

## Maternal Health 4



# Drivers of maternity care in high-income countries: can health systems support woman-centred care?

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In high-income countries, medical interventions to address the known risks associated with pregnancy and birth have been largely successful and have resulted in very low levels of maternal and neonatal mortality. In this Series paper, we present the main care delivery models, with case studies of the USA and Sweden, and examine the main drivers of these models. Although nearly all births are attended by a skilled birth attendant and are in an institution, practice, cadre, facility size, and place of birth vary widely; for example, births occur in homes, birth centres, midwifery-led birthing units in hospitals, and in high intervention hospital birthing facilities. Not all care is evidenced-based, and some care provision may be harmful. Fear prevails among subsets of women and providers. In some settings, medical liability costs are enormous, human resource shortages are common, and costs of providing care can be very high. New challenges linked to alteration of epidemiology, such as obesity and older age during pregnancy, are also present. Data are often not readily available to inform policy and practice in a timely way and surveillance requires greater attention and investment. Outcomes are not equitable, and disadvantaged segments of the population face access issues and substantially elevated risks. At the same time, examples of excellence and progress exist, from clinical interventions to models of care and practice. Labourists (who provide care for all the facility's women for labour and delivery) are discussed as a potential solution. Quality and safety factors are informed by women's experiences, as well as medical evidence. Progress requires the ability to normalise birth for most women, with integrated services available if complications develop. We also discuss mechanisms to improve quality of care and highlight areas where research can address knowledge gaps with potential for impact. Evaluation of models that provide woman-centred care and the best outcomes without high costs is required to provide an impetus for change.

### Introduction

Global efforts to end preventable maternal and newborn mortality have appropriately focused on addressing of known risks associated with pregnancy and birth. This approach has been the great success of medical intervention in high-income countries (HICs), resulting in very low maternal mortality (12 deaths per 100 000 livebirths) and neonatal mortality (four deaths per 1000 livebirths).<sup>1,2</sup> HICs virtually guarantee antenatal care and a skilled birth attendant, and generally have institutional births, which can provide appropriate emergency care for complications.

The new era of Sustainable Development Goals (SDGs)<sup>3</sup> brings HICs under the accountability lens, providing an opportunity for timely reflection on the status of maternal health and its drivers in these countries. Although mortality is generally low, the picture is far from perfect. Care varies greatly, not all care is evidenced based, and some care might actually be harmful. In some settings, fear prevails among subsets of women and providers, driving increased and inappropriate intervention. Medical liability costs are enormous, human resource shortages are common, and costs of provision can be very high. Outcomes are not equitable, and disadvantaged sub-populations can face substantially elevated risks. New challenges linked to changing epidemiology, such as older age at birth and increased obesity are also present. At the same time, examples of excellence and progress are evident, from clinical interventions to models of care. This

Series paper presents the main drivers of the models of maternity and childbirth care in 14 HICs, and their influences on outcomes. Drivers are factors that cause a particular phenomenon to happen or develop. This Series paper also includes mechanisms and research direction to promote evidence-based change and woman-centred care.

To explore potential drivers, including cost, we compared available national data from 14 representative HICs. We also draw on the scientific literature, particularly reviews, to identify additional potential drivers (methods are shown in the appendix).

### Health system and epidemiological drivers

Health system drivers of maternal health outcomes include birth setting (home, free-standing birthing centre, hospital-sited midwifery-led birthing unit, or hospital), cost of models of care, and size and location of facilities (rural and remote). Epidemiological drivers of maternal health outcomes include maternal mortality and morbidity surveillance and audits, and the changing epidemiology of women giving birth. Evaluation of data for these health system drivers can provide evidence for necessary change.

### Care delivery models in high-income countries: birth setting

#### Hospital births

Most women in HICs have access to antenatal care, and postnatal care, including settings where postnatal care includes home visits by midwives and health visitors.

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## Key messages

- Women should be offered care that supports the safe physiological process of labour with the lowest level of intervention possible, to reduce overintervention, and support woman-centred care. Countries, care systems, and providers need to consider how they will promote this.
- High-income countries (HICs) with a combination of lowest intervention rates, best outcomes, and lowest costs have integrated midwifery-led care through different models, including team-based care in maternity hospitals, low-risk units alongside full-scope maternity hospitals, and freestanding or home-based midwifery. Such experiences in HICs are informative for countries where maternal mortality is decreasing, and transitions in care models are occurring.
- Most HICs lack robust surveillance systems for ascertainment of maternal deaths, and for accurate identification of the underlying cause of death and instances of preventable death. State, provincial, or national level audits of maternal death are needed, with results collated, analysed, and disseminated, along with recommendations for prevention. Data should specifically be disaggregated by vulnerable populations.
- Maternal safety programmes are recognising the importance of protocols, drills, and team training in a simulation environment, to address preventable causes of mortality and morbidity, such as massive obstetric haemorrhage.
- HICs experience variation in practice that is not evidence-based nor attributable to size of facility, providing opportunities for improvement of quality of care, and outcomes.
- Malpractice liability might pose a barrier to optimal maternity care in North America, especially the USA, by reducing the number of obstetricians willing to pay high premiums and by contributing to overuse of services based on fear. Some countries manage to overcome liability barriers by state support provision for those infants born with serious neurological birth injury. Research from other countries suggests that state support should be in conjunction with implementation of safety programmes at the facility level.

