Addiction to alcohol and other drugs is a serious problem in the United Kingdom and the USA (Weber et al 2002). Alcohol and nicotine continue to be the commonest drug of abuse followed closely by cannabis. The government and local health organisations have recognised the increasing problem of substance abuse among teenagers and young adults. One area of concern is the use of substances during pregnancy. This problem is much more prevalent than previously recognised and was highlighted in a study involving anonymous screening of consecutive urine samples testing positive for pregnancy from a UK inner city clinic. This study showed that at least 16% of women had been taking one or more illicit substances (Sherwood et al 1999).

Pregnancy
Abusing substances during pregnancy can lead to significant health related effects on the general outcome of pregnancy. Premature rupture of the membranes, meconium-stained liquor and foetal distress are more common in women who misuse substances (Ostrea et al 1992).

Substance abuse during the pre-natal period is often associated with other factors that contribute to poor foetal health and infant outcome distinct from the specific teratologic effects of any one agent. Women who are chronic alcohol, heroin and marijuana or cocaine abusers often fail to seek pre-natal care and are themselves in sufficiently poor health and hence compromise the growth and well-being of the foetus. Other factors that contribute to general poor foetal health include: severe poverty; virtual homelessness; early histories of abuse and neglect; chronic and acute violence; multigenerational substance abuse with resulting parental isolation and lack of family support systems. Prematurity and intra-uterine growth retardation have been shown to be associated with illicit drug use in pregnancy (Gillogley et al 1990). Hulse et al (1997) reported on studies comparing the birth weight of infants born to children of healthy controls with those born to mothers who abuse heroin or methadone, finding that birth weight was significantly lower in the mothers who were taking drugs. Sherwood et al (1999) found similar problems in infants born to mothers taking cannabis.
The Foetus
Most drugs cross the placenta and thus pregnant addicts risk passive drug dependency in their foetus. Pre-natal drug withdrawal can inhibit foetal oxygen consumption, resulting in hypoxia or death.
Post-natal drug withdrawal is characterised by the ‘neonatal abstinence syndrome’ that includes hyper-irritability, tremors, gastrointestinal dysfunction, respiratory distress, and autonomic nervous system problems. Hyperphagia (excessive swallowing) also occurs, associated with weight loss (Shephard et al 2002).

Alcohol
Alcohol acts as a direct neuro-teratogen affecting foetal facial morphology and growth, and brain growth, structure and function through mechanisms not yet elucidated.
Alcohol related birth defects include: congenital malformations; cardiac atrial and ventricular septal defect, including Tetralogy of Fallot; skeletal abnormalities; hypoplastic kidneys; horseshoe kidneys; ocular strabismus; and, neurosensory hearing loss (Ernhart et al 1989).
The Foetal Alcohol Syndrome (FAS):
FAS is the name given to the condition in which the child has a set of clinical characteristics due to the direct effect of alcohol abuse during pregnancy (Goodlet and West 1992)—see Table 1. A diagnosis of FAS is made if the child has the features in Table 1 and there has been confirmed alcohol exposure during pregnancy. Other terms are used to classify individuals who do not have FAS but share some FAS characteristics—including: foetal alcohol effects, alcohol related neuro-developmental disorder and static encephalopathy (Clarren and Astley 1993). Nowadays, clinicians feel it is more appropriate to use a broader category called Foetal Alcohol Spectrum Disorders (FASD).
As well as the physical clinical features, there may be major problems with behaviour and emotions. Many children with FAS also have features of Attention Deficit Hyperactivity Disorder which includes poor concentration, easily distracted, restlessness, hyperactivity, and poor impulse control. There may be problems with social skills, poor problem solving skills, disinhibition and memory deficits (Nanson and Hiscock 1990).

