Abstract
Complementary and alternative medicine (CAM) encompasses a broad domain of methods and treatments, including alternative medical systems, biologically based therapies, mind-body interventions, body-based methods and energy therapies. While some CAM treatments have proven efficacy, others are less established. Pediatric use of CAM has significantly increased in the past several years, particularly in children with chronic or severe illnesses. Nevertheless, information regarding use, efficacy, safety and interactions of CAM therapies in children is limited. This paper focuses on reviewing the use of CAM in the pediatric population, relationships between alternative medicine utilization and immunization, CAM regulation in Canada, adverse effects of alternative medications, pediatric CAM research and considerations for integrative medicine.

Many definitions have been suggested in the literature for complementary and alternative medicine (CAM), but the most widely used is that of the National Institute of Health (NIH): “Broad domain of healing resources that encompass all health systems, modalities, and practices and their accompanying theories and beliefs, other than those intrinsic to the politically dominant health system of a particular society or culture in a given historical period.” (NIH Panel on Definition and Description, 1997) Complementary and alternative medicine is a composite term consisting of two definitions per se. Alternative medicine refers to all diagnostic and treatment methods and products that diverge from and that are used in place of conventional medicine. In contrast, complementary medicine uses alternative methods and practices together with conventional therapy. The term “Natural Health Products” (NHP) refers to complementary medicines or traditional remedies.

CAM encompasses a broad domain of methods and treatments including alternative medical systems (Western homeopathic and naturopathic medicine, traditional Chinese medicine, Ayurveda – a traditional Indian holistic system of medicine), biologically based therapies (vitamins, dietary supplements, herbal or animal products), mind-body interventions (hypnosis, meditation, prayer, mental healing), body-based methods (chiropractic or osteopathic manipulation, massage) and energy therapies (Reiki, therapeutic touch, electromagnetic fields). While there is evidence that some of these therapies are efficacious, others are less proven. The more prominent CAM modalities in North America are massage, naturopathy, acupuncture, chiropractic, vitamins, herbal medicine and homeopathy. However, more controversial and less widespread “treatments” such as shamanism, psychic surgery or urine therapy are sometimes practiced, especially outside the Western hemisphere.

As a result of research and public awareness, the list of what is considered to be CAM changes continually as therapies that are proven to be safe and effective become incorporated into conventional medicine. Willowbark, cinchona and foxglove were alternative treatments before salicylates, quinine and digitalis alkaloids, respectively, were derived.1 Mind-body techniques, such as patient support groups and cognitive-behavioural therapy, that were considered alternative in the past are now a part of daily practice.

Increased Use of CAM
CAM is used by approximately 40% of North Americans.2 More than $11 billion is spent per year on visits for non-conventional medical treatments, most of which are not covered by a health plan.3 Indeed, in 1995, the amount spent on herbal products exceeded $1.5 billion4, rising to $5.1 billion in 1997.5 The reported prevalence of herbal product use in the United States is estimated to be 3%-12%6,7, with Americans spending more on CAM than on all US hospitalizations.7 Similarly, Australians spend more on CAM than on all prescription drugs.7 Recent data also suggests that the overall health care cost for adults is increased when complementary therapies are included as a treatment option since CAM is used in addition to the usual therapies8,9

The increased interest in CAM therapies in the media and on the Internet, plus wider availability to a larger percentage of the population has led medical schools in United States and Canada to incorporate courses on CAM into the curriculum.10-12 Physicians, including pediatricians, are using CAM therapies themselves13-15 and those who use these therapies tend to refer more patients to CAM than those who do not.16-21
Most parents learn about CAM either through the media or by word of mouth and parents rarely discuss CAM with doctors because they see it as a part of normal life. Moreover, in some cases the main reason for CAM use is parental concern about potential toxicity of conventional treatments, including cancer therapy. However, effects of CAM treatments are often more holistic than targeted (e.g., improved mood, sleep) and, in such cases, consumers should be educated and made aware of the benefits and risks. As a result of their uncertainty, many parents will likely require guidance from health professionals when making alternate treatment decisions.

**CAM in the Pediatric Population**

Pediatric use of CAM has significantly increased in the last several years in educated and affluent families, in homeless youth and particularly in children with chronic or severe illnesses. It is estimated that in England and the United States approximately 20-33% of children have used at least one CAM therapy, most commonly vitamins and botanical products. The use among adolescents is even higher at approximately 50-75%. Finally, CAM use in children is positively correlated with parents’ use as well as increased child and parent age.

