Mr James Downie
Chief Executive Officer
Independent Hospital Pricing Authority
By email: submissions.ihpa@ihpa.gov.au

WOMEN'S & CHILDREN'S HEALTHCARE AUSTRALASIA

Dear James,

Re: Pricing Framework for Australian Public Hospital Services 2020-21

Thank you for the opportunity to provide feedback on the IHPA stakeholder consultation paper for the Pricing Framework for Australian Public Hospital Services 2020-21. As you know, Children's Healthcare Australasia's (CHA) membership comprises 90 paediatric services, including both specialist children's hospitals and general hospitals providing paediatric services, large and small. While Women's Healthcare Australasia)WHA) represents 120 maternity services across Australia. We have consulted our members about the questions posed in the consultation paper for the Pricing Framework 2020-21. This submission offers feedback related only to the provision of women's and children's healthcare services.

1. Are the Pricing Guidelines still relevant in providing guidance on IHPA's role in pricing Australian public hospital services?
Yes. The pricing guideline continues to be relevant to the provision of women's and children's healthcare services.

2. Does the proposed addition to the Pricing Guidelines appropriately capture the need for pricing models to support 'value' in hospital and health services?

Both WHA and CHA strongly support the proposed addition of "promoting value" as proposed. ABF has increased the transparency and efficiency of public hospital services over the past decade or so, but can be challenging in terms of supporting innovation in models of care intended to support improvements in quality and outcomes of care at lower cost.

An example of this from the children's healthcare sector is care coordination by children's hospitals for children with multiple, complex, and often lifelong diagnoses, who require input from multiple subspecialist to their care on an ongoing basis. In recent years the Children's Hospitals have collaborated through CHA to share information and ideas about coordinating care for these children, with measurable improvements for children & their families, including significant reductions in unplanned ED attendances, reduced admission, and fewer days spent in hospital as an inpatient. This has been achieved through various approaches but they all have in common coordinating timely contact for the child and family with multidisciplinary teams of specialists, nurses and allied health, effectively breaking down subspeciality silos, and ensuring everyone is on the same page with care planning & delivery. However, under ABF, these reductions in inpatient stays have effectively resulted in millions of dollars of foregone revenue for these hospitals, compared with when they were not coordinating care for this high risk group of children. There needs to be greater consideration given to finding pricing models that support such innovations where outcomes are demonstrably better and costs are reduced.

An example of this from the maternity & newborn space, is the issue of the unqualified neonate receiving medical care while co-located with the mother on a postnatal ward. IHPA is well versed in this issue from previous submissions by WHA, but to briefly summarise the issue which is an ongoing one: Changing evidence on best practice care, together with rising birth rate and pressure on finite nursery cots, has resulted in many hospitals providing medical care to newborn babies while the baby is kept on the ward with the mother, rather than separating the baby by admitting it to a special care nursery. This change in practice reduces cost and improves outcomes for mothers and babies, but results in the hospital being financially penalised, as the newborn is unable to be 'qualified', which means the costs of their care are unable to be

claimed separately from that of the mother's birth episode. WHA estimated in its submission about IHPA's work program for 2015-16, that as many as half of all babies cared for on postnatal wards are receiving medical care but are not triggering 'qualified' status as they are not admitted to a nursery. WHA members would welcome advice from IHPA about how this situation could be addressed moving forward, and whether the perverse incentive to separate mothers from their mildly unwell babies to trigger funding can be removed.

3. What should IHPA prioritise when developing AR-DRG Version 11.0 and ICD-10-AM/ACHI/ACS Twelfth Edition?

WHA members are experiencing significant difficulties with the way in which the current ICD classification captures neonatal trauma. While maternity services support the inclusion of a Hospital Acquired Complication relevant to newborns in the national list, there are problems with accurately identifying neonatal trauma using the current codes. The picture emerging from analysis of coded data is overstating actual trauma to a large extent, with normal, non-harmful, distortions of the fetal head in babies born vaginally, being included in grouped up data on trauma. If neonatal trauma is to be meaningfully measured and managed in maternity services, there is a need for a redesign of the relevant codes and their aggregation.

4. Are there other priorities that should be included as part of the comprehensive review of the admitted acute care classification development process?

No.

5. Are there any impediments to implementing pricing using the AECC Version 1.0 for emergency departments from 1 July 2020?

CHA has facilitated active contributions to consultations and workshops on the AECC hosted by IHPA over the past few years. There is support for the principle behind the development of the classification, i.e. that the classification should have a stronger emphasis on patient factors such as diagnosis rather than simply on triage category. The biggest impediment to implementing pricing based on the AECC in the view of members will be having the data systems to capture the relevant information. While most (though not all) children's hospitals now have Electronic Health Records that can be adapted to the new classification, the majority of children's emergency care is provided in mixed Emergency Departments. Many hospitals are yet to access EMR systems for emergency care. No doubt the proposed pricing will help to stimulate development of appropriate systems to capture the necessary data.

6. Are there any impediments to implementing pricing for mental health services using AMHCC Version 1.0 from 1 July 2020?

CHA members have noted IHPA's intention to shadow price mental health services in 2020-21 using the AMHCC version 1.0. There is considerable interest among providers of child & adolescent mental health services in seeing the resulting analysis, and ensuring that mental health services for children and adolescents is appropriately captured & priced before we move from shadow pricing to ABF funding of these services.

WHA member hospitals are also interested in the development of the AMHCC and shadow pricing. Demand for perinatal mental health care has continued to grow in recent years, with concerns being raised by maternity providers about capacity to fund appropriately services with appropriate clinical workforces to care for mothers and their babies, when inpatient mental health care is required before or after childbirth. There continues to be a significant shortfall in services offering inpatient perinatal mental health care that enable babies to co-reside with their mothers to support attachment and breastfeeding while the mother receives mental health care. Pricing of these services must take into account the need to provide care to a baby that is not itself a patient of the mental health service, but whose care is nevertheless important to the recovery of mental health for the mother, as well as to the prevention of mental ill-health through attachment issues) of the infant.

7. Are there adjustments for legitimate and unavoidable cost variations that IHPA should consider for NEP20?
CHA recommends IHPA consider unbundling the ICU component of the DRG price for *MDC15 Newborns and Other Neonates.*

The high cost of treating patients in Intensive Care Units (ICU) is recognised in the NEP19 through the provision of a price adjustment based on the time a patient spends in ICU. This adjustment is applied to all patients utilising ICU except those assigned a Major Diagnostic Category (MDC) of 'Newborns and Other Neonates' (Neonates), where the AR-DRG price is inclusive of a 'Bundled ICU' component.

This differential model for patients requiring treatment in Paediatric Intensive Care Unit (PICU) creates issues in understanding productivity and efficiency as the level of funding is impacted by the proportion of neonates and associated PICU bed utilisation which is subject to variation.

This issue is most evident for long stay, complex patients receiving ventilatory support where age is a prime factor in determining the level of funding received with neonatal patients significantly impacted despite being managed under the same model of care as their older (non-neonatal) patients.

A CHA member, Queensland Children's Hospital (QCH), has conducted a case study for this issue. QCH estimates how much funding is received for providing care to a patient with elective admission from NICU at transferring hospital via QCH Operating Theatre to PICU and then discharged home after 226 days in PICU. If the patient is 27 days old on admission, this episode will be coded to P06A (with bundling ICU payment) and the hospital receives $379,670. However, if the same patient is 28 days old on admission, this episode can be coded to A13A (with unbundling ICU adjustment) and QCH can receive additional $848,688 for providing the same care.

QCH's analysis also indicates complex, long stay patients that require significant time in ICU and are typically transferred from other hospitals to specialist paediatric, quaternary facilities are significantly underfunded while less complex patients that do not require treatment in ICU are overfunded.

It is recommended IHPA consider unbundling the ICU component of the DRG price for Newborns and Other Neonates to provide consistency for all patients treated in a PICU and create a more transparent and equitable model. More details about this analysis by Stuart Bowhay at QCH is provided at Appendix A.

8. Is there any objection to IHPA phasing out the private patient correction factor for NEP20?
The proposed approach sounds reasonable.

9. Do you support IHPA making the NBP publicly available, with appropriate safeguards in place to protect patient privacy?
Yes. WHA and CHA support IHPA's commitment to make access to the National Benchmarking Portal publicly available in the future. Given the richness of the data IHPA collects, greater accessibility by clinicians and managers, and by other stakeholders like non-government organisations, could accelerate efforts to identify ways of improving outcomes and lowering costs. WHA and CHA would certainly welcome the opportunity to access the portal, and would use the data there to help identify trends in costs of women's & children's healthcare, to identify services with demonstrably better or more efficient care for particular cohorts of patients, and to help those services share the strategies/approach they are using with peers caring for similar patients. Ultimately, once the ANACC and AECC are widely implemented, there would also be opportunities to map patient journeys to better identify which hospitals are succeeding in improving health outcomes and reducing the need for admission of target groups of patients, particularly those with chronic and/or complex conditions. It is a source of frustration to our members in states that do not currently allow access to the NBP, that they can not currently benefit from analysing their service & opportunities to improve. Those that can access the NBP share insights with peers across our networks and

report finding the information and the analytics and filtering functions in the portal to be useful. The portal could be even more valuable if the data was more up to date.

10. What are the estimated costs of collecting the IHI in your state or territory?
WCHA does not have access to this information.

11. Would you support the introduction of an incentive payment or other mechanism to assist in covering these costs for a limited time period?
Consistent use of the Individual Healthcare Identifier across all hospitals is a no brainer for the reasons outlined in the consultation paper. Given that the stated 'in principle' support for the IHI by state and territory governments has not yet translated into implementation of the appropriate data systems to assign and capture the IHI in all public hospitals, WCHA is supportive of an incentive type approach as mooted in the consultation paper. One consideration in this will be that hospitals are at varying stages in roll out of Electronic Medical Records, which will have some bearing on ease of implementation of the IHI.

12. What initiatives are currently underway to collect PROMs and how are they being collated?
There is growing interest in PROMs among both WHA and CHA members. At present the approaches being taken are fragmented and particular to the hospital or service involved. Some member hospitals rely upon state-wide PROM survey tools, such as that used in Victoria. However, this tool does not provide any data specific to the provision of either maternity or children's healthcare, but is a generic questionnaire for any hospital inpatient and is run only yearly. Others have contracted third party providers such as Press Ganey or Patient Opinion to capture and provide patient feedback, with varying degrees of satisfaction about the usefulness of the data gained from such services. One member, Queensland Children's Hospital, has become the first children's tertiary service globally to become accredited with Planetree International, a non-government body that has established an accreditation process for partnering with consumers that includes, inter alia, collection of PROMs and Patient Reported Experience Measures. Several member hospitals are interested in benchmarking PROMs with one another, to help identify teams or services that are examplars from the point of view of women, children & families. But there is at present no standard indicators collected that would lend themselves to such networking.

The WHA Board has considered the ICHOM Outcome measure for maternity care with a view to encouraging & facilitating member hospitals to collect and report these measures. Use of the ICHOM maternity indicators would facilitate not only national benchmarking & networking but also help learn from international peer services. However, the majority of the indicators proposed in the ICHOM Maternity Indicator set are either not currently collected in Australia, or the data is so dispersed across tertiary, secondary and primary care services that it is not accessible. For example, the ICHOM maternity indicators identify the importance of longer term health and wellbeing for women following childbirth, with indicators relating to 6 and 12 months after the birth of a child. Most maternity hospitals have no contact with women beyond discharge following the birth, unless the woman becomes pregnant again, or presents in the ED at 2 in the morning for want of postnatal support. A recent PhD study in Queensland found that as many as 14% of women undergoing caesarean sections experienced a post operative infection, but because these were treated by GPs after the woman had been discharged, the hospitals providing the surgery are unaware of this outcome. Collection of PROMs beyond the episode of admitted care would go a long way to identifying such opportunities to reduce HACs and improve care.

13. Should a national PROMs collection be considered as part of national data sets?
Yes. There is clear evidence from a range of settings and countries, that PROMs are an essential source of data for anyone serious about improving the value of healthcare services. It is important that Australia is finally moving to consider developing systems for capturing PROMs and making the resulting information available to service managers and providers. WCHA would make a plea, though, that whatever kinds of national data collections are designed, that they make it possible for different clinical services to collect

relevant information from their patients, across the continuum of care. A one-size-fits-all PROMs tool will not deliver meaningful information to drive improvements in value in women's and children's healthcare.

14. Are there any impediments to shadow pricing the 'fixed plus variable' model for NEC20?
We received no comment from members about this.

15. Are there any additional alternative funding models IHPA should explore in the context of Australia's existing NHRA and ABF framework?
WCHA welcomes IHPAs ongoing interest in assessing funding models to provide greater flexibility and support innovation as services strive to improve patient experience and outcomes and find efficiencies with new models of care.

16. IHPA proposes investigating bundled payments for stroke and joint pain, in particular knee and hip replacements. Should any other conditions be considered?
WHA remains interested in seeing the bundled maternity pricing implemented, pending the implementation of the IHI by all jurisdictions. And there is interest in bundled pricing for some cohorts of children with chronic conditions.

17. Is IHPA's funding approach to HACs improving safety and quality, for example through changing clinician behaviour and providing opportunities for effective benchmarking?
Each of WHA and CHA have specific recommendations on HACs.

Re HACS in maternity care:
As noted under Question 3 above, there is concern about the reliability and value of current data being reported against the neonatal trauma HAC. Current classification and coding rules are not sufficiently nuanced to discriminate between genuine neonatal trauma, and commonplace non-concerning temporary impacts on newborns of the birth process.

The inclusion of third and fourth degree perineal tears on the list of HACs has had a more positive and meaningful impact, even though this HAC is not currently included in pricing penalties due to difficulties with stratifying risk. Inclusion of perineal tears as a HAC has increased the attention paid by hospital executives and clinical leaders to this harm, and provided increased motivation to focus on reducing rates of severe tears wherever possible. While a third or fourth degree perineal tear is sometime unavoidable, there are evidence based approaches to care that can significantly reduce the risk of this harm, as confirmed in the recently complete national collaborative improvement project hosted by WHA in partnership with the NSW Clinical Excellence Commission, and supported by Safer Care Victoria and Clinical Excellence Queensland.

The Perineal Tears Collaborative achieved an overall reduction of 13.43% among 18,245 women who received care in line with the WHA Perineal Protection Bundle. Women who required an instrumental assisted delivery where forceps were used benefitted the most, with a 25% reduction in the rate of severe perineal harm. WHA will be publishing the bundle and supportive tools to assist with its implementation in August 2019, and is also preparing articles for peer review in relevant international journals. One of the benefits of the Collaborative, which collected detailed data on the care of more than 18 thousand women, is the development of a risk stratification, to help clinical teams better identify women at higher risk of a severe perineal tear and to provide information to the woman and offer care that may help to reduce her risk of this harm.

Re HACs in children
CHA recommends IHPA consider use Rhee Score[1] to replace Charlson Score as a risk factor to predict the likelihood of a HAC occurring in paediatric populations.

[1] Rhee D, Salazar, JH & Zhang, Y et al. 2013, A Novel Multispecialty Surgical Risk Score for Children, John Hopkins University School of Medicine, Baltimore

NEP19 adopts Charlson Score to adjust the risk of having a HAC. The Charlson Score was developed based on 1-year mortality rates in a largely adult population of 607 patients from a New York Hospital in 1984. A CHA member hospital, Sydney Children Hospital Network (SCHN) raises a concern about using the Charlson Score to predict the likelihood of a HAC occurring in paediatric patients.

In 2018, Sydney Children's Hospital Network and Queensland Children's Hospital shared inpatient data to support a comparative analysis of the Charlson Score and a paediatric alternative model, Rhee Score, using the following datasets:

- 196,834 HAC in-scope inpatient episodes from SCHN for patients aged 0 – 19 and discharged between 01/07/2014 and 30/06/2018
- 74,490 HAC in-scope inpatient episodes from Queensland Children's Hospital (formerly Lady Cilento) aged 0 – 19 and discharged between 01/07/2014 and 30/06/2017
- Diagnosis information available to flag HACs and assign comorbidity scores
- Current risk adjustment model factors (e.g. gender, transfer status, ICU hours etc.) also included to allow full model to be run

The analysis has shown the Rhee Score outperforms the current Charlson Score with regards to predicting the likelihood of HACs in paediatric patients. SCHN has also used Machine Learning techniques (cross validation, bootstrap resampling and synthetic oversampling) to provide validations of the robustness of these subset models. Cross validated results were largely in agreement. The details of this analysis and references for the Rhee Score and other models are available at Appendix B.

