

Microbial deterioration of stored water for users supplied by stand-pipes and ground-tanks in a peri-urban community

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Abstract

Two forms of water service delivery in peri-urban settlements in the eThekweni municipal region are communal stand-pipes and household ground-tanks. Water from these sources requires storage prior to use. Previous studies have shown that water quality tends to deteriorate during storage. This study was conducted during the winter season and tested water from stand-pipe and ground-tank households for deterioration of microbial quality relative to source. Thirty stand-pipe and 27 ground-tank households were sampled for a period of 10 d. Samples were tested for total organisms, total coliforms, *Escherichia coli*, conductivity, turbidity, pH and free and total chlorine. Households were divided into groups on the basis of the age distribution of members to assess the impact of household composition on stored water quality. Stand-pipe households were further divided according to the type of water containers used. Results indicated that both ground-tank and stand-pipe water deteriorated during storage although ground-tank water was of better quality than stand-pipe water. There was no significant difference in water quality between stand-pipe households that used open-top containers and those that used closed-top containers. Comparison of the water quality relative to age distribution of households showed that householders were at increased risk of consuming faecally contaminated water if children were present in the case of households supplied by ground-tanks, but not for those supplied by stand-pipes. Results from stand-pipe households with adults only indicated that such households maintained better personal hygiene but lower container hygiene than those households consisting of children, whereas the opposite effect was seen in those stand-pipe households with children present.

Keywords: drinking water quality, stored water, stand-pipes, ground-tanks, *E. coli*, total coliforms

Introduction

It is a basic human right for every individual to be provided with a supply of potable water. The South African government introduced the free basic water policy in 1994 in order to supply poor communities with potable water. The city of Durban, KwaZulu-Natal, is provided with water by the eThekweni Municipality at four service levels: public stand-pipes, ground-tanks, roof tanks, and in-house full pressure taps.

Stand-pipes and ground-tanks represent the two lowest levels of water supply in Durban (Brocklehurst, 2002) and are encountered in informal and low-income peri-urban communities. Water received via such sources requires storage prior use. Numerous studies from several countries have indicated that it is during this period of collection and storage that the microbiological and physico-chemical quality of water may deteriorate to levels unsafe for human consumption (Genthe et al., 1997; Jagals et al., 1997; Jenssen et al., 2002; Bailey and Archer, 2004; Gundry et al., 2004; Jagals et al., 2004; Wright et al., 2004; Trevett et al., 2005).

Various reasons have been proposed for the deterioration of water quality between the source and point-of-use. The hygienic

condition of the water storage containers and the environment in which these containers are stored are believed to be major factors leading to the deterioration of stored water (Jagals et al., 1999; Gundry et al., 2004; Jagals et al., 2004; Trevett et al., 2005). Studies have shown that water stored in open-top buckets is of lower microbiological water quality than water stored in screw-top closed containers (Jagals et al., 1997). Uncovered containers are exposed to environmental conditions, such as dust and dirt, which may contribute to the deterioration in water quality (Jagals et al., 1997; Jagals et al., 1999; Wright et al., 2004; Trevett et al., 2005). Storage containers placed on the floor may be more likely to be contaminated by animals or children than containers placed on an elevated surface, e.g. on a table or chair (Jensen et al., 2002). Studies have suggested that the vessels used to remove water from the storage container may also contribute to the microbiological deterioration of water quality (Jagals et al., 1997; Jagals et al., 1999; Trevett et al., 2005). Water stored in open-top containers appears more likely to become contaminated by unhygienic vessels than screw-cap closed containers, which do not require the use of such vessels (Jensen et al., 2002; Trevett et al., 2005).

Areas provided with water by stand-pipes or ground-tanks are also less likely to have adequate sanitation provision (Genthe and Seager, 1996). Poor sanitation is likely to affect the health status of community members, particularly pre-school age children. Combined with poor hygiene, such as lack of hand-washing or use of a common source of stored water for washing, this means that stored drinking water could become faecally contaminated and may contribute to the spread of diseases such as cholera, hepatitis A, hepatitis E, typhoid, dysentery and

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