Children with chronic illnesses such as cancer, respiratory diseases including asthma and cystic fibrosis, pediatric rheumatology patients and children with special health care needs use CAM in 30-70% of cases. CAM therapies are also used for acute pediatric pain management. Parents often turn to alternative medicine as a last resort when conventional medicine can do little. It has also become clear that parents of children admitted to intensive care units and neonatal intensive care units are interested in CAM therapies for their children. A study conducted in Denmark showed that 53% of pediatric patients had tried CAM and 25% had used it within the previous month.

Evidence suggests that CAM usage in children will increase further. At the same time, most pediatric literature regarding CAM is limited to the United States and is based on non-randomized, self-administered questionnaires with low response and completion rates that have not taken into account non-English speaking families.

**CAM use in Canada**

Literature regarding the use of CAM therapies by children in Canada is very limited. In one preliminary study, however, it was reported that Canadians living in western provinces were the biggest users of CAM therapies while people in Atlantic Canada used CAM the least. Neither insurance coverage nor provincial registration of CAM professionals appeared to account for these regional differences.

In 1994, 11% of patients in a pediatric outpatient clinic in Montreal had previously consulted one or more CAM practitioners while 24% of children in a small rural community in Alberta were reported to have used CAM at least once. When compared to children who had not used CAM, children using CAM were older, had more educated mothers and had parents who had previously used CAM themselves. However, there were several important limitations of these studies including small sample size. Also, the studies failed to elaborate on the specific CAM therapies used as well as the circumstances surrounding their use.

**CAM Adverse Effects**

Most parents using CAM therapies for their children believe that these treatments are safe because they are natural. Unfortunately, as in mainstream therapies, CAM therapies have the potential for adverse effects and drug interactions. An increasing number of publications in the medical literature over the last decade has shed light on the fact that different remedies may cause adverse effects or interact with both prescribed and over-the-counter medications. Some of the most common questions asked by parents about CAM therapies regard contraindications to NHP, adverse reactions, drug-herb interactions, breastfeeding concerns as well as the safety and effectiveness of CAM therapies compared to prescription drugs. Parents giving CAM to their children (kids do not take NHP voluntarily) are at times unaware of the possible risks of these treatments. Therefore, physicians should be prepared to discuss alternative therapies with parents to minimize risks and parental misconceptions. It is important for health care providers not only to answer patient’s questions, but also to actively inquire about CAM use and to educate families about the benefits and risks in addition to potential interactions of CAM products with other medications.

A study examining the quality of reports of 251 CAM randomized controlled trials in the pediatric population showed that information on adverse events was reported in less than one quarter (22%) of the trials and costs were mentioned in only a minority of reports (4%). Most adverse effects of CAM are associated with herbal products, the majority of which are available without a prescription. Toxic effects have been associated with herbal ingredients including ephedra, aconite, licorice, synthetic adulterants and heavy metals while other problems may occur as a result of interactions with other herbs or drugs. Serious adverse events in adults include neurotoxicity (brain damage, encephalopathy), hepatic toxicity (toxic hepatitis, liver failure) and cardiovascular events (arrhythmias, chest pain, hypertension or hypotension, myocardial infarction, death).

Some case reports on the adverse effects and complications of CAM use include pain, fatigue, bleeding and infections after acupuncture, aggravation of symptoms after using homeopathy and serious neurologic and vertebrobasilar traumas after cervical chiropractic manipulation. However, most of the evidence on the adverse effects of CAM use is anecdotal and it is difficult to estimate the size of the problem at present.

**CAM and Immunization**

A growing group of parents do not immunize children, at times based on advice given by CAM providers. Many naturopaths, homeopaths and chiropractors advise their patients against immunizations for different reasons. For instance, naturopaths feel that the procedure is “unnatural” and therefore unnecessary, homeopaths use unproven “homeopathic immunization” (infectious
agents in high dilutions), while chiropractors think that vaccines have high complication rates and increase manifestations of pre-existing chronic diseases. A review of 26 Internet sites opposing childhood immunization showed that most of them (58%) were associated with groups promoting alternative medicine. Another survey conducted in 1000 schools in the United States revealed that 19% of school personnel were concerned that children’s immune systems could be weakened by too many immunizations. Interestingly, almost half (46%) of the respondents or their family members had used alternative medicine in the previous 5 years and children attending a school with these respondents were more likely to have an exemption from vaccination.