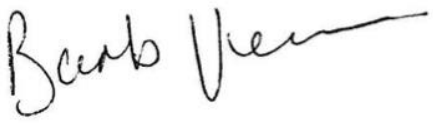
It is recommended IHPA consider adopting the Rhee Score to predict the risk of HACs occurring in paediatric patients up to the age of 18 years

18. What should IHPA consider to configure software for the Australian context that can identify potentially avoidable hospital readmissions?
WCHA would be happy to facilitate contact with focus groups of relevant clinicians from the women's and children's healthcare sectors to assist with answering this question in relation to care of women having a baby, of neonates and of children requiring inpatient care, if IHPA would be interested to do so.

Further information.

WCHA would be happy to facilitate further discussion with members about these matters if you require clarification or further explanation for any of the comments provided here. Please don't hesitate to contact me if we can assist further. Thank you again for the opportunity to provide advice on these matters.

Kind regards



Dr Barbara Vernon
Chief Executive Officer
Women's & Children's Healthcare Australasia

12 July 2019

What a difference a day makes - The impact of bundled ICU pricing for newborns

Stuart Bowhay[1]

[1] Children's Health Queensland Hospital & Health Service

With a 2018-19 budget of $42.3 million, the Critical Care Management team at Queensland Children's Hospital (QCH) recognise a sound knowledge of activity-based management is a key factor in managing and understanding the performance of the Paediatric Intensive Care Unit.

The high cost of treating patients in Intensive Care Units (ICU) is recognised in the 2018-19 National Efficient Price Determination through the provision of a price adjustment based on the time a patient spends in ICU. This adjustment is applied to all patients utilising ICU except those assigned a Major Diagnostic Category (MDC) of 'Newborns and Other Neonates' (Neonates), where the AR-DRG price is inclusive of a 'Bundled ICU' component.

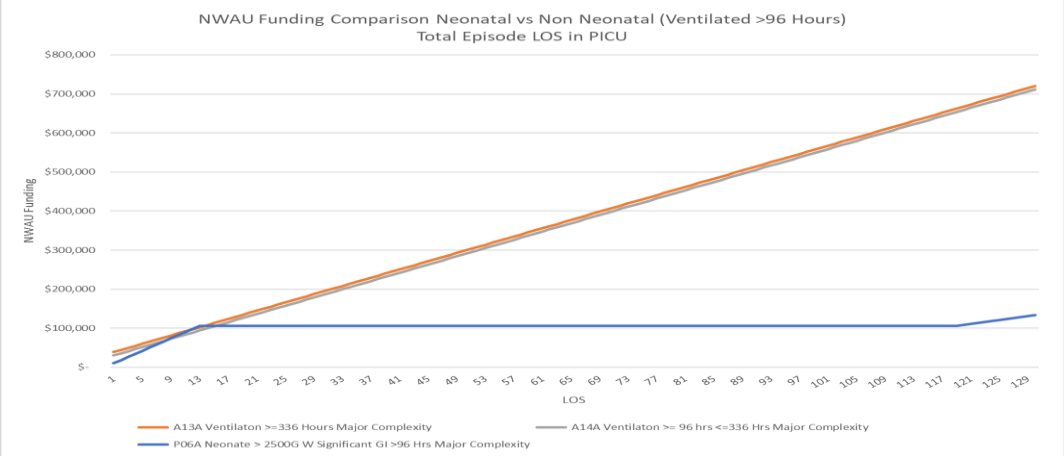
This differential model for patients requiring treatment in Intensive Care Unit (ICU) with neonates funded on a bundled, semi-fixed price and non-neonates funded on a variable rate determined by the length of stay in ICU creates issues in understanding productivity and efficiency as the level of funding is impacted by the proportion of neonates and associated ICU bed utilisation which is subject to variation.

QCH - PICU Utilisation (Hours) for Discharged Patients by Financial Year

Major Diagnostic Category	ICU Funding Type	2015/16	2016/17	2017/18	2018/19 (6 months)
15 Newborns & Other Neonates	Bundled in AR-DRG Price	24,329	28,527	33,481	19,941
All Other MDC	Actual utilisation (Hourly rate)	144,843	178,052	151,834	84,515
Total PICU Hours		169,172	206,579	185,315	104,456
Newborns & Other Neonates % of Total		14.4%	13.8%	18.1%	19.1%

The high variability in length of stay in ICU for neonatal patients (including patients who do not require ICU) compromises the veracity of the 'bundled ICU' component of the DRG price.

This issue is most evident for long stay, complex patients receiving ventilatory support where age* is a prime factor in determining the level of funding received with neonatal patients significantly impacted despite being managed under the same model of care as their non-neonatal equivalents.



*The Neonatal MDC is not defined exclusively based on primary diagnosis but on the assignment logic of age (<28 days) or Age < 1 year and Admission weight <2500 grams or Age < 1 year and specified low birth weight/ immaturity diagnoses.

Analysis of QCH neonatal activity shows 17.2% of patients required PICU and 83.1% of PICU hours were covered by two DRGs; P02Z and P06A.

Queensland Children's Hospital Neonatal Activity July 2016 to December 2018

Patient Separations

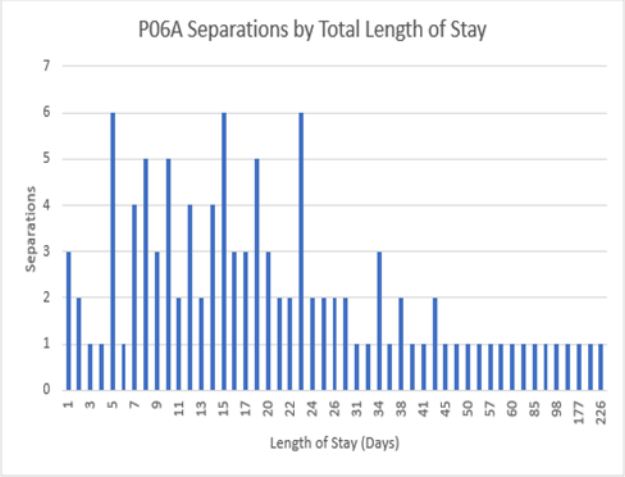
AR-DRG	PICU Stay- No	PICU Stay - Yes	Total	% requiring PICU Stay	Total PICU Hours	% of Total PICU hours
P02Z CARDIOTHORACIC AND VASCULAR PROCEDURES FOR NEONATES	-	109	109	100.0%	41,383	50.5%
P06A NEONATE, ADMWT >=2500G W SIGNIFICANT GI/VENT>=96HRS, MAJOR COMPLEXITY	19	89	108	82.4%	26,715	32.6%
Other Neonatal DRGs	1,825	185	2,010	9.2%	13,850	16.9%
Total Neonatal DRGs	1,844	383	2,227	17.2%	81,949	100.0%

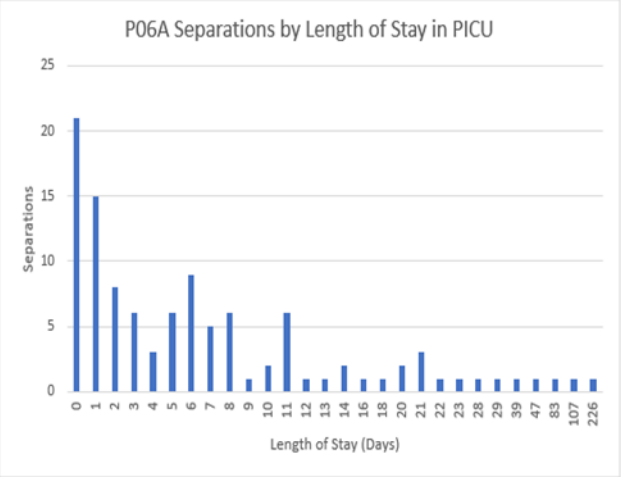
Patient Average Length of Stay

AR-DRG	PICU Stay- No	PICU Stay - Yes	Total	Min Length of Stay (Days)	Max Length of Stay (Days)	Max PICU Length of Stay (Days)
P02Z CARDIOTHORACIC AND VASCULAR PROCEDURES FOR NEONATES	-	38.94	38.94	4	386	380
P06A NEONATE, ADMWT >=2500G W SIGNIFICANT GI/VENT>=96HRS, MAJOR COMPLEXITY	10.84	31.35	27.74	1	226	226
Other Neonatal DRGs	2.21	9.16	2.85	1	151	22
Total Neonatal DRGs	2.30	22.79	5.82	1	386	380

The length of stay distribution for AR-DRG P06A at QCH of 1 to 226 days is reflective of the wide range in the 2018-19 Price Determination (lower bound 13 days, upper bound of 119 days) is indicative of a wide underlying casemix which is supported by a regrouped sample of 31 separations with neonatal logic excluded.

Note: 21 of 108 Separations (19.4%) required no PICU stay.





QCH Sample Casemix Regrouped excluding Neonatal Logic

DRG	DRG Description	Separations
801B	GIS UNRELATED TO PRINCIPAL DIAGNOSIS, INTERMEDIATE COMPLEXITY	1
A13A	VENTILATION >=336HOURS, MAJOR COMPLEXITY	1
A14A	VENTILATION >=96HOURS & <336HOURS, MAJOR COMPLEXITY	8
A14B	VENTILATION >=96HOURS & <336HOURS, INTERMEDIATE COMPLEXITY	1
B02A	CRANIAL PROCEDURES, MAJOR COMPLEXITY	1
D66A	OTHER EAR, NOSE, MOUTH AND THROAT DISORDERS, MAJOR COMPLEXITY	1
E01A	MAJOR CHEST PROCEDURES, MAJOR COMPLEXITY	2
E02A	OTHER RESPIRATORY SYSTEM GIS, MAJOR COMPLEXITY	1
E40A	RESPIRATORY SYSTEM DISORDERS W VENTILATOR SUPPORT, MAJOR COMPLEXITY	1
E41A	RESPIRATORY SYSTEM DISORDERS W NON-INVASIVE VENTILATION, MAJOR COMPLEXITY	1
F09A	OTHER CARDIOTHORACIC PROCEDURES W/O CPB PUMP, MAJOR COMPLEXITY	2
F19A	TRANS-VASCULAR PERCUTANEOUS CARDIAC INTERVENTION, MAJOR COMPLEXITY	3
F19B	TRANS-VASCULAR PERCUTANEOUS CARDIAC INTERVENTION, MINOR COMPLEXITY	1
G02A	MAJOR SMALL AND LARGE BOWEL PROCEDURES, MAJOR COMPLEXITY	1
G02B	MAJOR SMALL AND LARGE BOWEL PROCEDURES, INTERMEDIATE COMPLEXITY	3
K62A	MISCELLANEOUS METABOLIC DISORDERS, MAJOR COMPLEXITY	1
R61A	LYMPHOMA AND NON-ACUTE LEUKAEMIA, MAJOR COMPLEXITY	1
T01A	INFECTIOUS AND PARASITIC DISEASES W GIS, MAJOR COMPLEXITY	1
Total		31

In comparison to non-neonates, the current model underfunds those neonatal patients who have received ICU care and overfunds those patients who have not.

Example - Underfunded Activity

DRG	Age on Adm (Days)	Length of Stay	PICU Hours	NWAU	Regrouped DRG	NWAU	NWAU Variance from Neonatal DRG	$ Variance from Neonatal DRG
P06A	26	226	5,429	75.75	A13A	245.08	169.33	$848,688
P06A	37	202	1,989	63.49	A14A	121.79	58.30	$292,181
P06A	17	57	537	21.09	A14A	49.19	28.10	$140,838
P06A	1	54	338	21.09	A14A	40.45	19.36	$ 97,053
P06A	2	48	235	21.09	A14A	35.93	14.84	$ 74,390

Example - Overfunded Activity

DRG	Age on Adm (Days)	Length of Stay	PICU Hours	NWAU	Regrouped DRG	NWAU	NWAU Variance from Neonatal DRG	$ Variance from Neonatal DRG
P06A	5	23	69	21.09	G02B	8.6913	(12.39)	($62,121)
P06A	6	11	-	17.92	F19A	4.6987	(13.22)	($66,273)
P06A	4	22	-	21.09	F19B	6.8538	(14.23)	($71,331)
P06A	19	23	-	21.09	E02A	6.1844	(14.90)	($74,686)
P06A	9	23	9	21.09	F09A	6.1592	(14.93)	($74,812)

Conclusion

Analysis of QCH activity indicates considerable variation in underlying casemix and associated resource utilisation of patients grouped to AR-DRG P06A.

Complex, long stay patients that require significant time in ICU and are typically transferred from other hospitals to specialist paediatric, quaternary facilities are significantly underfunded while less complex patients that do not require treatment in ICU are overfunded.

It is recommended IHPA consider unbundling the ICU component of the DRG price for Newborns and Other Neonates to provide consistency for all patients treated in an ICU and create a more transparent and equitable model.

Hospital Acquired Complications

Paediatric Risk Adjustment

CHA Performance and Efficiency Special Interest Group – May 2018

The Sydney children's Hospitals Network

care, advocacy, research, education

What are HACs?

- Hospital Acquired Complications (HACs) refers to a national list of 16 complications developed by the Australian Commission on Safety and Quality in Health Care.

- These represent high priority conditions that can arise during hospital stays but where mitigation strategies can reduce (but not necessarily eliminate) the probability of these complications occurring.

- Extensive ICD code level specifications of the HAC list can be found on the Commission's website

https://www.safetyandquality.gov.au/our-work/indicators/hospital-acquired-complications/

The Sydney children's Hospitals Network
care, advocacy, research, education

What are HACs?

Complication	Diagnosis
Pressure injury	• Stage III ulcer • Stage IV ulcer • Unspecified decubitus ulcer and pressure area
Falls resulting in fracture or intracranial injury	• Intracranial injury • Fractured neck of femur • Other fractures
Healthcare-associated infection	• Urinary tract infection • Surgical site infection • Pneumonia • Blood stream infection • Central line and peripheral line associated bloodstream infection • Multi-resistant organism • Infection associated with prosthetics/implantable devices • Gastrointestinal infections
Surgical complications requiring unplanned return to theatre	• Post-operative haemorrhage/haematoma requiring transfusion and/or return to theatre • Surgical wound dehiscence • Anastomotic leak • Vascular graft failure • Other surgical complications requiring unplanned return to theatre
Unplanned intensive care unit admission	• Unplanned admission to intensive care unit
Respiratory complications	• Respiratory failure including acute respiratory distress syndrome requiring ventilation • Aspiration pneumonia
Venous thromboembolism	• Pulmonary embolism • Deep vein thrombosis
Renal failure	• Renal failure requiring haemodialysis or continuous veno-venous haemodialysis
Gastrointestinal bleeding	• Gastrointestinal bleeding
Medication complications	• Drug related respiratory complications/depression • Haemorrhagic disorder due to circulating anticoagulants • Hypoglycaemia
Delirium	• Delirium
Persistent incontinence	• Urinary incontinence
Malnutrition	• Malnutrition
Cardiac complications	• Heart failure and pulmonary oedema • Arrhythmias • Cardiac arrest • Acute coronary syndrome including unstable angina, STEMI and NSTEMI
Third and fourth degree perineal laceration during delivery	• Third and fourth degree perineal laceration during delivery
Neonatal birth trauma	• Neonatal birth trauma

What are the funding impacts of HACs?

Price of an admitted acute ABF Activity =

$$\{[PW \times A_{Paed} \times (1 + A_{SPA}) \times (1 + A_{Ind} + A_{Res} + A_{RT} + A_{Dia}) \times (1 + A_{Treat}) + (A_{ICU} \times \text{ICU hours})] - [(PW + A_{ICU} \times \text{ICU hours}) \times A_{PPS} + LOS \times A_{Acc}] - PW \times A_{HAC}\} \times NEP$$

	Complication	Final incremental cost	Adopted adjustment
	All HACs	8.8%	8.1%
1	Pressure injury	14.3%	12.5%
2	Falls resulting in fracture or other intracranial injury	2.5%	2.4%
3	Healthcare associated infection	9.0%	8.3%
4	Surgical complications requiring unplanned return to theatre	14.2%	12.4%
5	Unplanned intensive care unit admission	n/a	n/a
6	Respiratory complications	18.3%	15.5%
7	Venous thromboembolism	13.0%	11.5%
8	Renal failure	27.0%	21.3%
9	Gastrointestinal bleeding	10.7%	9.7%
10	Medication complications	8.7%	8.0%
11	Delirium	10.2%	9.2%
12	Persistent incontinence	2.6%	2.5%
13	Malnutrition	6.7%	6.3%
14	Cardiac complications	11.8%	10.5%
15	Third and fourth degree perineal laceration during delivery	n/a	n/a
16	Neonatal birth trauma	n/a	n/a

What is risk adjustment?

