

Hur går det för barn som behöver intensivvård i Sverige?

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Bakgrund:

Paediatric Intensive Care in Sweden

An epidemiological survey focusing on Diagnostic Panorama, Outcome and Factors influencing Long-term Mortality

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Thesis for doctoral degree (Ph.D.)
2018

Paediatric Intensive Care in Sweden

An epidemiological survey focusing on Diagnostic Panorama, Outcome and Factors influencing Long-term Mortality



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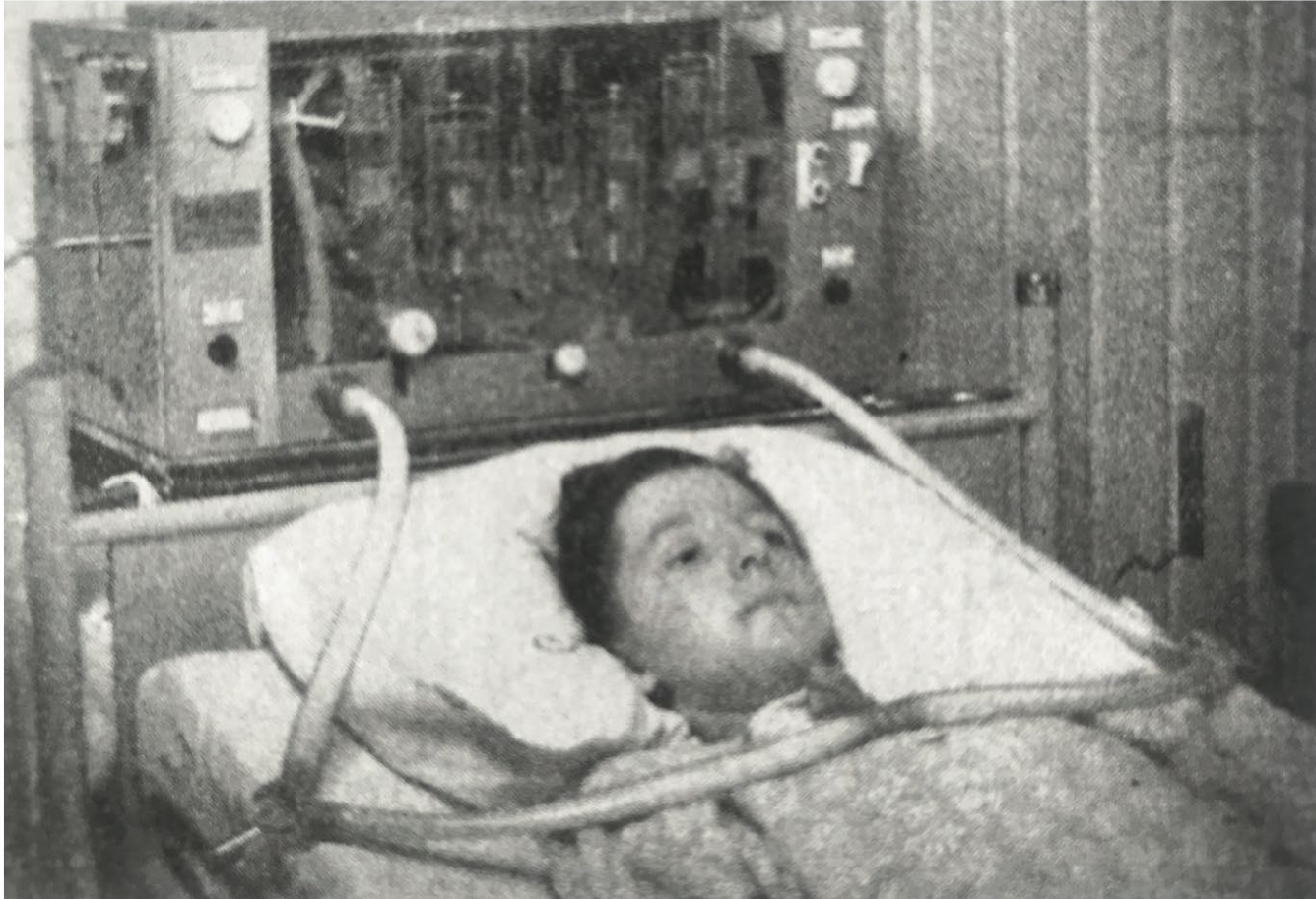
Mikroskopisk historisk återblick

- 1952-53 Polioepidemi i Öresundsområdet, Åke Bauer sätter upp post op + IVA i Borås
- 1955 Världens första BIVA i Gtb. (Göran Haglund.)
- 1958 IRDS Case report!
- 1961 Kronprinsessan Lovisas sjukhus (Hans Feychting)
- Mortalitet för ventilations beroende polio patienter föll från över 80 % till 0 över några år, sepsis barnen mortalitet 60-98%

KLS med "akut avdelningen"



Ventilatorernas era



The Gothia ventilator by Göran Haglund and Åke Waldinger: Nordisk Medicin 1955: 53: 804

Fortsättningen?

- Slutet av 1990 talet hade internationella studier visat att outcome var bättre för barn som vårdats på BIVA i stället för vuxen IVA. Trent vs. Victoria
- Samtidigt saknade Sverige en översikt över vilka barn som Intensivvårdades i Sverige.
- Ett initiativ av ledande Svenska barn IVA läkare ville veta mer!
- SIR bildas 2001 och barn data började redovisas 2007

En nationell kohort formades. IVA vårdade barn i Sverige 1998-2001 följdes i fem år

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Immediate and 5-year cumulative outcome after paediatric intensive care in Sweden

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Appendix 1 - Participating ICUs

Astrid Lindgren Children's Hospital, Stockholm PICU, *Ninna Gullberg*;

BUS, Children and Youth's Hospital Lund PICU, *Ann-Kristin Olsson*;
Queen Silvia's Hospital, Gothenburg, PICU, *Sylvia Göthberg*;
Arvika Hospital ICU, *Jennie Ståh*;
Bollnäs Hospital ICU, *Anders Backman*;

Borås Hospital ICU, *Claes Håkan Björklund*;
Danderyd Hospital ICU, *Carl-Johan Wickerts*;
Eksjö, Höglunds Hospital ICU, *Jesper Raaby*;
Eskilstuna, Mälar Hospital ICU, *Krister Blomberg*;
Falun Regional Hospital ICU, *Pehr Guldbrand*;

Gävle County Hospital ICU, *John Mälstam*;
Göteborg, Sahlgrenska University Hospital ICU, *Stefan Lundin*;

Appendix 1 Continued.

