
Cariboo Memorial Hospital	34	2	4		1	41		41	2%
East Kootenay Regional Hospital	20					20		20	1%
Kelowna General Hospital	28					28		28	2%
Kootenay Bound Reg Hospital	7					7		7	0%
Penticton Regional Hospital	12					12		12	1%
Royal Inland Hospital	2					2		2	0%
Vernon Jubilee Hospital	8	1				9		9	1%
<b>Fraser</b>		<b>4</b>		<b>1</b>		<b>5</b>		<b>5</b>	<b>0%</b>
Chilliwack General Hospital				1		1		1	0%
Royal Columbian Hospital		4				4		4	0%
<b>Vancouver Coastal</b>	<b>1</b>	<b>1</b>	<b>12</b>			<b>14</b>	<b>1</b>	<b>15</b>	<b>1%</b>
Lions Gate Hospital			4			4		4	0%
Powell River General Hospital			3			3		3	0%
Richmond Hospital			1			1		1	0%
Sechelt Hospital			1			1		1	0%
St. Paul's Hospital		1				1	1	2	0%
Vancouver General Hospital	1		3			4		4	0%
<b>Vancouver Island</b>	<b>2</b>		<b>2</b>	<b>344</b>		<b>348</b>	<b>7</b>	<b>355</b>	<b>22%</b>
Victoria General Hospital	2		2	333		337	6	343	21%
Comox Valley Hospital				2		2		2	0%
Royal Jubilee Hospital				1		1		1	0%
West Coast General Hospital				8		8	1	9	1%
<b>Northern</b>	<b>1</b>				<b>296</b>	<b>297</b>	<b>4</b>	<b>301</b>	<b>18%</b>
Prince George Regional Hospital	1				224	225	4	229	14%
Dawson Creek & District Hospital					1	1		1	0%
Fort St. John General Hospital					49	49		49	3%
G.R. Baker Memorial Hospital					2	2		2	0%
Mills Memorial Hospital					14	14		14	1%
Prince Rupert Regional Hospital					6	6		6	0%
<b>Provincial Health Services Authority</b>	<b>98</b>	<b>346</b>	<b>228</b>	<b>95</b>	<b>49</b>	<b>816</b>	<b>32</b>	<b>848</b>	<b>52%</b>
B.C. Children's Hospital	98	346	228	95	49	816	32	848	
<b>Total ICU Visits, BC</b>	<b>213</b>	<b>354</b>	<b>246</b>	<b>440</b>	<b>346</b>	<b>1,599</b>	<b>44</b>	<b>1,643</b>	<b>100%</b>
<b>% Treated in Home HA</b>	<b>52%</b>	<b>0%</b>	<b>97%</b>	<b>78%</b>	<b>85%</b>	<b>62%</b>			
<b>% BC ICU Child Visits</b>	<b>13%</b>	<b>22%</b>	<b>15%</b>	<b>28%</b>	<b>22%</b>	<b>100%</b>			
<b>% BC Population</b>	<b>15%</b>	<b>40%</b>	<b>22%</b>	<b>15%</b>	<b>8%</b>	<b>100%</b>			

Note: Children from VCH that were admitted to either a VCH hospital or BCCH were assumed to have received the service in their home HA.

### 3.0 Literature on Volumes & Outcomes

In preparation for development of the Children & Critical Care Tiers module, a literature search was undertaken on the relationship between volumes and outcomes in adult, pediatric and neonatal ICUs. Most of the literature focused on adult and not pediatric or neonatal ICUs.

Although the literature is conflicting, most studies suggest there is a positive relationship between volumes and outcomes (higher volumes, better outcomes). Some noted the relationship existed only for high risk/complexity patients.

#### *Adult ICUs:*

- Most studies/literature reviews suggest there is a relationship between volumes and outcomes (higher volumes, better outcomes),<sup>1-5</sup> although some report no relationship.<sup>6-8</sup>
- One literature review (n=20 studies) suggested there was a high volume threshold at which point the risk benefit is lost (more than 450 cases per year per diagnostic category and more than 711 cases not specific to a diagnostic category). Optimal ICU performance was noted to be between low and high volumes.<sup>1</sup>
- One systematic review and meta-analysis (n=29 studies) found that 63% of the studies reported a statistically significant association between higher admission volumes and improved outcomes. The magnitude of the benefits was greatest in selected high risk conditions (cardiovascular, respiratory, severe sepsis, hepato- G.I., neurologic and postoperative admission diagnoses).<sup>9</sup>
- Two individual studies that focused on specific patient groups only (e.g., renal, subarachnoid hemorrhage) concluded a positive volume/outcome relationship.<sup>10,11</sup>
- One study of 29 ICUs in Spain reported no relationship between volumes and outcomes.<sup>12</sup> Another concluded the benefit was seen only in high-risk patients<sup>13</sup> and another only with certain diagnoses.<sup>14</sup>
- One study concluded the number of pressure ulcer prevalence and catheter-related bloodstream infection rates were higher in larger hospitals.<sup>15</sup>
- One study showed that reduced ICU bed availability was associated with increased rates of ICU readmission and ward cardiac arrest.<sup>16</sup> One literature review identified 70 - 75% to be the optimal ICU occupancy rate.<sup>17</sup> Another study did not show a relationship between ICU bed availability and occupancy.<sup>18</sup>

