## Rates of pelvic inflammatory disease and ectopic pregnancy in Australia, 2009 to 2014: ecological analysis of hospital data

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**Supplementary online material.  Supplementary material for Sex Transm Infect**

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**METHODS**

A description of data sources and diagnosis codes used to identify primary diagnoses of pelvic inflammatory disease (PID) and ectopic pregnancy (EP) is provided in supplementary tables 1 and 2 and described below.

**Data sources for hospital admissions and emergency department presentations of PID and EP**

We obtained line-listed data about admissions to hospital and attendances at emergency departments (EDs) for 15 to 44 year old female patients with a principal diagnosis of PID or EP from separate registers from state Departments of Health in the Australian states of New South Wales, Victoria and Queensland.

Hospital admitted data systems collect data for day cases and overnight hospitalisations from all public (government funded) and private hospitals in the state. Diagnoses codes for episodes of patient care assigned are assigned by trained coders following discharge. In 2014, data systems about hospital admissions for the three states included data for 998 hospitals.1 2

ED information systems collect data about emergency presentations to public hospitals with a designated ED that include major metropolitan and non-metropolitan EDs and represented an estimated 88% of ED occasions of service in 2014.3 4 Notably, the number of EDs included in ED information systems has increased over time, contribution of data by hospitals to ED systems is voluntary, and diagnosis codes are assigned by clinicians rather than medical record coders. Therefore, the number and breakdown of hospitals contributing data annually varies and data completeness varies between hospitals. In the three states, the number of hospitals contributing data about ED attendances increased from 151 (during July 2010 to June 2011) to 247 (during July 2013 to June 2014). The increase in the number of hospitals reporting ED attendance data during the study period was mostly due to an increase in reporting for small non-principal hospitals.4 To maximise comparability over time, ED records were only included if they arose from EDs that annually contributed data during 2009-2014, if there was <50% variability in the annual number of presentations, and >75% records had a principal diagnosis coded. For this study, ED data were included for 145 hospitals (metropolitan n=75, inner-regional n=49, outer-regional/remote n=21).

Each patient record included a principal diagnosis for the main reason for admission or emergency presentation and ‘other’ diagnoses for additional diagnoses made coded using the International Classification of Diseases (ICD10-AM) or for some EDs, ICD9-CM or Systematized Nomenclature of Medicine (SNOMED).4-6 The number of other diagnosis codes available varied between jurisdictions. We excluded records with an ‘other’ PID or EP diagnosis because they might represent pre-existing conditions. Admissions or ED presentations with a principal diagnosis ICD10-AM (or concordant ICD9-CM or SNOMED) of: i) N70.0, N70.1, N70.9, N71.0, N71.1, N71.9, N73.0, N73.1, N73.2, N73.3, N73.4, N73.5, N73.8, N73.9, A56.1, N74.4, A54.2, N74.3, were classified as PID; or, ii) O00.1, O00.2, O00.8, O00.9 as EP. PID admissions were further categorised as CT-or-NG-related PID (chlamydial PID (N74.4 + A56.1) or gonococcal PID (N74.3 + A54.2), *acute PID* [N70.0, N71.0, N73.0), *unspecified PID* (N70.9, N71.9, N73.2, N73.5, N73.8, N73.9), or, *chronic PID* (N70.1, N71.1, N73.1, N73.4).

**Data sources for population and live birth denominators**

Population denominator data were obtained at residential postcode level and included estimated residential population by year and age,7 remoteness,8 and level of socio-economic disadvantage based on the index of relative socio-economic disadvantage9 of residential postcode. As in another Australian study, we obtained the number of live births for the three states by maternal age and year (2009-2014), these data were not at postcode level.10 Other pregnancy outcome data (e.g. stillbirths, abortion) are not routinely available so we could not construct a denominator of all conceptions.

**Sensitivity analyses**

Two sensitivity analyses were undertaken to examine the robustness of our results. The first used linear splines to model the association for changes in PID and EP rates over time with knots specified at two year intervals, rather than assuming a linear relationship. The second repeated our univariable and multivariable analysis of PID and EP population rates by year, omitting postcodes recoded to neighbouring postcodes.