Göteborg Östra Hospital ICU, *Christina Raner*;
Halmstad County Hospital ICU, *Mats Juhlin-Dannfelt*;
Helsingborgs Hospital ICU, *Birgitta Neyman-Thulin*;

Hudiksvalls Hospital ICU, *Jan Hedenmark*;
Jönköping, Ryhov County Hospital ICU, *Mats Persson*;
Kalmar County Hospital, *Sten Borgström*;
Karlskoga Hospital ICU, *Bo Jedheim*;
Karlskrona Blekinge Hospital ICU, *Christer Nilsson*;

Karlstad Central Hospital ICU, *Lars-Åke Johansson*;
Kristianstad Central Hospital ICU, *Tomas Nolin*;
Linköping University Hospital Thoracic ICU, *Sten Walther*;
Ljungby Hospital ICU, *Inga Tjäder*;
Luleå Hospital ICU, *Krister Ruuth*;

Lund University Hospital ICU, *Peter Dahm*;
Lycksele Hospital ICU, *Leif Boström*;
Malmö University Hospital, ICU, *Einar Wemersson*;
Mora Hospital ICU, *Göran Blohm*;
Motala Hospital ICU, *Lena Fagerstöm*;

Norrköping, Vrinnevi Hospital ICU, *Ola Lindberget*;
Norrtälje Hospital ICU, *Johan Sandberg*;
Nyköpings Hospital ICU, *Harald Zetterquist*;
Oskarshamn Hospital ICU, *Bo Gustafsson*;
Skellefteå Hospital ICU, *Eva Feil*;

Skövde Hospital ICU, *Eva Nordenskjöld*;
Sollefteå Hospital ICU, *Göran Mossberg*;
Stockholm, Karolinska Hospital Burn ICU, *Carl-Johan Wallin*;
Stockholm, Karolinska Hospital ICU, *Claes-Roland Martling*;
Stockholm, Karolinska Hospital Neurosurgical ICU, *Bo-Michael Bellander*;

Stockholm, St. Göran Hospital ICU, *Hans Blomqvist*;
Stockholm, South Hospital, ICU, *Jan Häggqvist*;
Stockholm, South Hospital, Medical ICU, *Bengt Ullman*;
Stockholm, Huddinge University Hospital ICU, *Leif Tokics*;
Sunderbyns Hospital ICU, *Ivar Wizelius*;

Torsby Hospital ICU, *Eva-Lena Eriksson*;
Trollhättan, Norra Älvsborg County Hospital ICU, *Lars Öhrn*;
Uddevalla Hospital ICU, *Leif Dolonius*;
Umeå, The University Hospital of Northern Sweden ICU, *Björn Biber*;
Uppsala University Hospital ICU 70G, *Hans Stjernström*;

Visby Hospital ICU,* *Thomas Widén*
Värnamo Hospital ICU, *Terje Blomstrand*;
Västerviks Hospital ICU, *Jan Idvall*;
Växjö Central Hospital ICU, *Gunnar Lindberg*;
Ystad Hospital ICU, *Eva D. Andersson*;

Örnköldsviks Hospital ICU, *Sonja Ljesevic*;
Östersunds Hospital ICU, *Caroline Starlander*;
Örebro University Hospital ICU, *Lars Berggren*

*Number of patients, but incomplete identification numbers.

Resultat

Table 1

Number of admissions, demographics.

	Number of admissions	Number of patients*	Age median (years)	LOS median (days)	LOS > 3 days	ICU mortality	5-year mortality
All admissions	8063	6661	6.1	1	1038 (13%)	140 (2.1%)	366 (5.6%)
PICU (<i>n</i> = 3)	3561	2755	2.1	1	661 (19%)	69 (2.5%)	201 (7.3%)
PICU age 1–6 months	926	650	0.2	2	268 (29%)	20 (3.1%)	61 (9.4%)
PICU age 6 months–16 years	2635	2105	4.8	1	393 (15%)	49 (2.3%)	140 (6.6%)
Adult ICU (<i>n</i> = 52)	4502	3906	9.5	1	377 (8%)	71 (1.9%)	165 (4.3%)
University ICU (<i>n</i> = 10)	1675	1390	8.5	1	240 (14%)	43 (3.1%)	107 (7.7%)
General ICU (<i>n</i> = 42)	2827	2516	9.9	1	137 (5%)	28 (1.2%)	58 (2.4%)

LOS and mortality for different groups.

*In mortality and LOS calculations, 87 patients (in a general ICU) are excluded as they lack dates for ICU admission.

LOS, length-of-stay; ICU, intensive care unit; PICU, paediatric intensive care unit.

Indelning av kohorten efter ålder, kön, ICU, ANZPIC´s diagnosgrupper etc.

Definition diagnosgrupper:

The diagnostic groups consisted of Cardiovascular , Gastrointestinal/Renal , Injury, Respiratory, Neurological, Post-operative ENT/Thoracic, Post-operative Neuro, Post-operative Other and Miscellaneous group . The Miscellaneous group included malignancies, endocrine disorders, allergic reactions, sepsis and post- cardiac arrest, in accordance with the recommendations for the ANZPIC registry.