- Risk adjustment refers to recognising that there are patient related characteristics that will increase the likelihood of a HAC occurring and adjusting the funding impact accordingly.

- The design of the risk adjustment process balances two differing perspectives:

    - Hospitals that treat more high risk patients should not be disadvantaged compared to other hospitals who treat fewer high risk patients – hence risk adjustment should reduce the funding impact for high risk patients

    - High risk patients should expect hospitals to take all necessary actions to manage their higher risk – hence risk adjustment should not adjust the funding impact to zero

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What risk factors are used?

- A forward stepwise approach was used to construct logistic regression models with the following factors to predict the probability of a HAC occurring.

Risk Factors	01. Pressure injury	02. Falls resulting in fracture or other intracranial injury	03. Healthcare associated infection	04. Surgical complications requiring unplanned return to theatre	06. Respiratory complications	07. Venous thromboembolism	08. Renal failure	09. Gastrointestinal bleeding	10. Medication complications	11. Delirium	12. Persistent incontinence	13. Malnutrition	14. Cardiac complications
Admission Status	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Patient Age	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MDC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ICU Status	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DRG Type	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Charlson Score	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gender	×	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	×	×
Transfer Status	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓

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How are the risk factors used?

- Patients are assigned a *complexity score* based on the risk factors and the HAC in question. This is a score between 0 and 100, with 0 being extremely low risk and 100 being extremely high risk.
- As a separate risk adjustment model is constructed for each HAC, patients will have different complexity scores for different HACs.
- An example of how some risk factors contribute to a patient's complexity score:

Groups	01. Pressure injury	02. Falls resulting in fracture or other intracranial injury	03. Healthcare associated infection	04. Surgical complications requiring unplanned return to theatre	06. Respiratory complications	07. Venous thromboembolism	08. Renal failure	09. Gastrointestinal bleeding	10. Medication complications	11. Delirium	12. Persistent incontinence	13. Malnutrition	14. Cardiac complications
Baseline	46.6	24.1	56.4	41.2	47.3	36.6	28.2	41.3	42.9	36.6	29.8	39.1	46.0
Emergency admission	4.7	8.0	4.8	0.7	4.8	3.2	2.8	4.4	4.7	4.7	5.0	4.5	2.4
ICU Hours	10.3	4.9	10.4	13.5	15.1	11.0	21.9	7.7	7.1	10.8	7.5	10.0	12.6
Admission Transfer Status	2.8	1.2	2.1	1.7	0.4	3.2	0	2.3	1.6	2.0	2.1	2.3	1.4

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Patient age as a risk factor

Age Group	01. Pressure injury	02. Falls resulting in fracture or other intracranial injury	03. Healthcare associated infection	04. Surgical complications requiring unplanned return to theatre	06. Respiratory complications	07. Venous thromboembolism	08. Renal failure	09. Gastrointestinal bleeding	10. Medication complications	11. Delirium	12. Persistent incontinence	13. Malnutrition	14. Cardiac complications
000 to 004	0	0	0	0	0	0	0	0	0	0	0	0	0
005 to 009	0	0	-2.6	-4.0	-2.0	-8.5	0	0	0	3.8	0	0	-2.6
010 to 014	1.6	0	-2.3	-3.4	-3.9	-8.5	0	0	0	4.7	0	0	-2.0
015 to 019	-0.9	0	-1.1	-2.8	-0.4	1.1	0	0	2.7	7.5	8.1	3.8	-0.3
020 to 024	-5.3	0	-1.1	-2.9	0.2	2.8	0	0	2.4	7.9	8.1	3.8	0.2
025 to 029	-4.8	0	-0.8	-2.2	0.9	2.7	0	1.4	2.8	8.5	8.1	3.8	0.6
030 to 034	-4.5	0	-0.3	-1.6	0.8	3.6	3.6	1.4	3.0	9.5	9.8	3.8	0.9
035 to 039	-4.5	0	0.1	-1.4	1.0	4.2	3.6	2.4	3.0	10.8	10.9	4.4	1.6
040 to 044	-3.6	4.0	0.8	-0.6	1.3	5.5	3.6	3.3	3.7	11.4	10.3	5.0	2.9
045 to 049	-3.2	4.0	1.3	0.0	1.9	5.5	3.6	3.4	3.7	12.7	11.8	4.8	4.1
050 to 054	-2.7	4.9	2.0	0.5	2.4	5.7	3.6	4.1	4.1	13.7	11.7	5.9	5.6
055 to 059	-1.9	5.8	2.3	0.4	2.4	6.0	3.6	4.3	4.4	14.5	12.1	6.6	6.5
060 to 064	-1.9	7.0	2.9	1.0	3.0	6.9	3.6	5.2	5.2	16.4	14.7	7.0	7.7
065 to 069	-1.1	8.6	3.5	0.9	3.3	7.7	3.6	5.8	5.6	17.8	15.8	7.1	8.8
070 to 074	0.2	9.0	4.1	1.4	4.5	8.2	3.6	6.9	6.4	20.1	17.4	7.8	9.7
075 to 079	0.7	12.0	4.9	1.7	5.1	8.6	3.6	7.9	7.0	22.0	18.9	8.3	10.6
080 to 084	2.5	13.9	6.1	1.9	6.5	8.4	3.6	8.6	7.5	24.1	20.7	9.3	11.5
085 to 089	4.1	14.9	7.3	2.5	8.0	8.7	3.6	9.7	7.8	25.6	21.9	10.6	12.6
090 to 095	6.0	16.6	8.3	2.4	10.0	8.8	3.6	10.4	7.4	27.2	23.3	11.8	13.7

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Charlson score as a risk factor

Charlson Score	01. Pressure injury	02. Falls resulting in fracture or other intracranial injury	03. Healthcare associated infection	04. Surgical complications requiring unplanned return to theatre	06. Respiratory complications	07. Venous thromboembolism	08. Renal failure	09. Gastrointestinal bleeding	10. Medication complications	11. Delirium	12. Persistent incontinence	13. Malnutrition	14. Cardiac complications
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	2.6	3.2	3.3	2.7	3.5	2.2	3.0	3.7	4.1	3.0	3.1	3.7	4.8
2	5.1	4.9	6.1	5.9	4.7	4.4	5.6	6.0	7.5	4.6	4.7	7.1	6.0
3	7.0	6.4	7.7	6.2	7.2	5.2	6.4	8.0	10.6	6.0	8.0	7.7	8.1
4	6.4	6.0	7.3	6.5	6.7	5.2	6.5	8.0	12.1	6.0	6.8	7.7	7.4
5	7.8	7.0	7.7	7.5	5.8	7.8	6.5	8.0	11.2	6.0	6.8	10.0	6.5
6	8.7	7.6	9.0	8.0	7.5	7.5	6.5	10.2	12.4	7.7	8.9	9.8	9.9
7	10.5	9.2	10.1	8.8	8.3	8.5	9.5	11.3	14.0	8.5	9.7	10.6	10.8
8	12.2	9.2	10.7	9.4	9.6	9.1	9.5	12.9	14.5	9.2	10.6	12.2	11.5
9	12.2	9.2	10.7	9.4	9.6	11.6	9.5	12.9	14.8	9.7	10.9	12.2	11.5
10	12.2	9.2	11.1	10.6	9.6	11.6	9.5	12.9	15.2	9.5	10.9	12.2	11.5
11	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8
12	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8
13	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8
14	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8
15	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8
16	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8

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Adjusting the funding impact of a HAC

- The complexity score assigned for a patient and HAC categorises it as low, moderate or high complexity. Patients that are moderate or high complexity have the adjustment “dampened” and hence receive a smaller NWAU adjustment.

Complexity Groups	1. Pressure injury	2. Falls resulting in fracture or other intracranial injury	3. Healthcare associated infection	4. Surgical complications requiring unplanned return to theatre	6. Respiratory complications	7. Venous thromboembolism	8. Renal failure	9. Gastrointestinal bleeding	10. Medication complications	11. Delirium	12. Persistent incontinence	13. Malnutrition	14. Cardiac complications
Quantile cut off points													
Low	1	1	1	1	1	1	1	1	1	1	1	1	1
Moderate	67	54	76	72	75	64	68	62	65	74	57	66	77
High	73	61	83	76	81	69	71	69	71	80	64	72	81
Dampening Factors													
Low	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Moderate	0.365	0.520	0.180	0.564	0.591	0.720	0.352	0.761	0.466	0.746	0.833	0.763	0.750
High	0.309	0.178	0.105	0.515	0.417	0.539	0.304	0.661	0.198	0.581	0.608	0.610	0.580
Adjustments													
Low	12.5%	2.4%	8.3%	12.4%	15.5%	11.5%	21.3%	9.7%	8.0%	9.2%	2.5%	6.3%	10.5%
Moderate	4.6%	1.2%	1.5%	7.0%	9.1%	8.3%	7.5%	7.4%	3.7%	6.9%	2.1%	4.8%	7.9%
High	3.9%	0.4%	0.9%	6.4%	6.4%	6.2%	6.5%	6.4%	1.6%	5.4%	1.5%	3.8%	6.1%

Risk adjustment: an example

- The patient is an 81 year old male who was a booked admission for a coronary artery bypass graft.
- The patient has a background of ischaemic heart disease, old myocardial infarction, hypertension, peripheral vascular disease and type 2 diabetes managed with oral medication.
- The operation was successful and the patient spent 24 hours in the intensive care unit before being transferred to the cardiac ward.
- While on the ward, the patient slipped and fell heavily while in the shower, resulting in a fracture of the lumbar vertebra L4-L5.
- The fracture was managed conservatively and the patient was discharged home 12 days following admission.

Complexity score calculations	
Risk factor breakdown	**Complexity Score**
Baseline	*24.1*
Age Group :080 to 084	*13.9*
Charlson Score = 3	*6.4*
DRG Type: Intervention	*4.6*
Gender: Male	*0*
MDC: Diseases & Disorders of the Circulatory System	*-3.5*
Emergency admission: Yes	*8.0*
ICU Hours: Yes	*4.9*
Admission transfer status: No	*0*
Total	**58**
Adjustment calculations	
Complexity group	Moderate
Incremental cost	2.4%
Dampening	*0.520*
Final adjustment	1.2%

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Risk adjustment: an example

Age Group	01. Pressure injury	02. Falls resulting in fracture or other intracranial injury	03. Healthcare associated infection	04. Surgical complications requiring unplanned return to theatre	06. Respiratory complications	07. Venous thromboembolism	08. Renal failure	09. Gastrointestinal bleeding	10. Medication complications	11. Delirium	12. Persistent incontinence	13. Malnutrition	14. Cardiac complications
000 to 004	0	0	0	0	0	0	0	0	0	0	0	0	0
005 to 009	0	0	-2.6	-4.0	-2.0	-8.5	0	0	0	3.8	0	0	-2.6
010 to 014	1.6	0	-2.3	-3.4	-3.9	-8.5	0	0	0	4.7	0	0	-2.0
015 to 019	-0.9	0	-1.1	-2.8	-0.4	1.1	0	0	2.7	7.5	8.1	3.8	-0.3
020 to 024	-5.3	0	-1.1	-2.9	0.2	2.8	0	0	2.4	7.9	8.1	3.8	0.2
025 to 029	-4.8	0	-0.8	-2.2	0.9	2.7	0	1.4	2.8	8.5	8.1	3.8	0.6
030 to 034	-4.5	0	-0.3	-1.6	0.8	3.6	3.6	1.4	3.0	9.5	9.8	3.8	0.9
035 to 039	-4.5	0	0.1	-1.4	1.0	4.2	3.6	2.4	3.0	10.8	10.9	4.4	1.6
040 to 044	-3.6	4.0	0.8	-0.6	1.3	5.5	3.6	3.3	3.7	11.4	10.3	5.0	2.9
045 to 049	-3.2	4.0	1.3	0.0	1.9	5.5	3.6	3.4	3.7	12.7	11.8	4.8	4.1
050 to 054	-2.7	4.9	2.0	0.5	2.4	5.7	3.6	4.1	4.1	13.7	11.7	5.9	5.6
055 to 059	-1.9	5.8	2.3	0.4	2.4	6.0	3.6	4.3	4.4	14.5	12.1	6.6	6.5
060 to 064	-1.9	7.0	2.9	1.0	3.0	6.9	3.6	5.2	5.2	16.4	14.7	7.0	7.7
065 to 069	-1.1	8.6	3.5	0.9	3.3	7.7	3.6	5.8	5.6	17.8	15.8	7.1	8.8
070 to 074	0.2	9.0	4.1	1.4	4.5	8.2	3.6	6.9	6.4	20.1	17.4	7.8	9.7
075 to 079	0.7	12.0	4.9	1.7	5.1	8.6	3.6	7.9	7.0	22.0	18.9	8.3	10.6
080 to 084	2.5	13.9	6.1	1.9	6.5	8.4	3.6	8.6	7.5	24.1	20.7	9.3	11.5
085 to 089	4.1	14.9	7.3	2.5	8.0	8.7	3.6	9.7	7.8	25.6	21.9	10.6	12.6
090 to 095	6.0	16.6	8.3	2.4	10.0	8.8	3.6	10.4	7.4	27.2	23.3	11.8	13.7

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Risk adjustment: an example

Charlson Score	01. Pressure injury	02. Falls resulting in fracture or other intracranial injury	03. Healthcare associated infection	04. Surgical complications requiring unplanned return to theatre	06. Respiratory complications	07. Venous thromboembolism	08. Renal failure	09. Gastrointestinal bleeding	10. Medication complications	11. Delirium	12. Persistent incontinence	13. Malnutrition	14. Cardiac complications
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	2.6	3.2	3.3	2.7	3.5	2.2	3.0	3.7	4.1	3.0	3.1	3.7	4.8
2	5.1	4.9	6.1	5.9	4.7	4.4	5.6	6.0	7.5	4.6	4.7	7.1	6.0
3	7.0	6.4	7.7	6.2	7.2	5.2	6.4	8.0	10.6	6.0	8.0	7.7	8.1
4	6.4	6.0	7.3	6.5	6.7	5.2	6.5	8.0	12.1	6.0	6.8	7.7	7.4
5	7.8	7.0	7.7	7.5	5.8	7.8	6.5	8.0	11.2	6.0	6.8	10.0	6.5
6	8.7	7.6	9.0	8.0	7.5	7.5	6.5	10.2	12.4	7.7	8.9	9.8	9.9
7	10.5	9.2	10.1	8.8	8.3	8.5	9.5	11.3	14.0	8.5	9.7	10.6	10.8
8	12.2	9.2	10.7	9.4	9.6	9.1	9.5	12.9	14.5	9.2	10.6	12.2	11.5
9	12.2	9.2	10.7	9.4	9.6	11.6	9.5	12.9	14.8	9.7	10.9	12.2	11.5
10	12.2	9.2	11.1	10.6	9.6	11.6	9.5	12.9	15.2	9.5	10.9	12.2	11.5
11	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8
12	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8
13	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8
14	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8
15	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8
16	12.2	9.2	13.0	10.6	11.5	11.6	9.5	12.9	17.7	12.4	10.9	12.2	14.8

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Risk adjustment: an example

Groups	01. Pressure injury	02. Falls resulting in fracture or other intracranial injury	03. Healthcare associated infection	04. Surgical complications requiring unplanned return to theatre	06. Respiratory complications	07. Venous thromboembolism	08. Renal failure	09. Gastrointestinal bleeding	10. Medication complications	11. Delirium	12. Persistent incontinence	13. Malnutrition	14. Cardiac complications
Baseline	46.6	24.1	56.4	41.2	47.3	36.6	28.2	41.3	42.9	36.6	29.8	39.1	46.0
Emergency admission	4.7	8.0	4.8	0.7	4.8	3.2	2.8	4.4	4.7	4.7	5.0	4.5	2.4
ICU Hours	10.3	4.9	10.4	13.5	15.1	11.0	21.9	7.7	7.1	10.8	7.5	10.0	12.6
Admission Transfer Status	2.8	1.2	2.1	1.7	0.4	3.2	0	2.3	1.6	2.0	2.1	2.3	1.4

