

Unlocking big data to understand health services usage and government funding during pregnancy and early childhood, evidence in Australia

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Abstract

Background: Maternity care is a high-volume and high-cost area of health care, which entails various types of service use throughout the course of the pregnancy. Thus, the aim of this study was to explore the most common reasons and related costs of health services used by women and babies from pregnancy to 12-month postbirth.

Methods: We used linked administrative data from one state of Australia, which contained all births in Queensland between 01/07/2017 and 30/06/2018. Descriptive analyses were used to identify the 10 most frequent reasons and related costs for accessing inpatient, outpatient, emergency department, and Medicare services. These are reported separately for women and babies in different periods.

Results: We included 58,394 births in our data set. The results have highlighted that there was relatively uniform use of inpatient, outpatient, and Medicare services by women and babies, with the 10 most common services accounting for more than half of the total services accessed. However, the emergency department service use was more diverse. Medicare services accounted for the greatest volume (79.21%) of service events but only 10.21% of the overall funding, compared with inpatient services, which accounted for less volume (3.62%) but the highest amount of overall funding (75.19%).

Conclusion: Study findings provide empirical evidence about the full spectrum of services used by birthing families and their babies, and could assist health providers and managers to understand the services women and infants actually access during pregnancy, birth, and postbirth.

KEYWORDS

birth, costs, early childhood, health services use, pregnancy

1 | INTRODUCTION

Maternity care is a high-volume (there were 140.11 million births globally in 2019¹) and high-cost area of health care in high-income countries. In Australia, around A\$9 billion was invested in this area in 2018–19, making maternity care the sixth-largest area of health expenditure (6.82% of total health expenditure—A\$134 billion), with the majority of costs for public hospital admissions (A\$6 billion).² Moreover, it was estimated that National Health Service (NHS) England spent £4.7 billion on delivering maternity care in 2013–14.³ In the United States, inpatient care comprises the largest share of national healthcare spending, and birth is the leading reason for hospital admission.^{4,5} In 2008, Medicaid paid U\$22 billion for care associated with birth and U\$19 billion for the care of newborn babies.⁶ In 2011, more than U\$15.1 billion were paid to hospitals providing maternity care, which makes birth one of the most expensive conditions for hospital care in the United States.⁴ In low and middle-income countries without well-established public healthcare systems, the costs and quality of maternal care are generally lower; many women lack access to adequate care and may face high out-of-pocket costs to receive necessary care.^{7,8} Escalated costs of maternity care in high-income countries have not resulted in great improvements to the quality of care.⁹ Thus, ensuring high-value health care to optimize health outcomes, including women-centredness, is a priority in all nations regardless of income designation.

The provision of safe, high-quality, and accessible care during pregnancy and birth are key contributors to improvements in health outcomes for both women and children.¹⁰ Over the previous decades, standardized antenatal appointment schedules have been developed to operationalize this care. Yet, little is known about the services actually accessed by women outside these schedules, particularly given the changing demographics of those giving birth, such as increased prevalence of prepregnancy obesity and advanced maternal age.¹¹ The age of mothers who give birth in Australia has been rising for both first-time mothers and those who have given birth previously. From 2010 to 2020, the average maternal age increased from 30.0 years to 30.9, while the proportion of older mothers (aged 35 or over) has increased from 23% to 25.5%.¹² Compared with younger mothers (aged 20–34), older mothers are more at risk for pre-existing medical conditions that can affect the current pregnancy (e.g., hypertension), pregnancy complications (e.g., gestational diabetes), cesarean birth (which entail longer postnatal hospital stays relative to vaginal birth), and adverse outcomes for babies (e.g., stillbirth, preterm birth [less than 37 weeks of gestation], and low birthweight [less than 2500g]).^{13,14} These increased risks are associated with the usage of additional health services for mothers and babies (e.g., antenatal admission), compared with routine maternity care.¹⁵

Pregnancy and birth may entail multiple consultations with healthcare providers, screening tests, monitoring, and procedures.^{16,17} Currently, a wide variety of health services may be used simultaneously by women and babies over the course of the pregnancy. It is important to identify the spectrum of health service use as both value-based care and women-centered care require focusing on the woman's entire journey and not simply on episodes of care.^{18,19} There is thus a need to characterize all health service utilization throughout the pregnancy and birth journey. Big data and data linkage between hospital and community-based services allow the full spectrum of the pregnancy and birth journey to be mapped.

National statistics on Australian hospital service use have been published annually by the Australian Institute of Health and Welfare (AIHW), Australian Government; they report the 20 most common reasons for inpatient and emergency department (ED) health services. For example, “childbirth” is one of the broad categories of inpatient services reported. There were 294,898 admissions (2.65% of the total admitted care) related to “childbirth” in 2019–20, with 78.02% of them in public hospitals, and 21.98% admitted to private hospitals.²⁰ For ED presentations, 107,036 presentations (1.22% of the total ED presentations) were classified into “pregnancy, childbirth, and the puerperium” in 2020–21.²¹ However, none of the previous studies or government reports focused on maternity care, and none cover the whole course of the pregnancy for the service utilizations by women and babies. Thus, the aim of this study was to explore the most common reasons and related costs of health services used by women and babies from the onset of pregnancy to 12-months postbirth.

2 | METHODS

2.1 | Data source

This study utilized a whole-of-population data set, created by linking routine administrative data covering all births in Queensland (QLD), Australia, between 01/07/2012 and 30/06/2018. Women giving birth and their babies were identified from the Queensland Perinatal Data Collection, a mandatory collection of the details of all births, which includes women's demographic and clinical characteristics before and during pregnancy and birth, details of the birth, and postpartum events. These data were then linked to the Queensland Hospital Admitted Patient Data Collection, which records all inpatient events in private and public hospitals in QLD and includes the Australian Refined Diagnosis Related Groups (AR-DRG) code for each admission. Data were also linked to the Queensland Health Non-Admitted Patient Data Collection, which records all outpatient services in public hospitals in QLD

and is categorized by Tier 2 codes for each episode of care. Emergency Data Collection which records all ED presentations in public hospitals, including the principal diagnosis (based on the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM)) for each presentation was also linked. The data set also linked the MBS claims records including the Item Number for each service provided, thus covering community-based services. The protocol describing this data set is available here.²² Each classification (i.e., AR-DRG code, Tier 2 code, principal diagnosis, and Item Number) represents a class of individuals with similar clinical conditions requiring similar health services; the detailed classification information is also available here.^{23,24}

For this study, we included all the birth events between 01/07/2017 and 30/06/2018 because the outpatient service use was not available in our data set before 01/07/2016 as it was not collected. Additionally, the AR-DRG classification system updates over time, with some AR-DRG categories removed and new ones added, thus, the AR-DRG Version 6.0 and Version 6.x were used for the corresponding descriptions of this study.²⁵

2.2 | Identification of health service use

The 10 most frequent reasons for health service use (inpatient—AR-DRG code, outpatient—Tier 2 code, ED—principal diagnosis, and Medicare—Item Number) from conception to 12-months postbirth, and for the babies from birth to the child's first birthday were identified and ordered by the summed frequency. Services not listed on the MBS and ED services provided by private hospitals were not captured in this analysis, thus potentially underestimating the total number of services accessed.

2.3 | Identification of time periods

Three time periods (during pregnancy, at birth, and 12-month postbirth) for women were identified based on the difference between service date, birth date, and gestation days. For inpatient services, we used the admission date, as opposed to the separation date.

Two time periods (at birth and 12-month postbirth) for babies were identified based on the difference between service date and birth date. For inpatient services, we also used the admission date.

The data set recorded the exact date of Medicare services and gestation days in DD/MM/YYYY format; however, other services' dates and birth dates were provided only in MM/YYYY format. Therefore, for this study, the time period "at birth" includes the service utilizations in

the same month as the birth month; "during pregnancy" means from the conception month to the month before birth; and "12-month postbirth" covers the 12 months after the birth month, as we cannot identify the exact birth date. As such, this may limit the accuracy of the identification of time periods and related health service use and costs.

2.4 | Identification of health service costs

For admissions in public hospitals, the costs were assigned based on the average cost for each AR-DRG classification identified from the National Hospital Cost Data Collection (NHCCDC) produced by the Independent Hospital Pricing Authority (IHPA),²⁶ and adjusted for patient remoteness, Indigenous identification, intensive care, and private patient admissions, in accordance with the adjustments specified in the National Efficiency Price Determination. For admissions in private hospitals, the costs were assigned based on the average cost for each AR-DRG classification to private health insurers identified from the Private Hospital Data Bureau Annual Reports. For outpatient services, the costs were assigned based on the Tier 2 classification, and the average cost identified from the NHCCDC produced by the IHPA. Costs related to each ED presentation were assigned from a modified Urgency Related Group (URG) code based on if the patient was admitted or discharged from an ED, a broad reason for each presentation, and the corresponding cost from the NHCCDC produced by the IHPA. We used the NHCCDC round corresponding to the time the service was accessed. The Medicare costs were identified directly from the claim records.

The costs were summed for each type of service accessed throughout each time period and presented separately for birthing people and babies. All costs were inflated to 2020–21 Australian dollars based on the Reserve Bank of Australia Inflation Calculator.²⁷ For this study, the costs of public hospitals were presented from the perspective of the government (i.e., the funding costs rather than the actual costs to healthcare providers, or the out-of-pocket fees paid by individuals (the gap amount between fees charged by healthcare providers and subsidies paid by the federal government)). The costs of private hospitals were assigned from the perspective of private health insurers for hospital charges, and the funding costs of private hospitals for medical services were included in Medicare costs.

2.5 | Descriptive analysis

The total number of service events and related total costs by women and babies in three time periods

(during pregnancy, at birth, and 12-month postbirth), and grouped by inpatient (private hospitals, public hospitals, and all hospitals), outpatient, ED, and Medicare services are presented.

The frequency tables of the 10 most common reasons for service use and related costs (including total costs and unit cost for each service event) are presented separately for women and babies, grouped into three time periods, and grouped by inpatient, outpatient, ED, and Medicare services. The bar charts of the service use and costs for each type of service across three time periods are also presented separately for women and babies. All the cumulative percentages were calculated out of the total service use and total costs during each time period.

The analysis was conducted as per birth level; thus, the same woman may be included more than once if she had multiple births (such as twins or triplets) or experienced multiple pregnancies (i.e., different birth episodes) during 2017–18. All analyses were undertaken in SAS V9.4. All research was conducted in accordance with the principles outlined in the Declaration of Helsinki.

3 | RESULTS

3.1 | Total service use and costs

In total, 58,394 births in QLD, Australia, between 01/07/2017 and 06/30/2018 were included in the analysis. There were 6,605,774 services in total provided to women and babies from conception to 12-months postbirth for births during this period; 79.21% of them were Medicare services, followed by 15.52% episodes of care in outpatient clinics, 3.62% for admitted patient care in private or public hospitals, and ED care accounted for the lowest share (1.65%). Total cost was A\$2.17 billion, in which inpatient care was the most costly—accounting for 75.19% of the total cost (A\$1.63 billion); followed by outpatient services, Medicare services, and ED presentations, with A\$0.23 (10.61%), A\$0.22 (10.21%), and A\$0.09 (4%) billion, respectively. That is, the share of the admitted care cost was 20 times higher than the share of the service volume (Figure 1, Appendixes 1 and 2).