Fig. 1A **AICU**

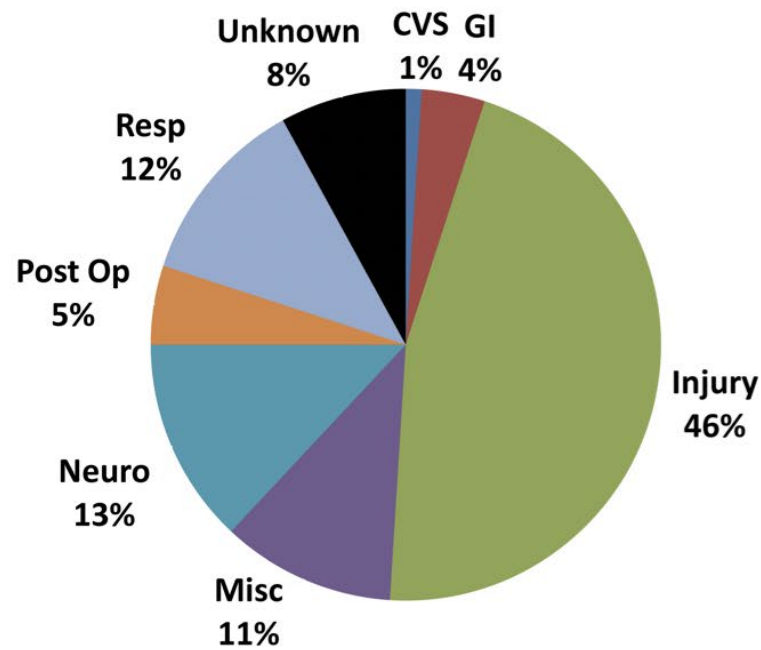
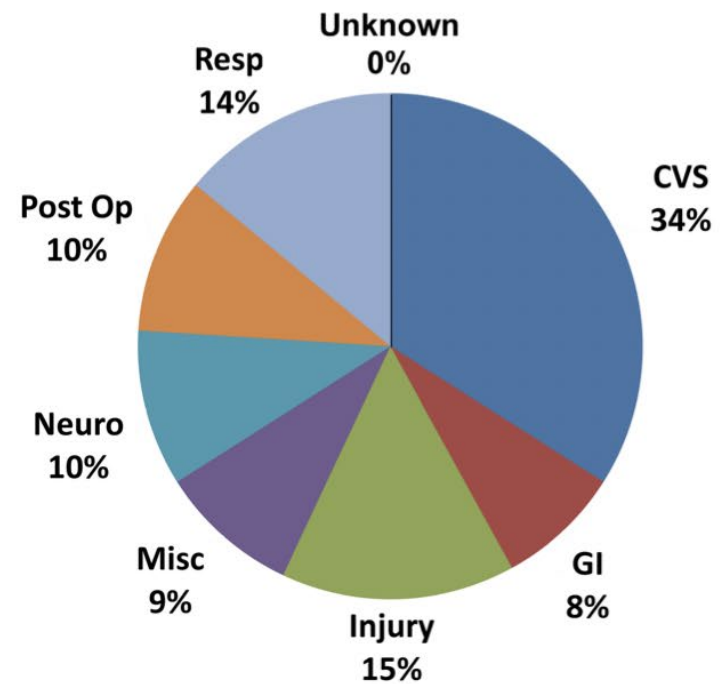


Fig 1B **PICU**



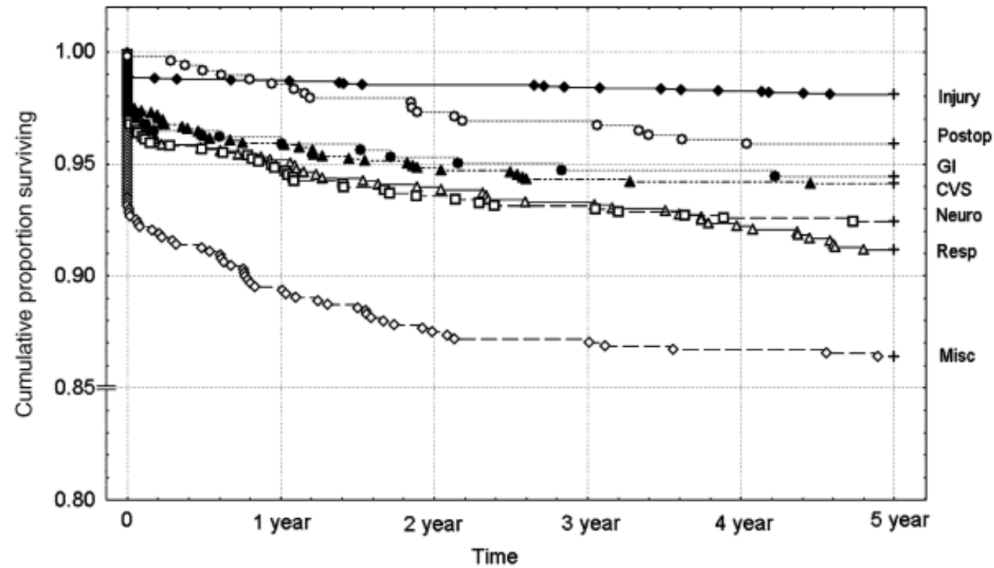


Fig. 4. Five-year survival for the different diagnostic groups: ◆, injury; ○, Postop. = postoperative (including postop. Neuro-, ear-nose- and throat and other surgery); ●, GI = gastrointestinal/nephrology; ▲, CVS = cardiovascular (includes postoperative cardiac surgery); □, Neuro; △, Resp. = respiratory; ◇, Misc. = Miscellaneous.

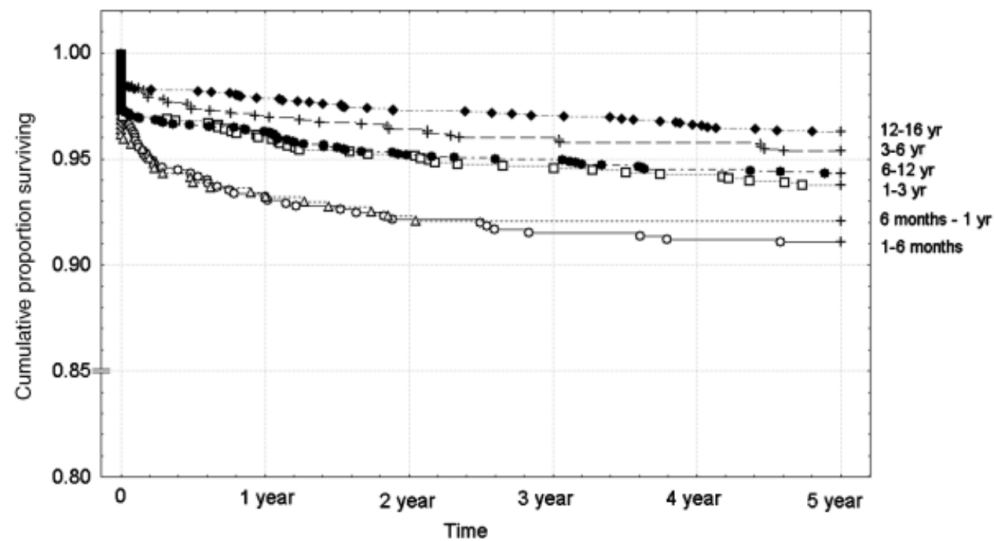
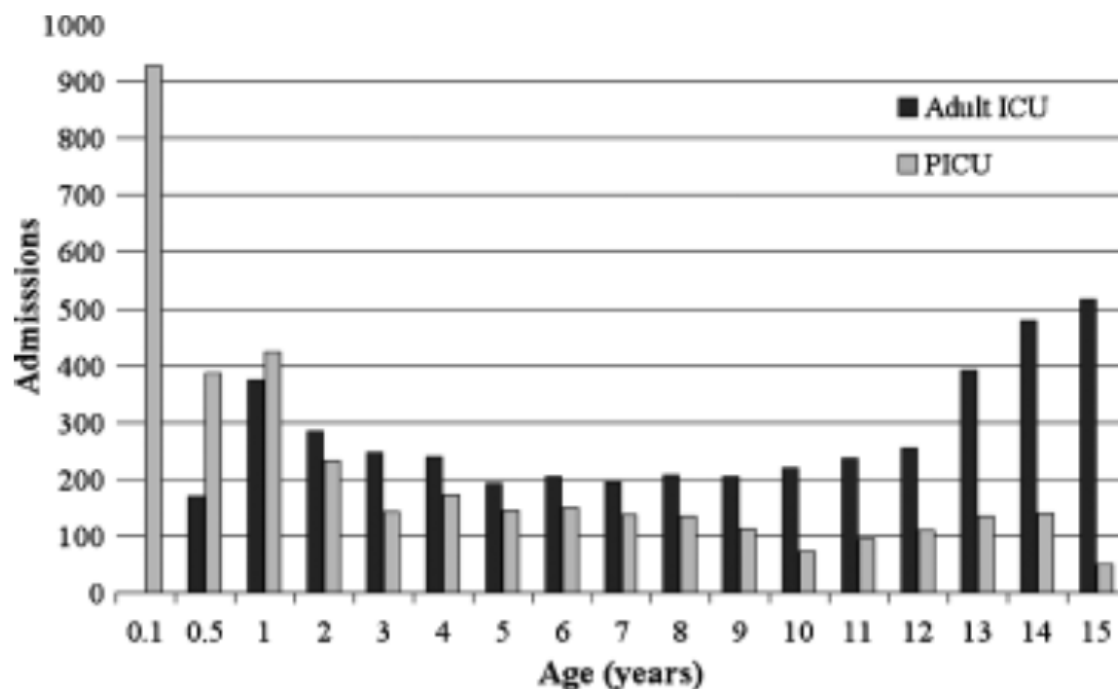