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Risk adjustment: an example

Complexity Groups	1. Pressure injury	2. Falls resulting in fracture or other intracranial injury	3. Healthcare associated infection	4. Surgical complications requiring unplanned return to theatre	6. Respiratory complications	7. Venous thromboembolism	8. Renal failure	9. Gastrointestinal bleeding	10. Medication complications	11. Delirium	12. Persistent incontinence	13. Malnutrition	14. Cardiac complications
Quantile cut off points													
Low	1	1	1	1	1	1	1	1	1	1	1	1	1
Moderate	67	54	76	72	75	64	68	62	65	74	57	66	77
High	73	61	83	76	81	69	71	69	71	80	64	72	81
Dampening Factors													
Low	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Moderate	0.365	0.520	0.180	0.564	0.591	0.720	0.352	0.761	0.466	0.746	0.833	0.763	0.750
High	0.309	0.178	0.105	0.515	0.417	0.539	0.304	0.661	0.198	0.581	0.608	0.610	0.580
Adjustments													
Low	12.5%	2.4%	8.3%	12.4%	15.5%	11.5%	21.3%	9.7%	8.0%	9.2%	2.5%	6.3%	10.5%
Moderate	4.6%	1.2%	1.5%	7.0%	9.1%	8.3%	7.5%	7.4%	3.7%	6.9%	2.1%	4.8%	7.9%
High	3.9%	0.4%	0.9%	6.4%	6.4%	6.2%	6.5%	6.4%	1.6%	5.4%	1.5%	3.8%	6.1%

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Paediatric Risk Adjustment

- The current risk adjustment model accounts for the paediatric population through the inclusion of age as a risk adjustor.
    - 5 year age brackets 0-4, 5-9, 10-14, 15-18
    - Majority of complexity score contributions are 0 or negative
    - For some HACs, children essentially grouped with adults (e.g. falls 0-39, renal failure 0-29, GI bleeding 0-24)

Age Group	01. Pressure injury	02. Falls resulting in fracture or other intracranial injury	03. Healthcare associated infection	04. Surgical complications requiring unplanned return to theatre	06. Respiratory complications	07. Venous thromboembolism	08. Renal failure	09. Gastrointestinal bleeding	10. Medication complications	11. Delirium	12. Persistent incontinence	13. Malnutrition	14. Cardiac complications
000 to 004	0	0	0	0	0	0	0	0	0	0	0	0	0
005 to 009	0	0	-2.6	-4.0	-2.0	-8.5	0	0	0	3.8	0	0	-2.6
010 to 014	1.6	0	-2.3	-3.4	-3.9	-8.5	0	0	0	4.7	0	0	-2.0
015 to 019	-0.9	0	-1.1	-2.8	-0.4	1.1	0	0	2.7	7.5	8.1	3.8	-0.3

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Paediatric Risk Adjustment

- What about the role of specialist paediatric facilities who, generally speaking, have a more complex casemix? Are complex *paediatric* patients sufficiently risk adjusted?

- In the current IHPA model, complexity is largely captured using the Charlson score, which is a popular index used to indicate how many comorbid conditions are present in a patient.

- Is the Charlson Index – developed based on 1 year mortality rates in a largely adult population of 607 patients from New York Hospital in 1984 – the best approach in predicting the likelihood of a HAC occurring in paediatric populations?

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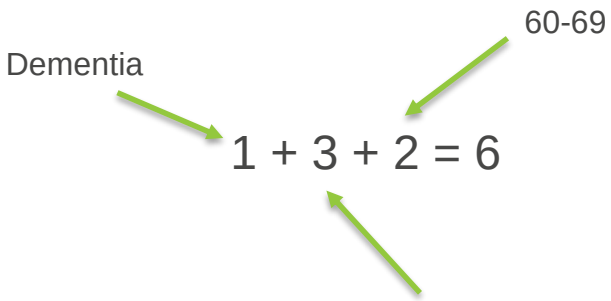
The Charlson Score

- The Charlson Score is calculated by adding together the scores of any conditions present in the table shown.
- For each decade of age over 40, one is added to the Charlson score.
- Example: a 65 year old patient with Dementia and Severe Liver Disease has a Charlson score of



Condition	Charlson Score
Myocardial Infarction Congestive Heart Failure Peripheral Vascular Disease Cerebrovascular Disease Dementia Chronic Pulmonary Disease Connective Tissue Disease-Rheumatic Disease Peptic Ulcer Disease Mild Liver Disease Diabetes without complications	1
Paraplegia and Hemiplegia Renal Disease Diabetes with complications Cancer	2
Moderate or Severe Liver Disease	3
Metastatic Carcinoma AIDS/HIV	6

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Paediatric Alternatives for Comorbidity Scoring

- Whilst the Charlson score is commonly used as a tool for assessing comorbidity in adult populations, similar approaches have been considered using paediatric populations to develop comorbidity scores for children
- Two such approaches that have been considered are:

    - Tai D, Dick, P & To, T et al. 2006, *Development of Paediatric Comorbidity Prediction Model*, University of Toronto and the Research Institute, The Hospital for Sick Children, Toronto
    - Rhee D, Salazar, JH & Zhang, Y et al. 2013, *A Novel Multispecialty Surgical Risk Score for Children*, John Hopkins University School of Medicine, Baltimore

- For simplicity, these will be referred to as the Tai score and the Rhee score respectively.

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The Tai Score

- 339, 077 hospital discharges from April 1, 1991 to March 31, 2002
- Population consisted of children aged between 1 and 14 in Ontario, Canada
- Logistic regression used to predict 1 year mortality post discharge
- For comparison with the Charlson score, an integer score for each condition has been assigned based on rounding the regression coefficients in the study (adopted approach from Rhee et al.)

Condition	Tai Score
Agranulocytosis Arrhythmia Coagulopathy Congenital subaortic stenosis Lung contusion Pyrexia Respiratory failure Septicemia Ventricular septal defect	1
Acidosis Candidiasis Developmental delay Feeding problem Head injury Hypertension Pneumonitis Stroke	2
Asphyxia Heart failure Leukaemia Shock	3
Brain cancer Diabetes insipidus	4

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The Rhee Score

- 2,087,915 patients aged under 18 years that underwent an inpatient surgical procedure between 1988 and 2006
- Two national data sources from the US:
    - The National (Nationwide) Inpatient Sample (NIS) – 1988 to 2005
    - The Kid's Inpatient Database (KID) – 2006 and validation sets
- Logistic regression used to predict in-hospital mortality
- For comparison with the Charlson score, an integer score for each condition has been assigned based on rounding the regression coefficients in the study.
- The Rhee score also adds 1 for patients under 24 months of age

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The Rhee Score

Condition	Rhee Score
Acute myocardial infarction Aortic or peripheral arterial embolism or thrombosis Aortic, peripheral, visceral artery aneurysms/dissection Birth trauma Cardiac or circulatory congenital anomalies Chronic obstructive pulmonary disease/bronchiectasis Chronic renal failure Coagulation or hemorrhagic disorders Coronary atherosclerosis/other ischemic heart disease Cystic fibrosis Diabetes mellitus or complications Drowning/submersion Gastrointestinal hemorrhage Hepatic tumors Hepatitis Immunity disorders (except AIDS) Influenza Liver disease (eg, cirrhosis, increased LFTs) Meningitis, encephalitis, or other CNS infection Motor vehicle traffic Peri-/endo-/myocarditis, cardiomyopathy,or tamponade	1

Condition	Rhee Score
Peritoneal or intestinal abscess, peritonitis Primary malignant bone or articular cartilage tumors Primary malignant tumor of adrenal or paraganglia Pulmonary vascular disease (eg, PE,pulmonary HTN) Respiratory distress syndrome Respiratory failure, insufficiency, arrest Septicemia (except in labor) Shock Short gestation, low birth wt, or fetal growth retardation Soft tissue sarcomas Suffocation Systemic lupus erythematosus or connective tissue disorder Thyroid disorders or other endocrine disorders	1
Acute cerebrovascular disease Acute renal failure CNS or miscellaneous intracranial or intraspinal neoplasms Coma, stupor, or brain damage Crushing injury or internal injury Firearm HIV infection Hypoxia, asphyxia, or aspiration during birth Leukemia Lymphomas or reticuloendothelial neoplasms Poisoning by nonmedicinal substances Suicide or intentional self-inflicted injury	2
Cardiac arrest or ventricular fibrillation or flutter Intracranial injury	3

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Analysis Overview

- Key question : Are the Tai and/or Rhee scores better predictors of the occurrence of a HAC when compared to the Charlson score? We will use Hospital Associated Infections (HAI) as a case study as it contains the most significant volume of occurrences.
- Analysis dataset:
  - 237,463 inpatient episodes from SCHN (153,424) and LCCH (84,039) for patients discharged between 01/07/2015 and 30/06/2017
  - 223,457 episodes in scope for HAC funding adjustment (excludes same day chemotherapy, haemodialysis, mental health DRGs etc.)
- Diagnosis information for episodes were used to flag if a HAC occurred for each episode
- Diagnosis information also used to assign each episode a Charlson score, a Tai score and a Rhee score

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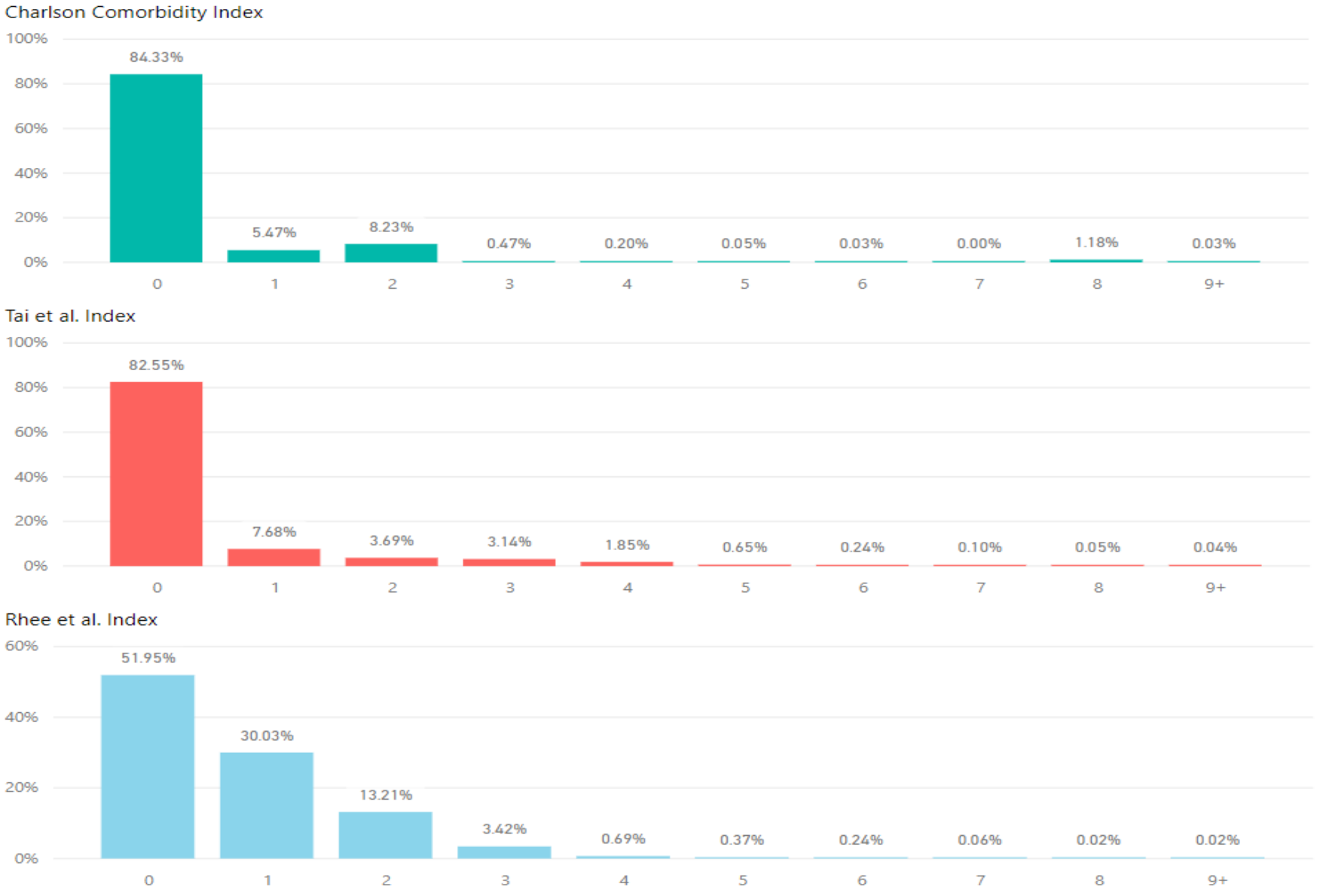
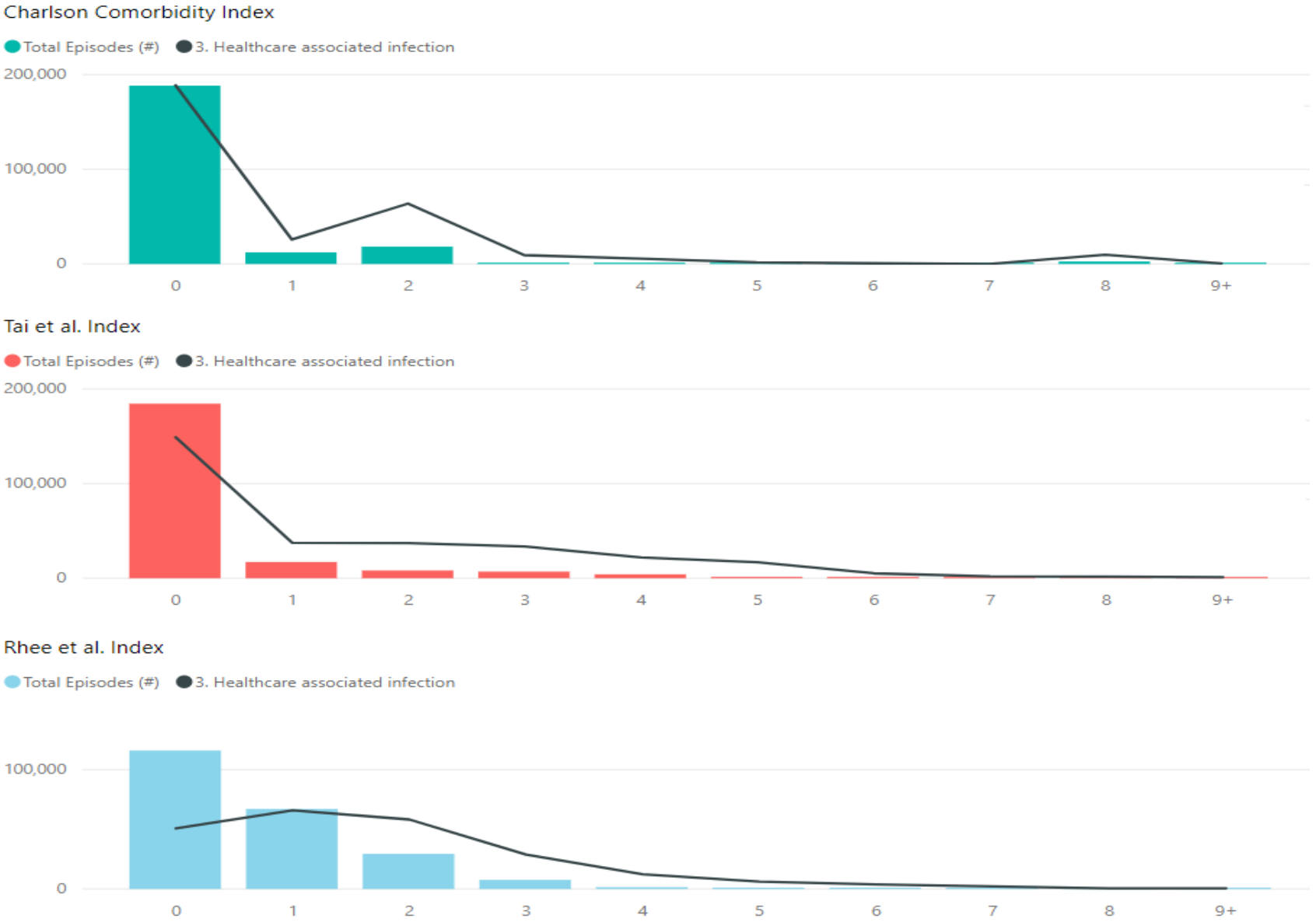
Do the scores segment a paediatric population?



How are HAIs distributed across the scores?



Comparing the comorbidity scores

- The Charlson scores identifies 84% of the population with no comorbidity. The Tai score performs similarly with 82.5% of the population, whilst the Rhee score only flags 52% of the population with no comorbidity.