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See Online for appendix

Home births are infrequent in most HICs, other than the Netherlands (table 1). In most HICs, women with high-risk and low-risk pregnancies deliver in the same place, a hospital. These facilities are well optimised for high-risk women, with technology and staffing for close monitoring and expeditious access to interventions. Conversely, these facilities might not be optimised for low-risk women, and staff monitor and intervene more than is necessary for the overwhelming majority of women. The consequences of overintervention include avoidable harms to women and newborns, such as rapidly rising incidence of placenta accreta linked to previous caesarean section, while driving escalating, unsustainable costs. In some settings, hospital-sited midwifery-led birthing units are an attempt to optimise care for low-risk women. Such units have lower rates of medical interventions during labour, and higher satisfaction levels, with no increased risk to mothers or babies.<sup>4</sup>

### Birth centres and home births

Midwives attending births at home or in free-standing birthing centres are another way to optimise birth for low-risk women. These centres are typically clustered around urban centres, with easy transfer to hospital when appropriate.<sup>5</sup>

Research on planned hospital versus planned home births in the UK indicates that home birth services with collaborative medical backup should be established and offered to women with low-risk pregnancies in all jurisdictions.<sup>6</sup> The National Institute for Health and Care Excellence (NICE) 2014 guidelines recommend that all birth settings should be available to women at low risk of birth-associated complications, and home birth should generally be considered a safe option, although an increased risk of adverse outcomes for the baby for nulliparous women compared with birth in a midwifery-led unit is noted.<sup>7</sup> A 2015 US study<sup>8</sup> showed a higher perinatal mortality (3·9 vs 1·8 deaths per 1000 deliveries) in planned out-of-hospital births but did not highlight important factors, including lack of insurance in 34·5% of the women (vs 1·0% for planned hospital birth) and no skilled attendant in 23·1% of the planned out-of-hospital births (vs <0·2% for planned hospital birth). A 2015 Canadian study<sup>9</sup> that compared planned hospital births with home births, attended by licensed midwives, found no difference in serious neonatal adverse outcomes, and noted that Canadian midwives are well integrated into the health-care system.

### Costs of models of care and outcomes

The cost of childbirth is disproportionately expensive in the USA compared with all other HICs within the Organization for Economic Co-operation and Development (OECD; table 1). Similar trends in higher costs can be seen in Australia and other HICs. Cost increases over time are largely attributed to use of interventions (appendix).

Some elements of increased spending improve outcomes, particularly for premature infants, although support of extremely preterm infants with neonatal intensive care is a significant expense in HICs. Increasing numbers of caesarean sections and inductions of labour are additional cost drivers in the USA, UK, and Canada; vaginal delivery is the least expensive, and unplanned caesarean is the most expensive mode of delivery.<sup>10</sup> Several studies from HICs,<sup>11–14</sup> including the Netherlands, show lower resource use and costs at home and birth centres than hospitals, especially in urban or academic medical centres.

### Size and location: rural and remote

The trend over the past two decades in HICs towards closure of smaller facilities providing maternity care means women travel further to receive care, especially for labour and delivery, and can involve relocation to maternity waiting homes.<sup>15</sup> Access costs in many cases are borne by women. Smaller hospitals have lower rates of obstetric intervention and improved neonatal outcomes among low-risk women.<sup>5,16</sup> A Canadian study<sup>17</sup> showed that travel to access maternity care in large hospitals is associated with adverse perinatal outcomes for infants. German<sup>18</sup> and Norwegian<sup>19</sup>

	Home birth rate (%)	Birth centre birth rate (%; free-standing)	Vaginal birth rate (%)	Caesarean-section rate (%)	Episiotomy rate (% of vaginal births)	Epidural in labour (%)	Main care provider	Most common remuneration type for physicians	Cost to patient (can pay privately)	Cost of vaginal birth (2015 US\$)	Cost of caesarean section (2015 US\$)	Overall health expenditure (% of GDP) 2014	Year of data
Australia	0.4%	2.2%	67.7%	32.3%	15.6%	29.9%	Midwife/GP/obstetrician	Salary	None (can pay privately)	\$6775	\$10 499	9.03%	2011/2012/2014
Canada	1.2%	N/A	72.9%	27.1%	17.0%	58.7%	Obstetrician/FP/GP/midwife	Government-set fee for service	None	\$2930	\$5420	11.18%	2002-03/2011-12/2013-14
Denmark	1.2%	N/A	77.9%	22.1%	4.9%	N/A	Midwife/obstetrician	Salary	None	\$2517	N/A	11.15%	2005/2010-12
Finland	0.6%	N/A	83.2%	16.8%	24.1%	49%	Midwife/obstetrician	Salary	None (facility fee €17)	\$2784	\$4561	8.85%	2008/2010/2013
France	0.0%	N/A	79.0%	21.0%	26.9%	82%	Midwife/GP/obstetrician	Salary	N/A	\$3676	\$6686	11.63%	2010/2012
Germany	0.0%	N/A	68.7%	31.3%	27.7%	<10%	Midwife/obstetrician	Salary (hospital)	N/A	\$2592	\$4253	11.06%	2010/2013
Japan	1.1%	N/A	80.8%	19.2%	N/A	10-50%	Midwife/obstetrician	Government-set fee for service	No net cost	\$3931	\$3931	9.27%	2010/2011
Netherlands	20.0%	11.4%	83.0%	17.0%	30.3%	11.3%	Midwife-obstetrician consultant role	Fee for service	None	\$2889	\$5618	11.96%	2010/2012/2013
New Zealand	3.3%	10.1%	74.7%	25.3%	12.0%	24.7%	Midwife/obstetrician/GP	Salary	None (can pay privately)	\$2477	\$4896	10.08%	2012
Norway	0.8%	0.5%	82.9%	17.1%	18.8%	28%	Midwife/obstetrician	Salary	None	\$1434	\$3801	9.07%	2010
Spain	N/A	N/A	75.0%	25.0%	43.0%	N/A	Midwife/obstetrician	Salary	None (can pay privately)	\$2303	\$2909	9.44%	2010/2011/2012
Sweden	<1%	N/A*	82.9%	17.1%	6.6%	34.4%	Midwife-obstetrician consultant role	Salary	None (facility fee US\$10 per day)	\$3025	\$6025	9.36%	2008/2010/2014
UK (England, Wales)	2%	2.3%	75.4%, 73.9%	24.6%, 26.1%	19.4%/ 20.1%	16%	Midwife-obstetrician consultant role	Salary	None	\$2741	\$4604	9.32%	2010/2013-14
USA	0.91%	0.43%	67.8%	32.2%	14.4%	71%	Obstetrician	Fee for service	N/A	\$10 232	\$15 591	17.85%	2012/2014

References in appendix. GP=general practitioner. FP=family practitioner. N/A=not available. \*Sweden's only birth centre is now closed.

