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Original article

Trends in Rates and Inequalities in Paediatric Admissions for Ambulatory Care Sensitive Conditions in Victoria, Australia (2003 to 2013)

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Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Ethics statement

Ethics approval for the study was granted by the Human Research Ethics Committee, Royal Children's Hospital (RCH HREC 37164). No human subjects or research on human subject was conducted. The VAED administrative database is used in this paper. The data used are de-identified and only aggregate level information is presented. In addition, we i.e. the Centre for Community Child Health are the secondary data custodians of the VAED.

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Statement of competing interests

The authors declare no conflicts of interest.

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Abstract

Aim: To examine 10-year trends and inequalities in paediatric admission rates for acute and chronic Ambulatory Care Sensitive Conditions (ACSCs) in Victoria, Australia.

Methods: Secondary data analysis of the Victorian Admitted Episodes Dataset of children aged 0-17 years and 11 months admitted with a principal diagnosis of acute ACSCs: gastroenteritis/dehydration, dental conditions, and urinary tract infections (UTIs) or chronic ACSCs: asthma and diabetic ketoacidosis, from 2003 to 2013. Main outcome measure was trends in paediatric hospital admission rates for ACSCs (per 1,000 population).

Results: Over the 10 years, hospital admission rates remained consistently high for asthma and dental conditions. Children from socioeconomically disadvantaged areas were more likely to be admitted for all acute conditions over time. Dental conditions were the only ACSC associated with increased rates of admissions in regional areas.

Conclusions: Inequalities in paediatric hospital admissions exist for acute conditions and have not changed from 2003 to 2013; disadvantaged Victorian children were more likely to be admitted to hospital at each time point. More equitable access to medical and dental care is needed. Primary care (medical and dental) should be a critical platform to address socioeconomic differences and effectively prevent avoidable hospital admissions in children.

Key words: primary healthcare, rural and remote health, health systems, hospitals, health policy

What is known about this topic? Ambulatory Care Sensitive Conditions (ACSCs) are conditions for which hospitalisation could be avoided and are used as indicators of accessibility to and overall effectiveness of primary healthcare.

What does this paper add? Inequalities in paediatric hospital admissions for acute conditions remains unchanged from 2003 to 2013. Children living in the most disadvantaged areas and outer regional areas of Victoria are the most at risk of being admitted to hospital with acute conditions.

Potential primary care and social determinant drivers of this inequality need to be better understood if we are to prevent avoidable hospital admissions in children.

Introduction

By the time children commence school, there are substantial inequalities in their health outcomes across social and economic gradients. Such inequalities are associated with later poor health and social outcomes and chronic morbidity.[1] Addressing these inequalities early has the potential to improve health outcomes in children and their risk of developing subsequent costly, adult chronic illnesses. [2]

The 2008 World Health Organisation (WHO) World Health Report recognised the importance of primary healthcare in addressing health inequalities.[3] Having policies that increase the supply and access to quality primary care in disadvantaged areas could be effective in reducing these health inequalities. This focus on primary care has led to several international efforts to measure the "quality" of primary care. Starfield et al. suggest that quality primary care is associated with better outcomes for children.[4] The well-known Commonwealth Fund of New York review of primary care [5] utilised a range of measures to document the potential quality metrics of high quality and equitable primary care, with Australia often being ranked as one of the best primary healthcare systems on these metrics; however, they are not specific to children.

Complementing these studies on primary care have been studies focussing on preventable hospitalisations through the metric of Ambulatory Care Sensitive Conditions (ACSCs); conditions where hospitalisation is avoidable with adequate and timely care provided by primary care.[6] ACSCs hospitalisation rates are internationally accepted, high-level health system performance indicators.[7] A Victorian ACSC study in 2001 developed a version of these indicators to inform policy on how best to decrease rates of hospital admissions, and reduce costs to the healthcare system. In children, they suggested timely treatment of acute conditions in primary care (e.g. urinary tract infections [UTIs], gastroenteritis/dehydration, and dental conditions), optimal management of chronic diseases in the community (e.g. asthma and diabetic ketoacidosis) and immunisations for vaccine-preventable conditions (e.g. measles) could all help reduce admissions.[6]

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Few other ACSC studies have reported on children and only one study has published on trends over time in Australian children.[8] Li et al [8] examined trends in ACSC hospitalisation rates from 1998/99 to 2005/06 in the Northern Territory and found consistently higher rates in indigenous versus non-indigenous children. Three cross-sectional studies have reported on Australian paediatric ACSC hospital admissions over the last 20 years either for total ACSCs or a combination of acute and chronic conditions but not for individual ACSCs. [9-11] Grouping conditions together could mask differences in admission rates for individual conditions.

To date, no studies have examined trends in paediatric admissions for ACSCs by socioeconomic area, health insurance status or geographic remoteness – factors which may be vital for guiding systemic solutions for inequalities. Given the increasing policy interest in the quality and equity of access to primary care and the current lack of associated good metrics, we aimed to examine individual acute and chronic paediatric ACSCs trends in (i) overall admission rates (per 1,000 population aged 0-17 years and 11 months) and (ii) admission rates by socioeconomic area, health insurance status and geographic remoteness in Victoria, from 2003 to 2013.

Methods

Data source

Victorian Admitted Episodes Dataset

We obtained hospital separation data from the Victorian Admitted Episodes Dataset (VAED) for all Victorian children (0 – 17 years and 11 months of age) with inpatient admissions occurring anytime during the period July 1st, 2003 to December 31st, 2013, as this period was used as part of a larger international study. The VAED is a minimum dataset containing data on all admitted patient activity submitted by all public and private hospitals.[12] The reason for admission is based on the primary or principal diagnosis using the International Statistical Classification of Diseases and Related Health Problems 10th revision (ICD-10) codes.[13]

Outcome measure:

ACSC conditions

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Acute ACSC conditions included gastroenteritis/dehydration and UTIs, while chronic conditions included asthma and diabetic ketoacidosis– all internationally accepted as prevention quality indicators (PQIs) for ACSCs by the Agency for Healthcare Research and Quality (AHRQ).[7] We also included dental conditions as an acute condition, given they are a leading cause of all ACSCs admissions in Victoria and were included in the Victorian 2001-02 ACSC study.[6] Appendix Table 1 specifies the age range of children in the dataset and Appendix Table 2 indicates the ICD-10 codes used to identify each ACSC.

Exposure measures:

Index of Relative Socioeconomic Disadvantage (IRSD)

The Australian Bureau of Statistics (ABS) has compiled Socioeconomic Indexes for Areas (SEIFA) from individual census variables. SEIFA provides measures of the social and economic status by geographic area. We selected one of these indexes - IRSD - because it is a comprehensive measure of socioeconomic inequity, being derived from summing multiple weighted variables including adult education, occupation, non-English speaking background, Indigenous origin, and the economic resources of households for each postcode area.[14] The higher the value of IRSD, the less disadvantaged the area. We ordered areas from the lowest to highest score and aggregated them by quintile from lowest (Q1) to highest (Q5).