Fig. 5. Five-year survival for the different age-groups: ◆, 12-16 years; + 3-6 years; ●, 6-12 years; □, 1-3 years; △, 6 months- 1 year; ○, 1-6 months.



*Fig.1. Age of admitted patients in adult vs. paediatric ICU (PICU) 0.1= age 1–6 months, 0.5 = age 6 months–1 year. *Data on patients < 6 months old was not collected from adult ICU.*

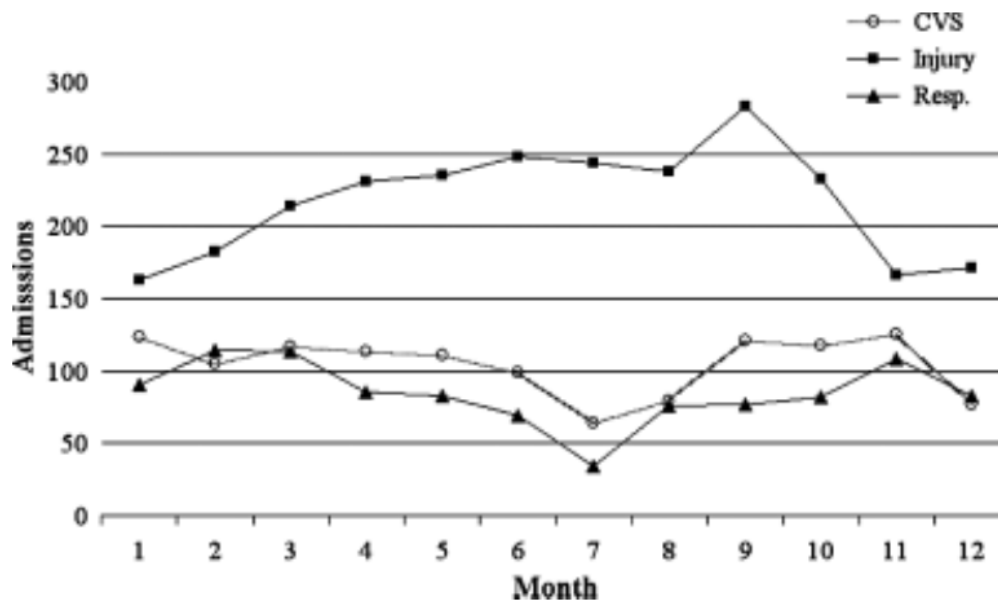


Fig. 3. Seasonal variation in reason for admittance to ICU; the lowest number of admissions/month in the respiratory and CVS group coincides with summer vacation. The peak in admissions for injury coincides with first month of school.

Table 2

Yearly mortality of cohort in comparison with background mortality for Swedish residents of same age without admission to intensive care unit (ICU) care.

Mortality	Cohort (%)	Background (%)
Year 1	3.68	0.018
Year 2	0.84	0.015
Year 3	0.36	0.013
Year 4	0.36	0.014
Year 5	0.28	0.013

Saknas: risk scoring....och vad består den sena döden av..

Ny kohort:

Alla BIVA vårdade barn i Sverige (2008-2009-2010)

3 BIVA, 3688 barn, 5019 VTF. Följdes till 2012

Data för PIM2, ANZPIC, antal inläggningar/person, CCC*,

Analys utifrån de olika grupperna:

PICU mortalitet, Mortality Ratio och Mortality rate ratio

* CCC definition:



RESEARCH ARTICLE

Survival after PICU admission: The impact of multiple admissions and complex chronic conditions

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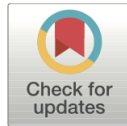
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Abstract

Objective

Factors predicting survival over time after pediatric intensive care unit (PICU) admissions are not fully understood. The primary aim of the current study was to investigate whether multiple admissions (MADM) compared to single PICU admissions (SADM) were associated with poor survival over time after being admitted to PICU facilities. Our secondary aim was to investigate if the presence of a complex chronic condition (CCC) would further impair prognosis.