#### *Pediatric ICUs:*

- There are less studies/literature reviews published on volume and outcomes in pediatric ICUs.
- 3 articles show a relationship between PICU volume and morbidity/mortality (higher volumes, better outcomes):
  - Tilford's study<sup>19</sup> examined the volumes & outcomes in 16 PICUs that ranged from 4 - 20 beds (147 - 1,246 admissions/yr, with an average of 863/yr). The study reported significant effects of patient volume on both risk-adjusted mortality and patient length of stay. A 100% increase in PICU volume decreased both risk-adjusted mortality (adjusted odds ratio: .95) and reduced length of stay (incident rat ratio: .98). Factors such as fellowship training programs, university hospital affiliation, number of PICU beds and children's hospital affiliation had no effect on risk-adjusted mortality or patient length of stay.



- Marcin's study<sup>20</sup> examined the volumes & outcomes in 15 PICUs (152 - 2,156 admissions/yr). On average, admission to higher-volume PICUs was associated with lower severity-adjusted mortality (odds ratio = 0.68 per 100 patient increase in volume). However, although severity-adjusted mortality rates decreased as annual PICU admission volumes increased, there was a slight increase in mortality rates among PICUs with very high annual admission volumes. This suggests that, although increasing PICU volumes are on average associated with lower mortality rates, there may be a point at which increasing volume not only does not result in further reductions in severity-adjusted mortality rates, but may be associated with some increase in mortality rates. The lowest severity-adjusted mortality rates were among PICUs with annual admission volumes between 992 and 1,491.
- Ruttman's<sup>21</sup> study examined the relationship between diagnostic diversity within a PICU and mortality risk. The study concluded no relationship although did note a small but significant volume effect present. A volume increase of 10 patients/month was associated with a 4% decrease of the adjusted mortality odds ratio.
- One PICU article showed a relationship between ICU volume and LOS (higher volume, shorter LOS) for critically ill children with acute asthma.<sup>24</sup>
- One PICU study (Markovitz<sup>22</sup>) examined the volumes & outcomes in 92 PICUs (186,643 patients). For patients with low severity of illness, PICU volume was not related to mortality. For patients with high severity of illness, PICU volume is inversely related to mortality (i.e., higher PICU volumes were associated with higher risk– adjusted mortality). Potential explanations included differences in quality of care, issues with unmeasured confounding or calibration of existing severity of illness scores. Kahn<sup>23</sup> in a later article noted the relationship was conditional on severity of illness and that the association between higher volume and higher risk of death was largely confined to more acutely ill patients. He proposed that the study results could be attributable to limitations in the study design, including differing case-mixes between high volume and low volume PICU's.

#### Neonatal ICUs:

- 3 articles in the NICU literature showed a relationship between higher volumes and better outcomes.<sup>25,26</sup>

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**Appendix 1: ICU Visits & Days, All BC Hospitals, 2018/19 & 2017/18 (Children Ages 16.9 & Under)**