- Beyond a Charlson score of 2, there is extremely low volume of patients in the higher comorbidity categories. The distribution is less skewed for the Tai score and even more so for the Rhee score indicating a better ability for these two to segment the population.

- The distribution of HAI is also less skewed across the range of comorbidity scores when using the Tai and Rhee scores compared to the Charlson score. We would expect this to translate into greater explanatory power in a predictive model.

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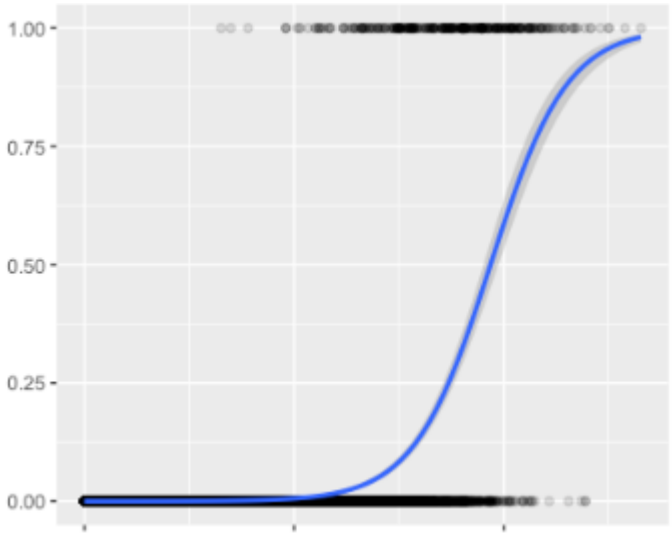
Logistic Regression

- A logistic regression model is a statistical technique used to estimate the *probability* of a binary outcome event occurring (in this case HAC or no HAC) based on a set of predictor variables (in this case the Charlson score, Tai score or Rhee score).
- The regression model provides an estimated probability for each episode. This is converted to a prediction of HAC or no HAC based on the choice of a *prediction threshold* (e.g. if the predicted probability is greater than 50%, we will predict this episode to have a HAC occurring.)



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Sensitivity and Specificity

- For each episode there is:
  - The actual value : HAC or no HAC
  - The predicted value : HAC or no HAC
- This means there are 4 possible combinations, 2 of which are correct predictions and 2 of which are errors.
- These rates will depend on where we set the prediction threshold

$$\text{True Positive Rate} = \text{Sensitivity} = \frac{\#\text{ true positive}}{\#\text{ total actual HAC}}$$

$$\text{True Negative Rate} = \text{Specificity} = \frac{\#\text{ true negative}}{\#\text{ total actual no HAC}}$$

$$\text{False Positive Rate} = 1 - \text{Specificity} = \frac{\#\text{ false positive}}{\#\text{ total actual no HAC}}$$

		Actual Value: HAC	Actual Value: No HAC
Predicted Value	HAC	True Positive	False Positive
	No HAC	False Negative	True Negative

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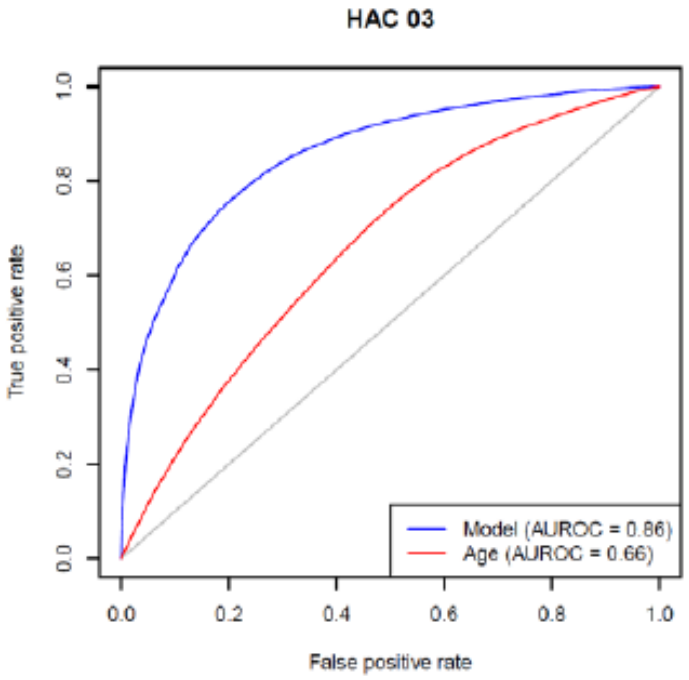
ROC Curves and the AUROC

- The Receiver Operating Characteristic (ROC) curve is a plot of the true positive rate against the false positive rate across the full range of prediction thresholds.
- A good predictor has an ROC curve that hugs the top left corner of the plot – suggesting high true positive and low false positive rates. The diagonal represents a predictor that performs no better than chance.
- The area under the ROC curve (AUROC) is used as a measure of model performance – the larger the better (with 0 ≤ AUROC ≤ 1).



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Assessing predictive power of each score

- An approach similar to the IHPA risk adjustment factor selection process has been used to compare the relative performance of each comorbidity score.
- A logistic regression is conducted using only the comorbidity score as a predictor – and ROC curves are constructed for across the three alternatives for each HAC.
- The area under the ROC curve (or AUROC) is used to compare model performance – the larger the AUROC the better (with $0 \leq \text{AUROC} \leq 1$)
- Note : the analysis has not controlled for the other risk adjustment factors present in the current IHPA model and is only looking to compare the relative performance of each of the comorbidity scores.

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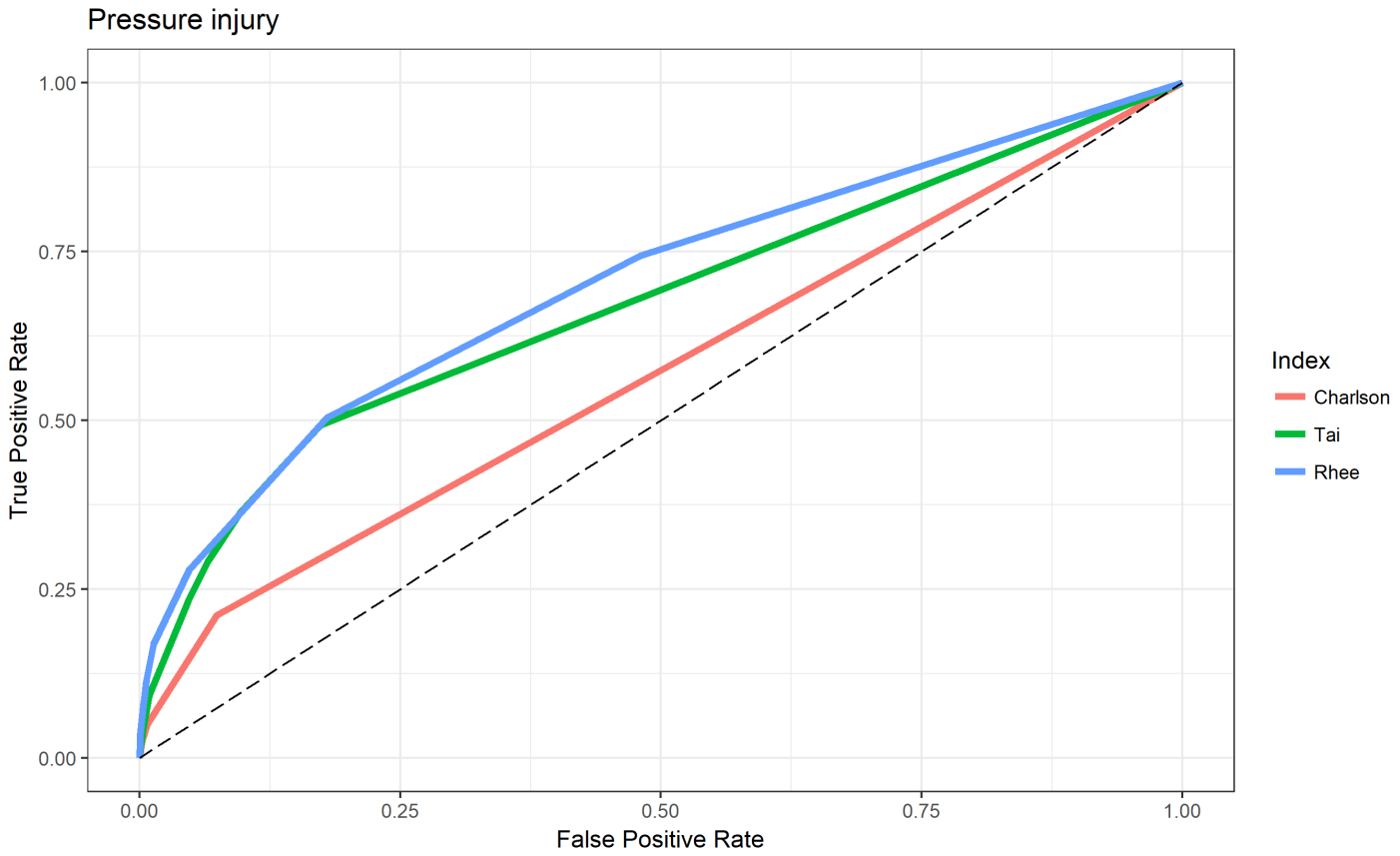
Results – Comparing AUROC

HAC Details		Area Under ROC Curve		
HAC	No. HAC Episodes	Charlson	Tai	Rhee
1. Pressure injury	355	0.5803	0.6716	0.7014
2. Falls	9	0.7051	0.6354	0.6265
3. Healthcare associated infection	1837	0.6204	0.6826	0.7098
4. Surgical complications	430	0.5750	0.5895	0.7210
6. Respiratory complications	258	0.5821	0.7367	0.7002
7. Venous thromboembolism	92	0.5871	0.6435	0.8653
8. Renal failure	25	0.7432	0.7041	0.7677
9. Gastrointestinal bleeding	166	0.6966	0.6979	0.7187
10. Medication complications	305	0.6274	0.6160	0.7043
11. Delirium	121	0.6215	0.7033	0.7038
12. Persistent incontinence	15	0.7095	0.7119	0.7164
13. Malnutrition	176	0.6533	0.6739	0.7592
14. Cardiac complications	452	0.5711	0.6114	0.7256

Results – ROC Curves – Pressure injury



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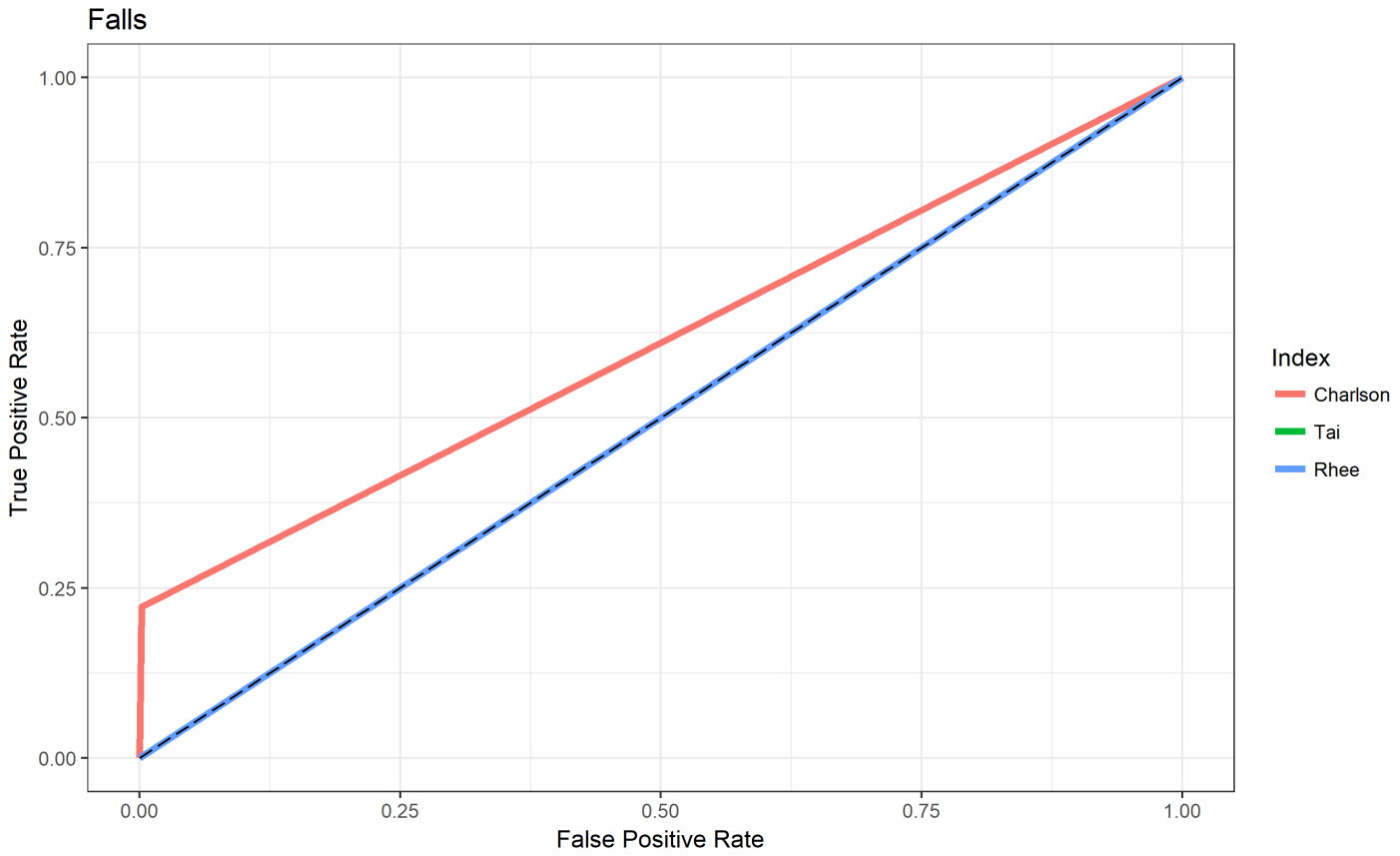
Results – ROC Curves – Falls



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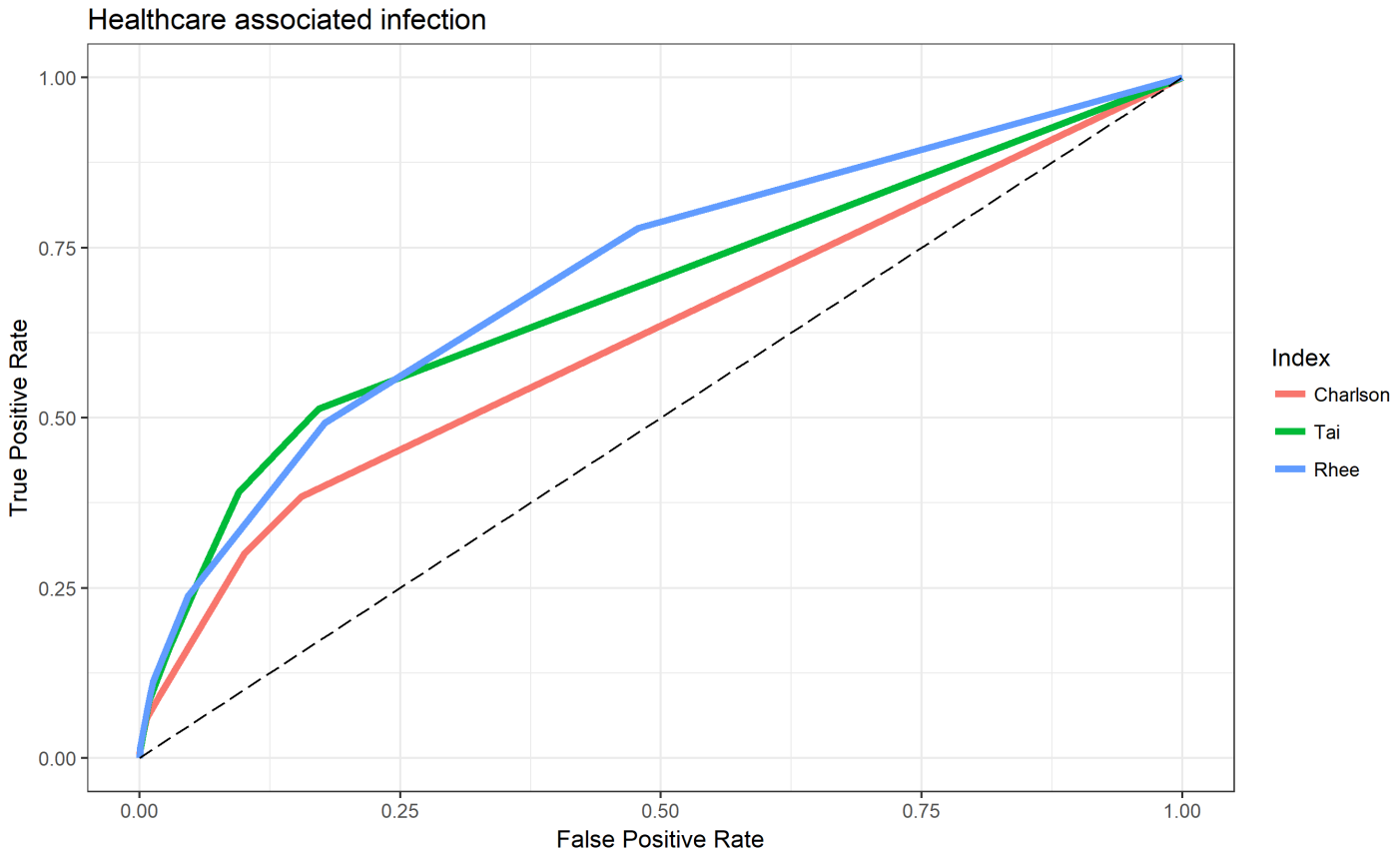
Results – ROC Curves – HAI