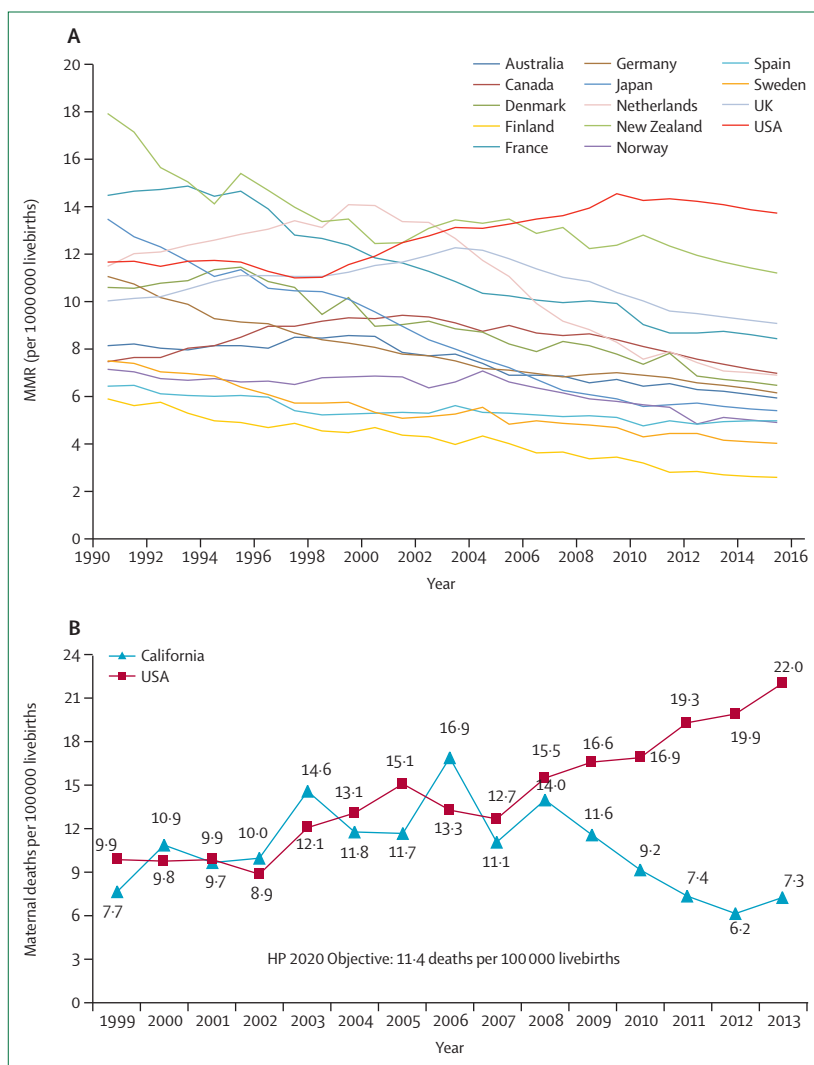
**Table 1: Variations in interventions related to birth and cost comparisons in selected high-income countries**

studies, show smaller maternity hospitals have higher rates of neonatal death. More research is needed to clarify these issues and to identify how low-risk maternity care in rural areas can be delivered safely and acceptably.

### Need for health system responses to prevailing epidemiological burden

#### Maternal mortality surveillance in HICs

Most HICs have experienced declines in maternal mortality since 1990, although the rate varies (figure 1).<sup>1</sup>



**Figure 1: Maternal mortality ratio per 100 000 livebirths from 1990–2015 for selected countries (A)<sup>1</sup> and maternal mortality rate in California and USA between 1999–2013 (B)**  
Data source for part B was the State of California, Department of Public Health, California Birth and Deaths Statistical master files 1999–2013. Maternal mortality for California (deaths  $\leq$ 42 days post partum) was calculated using International Statistical Classification of Diseases and Related Health Problems 10th Revision cause of death classification (codes A34, O00–O95, O98–O99). US data and HP2020 Objective use the same codes. US maternal mortality data is published by the National Centre for Health Statistics (NCHS) through 2007 only. US maternal mortality rates from 2008 through 2013 were calculated using CDC Wonder Online Data based accessed at <http://wonder.cdc.gov/> on March 11, 2015. Produced by California Department of Public Health, Center for Family Health, Maternal, Child and Adolescent Health Division, March 2015. MMR=maternal mortality ratio.

The UK Confidential Enquiry into Maternal Deaths is possibly the finest existing surveillance system for maternal death.<sup>20</sup> This legislated and comprehensive examination of clinical circumstances and context relies on information from midwives, obstetricians, coroners, members of the public, the media, vital statistics records, and linked birth–death records. The UK vital registration system only identified 53% of the deaths in the most recent inquiry.<sup>21</sup> Deaths from direct causes (such as pre-eclampsia and eclampsia) decreased from 1985–87 to 2009–11, whereas rates of maternal death from indirect causes (such as cardiac causes) increased.<sup>21</sup> A substantial number of deaths from influenza emphasises the need to use influenza vaccine in pregnant women.<sup>20</sup> Cardiovascular disease was the largest single cause of death in 2010–12, similar to rates in Australia and the USA.<sup>20</sup>

#### Maternal mortality in Canada and the USA

Global assessments of maternal mortality ratios in 2013 revealed some disappointing trends: the ratio was increased in 19 countries, including Canada and the USA.<sup>20,22</sup> However, both countries had reduced their ratios in 2015: Canada at six deaths per 100 000 livebirths, and the USA at 14 deaths per 100 000 livebirths.<sup>2</sup> The USA has moved from having one of the lower maternal mortality ratios among HICs, to having the highest in 25 years.<sup>23</sup> This rise in ratio might be a result of an ageing maternity population with increasing comorbidities and ever-rising body-mass indices,<sup>24</sup> as well as overuse (increasing interventions), underuse (lack of risk-appropriate care), and lack of access to care. Mortality data can be based on modelling (figure 1A) or vital registration (figure 1B). Additionally, improved surveillance (eg, introduction of a pregnancy checkbox on death certificates) could be an important contributor to the relatively high rate and temporal increase in maternal mortality rates in the USA (appendix). Identification of the true state of maternal mortality will take careful correlation of case reviews with vital record coding for both direct and indirect maternal deaths.

