Socio-economic disparities in access to assisted reproductive technologies in Australia

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Abstract Women from disadvantaged socio-economic groups access assisted reproductive technology treatment less than women from more advantaged groups. However, women from disadvantaged groups tend to start families younger, making them less likely to suffer from age-related subfertility and potentially have less need for fertility treatment. Whether socio-economic disparities in access to assisted reproductive technology treatment persist after controlling for the need for treatment, has not been previously explored. This population based study demonstrates that socio-economic disparities in access to assisted reproductive technology treatment persist after adjusting for several confounding factors, including age at first birth (used as a measure of delayed childbearing, hence a proxy for need for fertility treatment), geographic remoteness and Australian jurisdiction. Assisted reproductive technology access progressively decreased as socio-economic quintiles became more disadvantaged, with a 15.8% decrease in access in the most disadvantaged quintile compared with the most advantaged quintile after controlling for confounding factors. The adjusted rate of access to assisted reproductive technology treatment also decreased by 12.3% for women living in regional and remote...
Introduction

Subfertility affects approximately 15% of women of reproductive age at any given time worldwide, causing significant personal suffering to millions of couples around the globe from all socio-economic backgrounds (Boivin et al., 2007). The treatment of subfertility has been revolutionised over the last three decades, primarily through assisted reproductive technologies, such as IVF. The latest global estimates indicate that over 1.6 million assisted reproductive technology cycles are undertaken each year and that more than 6 million children have been born following assisted reproductive treatment (ICMART, 2015). Despite assisted reproductive technology becoming a mainstream medical intervention, there are widespread disparities in access to treatment between countries (Chambers et al., 2009; Ferraretti et al., 2013) and among different socio-economic and ethnic groups within countries (Hammoud et al., 2009; Jain, 2006; Smith et al., 2011).

The principle that healthcare systems ought to provide equal access for equal need has been widely recognized and has been the subject of recent attention by governments (Agency for Healthcare Research and Quality (AHRQ, 2012; Centers for Disease Control and Prevention (CDC, 2011; Marmot et al., 2011). There exists only limited knowledge of how disparities impact on access to assisted reproductive technology treatment. Furthermore, much of the previous research regarding access to assisted reproductive treatment has focused on ethnic disparities in the USA, which may not reflect socio-economic conditions and disparities in other countries (Bitler and Schmidt, 2012; Hammoud et al., 2009; Inhorn and Fakh, 2006; McCarthy-Keith et al., 2010; Smith et al., 2011).

In Australia, assisted reproductive technology treatment has historically been subsidised through the public health insurance scheme, Medicare. Since 2001, women have been eligible for partial reimbursement of almost all assisted reproductive technology cycles with no funding limit criteria, such as the number of previous cycles, maternal age, duration of subfertility, body mass index (BMI) or smoking status. Although assisted reproductive technology in Australia is primarily regulated by the federal government (NHMRC, 2007) legislative differences exist between the eight Australian states and territories. Patients pay an average out-of-pocket cost of approximately $3000 – $4000 AUD ($2200 – $3000 USD, 2015) for a fresh embryo transfer cycle and $1500 – $2000 AUD ($1100 – $1500 USD, 2015) for a frozen embryo transfer cycle, which represents about one third the cost of assisted reproductive technology fresh and frozen embryo cycles, respectively (Chambers et al., 2012). This relatively supportive environment had led to Australia having one of the highest assisted reproductive technology utilisation rates in the world (Chambers et al., 2009, 2014b).

We have previously demonstrated disparities in access to assisted reproductive technology treatment based on unadjusted measures of socio-economic status (Chambers et al., 2013). However, to our knowledge no study has accounted for the fundamental differences in the prevalence of subfertility across socio-economic groups. Importantly, women in low socio-economic groups typically start their families earlier than those in higher socio-economic groups and therefore potentially have less need for fertility treatment (Raisänen et al., 2013). Like most developed countries, the average age of first time mothers in Australia is also increasing (Hilder et al., 2014), as is the average age of women undergoing assisted reproductive technology treatments (Macaldowie et al., 2015), indicating an increased need for assisted reproductive technology treatment due to age related subfertility.

