SEX-SELECTIVE ABORTION

A Systematic Map of the Volume and Nature of the Research

DRAFT REPORT

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Contents

Summary

Background

This report takes the form of a systematic map examining the volume and nature of research concerning sex-selective abortion. The map is not intended to supply an answer to the question "What is the extent of sex-selective abortion in England, Wales and -Scotland?" Rather, the purpose of the map is to describe the volume and key characteristics of research concerning sex-selective abortion; i.e. to identify and describe what research has been carried out in this area.

Methodology

Empirical, quantitative, English language research focussed upon sex-selective abortion and published from the year 2000 onwards was sought via bibliographic database and citation searching.

Results – volume and nature of the research

A sizeable international literature in relation to sex-selective abortion was found totalling 332 studies. The country of focus was India in almost half (153) of these studies, China in 79 studies (24%), and Asia (not including India, China or Pakistan) in 37 (11%) of studies.

OECD countries were examined in 23 (7%) reports of 20 relevant studies (four secondary, linked reports of existing analyses were identified). Six unique studies focussed upon populations within the UK, five the US, four Canada, two Greece, two Norway and one Italy.

The extent of sex-selective abortion taking place in a population is often assessed by examining the sex ratio at birth (SRB) – the number of boys born alive per 100 girls born alive. The research in this map appeared to examine relatively few confounders or moderators of the SRB, although this is likely due to the constraints imposed by analysis of pre-existing datasets.

Conclusions/Further research

To the extent that it is possible, future research should give further consideration to important confounders such as socio-economic status, marital status, birth order, parity and parental age. Future research might also be situated within the context of alternative explanations for perturbations and prevailing trends in the SRB.

In order to establish the extent to which sex-selective abortion is taking place in UK-relevant contexts, relevant studies would have to be subjected to critical appraisal to assess the reliability of their findings. Where results are robust but inconsistent, examination of the scope of the studies and the specification of their analytical models would be required in order to explain mixed and conflicting findings.

1 Background

1.1 Type of review: systematic map

Sex-selective abortion is the termination of a pregnancy due to the sex of a foetus. The extent to which sex-selective abortion takes place is often determined by examining the sex ratio at birth (SRB). The SRB, also known as the secondary sex ratio, may be defined as the number of boys born alive per 100 girls born alive.

This report takes the form of a systematic map (Gough et al. 2012) describing the volume and key characteristics of research concerning sex-selective abortion and distortions of the expected SRB. The purpose of a systematic map is to describe and characterize research (e.g. in terms of country of origin, population examined, or methodology). Prominent advantages of maps lie in their capacity to supply a broad overview of a research field and to identify gaps in the evidence base. Maps are also useful for prioritising research questions appropriate for systematic review - a broad initial review question may be followed by a narrower question focusing upon a subset of studies understood within the context of the wider literature.

1.2 Limitations of the systematic map

1.2.1 Relevant literature may be missed

Due to time constraints, a comprehensive rather than exhaustive search strategy was used to identify relevant literature (see section 2.2 below). It is therefore possible that the map will not provide a complete picture of the research in this area.

1.2.2 What the map will NOT do

This systematic map can only be used to describe the volume and nature of research in relation to sex-selective abortion.

In order to determine the extent of sex-selective abortion in GB-relevant contexts it would be necessary to carry out a full systematic review, extract the findings of relevant studies, critically appraise these studies to establish the validity of their results, and provide explanation for any discrepancies across the literature.

Data extraction, critical appraisal and synthesis were not undertaken in this mapping exercise. It should be noted that this systematic map **CANNOT** supply an answer to the question "What is the extent of sex-selective abortion in England, Wales and Scotland?"

1.3 Rationale for the review

A preference for sons rather than daughters may result in prospective parents seeking induced abortion due to the sex of the foetus. Following a Crown Prosecution Service decision not to prosecute two doctors for agreeing to perform abortions solely on the grounds of gender (Dyer 2013), the Department of Health issued guidance stating that "Abortion on the grounds of gender alone is illegal." (Public Health Directorate 2014: p10). Nevertheless, in February 2015 an attempt was made to amend the 1967 Abortion Act in order to explicitly outlaw gender-selective abortion (although abortion on the ground of gender alone is already illegal). Although the proposed amendment was defeated (Hansard 2015), an alternative amendment arranging for a review of the extent of sex-selective abortion in England, Wales and Scotland was passed (House of Commons 2015).

Worldwide, more boys than girls are born: the sex ratio at birth typically ranges between 104 and 107 boys for every 100 girls (Chahnazarian 1988). This is because the sex ratio at conception is unbiased, but female mortality during pregnancy exceeds male mortality (Orzak et al. 2015). Distortions in the expected sex-ratio attributed to son preference have been recorded in Asia, the Middle East and Africa (Whitehead et al. 2014). Inferring sex-selective abortion from sex ratios however, may be problematic (James 1997) and there are numerous other factors aside from sex-selective abortion which may be implicated in skewed sex ratios at birth including climate, economic depression, exposure to radiation or pollutants, latitude, obesity, parental age, smoking and stress.

