20.1 INTRODUCTION

The association between arsenic ingestion and skin cancer was first documented more than a century ago (Hutchinson, 1887). Since an animal model for the carcinogenicity of arsenic has never been developed, all risk assessments have to be based on human data. In an area along the southwest coast of Taiwan, a high prevalence of skin cancer among the residents was noted in the early 1960s (Yeh, 1963). This area is also known as the ‘blackfoot disease endemic area’ (BFD area). Blackfoot disease is a peripheral vascular disease that often causes black discoloration in patients’ feet as a result of gangrene, and it was speculated that the disease was associated with arsenic intoxication (Tseng, 1977) because high levels of arsenic were found in water from many wells used as the sources of drinking-water in this area (Kuo, 1968; Lo et al., 1977). Tseng et al. (1968) conducted physical examinations on a total of 47,921 people (including 40,421 in the BFD area) and found a dose-response correlation between arsenic level in drinking-water and prevalence of skin cancer in both men and women. Those findings were confirmed by other investigators using death certificates to
identify cases (Chen et al., 1988; Wu et al., 1989). All these studies were ecologic studies. The mean or median arsenic level in the drinking-water of a given village was used to represent the exposure level for all residents in that village, and the villages were further aggregated into four exposure categories: low (0–0.30 ppm), mid (0.30–0.59 ppm), high (0.60 ppm and over), and undetermined. A linear dose-response relationship was observed between the mean (or median) arsenic level in drinking-water and occurrence of skin cancer in all these studies.

Recently, another study was conducted in Taiwan which used the National Cancer Registry Program (the Registry) to identify skin cancer cases (Guo et al., 1994). A new approach for analysing ecological data was applied, and the results suggested a non-linear dose-response relationship. Since reporting of cancer cases is not mandatory in Taiwan, incomplete case ascertainment is a factor that might contribute to the difference in the shape of the dose-response curve projected. The difference may also be due to the fact that different approaches were applied to identify cases. The goals of this chapter are to compare results from different studies and to estimate the ascertainment rate of skin cancer cases by the Registry.

20.2 MATERIALS AND METHODS

20.2.1 Comparison of attributes of the major studies

Many studies have been conducted in Taiwan to evaluate the association between arsenic ingestion and skin cancer. Only those that provided information on exposure that is sufficient for conducting a dose-response assessment are included in the comparison; namely the studies by Tseng et al. (1968), Chen et al. (1988), Wu et al. (1989), and Guo et al. (1994). Table 20.1 shows various essential attributes of the four major studies and lays out the fundamental differences among those studies. The major differences include the approach for case identification and the exposure indicator. In addition, all the studies except the one by Guo et al. used arsenic measurements conducted by Kuo (1968) using a method proposed by Natelson (1961) with slight modification. Guo et al. used exposure data obtained from a nationwide survey conducted by the Taiwan Provincial Institute of Environmental Sanitation (Lo et al., 1977) with the standard mercuric-bromide stain method (American Public Health Association, 1985), which is somewhat less accurate than the method applied by Kuo (1968).

20.2.2 Estimation of the case ascertainment rate of the Registry

In order to estimate the case ascertainment rate of the Registry, estimates of ‘true risks’ are necessary. Among the three studies that did not use data from the Registry, the one by Tseng et al. (1968) should reflect an almost