This study uses national population datasets to investigate disparities in access to assisted reproductive technology based on socio-economic status and geographic remoteness, after accounting for average (mean) age at first birth as a proxy for the underlying need for fertility treatment across socio-economic groups.

Materials and methods

Data sources

Three population datasets were used to undertake this study. The Australian and New Zealand Assisted Reproduction Database (ANZARD) was used to quantify the number of women who underwent assisted reproductive technology treatment and number of assisted reproductive technology cycles performed in 2009 – 2012 in Australia, by Australian postcode of a woman’s usual residence. ANZARD collects assisted reproductive treatment and outcomes data for all assisted reproductive technology cycles performed in all fertility clinics in Australia and New Zealand, and is managed by the National Perinatal Epidemiology and Statistics Unit (NPESU), University of New South Wales. For this study assisted reproductive technology treatment was limited to initiated autologous fresh and frozen/thaw cycles which account for 95% of the total assisted reproductive treatment cycles performed in Australia (Macaldowie et al., 2014).

A measure of socio-economic status (SES) was assigned to each woman’s postcode of residence using the Australian Bureau of Statistics (ABS) Socio-economic Index for Areas (SEIFA). The Index of Relative Socio-economic Advantage and Disadvantage (ISRAD) was used and based on 2011 census data. The ISRAD incorporates variables indicating disadvantage such as low income, unemployment, low-status occupations and low education, and variables indicative of advantage such as high income, well paid occupations, higher education and high wealth (ABS, 2011b). Similarly, a measure of remoteness (major cities or regional and remote areas) was assigned to

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each woman’s postcode based on the Accessibility and Remoteness Index of Australia (ARIA) produced by the Australian Population and Migration Research Centre at the University of Adelaide. This index quantifies geographic access to health care services in Australia using road distances to the nearest service centres (ABS, 2011c; Magliano et al., 2014).

The Estimated Residential Populations (ERP) of Australia supplied by the ABS 2011c Census data were used to ascertain the number of women of reproductive age (aged 20 – 44) in each postcode (ABS, 2012).

The National Perinatal Data Collection (NPDC) was used to ascertain the average (mean) maternal age at first birth by postcode in 2009 – 2012. The NPDC is Australia’s national population-based data collection of pregnancy and childbirth (Li et al., 2013). The average age at first birth was used as a proxy for need for fertility treatment and was included as an explanatory variable in the statistical modelling.

This study calculated the proportion and rate of women (per 1000 women of reproductive age) that accessed assisted reproductive technology treatment in each Australian postcode. The numerator was the number of women who accessed treatment, per postcode, sourced from ANZARD. The denominator was the number of women of reproductive age residing in each postcode, sourced from the ERP. Similar calculations were undertaken by assisted reproductive technology cycle where the number of cycles performed (per postcode) was used as the numerator.

The study was approved by the Human Research Advisory Panel, University of New South Wales, Australia on 10 December 2014 (reference number: 9-14-057).

Statistical methods

Summary statistics were calculated for the number of women who accessed assisted reproductive technology treatment and the number of assisted reproductive technology cycles performed in 2009 – 2012. Poisson regression models were fitted to the data in a generalised linear modelling (glm) framework, to investigate the relationships between the number of women who accessed assisted reproductive technology treatment by SES quintile, remoteness category and Australian jurisdiction. Models were implemented in R 3.2.0 using the glm command in the stats library (R Core Team, 2015). The proportion of women in each postcode who accessed assisted reproductive technology treatment were incorporated into the model as the number of women who accessed assisted reproductive technology treatment in a postcode as the outcome, and the number of women of reproductive age in the respective postcode as a log offset. The models were risk adjusted for the following covariates; socio-economic status quintile (SES5 - most advantaged, SES4, SES3, SES2, SES1 - most disadvantaged), remoteness category ([1] major cities, [2] regional and remote Australia), state or territory (New South Wales and Australian Capital Territory [NSW and ACT], Northern Territory [NT], Queensland [QLD], South Australia [SA], Tasmania [TAS], Victoria [VIC], Western Australia [WA]) and need for fertility treatment (mean age at first birth). Univariate models were fitted initially for each covariate to investigate the relationship between the outcome and covariate without the influence of any other covariates. Multivariable models were then fitted that included all covariates simultaneously. The analysis by jurisdiction was included to reflect varying legislation, likely differences in the number of fertility clinics among states and territories, and possible underlying demographic differences.