Studies examining whether or not an excess of males is born to UK parents of Asian, Middle Eastern, South American and African heritage have produced conflicting results (Department of Health 2013, Department of Health 2014, Smith and Fogarty 2014, Dubuc and Coleman 2007). There is therefore a need to identify the evidence-base in relation to sex-selective abortion.

1.4 Aims and objectives

This review is being undertaken in order to inform the Department of Health about the volume and nature of research evidence concerning sex-selective abortion. Information about the evidence available may be used to support commissioning decisions regarding further research, research synthesis and analysis.

1.4.1 Research question

What is the volume and nature of research in relation to sex-selective abortion?

2 Methods

2.1 Stakeholder involvement

Beneficial aspects of stakeholder involvement include: the provision of expertise on the issue of concern; perspectives on relevant areas upon which to focus the work; suggestions for relevant research; ideas about ways to communicate findings in an accessible format; and the potential to communicate research findings to stakeholder networks (Rees and Oliver 2012). Unfortunately, the timelines required for this project necessitated limiting stakeholder involvement at the mapping stage.

2.2 Search strategy

Potentially relevant research was sought via bibliographic database searching and backwards and forwards citation searching. Material published in the English language from the year 2000 onwards was sought.

2.2.1 Bibliographic database searches

Preliminary scoping searches revealed that some relevant literature was to be found in the social science literature (e.g. demography journals). Therefore, bibliographic databases concerning the disciplines of social science and geography were searched in addition to medical bibliographic databases.

Literature was sought within the following disciplines/bibliographic databases:

MEDICINE/HEALTH

- PUBMED
- EMBASE
- POPLINE

SOCIAL SCIENCE

- SCOPUS (for the purposes of forward citation searching – see section 2.2.2)
- WEB OF SCIENCE (SOCIAL SCIENCE CITATION INDEX/SCIENCE CITATION INDEX)

GEOGRAPHY/DEMOGRAPHY

- GEOBASE

GREY LITERATURE

- OPEN GREY
- ZETOC

Search strings were based upon a combination of free-text and database-specific terms that were created in collaboration with our Information Scientist. The concepts combined were: (abortion) AND (sex/gender) OR (sex ratios at birth). In order to limit the amount of literature retrieved, whilst obtaining as many relevant references as possible in the time available, a comprehensive (sensitive), rather than exhaustive (maximally sensitive) search was conducted (Brunton et al. 2012). A sample search strategy is provided in Appendix 1. Located citations were uploaded into EPPI-Reviewer software, for management of retrieval, screening and coding (Thomas et al. 2010).

2.2.2 Citation searching

Reference lists of included studies were searched for potentially relevant, previously published research i.e. backwards citation searching.

The SCOPUS database was employed for forward citation searching i.e. to locate research subsequently citing included studies.

2.3 Screening for inclusion

All reviewers screened 20 studies to ensure consistency in the application of the eligibility criteria. Inter-rater agreement was in excess of 90%. Citations identified by the search (N=12,224) were assessed on the basis of title and abstract for their eligibility for inclusion. Studies included on title and abstract were then screened on full-text using the same criteria.

2.3.1 Eligibility criteria

Studies satisfying the following criteria were included in the review:

- Reported in the English language
- Published in or after the year 2000
- Empirical, quantitative study
- Focussed upon the extent to which sex-selective abortion is taking place

A further final eligibility criterion was applied to identify studies relevant to UK contexts:

- Concerns OECD country

Region-specific codes were used to categorize non-OECD studies by region e.g. Africa, Asia, Caucasus, China, India.

Excluded research not examining sex-selective abortion but examining alternative explanations for skewed or altered sex ratios at birth was tagged using an ‘alternative explanations’ code.

2.3.2 Rationale for eligibility criteria

Date limit

Studies published more than 15 years ago were not sought in order to make the included pool of research manageable in the time available.

English language only

Time and resources available did not permit translation of foreign language material.

Study design: empirical, quantitative studies

Research providing information regarding the extent of sex-selective abortion was included. Qualitative research examining people's views and experiences, commentary articles, opinion pieces, literature reviews, ethnical and discursive essays, and legal arguments were excluded as these do not provide reliable information regarding the quantification of sex-selective abortion. Included studies were required to present methods in relation to research design, conduct and analysis.

Alternative explanations

In order to identify studies providing important contextual information pertinent to the examination of sex ratios, studies not focussing upon sex-selective abortion but providing alternative explanations for skewed or changing sex ratios (e.g. with regard to various external, physiological, environmental or temporal factors), were grouped under a unique exclusion code: 'alternative explanations'. Studies captured under this exclusion criterion were then categorised by one reviewer who grouped the explanations by type (see Figure 3.1, page 11).

2.4 Double-coding and categorizing the research

Key-wording of the studies was carried out using a standardized coding tool. The coding tool was created *a priori* by the lead reviewer with respect to characteristics of interest and refined in collaboration with two additional reviewers during the coding process. Using the finalized coding tool, each included study was coded independently for content and focus by two reviewers. Reviewers then met to agree their coding, with differences resolved via the arbitration of a third reviewer when necessary.

Study aims were extracted, to improve understanding of the objectives of the included studies. Studies were then categorized according to country of study, parental populations, dataset employed and study design. Finally studies were examined to see whether they had given consideration to factors that may influence estimates of the extent of sex-selective abortion as estimated by the sex ratio at birth, (e.g. maternal age, paternal age, birth order and parity, socioeconomic status, other).