For different time periods, nearly half of the events (44.53%) were assessed by women during pregnancy, which accounted for 14.65% of the total costs. Costs were

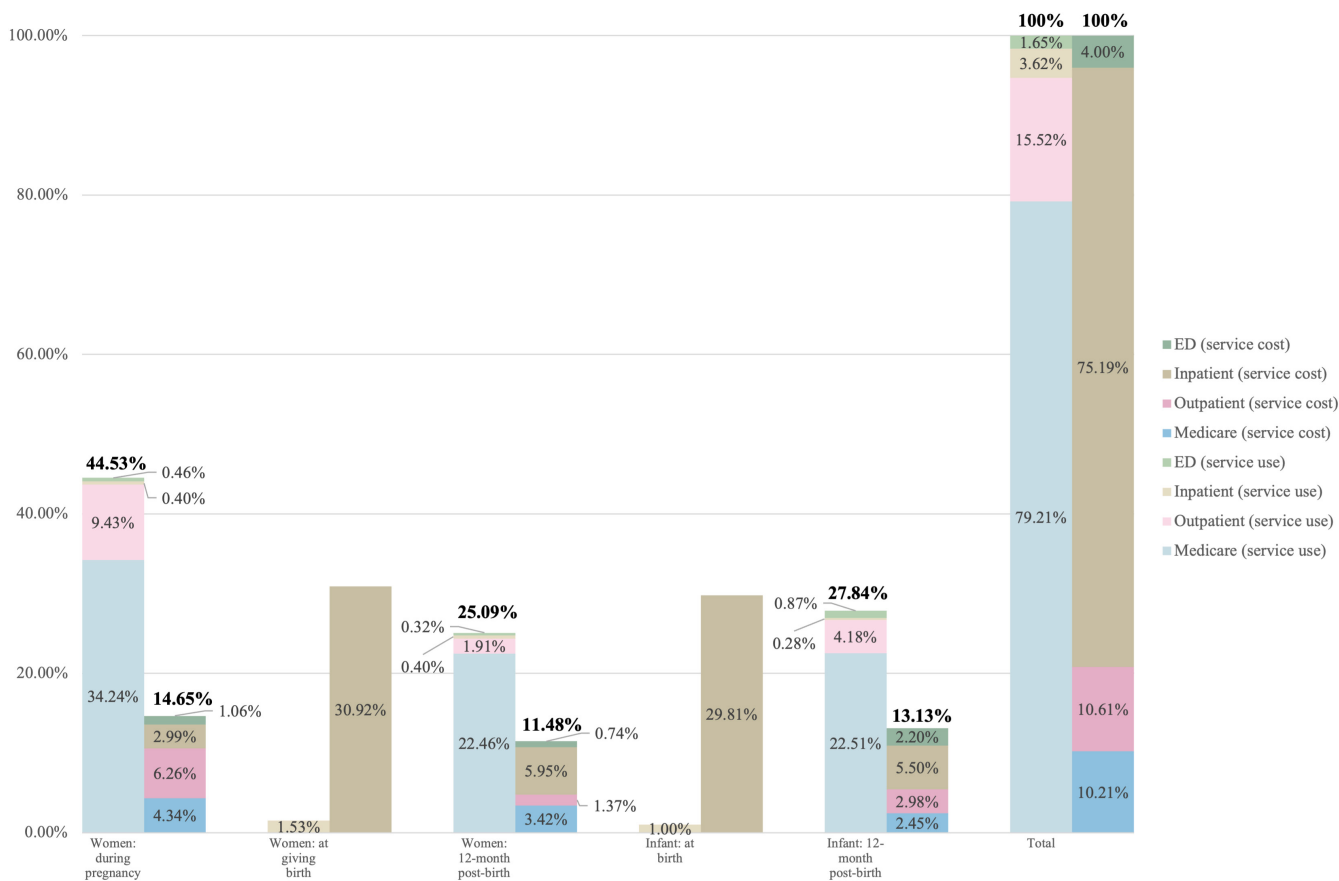


FIGURE 1 The percentage of total service events and costs by women and babies from pregnancy to 12-month postbirth—all births in Queensland, Australia, 2017/18. [Color figure can be viewed at wileyonlinelibrary.com]

highest when women gave birth (A\$0.67 billion), and the second-highest costs (A\$0.65 billion) were related to babies at birth. The share of neonatal admissions cost at birth was 30 times higher than the service volume percentage. The remaining costs were distributed similarly across the other three time periods for women and babies.

3.2 | For women

During pregnancy, the most common service use for each type of service is as follows: inpatient admissions in hospitals (“antenatal and other obstetric admission,” 63.85%), outpatient services in public hospitals (“midwifery and maternity,” 59.23%), ED presentations in public hospitals (“threatened abortion,” 10.35%), and Medicare services (“antenatal attendance,” 10.38%). Furthermore, we can see that the ranking of service use could be different from the order of related costs (i.e., the most frequent reason for the service use did not necessarily account for the largest share of total costs, or vice versa). For example, the most common inpatient service is the same as the highest related costs (63.85% of the total admissions and 54.87% of the total costs) (Figures 2–5).

Across four types of services during pregnancy, the cumulative percent of the 10 most common services used was highest for outpatient care (usage: 94.56%; costs: 93.13%) followed by inpatient services (usage: 83.19%; costs: 72.82%). The distribution of service use was more diverse in Medicare and ED services due to the cumulative percent of the 10 most common services accounting for only 55.23% and 39.65% of total services, respectively.

In the 12-month postpartum category, the most common service use was “other factors influencing health status” (22.05%), “midwifery and maternity” (40.32%), “inflammatory disorders of breast” (3.44%), and “less than 20 min GP consultation” (18.69%), for inpatient, outpatient, ED, and Medicare services, respectively. Notably, 4.53% of admission was due to mental health. The cumulative percentage of inpatient (usage: 56.36%; costs: 50.96%), outpatient (usage: 75.89%; costs: 70.13%), ED (usage: 21.93%; costs: 22.52%), and Medicare (usage: 51.08%; costs: 29.39%) services postbirth was all lower than those during pregnancy.

3.3 | For babies

For babies admitted at birth, the most common admission was for babies weighing greater than 2499 grams, without significant operating room procedures and problems (74.13%). All the 10 most common admissions did not

have significant operating room procedures. The cumulative proportion of the 10 most frequent admissions was 94.85% of total services, and the related costs accounted for 84.18% of total costs (Figures 2–5).

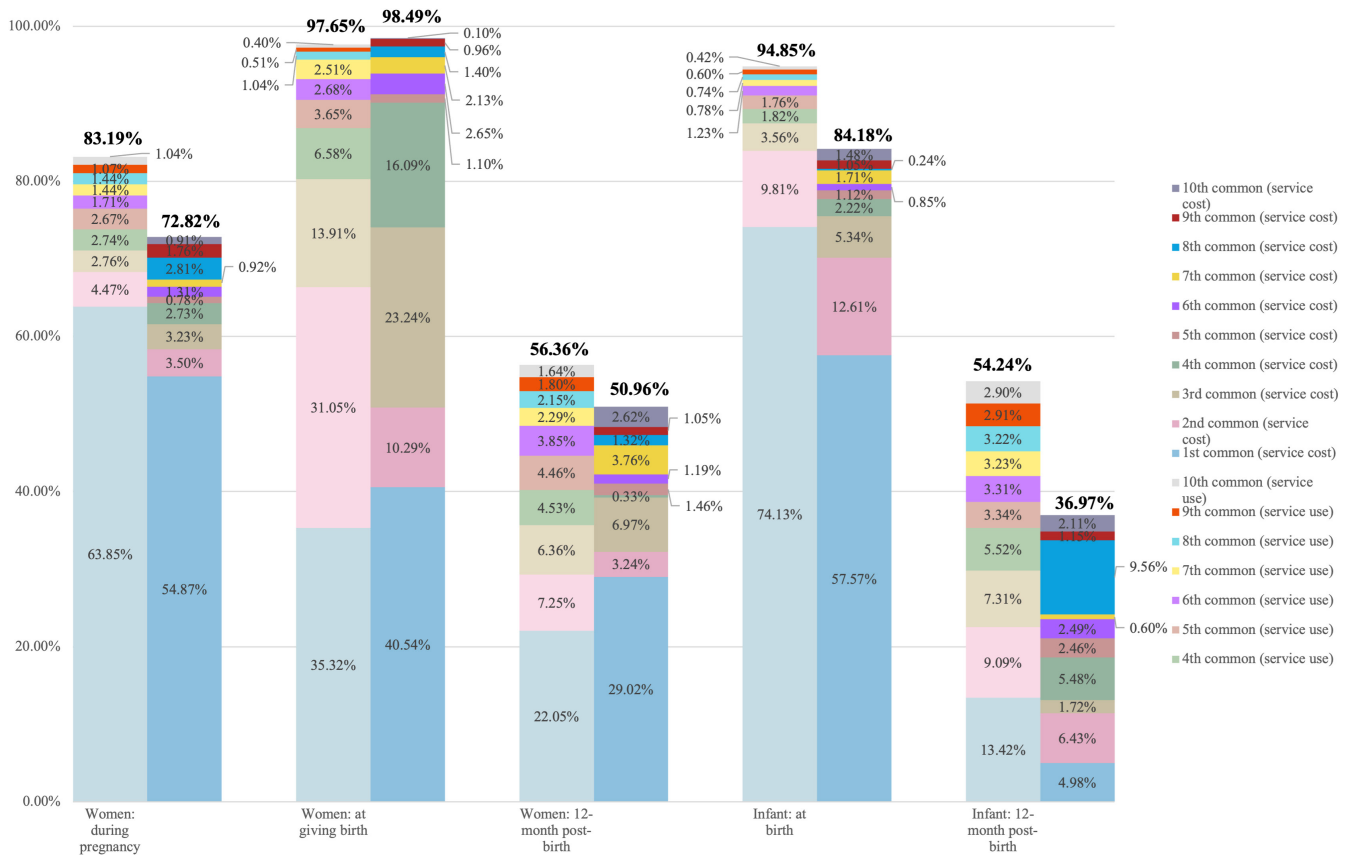
In the 12-months postbirth, the most common service use for each type of service is “whooping cough and acute bronchiolitis without complications and/or comorbidity” (13.42%), “community health services—child and youth health” (27.60%), “viral infection, unspecified” (11.03%), and “less than 20 minutes GP consultation” (28.21%), for inpatient, outpatient, ED, and Medicare services, respectively. The most frequent Medicare service was the same as the mothers. Interestingly, the cumulation of the top 10 outpatient (87.75%) and Medicare services (84.06%) were relatively higher than inpatient (54.24%) and ED services (53.09%).

Appendixes 3–7 showed the details of usage (frequency and percent) and costs (total costs, unit costs, and percent) for each top 10 service and the remaining services of inpatient, outpatient, ED, and Medicare care at different time periods for women and babies.

4 | DISCUSSION

The results of this study characterize the top 10 most frequent services used and related costs for inpatient, outpatient, ED, and Medicare services. The share of admission in public and private hospitals is aligned with the previous report across Australia.²⁰ The most frequent inpatient service during pregnancy, at birth, and 12-month postpartum for women was “antenatal and other obstetric admission,” “vaginal delivery,” and “other factors influencing health status.” For babies, the leading cause was “neonate admission with weight greater than 2499 grams, without significant operating room procedure and problem” at birth and “whooping cough and acute bronchiolitis without complication and/or comorbidity” after birth. Our findings are similar to other studies that found that the admission of full-term neonates with ≥ 2500 g birth weight is not an infrequent event.^{28,29} In addition, AIHW reported that babies (under 1 year) were more frequently hospitalized, and the admission rate was 54.5% in 2017–18.³⁰

In previous studies exploring service utilization and pregnancy costs, most of them focused on services provided at a certain stage of the maternal care continuum,³¹ evaluated the association between the service utilization rate and health outcomes,³² or explored factors associated with maternal healthcare service use.^{33–35} This study added value by aggregating the maternal health service use and costs at the population level and throughout the course of pregnancy. We specifically explored all types of healthcare utilization, not just obstetric or midwifery care, identifying the range of other services accessed by women and babies.