The proportion of women in a postcode who accessed assisted reproductive technology treatment, rather than the proportion of assisted reproductive technology cycles in a postcode, was chosen as the outcome measure in this study because this better reflects equity of access to assisted reproductive technology treatment. Furthermore, there was a very strong correlation (coefficient \(= 0.99\)) between the number of women who accessed assisted reproductive technology in a postcode and the number of assisted reproductive technology cycles in a postcode, indicating that either outcome measure is acceptable. This measure of access to assisted reproductive technology is essentially the level of utilisation, and not the level of provision. That is, while treatment may be available to women through the provision of fertility clinics, barriers may exist that impede their access to treatment (e.g. economic or geographic).

Relative risks (RR) were calculated as the exponential of the coefficient from the Poisson regression model, allowing for the RR to be interpreted as a percentage increase or decrease in assisted reproductive technology usage in comparison to the baseline category. The ‘best fitting’ models were selected based on standard model fit criteria; Akaike information criterion (AIC), Bayesian information criterion (BIC) and likelihood ratio tests.

Interactions were explored between covariates (SES quintile and remoteness category, SES quintile and mean age at first birth, remoteness category and mean age at first birth). Zero inflated Poisson regression models were also explored to account for the postcodes where no women accessed assisted reproductive technology treatment. The interaction terms were not statistically significant when fitted individually and simultaneously and zero inflated Poisson models did not improve the model fit, therefore, these results are not present here.

Results

Summary statistics

Australia comprised 2516 postcodes calculated from the 2011 Census (ABS, 2011a). Complete data were available for 2472 postcodes including 399 (16%) postcodes where no women accessed assisted reproductive technology between 2009 and 2012. The majority (95%) of the 399 postcodes were in regional/remote Australia and 29% (116/399) were from the most deprived SES quintile and (35/399) 9% were from the most advantaged quintile. These postcodes also have reasonably small resident populations.

There were 85,602 women who accessed 219,857 assisted reproductive technology treatment cycles in 2009 – 2012, and could be assigned to an Australian postcode of residence. Summary statistics of the number and rate of women who accessed assisted reproductive technology treatment in 2009 – 2012 are presented in the Table 1. On average eight women (median) per postcode accessed at least one assisted reproductive technology cycle in 2009 – 2012. This translated to an average rate of 17 women (median) per 1000
women of reproductive age in a postcode that accessed at least one assisted reproductive technology cycle in 2009 – 2012. On average 20 assisted reproductive technology cycles (median) were undertaken by an average of eight women per postcode in 2009 – 2012. This translated to a rate of 41 (median) cycles per 1000 women of reproductive age in 2009 – 2012. There were 1277 women and 16,689 cycles in 2009 – 2012 that could not be assigned to an Australian postcode, these women (and cycles) include overseas residents and postcodes not stated or that were invalid. These women and cycles were not included in this study.

Boxplots

Boxplots were generated to visualise the relationship between the rate of assisted reproductive technology usage in each postcode by jurisdiction, SES quintile and remoteness category. Boxplots were also generated to visualise the relationship between mean age at first birth in each postcode by jurisdiction, SES quintile and remoteness category. Figure 1 presents the boxplots for the rate of assisted reproductive technology access by women of reproductive age among postcodes by jurisdiction, SES quintile and remoteness category. Boxplot 1A shows that there is variation in the rate of assisted reproductive technology access between jurisdictions. The highest median rate of assisted reproductive technology usage was in the jurisdictions with the highest population density (i.e. people per square kilometre): NSW and ACT, QLD, TAS and VIC. These jurisdictions have similar distributions of rate of assisted reproductive technology usage, among the postcodes within those jurisdictions. The rate of assisted reproductive technology usage is lowest in those jurisdictions with the lowest population density: NT, SA and WA. Boxplot 1B shows a clear decrease in assisted reproductive technology usage with increasing socio-economic disadvantage. The highest rates are in the most advantaged postcodes, and the lowest rates are in the most disadvantaged postcodes. Boxplot 1C shows a clear difference in assisted reproductive technology usage between major cities and regional and remote areas, where rates of assisted reproductive technology usage were higher in major cities than in regional and remote areas.