Nicotine
Smoking during pregnancy is estimated to account for 20 to 30% of low-birth weight babies, up to 14% of pre-term deliveries, and some 10% of all infant deaths. The odds of smoking asthma are more than twice as high among children whose mothers smoke more than 10 cigarettes a day.
Smoking increases the risk of growth restriction, pre-term birth, miscarriage and peri-natal death (Coleman et al 2004, Charlton 1996). Despite this, over a quarter of pregnant women in the UK smoke during pregnancy (Owen & Penn 1999).
Studies in rodents have shown that chronic nicotine exposure is associated with dose dependent changes in behavioural and cognitive responses, a

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Foetal Alcohol Syndrome: features</th>
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<tr>
<td>Small birth weight</td>
<td></td>
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<tr>
<td>Small head circumference</td>
<td></td>
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<tr>
<td>Small, widely spaced eyes</td>
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<tr>
<td>Flat midface</td>
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<tr>
<td>Short, upturned nose</td>
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<tr>
<td>Smooth, wide philtrum</td>
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<td>Thin upper lip</td>
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diminished adrenal response to hypoxia that may predispose to sudden infant death syndrome and central nervous system toxicity (Dempsey & Benowitz 2001).

Pre-natal exposure to maternal tobacco smoking is a relatively recent addition to previously documented risk factors for ADHD. For example, Milgerger (1998) found a 2.7x increased risk for ADHD associated with maternal smoking in 140 cases and 120 controls, and a 3.3x increased risk for ADHD in their 303 high-risk siblings. Weitzman (1992) found that maternal smoking was associated with increased rates of problem behaviour in early and middle childhood even when due allowance is made for a series of potentially confounding factors.

Cannabis
After alcohol, cannabis is the most commonly abused drug in the US and, like alcohol, cannabis cuts across different socio-economic groups and strata. Tetrahydrocannabinol (THC) is the most potently psychoactive substance, readily crossing the placenta (Perez-Reyes & Wall 1982). The rate of women reporting use during pregnancy varies from 5 to 34%, (Zuckerman 1988). Longer-term studies of the outcome of pre-natal cannabis exposure are few in number. In one study, no association was found between pre-natal cannabis use and developmental scores at 12 and 24 months, (Fried and Watkinson 1988). In a study to document the prevalence of cannabis use in a large sample of British pregnant women, Fergusson et al (2004) found that 5% of mothers reported smoking cannabis before and/or during pregnancy. These women were more likely to be younger, of lower parity, better educated and more likely to use alcohol and cigarettes. Babies of women who used cannabis at least once per week before and throughout pregnancy were 216g lighter than those of non-users and also had significantly shorter birth lengths and smaller head circumferences. Ammenheuser et al (1998) found that mothers who smoked cannabis during pregnancy produced babies with higher lymphocyte mutation rates than those of non-smokers. Cornelius et al (1995) reviewed existing studies and found several results were contradictory and inconsistent. They did find suggestions that the gestation period was shorter in those women who were smoking cannabis when adolescent.

Amphetamine
The use of so called ‘club drugs’ such as methamphetamine by women of child bearing age has been a growing public concern in the UK. Ericksson et al (1994) looked at 65 children born to women who had used amphetamines during pregnancy, conducting a follow up study at age one, four, eight and ten. IQ was normal for all but 10 years of age and 12% of children attended one class below the norm for their biological age. At 4 years, 35% had aggressive behavior and at 8 years, 23% were aggressive. Based on the findings from human studies, and confirmed in animal experiments, amphetamines increase the risk of cleft palates, cardiac abnormalities and foetal growth reduction (Plessinger 1998).

Cocaine
Studies show that women who use cocaine during pregnancy are at least twice as likely as other women to have a premature baby. The baby may be much smaller at birth than it would be otherwise, because cocaine causes blood vessels to constrict, which decreases the flow of nutrients and oxygen to the baby.
Foetuses exposed to cocaine are at risk of significant neuro-developmental impairment (Dempsey et al 2000, Frank et al 2001).