Routine reporting of maternal mortality in Canada uses vital registration, but the most recent comprehensive report in 2004<sup>25</sup> showed that vital registration only identified 41% of maternal deaths between 1997 and 2000. More recently, the Canadian Perinatal Surveillance System has linked data from all hospital deaths among women aged 15–54 years to pregnancy-related hospitalisations and those within 1 year after the end of pregnancy (includes 98% of births).<sup>26</sup> Mortality based on vital registration data reveal an increasing trend, whereas the more accurate rates based on hospitalisation data do not show any significant change.<sup>26,27</sup>

#### The need for maternal death and severe maternal morbidity audits

Enhanced data is needed to drive practice improvement—especially in terms of an information system that is

feasible (low burden and low cost), timely, reliable, and actionable. Comprehensive details on the social circumstances and clinical context surrounding each maternal death are important in view of the small number of heterogeneous maternal deaths that occur in HICs. The lesson learnt from the UK Enquiry is that maternal death audits and severe maternal morbidity surveillance are complementary activities informing policies and quality improvement activities to reduce preventable mortality.<sup>20</sup>

## Case study countries

### USA

Most women give birth in hospitals, under the care of obstetricians. In many rural areas of the USA, women must travel long distances to access obstetric care.<sup>14</sup> Compared with all other OECD nations, maternal health care for the average woman is expensive, risky, and inconsistent. Large out-of-pocket expenses for care during pregnancy are common.<sup>28,29</sup> Despite high investment, important indicators of health system performance such as maternal and neonatal mortality, and preterm and low weight births, significantly lag behind OECD averages.<sup>30</sup> Equally concerning are large disparities within the USA that exist along regional, socioeconomic, and racial lines.

Maternity and newborn care constitutes the single largest category of hospital payouts by both private and public insurers in the USA.<sup>31</sup> 25% of all hospital discharges are either a mother or a newborn baby after childbirth.<sup>32</sup> Of concern, charges for childbirth in the USA tripled between 1996 and 2013.<sup>31</sup> Payment models vary but fee for service is most common, which provides financial incentives for high use. Labour induction, epidurals, caesarean deliveries, and other childbirth interventions have escalated in the past few decades in a manner that appears to be largely independent of patient risks or preferences.<sup>33,34</sup>

Underlying the US payment system is a care-delivery model that is influenced by birth setting, workforce, malpractice policies, and patient agency. Most of the childbirth charge comes from the facility fee,<sup>35</sup> which can vary ten fold between facilities.<sup>36</sup> The facility fee reflects the hospital-based birth settings that 99% of Americans choose; most of these settings have staffing ratios and equipment that closely resembles the intensive care unit.<sup>8,37–39</sup> Relatively few women choose midwives over obstetricians despite possible benefits for low-risk women with regard to cost and intervention rates.<sup>40</sup>

Even when birth setting, workforce, payment model, and malpractice policies are held relatively constant, substantial unexplained variation persists in the provision of maternal health care. Hospital caesarean section rates vary from 6% to 70%; early elective delivery rates from 0% to 83%, and third and fourth degree tears from 0.5% to 95%.<sup>34</sup> Black Americans are significantly more likely than are white Americans to experience preterm birth, neonatal and maternal mortality, as well as

hypertension, obesity, and other complicating conditions of pregnancy.<sup>40</sup> More disturbingly, the overwhelming majority of childbirth in black Americans occurs in a concentrated set of hospitals that experience higher rates of severe maternal morbidity.<sup>41</sup>

Reforms to the US maternal health system are underway. Concerted efforts have been made to improve surveillance, audit, and feedback of important birth outcomes.<sup>42,43</sup> Payment reforms to reduce unnecessary interventions, including a hard stop that eliminates payment for early elective inductions of labour, have had early success,<sup>44</sup> although evidence is conflicting on increases in stillbirth rates.<sup>45,46</sup> The Affordable Care Act has improved access to care, recent measures to ensure appropriate resources are available for the types of high-risk care in which the USA excels.<sup>47</sup> Nonetheless, the USA has much room to improve maternal health-care affordability and outcomes, particularly for the average patient with a low-risk pregnancy.

### Sweden

Sweden has one of Europe's highest birth rates. Its maternal mortality ratio in 2015<sup>2</sup> was four deaths per 100 000 livebirths, one of the lowest in Europe. Sweden has sparsely populated mountainous areas and remote islands, and long travel distances. Despite these obstacles, coverage is good, and all women have access to antenatal care and childbirth care.

Antenatal care is organised mainly at primary levels, provided by midwives for healthy women. Obstetricians and midwives provide antenatal care to women with high-risk pregnancies at specialist units, with planned programmes, and follow-up. All birthing facilities are located at hospitals, which are staffed by obstetricians and midwives; midwives are responsible for births of healthy women. Birthing facilities are hospital-sited midwifery-led birthing units, but all have access to skilled obstetricians and neonatologists. Less than 1% of all births are home births. Maternity care is publicly funded, and provided mainly in public facilities, with some publicly funded care in private facilities. Staffing does not differ by sector.

Labour induction for singleton pregnancies at more than 37 weeks' gestation was 17.1% in 2014.<sup>48</sup> Electronic fetal monitoring is used in all women at admission, continuously if indicated. Intravenous access is routine. Pain relief in labour involves use of nitrous oxide (81% of women) and minimal motor block epidural analgesia (53% of primiparas, 21% of parous women). Low-risk women are permitted to consume fluids in labour. Skin-to-skin contact for the first hour is standard care.