HA of Treating Hosp	Treating Hospital	2018/19								2017/18								
		Visits					Days			Visits					Days			
		< 2 Yrs	2 - 13.9 Yrs	14 - 16.9 Yrs	Total	% Total	Pt Days	% Tot	Avg LOS	< 6 mos	6 mos to 1.9 Yrs	2 - 13.9 Yrs	14 - 16.9 Yrs	Total	% Total	Pt Days	% Tot	Avg LOS
IHA	Cariboo Memorial Hospital	18	16	7	41	2%	96	2%	2.3	7	9	8	2	26	2%	73	1%	2.8
	East Kootenay Regional Hospital	3	8	9	20	1%	33	1%	1.7	1	1	8	4	14	1%	22	0%	1.6
	Kelowna General Hospital	7	14	7	28	2%	39	1%	1.4	1	4	8	7	20	1%	33	1%	1.7
	Kootenay Boundary Reg. Hospital		5	2	7	0%	14	0%	2.0	1	2	4	1	8	0%	10	0%	1.3
	Penticton Regional Hospital	3	8	1	12	1%	26	0%	2.2	1		12	3	16	1%	31	1%	1.9
	Royal Inland Hospital	1	1		2	0%	2	0%	1.0	1	1	2	3	7	0%	20	0%	2.9
	Shuswap Lake General Hospital					0%		0%	-				1	1	0%	1	0%	1.0
Vernon Jubilee Hospital	2	5	2	9	1%	14	0%	1.6	2		6	2	10	1%	14	0%	1.4	
FHA	Abbotsford Regional Hosp					0%		0%	-					0	0%	0	0%	-
	Burnaby Hosp					0%		0%	-					0	0%	0	0%	-
	Chilliwack Gen Hosp			1	1	0%	2	0%	2.0					0	0%	0	0%	-
	Langley Memorial Hospital					0%		0%	-					0	0%	0	0%	-
	Ridge Meadows					0%		0%	-					0	0%	0	0%	-
	Royal Columbian Hosp			4	4	0%	30	1%	7.5				5	5	0%	32	1%	6.4
Surrey Memorial					0%		0%	-				1	1	0%	1	0%	1.0	
VCH	Lion's Gate Hosp	2		2	4	0%	36	1%	9.0				2	2	0%	2	0%	1.0
	Mt St Joseph Hosp					0%		0%	-				1	1	0%	5	0%	5.0
	Powell River Gen Hosp		3		3	0%	6	0%	2.0		1		1	2	0%	3	0%	1.5
	Richmond Hosp			1	1	0%	10	0%	10.0									-
	Sechelt Hosp		1		1	0%	2	0%	2.0					0	0%	0	0%	-
	St Paul's Hosp	1		1	2	0%	6	0%	3.0					0	0%	0	0%	-
	Vancouver Gen Hosp			4	4	0%	38	1%	9.5			1	5	6	0%	34	1%	5.7
VIHA	Cowichan District Hosp					0%		0%	-					0	0%	0	0%	-
	Nanaimo Reg Gen Hosp					0%		0%	-					0	0%	0	0%	-
	North Island Hosp - Comox Valley			2	2	0%	2	0%	1.0									-
	Royal Jubilee Hosp			1	1	0%	5	0%	5.0				2	2	0%	2	0%	1.0
	St Joseph's Hosp					0%		0%	-					0	0%	0	0%	-
	Victoria General Hosp	162	153	28	343	21%	1197	22%	3.5	76	53	134	27	290	18%	1282	22%	4.4
West Coast Gen Hosp	4	5		9	1%	12	0%	1.3	3		3	3	9	1%	11	0%	1.2	
NHA	Dawson Creek Hosp	1			1	0%	1	0%	1.0			2		2	0%	2	0%	1.0
	Ft St John Hosp	27	18	4	49	3%	107	2%	2.2	4	18	16	8	46	3%	137	2%	3.0
	GR Baker Hosp		2		2	0%	2	0%	1.0			1		1	0%	1	0%	1.0
	Mills Memorial	11	2	1	14	1%	49	1%	3.5	2	2	7	3	14	1%	26	0%	1.9
	Prince Rupert Hosp	1	5		6	0%	7	0%	1.2	1		3	1	5	0%	5	0%	1.0
	Univ Hosp of N BC	119	97	13	229	14%	527	10%	2.3	38	43	93	21	195	12%	465	8%	2.4
PHSA	BC Children's Hosp	329	414	105	848	52%	3211	59%	3.8	212	161	481	93	947	58%	3,503	61%	3.7
<b>Total</b>		<b>691</b>	<b>757</b>	<b>195</b>	<b>1,643</b>	<b>100%</b>	<b>5,474</b>	<b>100%</b>	<b>3.3</b>	<b>350</b>	<b>295</b>	<b>789</b>	<b>196</b>	<b>1,630</b>	<b>100%</b>	<b>5,715</b>	<b>100%</b>	<b>3.5</b>
<b>% Total</b>		<b>42%</b>	<b>46%</b>	<b>12%</b>	<b>100%</b>					<b>43%</b>	<b>43%</b>	<b>46%</b>	<b>11%</b>	<b>100%</b>				
<b>% BC's Child Population</b>		<b>12%</b>	<b>70%</b>	<b>18%</b>	<b>100%</b>					<b>12%</b>	<b>70%</b>	<b>18%</b>	<b>100%</b>					