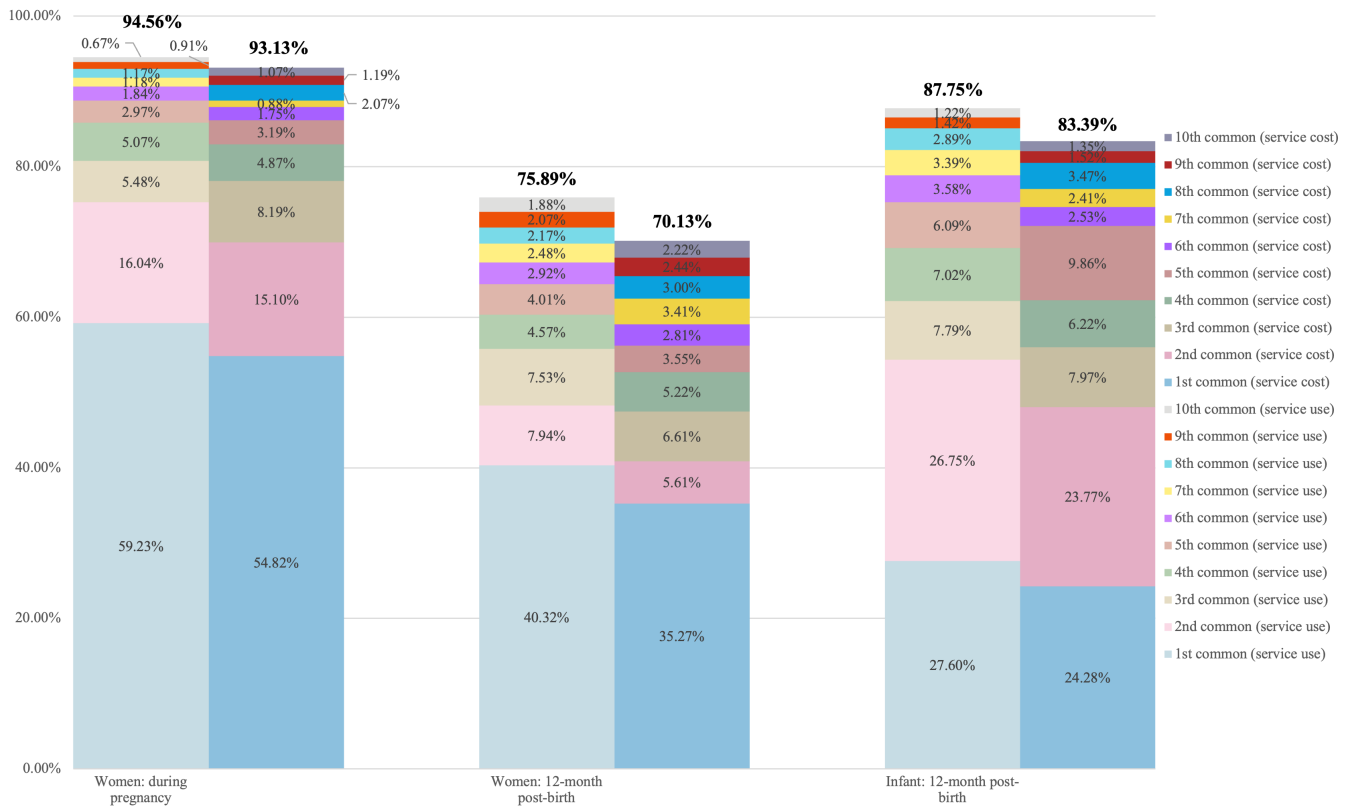
AR-DRG description					
Rank	Women: during pregnancy	Women: at giving birth	Women: 12-month post-birth	Babies: at birth	Babies: 12-month post-birth
1 st	Antenatal and Other Obstetric Admission	Vaginal Delivery	Other Factors Influencing Health Status	Neonate, AdmWt >2499 g W/O Significant OR Procedure W/O Problem	Whooping Cough and Acute Bronchiolitis W/O CC
2 nd	False Labour	Antenatal and Other Obstetric Admission	Antenatal and Other Obstetric Admission	Neonate, AdmWt >2499 g W/O Significant OR Procedure W Other Problem	Otitis Media and URI
3 rd	Abdominal Pain or Mesenteric Adenitis	Caesarean Delivery W Severe CC	Postpartum and Post Abortion W/O OR Procedures	Neonate, AdmWt >2499 g W/O Significant OR Procedure W Major Problem	Oesophagitis and Gastroenteritis W/O Cat/Sev CC
4 th	Other Uterine and Adnexa Procedures for Non-Malignancy	Caesarean Delivery W Catastrophic CC	Mental Health Treatment, Sameday, W/O ECT	Neonate, AdmWt 2000-2499 g W/O Significant OR Procedure W Other Problem	Viral Illness
5 th	Other Female Reproductive System OR Procedures	False Labour	Other Factors Influencing Health Status, Sameday	Neonate, AdmWt 2000-2499 g W/O Significant OR Procedure W/O Problem	Signs and Symptoms
6 th	Menstrual and Other Female Reproductive System Disorders	Other Factors Influencing Health Status	Abortion W OR Procedure	Neonate, Died or Transferred <5 Days of Adm, W/O Significant OR Proc, Newborn	Other Factors Influencing Health Status
7 th	Oesophagitis and Gastroenteritis W/O Cat/Sev CC	Postpartum and Post Abortion W/O OR Procedures	Vaginal Delivery	Neonate, AdmWt >2499 g W/O Significant OR Procedure W Multi Major Problems	Other Factors Influencing Health Status, Sameday
8 th	Other Factors Influencing Health Status	Vaginal Delivery W OR Procedure W/O Catastrophic or Severe CC	Abdominal Pain or Mesenteric Adenitis	Neonate, Died or Transf <5 Days of Adm, W/O Significant OR Proc, Not Newborn	Anxiety Disorders
9 th	Miscellaneous Metabolic Disorders W/O Catastrophic or Severe CC	Vaginal Delivery W OR Procedure W Catastrophic or Severe CC	Menstrual and Other Female Reproductive System Disorders	Neonate, AdmWt 2000-2499 g W/O Significant OR Procedure W Major Problem	Kidney and Urinary Tract Infections W/O Catastrophic or Severe CC
10 th	Red Blood Cell Disorders W/O Catastrophic or Severe CC	Other Factors Influencing Health Status, Sameday	Laparoscopic Cholecystectomy W/O Closed CDE W/O Cat or Sev CC	Neonate, AdmWt 1500-1999 g W/O Significant OR Procedure W Major Problem	Other Head Injury

AR-DRG: Australian Refined Diagnosis Related Groups; W: With; W/O: Without; OR: Operating Room; ECT: Electro Convulsion Therapy; CDE: Common Duct Exploration; Cat/Sev: Catastrophic or Severe; CC: Complication and/or Comorbidity; Adm: Admitted; AdmWt: Admission Weight; Transf: Transfer; Multi: Multiple; URI: Upper Respiratory tract Infection; Proc: Procedures.

FIGURE 2 The 10 most common reasons and costs for admission in all hospitals for women and babies from pregnancy to 12-month postbirth—all births in Queensland, Australia, 2017/18. [Color figure can be viewed at wileyonlinelibrary.com]

The results have highlighted that there was relatively uniform use of inpatient, outpatient, and Medicare services by women and babies in all time periods, with the 10

most common services accounting for more than half of the total services accessed. However, the ED services were more diverse in distribution with less than 50% of the total



Tier 2 description			
Rank	Women: during pregnancy	Women: 12-month post-birth	Babies: 12-month post-birth
1 st	Midwifery And Maternity	Midwifery And Maternity	Community Health Services - Child and Youth Health
2 nd	Physiotherapy	Physiotherapy	Midwifery And Maternity
3 rd	Community Health Services - Child and Youth Health	Community Health Services - Child and Youth Health	Paediatrics
4 th	Gynaecology	Gynaecology	Community Health Services - Maternal health
5 th	Community Health Services - Maternal health	Community Health Services - Maternal health	Paediatric Medicine
6 th	Obstetrics - Management Preg W/O Comp	Obstetrics - Management Preg W/O Comp	Physiotherapy
7 th	Endocrinology	Endocrinology	Primary Health Care
8 th	General Counselling	General Counselling	Audiology
9 th	Social Work	Social Work	Nutrition/Dietetics
10 th	General Surgery	General Surgery	Speech Pathology

W/O: Without; Preg: Pregnancy; Comp: Complications.

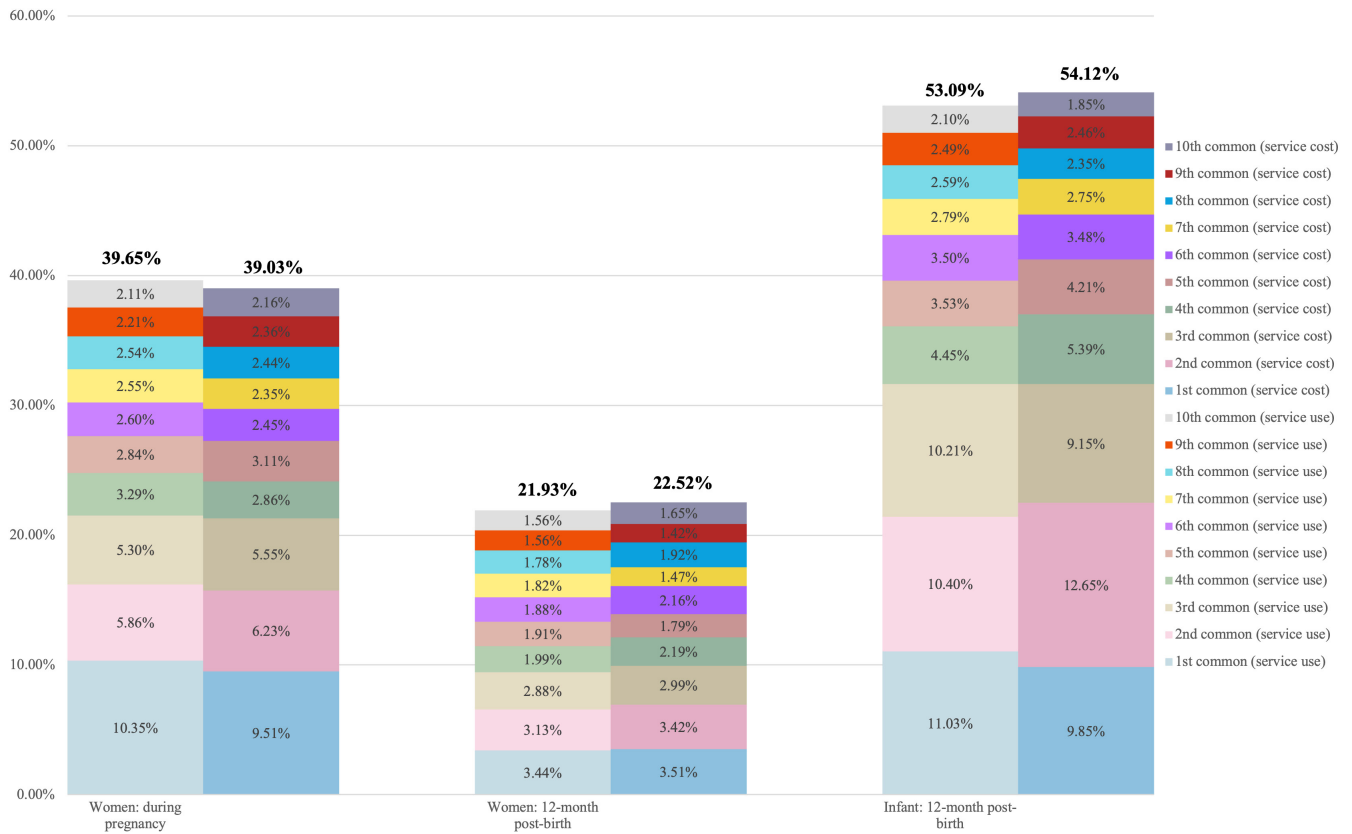
FIGURE 3 The 10 most common reasons and costs for outpatient services accessed by women and babies from pregnancy to 12-month postbirth—all births in Queensland, Australia, 2017/18. [Color figure can be viewed at wileyonlinelibrary.com]

services used. Furthermore, Medicare services accounted for the greatest volume (79.21%) of all service events but only 10.21% of the overall funding, compared with inpatient services, which were less frequently accessed (3.62%) but with the highest amount of overall funding (75.19%). This aligns with the previous government report that hospital spending accounted for a larger share of total health spending than the primary health care.³⁶

Additionally, eight inpatient and six outpatient services (out of the top 10) accessed by women during pregnancy were not directly provided by obstetricians or midwives but may be related (e.g., maternal mental health issues³⁷ and physical therapy for the treatment of lumbopelvic pain during pregnancy³⁸). In our study, these services included inpatient services for abdominal pain, oesophagitis or gastroenteritis, and mental health treatment. Outpatient services included care for endocrinology, nutrition, and

physiotherapy. Furthermore, a large volume of Medicare services was accessed during pregnancy and birth. One of the possible reasons for these nonobstetric health service uses might be the increased and higher prevalence of chronic health conditions (e.g., mental and behavioral conditions, back problems, and diabetes) for women at reproductive age relative to men at the same age.^{39,40} In 2020–21, 30% of women aged 15–44 years in Australia had one or more chronic conditions.³⁹

The wide variety of health services (either related to pregnancy and birth or not) being used as demonstrated in this study indicate the importance and need to consider the full spectrum of health services being accessed, and future research is recommended to investigate whether these health service uses are attributed to pregnancy and birth. If so, how might they affect the health outcomes for mothers and babies? Value-based care considers the total



Principal diagnosis			
Rank	Women: during pregnancy	Women: 12-month post-birth	Babies: 12-month post-birth
1 st	Threatened abortion	Inflammatory disorders of breast	Viral infection, unspecified
2 nd	Pain localised to other parts of lower abdomen	Other and unspecified abdominal pain	Acute bronchiolitis, unspecified
3 rd	Hyperemesis gravidarum with metabolic disturbance	Pain localised to other parts of lower abdomen	Acute upper respiratory infection, unspecified
4 th	Pregnant state, incidental	Calculus of bile duct without cholangitis or chole	Fever, unspecified
5 th	Acute abdomen	Threatened abortion	Feeding problem of newborn, unspecified
6 th	Abnormal uterine and vaginal bleeding, unspecified	Acute abdomen	Nausea and vomiting
7 th	Urinary tract infection, site not specified	Sprain and strain of other and unspecified parts o	Superficial injury of head, part unspecified
8 th	Nausea and vomiting	Abnormal uterine and vaginal bleeding, unspecified	Viral intestinal infection, unspecified
9 th	Other and unspecified abdominal pain	Urinary tract infection, site not specified	Acute obstructive laryngitis [croup]
10 th	Other gastroenteritis and colitis of infectious an	Headache	Rash and other nonspecific skin eruption