Regional Areas

Regional areas were defined based on a measure of relative access to services using the ABS's Accessibility and Remoteness Index of Australia (ARIA+).This is a standard national measure of geographic remoteness with values ranging from 0 (major city) to 15 (very remote). The ABS use five population categories forming the Remoteness Areas classification: major cities, inner regional, outer regional, remote and very remote.[15]

Health Insurance

The rate of admissions with private hospital insurance per 1,000 population was calculated.

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Data analysis

The rate of admissions per 1,000 population was calculated using ABS estimates of children in the Victorian population aged 0-17 years and 11 months for each financial year of 2003 to 2013. The rate of admissions per 1,000 children for the overall Victorian paediatric population were then stratified by IRSD ratio, IRSD quintiles, regional areas and health insurance status.

The IRSD ratio was calculated by dividing IRSD quintile 1 by IRSD quintile 5. This gives an indication of the level of inequity with a ratio over one suggesting a greater inequality in admissions. [16,17]

The number of admissions per 1,000 population for each regional area were derived using postcodes from the index of remoteness areas for Victorian Statistical Areas Level 2 (SA2) and Victorian population by SA2 from 2004-2013.[18] The rate of admissions with hospital insurance per 1,000 population data was calculated using data from the Australian Prudential Regulation Authority (APRA).[19]

To determine trends, a poisson regression model with the number of admissions as the outcome variable, the number of population as the exposure variable, and year as the predictor variable, was fitted to each condition. Since we have annual admissions for 10 years, the regression model has been fitted using the data with a sample size of 10. The trends can be examined by the coefficient and p value of the predictor variable year. A positive coefficient indicates the rate of admission increases with year while a negative coefficient indicates the rate of admission decreases with year. The p values suggests the significance of the trend. The p values, coefficients, incidence rate ratio (IRR) and confidence interval for the predictor variable are reported (Appendix Table 3). For IRSD ratio, a linear regression model with the ratio as the outcome variable and the year as the predictor variable was fitted to each condition. The coefficients and p values for the predictor variable are also reported (Appendix Table 3). For gastroenteritis/dehydration, the free rotavirus vaccine was first released in July 2007. For the first four years (07/2003-06/2007) there was no intervention and the final six years there was an intervention. To examine the effect of

such intervention, a simple interrupted time series model was fitted. We have created a dummy intervention variable where 0 is placed for the first four years when the free rotavirus vaccine was not available and 1 for the final six years when the free rotavirus vaccine was available. Then we fitted a linear model with the number of admissions per 1,000 children as the response variable and the dummy intervention variable as the predictor. All analyses were performed in R version 3.5.3.

Results

Hospital admission rates

Hospital admissions rates for chronic conditions remained stable over the 10 years, while rates for acute conditions varied. Admission rates remained consistently high over time for asthma and dental conditions compared to UTIs and diabetic ketoacidosis, which were consistent but low (Figure 1). Admissions for dental conditions and gastroenteritis/dehydration showed downward trends whilst asthma had a small upward trend (all $p<0.001$). Gastroenteritis/dehydration admission rates showed the greatest decline compared to the other conditions (62% decline between 2006/07– 2012/13) (Figure 1). The simple interrupted time series model revealed that the introduction of the free rotavirus vaccine decreased the rate of admissions for Gastroenteritis/dehydration. The coefficient of the dummy intervention variable is -1.67 with confidence interval [-2.44, -0.88] and p-value 0.003.

Inequality by socioeconomic disadvantage

All acute ACSCs had consistent IRSD ratios greater than one over time; children living in the most disadvantaged areas had a higher rate of admissions compared to those living in the least disadvantaged areas. (Figure 2; Appendix Figure 1). Only the IRSD ratio for dental conditions showed a significant downward trend over time ($p=0.03$, Figure 2). Both chronic conditions (asthma and diabetes ketoacidosis) mostly had IRSD ratios greater than one. Admissions for asthma showed a significant downward trend in the IRSD ratio over time ($p=0.02$, Figure 2).

Social determinants

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Regional areas

There were no differences in admissions by regional areas for any conditions except dental conditions (Figure 3). Admissions for dental conditions were consistently higher over time in outer regional Victoria with all areas showing significant downward trends in admission rates ($p<0.001$, Figure 3).

Health insurance

For acute conditions, there were consistently higher hospital admissions over time for those without health insurance compared to those with insurance, except for dental conditions where the reverse was seen. Significant downward trends in admissions were seen for children both with and without health insurance for gastroenteritis/dehydration and for children without health insurance for dental conditions and asthma (all $p<0.001$, Appendix Figure 2). A significant upward trend in admissions was also evident for children with health insurance for UTIs ($p<0.001$), although total numbers of children admitted were small (Appendix Figure 2).

For chronic conditions, there were no differences in hospital admissions for diabetic ketoacidosis over time according to health insurance status but asthma admissions were consistently higher for families without health insurance. There were also significant upward trends in hospital admissions over time for those with health insurance (Appendix Figure 2) for both asthma and diabetic ketoacidosis ($p<0.001$ and $p=0.02$, respectively) although total numbers of children admitted were small.

Discussion

This is the first Australian study to describe 10-year trends in inequalities and rates of paediatric hospital admissions for ACSCs. We found that: (1) rates of admission for chronic conditions remained relatively stable over time, as did rates of inequality; (2) rates of admission for acute conditions were more variable although inequalities generally persisted; and (3) the impact of measurable social determinants such as access to private health insurance and living in regional areas predominantly impacted

dental ACSCs (not covered by Medicare, Australia's public health insurance scheme) but no other conditions.

Children with chronic conditions living in the more disadvantaged areas of Victoria were most at risk of being admitted to hospital in any year.. Previous studies have demonstrated mixed findings. For example, one Australian cross-sectional analysis of paediatric asthma admissions is consistent with our research[20] while another study surprisingly reported the reverse findings.[9] No studies looking at trends over time were identified. We hypothesise that if children with chronic conditions receive adequate access to primary care then morbidity and avoidable admissions could be reduced. However, access to secondary specialist care may be equally important, especially for children from disadvantaged families. However of concern is that recent research has shown that children from more disadvantaged families are also reported to access less secondary care compared to children from more advantaged families.[21]

For acute conditions our findings regarding inequalities reinforce those from previous cross-sectional Australian studies [9, 10] especially in regard to gastroenteritis/dehydration and dental. [10, 22] However, our study also shows that trends have remained unchanged for 10 years aside from the decrease in gastroenteritis/dehydration likely due to the introduction of the rotavirus vaccine in 2007. [23] This reduction in admissions for gastroenteritis is supported by previous evidence [23] and is an example of how a national vaccination program successfully reduced hospital admission rates for a vaccine-preventable condition; the ultimate primary care intervention.