The overall caesarean-section rate is approximately 18%, of which 54% are planned (elective); rates are highly variable between hospitals (12–22%). Maternal requested caesarean section is covered by national guidelines<sup>49</sup> and comprises 17% of all caesareans. The caesarean section rate for multiple births is 58% and for breech presentation is 91%.<sup>48</sup>



Health facilities publish benchmarking data for quality indicators such as caesarean section rates and complications.<sup>50</sup> Women or their relatives, or health facilities or staff can report unexpected outcomes to the Health and Social Care Inspectorate. Economic support or compensation for adverse maternal or infant outcomes is paid by insurance covering all publicly funded health care (Landstingens Ömsesidiga Försäkringsbolag). National data are collected for women's experiences during childbirth. Stipulations for maternity leave are integrated into parental-leave schemes.<sup>51</sup>

Complementary efforts to improve reproductive health include free contraceptive counselling, and subsidised contraception for young women. These interventions have decreased teenage deliveries and abortions.<sup>52</sup> Teenage delivery rates are among the lowest globally. Induced abortion is legal.

Women generally have good health status. However, obesity has been increasing; in 2014, 13% of all mothers were obese.<sup>48</sup> About 6% of women smoke in early pregnancy.<sup>48</sup> Immigrant women, comprising more than 25% of women giving birth, use less antenatal care and less preventive care, such as cervical screening.<sup>48,53,54</sup> Being foreign born is an independent risk factor for induced abortion and migrant women requesting termination of pregnancy had lower contraceptive use compared with Swedish-born women.<sup>55</sup>

### Demographics of pregnant women

Changes in the underlying epidemiology of who is giving birth will affect care and outcomes. In Australia, the percentage of women 35 years and older was 22.7% of the total who gave birth, but accounted for 40% of the total maternal deaths. In the UK, 74% of deaths occurred in women with pre-existing medical conditions.<sup>21</sup>

### Obesity

More than one in five pregnant women are overweight or obese globally, putting these women at increased risk of congenital anomalies (specifically neural tube and abdominal wall defects), venous thromboembolism, pre-eclampsia, gestational diabetes, post-partum haemorrhage, and increased chance that an operative vaginal birth or a caesarean section will be required (appendix).<sup>56,57</sup> Caesarean section rates are more than doubled with increased operative morbidity; successful vaginal birth after caesarean section rates are decreased to 57.1% for women who weigh 90–135 kg, and 13.3% for women who weigh more than 135 kg, compared with 81.8% success for women who weigh less than 90 kg.<sup>58</sup> Additionally, hospital costs are increased for both maternal and neonatal indications in obese women.

### Tobacco and alcohol use

Overall rates of smoking at the start of or during pregnancy vary between 5.5% and 23% for the selected HICs.<sup>48,59</sup> Alcohol intake in Europe is the highest in the

world, followed by the Americas (WHO region), resulting in a higher prevalence of alcohol dependence and alcohol-use disorders than in other WHO regions (appendix).<sup>60</sup>

### Trauma-informed practice

Women experience a high prevalence of abuse and violence (one in three women), globally. Femicide from intimate partner violence is not currently included in maternal mortality data. Women who are young, immigrant, Indigenous, and women who have a disability are at increased risk of intimate partner violence;<sup>61,62</sup> prevalence is especially high in those women who continue to drink alcohol after discussion at the first prenatal visit. Trauma-informed practice is an approach to support all women in terms of providing safe care in the health system for women who experience violence. Use of a trauma-informed conversation in which judgment is suspended and substituted with supportive information and questions as suggested by the British Columbia Centre of Excellence for Women's Health is designed to move towards greater safety and a harm reduction model when abstinence from alcohol is not possible.<sup>61</sup>

### Vulnerable women

Vulnerable populations (immigrant, Indigenous, or ethnic minorities) are associated with poor health outcomes, including high maternal mortality among African American women (at rates 3–4 times the rates for Hispanic and non-Hispanic whites),<sup>63</sup> south Asian women (India and Pakistan) in the UK,<sup>64</sup> Aboriginal and Torres Strait Islander women in Australia,<sup>65</sup> and refugee women in France and the UK. These women often have other adverse outcomes, including increased caesarean section rates, preterm birth, and low birthweight infants. Pregnant Canadian and Australian Indigenous women have high rates of gestational diabetes and pre-existing diabetes,<sup>65,66</sup> and Torres Strait Islander women have an incidence of diabetes of 3–6 times the national average.<sup>67</sup> High rates of micronutrient deficiency, alcohol, and tobacco use are also reported, and nutritional intake is poor in a population with very low socioeconomic indicators. As noted by Graham and colleagues in this Series,<sup>68</sup> *The Lancet's* 2014 commission report on culture and health concluded that the neglect of culture is the single biggest obstacle to development of equitable health care.<sup>69</sup>

### Preterm birth

Preterm birth remains the least well understood and greatest contributor to poor perinatal outcomes globally, and is both stressful for families and costly to the health system. Risk factors for preterm birth and its attempted prevention and treatment also have implications for maternal health, including extremes of maternal age (both young and old), assisted reproductive technology,

multiple gestation, low maternal socioeconomic status, late or no prenatal care, substance abuse, tobacco use, bacterial vaginosis, and periodontal disease.<sup>70</sup> In the search for potentially modifiable risk factors for preterm birth and infant health, gut and vaginal microbiomes are important ongoing research areas.<sup>71,72</sup>

## Drivers of clinical quality of care

### Biology in conflict

Drivers of clinical quality of care include women's autonomy, the role of the health-care provider and patient safety, as well as intersecting drivers such as social support, clinical evidence, fear, and medical liability.