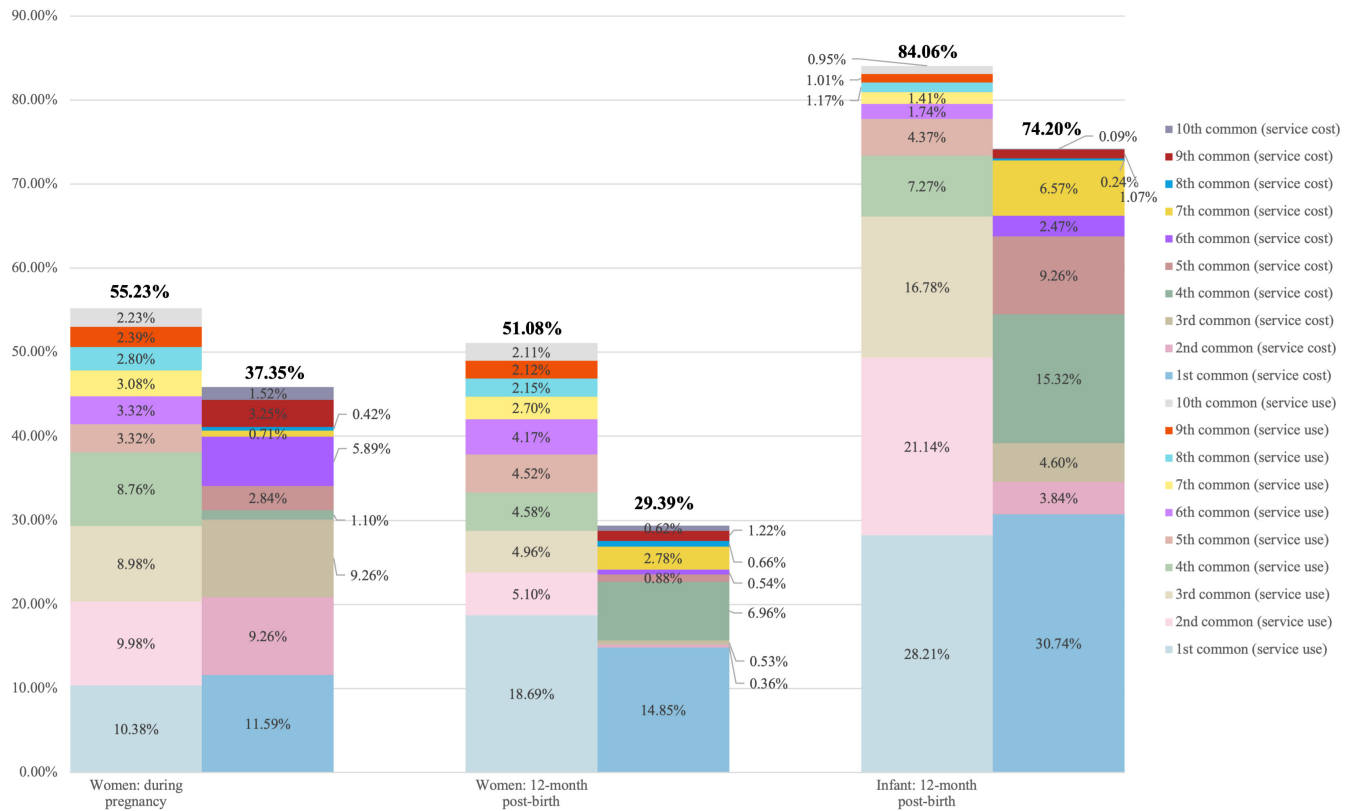
FIGURE 4 The 10 most common reasons and costs for ED services accessed by women and babies from pregnancy to 12-month postbirth—all births in Queensland, Australia, 2017/18. [Color figure can be viewed at wileyonlinelibrary.com]

costs of all services accessed over the pregnancy journey when defining value.^{18,19} Integrated perinatal care provided by multidisciplinary teams has great potential to improve efficiency and effectiveness.⁴¹ As such, there is a need to be able to routinely capture all care accessed by women and babies, and big data offers a valuable opportunity for this.

4.1 | Strengths and limitations

The strength of our analyses is that they drew on data from a whole-of-population linked routine administrative data set, demonstrating the value of big data. Furthermore, we included the service utilization and costs for all types of health care, not just obstetric or midwifery care, throughout the pregnancy to 12-months postpartum in

community and hospital settings. Nonetheless, there are several limitations. These include there being no information on services not listed on the MBS and ED services provided by private hospitals, thus, potentially underestimating the total number of services accessed. In addition, the data set provided the service date and birth date in the month rather than by the day, which may limit the accuracy of the identification of time periods and thus the allocated number of service events and costs. Finally, the results covered women who gave birth between 01/07/2017 and 30/06/2018. Although these were the most recent data available to the researchers due to the delays in the collection and release of administrative data, it is possible that the utilization of services and related costs have changed over time, especially due to the COVID-19 pandemic.⁴² This demonstrates the need to be able to monitor use and costs at the service level where



Brief item description			
Rank	Women: during pregnancy	Women: 12-month post-birth	Babies: 12-month post-birth
1 st	T4 - Obstetrics, ANTENATAL ATTENDANCE	A1 - General Practitioner Attendances To Which No Other Item Applies, 2 - Level B	A1 - General Practitioner Attendances To Which No Other Item Applies, 2 - Level B
2 nd	A1 - General Practitioner Attendances To Which No Other Item Applies, 2 - Level B	P13 - Bulk-Billing Incentive	M1 - Management Of Bulk-Billed Services, where the service is provided at, or from, a practice location that is in a MMM 2 area under the Modified Monash Model classification system
3 rd	P13 - Bulk-Billing Incentive	P10 - Patient Episode Initiation	M1 - Management Of Bulk-Billed Services, where the service is provided at, or from, a practice location that is in a MMM1 area under the Modified Monash Model classification system
4 th	P10 - Patient Episode Initiation	A1 - General Practitioner Attendances To Which No Other Item Applies, 3 - Level C	A1 - General Practitioner Attendances To Which No Other Item Applies, 3 - Level C
5 th	P1 - Haematology	M1 - Management Of Bulk-Billed Services, where the service is provided at, or from, a practice location that is in a MMM1 area under the Modified Monash Model classification system	A4 - Consultant Physician Attendances To Which No Other Item Applies
6 th	A1 - General Practitioner Attendances To Which No Other Item Applies, 3 - Level C	M1 - Management Of Bulk-Billed Services, where the service is provided at, or from, a practice location that is in a MMM 2 area under the Modified Monash Model classification system	A22 - General Practitioner After-Hours Attendances To Which No Other Item Applies, 2 - Level B
7 th	M1 - Management Of Bulk-Billed Services, where the service is provided at, or from, a practice location that is in a MMM1 area under the Modified Monash Model classification system	T4 - Obstetrics, ANTENATAL ATTENDANCE	A4 - Consultant Physician Attendances To Which No Other Item Applies
8 th	M1 - Management Of Bulk-Billed Services, where the service is provided at, or from, a practice location that is in a MMM 2 area under the Modified Monash Model classification system	P2 - Chemical, 5 or more tests described in item 66500	P10 - Patient Episode Initiation
9 th	I1 - Ultrasound, 5 - Obstetric And Gynaecological, if the dating of the pregnancy (as confirmed by ultrasound) is less than 12 weeks of gestation (R)	P2 - Chemical, Iron studies	P3 - Microbiology
10 th	P2 - Chemical, Iron studies	P1 - Haematology	P13 - Bulk-Billing Incentive

FIGURE 5 The 10 most common reasons for Medicare services accessed by women and babies from pregnancy to 12-month post-birth—all births in Queensland, Australia, 2017/18. [Color figure can be viewed at wileyonlinelibrary.com]

data are more readily available. As the data set is updated over time, this will enable future analyses on this topic, and future studies can compare the changes in service use and costs over time.

4.2 | Conclusion

In conclusion, our study has identified the most common inpatient, outpatient, ED, and Medicare service uses

for women and babies in different time periods, thereby providing empirical evidence about the full spectrum of services utilized by women and babies during antenatal, intrapartum, and postnatal care. Thus, the study findings could assist health providers and managers to understand the services women and babies actually accessed throughout the pregnancy and birth journey.

AUTHOR CONTRIBUTIONS

YH led the data analysis, interpretation of the results, and drafting of the manuscript. XZ contributed to the construction of tables and figures, and editing of the final manuscript. EC conceived the original study idea, contributed to the interpretation of the results, and editing of the final manuscript. All authors read and approved the final manuscript.

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CONFLICT OF INTEREST STATEMENT

We have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

Individual-level data from this study cannot be shared by the research team, due to the ethics approval and access approvals granted. Requests for access to the individual-level data may be made directly to the data custodians by means of the Queensland Health, Statistical Services Branch with appropriate ethics and relevant approvals. The authors can share the data dictionary upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The data used in this study were deidentified before its use. All methods were performed in accordance with the Declaration of Helsinki. The Townsville Hospital and Health Service Human Research Ethics Committee (HREC; HREC/16/QTHS/223) and the Australian Institute of Health and Welfare HREC (EO2017-1-338) granted permission to access the raw data used in this study.

CONSENT FOR PUBLICATION

Not applicable.

CODE AVAILABILITY

SAS V9.4. The code used for this study is available from the corresponding author upon reasonable request.

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REFERENCES

1. United Nations Department of Economic Social Affairs. 2019 Revision of World Population Prospects. 2019.
2. Australian Institute of Health Welfare. *Disease Expenditure in Australia 2018–19*. Australian Institute of Health Welfare; 2021 [updated 25/8/2021]. Available from: <https://www.aihw.gov.au/reports/health-welfare-expenditure/disease-expenditure-australia>
3. Team NMR. *Better Births: Improving Outcomes Of Maternity Services in England: A Five Year Forward View for Maternity Care*. National Health Service; 2016.
4. Torio CM, Moore BJ. *National Inpatient Hospital Costs: The Most Expensive Conditions by Payer, 2013: Statistical Brief #204: Agency for Healthcare Research and Quality (US)*. Vol 2006. Healthcare Cost and Utilization Project (HCUP) statistical briefs; 2006.
5. Martin AB, Hartman M, Whittle L, Catlin A, Team NHEA. National health spending in 2012: rate of health spending growth remained low for the fourth consecutive year. *Health Aff.* 2014;33(1):67-77.
6. Wier LM, Andrews RM. *The National Hospital Bill: The Most Expensive Conditions by Payer, 2008: Statistical Brief # 107: Agency for Healthcare Research and Quality (US)*. Vol 2006. Healthcare Cost and Utilization Project (HCUP) statistical briefs; 2006.
7. Benova L, Tunçalp Ö, Moran AC, Campbell OMR. Not just a number: examining coverage and content of antenatal care in low-income and middle-income countries. *BMJ Glob Health.* 2018;3(2):e000779.
8. Banke-Thomas A, Abejirinde IO, Ayomoh FI, Banke-Thomas O, Eboime EA, Ameh CA. E-income countries from a provider's perspective: a systematic review. *BMJ Glob Health.* 2020;5(6):e002371.
9. Shaw D, Guise J-M, Shah N, et al. Drivers of maternity care in high-income countries: can health systems support woman-centred care? *Lancet.* 2016;388(10057):2282-2295.
10. Lowe NK. Birth settings in America: Outcomes, quality, access, and choice. *J Obstet Gynecol Neonatal Nurs.* 2020;49(4): 331-335. <https://doi.org/10.1016/j.jogn.2020.06.001>
11. Beaujouan É, Sobotka T. Late childbearing continues to increase in developed countries. *Popul Soc.* 2019;562(1):1-4.
12. Australian Institute of Health Welfare. *Australia's mothers and babies*. AIHW; 2022.
13. Australian Institute of Health Welfare. *Older mothers in Australia 2019*. AIHW; 2021.