Our findings for dental conditions showed regional and socioeconomic inequalities with the paradox of private insurance leading to more admissions. This could be due to difficulties accessing dental services and/or a lack of water fluoridation in regional areas.[24] Private health insurance was also associated with higher dental admissions but reasons for this are unclear. In Australia, the availability of dental services in Australia is

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complex. Through Medicare there is restricted dental health coverage for young children [25] and variable state based services for school aged children. However the majority of dental treatments (especially those requiring admission) are self-funded or subsidised by a private health insurance fund, which may well explain the high rates of admission for those with private health insurance.[26] Access to adequately and publicly funded dental services that can meet the needs of children in the community remains a vexed issue of inequity especially in regional and rural areas.

These results reinforce the importance of children receiving equitable access to primary health and dental care. Strong primary healthcare systems are associated with increased equity in a variety of population health outcomes across multiple jurisdictions[27] and timely access can help mediate important child health outcomes. There are a number of important national policies and strategic frameworks that focus on (1) children with chronic illness – National Strategic Framework for Child and Youth Health; [28] (2) the importance of primary care – The National Primary Care Strategic Framework;[29] and (3) the inequities in service delivery – The National Action Plan for the Health of Children and Young People: 2020-2030.[30] Collectively they suggest there is both a receptivity and policy authorising environment to more purposefully consider how primary care might better address the needs of children and young people. This may be an important translational outcome from our study given that inequities have not substantially changed over a 10 year period.

However, having these strategies in place is not enough. Evaluation must occur concurrently to ensure progress and disrupt the current very stable rates. The Grattan Institute recommends driving system reform by strengthening Primary Health Networks (PHNs), to allow them to conduct needs analyses with their local population (as many do) and facilitate local, place-based interventions designed to reduce inequalities in children's hospitalisations for ACSCs.[22] To guarantee success,

performance should be measured and the PHNs could be held accountable for both innovation and progress.

Strengths and limitations

This is the first study to examine paediatric trends in incidence and inequalities for specific ACSCs in Victoria. The reliability and validity of the data in the VAED has been well documented.[31] Even though the data presented here are now seven years old, more recent data from the Victorian Health Information Surveillance System suggests these findings are relevant to today's healthcare provision.[32]

However, admission rates may have been overestimated as repeated hospitalisations were not excluded from analyses due to lack of a unique identifier. Higher rates of hospitalisation could reflect higher disease prevalence, but due to a lack of available prevalence data for Victoria children this could not be verified. The increase in asthma admissions from 2008/09 followed by a drop in 2011/12 cannot be explained by changes in asthma prevalence, as asthma prevalence data for Australian children indicates a gradual decline from 2001 to 2014/15[33, 34] Misclassification of diagnosis codes for conditions could have occurred, as well as codes changing over different time periods. For example, The Royal Children's Hospital, a major contributor to the VAED, assigned symptoms of wheezing to the asthma ICD code prior to 2011/12. This subsequently changed so that symptoms of wheezing had its own ICD code to help differentiate between certain conditions, potentially affecting asthma admission trends over time. Finally, caution needs to be taken when interpreting data with small numbers, such as diabetic ketoacidosis where total numbers of children admitted were under 1 per 1000 children.

Conclusion

Rates of paediatric ACSC admissions and associated inequities were relatively and worryingly stable in Victoria from 2003 to 2013. Although there is a clear policy authorising environment to encourage both equitable service delivery and a focus on primary care, these preventable and unequal admission rates would suggest we need a

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much greater focus on primary care and particularly general practice; but strengthened by secondary paediatric services to provide support to GP's and where needed to deliver direct care. The high prevalence of chronic condition admissions (asthma, dental) and the consistent inequalities over time would suggest that primary care may have more to deliver for equitable child health. Although not perfect, ACSCs are a useful indicator of the effectiveness of primary care for children. Regular reporting could provide the dual benefit as lead indicators to drive primary and secondary care access and quality; and concurrently reduce the need for costly inpatient care.

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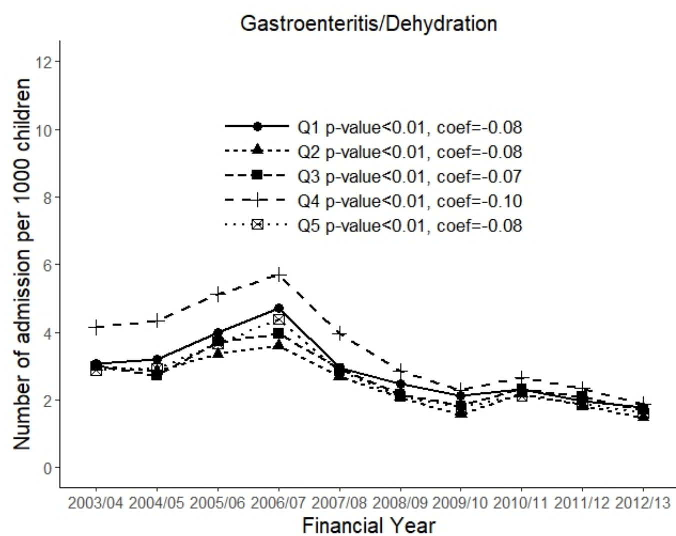
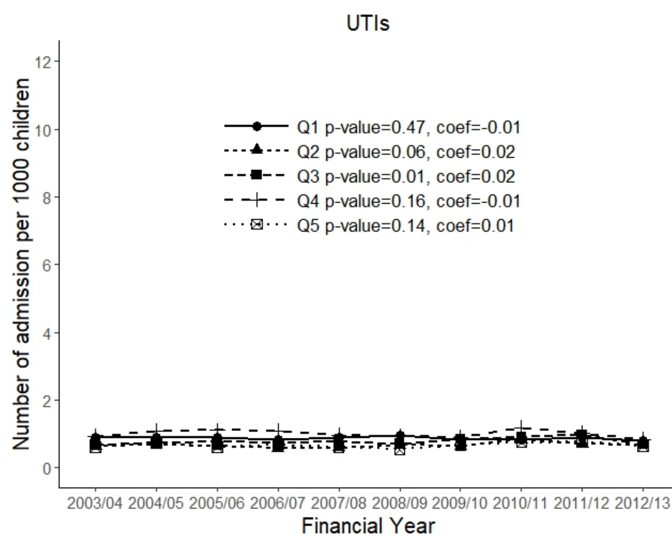
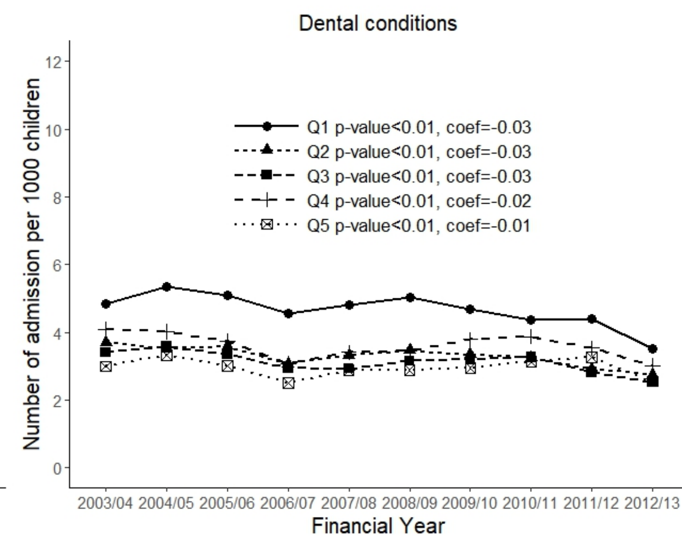
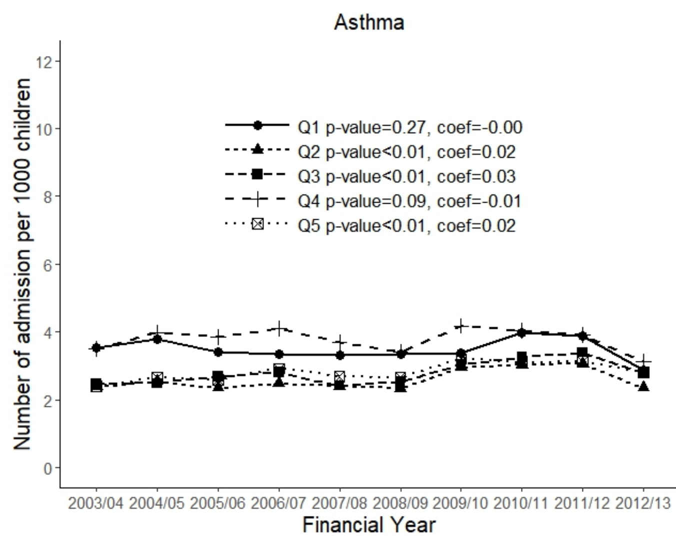
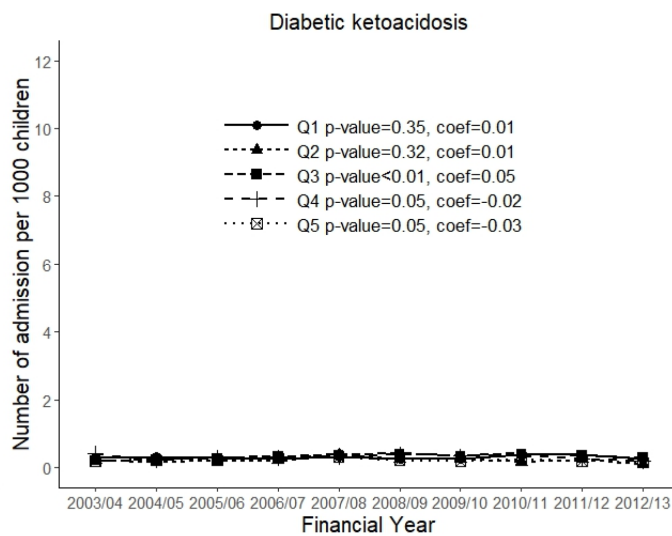
Supplementary Figure 1. Number of hospital admissions for selected ACSCs condition in Victoria by IRSD quintiles, 2003/04-2012/13











