swimming frequency in the U.S. According to Schets et al. (2011), the mean volume of water ingested by children (<15 years) during an average swimming pool event lasting 81 minutes was 51 mL or 0.63 mL/min (38 mL/hour). The values for children were slightly lower for swimming in freshwater and seawater. For adults, the mean volume of water ingested ranged from 0.5 to 0.6 mL/min (30 to 36 mL/hour) for men and 0.3 to 0.4 mL/min (20 to 26 mL/hour) for women (see Table 3-92).

The advantages of this study are that it is based on a relatively large sample size and that data are provided for various types of swimming environments (i.e., pools, freshwater, and seawater). However, the data were collected from a population in The Netherlands and may not be entirely representative of the United States. While the ingestion data are based primarily on self-reported estimates, the mean values reported in this study are similar to those based on measurements of cyanuric acid in the urine of swimmers as reported by Dufour et al. (2006).

3.6.2.3. *Dorevitch et al. (2011)—Water Ingestion During Water Recreation*

Dorevitch et al. (2011) estimated the volumes of water ingested during "limited contact water recreation activities." These activities included such as canoeing, fishing, kayaking, motor boating, rowing, wading and splashing, and walking. Full contact scenarios (i.e., swimming and immersion) were also evaluated. Dorevitch et al. (2011) estimated water intake among individuals greater than 6 years of age using two different methods in studies conducted in 2009. In the first surface water study, self-reported estimates of ingestion were obtained via interview from 2,705 individuals after they engaged in recreation activities in Chicago area surface waters. A total of 2,705 participants reported whether they swallowed no water, a drop or two, a teaspoon, or one or more mouthfuls of water during one of the five limited contact recreational activities (i.e., canoeing, fishing, kayaking, motor boating, and rowing). A second study was conducted in swimming pools where 662 participants engaged in limited contact scenarios (i.e., canoeing, simulated fishing, kayaking, motor boating, rowing, wading/splashing, and walking), as well as full contact activities such as swimming and immersion. Participants were interviewed after performing their water activity and reported on their estimated water ingestion. In addition, 24-hour urine samples were collected for analysis of cyanuric acid, a tracer of swimming pool water. Translation factors for each of the reported categories of ingestion (e.g., none, drop/teaspoon, mouthful) were developed using the results of the urine analyses. These translation factors were used to estimate the volume of water ingested for the various water activities evaluated in this study (Dorevitch et al., 2011). Table 3-93 presents the estimated volumes of water ingested for the limited and full contact scenarios. Swimmers had the highest estimated water intake (mean = 10 mL/hr; 95% upper confidence limit = 35 mL/hr) among the activities evaluated.

The advantage of this study is that it provides information on the estimated volume of water ingested during both limited and full contact recreational activities. However, the data are based on self-reporting, and data are not provided for individual age groups of the population.

3.7. REFERENCES FOR CHAPTER 3

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