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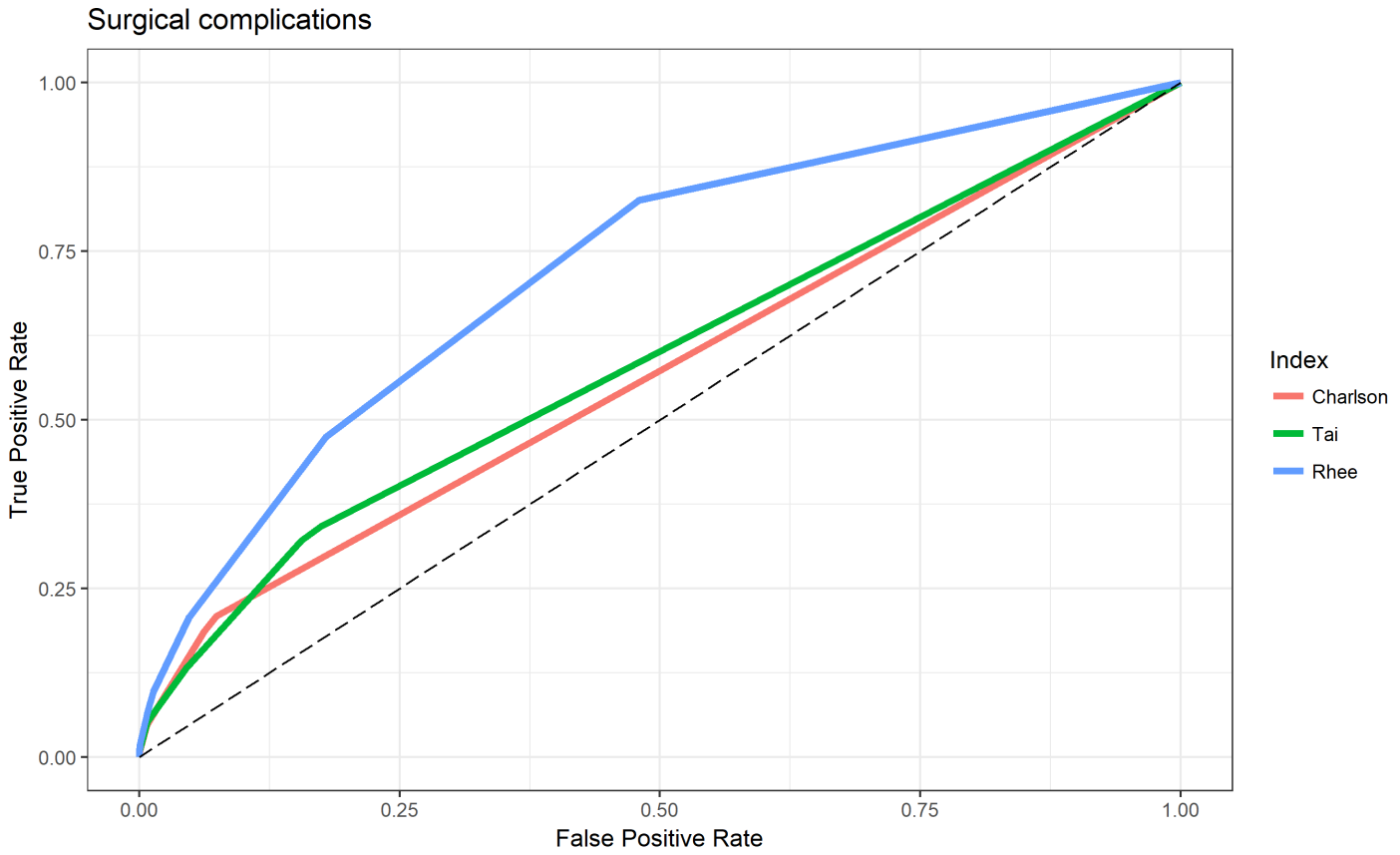
Results – ROC Curves – Surgical complications



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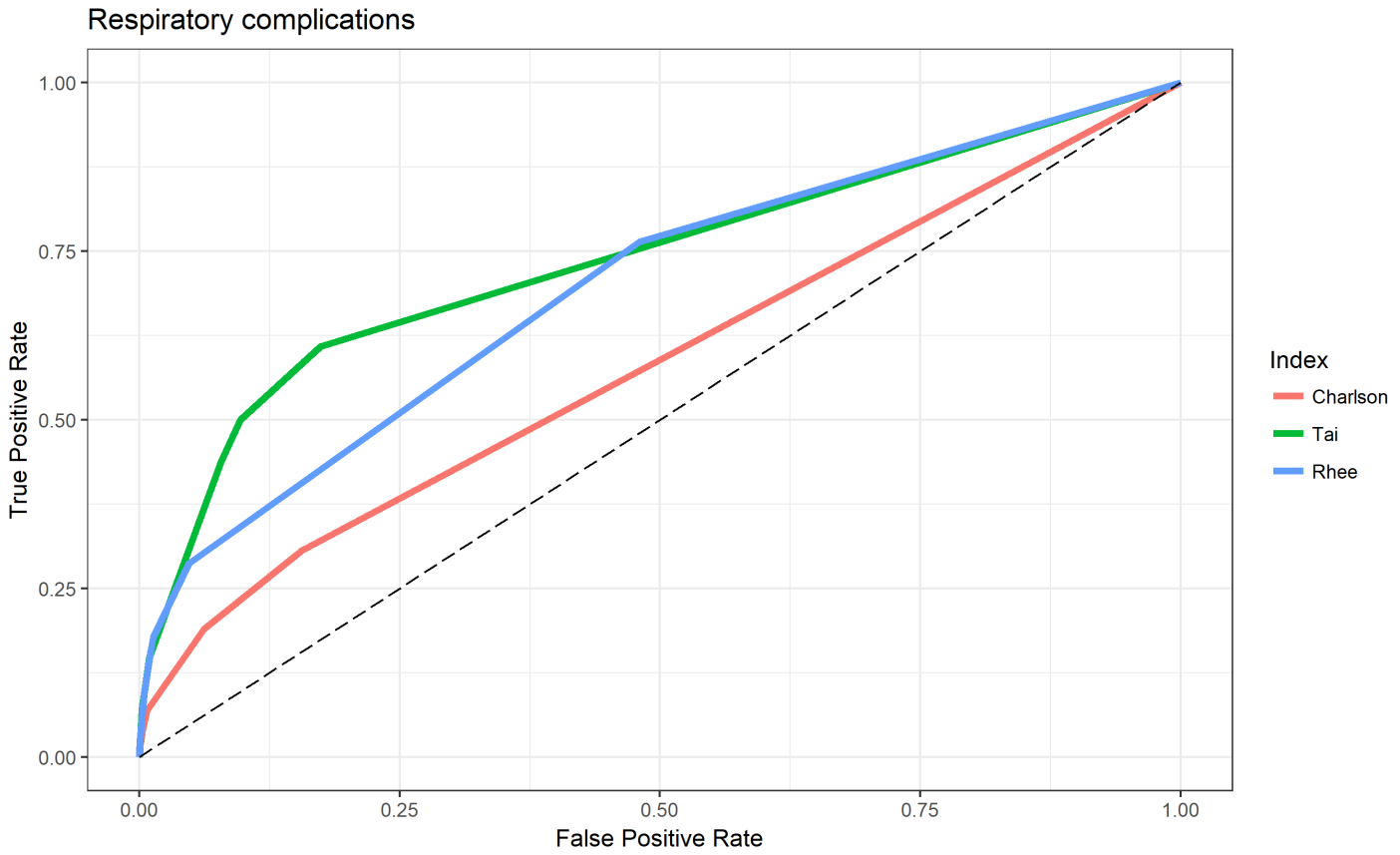
Results – ROC Curves – Respiratory Complications



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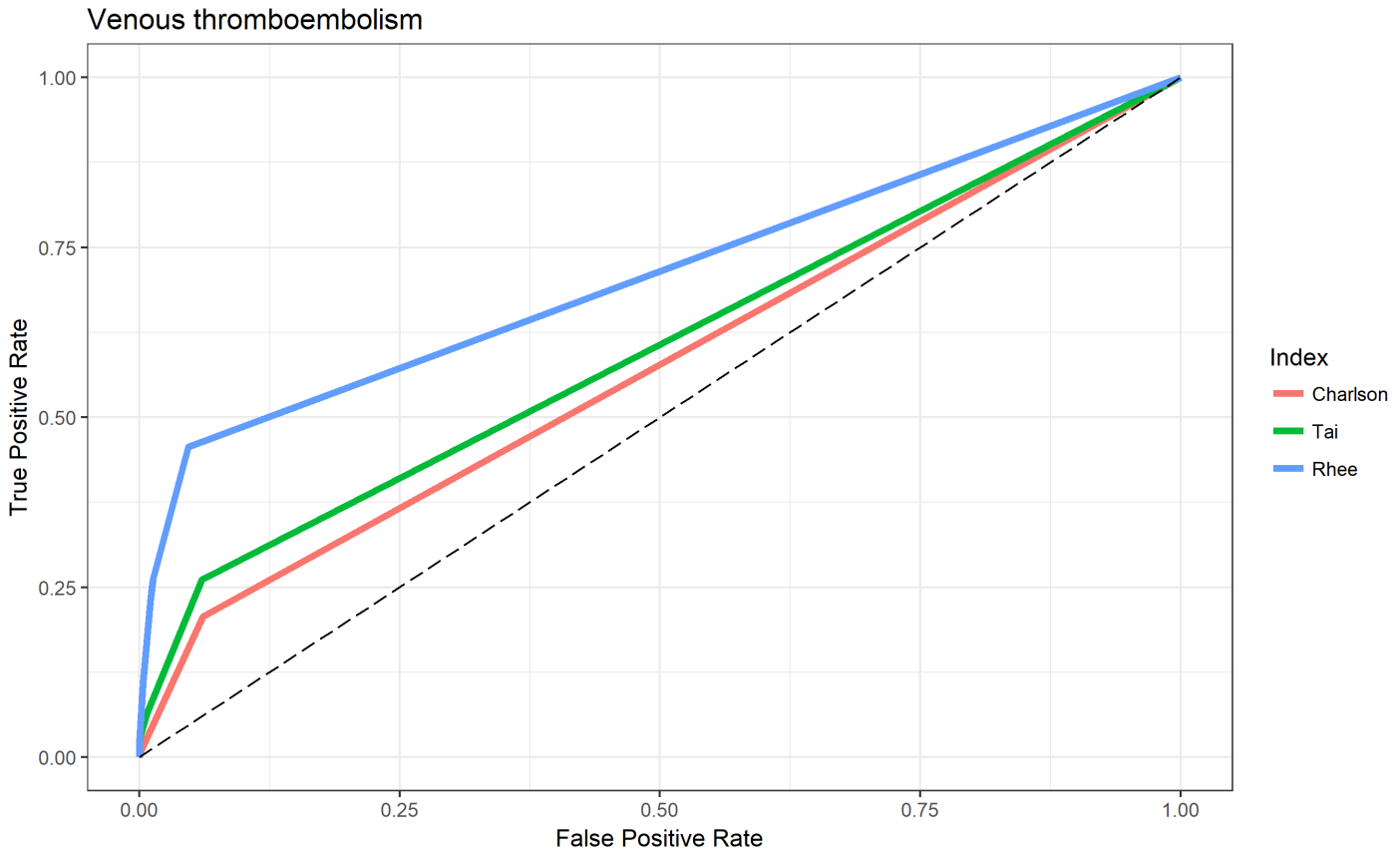
Results – ROC Curves – Venous thromboembolism



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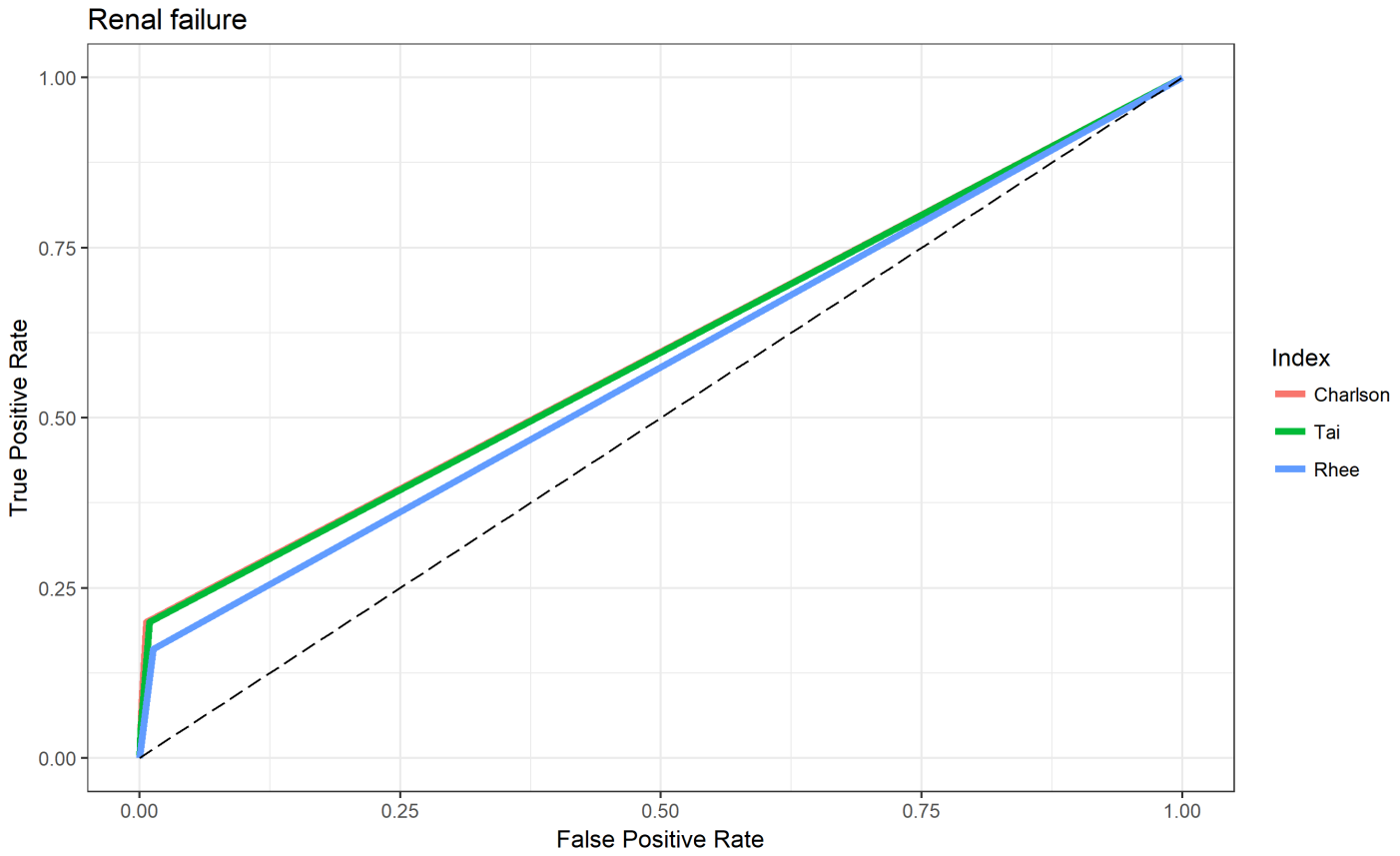
Results – ROC Curves – Renal failure