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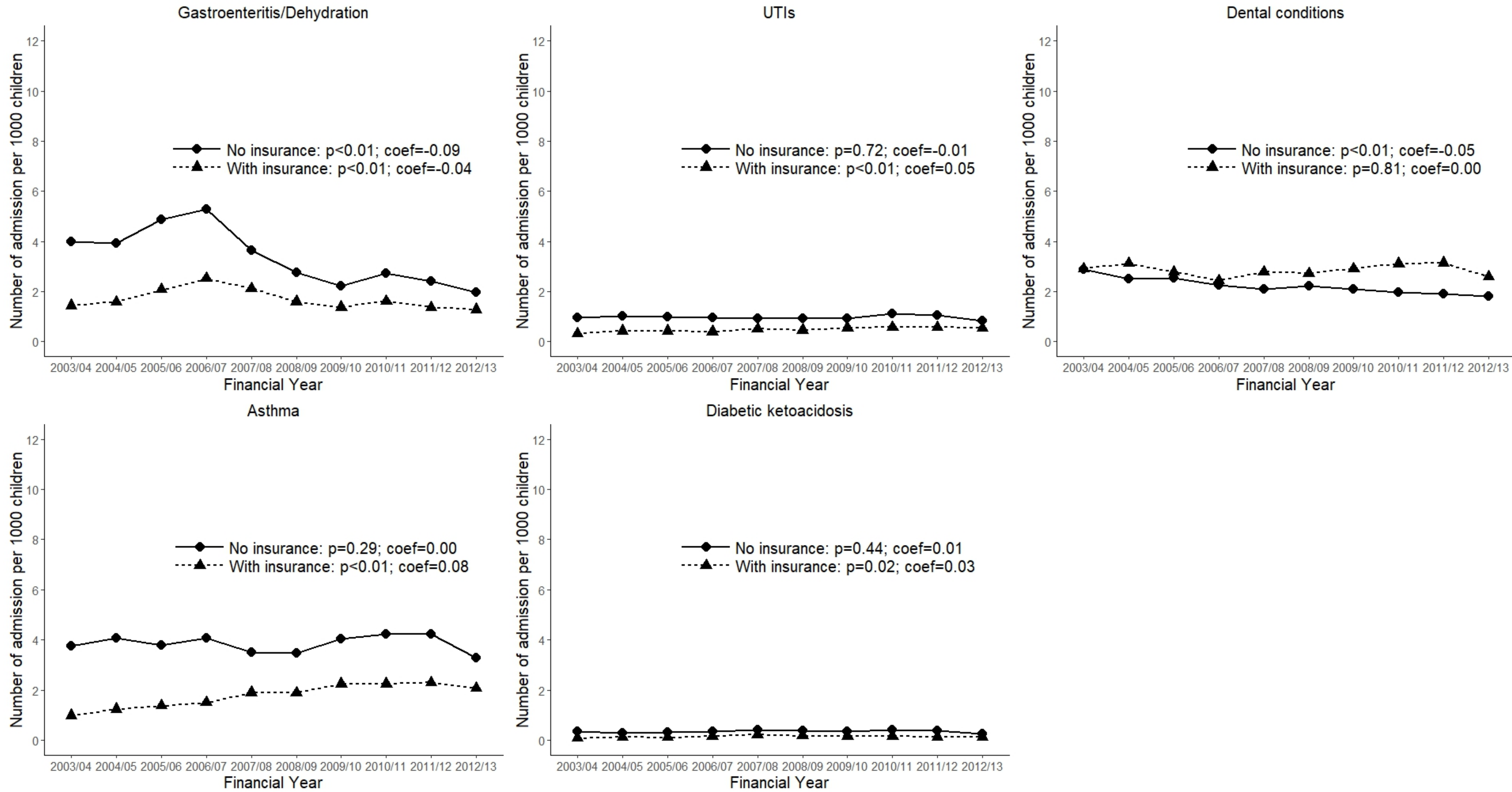
Supplementary Figure 2. Number of hospital admissions for each ACSCs condition in Victoria by health insurance status, 2003/04-2012/13