Many women in HICs are delaying marriage and reproduction until they complete higher education and find permanent work (figure 2). The consequences of this delay are decreased fertility, a rising age at giving birth, and complications due to coexisting medical conditions that increase with age. Spain, Germany, and Japan have very low total fertility rates at 1.3–1.4 births per woman, and all Nordic countries are under replacement levels at 1.7–1.9 births per woman (appendix).<sup>73,74</sup>

### Autonomy of women

Women drive care because they have high expectations for a positive birth experience and a healthy baby. Fear of pregnancy and childbirth is common, affecting as many as 25% of women in HICs,<sup>75</sup> and can be so intense as to be termed tokophobia.<sup>76</sup> Women are set up to feel inadequate and responsible if a perfect outcome is not achieved, despite having little control over this mostly physiological process.<sup>77,78</sup> The extent to which women share in the general western valuation of technology is revealed in a study<sup>79</sup> in which more than 70% of women interviewed supported high-tech hospital birth, including use of electronic fetal monitoring. Primary caesarean section rates, where reported, are higher for women age 35 years and older.<sup>80–83</sup> However, maternal preference caesarean rates vary across HICs and surveys typically show physicians report higher maternal preferences than women do themselves.<sup>84–86</sup>

A multicountry systematic review found experiences during childbirth were reported as unsatisfactory when they occurred in the absence of one or more of the following situations: quality care promoting wellbeing with a focus on individual needs; unrushed caregivers who provide continuity of care and communicate effectively; involvement in decision making about care and procedures; and kindness and respect.<sup>87</sup> Immigrant women gave worse ratings than did non-immigrant women due to communication difficulties resulting from language barriers, unfamiliarity with how care was provided, and experiences of discrimination<sup>87</sup>—experience of birth from the perspective of immigrant women is particularly relevant to inform health system responses, in view of the current global migration trends.

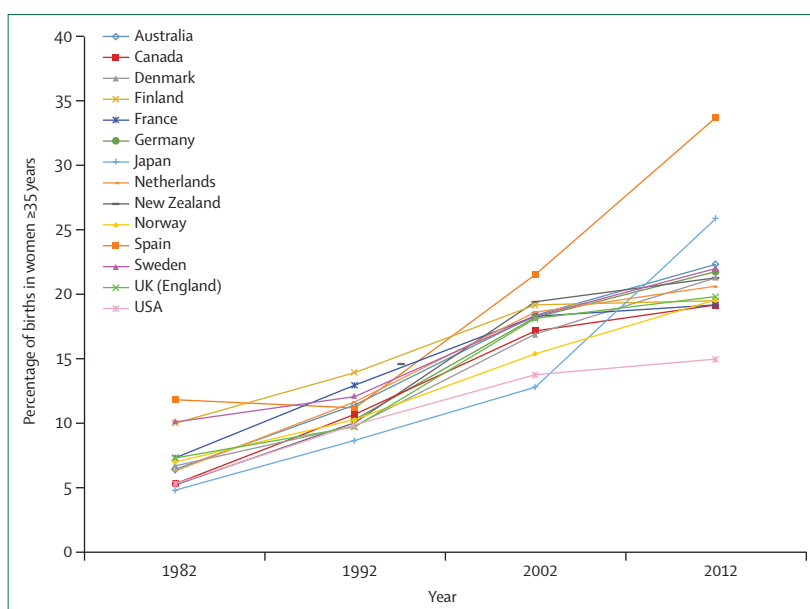


Figure 2: Percentage of births to women aged 35 years or older, in high income countries, 1982–2012

### Fear of pain in labour

Pain relief options in labour and what is accessible in any given birthing environment depend on the culture, woman's preference, and availability of obstetric anaesthesia services. Existing data suggest wide variations in the use of epidural analgesia with rates of 82% in France, 71% in the USA, 59% in Canada, and 10–50% in other countries (table 1). Comparative information on availability of a mobile or minimal motor block labour epidural for analgesia is non-existent.

### Maternity (or pregnancy) leave

The International Labour Organization convention on maternity leave stipulates at least 14 weeks of leave.<sup>88</sup> Most OECD countries tie public income support payments to taking of maternity leave for periods ranging from 6 weeks (Australia) to 39 weeks (UK); some integrate maternity leave into parental leave schemes (appendix).<sup>51</sup> The USA is the only OECD country that does not provide paid maternity or parental leave<sup>89</sup> and 30% of US women take no maternity leave.<sup>89</sup> In Japan, qualification for paid child care leave is challenging, so only 4% of women in non-regular jobs can return to work after leave.<sup>90</sup> Mental health is a well-recognised health concern during pregnancy and post partum. Linked data in Europe (SHARE)<sup>91</sup> suggest that a more generous maternity leave during the birth of a first child is associated with a significantly reduced score of 0.38 points in the Euro-D depressive symptom scale at later ages (over 50 years for a 16–25 years cohort).

### Adolescents

Adolescents are a special population whose reproductive health needs are often suboptimally met.

Teen pregnancy rates in the selected countries in this Series paper have mostly declined, and birth rates for adolescents have declined except for the USA, with increased abortion rates in Finland, the Netherlands, Sweden, and the UK.<sup>92</sup> In the UK and USA, teen pregnancy rates are increased in the most socio-economically disadvantaged groups.<sup>93,94</sup>

## Influence of the provider on maternity care outcome

### Models of care

Maternity care providers in HICs vary from single practitioners (family physician, general practitioner, midwife, or obstetrician) to group practices of single provider cadres, to shared care between midwives and obstetricians, in both public, and private settings.

A mixture of models of care is found in the UK, Canada, Germany, Japan, and Australia (appendix).<sup>95–97</sup> In western Europe, Scandinavia, and New Zealand, midwives provide 70–80% of care during pregnancy and for low-risk births, leading to lower intervention rates. A review<sup>98</sup> of continuous care led by licensed midwives showed several benefits for mothers and babies, and identified no adverse effects compared with models of medical-led care or shared care. The main benefits of midwifery-led care were reductions in epidurals, episiotomies, and instrumental births. The rate of caesarean births did not differ. In France, the roles of different types of health-care providers have changed, with greater involvement of general practitioners, and especially midwives.<sup>97</sup> In Japan, midwives work at hospitals and clinics, provide care for low-risk women during pregnancy, labour, and post partum, and cooperate with physicians for women at risk.