Resultat

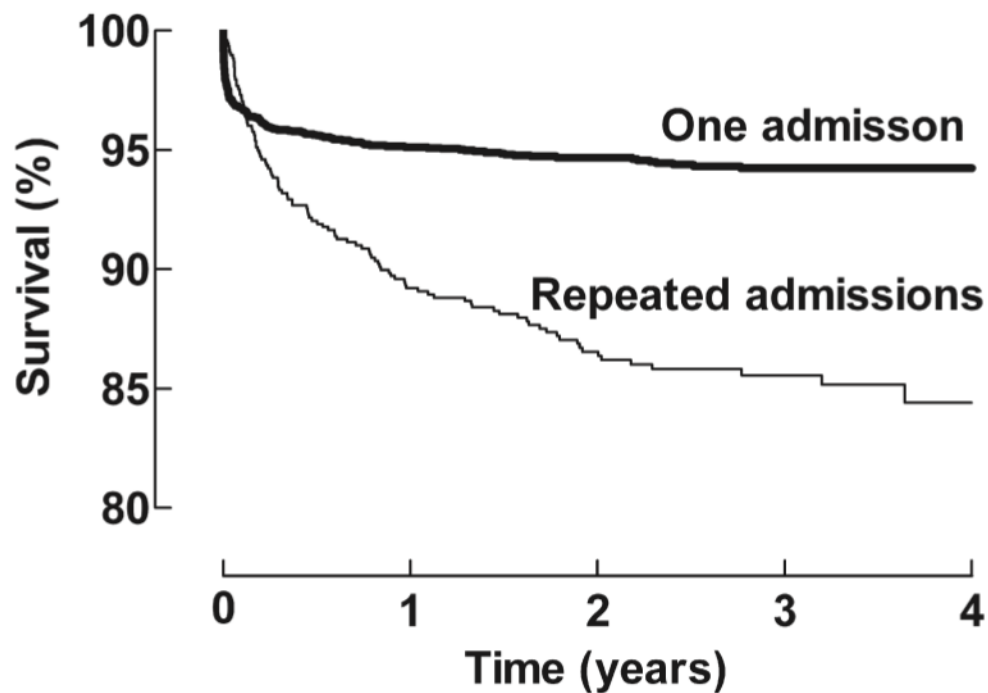


Fig 2. Cumulative survival for the single and multiple admission groups. Statistically significant differences between curves are as follows: Hazard Ratio 3.28; 95% CI 2.43–4.44, Log-rank (Mantel-Cox) or Gehan-Breslow-Wilcoxon Test, both $p < 0.0001$.

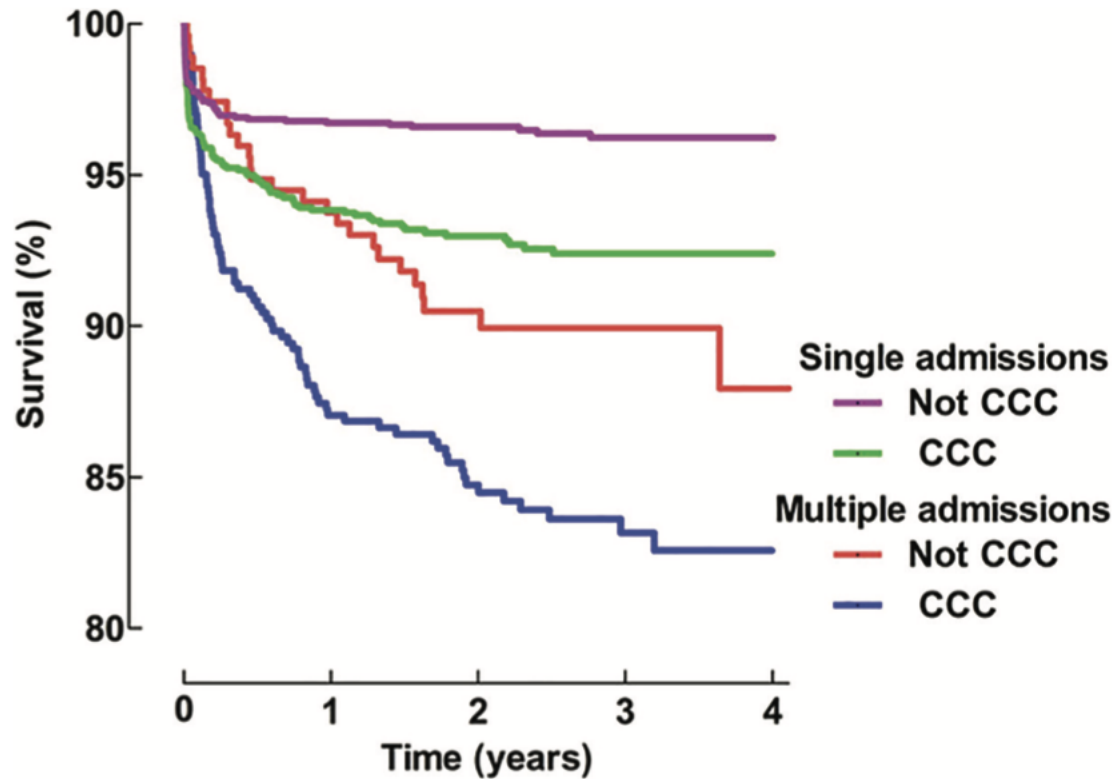


Fig 2. K-M curves for patients with single admissions (SADM) and multiple admissions (MADM) with or without a complex chronic condition (CCC).

Subgroup		Subgroup	p-values (Log-rank (Mantel-Cox) Test)	p-values (Gehan-Breslow- Wicoxon Test)
MADM + CCC	vs	MADM Not CCC	0.0208	0.0166
MADM + CCC	vs	SADM + CCC	<0.0001	<0.0001
MADM + CCC	vs	SADM Not CCC	<0.0001	<0.0001
MADM Not CCC	vs	SADM + CCC	0.1674	0.2982
MADM Not CCC	vs	SADM Not CCC	<0.0001	<0.0001
SADM + CCC	vs	SADM Not CCC	<0.0001	<0.0001

Values of $p < 0.0083$ were considered statistically significant after Bonferroni correction ($K=6$).

Table 2. p-values for comparison between patients with single (SADM) or multiple (MADM) admissions with or without a complex chronic condition (CCC).

Single admission

ANZPIC

Diagnostic group	All groups	CVS	GI	Injury	Neuro	Post op	Resp	Misc
Numbers of patients	2,909	1,087	279	209	312	70	518	434
PICU mortality n (%)	88 (3.0)	22 (2.0)	5 (1.8)	4 (1.9)	13 (4.2)	0 (0.0)	11 (2.1)	33 (7.6)
Mortality rate								
Deaths/person years	0.023	0.015	0.009	0.008	0.027	0.011	0.021	0.066

Multiple admission

ANZPIC

Diagnostic group	All groups	CVS	GI	Injury	Neuro	Post op	Resp	Misc
Numbers of patients	779	342	89	15	63	15	163	92
PICU mortality n (%)	52 (6.7)	19 (5.6)	5 (5.6)	0 (0.0)	3 (4.8)	0 (0.0)	11 (6.7)	11 (12)
Mortality rate								
Deaths/person years	0.062	0.039	0.042	0.000	0.191	0.029	0.107	0.141
Mortality Rate Ratio	2.69	2.59	4.78	0.00	7.07	2.50	5.07	2.16

n=number of patients in group, MR=mortality rate (total number of deaths during time of follow-up, divided by total accumulated person-time during follow-up), expressed as deaths per person-years of follow-up time. MRR=mortality rate ratio (MR SADM / MR MADM).

Table 3. PICU mortality and mortality rate (MR) with mortality rate ratio (MRR) for single (SADM) and multiple (MADM) admissions groups, depending on admission diagnostic group.