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Appendix Table 2. ICD-10-AM codes used to identify the ACSCs used in this study

Condition	ICD10 code	Age range
Asthma	J45, J46	2-17 years
Diabetic complications (ketoacidosis or hypoglycaemia)	E10.0, E10.10, E10.11, E13.11, E14.11, E10.12, E10.64	6-17 years
Dehydration	E86	3 months-17 years
Gastroenteritis	A08, A09, K52.8, K52.9	3 months-17 years
Urinary tract infection	N10, N15.1, N30.0, N39.0, N15.9, N12, N28.83, N28.84, N28.85	3 months-17 years
Dental conditions (dental caries, gingivitis, periodontal disease)	K02, K04, K05	3-17 years

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Supplementary Table 3. Poisson regression results for each ACSC condition

Condition	Category		Variable	Estimate	Standard error	z value	P-value	IRR	Confidence Interval
Asthma	Total admission		Intercept	1.288	0.011	118.66	<0.001		
			Financial year	0.013	0.002	7.769	<0.001	1.013	[1.01, 1.017]
	IRSD	Q 1	Intercept	10.198	8.149	1.251	0.211		
			Financial year	-0.004	0.004	-1.098	0.272	0.996	[0.988, 1.004]
		Q 2	Intercept	-37.327	8.663	-4.309	<0.001		
			Financial year	0.019	0.004	4.418	<0.001	1.019	[1.011, 1.028]
		Q 3	Intercept	-55.531	7.99	-6.95	<0.001		
			Financial year	0.028	0.004	7.079	<0.001	1.029	[1.021, 1.037]
		Q 4	Intercept	12.501	6.676	1.873	0.061		
			Financial year	-0.006	0.003	-1.674	0.094	0.994	[0.988, 1.001]
		Q 5	Intercept	-43.246	7.412	-5.835	<0.001		
			Financial year	0.022	0.004	5.974	<0.001	1.022	[1.015, 1.03]
	Remoteness	Major Cities	Intercept	-33.787	3.964	-8.524	<0.001		
			Financial year	0.017	0.002	8.845	<0.001	1.018	[1.014, 1.022]
		Inner Regional	Intercept	-2.651	7.651	-0.347	0.729		
			Financial year	0.002	0.004	0.5	0.617	1.002	[0.994, 1.009]
		Outer Regional	Intercept	3.244	15.869	0.204	0.838		
			Financial year	-0.001	0.008	-0.122	0.903	0.999	[0.984, 1.015]
	Insurance	No	Intercept	5.585	4.045	1.381	0.167		
			Financial year	-0.002	0.002	-1.048	0.294	0.998	[0.994, 1.002]
		Yes	Intercept	-162.772	7.094	-22.945	<0.001		
			Financial year	0.081	0.004	23.03	<0.001	1.085	[1.077, 1.092]
Diabetes	Total admission		Intercept	-0.849	0.037	-23.145	<0.001		
			Financial year	0.007	0.006	1.202	0.229	1.007	[0.996, 1.019]
	IRSD	Q 1	Intercept	-27.565	28.162	-0.979	0.328		
			Financial year	0.013	0.014	0.935	0.35	1.013	[0.986, 1.041]

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		Q 2	Intercept	28.361	30.366	0.934	0.35			
			Financial year	-0.015	0.015	-0.985	0.324	0.985	[0.956,	1.015]
		Q 3	Intercept	-92.326	23.948	-3.855	<0.001			
			Financial year	0.045	0.012	3.807	<0.001	1.046	[1.022,	1.071]
		Q 4	Intercept	46.552	23.648	1.969	0.049			
			Financial year	-0.024	0.012	-2.019	0.043	0.976	[0.954,	0.999]
		Q 5	Intercept	51.987	27.068	1.921	0.055			
			Financial year	-0.027	0.013	-1.978	0.048	0.974	[0.948,	1]
	Remoteness	Major Cities	Intercept	16.934	14.705	1.152	0.249			
			Financial year	-0.009	0.007	-1.244	0.214	0.991	[0.977,	1.005]
		Inner Regional	Intercept	-65.875	21.318	-3.09	0.002			
			Financial year	0.032	0.011	3.05	0.002	1.033	[1.012,	1.055]
		Outer Regional	Intercept	-24.553	48.659	-0.505	0.614			
			Financial year	0.012	0.024	0.485	0.627	1.012	[0.965,	1.061]
	Insurance	No	Intercept	-11.51	13.57	-0.848	0.396			
			Financial year	0.005	0.007	0.769	0.442	1.005	[0.992,	1.019]
		Yes	Intercept	-61.606	25.121	-2.452	0.014			
			Financial year	0.03	0.013	2.373	0.018	1.03	[1.005,	1.056]
Gastro/Dehydration	Total admission		Intercept	1.59	0.01	155.411	<0.001			
			Financial year	-0.084	0.002	-46.43	<0.001	0.919	[0.916,	0.923]
	IRSD	Q 1	Intercept	159.706	9.135	17.484	<0.001			
			Financial year	-0.079	0.005	-17.366	<0.001	0.924	[0.916,	0.932]
		Q 2	Intercept	166.703	9.004	18.513	<0.001			
			Financial year	-0.083	0.004	-18.411	<0.001	0.921	[0.913,	0.929]
		Q 3	Intercept	143.357	8.271	17.333	<0.001			
			Financial year	-0.071	0.004	-17.214	<0.001	0.932	[0.924,	0.939]
		Q 4	Intercept	209.256	7.076	29.574	<0.001			
			Financial year	-0.104	0.004	-29.392	<0.001	0.902	[0.895,	0.908]
		Q 5	Intercept	167.066	7.791	21.443	<0.001			
			Financial year	-0.083	0.004	-21.316	<0.001	0.921	[0.914,	0.928]