2.5 Quality assurance

In order to eliminate errors, and errors of omission, independent coding of studies, followed by agreement between reviewers was undertaken. Due to the time constraints of the project, double-screening of studies for eligibility for inclusion was not possible. Nevertheless a sample of screening decisions was reviewed to assess inter-rater reliability, which exceeded 90%.

3 Results

3.1 Study Selection and number of included studies

Bibliographic database and citation searching provided a total of 15,217 citations. After removing 2993 duplicate references, 12,224 records remained. Of these, 12,179 were excluded on title and abstract because they did not meet the eligibility criteria. The full texts of 45 citations were retrieved. After re-application of the eligibility criteria upon the full text of the 45 studies included on title and abstract, 20 relevant studies, reported in 23 papers were included in the map.

Number of unique included studies: N = 20.

A flow diagram illustrating the process of study selection throughout the review is presented in Figure 3.1 below. References of the included studies are provided in Appendix 2.

Seven of the 20 studies focussed upon UK populations (Adamou et al. 2013, Anagnostopoulos 2014, Drakos 2011, Department of Health 2013, Department of Health 2014, Dubuc and Coleman 2007, Smith and Fogarty 2014). Of these seven UK studies, two reported an analysis of the same dataset over the same period (Drakos 2011, Adamou et al. 2013).

3.1.1 Linked studies

The unpublished report by Anagnostopoulos (2014) represents a critique of an analysis originally reported in the Independent newspaper on Tuesday 14th January 2014.

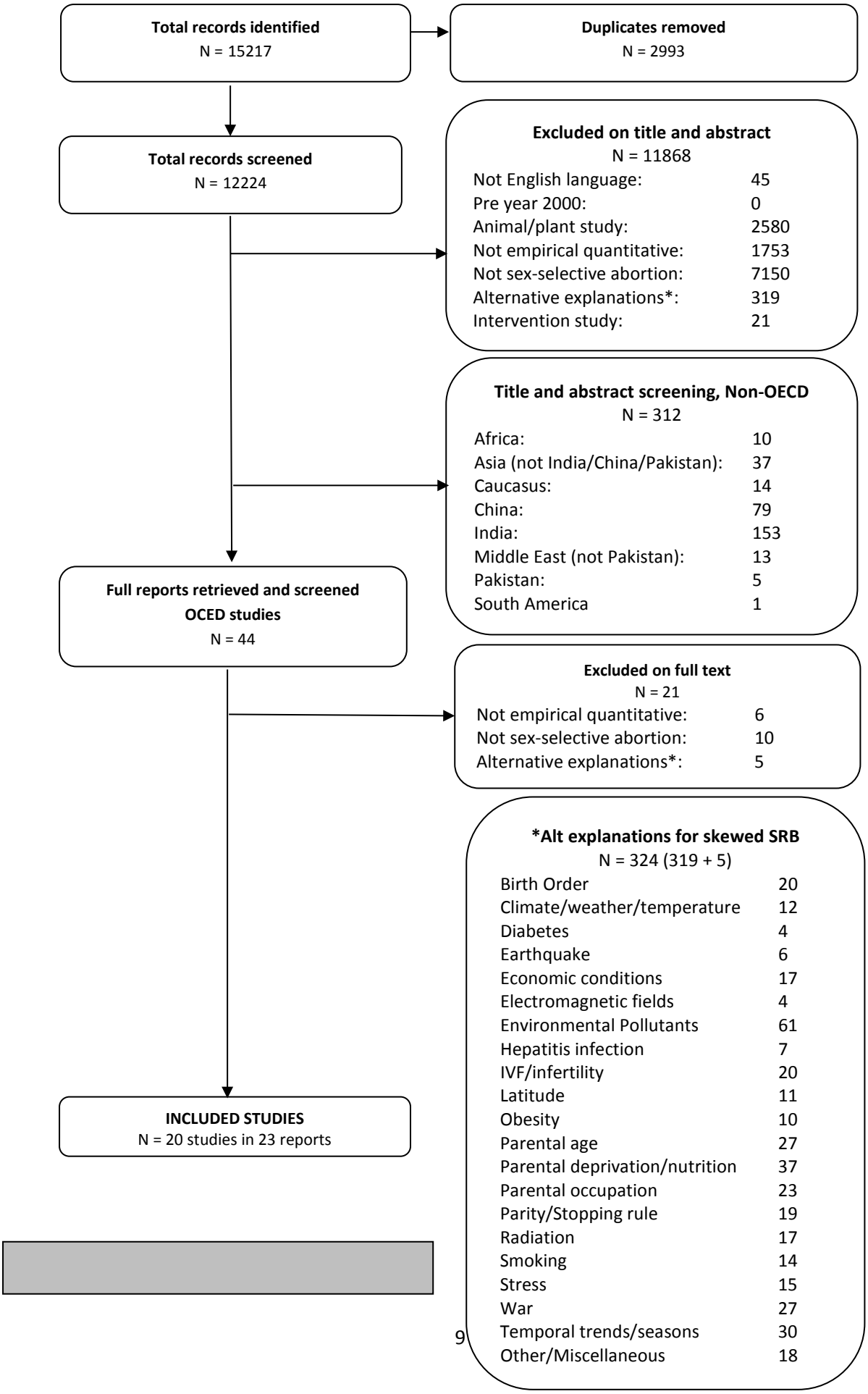
Three further secondary reports (linked studies) were identified (Almond et al. 2013, Egan et al. 2011b, Drakos 2011).