14. Lean SC, Derricott H, Jones RL, Heazell AEP. Advanced maternal age and adverse pregnancy outcomes: a systematic review and meta-analysis. *PLoS One*. 2017;12(10):e0186287.
15. Bell JS, Campbell DM, Graham WJ, Penney GC, Ryan M, Hall MH. Can obstetric complications explain the high levels of obstetric interventions and maternity service use among older women? A retrospective analysis of routinely collected data. *BJOG*. 2001;108(9):910-918.
16. Koblinsky M, Moyer CA, Calvert C, et al. Quality maternity care for every woman, everywhere: a call to action. *Lancet*. 2016;388(10057):2307-2320.
17. Boerma T, Ronsmans C, Melesse DY, et al. Global epidemiology of use of and disparities in caesarean sections. *Lancet*. 2018;392(10155):1341-1348.
18. Enticott J, Braaf S, Johnson A, Jones A, Teede HJ. Leaders' perspectives on learning health systems: a qualitative study. *BMC Health Serv Res*. 2020;20(1):1-13.
19. Enticott J, Johnson A, Teede H. Learning health systems using data to drive healthcare improvement and impact: a systematic review. *BMC Health Serv Res*. 2021;21(1):1-16.
20. Australian Institute of Health Welfare. *Admitted patient care 2019–20*. Australian Institute of Health Welfare; 2021 [updated 6/12/2021]. Available from: <https://www.aihw.gov.au/getmedia/3af0762a-9542-4451-9a82-4fac56fc6d8f/5-admitted-patient-care-2019-20-tables-services.xls.aspx>.
21. Australian Institute of Health Welfare. *Emergency department care 2020–21*. Australian Institute of Health Welfare; 2021 [updated 30/11/2021]. Available from: <https://www.aihw.gov.au/getmedia/0d0d6cbf-e764-4a89-a71a-b03c5156235d/Emergency-Department-Care-2020-21.xlsx.aspx>
22. Callander EJ, Fox H. What are the costs associated with child and maternal healthcare within Australia? A study protocol for the use of data linkage to identify health service use, and health system and patient costs. *BMJ Open*. 2018;8(2):e017816.
23. Independent Hospital Pricing Authority. *Classifications*. IHPA; 2022. Available from: <https://www.ihpa.gov.au/what-we-do/classifications>
24. Department of Health Australian Government. Search the MBS, MBS Online Canberra: Department of Health Australian Government. Available from: <http://www9.health.gov.au/mbs/search.cfm>
25. Australian Refined Diagnosis Related Groups Version 6.x, Addendum. The National Casemix and Classification Centre, Australian Health Services Research Institute, University of Wollongong. 2012 Contract No.: 19 May 2020.
26. Independent Hospital Pricing Authority (IHPA). *National Hospital Cost Data Collection, Public Hospitals Cost Report, Round 20 (Financial Year 2015–16)*. IHPA; 2018.
27. Reserve Bank of Australia. Inflation Calculator. Available from: <https://www.rba.gov.au/calculator/financialYearDecimal.html>
28. Rohininath T, O'Connell L, Sheehan K, Corcoran D, Matthews T, Clarke T. Workload and short-term outcome of babies weighing 2,500 grams or more at birth admitted to the paediatric unit of the Rotunda Hospital. *J Matern Fetal Neonatal Med*. 2005;17(2):139-143.
29. Tracy SK, Tracy MB, Sullivan E. Admission of term infants to neonatal intensive care: a population-based study. *Birth*. 2007;34(4):301-307.
30. Australian Institute of Health Welfare. *Admitted patient care 2017–18*. AIHW; 2019.
31. Yaya S, Ghose B. Global Inequality in Maternal Health Care Service Utilization: Implications for Sustainable Development Goals. *Health Equity*. 2019;3(1):145-154.
32. Zhao P, Han X, You L, Zhao Y, Yang L, Liu Y. Maternal health services utilization and maternal mortality in China: a longitudinal study from 2009 to 2016. *BMC Pregnancy Childbirth*. 2020;20(1):220.
33. Callander EJ, Shand A, Nassar N. Inequality in out of pocket fees, government funding and utilisation of maternal health services in Australia. *Health Policy*. 2021;125(6):701-708.
34. Hamal M, Dieleman M, De Brouwere V, de Cock Buning T. Social determinants of maternal health: a scoping review of factors influencing maternal mortality and maternal health service use in India. *Public Health Rev*. 2020;41(1):13.
35. Fox H, Topp SM, Callander E, Lindsay D. A review of the impact of financing mechanisms on maternal health care in Australia. *BMC Public Health*. 2019;19(1):1540.
36. Australian Institute of Health Welfare. *Health Expenditure Australia 2019–20*. AIHW; 2021.
37. Schmied V, Johnson M, Naidoo N, et al. Maternal mental health in Australia and New Zealand: a review of longitudinal studies. *Women Birth*. 2013;26(3):167-178.
38. Ev B, Pool J, Mens J, Pool-Goudzwaard A. Recommendations for physical therapists on the treatment of lumbopelvic pain during pregnancy: a systematic review. *J Orthop Sports Phys Ther*. 2014;44(7):464-A15.
39. Australian Bureau of Statistics. *Health Conditions Prevalence*. ABS; 2020–21 Available from: <https://www.abs.gov.au/statistics/health/health-conditions-and-risks/health-conditions-prevalence/latest-release>
40. Australian Bureau of Statistics. *Chronic conditions*. ABS; 2017–18 Available from: <https://www.abs.gov.au/statistics/health/health-conditions-and-risks/chronic-conditions/2017-18>
41. Rodríguez C, des Rivières-Pigeon C. A literature review on integrated perinatal care. *Int J Integr Care*. 2007;7:e28.
42. Aranda Z, Binde T, Tashman K, et al. Disruptions in maternal health service use during the COVID-19 pandemic in 2020: experiences from 37 health facilities in low-income and middle-income countries. *BMJ Glob Health*. 2022;7(1):e007247.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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APPENDIX 1

The number of service events by women and babies in three time periods—all births in Queensland, Australia, 2017/18.

	Inpatient services in public hospitals, <i>n</i> (%)	Inpatient services in private hospitals, <i>n</i> (%)	Inpatient services in all hospitals, <i>n</i> (%)	Outpatient services, <i>n</i> (%)	ED services, <i>n</i> (%)	Medicare services, <i>n</i> (%)	Total ^c , <i>n</i> (%)
Women	111,987 (64.40%)	41,867 (64.48%)	153,854 (64.42%)	749,477 (73.09%)	51,858 (47.44%)	3,745,151 (71.58%)	4,700,340 (71.16%)
Pregnancy	19,320 (11.11%)	6818 (10.50%)	26,138 (10.94%)	623,068 (60.76%)	30,706 (28.09%)	2,261,808 (43.23%)	2,491,720 (44.53%)
At giving birth	75,041 (43.15%)	26,055 (40.13%)	101,096 (42.33%)	—	—	—	101,096 (1.53%)
12-month postbirth	17,626 (10.14%)	8994 (13.85%)	26,620 (11.15%)	126,409 (12.33%)	21,152 (19.35%)	1,483,343 (28.35%)	1,657,524 (25.09%)
Babies	61,918 (35.60%)	23,063 (35.52%)	84,981 (35.58%)	275,998 (26.91%)	57,466 (52.56%)	1,486,989 (28.42%)	1,905,434 (28.84%)
At birth	45,243 (26.02%)	21,043 (32.41%)	66,286 (27.75%)	—	—	—	66,286 (1.00%)
12-month postbirth	16,675 (9.59%)	2020 (3.11%)	18,695 (7.83%)	275,998 (26.91%)	57,466 (52.56%)	1,486,989 (28.42%)	1,869,148 (27.84%)
Total	173,905 (72.81%) ^a	64,930 (27.19%) ^a	238,835 (36.62%) ^b	1,025,475 (15.52%) ^b	109,324 (1.65%) ^b	5,232,140 (79.21%) ^b	6,605,774

Note: Italic means total number of women and babies. Women include the total service use of women throughout three time periods; Babies includes the total service use of babies throughout two time periods; % are all column percentages except for total. Grey shading means the total costs for each type of service.

Abbreviation: ED, Emergency Department.

^a % are percentage of inpatient services in all hospitals (i.e., 238,835).

^b % are percentage of total services use (i.e., 6,605,774).

^c The total services use includes inpatient services in all hospitals, outpatient, ED, and Medicare services.

APPENDIX 2

Total health expenditure of different types of services use by women and babies in three time periods—all births in Queensland, Australia, 2017/18.

	Inpatient costs in public hospitals, \$ (%)	Inpatient costs in private hospitals, \$ (%)	Inpatient costs in all hospitals, \$ (%)	Outpatient costs, \$ (%)	ED costs, \$ (%)	Medicare costs, \$ (%)	Total ^c , \$ (%)
Women	\$646.32 (49.10%)	\$219.32 (69.38%)	\$865.64 (53.03%)	\$165.55 (71.88%)	\$39.14 (45.04%)	\$168.42 (76.01%)	\$1238.76 (57.05%)
During pregnancy	\$52.36 (3.98%)	\$12.66 (4.00%)	\$65.02 (3.98%)	\$135.85 (58.99%)	\$23.11 (26.59%)	\$94.21 (42.52%)	\$318.19 (14.65%)
At giving birth	\$489.28 (37.17%)	\$182.13 (57.62%)	\$671.42 (41.13%)	—	—	—	\$671.42 (30.92%)
12-month postbirth	\$104.68 (7.95%)	\$24.53 (7.76%)	\$129.21 (7.92%)	\$29.70 (12.89%)	\$16.03 (18.45%)	\$74.22 (33.50%)	\$249.15 (11.48%)
Babies	\$669.98 (50.90%)	\$96.79 (30.62%)	\$766.77 (46.97%)	\$64.76 (28.12%)	\$47.76 (54.96%)	\$53.15 (23.99%)	\$932.44 (42.95%)
At birth	\$557.64 (42.36%)	\$89.63 (28.35%)	\$647.27 (39.65%)	—	—	—	\$647.27 (29.81%)
12-month postbirth	\$112.35 (8.53%)	\$7.16 (2.27%)	\$119.51 (7.32%)	\$64.76 (28.12%)	\$47.76 (54.96%)	\$53.15 (23.99%)	\$285.17 (13.13%)
Total	\$1316.31 (80.64%) ^a	\$316.11 (19.36%) ^a	\$1632.42 (75.19%) ^b	\$230.31 (10.61%) ^b	\$86.90 (4.00%) ^b	\$221.57 (10.24%) ^b	\$2171.20

Note: Italic means total costs for women and babies. Women includes the total service costs of women throughout three time periods; Babies includes the total service costs of babies throughout two time periods; \$ are in a unit of million; \$ = Australian Dollars; % are all column percentages except for total.

Abbreviation: ED, Emergency Department.

^a % are percentage of inpatient costs in all hospitals (i.e., \$1632.42).

^b % are percentage of total costs (i.e., \$2171.20).

^c The total costs include inpatient services in all hospitals, outpatient, ED, and Medicare services.

APPENDIX 3

The 10 most common reasons and related costs for services accessed by women during pregnancy—all births in Queensland, Australia, 2017/18.