	Patients with Multiple Admissions		Patients with a Single Admission	
	All	Deceased	All	Deceased
Numbers of patients	272	27 (9.9%)	1,688	68 (4.0%)
Median age years (mean)*	0.5 (3.0)	0.4 (3.4)	0.4 (3.2)	1.3 (4.5)
Male sex (% of total)	172 (63%)	19 (11%)	1,156 (57.9%)	40 (3.6%)
ANZPIC diagnostic groups				
Cardiovascular	41	4 (9.7%)	319	12 (3.7%)
Respiratory	93	11 (11.8%)	412	15 (3.6%)
Miscellaneous	35	4 (11.4)	207	19 (9.2%)
Neurological	36	3 (8.3%)	252	11(4.3%)
Gastrointestinal/Renal	43	5 (11.6%)	226	5 (2.2%)
Postoperative	10	0	67	2 (3.0%)
Injury	14	0	205	4 (1.9%)

* Both median and mean age are presented to illustrate skewed distribution.

Table 4. MADM and SADM patients without CCC and deaths in admission diagnostic groups.

SADM, MADM and MR for admission diagnostic groups

The impact of SADM and MADM was explored in detail for the diagnostic groups. The results are presented in *4a and 4b*.

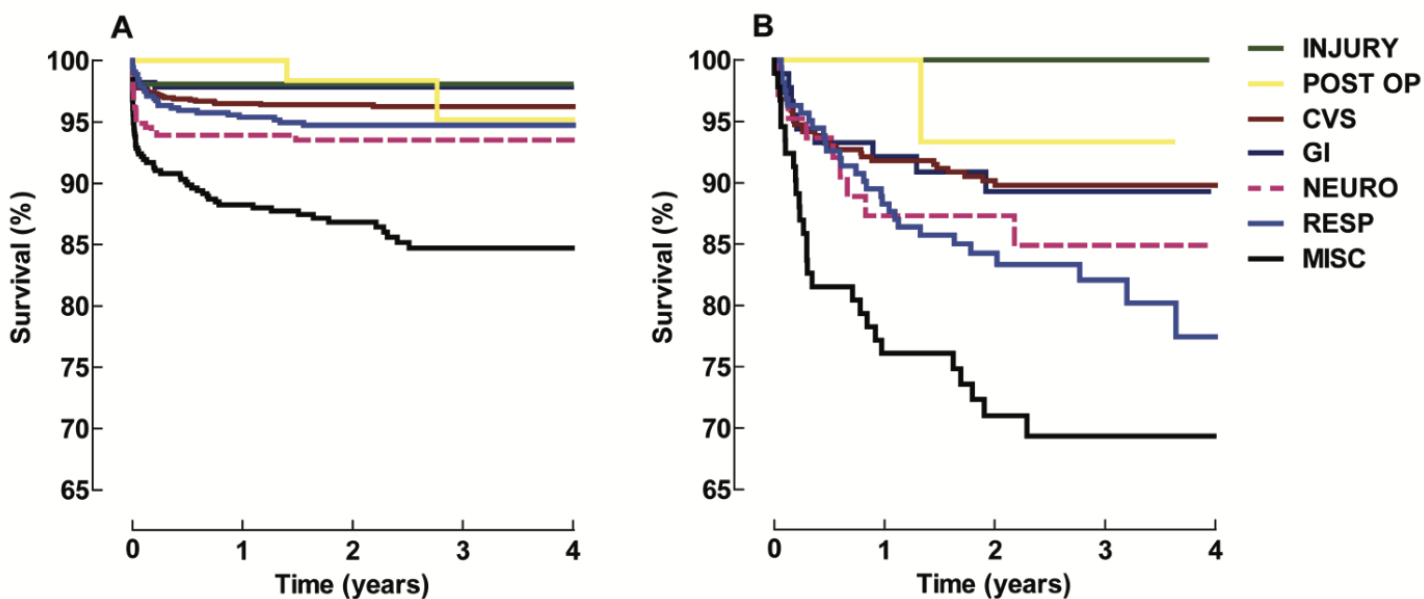


Fig 3. Kaplan-Meier plots showing diagnostic group survival on single admission (a) and multiple admissions (b). There was a difference ($p < 0.001$) between single and multiple admissions in all of the diagnostic groups except Inj and Post Op. Neuro displayed a $p = 0.04$. All p -values are presented in Table 9.