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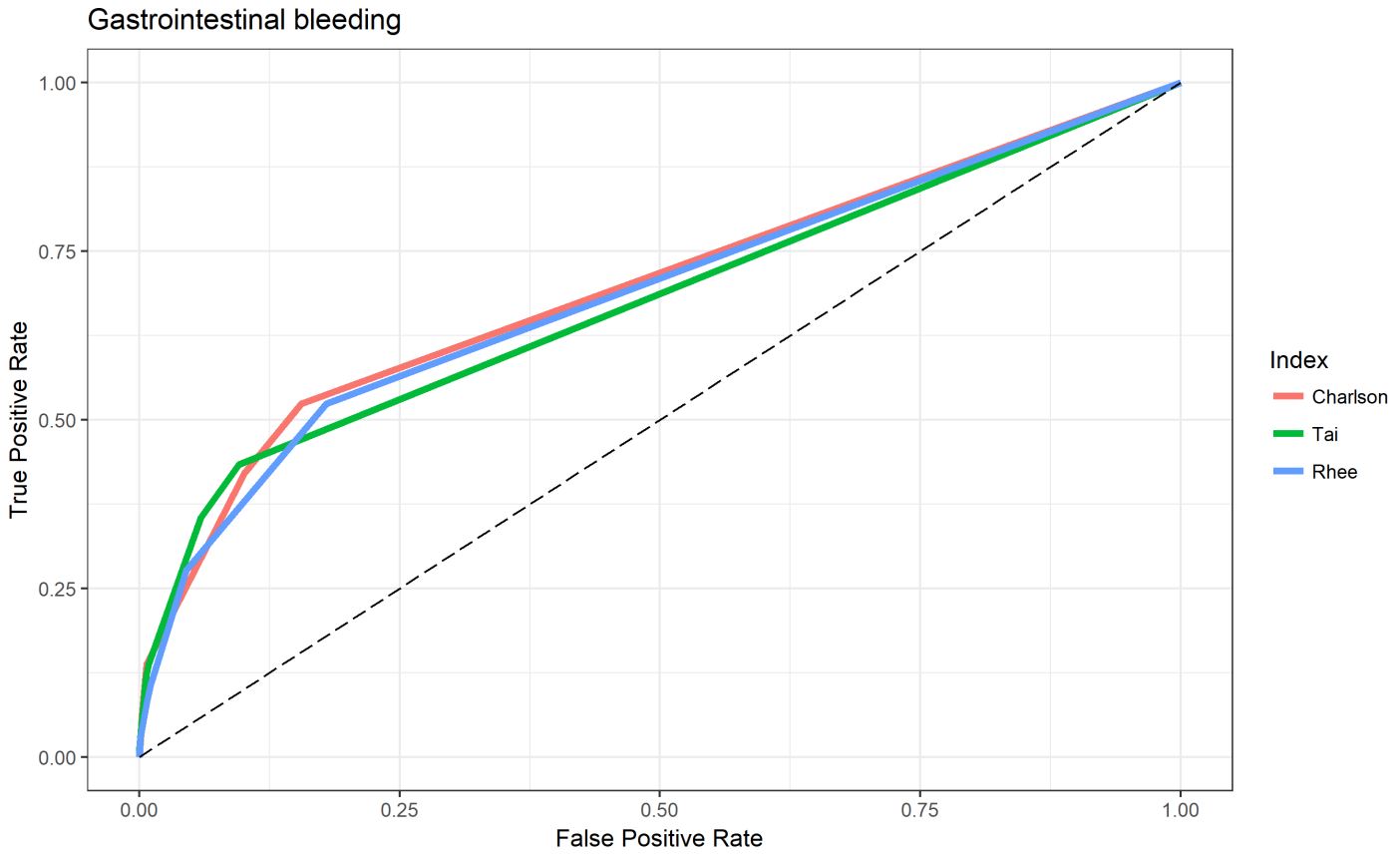
Results – ROC Curves – Gastrointestinal bleeding



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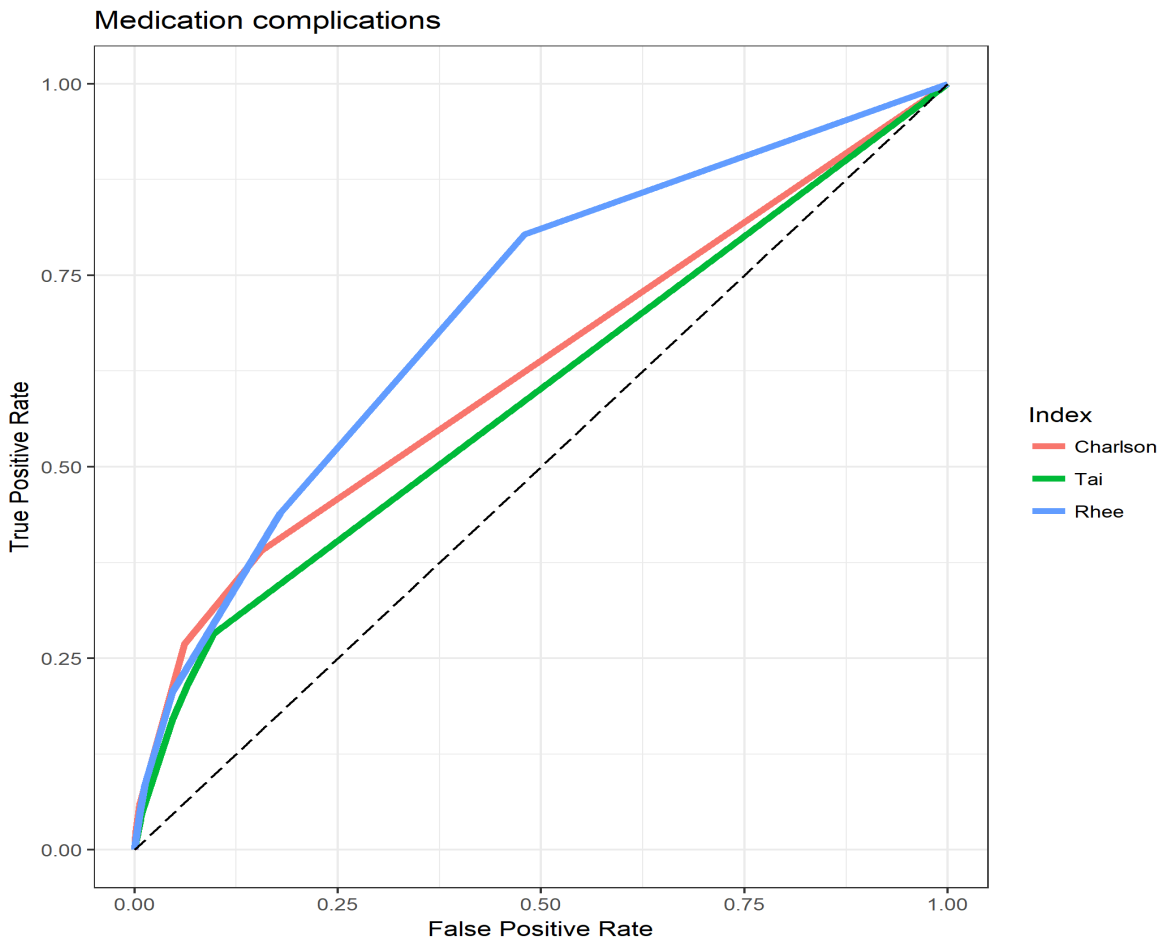
Results – ROC Curves – Medication complications



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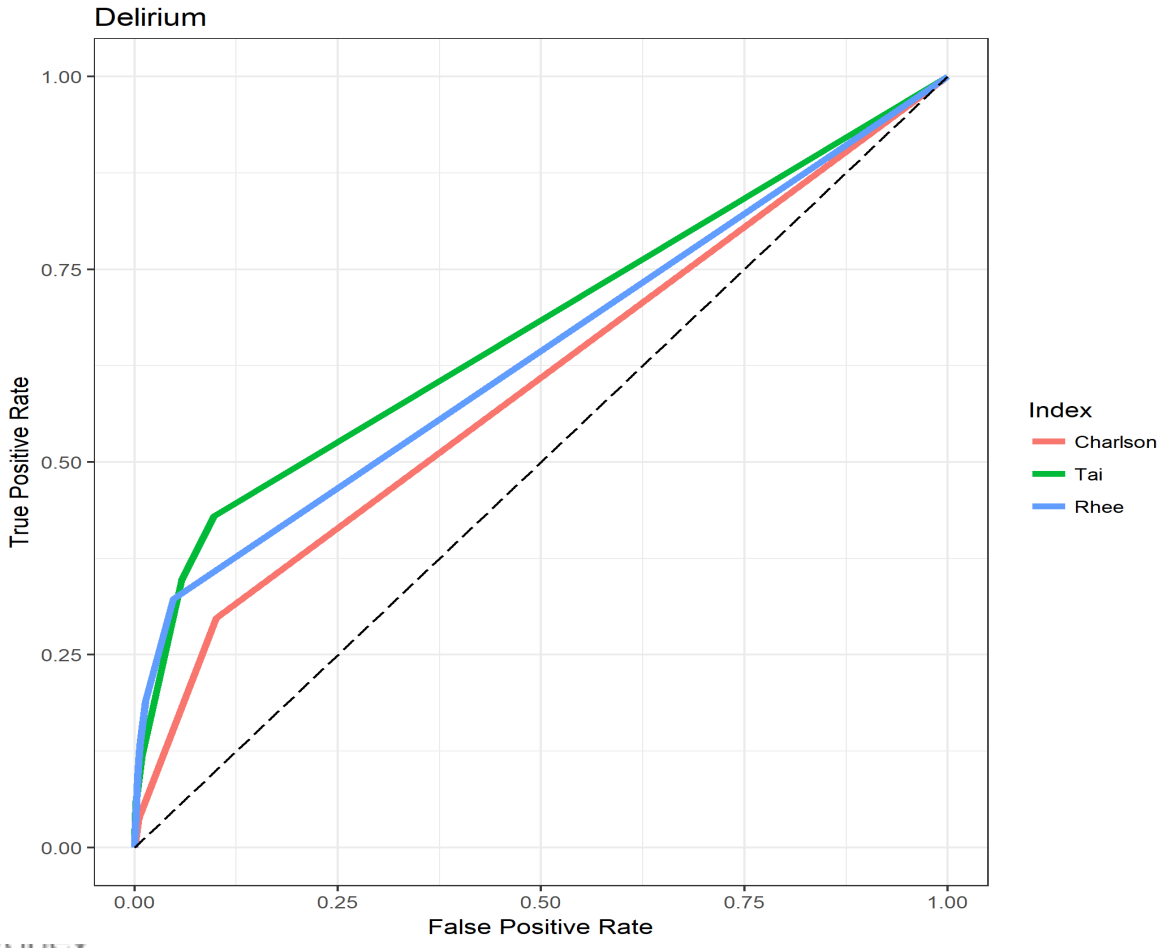
Results – ROC Curves - Delirium



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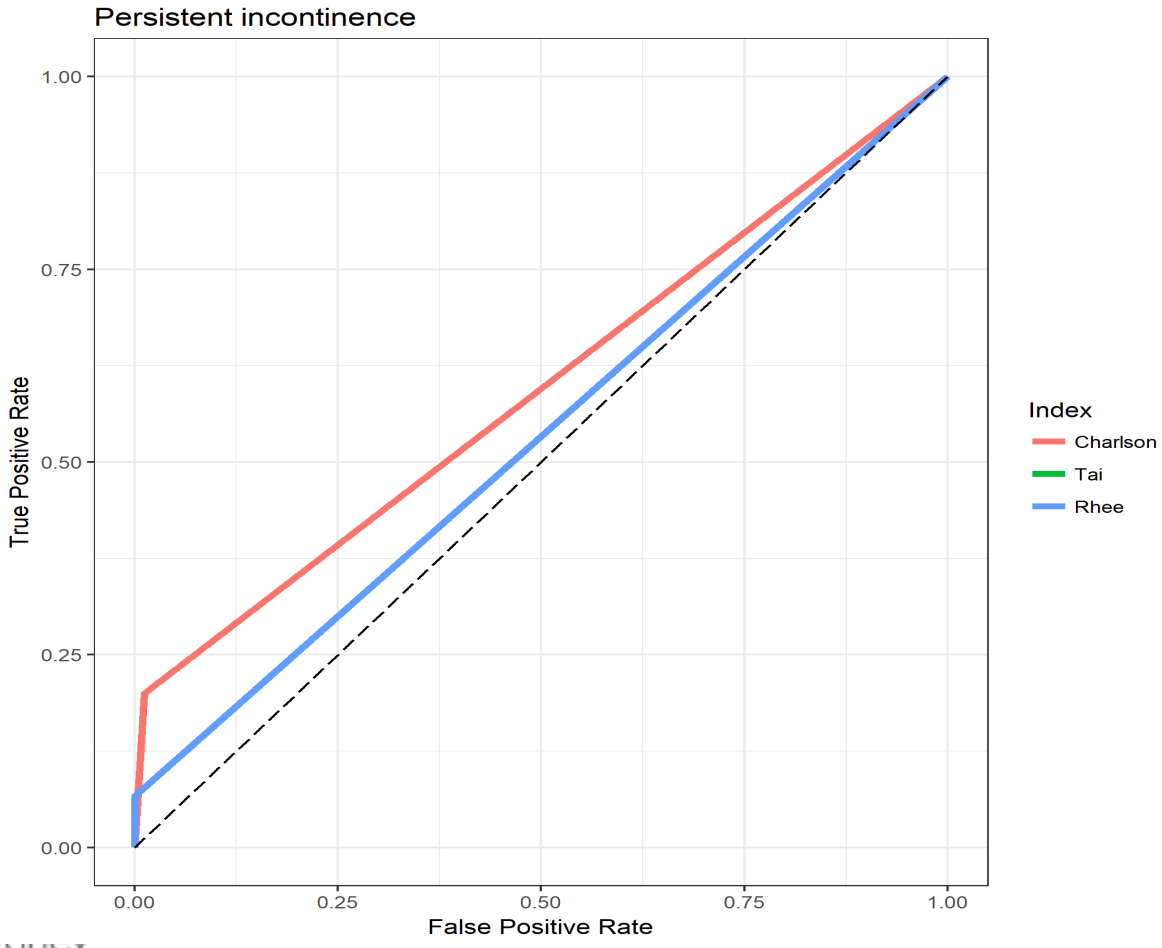
Results – ROC Curves – Persistent incontinence



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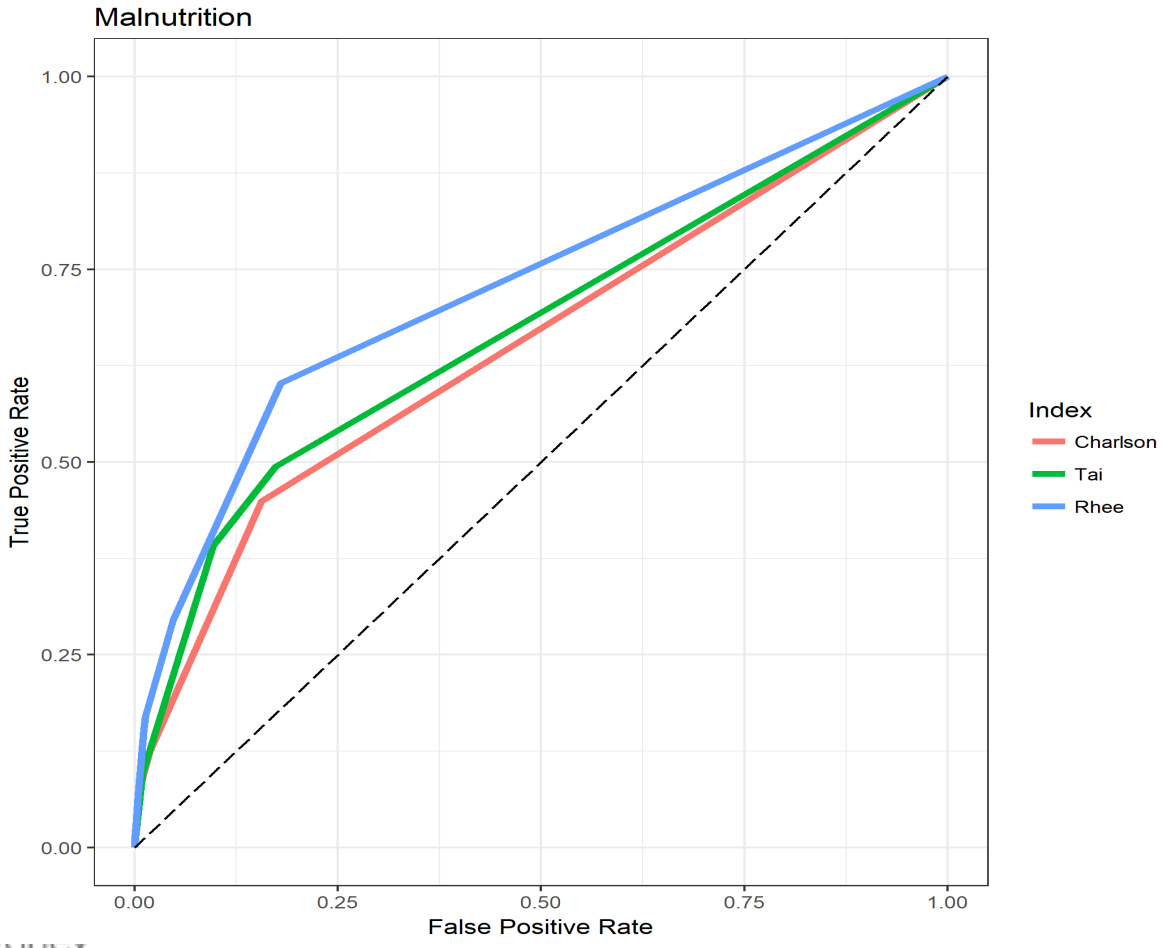
Results – ROC Curves - Malnutrition