**RESULTS**

We show the annual number of diagnoses of PID and EP by diagnosis code in hospital admissions and ED presentations in supplementary table 2 and PID and EP rates per 100 000 women with 95% confidence intervals are shown in supplementary table 3.

Results for the linear splines sensitivity analysis are shown in supplementary table 4. The rate of change for population rates of PID and EP did not alter during the overall study period. The rate of change for EP rates among births in EDs during 2011 to 2012 was higher than the rate of change during 2009 to 2010.

Supplementary table 1: Data sources and description

|  |  |  |  |
| --- | --- | --- | --- |
| **Datatype** | **Source**  | **Coverage** | **Description** |
| Hospital admission  | * Victorian Admitted Episodes Dataset
* NSW Admitted Patient Data Collection
* Queensland Hospital Admitted Patient Data Collection
 | All **public** and **private** hospitals in the Australian states of Victoria, NSW and Queensland are required to report the principal cause of hospitalisation (and other diagnoses) for each admitted episode of care ending in discharge, transfer or death.Number of hospitals providing admissions data (2009-14)* 2009: N=973 [public (n=533), private (n=440)]
* 2014: N=998 [public (n=532), private (n=466)]
 | * Line listed de-identified demographic, clinical and administrative data for all admitted episodes of patient care
* Core data items: age-group, year, patient residential postcode, principal diagnosis code *(ICD10-AM*), other diagnoses code/s (number varied between jurisdictions)
* Diagnoses coded by clinical coders.
 |
| Emergency department | * Victorian Emergency Minimum Dataset
* NSW Emergency Department Data Collection
* Queensland Emergency Department Information system
 | * **Public hospitals** with a designated emergency department.
* Data inclusion limited to hospitals during 2009-2014:
1. providing data annually
2. with <50% variation in the number of ED presentations
3. > 75% completeness of diagnosis codes OR
4. >10000 annual presentations & <75% completeness.

Number of hospitals providing data to emergency datasets (2009-14)  | * Line listed de-identified demographic, clinical and administrative data for emergency department presentations.
* Core data items: age-group, year, patient residential postcode, principal diagnosis code (*ICD10-AM, ICD9-CM, SNOMED*), departure status (admitted, care complete in emergency)
* Diagnoses coded by clinicians.
* Other diagnosis code not provided by all jurisdictions.
 |
|  | 2010-11n | 2013-14n |
| Hospitals reporting data Hospitals excluded **Total hospitals included:** | 1516**145** | 247102 **145** |
| Population denominator  | Australian Bureau of Statistics  | * Estimated residential population (2009-14)
* Australian Statistical Geography Standard area classification
* IRSD: a summary measure of variables derived from the Australian census indicating relative disadvantage of an area (e.g. proportion of low income households, persons unemployed, disability, manual laborers, low education, single parent families)
 | * Number of residents by postcode, age, year
* Remoteness of residential postcode: metropolitan, inner-regional, outer-regional or remote
* Deciles of relative disadvantage of postal area for Australia
 |
| Birth denominator | Australian Bureau of Statistics | * Number of live births (2009-14)
 | * Number of live births by maternal age, year for the states of Victoria, NSW, Queensland
 |
| **Abbreviations:** NSW: New South Wales; ICD10-AM: International Classification of Diseases, 10th Revision Australian Modification; ID9-CM: International Classification of Diseases, 9th Revision; SNOMED: Systematized Nomenclature of Medicine; IRSD: Index of Relative Socioeconomic Disadvantage |