Almond et al. (2013) was found to be a secondary report of an analysis of Canadian census data previously reported by Almond et al. (2009).

Egan et al. (2011b) was a conference proceeding relating to a fuller report provided by Egan et al. (2011a).

The UK analysis initially conducted by Drakos (2011) was further developed by Adamou et al. (2013).

Although we do not give further consideration to these secondary reports where primary reports are available, it should be noted that multiple analyses of the same datasets may contain alternative models to elucidate the extent of sex selective abortion. Any further analyses of these studies should involve careful examination of secondary reports to discern whether they make a unique contribution to the field.


Total records identified
N = 15217
Duplicates removed
N = 2993
Total records screened
N = 12224
Excluded on title and abstract
N = 11868
Not English language: 45
Pre year 2000: 0
Animal/plant study: 2580
Not empirical quantitative: 1753
Not sex-selective abortion: 7150
Alternative explanations*: 319
Intervention study: 21
Title and abstract screening, Non-OECD
N = 312
Africa: 10
Asia (not India/China/Pakistan): 37
Caucasus: 14
China: 79
India: 153
Middle East (not Pakistan): 13
Pakistan: 5
South America 1
Full reports retrieved and screened
OCED studies
N = 44
Excluded on full text
N = 21
Not empirical quantitative: 6
Not sex-selective abortion: 10
Alternative explanations*: 5
*Alt explanations for skewed SRB
N = 324 (319 + 5)
Birth Order 20
Climate/weather/temperature 12
Diabetes 4
Earthquake 6
Economic conditions 17
Electromagnetic fields 4
Environmental Pollutants 61
Hepatitis infection 7
IVF/infertility 20
Latitude 11
Obesity 10
Parental age 27
Parental deprivation/nutrition 37
Parental occupation 23
Parity/Stopping rule 19
Radiation 17
Smoking 14
Stress 15
War 27
Temporal trends/seasons 30
Other/Miscellaneous 18
INCLUDED STUDIES
N = 20 studies in 23 reports

3.2 Stated aims of the included studies

The aims of the 20 included studies are shown in Table 3.1 below. All studies examined the sex ratio at birth whether or not the aim of investigating the practice of sex-selective abortion was made explicit in the objectives.

One UK study using data from the second National Survey of Sexual Attitudes and Lifestyles had the stated aim of examining the differences between women who have had multiple abortions and those who have had one (Stone and Ingham 2011). Stone and Ingham (2011) reported risk of repeat abortion in white women compared to Indian, Chinese and other Asian women, but there was nothing to indicate that observed differences were due to sex-selective abortion and therefore this study was excluded from the review.

Table 3.1 Stated aims of the 20 included studies

Study	Stated aim
Abrevaya J (2009) Are There Missing Girls in the United States? Evidence from Birth Data.	To investigate whether irregularities in boy births are present among specific races within the US and if gender selection is arising from cultural biases mirroring those in the parents' home countries.
✱ Adamou A, Drakos C, Iyer S (2013) Missing women in the United Kingdom.	To examine sex selection in the UK among immigrant families and the gender composition of previous births, conditional on socio-economic characteristics.
✱ Anagnostopoulos C (2014) Gender imbalances in the 2011 Census data on families: preliminary analysis.	An analysis of UK 2011 Census data on gender breakdowns for families of various nationalities.
Almond D, Edlund L, Milligan K (2009) O Sister, Where Art Thou? The Role of Son Preference and Sex Choice: Evidence from Immigrants to Canada.	To study South-East Asian immigrants to Canada by analysing the 2001 and 2006 Censuses.
Almond D, Edlund L (2008) Son-biased sex ratios in the 2000 United States Census.	To examine male-biased sex ratios among US-born children of Chinese, Korean, and Asian Indian parents in the 2000 US Census.
Auger N, Daniel M, Moore S (2009) Sex ratio patterns according to Asian ethnicity in Quebec, 1981-2004.	To evaluate patterns in the secondary sex ratio (SSR, number of male per 100 female births) according to ethnicity in Quebec, Canada.

