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CLINICAL ARTICLE

Trends in preterm birth in singleton deliveries in a Hong Kong population

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ABSTRACT

Objective: To examine trends in preterm birth and its relationship with perinatal mortality in Hong Kong. *Methods:* In a retrospective cohort study, data were reviewed from singletons delivered between 1995 and 2011 at a university teaching hospital. Trends in preterm birth (between 24 and 36 weeks of pregnancy), perinatal mortality, and subtypes of preterm birth (spontaneous, iatrogenic, and following preterm premature rupture of membranes [PPROM]) were examined via linear regression. *Results:* There were 103 364 singleton deliveries, of which 6722 (6.5%) occurred preterm, including 1835 (1.8%) early preterm births (24–33 weeks) and 4887 (4.7%) late preterm births (34–36 weeks). Frequency of preterm birth remained fairly consistent over the study period, but that of spontaneous preterm birth decreased by 25% ($\beta = -0.83$; $P < 0.001$), from 4.5% to 3.8%. Frequency of preterm birth following PPROM increased by 135% ($\beta = 0.82$; $P < 0.001$), from 0.7% to 1.7%. The perinatal mortality rate decreased from 56.7 to 37.0 deaths per 1000 deliveries before 37 weeks ($\beta = -0.16$; $P = 0.54$). Early preterm birth contributed to 16.0% of all deaths. *Conclusion:* Although the overall rate of preterm birth in Hong Kong has remained constant, the frequencies of its subtypes have changed. Overall perinatal mortality is gradually decreasing, but early preterm birth remains a major contributor.

1. Introduction

Despite the increased accessibility and improved standards of prenatal care in most countries, the incidence of preterm birth has continued to rise over the past two decades in some nations [1]. Late preterm birth (at 34–36 weeks of gestation) is still the most common type, accounting for up to 72% of all preterm births in the USA in 2012 [2]. Although survival of preterm newborns has greatly improved because of advances in neonatal intensive care, the social and economic burdens of preterm birth remain substantial. Preterm-related complications are estimated to account for more than 35% of the 3.1 million neonatal deaths that occur worldwide every year, and preterm birth is still the second most common cause of death among children younger than 5 years [3].

In Asia, the estimated incidence of preterm birth varies from 7.2% in East Asia to 13.6% in Southeast Asia [1]. The reason for the differences among Asian regions is unclear, but a comparison between Chinese women living in China, Hong Kong, and Australia showed that the frequency of preterm birth was higher for those residing in high-income regions [4]. This variation might be partly related to increased medical interventions. In the USA, for example, an increase in the frequency of preterm birth was caused mainly by a rise in the number of medically indicated deliveries, whereas spontaneous preterm birth decreased [5,6]; once healthcare providers became aware of the problem, efforts were successfully made to reduce the preterm rates from 11.1% in 2006 to 9.9% in 2012 [2]. Nevertheless, the overall frequency of preterm birth provides no information on the role of medical interventions or on the relative contributions of spontaneous versus iatrogenic preterm birth to the perinatal mortality rate among preterm neonates.

Hong Kong lies between low-resource and high-resource countries in terms of economic development. In 2011, 93.6% of the 7.07 million individuals in Hong Kong were of Chinese ethnic origin [7]. Therefore, studies in Hong Kong of the trends in preterm birth and their impact on perinatal mortality would not be confounded by variation in ethnic origin due to population migration and immigration, and would help to elucidate the influence of changing obstetric practice and the associated perinatal mortality so that appropriate strategies for preventing preterm birth and reducing perinatal mortality can be devised.

It is also informative to examine the trends in early and late preterm birth, and in the three clinical subtypes (spontaneous preterm birth, iatrogenic preterm birth, and preterm births following preterm premature rupture of membranes [PPROM]). It is helpful to consider preterm birth following PPROM as a stand-alone subtype because—according to the latest Royal College of Obstetricians and Gynaecologists guideline for PPROM [8]—induction after PPROM is recommended at or after 34 weeks if there is no spontaneous onset of labor. Thus, preterm birth following PPROM includes both spontaneous and iatrogenic births.

The primary aim of the present study was to examine trends in preterm birth and associations with perinatal mortality among singleton

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Table 1
Frequency of preterm birth among 103 364 singleton deliveries.

Type	No. (%)
Preterm birth[a]	6722 (6.5)
Early preterm birth[b]	1835 (1.8)
Late preterm birth[c]	4887 (4.7)
Spontaneous preterm birth	4266 (4.1)
Spontaneous preterm birth after PPROM	338 (0.3)
Iatrogenic preterm birth	2456 (2.4)
Iatrogenic preterm birth after PPROM	754 (0.7)

Abbreviation: PPROM, premature rupture of membrane.
[a] Between 24 and 36 weeks, 6 days.
[b] Between 24 and 33 weeks, 6 days.
[c] Between 34 and 36 weeks, 6 days.

deliveries in Hong Kong. A secondary aim was to carry out a subgroup analysis for iatrogenic preterm birth to examine common indications and their associated perinatal mortality risk.

2. Materials and methods

In a retrospective cohort study, data were reviewed from all singletons delivered between January 1, 1995, and October 31, 2011, at the Prince of Wales Hospital in Hong Kong—a university obstetrics unit taking care of both high- and low-risk women, with more than 6000 deliveries per year. Ethics approval was obtained from the Joint Chinese University of Hong Kong–New Territories East Cluster Clinical Research Ethics Committee (reference number 2012.256). Informed consent was not required because the data did not contain any identifying information.