Supplementary table 2: Number of principal diagnoses of pelvic inflammatory disease and ectopic pregnancy by diagnosis code and year in: (A) public and private hospital admissions, and, (B) presentations to public hospital emergency departments that were included in the study (n=145)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1. **PUBLIC and PRIVATE HOSPITAL ADMISSIONs**
 | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **Total** |
| **ICD-10 code and description** | **n (%)** | **n (%)** | **n (%)** | **n (%)** | **n (%)** | **n (%)** | **n (%)** |
| **Pelvic inflammatory disease** |  |  |  |  |  |  |  |
| **N70** | **Salpingitis and oophoritis** |  |  |  |  |  |  |  |
| N70.0 | Acute salpingitis and oophoritis | 25 (1.2) | 39 (1.7) | 45 (1.8) | 47 (1.9) | 43 (1.7) | 40 (1.7) | 239 (1.7) |
| N70.1 | Chronic salpingitis and oophoritis | 358 (16.7) | 334 (14.4) | 365 (14.5) | 347 (14.3) | 394 (15.8) | 326 (13.7) | 2,124 (14.9) |
| N70.9 | Salpingitis and oophoritis, unspecified | 155 (7.2) | 177 (7.7) | 190 (7.6) | 183 (7.5) | 172 (6.9) | 172 (7.2) | 1,049 (7.4) |
| **N71** | **Inflammatory disease of uterus, except cervix** |  |  |  |  |  |  |  |
| N71.0 | Acute inflammatory disease of uterus | 28 (1.3) | 33 (1.4) | 23 (0.9) | 18 (0.7) | 25 (1.0) | 34 (1.4) | 161 (1.1) |
| N71.1 | Chronic inflammatory disease of uterus | 161 (7.5) | 156 (6.7) | 135 (5.4) | 138 (5.7) | 151 (6.0) | 139 (5.9) | 880 (6.2) |
| N71.9 | Inflammatory disease of uterus, unspecified | 217 (10.1) | 211 (9.1) | 256 (10.2) | 234 (9.6) | 257(10.3) | 231 (9.7) | 1,406 (9.9) |
| **N73** | **Other female pelvic inflammatory diseases** |  |  |  |  |  |  |  |
| N73.0 | Acute parametritis and pelvic cellulitis | 62 (2.9) | 61 (2.6) | 101 (4.0) | 80 (3.3) | 78 (3.1) | 72 (3.0) | 454 (3.2) |
| N73.1 | Chronic parametritis and pelvic cellulitis | 36 (1.7) | 42 (1.8) | 35 (1.4) | 37 (1.5) | 33 (1.3) | 24 (1.0) | 207 (1.5) |
| N73.2 | Unspecified parametritis and pelvic cellulitis | 1 (0.1) | 1 (0.0) | 3 (0.1) | 2 (0.1) | 3 (0.1) | 0 (0.0) | 10 (0.1) |
| N73.3 | Female acute pelvic peritonitis | 9 (0.4) | 7 (0.3) | 7 (0.3) | 6 (0.3) | 6 (0.2) | 6 (0.3) | 41 (0.3) |
| N73.4 | Female chronic pelvic peritonitis | 2 (0.1) | 3 (0.1) | 2 (0.1) | 1 (0.0) | 2 (0.1) | 0 (0.0)  | 10 (0.1) |
| N73.5 | Female pelvic peritonitis, unspecified | 9 (0.4) | 21 (0.9) | 14 (0.6) | 12 (0.5) | 8 (0.3) | 8 (0.3) | 72 (0.5) |
| N73.8 | Other specified female pelvic inflammatory diseases | 18 (0.8) | 24 (1.0) | 20 (0.8) | 18 (0.7) | 21 (0.8) | 21 (0.9) | 122 (0.9) |
| N73.9 | Female pelvic inflammatory disease, unspecified | 979 (45.7) | 1,079 (46.6) | 1,191 (47.5) | 1,165 (48.0) | 1,152 (46.0) | 1,160 (48.8) | 6,726 (47.1) |
| N74.3 | Female gonococcal PID (A54.2 +) | 2 (0.1) | 0 (0.0) | 1 (0.0) | 5 (0.2) | 1 (0.0) | 1 (0.0) | 10 (0.1) |
| N74.4  | Female chlamydial PID (A56.1 +) | 79 (3.7) | 126 (5.5) | 122 (4.9) | 136 (5.6) | 156 (6.2) | 141(5.9) | 760 (5.3) |
|  | **Total PID cases in admissions** | **2,141 (100)** | **2,314 (100)** | **2,510 (100)** | **2,429 (100)** | **2,502 (100)** | **2,375 (100)** | **14,271 (100)** |
| **Ectopic pregnancy** |  |  |  |  |  |  |  |
| **O00** | **Ectopic pregnancy** |  |  |  |  |  |  |  |
| O00.0 | Abdominal pregnancy | 8 (0.2) | 16 (0.4) | 15 (0.4) | 23 (0.6) | 21 (0.5) | 19 (0.5) | 102 (0.4) |
| O00.1 | Tubal pregnancy | 2,708 (70.0) | 2,693 (71.5) | 2,773 (69.7) | 2,692 (70.1) | 2,796 (68.7) | 2,809 (69.4) | 16,471 (69.9) |
| O00.2 | Ovarian pregnancy | 88 (2.3) | 70 (1.9) | 99 (2.5) | 71 (1.9) | 110 (2.7) | 87 (2.2) | 525 (2.2) |