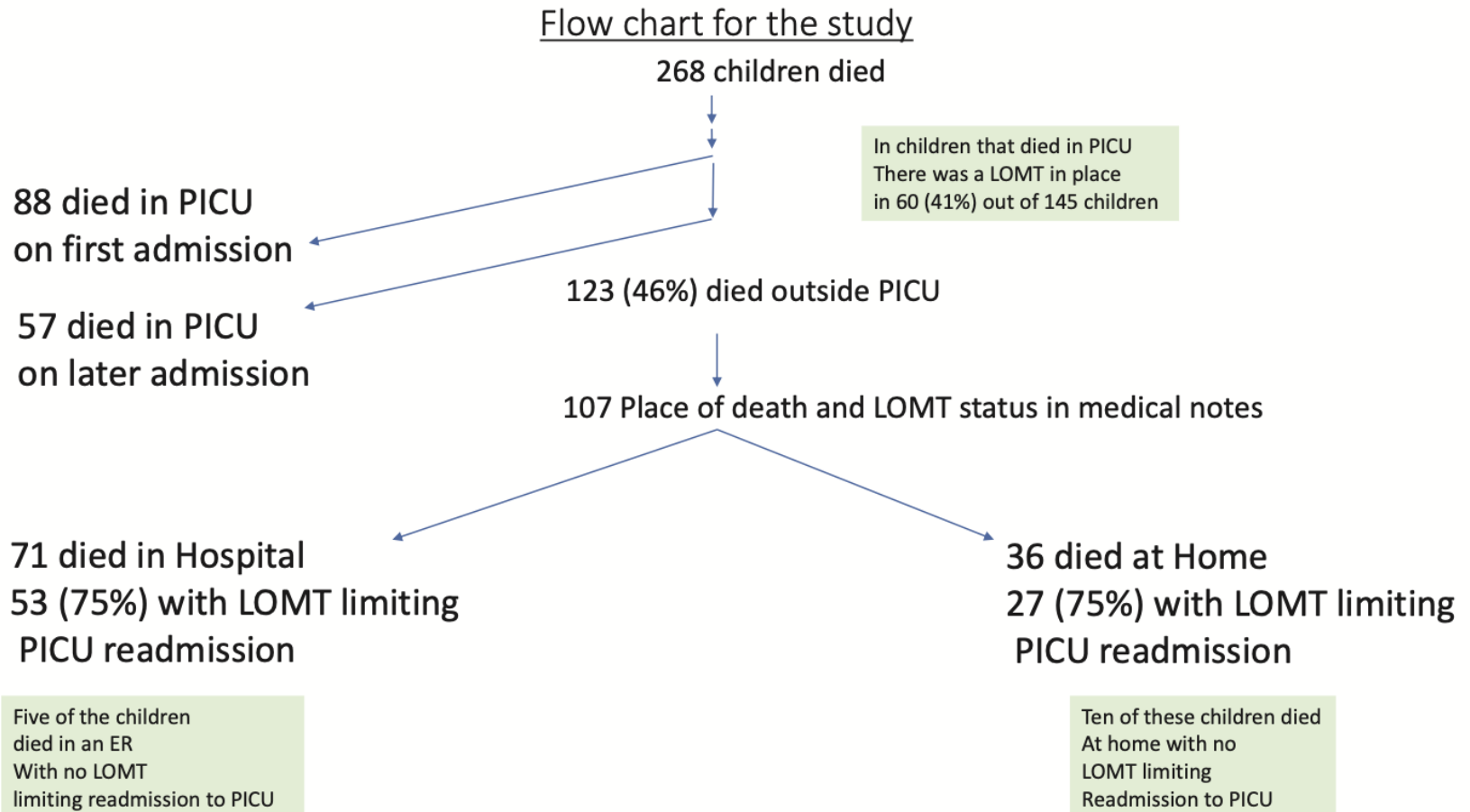
	Patients with Multiple Admissions and a Complex Chronic Condition		Patients with a Single Admission and a Complex Chronic Condition	
	All	Deceased	All	Deceased
Number of patients	507	82 (16.2%)	1221	92 (7.5%)
Age years, median (mean)*	0.1 (1.6)	0.3 (2.4)	1.0 (3.5)	0.7 (3.3)
Male sex (% of total)	276 (54.4%)	40 (14.5%)	675 (55.3%)	53 (7.8%)
ANZPIC diagnostic groups				
Cardiovascular	302	30 (9.9%)	768	28 (3.6%)
Respiratory	69	18 (26.0%)	106	12 (11.3%)
Miscellaneous	56	23 (41.0%)	227	42 (18.5%)
Neurological	27	7 (25.9%)	60	9 (15.0%)
Gastrointestinal	47	4 (8.5%)	53	1 (1.9%)
Postoperative	5	1 (20%)	3	0
Injury	1	0	4	0
Complex Chronic Conditions				
Subcategories	507	82 (16.2%)	1,221	92 (7.5%)
Age years, median (mean)*	0.1 (1.6)	0.3 (2.4)	1.0 (3.5)	0.7 (3.3)
Male sex	276 (54.4%)	40 (14.5%)	675 (55.5%)	53 (7.8%)
Cardiovascular	308	35 (11.4%)	761	29 (3.8%)
Respiratory	21	2 (9.5%)	47	4 (8.5%)
Neuromuscular	34	9 (26.4%)	82	12 (14.6%)
Congenital/genetic	44	6 (13.6%)	84	6 (7.1%)
Oncologic	40	19 (47.5%)	106	29 (25.5%)
Metabolic/endocrine	14	6 (42.8%)	88	8 (9.0%)
Renal	8	2 (25%)	12	1 (8.3%)
Gastrointestinal	24	1 (4.2%)	35	2 (5.7%)
Hematologic/immunologic	5	2 (40%)	3	1 (33.3%)
Miscellaneous**	0	0	3	0

* Both median and mean age are presented to illustrate skewed distribution.

** Miscellaneous includes rheumatologic, orthopedic, and psychiatric conditions.

Table 5. MADM and SADM patients with CCC and deaths in ANZPIC admission diagnostic groups and CCC subcategories.

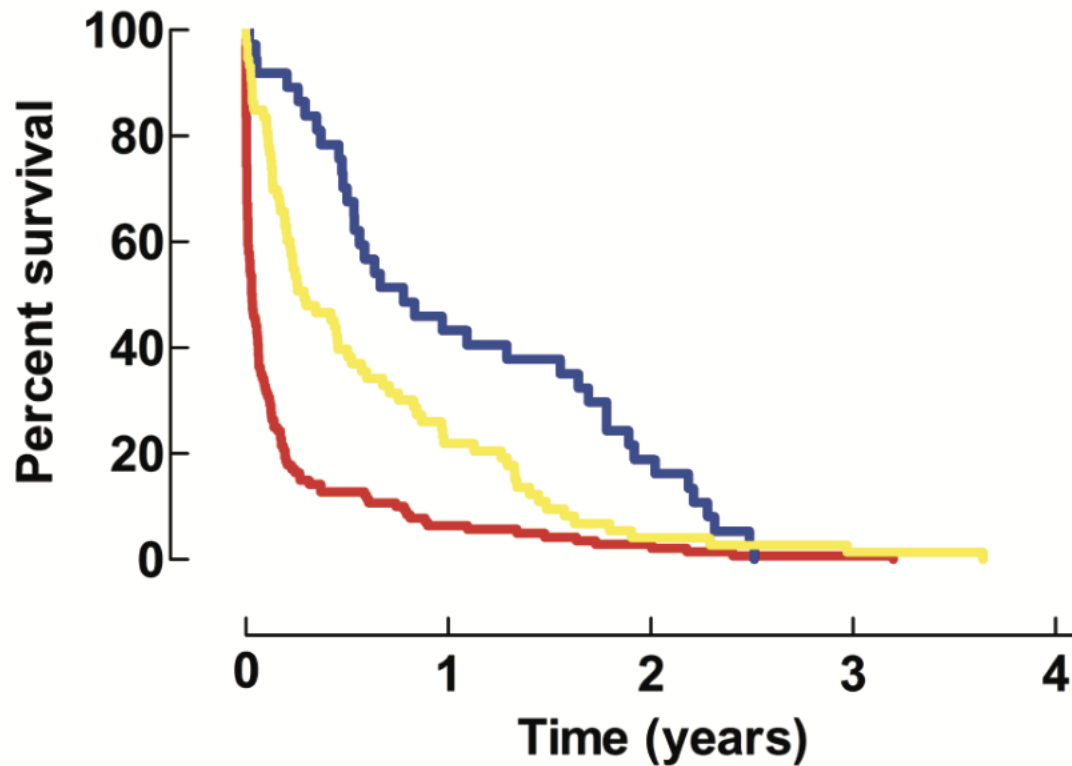
Var avlider de över tid och vilka är de?



Demographic data for the three groups presented in *table 15* below.

