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Preterm birth in singleton and multiple pregnancies: evaluation of costs and perinatal outcomes

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ABSTRACT

Objective: To estimate costs of preterm birth in singleton and multiple pregnancies.
Study design: Cost analysis based on data from a prospective cohort study and three multicentre randomised controlled trials (2006–2012) in a Dutch nationwide consortium for women's health research. Women with preterm birth before 37 completed weeks were included for analysis. Direct costs were estimated from a health care perspective, from delivery until discharge or decease of the neonates. Costs and adverse perinatal outcome per pregnancy were measured. Adverse perinatal outcome comprised both perinatal mortality and a composite of neonatal morbidity defined as chronic lung disease, intraventricular haemorrhage ≥ grade 2, periventricular leukomalacia ≥ grade 1, proven sepsis or necrotising enterocolitis. Using a moving average technique covering three weeks per measurement, costs and adverse perinatal outcome per woman delivering for every week between 24 and 37 weeks are reported.
Results: Data of 2802 women were available of whom 1503 (53.6%) had a preterm birth; 501 in 1090 singleton (46%) and 1002 in 1712 multiple pregnancies (58.5%). The most frequent perinatal outcomes were perinatal mortality, chronic lung disease and sepsis. For singleton pregnancies the peak of total costs was at 25 weeks (€88,052 per delivery), compared to 27 weeks for multiple pregnancies (€169,571 per delivery). The total costs declined rapidly with increasing duration of pregnancy. Major cost drivers were length of stay on the NICU and airway treatments. The peaks seen in costs paralleled with the prevalence of adverse perinatal outcome.
Conclusions: These data can be used to elaborate on the impact of preterm birth in case only data are available on duration of pregnancy.

Introduction

Preterm birth is the most important issue in obstetric care in the developed world. Of all perinatal mortality, 50–70% occurs after preterm birth and it is a major cause of neonatal morbidity [1,2]. Many developed countries have reported increasing preterm birth rates for the last two decades [3]. Results from the Global Burden of Disease (GBD) Study 2010 show that preterm birth complications attributed for 3.1% to all DALYs (disability-adjusted life years). As a result, preterm birth was 8th on the GBD ranking in 2010, despite the improvement in neonatal treatment of preterm infants in the last decades [4]. Interventions that may delay preterm birth, like administration of progestagens or use of a cervical pessary, are currently focus of research [5–9].

Preterm birth is important because of its adverse perinatal outcomes and of its associated health care costs. The annual financial burden of preterm birth in the USA was estimated to be $26 billion in 2005 [10]. Phibbs et al. reported population-based data that can be applied to clinical trials to assess the impact on costs of potential interventions that delay preterm birth [11]. They calculated (hospital) costs based on length of stay until discharge or neonatal death only, and found that potential savings were quite large; costs decreased from a median of $216,814 for infants born at 24 weeks to $591 for infants born at 37 weeks. They did not

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differentiate between singleton and multiple pregnancies, which is important as the risk of preterm birth and other pregnancy complications in multiple pregnancies is higher with inherent consequences on perinatal mortality and morbidity.

Reliable estimates of both neonatal mortality and morbidity as well as financial cost are needed, as these data could be used to compute neonatal outcomes and costs in studies that only have data available on duration of pregnancy. In this study, we calculated costs of preterm birth using various perinatal outcomes in a large number of singleton and multiple pregnancies to indicate potential savings in managing preterm birth.

Materials and methods

Population

For our study we used data from one prospective cohort study and three multicentre randomised controlled trials (RCTs) on preterm birth performed in the Dutch consortium for women's health research between 2006 and 2012. The prospective cohort study was the APOSTEL I (NTR 1857), which evaluated the use of fetal fibronectin testing and cervical length in 714 women with threatened preterm labour [12]. The APOSTEL II-trial (NTR 1336) compared maintenance tocolysis with nifedipine to placebo in 406 women with threatened preterm labour [13]. The AMPHIA-trial (ISRCTN 40512715) compared weekly intramuscular injections of 17-alpha-hydroxyprogesterone caproate to placebo in 671 multiple pregnancies [14]. The PROTWIN-trial (NTR 1858) compared a cervical pessary to expectant management in 813 multiple pregnancies [9]. The full design and results of these studies have been described elsewhere [9,12–14].

For this study, we included all women from whom complete data was available for perinatal outcomes and costs. We extracted data on 2802 women. Of these women, 1090 (39%) had a singleton pregnancy and 1712 (61%) had a multiple pregnancy resulting in the overall birth of 4552 infants (Fig. 1). Of the 1712 multiple pregnancies, 1674 (97.8%) were twins and 38 (2.2%) were triplets. No higher order multiple pregnancies were included. All women were followed until final discharge and the children were followed until death or discharge from the neonatal unit.