| O00.8 | Other ectopic pregnancy | 227 (5.9) | 230 (6.1) | 219 (5.5) | 239 (6.2) | 266 (6.5) | 262 (6.5) | 1,443 (6.1) |
| O00.9 | Ectopic pregnancy, unspecified | 839 (21.7) | 759 (20.1) | 875 (22.0) | 816 (21.2) | 879 (21.6) | 870 (21.5) | 5,038 (21.4) |
|  | **Total ectopic pregnancy cases in admissions** | **3,870 (100)** | **3,768 (100)** | **3,981 (100)** | **3,841 (100)** | **4,072 (100)** | **4,047 (100)** | **23,579 (100)** |
| 1. **EMERGENCY DEPARTMENT PRESENTATIONS**
 |  |  |  |  |  |  |  |
| **Pelvic inflammatory disease\*** |  |  |  |  |  |  |  |
| **N70** | **Salpingitis and oophoritis** |  |  |  |  |  |  |  |
| N70.0 | Acute salpingitis and oophoritis  | 1 (0.0) | 2 (0.1) | 0 (0.0) | 0 (0.0) | 1 (0.0) | 1 (0.0) | 5 (0.0) |
| N70.9 | Salpingitis and oophoritis, unspecified  | 3 (0.1) | 1 (0.0) | 1 (0.0) | 1 (0.0) | 0 (0.0) | 0 (0.0) | 6 (0.0) |
| **N71** | **Inflammatory disease of uterus, except cervix** |  |  |  |  |  |  |  |
| N71.0 | Acute inflammatory disease of uterus | 111 (4.3) | 134 (4.5) | 193 (5.6) | 236 (6.1) | 224 (5.5) | 190 (5.2) | 1088 (5.3) |
| N71.1 | Chronic inflammatory disease of uterus  | 1 (0.0) | 14 (0.5) | 15 (0.4) | 11 (0.3) | 0 (0.0) | 0 (0.0 | 41 (0.2) |
| N71.9 | Inflammatory disease of uterus, unspecified  | 585 (22.8) | 680 (22.9) | 951 (27.6) | 1178 (30.7) | 1285 (31.6) | 1304 (35.8) | 5983 (29.2) |
| **N73** | **Other female pelvic inflammatory diseases** |  |  |  |  |  |  |  |
| N73.0 | Acute parametritis and pelvic cellulitis  | 47 (1.8) | 33 (1.1) | 23 (0.7) | 8 (0.2) | 12 (0.3) | 7 (0.2) | 130 (0.6) |
| N73.9 | Female pelvic inflammatory disease, unspecified | 1,814 (70.7) | 2,097 (70.6) | 2,248(65.4) | 2,401 (62.6) | 2,545 (62.6) | 2,140 (58.8) | 13245 (64.5) |
| N74.4 | Female chlamydial PID (A56.1+) | 4 (0.2) | 10 (0.3) | 7 (0.2) | 3 (0.1) | 0 (0.0) | 0 (0.0) | 24 (0.1) |
|  | **Total PID cases in emergency** | **2566 (100)** | **2971 (100)** | **3438 (100)** | **3838 (100)** | **4067 (100)** | **3642 (100)** | **20522 (100)** |
| **Ectopic pregnancy**† |  |  |  |  |  |  |  |
| O00 | Ectopic pregnancy |  |  |  |  |  |  |  |
| O00.1 | Tubal pregnancy | 488 (16.4) | 481 (16.9) | 497 (16.6) | 517 (15.2) | 480 (13.5) | 484 (13.3) | 2947 (15.2) |
| O00.8  | Other ectopic pregnancy | 55 (1.8) | 66 (2.3) | 85 (2.8) | 60 (1.8) | 14 (0.4) | 7 (0.2) | 287 (1.5) |
| O00.9 | Ectopic pregnancy, unspecified | 2,431 (81.7) | 2,293 (80.7) | 2,414 (80.6) | 2,817 (83.0) | 3,055 (86.1) | 3,138 (86.5) | 16148 (83.3) |
|  | **Total ectopic pregnancy cases in emergency** | **2974 (100)**  | **2840 (100)**  | **2996 (100)** | **3394 (100)** | **3549 (100)** | **3629 (100)** | **19382 (100)** |
| **\* Concordant ICD10, ICD9, SNOMED codes for pelvic inflammatory disease:** N70.0 (614.0, 155969007); N70.1 (614.1, 155970008); N70.9 (614.2, 155971007, 155968004); N71.0 (615.0, 12308003, 15597200, 237037006); N71.1 (615.1, 155974004, 237044002); N71.9 (615.9; N73.0: 614.3); N73.1 (614.4; N73.8: 614.8); N73.9 (614.9, 139049001, 155967009, 155986001, 161793004, 198130006); N74.4 (188463006, 198176005, 237043008, 237084006, 189312004, 367504009). There were no emergency PID cases with N70.1, N73.1, N73.2, N73.3, N73.4, N73.5, N73.8, N74.3 ICD10 codes. |
| †**Concordant ICD10, ICD9, SNOMED codes for ectopic pregnancy:** O00.1 ( 633.1, 370382007, 387615001, 387617009, 149989008, 149990004, 156082006); O00.2 (633.2, 149988000); O00.8 ( 633.8, 172001, 14721006, 17433009, 8670900, 88144003); O00.9 (633.9, 139019003, 34801009, 15608003, 156083001, 82688001). There were no emergency ectopic pregnancy cases with O00.1, O00.2 codes. |