Figure 2 presents boxplots for the average (mean) age at first birth among postcodes by jurisdictions, SES quintile and remoteness category. Boxplot 2A shows that there are slight differences in the average age at first birth between jurisdictions, where the highest is in VIC (28.48 years) and the lowest in NT (25.89 years). Boxplot 2B shows the average age at first birth decreases with increasing SES disadvantage. In the most advantaged SES quintile the average age at first birth is 30.64 years, and 25.22 years in the most disadvantaged quintile. Boxplot 2C shows that there were also differences in average age at first birth by remoteness category, which was 2.65 years higher in major cities (29.34 years) than in regional and remote areas (26.69 years).

Poisson regression models

Table 2 summarizes the results from the univariate Poisson regression models. The outcome of the models (dependent variable) was the proportion of women who accessed assisted reproductive technology treatment in each postcode, and the independent covariates were SES quintile, remoteness category, jurisdiction and mean age at first birth. The RR of the coefficients for SES quintile and remoteness category showed that there was a 55% reduction in the rate of assisted reproductive technology usage in the most disadvantaged SES quintile compared with the most advantaged SES quintile, and a 37% reduction in assisted reproductive technology usage in regional and remote Australia compared with major cities. There were also differences between states and territories with the highest usage in NSW and ACT and VIC.

Table 3 summarizes the results from the multivariable Poisson regression model. A log likelihood test demonstrated that there is an improvement in model fit (P < 0.01) in this model compared with the null model. The outcome of the model was the proportion of women who accessed assisted reproductive technology treatment, after controlling for confounding factors. Adjusted rates account for any differences in assisted reproductive technology usage due to SES quintile, remoteness category, jurisdictions and mean age at first birth. Any remaining variation in assisted reproductive technology usage between postcodes cannot be explained by these factors and is due to variables that have not been accounted for in the model and/or random error.

Comparing the most advantaged SES quintile and the most disadvantaged SES quintile, given the other covariates are held constant, rates of assisted reproductive technology usage were reduced by a factor of 0.852. This represents a 15.8%
Figure 1  Box plots for assisted reproductive technology usage per 1000 women of reproductive age, Australia 2009 – 2012. The vertical axis of each box plot (i.e. the rate of women accessing assisted reproductive technology per 1000 women of reproductive age) was truncated at 100 so the boxplots are presented without the large outlying values. The dashed horizontal line shows the median rate of women accessing assisted reproductive technology per 1000 women of reproductive age across all postcodes. The box displays the interquartile range and the median, the whiskers display the upper and lower values within 1.5 times the interquartile range and outliers are individually displayed. Figure title for Boxplot 1A: Box plot of the rate of assisted reproductive technology usage per 1000 women of reproductive age 2009 – 2012 by jurisdiction in Australia Figure title for Boxplot 1B: Box plot of the rate of assisted reproductive technology usage per 1000 women of reproductive age 2009 – 2012 by SES Quintile in Australia. Figure title for Boxplot 1C: Box plot of the rate of assisted reproductive technology usage per 1000 women of reproductive age 2009 – 2012 by remoteness category in Australia.
Figure 2  Box plots for the mean age at first birth, Australia 2009 – 2012. The vertical axis of each box plot is the mean age at first birth. The dashed horizontal line shows the median of the mean age at first birth across all postcodes. The box displays the interquartile range and the median, the whiskers display the upper and lower values within 1.5 times the interquartile range and outliers are individually displayed. Figure title for Boxplot 2A: Boxplot of the mean age at first birth by jurisdiction in Australia. Figure title for Boxplot 2B: Boxplot of the mean age at first birth by SES Quintile. Figure title for Boxplot 2C: Boxplot of the mean age at first birth by remoteness category.
decrease in assisted reproductive technology usage from the most advantaged SES quintile compared with the most disadvantaged. Furthermore, the trend in assisted reproductive technology rates decreases through all SES quintiles with increasing socio-economic disadvantage.

Comparing major cities to regional and remote Australia, given the other variables are held constant; the rate of assisted reproductive technology usage was reduced by a factor of 0.877. This represents a 12.3% decrease in assisted reproductive technology usage in regional and remote Australia compared with major cities of Australia.