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	Remoteness	Major Cities	Intercept	169.78	4.292	39.555	<0.001			
			Financial year	-0.084	0.002	-39.284	<0.001	0.919	[0.916,	0.923]
		Inner Regional	Intercept	157.064	7.65	20.531	<0.001			
			Financial year	-0.078	0.004	-20.37	<0.001	0.925	[0.918,	0.932]
		Outer Regional	Intercept	153.577	15.709	9.777	<0.001			
			Financial year	-0.076	0.008	-9.688	<0.001	0.927	[0.913,	0.941]
	Insurance	No	Intercept	182.558	4.396	41.528	<0.001			
			Financial year	-0.09	0.002	-41.245	<0.001	0.914	[0.91,	0.918]
		Yes	Intercept	71.08	7.131	9.967	<0.001			
			Financial year	-0.035	0.004	-9.893	<0.001	0.965	[0.959,	0.972]
UTIs	Total admission		Intercept	-0.145	0.021	-6.823	<0.001			
			Financial year	0.006	0.003	1.862	0.063	1.006	[1,	1.013]
	IRSD	Q 1	Intercept	11.651	16.217	0.718	0.472			
			Financial year	-0.006	0.008	-0.726	0.468	0.994	[0.979,	1.01]
		Q 2	Intercept	-31.977	17.062	-1.874	0.061			
			Financial year	0.016	0.008	1.85	0.064	1.016	[0.999,	1.033]
		Q 3	Intercept	-40.725	15.023	-2.711	0.007			
			Financial year	0.02	0.007	2.695	0.007	1.02	[1.006,	1.035]
		Q 4	Intercept	18.176	12.959	1.403	0.161			
			Financial year	-0.009	0.006	-1.402	0.161	0.991	[0.979,	1.004]
		Q 5	Intercept	-22.751	15.22	-1.495	0.135			
			Financial year	0.011	0.008	1.468	0.142	1.011	[0.996,	1.026]
	Remoteness	Major Cities	Intercept	-1.27	7.817	-0.162	0.871			
			Financial year	0.001	0.004	0.151	0.88	1.001	[0.993,	1.008]
		Inner Regional	Intercept	-64.823	14.749	-4.395	<0.001			
			Financial year	0.032	0.007	4.386	<0.001	1.033	[1.018,	1.048]
		Outer Regional	Intercept	-36.892	31.983	-1.153	0.249			
			Financial year	0.018	0.016	1.151	0.25	1.018	[0.987,	1.051]
	Insurance	No	Intercept	2.884	8.027	0.359	0.719			
			Financial year	-0.001	0.004	-0.362	0.717	0.999	[0.991,	1.006]

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		Yes	Intercept	-106.514	13.513	-7.883	<0.001			
			Financial year	0.053	0.007	7.829	<0.001	1.054	[1.04,	1.068]
Dental conditions	Total admission		Intercept	1.466	0.01	148.388	<0.001			
			Financial year	-0.02	0.002	-12.433	<0.001	0.98	[0.977,	0.983]
	IRSD	Q 1	Intercept	57.946	7.049	8.22	<0.001			
			Financial year	-0.028	0.004	-8.001	<0.001	0.972	[0.966,	0.979]
		Q 2	Intercept	50.984	7.671	6.646	<0.001			
			Financial year	-0.025	0.004	-6.491	<0.001	0.976	[0.968,	0.983]
		Q 3	Intercept	50.778	7.531	6.742	<0.001			
			Financial year	-0.025	0.004	-6.591	<0.001	0.976	[0.968,	0.983]
		Q 4	Intercept	35.378	6.842	5.171	<0.001			
			Financial year	-0.017	0.003	-4.984	<0.001	0.983	[0.977,	0.99]
		Q 5	Intercept	11.259	7.221	1.559	0.119			
			Financial year	-0.005	0.004	-1.409	0.159	0.995	[0.988,	1.002]
	Remoteness	Major Cities	Intercept	15.887	4.239	3.748	<0.001			
			Financial year	-0.007	0.002	-3.481	<0.001	0.993	[0.989,	0.997]
		Inner Regional	Intercept	61.385	5.779	10.623	<0.001			
			Financial year	-0.03	0.003	-10.321	<0.001	0.971	[0.965,	0.976]
		Outer Regional	Intercept	42.034	10.204	4.12	<0.001			
			Financial year	-0.02	0.005	-3.904	<0.001	0.98	[0.971,	0.99]
	Insurance	No	Intercept	94.552	5.336	17.72	<0.001			
			Financial year	-0.047	0.003	-17.569	<0.001	0.954	[0.949,	0.959]
		Yes	Intercept	-0.296	5.485	-0.054	0.957			
			Financial year	0.001	0.003	0.245	0.806	1.001	[0.995,	1.006]