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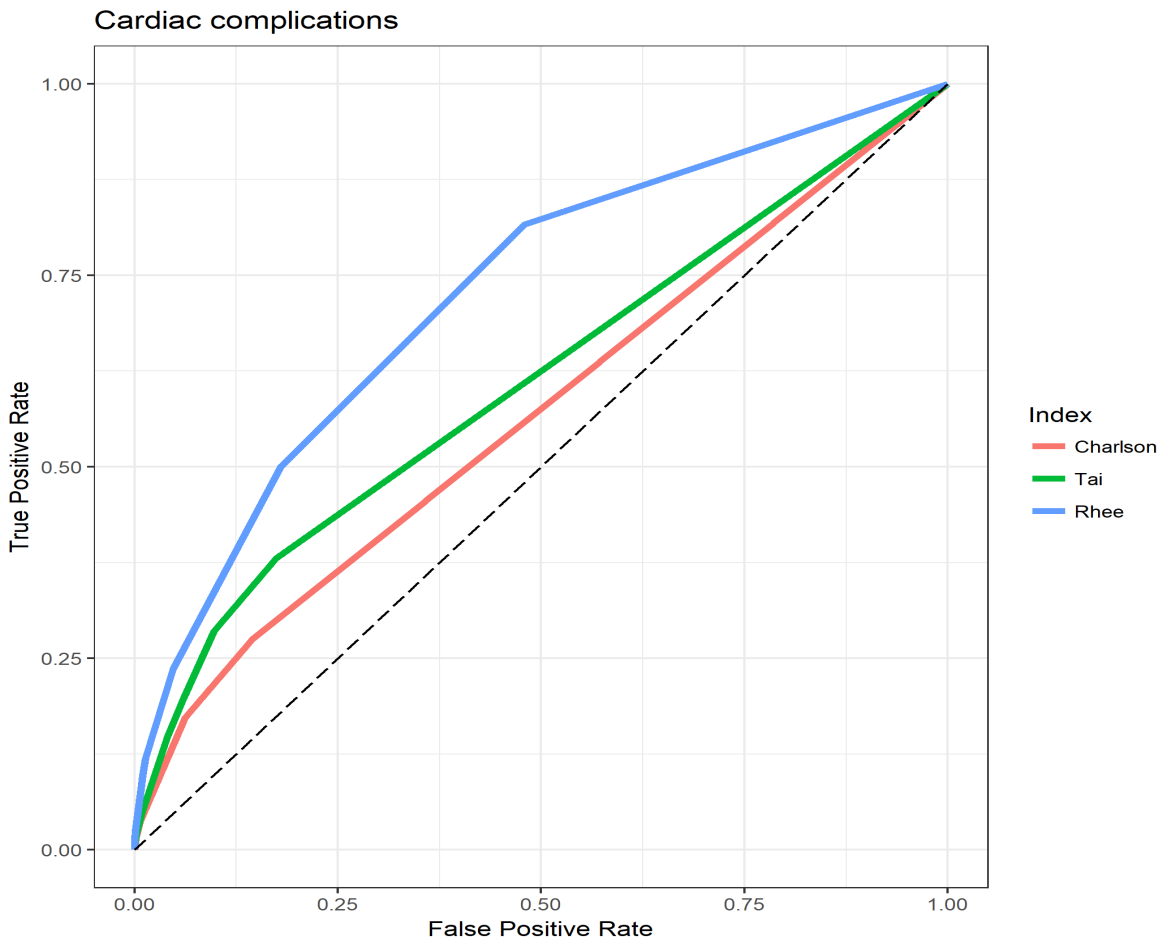
Results – ROC Curves – Cardiac complications



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Some observations

- The Charlson score was the worst performing of the three comorbidity scores for all but three HACs.
- The Rhee score was the best performing comorbidity score for 10 of the13 HACs modelled.
- The ability to build a meaningful predictive model is constrained by the number of episodes with a HAC. For example, there were only 9 episodes with a Fall (out of 223,457)
    - Another way of looking at this is that the most common HAC,

      Healthcare Associated Infections, occurred at a rate of 0.82%

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Next steps

- Further refinement and review of the ICD code list used in calculating the various comorbidity scores. This includes review from clinical coding teams to validate mapping of different versions (over time and across countries) to ICD10V9 AM / ICD10V10 AM and review by medical staff to ensure that these scores are clinically meaningful.

- Replicating this analysis on a broader paediatric population. It will be interesting to see the performance of the comorbidity scores for a population of children outside of specialist / tertiary paediatric facilities.

- Assessing the performance of these comorbidity scores in the full national risk adjustment model to see if the other risk factors account for the explanatory power suggested by these results.

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Acknowledgements

- I wish to acknowledge the assistance provided by the following people

    - Stuart Bowhay (Children's Health Queensland) for providing data for Lady Cilento.
    - Eui-soo Choi and Michael Man (NSW Health) for providing details on calculation of the Charlson score
    - Sally Chung (SCHN) for collating the ICD code list for the Rhee comorbidity score

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Dr Tony Sherbon
Chief Executive Officer
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PO Box 483
Darlinghurst NSW 1300

WOMEN'S HEALTHCARE AUSTRALASIA

Dear Tony,

Thank you for the opportunity for Women's Healthcare Australasia (WHA) to make a submission in relation to IHPA's Work Program for 2015-16.

As you know, WHA's membership comprises both specialist women's hospitals and general hospitals with maternity and women's health services. We now have 60 maternity units in our membership ranging from large city services with 10,000 births per annum to small rural units with fewer than 500 births a year. Together our members are providing care for more than 100,000 women giving birth each year, or approximately one third of all births in Australia. Details of our members are available on our website.

WHA acknowledges that IHPA's objectives in calling for public submissions on its work program are to:

- enhance focus on the equitable funding of public hospitals
- improve efficiency, accountability and transparency across the public health care system, and
- drive financial sustainability of public hospital services into the future.

In this submission, WHA would like to draw IHPA's attention to an ongoing issue in the delivery of maternity care that relates to all of these objectives, but particularly to the sustainability of public hospital services – that of the care and funding of 'unqualified' neonates. Unqualified babies are currently not in-scope for Activity Based Funding, since their care was not a funded hospital service in 2010. However, we believe this is anomalous to the effective, efficient and sustainable provision of neonatal care by hospitals.

We acknowledge that IHPA is aware of this issue already but would like to encourage IHPA to undertake some more details assessment of this issue and consider strategies to address it in the year ahead.

What is the issue with unqualified neonates under ABF?

In summary, the key issue is that of the more than 312,000 babies born in Australia each year[1], WHA estimates there are tens of thousands who are receiving medical care in maternity hospitals, but whose care does not currently trigger payments under Activity Based Funding. That is because these babies are not able to be recognized as 'patients' under the existing Commonwealth regulation – they are deemed to be 'unqualified' for Commonwealth funding.

As outlined in more detail below, the challenge of providing care for 'unqualified' babies is growing more acute over time. The rising birth rate is placing increasing pressure on cots in approved Special Care Nursery facilities. It is also significant that research over the past decade has highlighted the health benefits to mothers and their babies from remaining together. Even if more Special Care cot were made available, it is appropriate that maternity carers endeavour to care for babies that are not too seriously ill or disabled by providing the required medical treatment to the baby while it remains on the ward with its mother. However to do so means that the hospital is unable to claim funding for that care.

What is an 'unqualified' neonate?

The definition of 'qualified' neonates is set out in Commonwealth regulation: "'Neonatal Facilities for the treatment of newly born children approval under the Health Insurance Act 1973' (Commonwealth of Australia Circular HBF583/PH340, 1999)

This Circular provides for new born babies (defined *as "a child 9 days old or less")* to be qualified as patients and hence be eligible for Commonwealth funding under the National Health Act of 1953 and the National Insurance Act of 1973 only when:

- *the newborn baby occupies an approved bed of a neonatal intensive care facility in a hospital….*
- *there are two or more newly born children of the same mother in a hospital each such child in excess of one shall be deemed to be a patient of the hospital.*

Importantly, the Commonwealth Department of Health and Aged interpreted the above provisions of these Acts to *"provide for the occupancy of a new-born in a special care facility within a hospital"*, not just a neonatal intensive care facility.

[1] Hilder L, Zhichao Z, Parker M, Jahan S, Chambers GM 2014. Australia's mothers and babies 2012. Perinatal statistics series no. 30. Cat. no. PER 69. Canberra: AIHW. http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129550054

Neonatal special care is defined in the Circular to mean *"monitoring and care for newly born children suffering from illness or disability at birth requiring specialist medical care, nursing attention and hospital treatment".* Special care is further elaborated to include:

- continuous monitoring of respiration or heart rate or by transcutaneous transducers
- receiving additional oxygen
- receiving intravenous glucose and electrolyte solutions
- being tube fed
- monitoring following minor surgery in the preceding 24 hours
- being barrier nursed
- receiving phototherapy

On its own, this definition could include babies receiving medical care while on the ward with their mother, but the Circular specifically excludes this scenario, stipulating that *"the default benefits are not payable in respect of a newly born child accommodated in hospital with the mother unless such a child is accommodated in a separate special care facility which has been specifically approved for that purpose"*.

The Circular stipulates a range of conditions that must be met for a neonatal Special Care Nursery/NICU to be deemed to be approved. These relate to the expertise and mix of staffing, access to pathology and other diagnostic testing services, and referral systems in place for the unit.

What is the current picture re care of unqualified neonates?

WHA understands that this Commonwealth Circular has not been updated since 2001, whereas prior to that time it was reviewed and updated every 3-5 years. Yet the circumstances in which newborn care is provided have changed considerably during the past 15 years. There are at least 2 key factors at play:

1. **Increased demand for finite special care nursery cots**
   Demand for special care nursery places is often outstripping supply due to a variety of factors including:
   - significant increases in the annual birth rate (up 21% since 2000) to 312,159 babies[2]

[2] Hilder L, Zhichao Z, Parker M, Jahan S, Chambers GM 2014. Australia's mothers and babies 2012. Perinatal statistics series no. 30. Cat. no. PER 69. Canberra: AIHW., page 66 http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129550054

- increased rates of birth by caesarean section (at 32.4% of women nationally in 2012, up from 23.3% in 2000)[3]. Caesarean section has been found to be associated with an increased likelihood of NICU admission for those neonates born by caesarean section compared with babies born vaginally.[4]
- Improvements in technologies and know-how to support pre-term babies at younger gestational age (now available in specialist sites for babies as young as 23-24 weeks gestation) has contributed to increased demand on finite beds and other resources in neonatal special care nurseries.

2. Changing evidence re the wisdom of separating neonates from their mothers

Newborn babies requiring specialist medical care, nursing attention & hospital treatment are required to be separated from their mothers if their treatment & care is to attract funding. Research now confirms the benefits to the health and wellbeing of both newborn babies and their mothers from skin to skin contact and breastfeeding.[5] Some unwell neonates can receive appropriate medical treatment while remaining on a ward with their mothers, but such care is currently unfunded so there is little incentive for providers to keep mothers and babies together except where special care nurseries are overcrowded.

These factors are resulting in many hospitals providing care for babies on wards that they would once have admitted to a Special Care Nursery. In an effort to gauge the extent of this practice WHA recently invited its members to participate in a spot check of the neonates in their care on an agreed day. The survey asked hospitals to undertake a spot-check at a time of their choosing on Wednesday 15 April and to record:

- Total number of newborn babies present in the hospital on the day of the survey
- Total number of newborn babies admitted to their NICU and/or SCN (qualified)
- Total number of newborn babies rooming in with their mothers on wards (Labour or postnatal) – ie 'unqualified', and
- Of the unqualified babies, the number receiving medical care and type of care being provided

[3] AIHW NPSU 2003. Australia's mothers and babies 2000. AIHW Cat. No. PER 21. Canberra: AIHW National Perinatal Statistics Unit (Perinatal Statistics Series no. 12)., page 16 http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=6442458935

[4] Tracy SK, Tracy MB, Sullivan E 2007 'Admission of Term Infants to Neonatal Intensive Care: A Population-Based Study, *Birth* 34:4 December 2007

[5] For an overview of evidence on the benefits of skin to skin contact and breastfeeding see for example the World Health Organisation's Reproductive Health Library: http://www.who.int/elena/titles/early_breastfeeding/en/

47 WHA member hospitals responded, including tertiary hospitals and Level 1-5 maternity units from both urban and regional/rural areas. Collectively these hospitals care for **98,646** births per annum or approximately one third of total annual births in Australia.

The hospitals reported the following

- On 15 April 2015 they were caring for a total of **1,193** babies of which:
  - **579** (49%) were in NICU, Special Care, or admitted without their mother
  - **614** (51%) were with mothers on wards (unqualified)
- Of the unqualified babies:
  - **210** (34%) were receiving no additional medical care
  - **404** (66%) were receiving medical treatment
- The main forms of medical care/treatment being provided to the unqualified babies were:
  - Monitoring due to low birth weight: **3**
  - Receiving more than routine observations: **381**
  - Receiving phototherapy**: 124**
  - Receiving gavage or other assisted feeding: **14**
  - Receiving other treatment, including diagnostic testing, IV antibiotics or other medical treatment **171**

  NB the breakdown of treatments does not match the total number of unqualified babies receiving care because many of the babies were receiving more than one treatment.

Where to from here?

Due to ethics considerations, WHA was careful to ensure that no individual baby could be identified in the data provided back to WHA. The data was also collected on just one random day. The data collected is therefore indicative only and further, more rigorous analysis of the extent and types of medical care being provided to unqualified newborns would be required if this issue were to be effectively considered and addressed. However this preliminary data suggests there is a significant issue of underfunding of neonatal care in Australian maternity services at present due to the outdated definitions of qualified and unqualified baby upheld by the 2001 Commonwealth Circular.

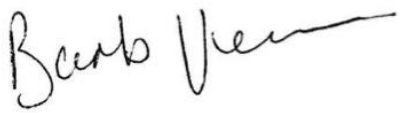
WHA acknowledges that this issue can not be resolved by IHPA in isolation. It will be up to the Commonwealth government to determine its position on the definition of a qualified neonate by updating its Circular. Technically care of unqualified neonates may be out of

scope for IHPA as their care was not a funded hospital service in 2010. However it is clear that care of most newborns is and will continue to be provided by hospitals, and that if Activity Based Funding is to provide a sustainable basis for the provision of neonatal care, then there is a case for reconsidering the definition of qualified babies, to include all those babies for whom specified medical treatment needs to be provided. WHA believes the location of the care (in NICU, in Special Care or on a ward) ought not to be the defining factor in whether funding is provided, but rather the identified and documented clinical need and treatment provided for each neonate that is less than well at birth and in the early weeks of life.

WHA would be interested to discuss this further with IHPA. We are confident our members would be willing to provide any assistance that might be required to undertake a more rigorous analysis of this issue than our preliminary spot-check can provide.

Thank you again for the opportunity to provide advice on these matters.

Kind regards



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