For a one year increase in mean age at first birth, there was an 11.5% increase in assisted reproductive technology usage, while holding all other covariates in the model constant.

### Table 2 Univariate models for proportion of women of reproductive age accessing assisted reproductive technology treatment by postcode, Australia 2009 – 2012.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>P-value</th>
<th>RR</th>
<th>95% CI(RR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-3.46</td>
<td>&lt;0.01</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>SES 5 – Most advantaged</td>
<td>NA</td>
<td>NA</td>
<td>1.00</td>
<td>NA</td>
</tr>
<tr>
<td>SES 4</td>
<td>-0.30</td>
<td>&lt;0.01</td>
<td>0.74</td>
<td>(0.73, 0.76)</td>
</tr>
<tr>
<td>SES 3</td>
<td>-0.44</td>
<td>&lt;0.01</td>
<td>0.64</td>
<td>(0.63, 0.66)</td>
</tr>
<tr>
<td>SES 2</td>
<td>-0.66</td>
<td>&lt;0.01</td>
<td>0.52</td>
<td>(0.50, 0.53)</td>
</tr>
<tr>
<td>SES 1 – Most disadvantaged</td>
<td>-0.79</td>
<td>&lt;0.01</td>
<td>0.45</td>
<td>(0.44, 0.46)</td>
</tr>
</tbody>
</table>

### Table 3 Multivariable model for proportion of women of reproductive age accessing assisted reproductive technology treatment by postcode, Australia 2009 – 2012.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>P-value</th>
<th>RR</th>
<th>95% CI(RR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-3.66</td>
<td>&lt;0.01</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>SES 5 – Most advantaged</td>
<td>NA</td>
<td>NA</td>
<td>1.00</td>
<td>NA</td>
</tr>
<tr>
<td>SES 4</td>
<td>-0.055</td>
<td>&lt;0.01</td>
<td>0.946</td>
<td>(0.928, 0.965)</td>
</tr>
<tr>
<td>SES 3</td>
<td>-0.056</td>
<td>&lt;0.01</td>
<td>0.945</td>
<td>(0.922, 0.968)</td>
</tr>
<tr>
<td>SES 2</td>
<td>-0.122</td>
<td>&lt;0.01</td>
<td>0.885</td>
<td>(0.857, 0.913)</td>
</tr>
<tr>
<td>SES 1 – Most disadvantaged</td>
<td>-0.160</td>
<td>&lt;0.01</td>
<td>0.852</td>
<td>(0.822, 0.883)</td>
</tr>
<tr>
<td>Major cities</td>
<td>NA</td>
<td>NA</td>
<td>1.00</td>
<td>NA</td>
</tr>
<tr>
<td>Regional and remote Australia</td>
<td>-0.131</td>
<td>&lt;0.01</td>
<td>0.877</td>
<td>(0.860, 0.894)</td>
</tr>
<tr>
<td>NSW and ACT</td>
<td>NA</td>
<td>NA</td>
<td>1.00</td>
<td>NA</td>
</tr>
<tr>
<td>NT</td>
<td>-2.005</td>
<td>&lt;0.01</td>
<td>0.135</td>
<td>(0.110, 0.165)</td>
</tr>
<tr>
<td>QLD</td>
<td>0.004</td>
<td>0.66</td>
<td>1.004</td>
<td>(0.985, 1.025)</td>
</tr>
<tr>
<td>SA</td>
<td>-0.967</td>
<td>&lt;0.01</td>
<td>0.380</td>
<td>(0.364, 0.397)</td>
</tr>
<tr>
<td>TAS</td>
<td>0.133</td>
<td>&lt;0.01</td>
<td>1.142</td>
<td>(1.084, 1.204)</td>
</tr>
<tr>
<td>VIC</td>
<td>-0.086</td>
<td>&lt;0.01</td>
<td>0.918</td>
<td>(0.902, 0.933)</td>
</tr>
<tr>
<td>WA</td>
<td>-0.118</td>
<td>&lt;0.01</td>
<td>0.889</td>
<td>(0.867, 0.911)</td>
</tr>
<tr>
<td>Mean age at first birth</td>
<td>0.108</td>
<td>&lt;0.01</td>
<td>1.115</td>
<td>(1.109, 1.120)</td>
</tr>
</tbody>
</table>