Orange PICU available

## Appendix 2: ICU Visits & Days by Location of Child's Home Residence, 2018/19 (Children Ages 16.9 & Under)

Pt HA	Treating Hosp	Visits	Days	% Visits	% Days	% Prov Child Pop'n
IHA	B.C. Children's Hospital	98	457			
	Cariboo Memorial Hospital	34	77			
	East Kootenay Regional Hospital	20	33			
	Kelowna General Hospital	28	39			
	Kootenay Boundary Reg. Hospital	7	14			
	Penticton Regional Hospital	12	26			
	Prince George Regional Hospital	1	1			
	Royal Inland Hospital	2	2			
	Vancouver General Hospital	1	28			
	Vernon Jubilee Hospital	8	12			
	Victoria General Hospital	2	26			
	<b>IHA Total</b>	<b>213</b>	<b>715</b>	<b>13%</b>	<b>13%</b>	<b>15%</b>
	FHA	B.C. Children's Hospital	346	1,205		
Cariboo Memorial Hospital		2	3			
Royal Columbian Hospital		4	30			
St. Paul's Hospital		1	5			
Vernon Jubilee Hospital		1	2			
<b>FHA Total</b>		<b>354</b>	<b>1,245</b>	<b>22%</b>	<b>23%</b>	<b>42%</b>
VCH	B.C. Children's Hospital	228	885			
	Cariboo Memorial Hospital	4	15			
	Lions Gate Hospital	4	36			
	Powell River General Hospital	3	6			
	Richmond Hospital	1	10			
	Sechelt Hospital	1	2			
	Vancouver General Hospital	3	10			
	Victoria General Hospital	2	3			
	<b>Van Coastal Total</b>	<b>246</b>	<b>967</b>	<b>15%</b>	<b>18%</b>	<b>20%</b>

Pt HA	Treating Hosp	Visits	Days	% Visits	% Days	% Prov Child Pop'n
Island H	B.C. Children's Hospital	95	378			
	Chilliwack General Hospital	1	2			
	Comox Valley Hospital	2	2			
	Royal Jubilee Hospital	1	5			
	Victoria General Hospital	333	1,160			
	West Coast General Hospital	8	11			
	<b>Island H Total</b>	<b>440</b>	<b>1,558</b>	<b>27%</b>	<b>28%</b>	<b>15%</b>
	NHA	B.C. Children's Hospital	49	238		
Cariboo Memorial Hospital		1	1			
Dawson Creek and District Hospital		1	1			
Fort St. John General Hospital		49	107			
G.R. Baker Memorial Hospital		2	2			
Mills Memorial Hospital		14	49			
Prince George Regional Hospital		224	520			
Prince Rupert Regional Hospital		6	7			
<b>NHA Total</b>		<b>346</b>	<b>925</b>	<b>21%</b>	<b>17%</b>	<b>7%</b>
OOP/ Unspec		B.C. Children's Hospital	32	48		
	Prince George Regional Hospital	4	6			
	St. Paul's Hospital	1	1			
	Victoria General Hospital	6	8			
	West Coast General Hospital	1	1			
<b>OOP/Unknown Total</b>	<b>44</b>	<b>64</b>	<b>3%</b>	<b>1%</b>		
		<b>1,643</b>	<b>5,474</b>	<b>100%</b>	<b>100%</b>	

## Appendix 3: ICU Visits by Major Clinical Category & Case Mix, 2018/19

(Children Ages 16.9 & Under)