Inpatient services in private hospitals													
Usage					Cost								
AR-DRG code	AR-DRG description	Frequency	Percent	AR-DRG cost	Unit cost	Percent	AR-DRG code	AR-DRG description	Frequency	Percent	AR-DRG cost	Unit cost	Percent
1st	O66Z Antenatal and other obstetric admission	13,398	69.35%	\$30.28	\$2260.13	57.83%	O66Z	Antenatal and other obstetric admission	3291	48.27%	\$5.39	\$1638.96	42.61%
2nd	O64Z False labour	891	4.61%	\$1.85	\$2080.30	3.54%	N07Z	Other uterine and adnexa procedures for nonmalignancy	703	10.31%	\$1.71	\$2430.79	13.50%
3rd	G66Z Abdominal pain or mesenteric adenitis	659	3.41%	\$1.95	\$2956.64	3.72%	N11Z	Other female reproductive system OR procedures	699	10.25%	\$0.51	\$729.48	4.03%
4th	G67B Oesophagitis and gastroenteritis W/O Cat/Sev CC	338	1.75%	\$0.51	\$1504.98	0.97%	N62Z	Menstrual and other female reproductive system disorders	281	4.12%	\$0.36	\$1264.70	2.81%
5th	Z64A Other factors influencing health status	333	1.72%	\$1.72	\$5177.48	3.29%	O64Z	False labour	278	4.08%	\$0.42	\$1507.86	3.31%
6th	X64B Other injury, poisoning and toxic effect diagnosis W/O Cat or Sev CC	221	1.14%	\$0.57	\$2567.63	1.08%	U60Z	Mental health treatment, same day, W/O ECT	200	2.93%	\$0.06	\$320.00	0.51%
7th	F74Z Chest pain	203	1.05%	\$0.67	\$3294.48	1.28%	K62B	Miscellaneous metabolic disorders W/O catastrophic or severe CC	198	2.90%	\$0.79	\$4013.60	6.28%
8th	G70B Other digestive system diagnoses W/O catastrophic or severe CC	192	0.99%	\$0.72	\$3737.40	1.37%	Q61B	Red blood cell disorders W/O catastrophic or severe CC	151	2.21%	\$0.32	\$2115.59	2.52%
9th	X60B Injuries W/O catastrophic or severe CC	182	0.94%	\$0.29	\$1620.76	0.56%	G66Z	Abdominal pain or mesenteric adenitis	63	0.92%	\$0.15	\$2431.21	1.21%
10th	N62Z Menstrual and other female reproductive system disorders	166	0.86%	\$0.50	\$2985.19	0.95%	Z64B	Other factors influencing health status, same day	43	0.63%	\$0.02	\$574.80	0.20%
	Cumulative	16,583	85.83%	\$39.06	\$2355.45	74.60%	Cumulative	—	5907	86.64%	\$9.74	\$1649.43	76.97%
	Other	2737	14.17%	\$13.30	\$4859.28	25.40%	Other	—	911	13.36%	\$2.92	\$3200.30	23.03%
	Total	19,320	100.00%	\$52.36	\$2710.15	100.00%	Total	—	6818	100.00%	\$12.66	\$1856.65	100.00%

(Continues)

APPENDIX 3 (Continued)

Inpatient services in all hospitals										Outpatient services					
Rank	AR-DRG code	AR-DRG description	Usage	Frequency	Percent	AR-DRG cost	Unit cost	Percent	Tier 2 code	Usage	Frequency	Percent	Tier 2 cost	Unit cost	Percent
1st	O66Z	Antenatal and other obstetric admission	16,689	63.85%	\$35.68	\$2137.64	54.87%	Midwifery and maternity	369,061	59.23%	\$744.47	\$201.78	54.82%		
2nd	O64Z	False labour	1169	4.47%	\$2.27	\$1944.17	3.50%	Obstetrics—management Preg W/O Comp	99,917	16.04%	\$20.51	\$205.28	15.10%		
3rd	G66Z	Abdominal pain or mesenteric adenitis	722	2.76%	\$2.10	\$2910.79	3.23%	Endocrinology	34,163	5.48%	\$111.13	\$325.73	8.19%		
4th	N07Z	Other uterine and adnexa procedures for nonmalignancy	716	2.74%	\$1.78	\$2482.03	2.73%	Obstetrics—management complex Preg	31,602	5.07%	\$6.62	\$209.36	4.87%		
5th	N11Z	Other female reproductive system OR procedures	699	2.67%	\$0.51	\$729.48	0.78%	Nutrition/dietetics	18,495	2.97%	\$4.34	\$234.65	3.19%		
6th	N62Z	Menstrual and other female reproductive system disorders	447	1.71%	\$0.85	\$1903.63	1.31%	Maternal fetal medicine	11,448	1.84%	\$2.37	\$207.02	1.75%		
7th	G67B	Oesophagitis and gastroenteritis W/O Cat/Sev CC	376	1.44%	\$0.60	\$1598.34	0.92%	Physiotherapy	7355	1.18%	\$1.20	\$163.34	0.88%		
8th	Z64A	Other factors influencing health status	376	1.44%	\$1.83	\$4859.26	2.81%	Anesthetics	7262	1.17%	\$2.81	\$387.47	2.07%		
9th	K62B	Miscellaneous metabolic disorders W/O catastrophic or severe CC	279	1.07%	\$1.14	\$4094.68	1.76%	Social work	5676	0.91%	\$1.62	\$285.90	1.19%		
10th	Q61B	Red blood cell disorders W/O catastrophic or severe CC	272	1.04%	\$0.59	\$2163.36	0.91%	General medicine	4199	0.67%	\$1.45	\$346.50	1.07%		
	Cumulative	—	21,745	83.19%	\$47.35	\$2177.34	72.82%	Cumulative	589,178	94.56%	\$126.53	\$214.75	93.13%		
	Other	—	4393	16.81%	\$17.67	\$4022.89	27.18%	Other	33,890	5.44%	\$9.33	\$275.19	6.87%		
	Total	—	26,138	100.00%	\$65.02	\$2487.52	100.00%	Total	623,068	100.00%	\$135.85	\$218.04	100.00%		
ED services															
Rank	Item number	Contents of item number	Usage	Frequency	Percent	Fee charged	Unit cost	Percent	Principal diagnosis	Usage	Frequency	Percent	URG cost	Unit cost	Percent
1st	16,500	T4—Obstetrics, antenatal attendance	234,673	10.38%	\$10.92	\$46.53	11.59%	Threatened abortion	3177	10.35%	\$2.20	\$691.97	9.51%		

APPENDIX 3 (Continued)

Medicare services		ED services										
Rank	Item number	Contents of item number	Usage	Cost	Usage	Cost	Usage	Cost				
			Frequency	Percent	Fee charged	Unit cost	Percent	Principal diagnosis	Frequency	Percent	Unit cost	Percent
2nd	23	A1—General practitioner attendances to which no other item applies, 2—Level B	225,774	9.98%	\$8.73	\$38.66	9.26%	Pain localised to other parts of lower abdomen	1800	5.86%	\$799.79	6.23%
3rd	74,995	P13—Bulk-billing incentive	203,147	8.98%	\$0.71	\$3.50	0.75%	Hyperemesis gravidarum with metabolic disturbance	1627	5.30%	\$787.92	5.55%
4th	73,928	P10—Patient episode initiation	198,041	8.76%	\$1.04	\$5.25	1.10%	Pregnant state, incidental	1010	3.29%	\$655.26	2.86%
5th	65,096	P1—Haematology	75,057	3.32%	\$2.68	\$35.70	2.84%	Acute abdomen	871	2.84%	\$825.41	3.11%
6th	36	A1—General practitioner attendances to which no other item applies, 3—Level C	74,990	3.32%	\$5.55	\$74.01	5.89%	Abnormal uterine and vaginal bleeding, unspecified	798	2.60%	\$709.41	2.45%
7th	10,991	M1—Management of bulk-billed services, where the service is provided at, or from, a practice location that is in a MMM1 area under the Modified Monash Model classification system	69,748	3.08%	\$0.67	\$9.56	0.71%	Urinary tract infection, site not specified	784	2.55%	\$692.12	2.35%
8th	10,990	M1—Management of bulk-billed services, where the service is provided at, or from, a practice location that is in a MMM 2 area under the Modified Monash Model classification system	63,280	2.80%	\$0.39	\$6.24	0.42%	Nausea and vomiting	781	2.54%	\$722.01	2.44%
9th	55,700	I1—Ultrasound, 5—Obstetric and gynaecological, if the dating of the pregnancy (as confirmed by ultrasound) is less than 12 weeks of gestation (R)	54,028	2.39%	\$3.06	\$56.68	3.25%	Other and unspecified abdominal pain	680	2.21%	\$803.00	2.36%
10th	66,596	P2—Chemical, iron studies	50,416	2.23%	\$1.44	\$28.47	1.52%	Other gastroenteritis and colitis of infectious an	648	2.11%	\$771.71	2.16%
	Cumulative	—	1,249,154	55.23%	\$35.19	\$28.17	37.35%	Cumulative	12,176	39.65%	\$740.75	39.03%
	Other	—	1,012,654	44.77%	\$59.02	\$58.28	62.65%	Other	18,530	60.35%	\$760.38	60.97%
	Total	—	2,261,808	100.00%	\$94.21	\$41.65	100.00%	Total	30,706	100.00%	\$752.60	100.00%

Note: \$ are in a unit of million.

Abbreviations: \$, Australian Dollars; AR-DRG, Australian Refined Diagnosis-Related Groups; Cat/Sev, catastrophic or severe; CC, complication and/or comorbidity; ECT, electroconvulsion therapy; ED, Emergency Department; OR, Operating Room; URG, Urgency-Related Group; W/O, without.

APPENDIX 4

The 10 most common reasons and related costs for inpatient services accessed by women at giving birth—all births in Queensland, Australia, 2017/18.

Public hospitals										
Rank	AR-DRG code	AR-DRG description	Usage			Cost			Percent	Percent
			Frequency	AR-DRG cost	Unit cost	Frequency	AR-DRG cost	Unit cost		
1st	O66Z	Antenatal and other obstetric admission	27,733	\$62.99	\$2271.15	36.96%	\$62.99	\$2271.15	36.96%	12.87%
2nd	O60Z	Vaginal delivery	25,304	\$198.23	\$7833.90	33.72%	\$198.23	\$7833.90	33.72%	40.51%
3rd	O01B	Cesarean delivery W severe CC	7206	\$92.08	\$12,778.88	9.60%	\$92.08	\$12,778.88	9.60%	18.82%
4th	O01A	Cesarean delivery W catastrophic CC	4224	\$78.81	\$18,657.49	5.63%	\$78.81	\$18,657.49	5.63%	16.11%
5th	O64Z	False labour	2992	\$6.29	\$2101.60	3.99%	\$6.29	\$2101.60	3.99%	1.29%
6th	Z64A	Other factors influencing health status	2218	\$16.10	\$7260.70	2.96%	\$16.10	\$7260.70	2.96%	3.29%
7th	O61Z	Postpartum and postabortion W/O OR procedures	2034	\$12.82	\$6302.10	2.71%	\$12.82	\$6302.10	2.71%	2.62%
8th	O02B	Vaginal delivery W OR procedure W/O catastrophic or severe CC	831	\$7.76	\$9343.64	1.11%	\$7.76	\$9343.64	1.11%	1.59%
9th	O02A	Vaginal delivery W OR procedure W catastrophic or severe CC	403	\$5.46	\$13,544.00	0.54%	\$5.46	\$13,544.00	0.54%	1.12%
10th	Z64B	Other factors influencing health status, same day	385	\$0.66	\$1724.18	0.51%	\$0.66	\$1724.18	0.51%	0.14%
	Cumulative	—	73,330	\$481.21	\$6562.20	97.72%	\$481.21	\$6562.20	97.72%	98.35%
	Other	—	1711	\$8.08	\$4721.66	2.28%	\$8.08	\$4721.66	2.28%	1.65%
	Total	—	75,041	\$489.28	\$6520.23	100.00%	\$489.28	\$6520.23	100.00%	100.00%
Private hospitals										
Rank	AR-DRG code	AR-DRG description	Usage			Cost			Percent	Percent
			Frequency	AR-DRG cost	Unit cost	Frequency	AR-DRG cost	Unit cost		
1st	O60Z	Vaginal delivery	10,406	\$73.96	\$7107.40	39.94%	\$73.96	\$7107.40	39.94%	40.61%
2nd	O01B	Cesarean delivery W severe CC	6855	\$63.96	\$9330.95	26.31%	\$63.96	\$9330.95	26.31%	35.12%
3rd	O66Z	Antenatal and other obstetric admission	3661	\$6.10	\$1665.53	14.05%	\$6.10	\$1665.53	14.05%	3.35%
4th	O01A	Cesarean delivery W catastrophic CC	2427	\$29.24	\$12,047.52	9.31%	\$29.24	\$12,047.52	9.31%	16.05%
5th	O64Z	False labour	695	\$1.06	\$1529.93	2.67%	\$1.06	\$1529.93	2.67%	0.58%
6th	O61Z	Postpartum and postabortion W/O OR procedures	505	\$1.48	\$2921.23	1.94%	\$1.48	\$2921.23	1.94%	0.81%
7th	Z64A	Other factors influencing health status	490	\$1.65	\$3373.72	1.88%	\$1.65	\$3373.72	1.88%	0.91%
8th	O02B	Vaginal delivery W OR procedure W/O catastrophic or severe CC	219	\$1.63	\$7428.13	0.84%	\$1.63	\$7428.13	0.84%	0.89%

APPENDIX 4 (Continued)

Private hospitals		Usage			Cost		
Rank	AR-DRG code	AR-DRG description	Frequency	Percent	AR-DRG cost	Unit cost	Percent
9th	K62B	Miscellaneous metabolic disorders W/O catastrophic or severe CC	146	0.56%	\$0.57	\$3911.98	0.31%
10th	Q61B	Red blood cell disorders W/O catastrophic or severe CC	115	0.44%	\$0.28	\$2439.91	0.15%
	Cumulative	—	25,519	97.94%	\$179.93	\$7050.83	98.79%
	Other	—	536	2.06%	\$2.20	\$4109.14	1.21%
	Total	—	26,055	100.00%	\$176.94	\$6791.18	100.00%
All hospitals		Usage			Cost		
Rank	AR-DRG code	AR-DRG description	Frequency	Percent	AR-DRG cost	Unit cost	Percent
1st	O60Z	Vaginal delivery	35,710	35.32%	\$272.19	\$7622.20	40.54%
2nd	O66Z	Antenatal and other obstetric admission	31,394	31.05%	\$69.08	\$2200.53	10.29%
3rd	O01B	Cesarean delivery W severe CC	14,061	13.91%	\$156.05	\$11,097.95	23.24%
4th	O01A	Cesarean delivery W catastrophic CC	6651	6.58%	\$108.05	\$16,245.46	16.09%
5th	O64Z	False labour	3687	3.65%	\$7.35	\$1993.84	1.10%
6th	Z64A	Other factors influencing health status	2708	2.68%	\$17.76	\$6557.37	2.65%
7th	O61Z	Postpartum and postabortion W/O OR procedures	2539	2.51%	\$14.29	\$5629.66	2.13%
8th	O02B	Vaginal delivery W OR procedure W/O catastrophic or severe CC	1050	1.04%	\$9.39	\$8944.12	1.40%
9th	O02A	Vaginal delivery W OR procedure W catastrophic or severe CC	517	0.51%	\$6.45	\$12,478.23	0.96%
10th	Z64B	Other factors influencing health status, same day	400	0.40%	\$0.67	\$1682.97	0.10%
	Cumulative	—	98,717	97.65%	\$661.29	\$6698.82	98.49%
	Other	—	2379	2.35%	\$10.13	\$4258.35	1.51%
	Total	—	101,096	100.00%	\$671.42	\$6641.39	100.00%

Note: \$ are in a unit of million.