Table 15

Deseaced	PICU	Hosp	Home
n=	145	71	36
cvs	43	21	6
GI	10	2	2
Misc	43	24	16
Neuro	17	7	3
Resp	27	15	9
post op other	1	2	0
Inj	4	0	0
LOS	7.7	8.1	2.8
Admissions	1.8	2.1	1.9
Age years	2.9	3.7	4.3
Male sex (%)	76 (52)	43 (61)	27 (75)



*Figure 7
Survival for the three groups over the time of the study. Place of death; red line PICU, yellow line in hospital, blue line at home.*

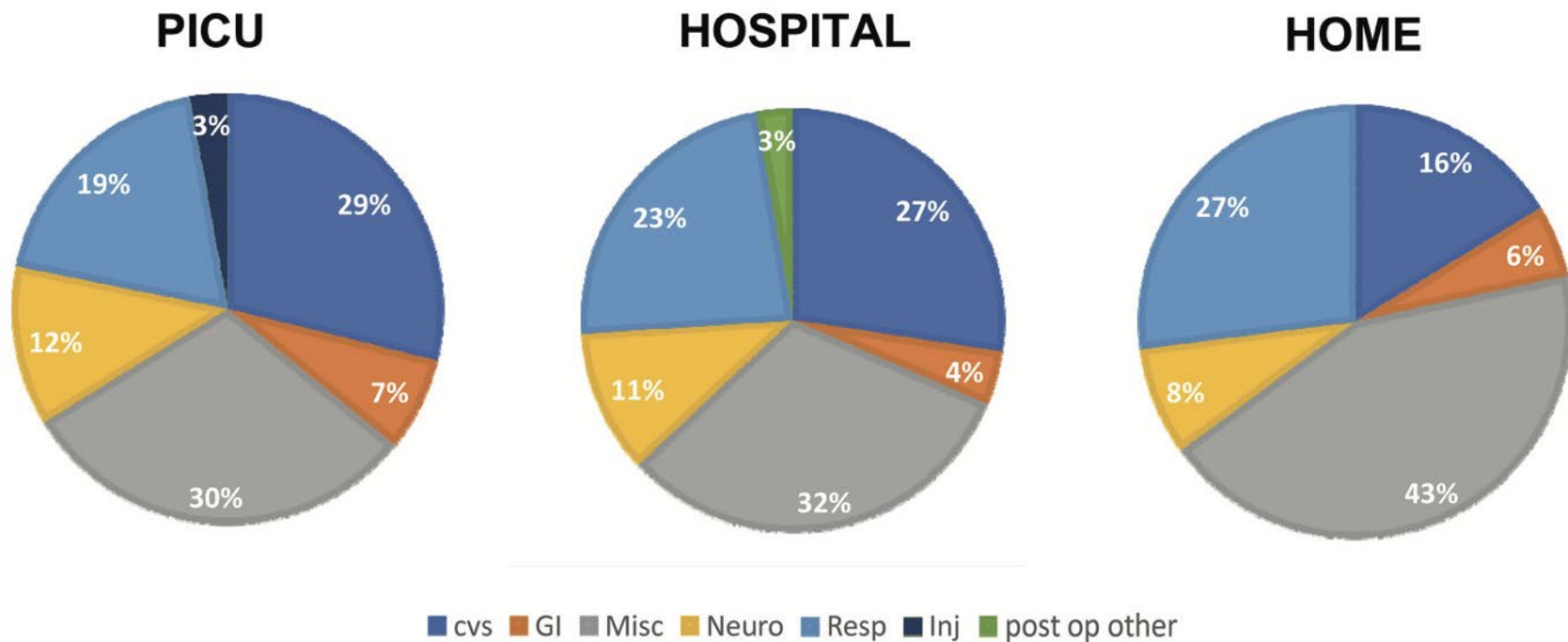
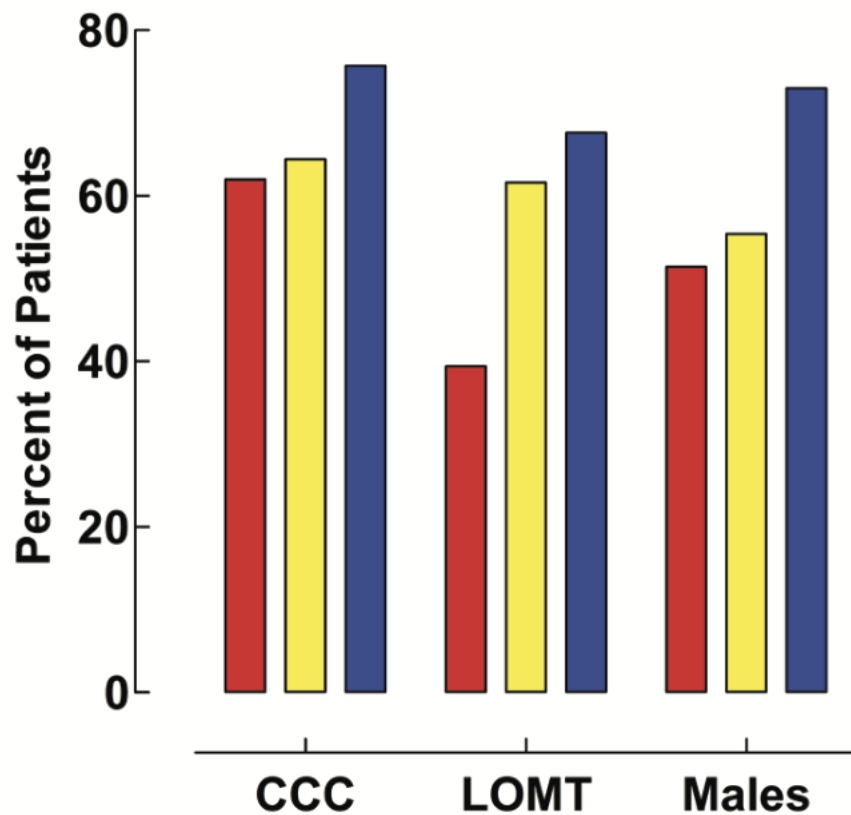


Fig 9. Admission diagnostic groups for the three locations of death, in PICU, in hospital or at home.



*Fig 8.
Presence of CCC and
LOMT in the three
groups respectively.
Place of death; red
colour PICU, yellow
colour in hospital, blue
colour at home.*

Slutkläm:

Svensk Barnintensivvård står sig väl!

Ur data går att ha nyanserad diskussion
gällande outcome för olika grupper;
SADM, MADM, CCC, osv.

LOMT verkar fungera och pojkar är känsligare.

Tack för visad
uppmärksamhet