Major Clinical Category/Case Mix Group	ICU Visits		ICU Days	
	#	% Total	#	% Total
<b>Diseases &amp; Disorders of the Respiratory System</b>	<b>419</b>	<b>26%</b>	<b>1773</b>	<b>32%</b>
Upper/Lower Respiratory Infection	160		663	
Asthma	88		193	
Viral/Unspecified Pneumonia	57		270	
Other Respiratory Diagnosis	21		97	
Bacterial Pneumonia	18		105	
Respiratory Failure	16		202	
Other Respiratory Intervention	12		32	
Symptom/Sign of Respiratory System	10		17	
Aspiration Pneumonia	9		62	
MCC 04 Unrelated Intervention	6		61	
Open Lung Resection	5		19	
Disease of Pleura	3		8	
Other Lung Disease	3		4	
Pleurectomy	3		17	
Postprocedural Respiratory Disorder	2		3	
Chronic Obstructive Pulmonary Disease	1		2	
Bacterial Disease of Respiratory System	1		8	
Malignant Neoplasm of Respiratory System	1		1	
Endoscopic Lung Resection	1		1	
Pneumothorax	1		1	
Other Intervention with Respiratory Diagnosis	1		7	
<b>Diseases &amp; Disorders of the Circulatory System</b>	<b>193</b>	<b>12%</b>	<b>464</b>	<b>8%</b>
Major Cardiothoracic Intervention with Pump	114		216	
Other/Miscellaneous Cardiac Disorder	14		65	
Major Cardiothoracic Intervention without Pump	11		51	
Minor Cardiothoracic Intervention	10		14	
Other/Miscellaneous Vascular Intervention	9		23	
Myocardial Infarction/Shock/Arrest without Coronary Angiogram	7		11	
Percutaneous Transluminal Cardiothoracic Intervention except Percutaneous Coronary Intervention	5		7	
Congenital Cardiac Disorder	5		14	
MCC 05 Unrelated Intervention	3		7	
Arrhythmia without Coronary Angiogram	2		2	
Pacemaker Implantation	2		2	
Cardiac Valve Replacement	2		2	
Cardiac Valve Repair except Percutaneous Transluminal Approach	2		2	
Cardiac Valve Disease, except Endocarditis	1		2	
Unstable Angina/Atherosclerotic Heart Disease with Coronary Angiogram	1		5	
Syncope	1		1	
Implantation of Cardioverter/Defibrillator	1		6	
Ventricular Assist Device Implantation	1		32	
Benign Hypertension	1		1	
Heart Failure without Coronary Angiogram	1		1	
<b>Diseases &amp; Disorders of the Nervous System</b>	<b>166</b>	<b>10%</b>	<b>459</b>	<b>8%</b>
Seizure Disorder, except Status Epilepticus	49		122	
Excision/Repair of Brain	27		31	
Status Epilepticus	17		27	

Major Clinical Category/Case Mix Group	ICU Visits		ICU Days	
	#	% Total	#	% Total
Other Disorder of Central Nervous System	13		83	
Insertion of Shunt/Brain Monitor	12		36	
Meningitis except Viral	8		40	
Intracranial Vessel Intervention except Extraction	7		30	
Craniotomy for Drainage	4		10	
Other Dysfunction of Central Nervous System	4		15	
Cranium Intervention	4		4	
Infection/Inflammation of Central Nervous System except Meningitis	3		7	
Management of Nervous System Device/Other Minor Intervention	2		2	
Hemorrhagic Event of Central Nervous System	2		9	
Thoracic/Major Intervention on Spine/Spinal Canal/Vertebra	2		4	
Drainage/Release of Brain	2		10	
Viral Meningitis	2		4	
Neuromuscular Disorder	2		2	
MCC 01 Unrelated Intervention	2		19	
Other Vascular Intervention with Nervous System Diagnosis	1		1	
Other Degenerative Disease of Nervous System	1		1	
Cerebrovascular Disorder	1		1	
Other Disorder of Nerve	1		1	
<b>Diseases &amp; Disorders of Ear, Nose, Mouth &amp; Throat</b>	<b>166</b>	<b>10%</b>	<b>399</b>	<b>7%</b>
Oral Cavity/Pharynx Intervention	49		60	
Influenza/Acute Upper Respiratory Infection	45		142	
Croup	13		36	
Hard/Soft Palate/Gingiva Intervention	11		13	
Glottis Intervention	8		30	
Miscellaneous Ear/Nose/Throat Disorder	7		8	
Sleep Apnea	6		15	
Disease of Oral Cavity/Salivary Gland/Jaw	6		7	
Larynx/Trachea Intervention with Ear/Nose/Throat Diagnosis	4		57	
Otitis Media with/without Ventilation Tube	3		4	
Other Musculoskeletal Intervention on Head	3		3	
Other Ear Intervention	2		2	
Tonsillitis/Pharyngitis	2		2	
Epiglottitis	2		8	
External Ear Intervention	1		1	
Ear/Nose/Throat Malignancy	1		7	
Nose/Nasal Cartilage Intervention	1		1	
Cochlear Implant	1		1	
Disequilibrium/Hearing Loss	1		2	
<b>Significant Trauma, Injury, Poisoning &amp; Toxic Effects of Drugs</b>	<b>151</b>	<b>9%</b>	<b>412</b>	<b>8%</b>
Poisoning/Toxic Effect of Drug	56		78	
Open Wound/Other/Unspecified Minor Injury	10		11	
Skull/Intracranial Intervention with Trauma/Complication of Treatment	9		117	
Concussion	9		9	
Single Intracranial Injury	8		25	
Single Injury to Internal Organ	8		16	
Multiple Injuries to Internal Organ	7		17	
Major Thoraco-abdominal/Vascular Intervention with Trauma/Complication of Treatment	7		29	
Spinal Intervention with Trauma/Complication of Treatment	5		52	
Fracture of Skull/Facial Bone	5		6	
Multiple Intracranial Injury	4		5	