We measured adverse perinatal outcome as follows. Adverse perinatal outcome comprised both perinatal mortality and a composite of neonatal morbidity defined as chronic lung disease (in need of oxygen at 28 days after birth or clinically determined bronchopulmonary dysplasia), intraventricular haemorrhage $\geq$ grade 2, periventricular leukomalacia $\geq$ grade 1, proven sepsis or necrotising enterocolitis.

We measured all neonatal resources uses in the postpartum period. Each resource use was multiplied by its unit price; e.g. the total days of admission on the neonatal care unit were multiplied by the daily costs of admission. Finally, all costs per women were summed leading to total neonatal costs per woman. For multiple pregnancies the costs of the neonates were summed, as this reflects the accurate costs of a multiple pregnancy as a whole. Resource use was collected from original case record forms. Days of admissions were determined separately for the neonatal care units (intensive, high, medium), maternity ward and home care to allow differentiation in associated costs. Costs of additional care, e.g. neonatal surfactant, days of intubation, continuous positive airway pressure (CPAP) and radiologic procedures, were taken into account.

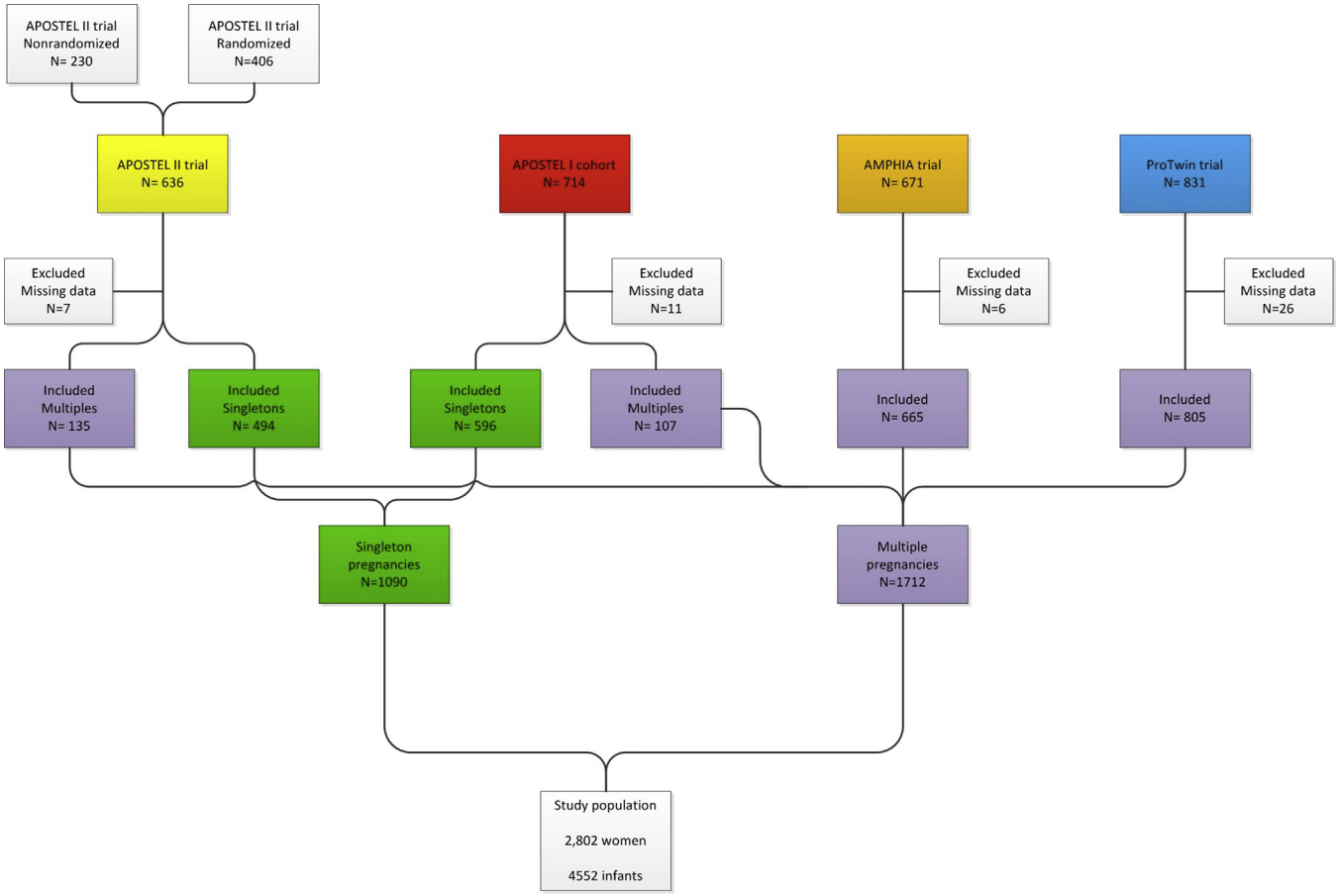

Fig. 1. Flowchart of the study population.