Tay et al (1996) showed that eyelid oedema and impaired visual attention was linked to cocaine exposure. Post-natally, infants exposed to cocaine continue to be exposed to ongoing parental substance abuse, are more neglected and abused and have parents with more frequent depression and higher overall stress and anxiety (Mayes 1995).

Babies exposed to cocaine pre-natally are more likely to be born at low birth-weight. They may also face an increased risk of cerebral palsy and problems with vision, hearing, coordination and motor skills. Some studies report that cocaine-exposed babies have a greater chance of dying of sudden infant death syndrome (SIDS)—however, it is not clear whether it is the poor health practice that surrounds this drug use that has the direct role.

Studies are inconclusive regarding cocaine-exposed children and their risk of having learning and behavioural problems. In one study, teachers reported more problem behaviours, such as poor attention, and language difficulties (Delaney-Black 2000). Some studies suggest that cocaine-exposed babies lag behind peers in motor skills, at least through the first seven months of life and then these differences tend to disappear after this time. One study found that cocaine exposed children were significantly shorter and lighter than unexposed peers at age 7 (Covington 2002).

| Tobacco / Nicotine:            | Babies: poor autonomic regulation and increased tremors, lower birth weight, decreased auditory habituation |
|                               | Younger children: hyperactivity in young children, poor orientation and impaired attention in a vigilance task |
| Cannabis                      | characteristics of newborn exposed to heavy maternal THC use are tremors and increased startle response in the first 7-14 days of life |
|                               | most studies have found no relationship with either minor or major morphologic abnormalities |
| Amphetamine                   | similar neonatal - deprivation syndrome as cocaine. |
| Cocaine:                      | use in late pregnancy |
|                               | shrill crying, irritability with increased tremulousness, startle responses, commonly repeated sneezing and decreased visual attention |
| Opiates:                      | restless, irritable, with a shrill cry and a squirming that excoriates knees, toes and face; muscular hypertonia, with brief periods of hypotonia; persistent high pitched cry & constant sucking and chewing of fingers which is not relieved by comforting; neonatal head circumference is reduced, and babies are often small and of low birth weight; reflexes are exaggerated and sleep is difficult; in less severe cases and at a later stage, autonomic symptoms such as yawning, sneezing, nasal stuffiness and sweating occur; in severe cases, neonatal convulsions can occur which can lead to death |

Table 2: Clinical Features of Children with Pre-natal Drug Exposure
Opiates
New-borns who have been exposed pre-natally to opiates are born passively addicted to the drug and exhibit withdrawal symptoms in the first days to weeks after delivery. Infants also have a two to three times increased risk of unexplained sudden death which is probably due to some sort of respiratory control difficulty (Davidson–Ward et al 1990). Infants of heroin addicts or methadone maintained mothers exhibit more tension, activity, and poorer coordination than their age-matched peers (Bernstein 1984).
Persistent weight retardation is a problem which appears to be correlated with methadone usage during pregnancy (Vance et al 1997).
On neuro-behavioral assessments in the new-born period, opiate-exposed infants are more easily aroused and more irritable (Jeremy & Hans 1985, Marcus & Hans 1982—see Table 2). They exhibit proportionately less quiet compared with active sleep and show increased muscle tone and poor motor control. Opiate-exposed infants are less often in alert states and are more difficult to bring to an alert state.

Conclusion
The field of behavioural and developmental teratology focuses on identifiable effects of pre-natal exposure to substances such as alcohol, cannabis and cocaine. Children developing amid the violence, substance abuse, poverty and discord increasingly common in inner city neighbourhoods, are at risk for dysfunctional development on a number of accounts. While specific syndromes such as that associated with maternal alcoholism during pregnancy have been clearly identified, controversy and conflicting findings still pertain regarding the long-term effects of any one of these agents on cognitive and intellectual development.
Clinicians working in the field of adult mental health, children's mental health and substance misuse teams should be aware of the different effects of substances on the developing foetus. Educating women on the possible harmful effects to the foetus of substances during pregnancy is an important health and social issue.

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