Major Clinical Category/Case Mix Group	ICU Visits		ICU Days	
	#	% Total	#	% Total
Other Thoraco-abdominal Intervention with Trauma/Complication of Treatment	4		12	
Internal Fixation of Facial Bone	2		5	
Other Major Bone Intervention with Trauma/Complication of Treatment	2		4	
Skin/Soft Tissue Intervention with Trauma without Flap/Graft	2		2	
Post-Operative Complication except Hemorrhage	2		8	
Fixation/Repair Hip/Femur	2		4	
Significant Injury/Exposure to Element	2		2	
Fracture of Femur	1		3	
Other Fracture/Dislocation of Arm/Shoulder	1		1	
Replacement/Fixation/Repair of Tibia/Fibula/Knee	1		1	
Ear/Nose/Throat Intervention with Trauma/Complication of Treatment	1		1	
Rib Fracture/Flail Chest	1		2	
Post-Operative Hemorrhage	1		1	
Skin/Soft Tissue Intervention with Trauma with Flap/Graft	1		1	
<b>Newborns &amp; Neonates with Conditions Originating in Perinatal Period</b>	<b>149</b>	<b>9%</b>	<b>656</b>	<b>12%</b>
Newborn/Neonate 1500+ gm with Major Cardiovascular Intervention	33		228	
Newborn/Neonate 2500+ grams, Other Minor Problem	25		94	
Newborn/Neonate 2500+ grams, Major Respiratory Complication	22		89	
Newborn/Neonate 2500+ grams, Cardiovascular Anomaly	16		35	
Newborn/Neonate 2500+ grams, Other Respiratory Problem	10		28	
Newborn/Neonate 2500+ grams, Septicemia/Other Neonatal Infection	9		33	
Newborn/Neonate 2500+ grams, Other Moderate Problem	8		25	
Newborn/Neonate 2500+ grams, Anomaly of Nervous/Respiratory/Digestive System	7		18	
Newborn/Neonate 1500+ grams with Major Gastro/Respiratory Intervention	5		15	
Newborn/Neonate 2000-2499 grams, Gestational Age <35 Weeks	3		5	
Newborn/Neonate 2500+ grams, Other Major Problem	3		6	
Newborn/Neonate 2000-2499 grams, Gestational Age 35-36 Weeks	3		40	
Newborn/Neonate 2000-2499 grams, Gestational Age 37+ Weeks	2		2	
Newborn/Neonate 2500+ grams, Chromosomal/Multiple Anomaly	1		1	
Newborn/Neonate 2500+ grams, Other Congenital Anomaly	1		35	
Newborn/Neonate 1500+ grams with Other Major Intervention	1		2	
<b>Diseases &amp; Disorders of the Digestive System</b>	<b>81</b>	<b>5%</b>	<b>270</b>	<b>5%</b>
Non-severe Enteritis	15		27	
Other Gastrointestinal Disorder	13		19	
Non-Complex Hernia Repair	12		13	
Symptom/Sign of Digestive System	8		12	
Complicated Appendectomy	5		12	
Complex Hernia Repair	4		100	
Non-Major Excision/Repair of Upper Gastrointestinal Tract, Unplanned	4		18	
Simple Appendectomy	3		5	
Esophagitis/Gastritis/Miscellaneous Digestive Disease	2		2	
Repair/Fixation & Other Moderate Intervention on Lower Gastrointestinal Tract	2		4	
Minor Upper Gastrointestinal Intervention	2		6	
Inflammatory Bowel Disease	2		7	
Colostomy/Enterostomy	2		27	
Open Large Intestine/Rectum Resection without Colostomy, Planned	2		2	
Intervention on Anus Excluding Reconstruction	1		6	
Gastrointestinal Obstruction	1		1	