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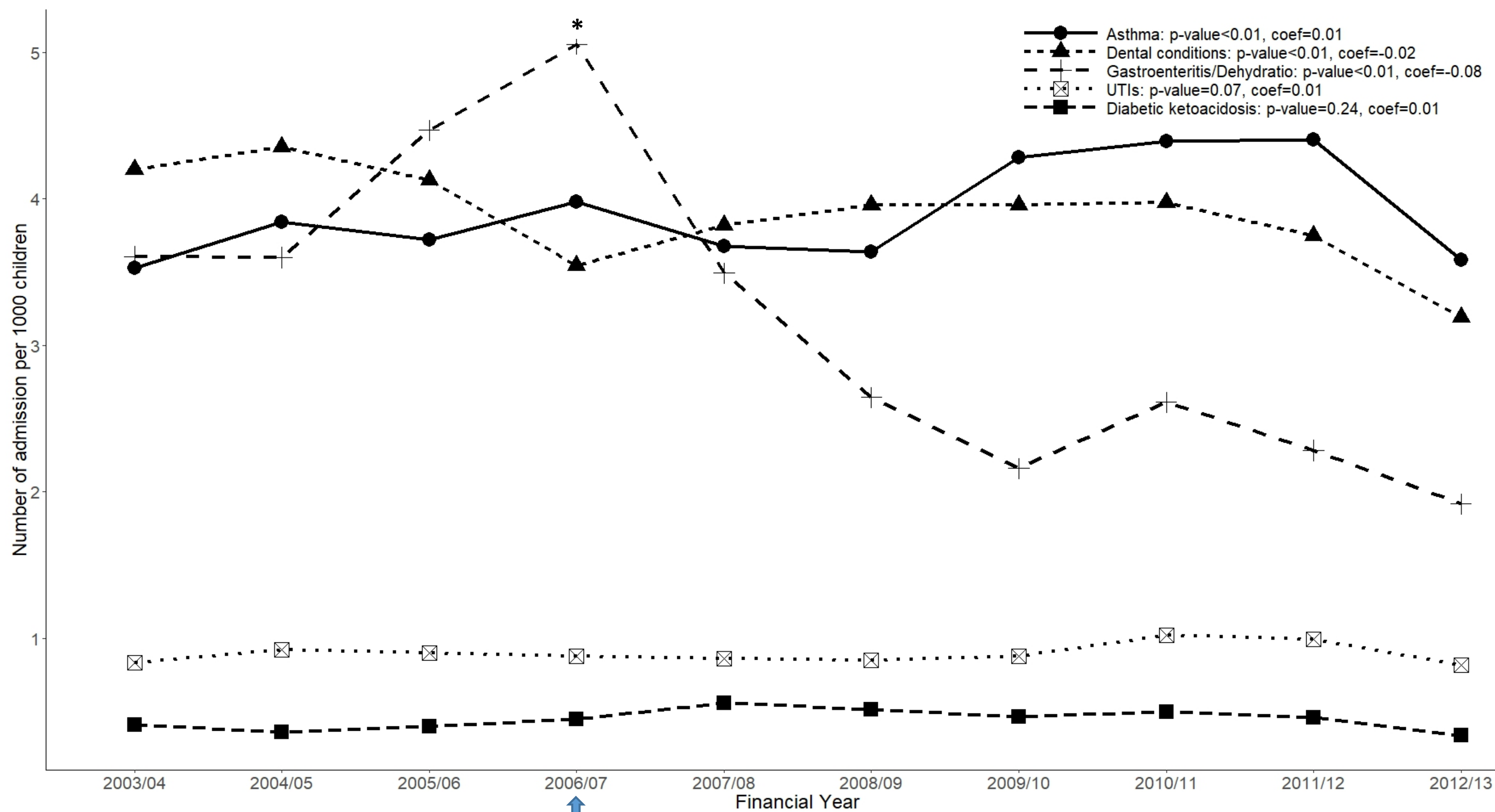
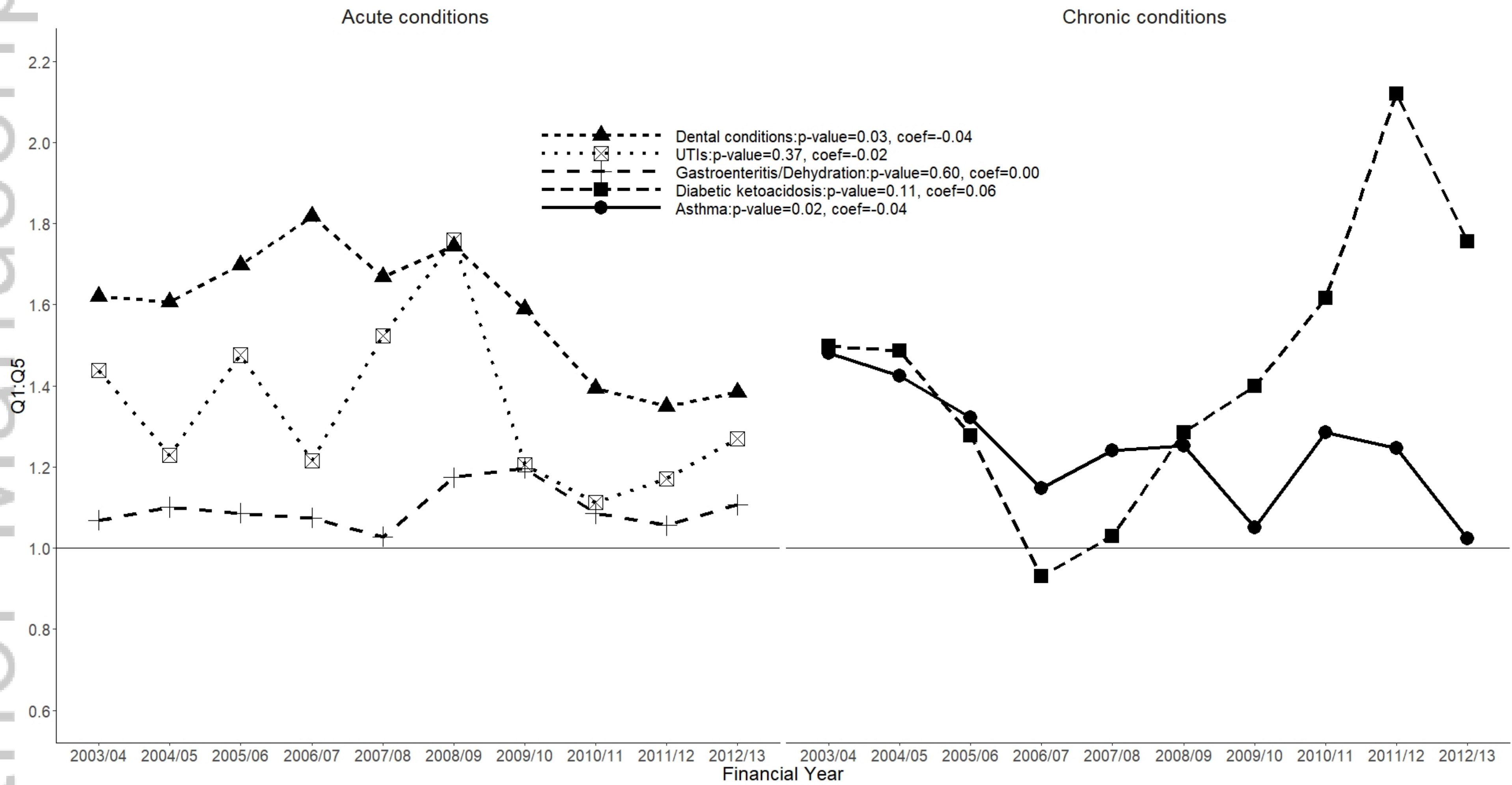
Figure 1. Total number of hospital admissions for selected ACSCs conditions in Victoria, 2003/04-2012/13



*Introduction of publically available free rotavirus vaccine from July 2007

Figure 2. Ratio between IRSD Quintiles 1 (most disadvantaged) and 5 (least disadvantaged) (Q1/Q5) for selected acute and chronic ACSCs condition in Victoria, 2003/04-2012/13*



*Measuring the ratio of the lowest to highest IRSD quintile is one way of describing inequities in outcomes. If the ratio is greater than 1, then this implies that the families living in the most disadvantaged area have a higher rate of admission

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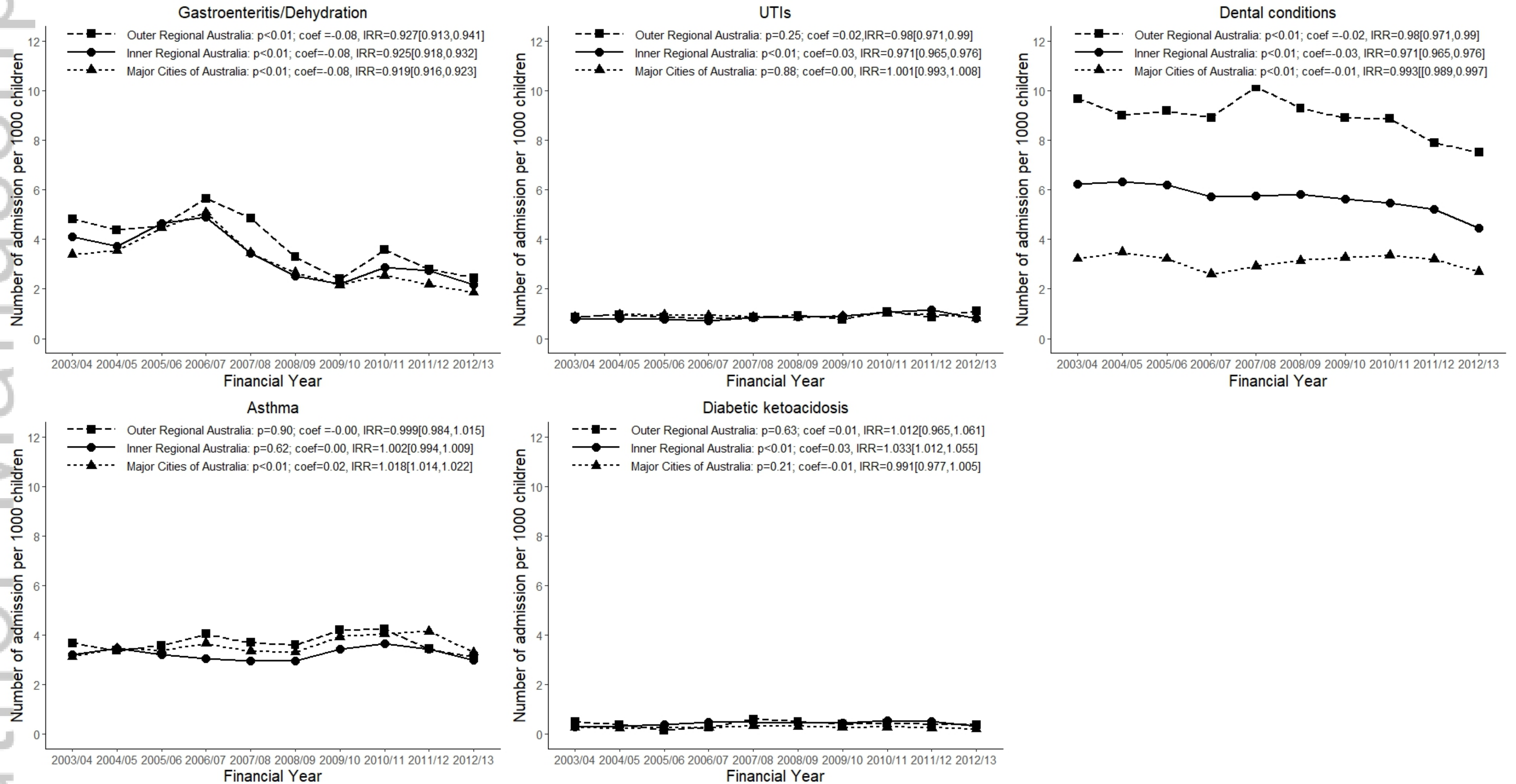
Figure 3. Rate of hospital admissions for selected ACSCs conditions in Victoria by regional areas, 2003/04-2012/13



