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INTRODUCTION AND BACKGROUND

Nitrate/nitrite impacts human health through a number of mechanisms via involvement in potentially detrimental biochemical processes (1). In the acute sense, nitrite interacts with the iron components of the hemoglobin molecule, the functional, biochemical unit of the red blood cell responsible for carrying oxygen throughout the body (2, 3). These iron components are essential for the normal bonding of the hemoglobin molecule with oxygen and when chemically altered, result in a form of hemoglobin known as methemoglobin (4,5). When somewhere between 3-15% of the hemoglobin in the blood is reduced to methemoglobin an individual is said to have methemoglobinemia due to the low oxygen content of the blood and the high percent of circulating, methemoglobin (6, 7). Infants less than six months of age that are bottle-fed are, for a number of reasons, more susceptible to this condition than adults (8, 9). This is why the World Health Organization has established an upward limit of 10 milligrams per liter of nitrate-nitrogen in potable waters (10, 11). In the chronic sense, nitrate/nitrite exposure has been linked, through animal and epidemiological study, to gastric and esophageal cancers via the interaction of nitrite and amines in the body forming carcinogenic nitrosamines (12, 13). Further, nitrate/nitrite has also been implicated, though not conclusively, via animal and epidemiological studies, to a number of chronic health conditions and developmental deficits in children (14, 15, 16, 17, 18).

Recently, much of the established wisdom about nitrate's acute health impacts has been challenged (19). Since the discovery in the late seventies and early eighties that cells of the human immune system produced nitric oxide in response to invading microorganisms or inflammatory states, some are proposing that nitrate produced by the body itself is really the cause of methemoglobinemia and not nitrate/nitrite taken into the body from the environment (20, 21, 22). Complexities also arise in interpreting the developmental findings related to long-term high nitrate exposure as pesticide exposures have also been linked to developmental deficits in children and could be playing a role in confounding or modify the findings of previous epidemiological work (23, 24).

This current work will build on the researcher's previous epidemiological work related to both the acute and chronic effects of nitrate/nitrite exposure in children in Transylvania, Romania (25). Rural villagers in the Transylvania region of Romania rely on water that can be very high in nitrate, with some of the highest rates reaching into the hundreds of parts per million a ten-fold increase above the regulatory levels (25). The

researcher's previous work, both a nested case control study examining risk factors for methemoglobinemia and a retrospective cohort study (pilot) looking at the relationship between high nitrate exposure and developmental deficits in children had supported traditional wisdoms related to current epidemiological and environmental health impacts of nitrate/nitrite (14, 26). However, prevalence of parasites in drinking water, capable of causing infectious and inflammatory states and the reported presence of long-lasting organo-chlorine pesticides in the environment could have bearing on previous findings (27). In the first sense by leading to infectious states that would support the theory that methemoglobinemia is related to infectious or inflammatory states and not nitrate exposure, and in the later sense by confounding the results of previous cohort studies illustrating a degree of association between chronic high nitrate exposure in children and negative neuro-developmental outcomes. That is why a portion of this work will focus on establishing the prevalence of *Giardia lamblia* and *Cryptosporidium sp.* parasites in potable well water and another portion will deal with establishing levels of organo-chlorine pesticides in the human food chain (eggs/cheese).

A final prevention oriented portion of this work will examine health promotion and education practices and infant feeding practices in Romania, in order to identify health education interventions that could help reduce the impact of environmentally mediated disease due to nitrate/nitrite exposures. During this research experience, four graduate students and one undergraduate student will work with faculty to perform environmental sampling and conduct survey and focus group sessions with both Romanian health authorities and affected villagers.

MAJOR SCHEDULED ACTIVITIES

In order to explore these issues the following research tasks are scheduled:

A. Gas chromatography and immunoassay analysis of foodstuffs and well water will be performed in order to determine pesticide exposures and parasitical water burdens. The data will be linked to previously collected exposure and neuropsychological evaluation data to determine the influence of nitrate exposure versus pesticide exposure on child health and development.

   This portion of the work will include a survey of the primary care giver responsible for providing infant care and will explore both the caregiver's pre-natal egg and cheese consumption patterns and consumption during the period of time they were breastfeeding. Further, consideration will be given to any egg or cheese containing foods, which might have been consumed by the children during the birth to two months of age period or from two months of age to six-months of age.

B. A barriers to breast-feeding descriptive survey will be conducted with 71 Romanian mothers. American and Romanian colleagues have jointly drafted and translated into the Romanian language a survey instrument to determine what barriers Romanian women experience in regard to maintaining breast-feeding practices. Romanian and American colleagues will administer the survey to 71 partici-

Goal 3. Increase understanding of Romanian approaches to public health education and promotion and how those differ from Western models. Currently, there are no descriptive surveys of the theoretical health promotion and health education models that Romanian public health authorities use. In the United States, a number of highly developed and refined approaches to health education exist (28). These approaches such as the health belief model, social cognitive theory, community development models, and ecological models help guide health educators in the United States when programs to improve the public health are developed, implemented, and evaluated. In the absence of such theoretical models much time, effort, and money can be wasted. In an effort to assist the Romanian public health authorities in identifying and improving their theoretical approaches this work is being conducted. This is based on the researchers direct experience working with the Romanian public health authorities since 1997.

1. Collect qualitative focus group data concerning public health education needs and approaches as they relate to water quality concerns of private water wells, interventions for improving water quality, infant feeding practices and perceived public health education needs.
2. A graduate student thesis will be developed examining public health intervention models from both the Western and Romanian perspective with comment on the models utility or lack thereof in the Romanian cultural setting. Following from this, jointly authored papers concerning public health theory and intervention on the part of Romanian and American colleagues.

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