Major Clinical Category/Case Mix Group	ICU Visits		ICU Days	
	#	% Total	#	% Total
Open Large Intestine/Rectum Resection without Colostomy, Unplanned	1		4	
Other Intervention with Gastrointestinal Diagnosis	1		1	
Gastrointestinal Hemorrhage	1		4	
<b>Diseases &amp; Disorders of the Endocrine System, Nutrition &amp; Metabolism</b>	<b>79</b>	<b>5%</b>	<b>233</b>	<b>4%</b>
Diabetes	51		83	
Disorder related to Nutrition	11		97	
Disorder of Fluid/Electrolyte Balance	6		15	
Disorder of Metabolism	4		25	
Cystic Fibrosis	2		6	
Disease/Disorder of Pancreas	2		2	
Dehydration	1		2	
MCC 10 Unrelated Intervention	1		2	
Disease/Disorder of Adrenal/Pituitary Gland	1		1	
<b>Diseases &amp; Disorders of the Musculoskeletal System &amp; Connective Tissue</b>	<b>57</b>	<b>3%</b>	<b>150</b>	<b>3%</b>
C1/C2/Thoracic Spine Intervention	16		51	
Osteotomy of Lower Limb except Foot	13		36	
Systemic Connective Tissue Disorder	5		24	
Spinal Vertebrae Intervention	4		8	
Craniofacial Bone Intervention with Musculoskeletal Diagnosis	3		3	
Soft Tissue Intervention of Lower Limb	3		3	
Other Repair Bone of Leg except Ankle/Foot	2		2	
Other Musculoskeletal Soft Tissue Intervention	2		3	
Other Musculoskeletal Disorder	2		12	
Limb Intervention with Graft/Device with Malignant Neoplasm	1		1	
Back Pain/Strain	1		1	
MCC 08 Unrelated Intervention	1		1	
Major Foot Intervention except Soft Tissue without Infection	1		1	
Hand Intervention	1		1	
Other Soft Tissue Disorder	1		2	
Resection/Amputation of Pelvis/Leg with Infection	1		1	
<b>Diseases &amp; Disorders of the Blood &amp; Lymphatic System</b>	<b>42</b>	<b>3%</b>	<b>151</b>	<b>3%</b>
Other Chemotherapy	10		10	
Acute Leukemia except Myeloid	5		11	
Other Anemia	4		35	
Intervention with Blood/Lymphatic System Diagnosis except Neoplasm	4		7	
Agranulocytosis	3		7	
Bone Marrow/Stem Cell Transplant	3		22	
Acute Myeloid Leukemia	3		25	
Intervention with Lymphoma	3		7	
Chemotherapy/Radiotherapy Admission for Neoplasm	2		10	
Lymphoma	2		10	
Hemoglobinopathy	1		5	
Splenectomy	1		1	
Purpura/Other Hemorrhagic Disorder	1		1	
<b>Diseases &amp; Disorders of the Kidney, Urinary Tract &amp; Male Reproductive System</b>	<b>40</b>	<b>2%</b>	<b>112</b>	<b>2%</b>
Kidney Transplant	9		22	
Lower Urinary Tract Infection	6		13	
Upper Urinary Tract Infection	4		11	
Intervention related to Dialysis	4		34	
Major Intervention on Male Reproductive System	3		7	
Major Intervention on Upper Urinary Tract	3		5	

Major Clinical Category/Case Mix Group	ICU Visits		ICU Days	
	#	% Total	#	% Total
Kidney Disease	2		4	
Renal Failure	2		4	
Urinary Obstruction without Percutaneous Drainage	2		3	
Non-Major Intervention on Male Reproductive System	2		4	
Radical Excision/Reconstruction of Bladder	2		2	
Other Intervention with Urinary System Diagnosis	1		3	
<b>Multisystemic or Unspecified Site Infections</b>	<b>37</b>	<b>2%</b>	<b>190</b>	<b>3%</b>
Other/Unspecified Sepsis/Shock	13		69	
Other/Unspecified Viral Illness	7		12	
Multisystemic/Unspecified Site Infection with Intervention	5		72	
Other Infectious/Parasitic Disease	5		15	
Fever	4		8	
Sepsis due to Staphylococcus Aureus/Pseudomonas/Enterococcus	3		14	
<b>Other Reasons for Hospitalization</b>	<b>24</b>	<b>1%</b>	<b>98</b>	<b>2%</b>
Other Factor Causing Hospitalization	7		9	
General Symptom/Sign	5		15	
Other Admission with Non-Major Intervention	4		5	
Palliative Care	2		3	
Convalescence	2		2	
Observation/Evaluation	2		2	
Prematurity and Growth Restriction, Age > 28 Days	1		30	
Multiple/Unspecified Congenital Anomaly	1		32	
<b>Diseases &amp; Disorders of the Skin, Subcutaneous Tissue &amp; Breast</b>	<b>17</b>	<b>1%</b>	<b>77</b>	<b>1%</b>
Other Disease/Disorder of Skin/Subcutaneous Tissue	5		57	
Cellulitis	4		8	
Other Skin/Subcutaneous Tissue Intervention	2		3	
Trauma of Skin/Subcutaneous Tissue/Breast	2		3	
MCC 09 Unrelated Intervention	2		3	
Lymphatic System Intervention with Skin Diagnosis	1		1	
Abscess	1		2	
<b>Miscellaneous CMG &amp; Ungroupable Data</b>	<b>8</b>	<b>0%</b>	<b>8</b>	<b>0%</b>
Diagnosis Not Generally Hospitalized	7		7	
Ungroupable	1		1	
<b>Diseases &amp; Disorders of the Hepatobiliary System &amp; Pancreas</b>	<b>6</b>	<b>0%</b>	<b>13</b>	<b>0%</b>
Liver Disease except Cirrhosis/Malignancy	1		1	
Other Intervention related to Hepatobiliary System	1		5	
Major Hepatobiliary Intervention	1		1	
Disorder of Pancreas except Malignancy	1		4	
Cirrhosis/Alcoholic Hepatitis	1		1	
Laparoscopic Cholecystectomy with/without Common Bile Duct Exploration	1		1	
<b>Burns</b>	<b>4</b>	<b>0%</b>	<b>4</b>	<b>0%</b>
Non-Extensive Burn	3		3	
Extensive Burn	1		1	
<b>Diseases &amp; Disorders of the Eye</b>	<b>3</b>	<b>0%</b>	<b>3</b>	<b>0%</b>
Lens Extraction/Insertion	1		1	
Other Ophthalmology Disorder	1		1	
Major Ophthalmology Disorder	1		1	
<b>Diseases &amp; Disorders of the Female Reproductive System</b>	<b>1</b>	<b>0%</b>	<b>2</b>	<b>0%</b>
Ovarian/Fallopian Tube I/V with Non Malig Diagnosis except Lap Approach	1		2	
<b>Grand Total</b>	<b>1,643</b>	<b>100%</b>	<b>5,474</b>	<b>100%</b>