Supplementary table 3: Annual PID and EP rates per 100 000 women aged 15 to 44 years, 2009 to 2014

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** |
|  |  | Rate (95% CI) | Rate (95% CI) | Rate (95% CI) | Rate (95% CI) | Rate (95% CI) | Rate (95% CI) |
| **Pelvic inflammatory disease** |  |  |  |  |  |  |
| Hospital admission rates | Total  | 60.6 (58.0-63.2) | 64.7 (62.1-67.4) | 69.5 (66.8-72.3) | 66.4 (63.8-69.1) | 67.5 (64.9-70.2) | 63.3 (60.8-65.9) |
| Admitted from ED | 34.9 (33.0-36.9) | 39.2 (37.1-41.3) | 43.9 (41.8-46.1) | 43.0 (40.9-45.2) | 45.0 (42.9-47.2) | 43.0 (40.9-45.1) |
|  |  |  |  |  |  |  |  |
| ED presentation rates | Total | 72.6 (69.8-75.5) | 83.0 (80.1-86.1) | 95.2 (92.1-98.4) | 104.9 (101.6-108.2) | 109.7 (106.3-113.1) | 97.0 (93.9-100.2) |
| Admitted to hospital | 21.1 (19.6-22.7) | 23.4 (21.8-25.0) | 29.2 (27.5-31.0) | 32.0 (30.2-33.9) | 37.1 (35.1-39.1) | 34.6 (32.7-36.5) |
| Discharged from ED | 51.5 (49.2-53.9) | 59.6 (57.1-62.2) | 66.0 (63.4-68.7) | 72.8 (70.1-75.7) | 72.6 (70.0-75.4) | 62.4 (59.9-65.0) |
| **Ectopic pregnancy**  |  |  |  |  |  |  |
| Hospital admission rates | Total  | 109.5 (106.1-113.0) | 105.3 (102.0-108.7) | 110.2 (106.9-113.7) | 105.0 (101.7-108.3) | 109.8 (106.5-113.2) | 107.8 (104.5-111.2) |
| Admitted from ED | 77.7 (74.8-80.6) | 73.9 (71.1-76.8) | 77.5 (74.6-80.4) | 76.9 (74.1-79.8) | 80.6 (77.7-83.5) | 79.5 (76.7-82.4) |
|  |  |  |  |  |  |  |  |
| ED presentation rates | Total | 84.1 (81.1-87.2) | 79.4 (76.5-82.3) | 83.0 (80.0-86.0) | 92.7 (89.6-95.9) | 95.7 (92.6-98.9) | 96.7 (93.6-99.9) |
| Admitted to hospital | 65.8 (63.1-68.5) | 62.4 (59.8-65.0) | 65.5 (62.9-68.2) | 72.6 (69.9-75.4) | 75.5 (72.7-78.4) | 74.2 (71.5-77.0) |
| Discharged from ED | 18.4 (17.0-19.8) | 17.0 (15.6-18.4) | 17.5 (16.1-18.9) | 20.1 (18.7-21.7) | 20.2 (18.9-21.7) | 22.5 (21.0-24.1) |
| Abbreviations: 95% CI, 95% confidence interval; ED, emergency department.  |