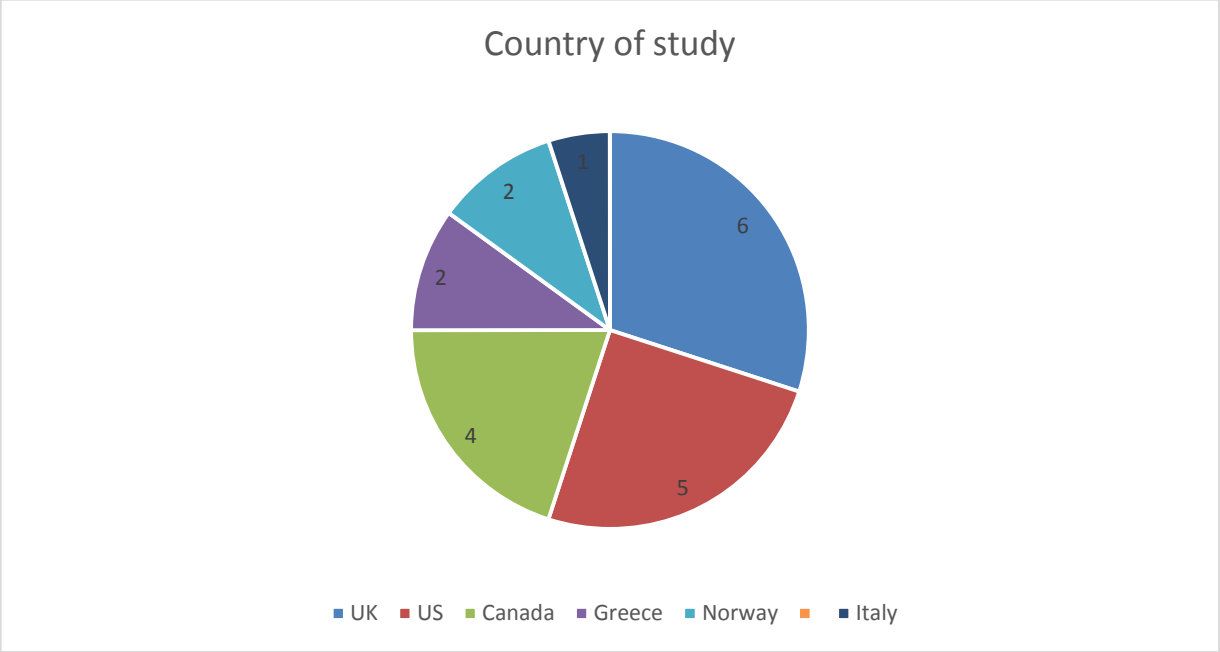
Study	Stated aim
✱ Department of Health (2013) Birth Ratios in the UK - a report on gender ratios at birth in the UK. London: Department of Health.	To report on the gender ratio at birth in the UK and investigate whether this varies by mothers' country of birth beyond the range that we would expect to see naturally occurring.
✱ Department of Health (2014) Birth ratios in England and Wales - a report on gender ratios at birth in England and Wales. London: Department of Health.	Update of DH (2013) gender ratio analysis and analysis of birth ratios by birth order, broken down by mother's country of birth and overall birth ratios and birth ratios by birth order, broken down by the child's ethnicity as stated by the mother.
✱ Dubuc S, Coleman D (2007) An increase in the sex ratio of births to India-born mothers in England and Wales: Evidence for sex-selective abortion.	Comparison of sex ratios at birth between major categories of immigrant mothers and mothers born in the UK.
Egan JF, Campbell WA, Chapman A et al. (2011a) Distortions of sex ratios at birth in the United States; evidence for prenatal gender selection.	To review sex ratios for US births to investigate potential prenatal sex selection.
Festini F, Taccetti G, Repetto T et al. (2003) Sex ratio at birth among Chinese babies born in Italy is lower than in China.	To calculate the SRB of an entire population of live births born during a decade to ethnic Chinese people settled abroad.
Gavalas V, Rontos K, Nagopoulos N (2015) Sex ratio at birth in twenty-first century Greece: the role of ethnic and social groups.	To investigate whether the SRB in Greece deviates from the norm among different ethnic groups controlling for socio-demographic characteristics of mother (education, age, and birth order) and illegitimacy.
González (2014) Missing girls in Spain.	An analysis of birth-certificate data to determine son-biased sex-ratios at birth among Asian immigrants in Spain.
Nandi A, Kalantry S, Citro B (2014) Sex-selective Abortion Bans are Not Associated with Changes in Sex Ratios at Birth among Asian Populations in Illinois and Pennsylvania.	To compare newborn sex ratios across different ethnic groups before and after sex- selective abortion bans in Illinois and Pennsylvania.

Study	Stated aim
Ray J, Henry D, Urquia M L (2012) Sex ratios among Canadian liveborn infants of mothers from different countries.	To compare sex ratios among infants of Canadian-born women with sex ratios in different immigrant groups.
Singh N, Pripp AH, Brekke T et al. (2010) Different sex ratios of children born to Indian and Pakistani immigrants in Norway.	To determine whether the low female-to-male ratio common in North-West Indian cultures also exists among families from the Indian subcontinent who live in Norway.
Smith D, Von Behren J (2005) Trends in the sex ratio of California births, 1960-1996.	To examine trends in the sex ratio at birth in California's large and diverse population.
✱ Smith C, Fogarty A (2014) Is the mothers' country of birth associated with the sex of their offspring in England and Wales from 2007 to 2011?	To assess the probability of having a male infant in women from different regions of the world compared to those born in the United Kingdom.
Tonnessen M, Aalandslid V, Skjerpen T (2013) Changing trend? Sex ratios of children born to Indian immigrants in Norway revisited.	The aim of this study is to see whether extended time series for the period 2006 to 2012 give further support to the hypothesis of sex-selective abortions among Indian immigrants to Norway.
Verropoulou G, Tsimbos C (2010) Differentials in sex ratio at birth among natives and immigrants in Greece: an analysis employing nationwide micro-data.	To investigate differentials in SRB between native and immigrant populations in Greece.
✱ *= UK study; DH = Department of Health; SRB = sex ratio at birth*	

3.3 Country of study

The country of focus for the 20 included studies is presented in Figure 3.2 below. Six unique studies focussed upon populations within the UK, five the US, four Canada, two Greece, two Norway and one Italy.