In North America, most births were assisted by physicians, with midwifery reintroduced over the last three decades. Births by certified nurse midwives and certified midwives in the USA in 2013 represented 12·0% of all vaginal births, or 8·2% of all births.<sup>99</sup> In Canada, midwifery began to be regulated in 1991, and planned home births by regulated midwives were first introduced in 1994. By 2013, all but two of ten provinces or territories had enacted legislation to regulate midwives.<sup>100</sup>

### Labourists—a potential solution?

Labourists are obstetricians who only provide care for labour and delivery and may be a possible solution to high intervention rates by obstetrician-led care. Studies find that care by full-time labourists was associated with 27% fewer caesarean deliveries,<sup>101</sup> whereas care provided by teams of labourists and midwives showed a nearly 50% reduction in both overall and nulliparous term single vertex caesarean delivery rates.<sup>102</sup> Other studies have found no difference in outcomes when labourists are present. The lack of a consistent role and funding model for labourists makes reliable conclusions about this model problematic at present.<sup>103</sup>

### Fear of litigation and malpractice insurance

Many authors discuss the essential balance between fear and trust, as birth is becoming increasingly medicalised due to domination of fear.<sup>104</sup> Obstetric providers are often sued, usually because of a neurologically compromised infant (table 2); despite the fact that as early as 1999, an International Cerebral Palsy Task Force strongly suggested that most cerebral palsy was a result of multifactorial and mostly unpreventable causes during either fetal development or the neonatal period.<sup>114</sup>

Fees for insurance liability coverage for obstetricians are high in Canada and the USA.<sup>1108,109</sup> The impact on the obstetric provider goes beyond the cost of indemnity payments, including time and stress, and can reduce availability of obstetricians.<sup>110</sup> Insurance affordability or availability was the reported reason for a 9·6% increase in the number of caesarean deliveries between Jan 1, 2012 and Dec 31, 2014, in the 2015 American College of Obstetricians and Gynecologists survey.<sup>110</sup> States with relatively high malpractice insurance premiums had higher rates of caesarean section and lower rates of delivery by vaginal birth after caesarean section than did states with lower premiums.<sup>111</sup> Furthermore, caesarean section rates were substantially reduced and vaginal birth after caesarean section rates were substantially increased in state-years, in which caps on non-economic damages were in force. Medical liability reforms that have been implemented or suggested include a no-fault system—at least for the neurologically impaired infant, caps on non-economic damages, and legal safe harbours.<sup>111,112</sup> A number of no-fault schemes exist throughout the world, including in New Zealand, Scandinavia, Japan, and parts of the USA.<sup>105,106,112,114</sup>

### Quality and safety issues

High quality care should be safe, effective, woman centred, timely, efficient, and equitable,<sup>107</sup> and a good outcome should be defined as what is meaningful and valuable to the individual woman.<sup>78</sup>

Improvement of care quality is a priority in HICs clearly evidenced by findings from Confidential Enquiries in France, Netherlands, and the UK, showing that overall almost half of maternal deaths are associated with substandard care.<sup>20,115</sup> In countries such as France, the Enquiry and attendant remediation efforts have reduced preventable maternal deaths due to suboptimal care by 10%.<sup>116</sup> The substantial variation in HIC obstetric hospital care raises concerns that clinical practice patterns rather than medical indications are driving increasing intervention rates.<sup>116,117</sup> These variations are not accounted for simply by different levels of care in size and type of facility. As noted by Miller and colleagues in this Series,<sup>118</sup> overuse of technology refers to use that is not based on evidence, with multiple drivers including fear of adverse outcome, revenue generation, and women's demand. Electronic fetal monitoring and prenatal ultrasound during pregnancy and labour are major contributors to intervention in maternity care.



	Confidential inquiry into maternal deaths or near miss	Tort system	No fault system for severe neurological birth injury	Cap on damages	Malpractice insurance fees/subsidies	Other
Australia <sup>105-107</sup>	No (has national maternal death report generated from ad-hoc national research dataset)	Yes	No; partial funding for high payouts	No	Government premium subsidies, private indemnity insurance required for private practice	..
Canada <sup>106,108,109</sup>	No	Yes	Partial in 4 provinces	Yes; \$100 000 for non-pecuniary losses in 1978, currently estimated at \$300 000	Premiums \$34 204–72 456; subsidies variable by province; insurance coverage at time of event effective whenever claim made	Losing party pays 2/3 of successful party's legal fees; health-care costs covered by state; fees not based on physician's record or claims history
Denmark <sup>106,107</sup>	No (regional maternal and perinatal reviews annually)	Yes	Yes	No	Yes, the regions pay compensation in case of malpractice from Patientforsikringen	Health-care costs covered by state
Finland <sup>106,107</sup>	No	Yes	Yes (in principle); the Finnish Patient Insurance Centre evaluates and covers; in cases of serious malpractice or misconduct the health-care provider can be charged but not for financial expenses	Case-based cap	Public hospitals cover all employees	Health-care costs covered by state
France <sup>106</sup>	Yes	Yes but tort-adverse system	Partial	Not available	Partial government subsidy	..
Germany <sup>106,108</sup>	No	Yes	No	Yes, and no punitive damages	Not available	Alternate dispute resolution encouraged; health-care costs covered by state
Japan <sup>106</sup>	Yes	Yes	Yes	No	Not available	..
Netherlands <sup>106</sup>	Yes	Yes	No	Yes; €1 250 000 per claim	Not available	..
New Zealand <sup>106</sup>	No (has Perinatal and Maternal Mortality Review Committee)	No	Yes	Not available	Not available	Health-care costs covered by state
Norway <sup>106,107</sup>	No	Yes	Yes	Case-based cap	NPE (governmental system) and private insurance for physicians in case claims not covered by NPE	Health-care costs covered by state
Spain <sup>106</sup>	No	Yes	No	No	No	..
Sweden <sup>106,107</sup>	No (Maternal Mortality review by Swedish Obstetrics and Gynecology Society)	Yes	Yes; patients eligible to receive compensation if suffered injury that could have been avoided	Yes; \$370 000 per claim	Insurance of \$300–600 annually through; the Swedish Medical Association	Health-care costs covered by state
UK (England) <sup>106,107</sup>	Yes	Yes	Government sponsored indemnification of medical injuries (National Health Service Litigation Authority)	No	No fees for NHS physicians, sliding scale if in private practice	Health-care costs covered by state
USA <sup>106,107,110-113</sup>	No	Yes	No (in 2 states only)	Non-economic in 28 states; federal legislation pending	No; base rates from \$16 240 to \$214 999; must have current insurance when claim made	..

NPE=Norsk pasientskade-erstatning.