Abbreviations: \$, Australian Dollars; AR-DRG, Australian Refined Diagnosis-Related Groups; CC, complication and/or comorbidity; OR, Operating Room; W, with; W/O, without.

APPENDIX 5 (Continued)

		Inpatient services in all hospitals				Outpatient services								
Rank	AR-DRG code	AR-DRG description	Usage	Percent	AR-DRG cost	Unit cost	Percent	Frequency	Tier 2 code	Usage	Percent	Tier 2 cost	Unit cost	Percent
1st	Z64A	Other factors influencing health status	5869	22.05%	\$37.49	\$6388.50	29.02%	50,964	Midwifery and maternity	50,964	40.32%	\$10.47	\$205.52	35.27%
2nd	O66Z	Antenatal and other obstetric admission	1929	7.25%	\$4.18	\$2167.40	3.24%	10,041	Physiotherapy	10,041	7.94%	\$1.66	\$165.79	5.61%
3rd	O61Z	Postpartum and postabortion W/O OR procedures	1694	6.36%	\$9.01	\$5317.94	6.97%	9516	Community health services—Child and youth health	9516	7.53%	\$1.96	\$206.12	6.61%
4th	U60Z	Mental health treatment, same day, W/O ECT	1205	4.53%	\$0.42	\$350.16	0.33%	5774	Gynaecology	5774	4.57%	\$1.55	\$268.49	5.22%
5th	Z64B	Other factors influencing health status, same day	1187	4.46%	\$1.88	\$1586.26	1.46%	5074	Community health services—Maternal	5074	4.01%	\$1.05	\$207.64	3.55%
6th	O05Z	Abortion W OR procedure	1024	3.85%	\$1.54	\$1505.38	1.19%	3687	Obstetrics—Management Preg W/O Comp	3687	2.92%	\$0.83	\$226.45	2.81%
7th	O60Z	Vaginal delivery	609	2.29%	\$4.86	\$7985.83	3.76%	3138	Endocrinology	3138	2.48%	\$1.01	\$322.48	3.41%
8th	G66Z	Abdominal pain or mesenteric adenitis	572	2.15%	\$1.71	\$2985.66	1.32%	2740	General counselling	2740	2.17%	\$0.89	\$325.15	3.00%
9th	N62Z	Menstrual and other female reproductive system disorders	479	1.80%	\$1.36	\$2843.11	1.05%	2618	Social work	2618	2.07%	\$0.73	\$277.29	2.44%
10th	H08B	laparoscopic cholecystectomy W/O closed CDE W/O Cat or Sev CC	436	1.64%	\$3.38	\$7755.28	2.62%	2382	General surgery	2382	1.88%	\$0.66	\$276.83	2.22%
	Cumulative	—	15,004	56.36%	\$65.84	\$4388.45	50.96%	95,934	Cumulative	95,934	75.89%	\$20.83	\$217.10	70.13%
	Other	—	11,616	43.64%	\$63.36	\$5454.73	49.04%	30,475	Other	30,475	24.11%	\$8.87	\$291.07	29.87%
	Total	—	26,620	100.00%	\$129.21	\$4853.74	100.00%	126,409	Total	126,409	100.00%	\$29.70	\$234.93	100.00%
		Medicare services				ED services								
Rank	Item number	Contents of item number	Usage	Percent	Fee charged	Unit cost	Percent	Frequency	Principal diagnosis	Usage	Percent	URG cost	Unit cost	Percent
1st	23	A1—General practitioner attendances to which no other item applies, 2—Level B	277,265	18.69%	\$11.02	\$39.76	14.85%	727	Inflammatory disorders of breast	727	3.44%	\$0.56	\$773.68	3.51%
2nd	74,995	P13—Bulk-billing incentive	75,583	5.10%	\$0.27	\$3.54	0.36%	662	Other and unspecified abdominal pain	662	3.13%	\$0.55	\$828.51	3.42%

(Continues)

APPENDIX 5 (Continued)

Medicare services			ED services										
Rank	Item number	Contents of item number	Usage		Cost		Usage		Cost				
			Frequency	Percent	Fee charged	Unit cost	Percent	Principal diagnosis	Frequency	Percent	URG cost	Unit cost	Percent
3rd	73,928	P10—Patient episode initiation	73,610	4.96%	\$0.39	\$5.32	0.53%	Pain localised to other parts of lower abdomen	609	2.88%	\$0.48	\$788.22	2.99%
4th	36	A1—General practitioner attendances to which no other item applies, 3—Level C	67,887	4.58%	\$5.16	\$76.04	6.96%	Calculus of bile duct without cholangitis or chole	421	1.99%	\$0.35	\$835.38	2.19%
5th	10,991	M1—Management of bulk-billed services, where the service is provided at, or from, a practice location that is in a MMM1 area under the Modified Monash Model classification system	66,998	4.52%	\$0.65	\$9.77	0.88%	Threatened abortion	403	1.91%	\$0.29	\$713.28	1.79%
6th	10,990	M1—Management of bulk-billed services, where the service is provided at, or from, a practice location that is in a MMM2 area under the Modified Monash Model classification system	61,793	4.17%	\$0.40	\$6.46	0.54%	Acute abdomen	398	1.88%	\$0.35	\$870.52	2.16%
7th	16,500	T4—Obstetrics, antenatal attendance	40,025	2.70%	\$2.06	\$51.49	2.78%	Sprain and strain of other and unspecified parts o	384	1.82%	\$0.23	\$611.89	1.47%
8th	66,512	P2—Chemical, 5 or more tests described in item 66,500	31,888	2.15%	\$0.49	\$15.34	0.66%	Abnormal uterine and vaginal bleeding, unspecified	376	1.78%	\$0.31	\$818.28	1.92%
9th	66,596	P2—Chemical, iron studies	31,387	2.12%	\$0.90	\$28.76	1.22%	Urinary tract infection, site not specified	330	1.56%	\$0.23	\$689.88	1.42%
10th	65,070	P1—Haematology	31,267	2.11%	\$0.46	\$14.68	0.62%	Other gastroenteritis and colitis of infectious an	859	1.63%	\$0.26	\$804.38	1.65%
	Cumulative	—	757,703	51.08%	\$21.81	\$28.79	29.39%	Cumulative	4639	21.93%	\$3.61	\$778.51	22.52%
	Other	—	725,640	48.92%	\$52.40	\$72.22	70.61%	Other	16,513	78.07%	\$12.42	\$752.29	77.48%
	Total	—	1,483,343	100.00%	\$74.22	\$50.03	100.00%	Total	21,152	100.00%	\$16.03	\$758.04	100.00%

Note: \$ are in a unit of million.

Abbreviations: \$, Australian Dollars; AR-DRG, Australian Refined Diagnosis-Related Groups; Cat/Sev, catastrophic or severe; CC, complication and/or comorbidity; CDE, common duct exploration; ECT, electroconvulsion therapy; ED, Emergency Department; OR, Operating Room; URG, Urgency-Related Group; W, with; W/O, without.

APPENDIX 6

The 10 most common reasons and related costs for inpatient services accessed by babies at birth—all births in Queensland, Australia, 2017/18

		Public hospitals			Private hospitals		
		Usage			Cost		
Rank	AR-DRG code	AR-DRG description	Frequency	Percent	AR-DRG cost	Unit cost	Percent
1st	P67D	Neonate, AdmWt >2499 g W/O significant OR procedure W/O problem	32,545	71.93%	\$321.97	\$9892.93	57.74%
2nd	P67C	Neonate, AdmWt >2499 g W/O significant OR procedure W other problem	4576	10.11%	\$68.32	\$14,930.75	12.25%
3rd	P67B	Neonate, AdmWt >2499 g W/O significant OR procedure W major problem	1792	3.96%	\$29.98	\$16,731.36	5.38%
4th	P66D	Neonate, AdmWt 2000–2499 g W/O significant OR procedure W/O problem	847	1.87%	\$5.93	\$6996.53	1.06%
5th	P66C	Neonate, AdmWt 2000–2499 g W/O significant OR procedure W other problem	787	1.74%	\$10.32	\$13,116.39	1.85%
6th	P60A	Neonate, died or transferred <5 days of Adm, W/O significant OR Proc, newborn	629	1.39%	\$5.03	\$7990.63	0.90%
7th	P60B	Neonate, died or transferred <5 days of Adm, W/O significant OR Proc, not newborn	350	0.77%	\$1.50	\$4278.85	0.27%
8th	P67A	Neonate, AdmWt >2499 g W/O significant OR procedure W multimajor problems	343	0.76%	\$9.09	\$26,514.97	1.63%
9th	P66B	Neonate, AdmWt 2000–2499 g W/O significant OR procedure W major problem	268	0.59%	\$5.07	\$18,904.99	0.91%
10th	P65C	Neonate, AdmWt 1500–1999 g W/O significant OR procedure W other problem	214	0.47%	\$8.19	\$38,265.46	1.47%
	Cumulative	—	42,351	93.61%	\$465.39	\$10,988.96	83.46%
	Other	—	2892	6.39%	\$92.24	\$31,896.42	16.54%
	Total	—	45,243	100.00%	\$557.64	\$12,325.39	100.00%
		Usage			Cost		
Rank	AR-DRG code	AR-DRG description	Frequency	Percent	AR-DRG cost	Unit cost	Percent
1st	P67D	Neonate, AdmWt >2499 g W/O significant OR procedure W/O problem	16,595	78.86%	\$50.65	\$3052.40	56.52%
2nd	P67C	Neonate, AdmWt >2499 g W/O significant OR procedure W other problem	1928	9.16%	\$13.29	\$6891.30	14.82%
3rd	P67B	Neonate, AdmWt >2499 g W/O significant OR procedure W Major Problem	568	2.70%	\$4.56	\$8021.60	5.08%
4th	P66C	Neonate, AdmWt 2000–2499 g W/O significant OR procedure W other problem	417	1.98%	\$4.02	\$9630.17	4.48%
5th	P66D	Neonate, AdmWt 2000–2499 g W/O significant OR procedure W/O problem	320	1.52%	\$1.33	\$4141.98	1.48%
6th	P60A	Neonate, died or transferred <5 days of Adm, W/O significant OR Proc, newborn	186	0.88%	\$0.44	\$2372.07	0.49%
7th	P67A	Neonate, AdmWt >2499 g W/O significant OR procedure W multimajor problems	175	0.83%	\$1.96	\$11,197.74	2.19%
8th	P60B	Neonate, died or transferred <5 days of Adm, W/O significant OR Proc, not newborn	138	0.66%	\$0.08	\$580.78	0.09%
9th	P66B	Neonate, AdmWt 2000–2499 g W/O significant OR procedure W major problem	128	0.61%	\$1.73	\$13,488.92	1.93%
10th	P65B	Neonate, AdmWt 1500–1999 g W/O significant OR procedure W major problem	67	0.32%	\$1.41	\$20,978.83	1.57%

(Continues)

APPENDIX 6 (Continued)