Figure 3.2: country of focus for the 20 included studies.



3.4 Parental place of birth

Study populations were categorised according parental birth place rather than ethnicity. Therefore the information presented in Table 3.2 below relates to native parents and first generation immigrant parents only. One of the 20 included studies specifically examined the practice of sex-selective abortion in second, as well as first generation immigrants (Almond et al. 2009).

Table 3.2 Parental birth places as defined in the 20 included studies

Place of birth	Number of studies
Africa	4
Asia	10
Bangladesh	4
Canada	1
Caribbean	2
China	13
Europe	4

Place of birth	Number of studies
Far East	1
Former Eastern Bloc	3
Greece	2
India	15
Japan	1
Korea	8
Middle East	1
Nepal	1
Pakistan	8
Philippines	6
South America	2
UK	3
US	3
Vietnam	3

3.5 Study type

All 20 included studies were secondary analyses of pre-existing datasets, 13 of which carried out multivariate analyses. The moderators/ confounders incorporated in studies' analyses are presented in section 3.6 and the datasets employed by the studies are presented in section 3.7.

3.6 Moderators of the sex ratio at birth

Numerous factors have been investigated in relation to the sex ratio at birth. Table 3.3 presents moderating factors subjected to analysis in the 20 included studies.

3.6.1 The constraints of using pre-existing data

When conducting secondary analyses of existing datasets such as census information, researchers face constraints with regard to the data available for incorporation into analytical models. In other words, the variables used may be limited to those available rather than those which are most desirable for testing a hypothesis. Data which are relatively easy to access include year, maternal age, birth order and parity. Data in relation

to other important factors, such as socio-economic status, health status or parental education for example, are less readily available. Moderators of the sex ratio at birth as reported in the 20 included studies are presented in Table 3.3.

3.6.2 Birth order and parity

Where son preference is in operation parents may be willing to tolerate one or more daughters but continue to produce further children until achieving the desired son: the so called "stopping rule" (Pham et al. 2012). Families may only resort to sex-selective abortion when family size becomes undesirably large (Adamou et al. 2013). If this is the case, the sex ratio at birth is less likely to be skewed for first born children. In addition, Egan et al. (2011a) have reported that because sex ratios decline with increasing parity and age, reversal of this normal trend may be suggestive of prenatal sex selection.

Therefore, parity and birth order are important factors to take into consideration when using the sex ratio at birth to determine the extent to which sex-selective abortion is taking place. Sixteen (80%) of the 20 included studies analysed data with respect to birth order or parity. Eight studies (40%) examined parental age (see Table 3.3 below).

Table 3.3 Moderators of the sex ratio at birth as reported in the 20 included studies

Study	Age (maternal)	Age (paternal)	Birth order/ parity	SES	Other
Abrevaya (2009)	✓	✓	✓		✓
Adamou et al. (2013)			✓	✓	✓
Almond et al. (2009)	✓	✓	✓	✓	✓
Almond and Edlund (2008)			✓		✓
Anagnostopoulos (2014)			✓		
Auger et al. (2009)	✓		✓	✓	✓
Department of Health (2013).					
Department of Health (2014)			✓		
Dubuc and Coleman (2007)			✓		
Egan et al. (2011a)	✓		✓		✓
Festini et al. (2003)					
Gavalas et al. (2015)	✓		✓	✓	✓

González (2014)	✓	✓	✓	✓	
Nandi et al. (2014)			✓	✓	✓
Ray et al. (2012)			✓		
Singh et al. (2010)			✓		
Smith and Von Behren (2005)	✓	✓	✓		
Smith and Fogarty (2014)					
Tonnessen et al. (2013)			✓		
Verropoulou and Tsimbos (2010)	✓	✓	✓		✓

3.6.3 Other moderators as reported in the included studies

Other moderator variables incorporated in the analyses included: antenatal care (Abrevaya 2009); previous abortion (Abrevaya 2009); place of residence (Adamou et al. 2013, Gavalas et al. 2015, Nandi et al. 2014); citizenship (Almond et al. 2009, Verropoulou and Tsimbos 2010); religion (Almond et al. 2009); first generation immigration (Almond et al. 2009); marital status (Auger et al. 2009, Gavalas et al. 2015); and year (Nandi et al. 2014).

3.7 Datasets

Compared to birth registers, census data and surveys of family or household composition may be a less reliable means of assessing the extent to which sex-selective abortion is taking place because over time children may leave the parental home. A record was made of the datasets employed in the 20 included studies as shown in Table 3.4 below.

Table 3.4 Datasets used in the 20 included studies.