Some parents believe that diseases such as measles, mumps and chickenpox are either harmless or no longer pose a real threat, and that children could suffer from these diseases and experience permanent disability or death because of immunization. It is not surprising in these circumstances that parents start seeking what are suggested to be less invasive alternatives. As shown from a survey conducted in Alberta, users of alternative health therapies are more concerned with the safety of vaccines and the short- and long-term effects on their children’s health than non-users. However, tragic cases have been reported when children are not immunized. In England, for example, one child suffered severe brain damage after contracting measles. The physician who had advised against vaccination was sued by the parents, found guilty of negligence and ordered to pay a significant amount of money in damages.

Although vaccines, like many other effective interventions, are not risk-free, it is clear that the benefits of immunization outweigh the risks. More complete information about immunization and vaccines should be given to parents and educational efforts should be made to alleviate parents’ fears and to increase acceptance of immunization.

**CAM Regulation**

In Canada, the federal government is not responsible for regulating CAM practitioners with respect to training, accreditation or the scope of practice. Instead, CAM is regulated at the provincial level and therefore some CAM practitioners, such as chiropractors, are consistently regulated while others, such as naturopaths, are regulated differently across the provinces. In contrast, NHP are subject to the federal Natural Health Products Regulations which include requirements for clinical trials, product labeling, product and site licensing, good manufacturing practices and adverse reaction reporting. NHP are defined as vitamins and minerals, herbal remedies, homeopathic medicines (except those containing substances listed in the Food and Drug Regulations), traditional medicines (Traditional Chinese Medicines), probiotics and others (e.g. amino acids and essential fatty acids). Although NHP do not require prescriptions, they must be safe for consideration as over-the-counter products.

**CAM Research**

The increased interest in CAM has attracted the attention of physicians and institutions and has led to a number of randomized controlled trials to determine the scientific basis of different treatments. Contrary to popular belief that few such trials involve children, more than 1400 pediatric CAM randomized controlled trials have been published and it has been shown that it is possible to evaluate many CAM treatments, especially herbal medicines, in the same way as conventional drugs. One of the biggest hurdles facing research into alternative treatments is the lack of funding for clinical trials. This is a significant problem given that the primary concern of the medical community about CAM therapies is the lack of evidence. In response to the growing need for reliable evidence, Canada has recently developed standards of evidence for NHP that will allow health care providers access to information about products that are safe and effective. This should help consumers make more informed choices.

A new study exploring CAM use by the pediatric population in Canada is currently being conducted at the Hospital for Sick Children Emergency Department (funded by the Hospital for Sick Children Foundation). The purpose of this cross-sectional study is to determine the rate of CAM use by children visiting the pediatric Emergency Department and to characterize the children and caregivers including non-English speaking families. It further aims to determine if visits to the Emergency Department are due to adverse effects of CAM use or due to drug interactions with CAM. Recently created Canadian CAM networks (www.camline.org, www.pedcam.ca) contain CAM-related information and evidence-based reviews of the safety and efficacy of CAM therapies and NHP for children as well as pregnant women.

**Integrative Medicine**

Despite the reservations of many conventional medicine practitioners, consumer interest and use of CAM is growing. CAM has already become a multi-billion dollar industry and is here to stay. According to Statistics Canada, farms across the country are increasingly growing medicinal herbs to diversify their operations. Furthermore, many Canadian practitioners of conventional medicine have started paying more attention to complementary therapies. Increasing interest in CAM is leading to a movement to integrate various CAM treatments with conventional health care and it is likely that some degree of integration will occur throughout Canada and the United States. CAM has been practiced since ancient times and more than 80% of the world population relies on herbs for health and healing.

Integrative approaches, which combine conventional medical treatments with alternative therapies shown to be safe and effective by high-quality scientific evidence, are becoming more and more acceptable. However, cost-benefit analysis comparing CAM treatments with conventional care should be conducted to assist authorities in making informed choices about services for integrated programs.

**Conclusion**

Unresolved issues such as limited evidence-based information on efficacy, adverse effects and interactions of CAM treatments for children, controversial relationships between alternative medicine utilization and immunization, inconsistent CAM regulation and