Supplementary table 4: Rate of change by time-period for hospital admission and emergency department presentation rates of pelvic inflammatory disease and ectopic pregnancy

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Pelvic inflammatory disease** | **Ectopic Pregnancy – population rates** | **Ectopic Pregnancy – live birth rates** |
|  | All admissions | All-ED | Non-admitted ED | All admissions | All-ED | Non-admitted ED | All admissions | All-ED | Non-admitted ED |
|  | Coef**\***  (95% CI) | Coef (95% CI) | Coef (95% CI) | Coef (95% CI) | Coef (95% CI) | Coef (95% CI) | Coef (95% CI) | Coef (95% CI) | Coef (95% CI) |
| **Time-period** |  |  |  |  |  |  |  |  |  |
| 2009 to 2010 | 5.3 (-9.7, 20.3) | 10.4 (-19.0, 39.7) | 7.9(-9.2, 24.8) | -2.6 (-21.9, 16.7) | -5.9 (-17.4, 5.7) | -1.7 (-6.5, 3.1) | -0.2 (-3.8, 3.5) | -0.7 (-1.7, 0.3) | -0.2 (-1.0, 0.5) |
| 2011 to 2012 | 1.2 (-6.3, 8.7) | 12.4 (-2.3, 27.0) | 7.5 (-1.0, 16.0) | 0.3(-9.4, 9.9) | 6.9 (1.2, 12.7) | 1.4 (-1.0, 3.8) | 0.1 (-1.7, 1.9) | 1.1(0.6, 1.6) † | 0.2 (-0.1, 0.6) |
| 2013 to 2014 | -2.2 (-9.7, 5.3) | -3.9 (-18.6, 10.8) | -5.0 (-13.5, 3.5) | 0.6 (-9.0, 10.3) | 2.5 (-3.3, 8.3) | 1.31 (-1.1, 3.7) | 0.5 (-1.3, 2.3) | 0.8 (0.3, 1.2) | 0.3 (-0.1, 0.7) |
| Abbreviations: ED, emergency department; Coef, coefficient; 95% CI, 95% confidence interval**\*** Coef represents the rate of change for each two year time-period † The rate of change for EP in the ED during 2011 to 2012 was higher than the rate of change during 2009 to 2010 (change in slope (95% CI): **1.8 (0.5, 3.1))** |

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