

## B. Introduction:

Birth weight is the most important determinant of perinatal, neonatal and postneonatal outcomes.<sup>1;2</sup> Poor growth during the intrauterine period increases the risks of perinatal and infant mortality and morbidity.<sup>1;3;4</sup> In addition, the intrauterine milieu affects the health of an individual not only during fetal life but also throughout the postnatal stages of life.<sup>5;6</sup> Compositional changes are noted in the developing brain exposed to an adverse intrauterine environment and/or fetal malnutrition.<sup>7</sup> Adverse intrauterine environment results in either low birth weight (LBW) or preterm birth. LBW is a multifaceted problem that includes a wide spectrum of health related problems from its origin to the consequences later in life.<sup>5;6</sup> Similarly preterm birth is also of significant public health importance because of its association with an increase in mortality and childhood morbidities such as developmental problems, cerebral palsy, learning difficulties, and an increased risk of sudden infant deaths.<sup>2;4</sup>

The birth weight of an infant is dependent on the length of the gestation and the intrauterine growth of the fetus. LBW can result from preterm birth or intrauterine growth restriction (IUGR) or a combination of the two. A preterm infant can be large for gestational age (rare), appropriate for gestational age or small for gestational age. LBW does not necessarily mean IUGR and vice versa. There may be significant overlaps among these groups of infants, which stresses the importance of a correct estimation of the gestational age of the newborn. Infants born at relatively mature gestation (32-36 weeks) are still at higher risk of death during infancy compared to term infants.<sup>8</sup> As there are more infants born in this gestational age stratum compared to lower gestational ages they have a marked impact on health care utilization and costs. For each preterm LBW infant born in Canada, the neonatal intensive care and postneonatal cost up to one year of age was conservatively estimated at \$ 8,443 in 1987 and \$ 48,183 in 1995 per surviving LBW infant.<sup>9</sup> The lifetime cost for permanent handicaps of neonatal origin were estimated to be \$ 676,800 per preterm LBW infant. A population based prevention strategy, which reduces the preterm birth rate by 20%, could save 2-billion dollars/year in health care costs nationally.<sup>9</sup>

Growth restricted infants represent a heterogeneous group of infants who have not reached their in-utero growth potential.<sup>1;10</sup> Intrauterine growth restriction (IUGR) is associated with increased risk of neonatal death in very low birth weight infants (VLBW) [odds ratio (OR) 2.77, 95% confidence interval (CI) 2.31, 3.33].<sup>11</sup> The extent of the impact depends on the underlying mechanism and timing of the insult.<sup>10</sup> Viral infections in the first trimester of pregnancy lead to symmetrical growth restriction (head circumference and weight) but utero-placental insufficiency in the later part of pregnancy leads to asymmetric growth restriction (discrepancy between head circumference and weight). LBW is closely related to preterm birth as it is estimated that approximately 50% of preterm infants weigh less than 2,500 grams while only 2% of full-term infants weigh below 2,500 grams.<sup>12</sup> Epidemiologists in the field are faced with the challenges of assessing the differential consequences of these components and at the same time separating the preterm component of LBW.<sup>13</sup>

This review analyzes the evidence for the determinants or causative factors, and the strategies for prevention of adverse pregnancy outcomes related to preterm, LBW, IUGR or small for gestational age (SGA) births.

### **C. Burden of illness:**

#### **a. Global:**

IUGR and LBW infants represent a significant health problem worldwide.<sup>1;14-17</sup> The IUGR-LBW rate is highest in South-Central Asia followed by Middle and Western Africa, Oceania and Latin America.<sup>18</sup> The significance of these findings should be understood within the context that 75% of these infants are born in Asia (greater total number of live births) while a small number of children are born in Oceania. These rates of IUGR-LBW are probably underestimates of the global situation as in the developing world a significant proportion of infants are born at home and are not registered as live births.<sup>18</sup>

The incidence of preterm birth is increasing. This rise is particularly noted in developed countries (the quality of data from the developing countries precludes any firm conclusions).<sup>14;16;19-21</sup> Dramatic reductions in mortality rates have been reported in the last 2 decades among preterm infants with less of a reduction in morbidity.<sup>14;22</sup> In the developed countries only France and Finland reported a reduction in preterm birth rates<sup>23</sup> until the early 1990's. However, the rates for LBW births have been reported to be on the rise again in Finland (4.4% rate for LBW births in 1998 compared to 4.0% in 1991).<sup>24</sup> The increase was chiefly attributed to a rising incidence of multiple births.<sup>24</sup> LBW/preterm birth rates are higher in the US compared to other developed countries and are believed to contribute to higher infant mortality in the US compared to other industrialized nations despite technological advances.<sup>22</sup>

#### **b. National (Canada):**

The rate of LBW among live born infants in Canada was 5.77% in 1995. This was a significant decline from 6.64% in 1975. However, there was a slight increase in the LBW rate, 5.77% in 1995 compared to 5.53% in 1985.<sup>12</sup> This rate was still higher than that reported from some European countries (Finland 4.0% in 1985, Ireland 4.4% in 1987, Norway 4.5% in 1985).<sup>18</sup>

The incidence of preterm birth has increased in Canada (excluding Ontario) (6.4% in 1981 to 6.7% in 1992 and 7.1% in 1997).<sup>20;21</sup> This increase is secondary to an increase in multiple births, an increase in obstetrical interventions, an increase in the registration of early gestation births and an increase in the use of ultrasound to estimate gestational age.<sup>20</sup> Higher incidences of preterm birth in twins and higher order pregnancy have been noted.<sup>21</sup> However, the major contribution (80%) to the increase in the preterm birth rate relates to singleton pregnancies.<sup>21</sup>

#### **c. Provincial (Ontario):**

The rate of LBW among singleton live births in Ontario decreased from 1995 to 1997 (5.0% in 1995, 4.7% in 1996 and 4.7% in 1997) (Toronto Public