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Appendix Table 1. Summary of overall admissions by age group, IRSD, remoteness and insurance status in Victoria, 2003/04-2012/13

Category		2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Total admission		**1,155,250**	**1,159,829**	**1,165,737**	**1,177,992**	**1,190,119**	**1,202,300**	**1,213,558**	**1,222,834**	**1,245,213**	**1,269,273**
Age group, n (%)	0-4yrs*	306,192 (26.5)	308,110 (26.6)	312,581 (26.8)	322,116 (27.3)	332,604 (27.9)	341,658 (28.4)	349,577 (28.8)	351,951 (28.8)	362,609 (29.1)	372,996 (29.4)
	5yrs-9yrs	318,582 (27.6)	317,273 (27.4)	317,376 (27.2)	317,490 (27)	319,103 (26.8)	322,017 (26.8)	325,307 (26.8)	332,729 (27.2)	341,708 (27.4)	352,461 (27.8)
	10yrs-14yrs	331,899 (28.7)	332,993 (28.7)	332,111 (28.5)	332,172 (28.2)	331,417 (27.8)	331,234 (27.6)	330,111 (27.2)	330,056 (27)	331,587 (26.6)	334,698 (26.4)
	15yrs-17yrs	198,577 (17.2)	201,453 (17.4)	203,669 (17.5)	206,214 (17.5)	206,995 (17.4)	207,391 (17.2)	208,563 (17.2)	208,098 (17)	209,309 (16.8)	209,118 (16.5)
IRSD**, n (%)	Q1	211,665 (18.3)	210,540 (18.2)	209,782 (18)	210,164 (17.8)	210,567 (17.7)	210,594 (17.5)	210,072 (17.3)	209,528 (17.1)	210,807 (16.9)	212,236 (16.7)
	Q2	248,027 (21.5)	246,886 (21.3)	246,077 (21.1)	247,716 (21)	249,722 (21)	251,620 (20.9)	252,367 (20.8)	253,524 (20.7)	257,080 (20.6)	261,411 (20.6)
	Q3	261,732 (22.7)	262,615 (22.6)	263,611 (22.6)	267,594 (22.7)	271,921 (22.8)	276,023 (23)	278,861 (23)	282,129 (23.1)	289,274 (23.2)	297,066 (23.4)
	Q4	263,802 (22.8)	268,670 (23.2)	273,680 (23.5)	281,306 (23.9)	288,569 (24.2)	295,811 (24.6)	300,557 (24.8)	303,338 (24.8)	312,095 (25.1)	321,196 (25.3)
	Q5	305,992 (26.5)	308,155 (26.6)	311,261 (26.7)	313,966 (26.7)	317,314 (26.7)	319,862 (26.6)	320,516 (26.4)	320,790 (26.2)	325,004 (26.1)	330,412 (26)
Remoteness, n (%)	Major Cities of Australia	834,988 (72.3)	839,600 (72.4)	845,699 (72.5)	858,265 (72.9)	870,655 (73.2)	881,617 (73.3)	885,935 (73)	888,281 (72.6)	907,103 (72.8)	928,274 (73.1)
	Inner Regional Australia	257,581 (22.3)	256,314 (22.1)	255,833 (21.9)	255,991 (21.7)	256,648 (21.6)	257,382 (21.4)	258,087 (21.3)	258,731 (21.2)	259,333 (20.8)	260,363 (20.5)

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	Outer Regional Australia	55,318 (4.8)	54,563 (4.7)	53,772 (4.6)	53,070 (4.5)	52,695 (4.4)	52,239 (4.3)	51,674 (4.3)	51,159 (4.2)	50,642 (4.1)	50,124 (3.9)
Insurance_status, n (%)	Insurance_Yes	540,443 (46.8)	534,019 (46)	531,301 (45.6)	543,525 (46.1)	560,688 (47.1)	568,171 (47.3)	577,022 (47.5)	588,416 (48.1)	603,354 (48.5)	613,936 (48.4)
	Insurance_No	750,788 (65)	762,856 (65.8)	773,116 (66.3)	777,233 (66)	777,412 (65.3)	785,746 (65.4)	785,363 (64.7)	780,903 (63.9)	790,474 63.5)	807,469 (63.6)

* Data not available for diabetes

** IRSD: Index of Relative Socioeconomic Disadvantage. The higher the value of IRSD, the less disadvantaged the area. The areas has been ordered from the lowest to highest score and aggregated by quintile from lowest (Q1) to highest (Q5).

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Original article

Trends in Rates and Inequalities in Paediatric Admissions for Ambulatory Care Sensitive Conditions in Victoria, Australia (2003 to 2013)

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Ethics statement

Ethics approval for the study was granted by the Human Research Ethics Committee, Royal Children's Hospital (RCH HREC 37164). No human subjects or research on human subject was conducted. The VAED administrative database is used in this paper. The data used are de-identified and only aggregate level information is presented. In addition, we i.e. the Centre for Community Child Health are the secondary data custodians of the VAED.

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Statement of competing interests

The authors declare no conflicts of interest.

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