Private hospitals							
Rank	AR-DRG code	AR-DRG description	Usage		Cost		
			Frequency	Percent	AR-DRG cost	Unit cost	Percent
	Cumulative	—	20,522	97.52%	\$79.45	\$3871.53	88.65%
	Other	—	521	2.48%	\$10.18	\$19,532.96	11.36%
	Total	—	21,043	100.00%	\$89.63	\$4259.29	100.00%
All hospitals							
Rank	AR-DRG code	AR-DRG description	Usage		Cost		
			Frequency	Percent	AR-DRG cost	Unit cost	Percent
1st	P67D	Neonate, AdmWt > 2499 g W/O significant OR procedure W/O problem	49,140	74.13%	\$372.62	\$7582.82	57.57%
2nd	P67C	Neonate, AdmWt > 2499 g W/O significant OR procedure W other problem	6504	9.81%	\$81.61	\$12,547.59	12.61%
3rd	P67B	Neonate, AdmWt > 2499 g W/O significant OR procedure W major problem	2360	3.56%	\$34.54	\$14,635.12	5.34%
4th	P66C	Neonate, AdmWt 2000–2499 g W/O significant OR procedure W other problem	1204	1.82%	\$14.34	\$11,908.95	2.22%
5th	P66D	Neonate, AdmWt 2000–2499 g W/O significant OR procedure W/O problem	1167	1.76%	\$7.25	\$6213.79	1.12%
6th	P60A	Neonate, died or transferred < 5 days of Adm, W/O significant OR Proc, newborn	815	1.23%	\$5.47	\$6708.36	0.85%
7th	P67A	Neonate, AdmWt > 2499 g W/O significant OR procedure W multimajor problems	518	0.78%	\$11.05	\$21,340.23	1.71%
8th	P60B	Neonate, died or transferred < 5 days of Adm, W/O significant OR Proc, not newborn	488	0.74%	\$1.58	\$3233.08	0.24%
9th	P66B	Neonate, AdmWt 2000–2499 g W/O significant OR procedure W major problem	396	0.60%	\$6.79	\$17,154.34	1.05%
10th	P65B	Neonate, AdmWt 1500–1999 g W/O significant OR procedure W major problem	281	0.42%	\$9.59	\$34,143.74	1.48%
	Cumulative	—	62,873	94.85%	\$544.85	\$8665.80	84.18%
	Other	—	3413	5.15%	\$102.42	\$30,009.12	15.82%
	Total	—	66,286	100.00%	\$628.80	\$9486.20	100.00%

Note: \$ are in a unit of million.

Abbreviations: \$, Australian Dollars; Adm, admitted; AdmWt, admission weight; AR-DRG, Australian Refined Diagnosis-Related Groups; Multi, multiple; OR, Operating Room; Proc, procedures; Transf, transfer; W/O, without; W, with.

APPENDIX 7

The 10 most common reasons and related costs for services accessed by babies during 12-month postbirth—all births in Queensland, Australia, 2017/18.

Inpatient services in public hospitals										Inpatient services in private hospitals									
Rank	AR-DRG code	AR-DRG description	Usage			Cost			AR-DRG code	Percent	Unit cost	AR-DRG code	AR-DRG description	Usage			Cost		
			Frequency	Percent	Unit cost	AR-DRG code	Percent	Unit cost						Frequency	Percent	Unit cost			
1st	E70B	Whooping cough and acute bronchiolitis W/O CC	2394	14.36%	\$5.59	\$2336.40	4.98%	Z61A	Signs and symptoms	553	27.38%	\$2.42	\$4377.31	33.80%					
2nd	D63Z	Otitis media and URI	1625	9.75%	\$7.39	\$4550.70	6.58%	Z64B	Other factors influencing health status, same day	154	7.62%	\$0.10	\$629.12	1.35%					
3rd	G67B	Oesophagitis and gastroenteritis W/O Cat/Sev CC	1313	7.87%	\$1.91	\$1455.43	1.70%	E70B	Whooping cough and acute bronchiolitis W/O CC	115	5.69%	\$0.35	\$3072.93	4.94%					
4th	T63Z	Viral illness	992	5.95%	\$6.38	\$6430.68	5.68%	E72Z	Respiratory problems arising from neonatal period	100	4.95%	\$0.20	\$2014.52	2.81%					
5th	U65Z	Anxiety disorders	602	3.61%	\$11.43	\$18,984.59	10.17%	D13Z	Myringotomy W tube insertion	96	4.75%	\$0.13	\$1333.99	1.79%					
6th	Z64A	Other factors influencing health status	574	3.44%	\$2.83	\$4933.16	2.52%	D63Z	Otitis media and URI	74	3.66%	\$0.29	\$3875.12	4.01%					
7th	B80Z	Other head injury	542	3.25%	\$2.51	\$4640.12	2.24%	G67B	Oesophagitis and gastroenteritis W/O Cat/Sev CC	54	2.67%	\$0.14	\$2681.38	2.02%					
8th	L63B	Kidney and urinary tract infections W/O catastrophic or severe CC	516	3.09%	\$1.26	\$2443.57	1.12%	M03Z	Penis procedures	54	2.67%	\$0.29	\$5298.58	4.00%					
9th	Z64B	Other factors influencing health status, same day	449	2.69%	\$0.61	\$1366.84	0.55%	M04Z	Testes procedures	54	2.67%	\$0.12	\$2258.71	1.70%					
10th	G70B	Other digestive system diagnoses W/O catastrophic or severe CC	412	2.47%	\$1.89	\$4578.54	1.68%	K62B	Miscellaneous metabolic disorders W/O catastrophic or severe CC	45	2.23%	\$0.18	\$3892.40	2.45%					
Cumulative	—	—	9419	56.49%	\$41.81	\$4439.40	37.22%	Cumulative	—	1299	64.31%	\$4.22	\$3244.99	58.87%					
Other	—	—	7256	43.51%	\$70.53	\$9720.40	62.78%	Other	—	721	35.69%	\$2.95	\$4085.47	41.14%					
Total	—	—	16,675	100.00%	\$112.35	\$6737.39	100.00%	Total	—	2020	100.00%	\$7.16	\$3544.99	100.00%					

(Continues)

APPENDIX 7 (Continued)

Inpatient services in all hospitals										Outpatient services						
Rank	AR-DRG code	AR-DRG description	Usage	Frequency	Percent	AR-DRG cost	Unit cost	Percent	Tier 2 code	Tier 2 cost	Usage	Frequency	Percent	Tier 2 cost	Unit cost	Percent
1st	E70B	Whooping cough and acute bronchiolitis W/O CC	2509	13.42%	4.98%	\$5.95	\$2370.16	4.98%	Community health services—Child and youth health	\$15.72	76,178	27.60%	\$15.72	\$206.41	24.28%	
2nd	D63Z	Otitis media and URI	1699	9.09%	6.43%	\$7.68	\$4521.28	6.43%	Midwifery and maternity	\$15.39	73,834	26.75%	\$15.39	\$208.45	23.77%	
3rd	G67B	Oesophagitis and gastroenteritis W/O Cat/Sev CC	1367	7.31%	1.72%	\$2.06	\$1503.86	1.72%	Paediatrics	\$5.16	21,503	7.79%	\$5.16	\$240.15	7.97%	
4th	T63Z	Viral illness	1032	5.52%	5.48%	\$6.54	\$6341.22	5.48%	Community health services—maternal health	\$4.03	19,385	7.02%	\$4.03	\$207.87	6.22%	
5th	Z61A	Signs and symptoms	624	3.34%	2.46%	\$2.94	\$4711.53	2.46%	Paediatric medicine	\$6.39	16,806	6.09%	\$6.39	\$380.02	9.86%	
6th	Z64A	Other factors influencing health status	618	3.31%	2.49%	\$2.98	\$4814.57	2.49%	Physiotherapy	\$1.64	9884	3.58%	\$1.64	\$165.65	2.53%	
7th	Z64B	Other factors influencing health status, same day	603	3.23%	0.60%	\$0.71	\$1178.43	0.60%	Primary health care	\$1.56	9344	3.39%	\$1.56	\$166.87	2.41%	
8th	U65Z	Anxiety disorders	602	3.22%	9.56%	\$11.43	\$18,984.59	9.56%	Audiology	\$2.25	7972	2.89%	\$2.25	\$282.06	3.47%	
9th	L63B	Kidney and urinary tract infections W/O catastrophic or severe CC	544	2.91%	1.15%	\$1.37	\$2526.24	1.15%	Nutrition/dietetics	\$0.99	3911	1.42%	\$0.99	\$252.23	1.52%	
10th	B80Z	Other head injury	543	2.90%	2.11%	\$2.52	\$4642.39	2.11%	Speech pathology	\$0.87	3366	1.22%	\$0.87	\$259.51	1.35%	
	Cumulative	—	10,141	54.24%	36.97%	\$44.18	\$4356.38	36.97%	Cumulative	\$54.00	242,183	87.75%	\$54.00	\$222.97	83.39%	
	Other	—	8554	45.76%	63.03%	\$75.33	\$8806.26	63.03%	Other	\$10.76	33,815	12.25%	\$10.76	\$318.12	16.61%	
	Total	—	18,695	100.00%	100.00%	\$119.51	\$6392.45	100.00%	Total	\$64.76	275,998	100.00%	\$64.76	\$234.63	100.00%	
Medicare services										ED services						
Rank	Item number	Contents of item number	Usage	Frequency	Percent	Fee charged	Unit cost	Percent	Principal diagnosis	URG cost	Usage	Frequency	Percent	URG cost	Unit cost	Percent
1st	23	A1—General practitioner attendances to which no other item applies, 2—Level B	419,463	28.21%	30.74%	\$16.34	\$38.96	30.74%	Viral infection, unspecified	\$4.70	6341	11.03%	\$4.70	\$741.54	9.85%	
2nd	10,990	M1—Management of bulk-billed services, where the service is provided at, or from a practice location that is in a MMM 2 area under the Modified Monash Model classification system	314,375	21.14%	3.84%	\$2.04	\$6.49	3.84%	Acute bronchiolitis, unspecified	\$6.04	5976	10.40%	\$6.04	\$1010.49	12.65%	

APPENDIX 7 (Continued)

Medicare services				ED services								
Rank	Item number	Contents of item number	Usage		Cost		Usage		Cost			
			Frequency	Percent	Fee charged	Unit cost	Percent	Frequency	Percent	URG cost	Unit cost	
3rd	10,991	M1—Management of bulk-billed services, where the service is provided at, or from, a practice location that is in a MMM1 area under the Modified Monash Model classification system	249,544	16.78%	\$2.44	\$9.79	4.60%	5865	10.21%	\$4.37	\$744.81	9.15%
4th	36	A1—General practitioner attendances to which no other item applies, 3—Level C	108,099	7.27%	\$8.14	\$75.31	15.32%	2559	4.45%	\$2.57	\$1004.98	5.39%
5th	116	A4—Consultant physician attendances to which no other item applies	65,055	4.37%	\$4.92	\$75.65	9.26%	2027	3.53%	\$2.01	\$990.90	4.21%
6th	5020	A22—General practitioner after-hour attendances to which no other item applies, 2—Level B	25,799	1.74%	\$1.31	\$50.91	2.47%	2009	3.50%	\$1.66	\$827.41	3.48%
7th	110	A4—Consultant physician attendances to which no other item applies	20,936	1.41%	\$3.49	\$166.70	6.57%	1606	2.79%	\$1.31	\$816.27	2.75%
8th	73,938	P10—Patient episode initiation	17,465	1.17%	\$0.13	\$7.41	0.24%	1491	2.59%	\$1.12	\$754.11	2.35%
9th	69,496	P3—Microbiology	15,056	1.01%	\$0.57	\$37.76	1.07%	1430	2.49%	\$1.18	\$822.49	2.46%
10th	74,995	P13—Bulk-billing incentive	14,102	0.95%	\$0.05	\$3.53	0.09%	1207	2.10%	\$0.88	\$752.51	1.85%
	Cumulative	—	1,249,894	84.06%	\$39.44	\$31.55	74.20%	30,511	53.09%	\$25.85	\$847.15	54.12%
	Other	—	237,095	15.94%	\$13.71	\$57.83	25.80%	26,955	46.91%	\$21.91	\$812.84	45.88%
	Total	—	1,486,989	100.00%	\$53.15	\$35.74	100.00%	57,466	100.00%	\$47.76	\$831.06	100.00%

Note: \$ are in a unit of million. Grey shading means the total costs for each type of service.

Abbreviations: \$, Australian Dollars; AR-DRG, Australian Refined Diagnosis-Related Groups; Cat/Sev, catastrophic or severe; CC, complication and/or comorbidity; ECT, electroconvulsion therapy; ED, Emergency Department; OR, Operating Room; URG, Urgency-Related Group; URL, upper respiratory tract infection; W/O, without.