Dataset	Number of studies
Census data [Canada, US x 2]	3
US Federal Birth Data	2
General Household Survey [UK]	1
General Registrations Office for Scotland	1
Hellenic Statistical Authority [Greece]	1
Live Birth Registry Quebec [Canada]	1
US National Centre for Health Statistics	3

National Family Health Survey of India	1
NN4B linked dataset [UK]	1
Northern Ireland Statistics and Research Agency	1
Norwegian Central Population Register	1
Office for National Statistics [UK]	4
Provincial Statistics [Canada]	1
Spanish National Statistical Institute	1
Statistics Norway	1
US State birth data	2

One study employed datasets from two different countries. Adamou et al (2013) compared findings from an analysis of UK data to those resulting from an analysis of data from the National Family Health Survey of India (NFHS) - because larger family size may be expected in India. The intention was to examine whether Indian immigrants in the UK demonstrated stronger gender selection compared to Indian residents at a given parity, or whether preferences changed "due to cultural contagion."

3.8 Interventions

Three of the 20 included studies examined the introduction of either ultrasound technology (Singh et al. 2010) or legislation (González 2014, Nandi et al. 2014) upon sex ratios.

Singh et al. (2010) investigated the effect of sex determination via ultrasound examination, introduced in the 1980s, upon the female-to-male ratio among Norwegian children born to parents of Indian or Pakistani origin.

González (2014) examined the sex ratio after the 2010 reform that deregulated abortion during the first 14 weeks of pregnancy in Spain. Nandi et al. (2014) exploited variation in the timing of bans in Illinois and Pennsylvania to compare pre-ban and post-ban sex ratios of Asian newborn children in these states.

4 Conclusions

We located a sizeable international literature in relation to sex-selective abortion totalling 332 studies. The country of focus was India in almost half (153) of these studies, China in 79 studies (24%), and Asia (not including India, China or Pakistan) in 37 (11%) studies. We would

note however, that the volume of published English language sex-selective abortion literature cannot be used to infer the extent of sex-selective abortion in different countries as some countries may be more likely than others to produce English language reports.

In 23 (7%) studies SRB was examined in OECD countries. Studies conducted in OECD countries where access to both prenatal sex-selection technology and abortion is available may be expected to provide information relevant to the GB context. Emigrants entering such countries from regions where son preference enacted through sex-selective abortion is relatively common are likely subject to the same cultural pressures regardless of final destination.

Seven studies focussed upon UK populations (Adamou et al. 2013, Anagnostopoulos 2014, Drakos 2011, Department of Health 2013, Department of Health 2014, Dubuc and Coleman 2007, Smith and Fogarty 2014). Further analyses relevant to the UK context are being conducted by Dr Sylvie Dubuc of the Department of Social Policy and Intervention, University of Oxford. To benefit from a cumulative approach to the findings of these sex-selective abortion studies, any potential future synthesis of the findings of UK studies could be timed to coincide with the publication of the work currently in progress.

This systematic map may be criticized for examining research within a relatively narrow time-frame (the year 2000 onwards). It could be argued that if the cultural factors driving sex-selective abortion have not changed, all research published following the introduction of technology allowing pre-natal sex selection should be eligible for inclusion in the review. The decision to limit included studies to those published within the last fifteen years was pragmatic and made necessary by the short time frame of this project.

The research in this map appeared to examine relatively few moderators of the sex ratio at birth although this is likely due to the constraints imposed by analysis of pre-existing datasets. To the extent that it is possible, future research should give further consideration to important confounders such as socio-economic status, marital status, birth order, parity and parental age. Future research might also be situated within the context of alternative explanations for perturbations in the SRB and prevailing trends (Davis et al. 1998) in the SRB.

This systematic map cannot supply an answer to the question "*What is the extent of sex-selective abortion in England, Wales and Scotland*?" In order to establish the extent to which sex-selective abortion is taking place in GB-relevant contexts, studies need to be subjected to critical appraisal to assess the reliability of their findings. Where results are robust but inconsistent, examination of the scope of the studies and the specifications of their analytical models is required in order to explain mixed and conflicting findings.

5 References

N.B. References for the 20 included studies and secondary, linked reports are presented in Appendix 2.

Adamou A, Drakos C, Iyer S (2013) Missing women in the United Kingdom. *IZA Journal of Migration* 2:10.

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Appendices

Appendix 1 Search strategy

Sample PUBMED search strategy

Search	Query	Items found	Time
#29	Search (#26 NOT #25) Filters: Publication date from 2000/01/01 to 2015/12/31; English	7358	07:56:10
#27	Search (#26 NOT #25)	19006	07:55:35
#28	Search (#26 NOT #25) Filters: Publication date from 2000/01/01 to 2015/12/31	8980	07:54:52
#26	Search (#17 OR #24)	25381	07:54:09
#25	Search (#17 OR #24) Filters: Other Animals	6375	07:54:07
#24	Search (#18 OR #19 OR #20 OR #21 OR #22 OR #23)	15781	06:23:46
#23	Search sex ratio[Title/Abstract]	9865	06:19:54
#22	Search gender preference[Title/Abstract]	159	04:04:03
#21	Search sex preference[Title/Abstract]	208	04:03:55
#20	Search son preference[Title/Abstract]	257	04:03:45
#19	Search Sex Preselection[MeSH Terms]	1153	04:03:37
#18	Search sex ratio[MeSH Terms]	7901	04:03:27