**Table 2: Factors affecting medical liability in selected high-income countries**

Lack of clear and respectful communication across the care team is one of the most common root causes of reported maternal and perinatal sentinel events.<sup>119,120</sup> This lack is further amplified in publications of women's experience of care. Mechanisms to improve patient

safety and quality of care in HICs include national quality or safety agencies (or both), accreditation programmes, subnational reporting, institution-specific mechanisms, involvement of patients (women) and families in planning, assessment, and delivering of

For more on **maternal safety bundles** see <http://www.safehealthcareforeverywoman.org>

their own care, required competencies for postgraduate training, and public reporting on key quality and safety indicators.

Key safety practices and tools include<sup>121</sup> maternal safety bundles, maternal safety early warning triggers, critical patient safety event reviews with root cause analysis, severe maternal morbidity case review forms, team-based simulation for obstetric emergencies, and validated communication tools.

### Drivers for change

#### Opportunities realised from data

Efforts can be made to reduce interventions in HICs by increased understanding of potentially modifiable risk factors and identification of opportunities to address such risk factors through education, professional guidelines, health policy, and quality improvement initiatives.

New opportunities are available to use data to inform health policy and practice. In the USA, efforts are underway to reconstitute maternal mortality reviews in every state to create a standard set of structured data elements for maternity care and to facilitate more accurate and timely collection of vital records and performance indicators directly from the electronic medical record.<sup>122</sup>

Detailed reviews of maternal deaths from two of the largest US states, California and New York, led to the development of state-wide pilot projects with best practice toolkits and large-scale engagement within performance improvement collaboratives.<sup>24</sup> These collaboratives focused on haemorrhage and severe hypertension, which account for more than 80% of severe maternal morbidity cases in the USA. The most populous US state, California, with nearly 500 000 annual births (1/8 of all US births), has a maternal mortality rate that is now half the national rate and is similar to other HICs (figure 1).

Implementation of national guidelines from France for non-invasive prenatal detection of aneuploidy successfully decreased amniocentesis, especially among women aged 38 years and older (from 61% to 42%) showing that professional recommendations are being followed.<sup>123</sup> Recent changes to the definition of the active phase of labour and redefinition of normal length of second stage of labour should inform professional and facility guidelines to decrease interventions for arrested progress.<sup>124,125</sup>

#### Innovation to improve access to care

Addressing of inequalities in both access to care and maternal outcomes is a priority requiring improved recognition of vulnerable women to allow more targeted or appropriate services to be delivered. The UK NHS Initiative to offer pregnant women a budget of up to £3000 to choose the care they receive is also intended to increase safety, and requires evaluation with improved data collection.<sup>126</sup>

#### Appropriate use of technology

Although technology is a major driver in high-resource settings, and might result in over-intervention, technology such as telehealth might have even greater benefit when women are geographically isolated. In HICs, telehealth has been tested in diabetes care, smoking cessation, alcohol cessation, influenza vaccination, and antepartum care with mostly positive results (appendix). As electronic technologies become increasingly prevalent, their ability to transcend access barriers and optimise convenience is attractive; understanding of where the value is worth the investment is a critical question.<sup>127</sup> E-health initiatives to improve access to care, woman-centred care, and improved pregnancy outcomes warrant further randomised trials.

#### Group antenatal care in HICs

CenteringPregnancy, and similar models of innovative group antenatal and postnatal care and education in the USA, Canada, Sweden, and Australia seek to address the concerns of consumers and professionals about the shortcomings of traditional antenatal care.<sup>128</sup> A Cochrane review<sup>129</sup> of a limited number of studies concluded that group antenatal care is positively viewed by women and is not associated with adverse outcomes for them or for their babies.

#### Conclusions

Models of maternity care in HICs are evolving; woman-centred care, accompanied by evidence that increasing interventions raise costs but do not improve outcomes, provides an opportunity to shift the balance in HICs, and to provide an example of best practice based on evidence.

Large variations in practice are evident in all HICs in all sizes of facilities, and among providers within the hospitals when either outcomes or processes of care are examined.

Data should drive health policy and currently too many knowledge gaps exist in HICs. Outcomes beyond mortality are required to comprehensively inform health policy, especially in view of the inequities that exist for Indigenous, ethnic, or marginalised populations. Indicator data should be disaggregated by ethnicity and vulnerable groups, with inclusion of rural versus urban contrasts. Additionally, nationally consistent oversight is needed and could be achieved by audit or confidential inquiry for maternal mortality and near miss (severe morbidity) with nationally supported provision of comparable data.

Quality improvement initiatives driven by data, evidence, and women's input are becoming standard in health-care facilities of HICs, and are beginning to improve outcomes, including reductions in maternal mortality in the USA. Leadership from national professional organisations is essential to support the adoption of best practice for quality, safety, and woman-centred care. Central to progress is the ability to change

from a perception that the pregnant and labouring woman is a risk waiting to happen, to one where birth is normalised to provide the best outcomes for most women, with services available in the event that complications develop. For women with existing or pregnancy-related medical problems, or with social circumstances that may require highly specialised care, coordinated team approaches in the pre-pregnancy and antenatal period are needed, as well as post partum, to optimise the management of pre-existing illness, and reduce morbidity from indirect causes.

Different models of care by providers should continue to be explored and evaluated in terms of their ability to meet women's needs, and reduce interventions, and costs, while outcomes are improved. Women should be involved in the process. With evolving evidence and guidelines to support low-risk women planning birth at home or in hospital birth centres, a focus on woman-centred care by accrediting bodies, and resurgence of midwifery-led care by licensed midwives in HICs where it had disappeared or waned, the tide of intervention-oriented birthing might be turning.

#### Contributors

DS conceptualised the paper. DS, FW, and J-MG did the literature search. NS did the US case study and cost analysis and KG-D did the Swedish case study. DS, J-MG, FW, and NS did the tables. DS, FW, KSJ, and EKM did the figures. All authors contributed to data interpretation; DS wrote the paper, with contributions from J-MG, KSJ, NS, BL, and EKM, and all authors commented on multiple versions. All authors are able to take public responsibility for the work.

#### Declaration of interest

We declare no competing interests.

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