CI = confidence interval; NSW and ACT = New South Wales and Australian Capital Territory; NT = Northern Territory; QLD = Queensland; RR = relative risk; SA = South Australia; SES = socio-economic status; TAS = Tasmania; VIC = Victoria; WA = Western Australia.
The rate ratios for states and territories suggested that there were significant differences in assisted reproductive technology usage between states and territories, given all other variables held constant. Most notably, there is an 86.5% reduction in assisted reproductive technology usage in the NT compared with NSW and ACT, and a 62.0% reduction in assisted reproductive technology usage in SA compared with NSW and ACT.

The coefficients from the multivariable Poisson regression model were used to predict the rate of women accessing assisted reproductive technology in postcodes based on SES quintile, remoteness category, jurisdiction and mean age at first birth. This provides estimates of the difference in rates of assisted reproductive technology usage in Australia based on observed values of the covariates. For example, a postcode in the most disadvantaged SES quintile in a major city in NSW and ACT, with a mean age at first birth of 30 years, predicted an assisted reproductive technology access rate of 31 women per 1000 women of reproductive age (over a four-year period). Similarly, a postcode in the most disadvantaged quintile in a regional and remote area in South Australia with an average age at first birth of 25 years predicted an assisted reproductive technology access rate of five women per 1000 women of reproductive age (over a four-year period).

**Discussion**

This study found significant variation in assisted reproductive technology usage between Australian postcodes after adjusting for socio-economic status, remoteness, jurisdiction and need for fertility treatment. This result suggests that disparities exist in access to assisted reproductive technology treatment which are not consistent with the principle of equal access for equal need. The level of disparity reflects the gradient of disadvantage even after accounting for need for fertility treatment, remoteness and which state or territory a woman resides. Women in the second most advantaged SES quintile had a 6% reduction in access to treatment compared with women living in the most advantaged quintile, while women in the most disadvantaged quintile had a 16% reduction in access compared with women living in the most disadvantaged quintile. Similarly, women living in regional and remote areas had a 12% reduction in access to treatment, after accounting for SES, jurisdiction and need for fertility treatment.

This study used mean age at first birth as a proxy for need for fertility treatment. While age-related subfertility is not the only cause of subfertility, age at first birth is a useful and readily available indicator for need for fertility treatment at a population level, since reproductive potential decreases significantly with age (Crawford and Steiner, 2015), and the average age of women accessing assisted reproductive technology treatment is five years older than women giving birth in the Australian population. There are other causes of subfertility that may differ between socio-economic groups, which this study could not control for. However, age at first birth provides an important proxy for differences in child bearing patterns and represents a major cause of subfertility between socio-economic groups.

In the univariate Poisson regression models the effect of SES status and remoteness category modelled on their own were very strong in relation to assisted reproductive technology usage. As expected when SES, remoteness, jurisdiction and average age at first birth were modelled simultaneously in the multivariable model, the effect sizes of the coefficients were reduced. However, the effects for the coefficients remained significant suggesting that socio-economic status, remoteness, jurisdiction and mean age at first birth in a postcode are all important factors in predicting assisted reproductive technology usage.

The NT had the largest negative coefficient in the multivariable model, the respective RR showed that there was an 86.5% reduction in assisted reproductive technology usage here compared with NSW and ACT. There are a number of reasons that the NT is considered such an outlier, in terms of rate of women who access assisted reproductive technology treatment. First, there is only one assisted reproductive technology clinic in the jurisdiction. The second reason may be due to the population structure. The population size of the NT is ranked the smallest of the eight jurisdictions in Australia and has a very low population density (0.18 persons per km²) compared with NSW (9.29 persons per km²) and also the whole of Australia (3 persons per km²).

There was a strong relationship between mean age at first birth and both SES quintile and remoteness category. Age at first birth was higher in the most advantaged SES quintiles and major cities, suggesting that there is an increased need for assisted reproductive technology treatments in these areas due to later childbearing. This finding supports UK studies that found while the incidence of subfertility was similar among SES groups, there were significantly higher age-specific estimates for women aged 25 – 40 years in higher SES groups, likely exaggerated by delaying conception (Dhalwani et al., 2013). There were also differences in assisted reproductive technology usage between states and territories, which may be due to differences in population demographics, access to fertility clinics and state and territory legislation.