Search	Query	Items found	Time
#17	Search (#11 and #16)	10234	04:02:10
#16	Search (#12 OR #13 OR #14 OR #15)	1719597	03:59:42
#15	Search sex distribution[MeSH Terms]	52126	03:59:17
#14	Search ((girl[Title/Abstract] OR girls[Title/Abstract] OR boy[Title/Abstract] OR boys[Title/Abstract] OR male[Title/Abstract] OR males[Title/Abstract] OR female[Title/Abstract] OR females[Title/Abstract] OR gender[Title/Abstract] OR genders[Title/Abstract] OR sex[Title/Abstract] OR sexes[Title/Abstract] OR son[Title/Abstract] OR sons[Title/Abstract] OR daughter[Title/Abstract] OR daughters[Title/Abstract]))	1695419	03:59:06
#13	Search sex[MeSH Terms]	7368	03:58:56
#12	Search sexism[MeSH Terms]	447	03:58:46
#11	Search (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #10)	80206	03:58:23
#10	Search (#8 AND #9)	16303	03:57:33
#9	Search (terminate[Title/Abstract] OR terminating[Title/Abstract] OR terminated[Title/Abstract] OR termination[Title/Abstract] OR terminations[Title/Abstract])	89869	03:57:24
#8	Search ((pregnant[Title/Abstract] OR pregnancy[Title/Abstract] OR pregnancies[Title/Abstract] OR baby[Title/Abstract] OR babies[Title/Abstract] OR	1360025	03:55:20

Search	Query	Items found	Time
	foetus[Title/Abstract] OR fetus[Title/Abstract] OR foetuses[Title/Abstract] OR fetuses[Title/Abstract] OR children[Title/Abstract] OR child[Title/Abstract]))		
#6	Search ((abort[Title/Abstract] OR abortion[Title/Abstract] OR abortions[Title/Abstract] OR aborted[Title/Abstract] OR aborting[Title/Abstract]))	56027	03:54:56
#5	Search Abortion Applicants[MeSH Terms]	583	03:54:43
#4	Search Abortion, Legal[MeSH Terms]	6926	03:54:35
#3	Search Abortion, Criminal[MeSH Terms]	1982	03:54:24
#2	Search Abortion, Eugenic[MeSH Terms]	1874	03:54:15
#1	Search Abortion, Induced[MeSH Terms]	33167	03:54:01

Appendix 2 Included studies

✱ = UK study

Δ = linked, secondary report

Abrevaya Jason (2009) Are There Missing Girls in the United States? Evidence from Birth Data. *American Economic Journal Applied Economics* 1(2): 1-34.

✱ Adamou A, Drakos C, Iyer S (2013) Missing women in the United Kingdom. *IZA Journal of Migration* 2:10.

Almond D, Edlund L (2008) Son-biased sex ratios in the 2000 United States Census. *Proceedings of the National Academy of Sciences of the United States of America* 105(15): 5681-2.

Almond D, Edlund L, Milligan K (2009) *O Sister, Where Art Thou? The Role of Son Preference and Sex Choice: Evidence from Immigrants to Canada.* Cambridge, MA: NBER Program. http://www.nber.org/papers/w15391.pdf

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Auger Nathalie, Daniel Mark, Moore Spencer (2009) Sex ratio patterns according to Asian ethnicity in Quebec, 1981-2004. *European Journal of Epidemiology* 24(1): 17-24.

✱ Δ Anagnostopoulos C (2014) Gender imbalances in the 2011 Census data on families: preliminary analysis. Unpublished report.

✱ Department of Health (2013) *Birth Ratios in the UK - a report on gender ratios at birth in the UK.* London: Department of Health.

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✱ Δ Drakos C (2011) *Missing Women: A Phenomenon of the Developed World? New Evidence from First Generation Immigrants in the United Kingdom.* University of Cambridge.

✱ Dubuc S, Coleman D David; (2007) An increase in the sex ratio of births to India-born mothers in England and Wales: Evidence for sex-selective abortion. *Population and Development Review* 33(2): 383-400.

Egan James, Campbell Winston, Chapman Audrey, Shamshirsaz Alireza, Gurram Padmalatha, Benn Peter (2011a) Do differences in the sex ratio at birth by race and nationality suggest prenatal gender selection in the US? *American Journal of Obstetrics and Gynecology* 204: S245-S245.

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Ray J G, Henry D A, Urquia M L (2012) Sex ratios among Canadian liveborn infants of mothers from different countries. *CMAJ* 184(9): E492-E496.

Singh N, Pripp AH, Brekke T, Stray-Pedersen B (2010) Different sex ratios of children born to Indian and Pakistani immigrants in Norway. *BMC Pregnancy and Childbirth* 10: 40.

Smith D, Von Behren, J (2005) Trends in the sex ratio of California births, 1960-1996. *Journal of Epidemiology and Community Health* 59(12): 1047-1053.

✱ Smith C, Fogarty A (2014) Is the mothers' country of birth associated with the sex of their offspring in England and Wales from 2007 to 2011? *BMC Pregnancy and Childbirth* 14: 332.

Tonnessen M, Aalandslid V, Skjerpen T (2013) Changing trend? Sex ratios of children born to Indian immigrants in Norway revisited. *BMC Pregnancy and Childbirth* 13: 170.

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