The study data were obtained from the Obstetric Specialty Clinical Information System database, which was set up by the Hong Kong Hospital Authority to record all maternal and perinatal outcomes in public hospitals. For this database, prenatal information and perinatal outcomes are prospectively recorded at each visit and at the time of delivery by the attending midwife. The accuracy and validity of the data are checked by a second midwife. Moreover, perinatal outcomes are reviewed in monthly and annual audit meetings to ensure that all adverse events were identified.

Gestational age was estimated on the basis of the date of last menstrual period and/or crown–rump length measurement during early dating ultrasound. A service for anomaly scans in the second trimester was introduced in 1997, and combined Down syndrome screening in the first trimester in 2003. Therefore, most women who delivered in the study period had had at least one prenatal scan. These scans were used to revise the estimated delivery date and gestational age if they were inconsistent with those calculated from the last menstrual period.

Preterm birth was defined as delivery between the start of week 24 and the end of week 36. Early preterm birth occurred between the start of week 24 and the end of week 33, and late preterm birth occurred between the start of week 34 and the end of week 36. Pregnancies that ended before week 24, including spontaneous abortions and medically or surgically terminated pregnancies, were excluded.

Preterm birth was classified into three subtypes: spontaneous preterm birth (birth following spontaneous onset of labor), iatrogenic preterm birth (medically indicated deliveries, with either induction of labor or cesarean), and preterm birth following PPROM (including both spontaneous and iatrogenic births).

Perinatal death was defined according to the US National Centre of Health Statistics, American Academy of Pediatrics Committee on Fetus and Newborn, and the American College of Obstetricians and Gynecologists Committee on Obstetric Practice [9,10]. The minimum gestational age was adjusted according to the legal definition of viability in Hong Kong (24 weeks' gestation). Therefore, in the present study, the overall perinatal mortality rate was defined as the sum of fetal deaths (≥24 weeks of gestation) plus neonatal deaths within the first 28 days of delivery, expressed per 1000 deliveries. Specific mortality risks were calculated per 1000 deliveries of the specified gestation or clinical condition.

The absolute and relative trends in the incidence of preterm birth overall and in the three subtypes, and in overall perinatal mortality were examined. Intrauterine deaths and lethal fetal anomalies were common confounders, because induction of labor was typically offered before term in these cases in the study cohort, and so they would be counted as iatrogenic preterm births in most cases. Therefore, in addition to calculating overall perinatal mortality, the analysis was repeated without these cases, thereby generating a corrected perinatal mortality rate to reflect more accurately the contribution of preterm birth to perinatal mortality. Perinatal mortality for iatrogenic preterm birth was also examined. Common indications were categorized and the specific mortality risk was calculated.

Statistical analysis was performed via PASW Statistics for Windows version 18.0 (IBM, Armonk, NY, USA). Descriptive analysis was used to calculate the prevalence of preterm birth. Trend analysis was undertaken by performing a linear-by-linear trend test, and then by fitting a linear regression model for each series and testing the regression coefficient (β) to see whether there was significant deviation from zero via a t test. For comparisons between groups, χ^2 tests were used as appropriate. All statistical tests were two-tailed. $P < 0.05$ was considered significant.

Table 2
Preterm births and related mortality.[a]

Gestational age at delivery	Deliveries (n = 103 364)	Perinatal deaths (n = 493)[b]	Overall perinatal mortality rate (per 1000 deliveries)	Intrauterine deaths and lethal anomalies (n = 348)[c]	Corrected number of deliveries (n = 103 016)	Corrected number of perinatal deaths (n = 145)	Corrected perinatal mortality rate (per 1000 deliveries)	Corrected contribution to overall mortality (%)[d]
24–33 weeks								
Total	1835 (1.8)	268 (54.4)	146.0	189 (54.3)	1646 (1.6)	79 (54.5)	48.0	16.0
Iatrogenic	698 (0.7)	178 (36.1)	255.0	156 (44.8)	542 (0.5)	22 (15.2)	40.6	4.5
Spontaneous	1137 (1.1)	90 (18.3)	79.2	33 (9.5)	1104 (1.1)	57 (39.3)	51.6	11.6
34–36 weeks								
Total	4887 (4.7)	65 (13.2)	13.3	48 (13.8)	4839 (4.7)	17 (11.7)	3.5	3.4
Iatrogenic	1758 (1.7)	45 (9.1)	25.6	36 (10.3)	1722 (1.7)	9 (6.2)	5.2	1.8
Spontaneous	3129 (3.0)	20 (4.1)	6.4	12 (3.4)	3117 (3.0)	8 (5.5)	2.6	1.6
≥37 weeks								
Total	96 642 (93.5)	160 (32.5)	1.7	111 (31.9)	96 531 (93.7)	49 (33.8)	0.5	9.9
Iatrogenic	23 999 (23.2)	89 (18.1)	3.7	66 (19.0)	23 933 (23.2)	23 (15.9)	1.0	4.7
Spontaneous	72 643 (70.3)	71 (14.4)	1.0	45 (12.9)	72 598 (70.5)	26 (17.9)	0.4	5.3

[a] Values are given as number (percentage) unless otherwise indicated.
[b] Fetal deaths (≥24 gestational weeks) plus neonatal deaths within the first 28 days of birth.
[c] Intrauterine deaths were intrauterine fetal deaths at a gestational age of less than 24 weeks.
[d] Percentages calculated with total number of perinatal deaths to reflect overall contribution to mortality.