To our knowledge, this is the first study to control for need for fertility treatment when evaluating disparities in access to fertility treatment. Other strengths of the study lie in the national population datasets used and the measure of equity of access based on proportions of women accessing treatment rather than proportion of assisted reproductive technology cycles performed. The study’s analysis was limited by socio-economic status being based on the weighted average relative socio-economic advantage and disadvantage of small geographic areas (postcodes), and therefore may not reflect the socio-economic status of an individual. Furthermore, the mean age at first birth in a postcode was used as a proxy for need for fertility treatment and would not fully capture an individual’s underlying need or desire for assisted reproductive technology treatment. Future research to quantify more direct predictors of fertility treatment uptake among different socio-economic groups would include data at the level of individual women, supported by qualitative studies.

This study was performed in Australia, which has relatively supportive funding arrangements for assisted reproductive technology and unrestricted public subsidisation based on age, number of previous cycles and duration of infertility. This provides a unique setting to evaluate the effects of socio-economic status on access to assisted reproductive technology treatment. While the absolute coefficients could not directly be applied to other settings the relative trends would...
be generalizable, and useful for informing policy in countries with similar population demographics.

The most obvious explanation for the disparity in access to assisted reproductive technology treatment is that socio-economically advantaged women have the financial capacity – individually and through private health insurance – to fund fertility treatments such as assisted reproductive technology. However, studies have shown that disparities in fertility treatment persist after adjusting for financial factors, with assisted reproductive technology treatment more likely to be used by older, more educated Caucasian women (ASRM, 2015; Bitler and Schmidt, 2012; Jain, 2006, McCarthy-Keith et al., 2010; White et al., 2006). This phenomenon is not restricted to fertility treatment, with disparities in access to healthcare and health outcomes persisting in a number of areas of healthcare despite financial barriers being minimised, such as vaccination and screening (Becker and Newsom, 2003; Gornick, 2000). Several studies using national data have shown that despite more disadvantaged SES groups making significantly more frequent visits to publicly-insured primary care services, they are significantly less likely than more advantaged socio-economic groups to make use of publicly-insured specialist services – of which assisted reproductive technology services would be categorised (Dunlop et al., 2000; Van Doorslaer et al., 2008). Other studies have reported that it is the recognition of fertility problems which differentiate access to fertility treatment between socio-economic groups rather than differences in treatment seeking behaviour (Morris et al., 2011). These two factors are not necessarily mutually exclusive. A previous policy analysis undertaken in Australia showed that when the out of pocket cost of an assisted reproductive technology treatment cycle was increased by one third there was a 21–25% decrease in access to treatment across all socio-economic groups (Chambers et al., 2013).

A growing body of evidence shows that the affordability of assisted reproductive technology treatment from the patient’s perspective, not only influences who has access to treatment, but also how it is practiced. Higher out of pocket expenses act as an incentive to transfer more embryos per cycle in the hope of achieving a pregnancy in the minimum number of cycles (Bitler and Schmidt, 2012; Chambers et al., 2014b; Hamilton and McManus, 2012). Such practices lead to increased risk of iatrogenic multiple birth pregnancies resulting in poorer health outcomes for mothers and children (Helmerhorst et al., 2004), and significant increase health care costs associated with their care (Chambers and Ledger, 2014; Chambers et al., 2014a). Countries such as Australia and the Nordic countries that have supportive funding for assisted reproductive technology through their national health insurance schemes have the lowest assisted reproductive technology multiple birth rates in the world (Chambers et al., 2011; Källén et al., 2010; Kupka et al., 2014; Macaldowie et al., 2014).

In conclusion, after adjusting for need for fertility treatment, disparities in access to assisted reproductive technology treatment persist among socio-economic groups. Public health policies, in addition to those that increase healthcare affordability, are needed to reduce inequity of access. Furthermore, studies are needed to fully understand differences in the burden of subfertility among different socio-economic groups and effective ways to ameliorate inequalities in access to care.

References


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