## Appendix 4: HA Operated Pediatric Inpatient Beds in BC

HA	Hospital	General Pediatric Beds	Pediatric Observation Beds	Ped ICU Beds <sup>1</sup>	Child & Youth MH Beds	Youth SU Beds <sup>2</sup>	Total Ped Beds	NICU Beds
IHA	Kelowna General	10			8		18	12
	Kootenay Boundary (Trail)	4					4	
	East Kootenay (Cranbrook)	2					2	
	Vernon	5					5	
	Royal Inland (Kamloops)	9			2		11	8
FHA	Abbotsford Regional	12					12	10
	Langley Memorial	9					9	
	Chilliwack General		4				4	
	Royal Columbian	12					12	24
	Ridge Meadows		4				4	
	Surrey Memorial	16			20		36	28 <sup>3</sup>
	Burnaby							8
	Creekside Withdrawal Management Centre					6	6	
	Last Door Recovery Centre					10 <sup>4</sup>	10	
VCHA	Lions Gate & Carlile Centre	10			10		20	9
	Richmond		4				4	6
	St Paul's							9
	Peak House					8	8	
	Young Bears Lodge					5	5	
Island HA	Nanaimo Regional	8					8	9
	St Joseph's General	4					4	
	Victoria General/Ledger House	16		5	14 <sup>5</sup>		35	22
	Cowichan District (Duncan)	4					4	
	Campbell River	1					1	
NHA	University Hospital of Northern B.C.	12 <sup>6</sup>			6 <sup>7</sup>		18	9
	Nechako Centre					8 <sup>8</sup>	8	
PHSA	B.C. Children's Hospital	97		22	54 <sup>9</sup>		173	
	BC Women's							60
	Ashnola (Keremeos)					22 <sup>10</sup>	22	
<b>TOTAL</b>		<b>231</b>	<b>12</b>	<b>27</b>	<b>114</b>	<b>59</b>	<b>443</b>	<b>214</b>

Source: Survey of health planners & ED working group in each HA and internet.

**Note: Several hospitals in BC do not have dedicated pediatric beds but admit children to beds on adult inpatient units. These hospitals are not included on the list above.**

<sup>1</sup> Beds have the capacity for invasive monitoring, inotropic drugs and mechanical ventilation.

<sup>2</sup> Excludes beds in home-based settings.

<sup>3</sup> Plan to increase to 48 beds in the future.

<sup>4</sup> Contracted beds and number of beds fluctuates.

<sup>5</sup> 14 beds: 5 child, 6 youth & 3 special care (assessment/stabilization) beds.

<sup>6</sup> 4 beds have the capacity for more intensive monitoring, up to and including continuous cardiorespiratory monitoring.

<sup>7</sup> 2 beds for planned admissions and 4 for crisis stabilization.

<sup>8</sup> Includes 1 detox bed.

<sup>9</sup> Includes 14 beds at Looking Glass (up to age 24), a residential eating disorders program operated by PHSA (BC Mental Health & Substance Use Services and BCCH) in collaboration with the Looking Glass Foundation.

<sup>10</sup> Includes beds for ages 17 - 24.