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Socio-demographic profiles in suburban developments: Implications for water-related attitudes and behaviors along the Mediterranean coast

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A B S T R A C T

This article examines how the socio-demographic characteristics of residents in low-density suburban developments are important factors in understanding and predicting the attitudes and behaviors of residents in relation to residential water use. This paper is based on information obtained from 230 surveyed residents in 9 municipalities of Girona (northeast Catalonia, Spain). First, we seek to define the socio-demographic profiles of the various population groups according to their members' birthplace. Subsequently, based on the existing literature, we analyze the relationships between social groups, their socio-demographic characteristics and their attitudes and behaviors regarding residential water use. Finally, after applying a Generalized Linear Mixed Model with panel data from 77 respondents, we examine whether the birthplace of the surveyed residents and their attitudes toward the conservation of water in homes are relevant factors in determining domestic water consumption. The results demonstrate the significance of birthplace (with its related socio-demographic and urban dynamics) and water conservation attitudes on residential water use and, therefore, the need to take these factors into account when managing this resource.

Introduction

Growing concern about the availability of water in sufficient quantities and quality has made the move toward sustainability when planning and managing water resources increasingly urgent. From this perspective, many international organizations, including the United Nations and the European Union, have proposed the implementation of comprehensive management plans that combine actions to guarantee the supply of water with actions addressed to control demand (EEA, 2009; UN-Water, 2012). The design of these integrated water management plans, however, needs to be developed while carefully assessing target sectors and populations, including the demographic, economic, social and cultural characteristics of these populations that are more relevant to water consumption (March & Saurí, 2010).

Regarding urban water in the northern Mediterranean region, social, economic and territorial changes have become important factors in understanding the increase in demand, particularly in the domestic sphere. Of particular relevance is demand from detached houses or multi-family residences in low-density areas (Durà, 1997, 2003; Nel lo, 2001). The widespread emergence of a new low-density residential model (and the social preference for this model) has led to new behavioral patterns with a greater tendency to consume water for swimming pools, gardens or recreational horticulture (Garcia, Llausàs, & Ribas, 2013; Saurí, 2003). These new cityscapes concur with the garden-city model of individual lifestyles and transmit social values that often lead to non-prudent behaviors regarding water use (Askew & McGuirk, 2004; Parés-Franzi, 2005).

It has been demonstrated for different contexts that water consumption per capita in low-density urban areas is usually greater than consumption per capita in areas of compact housing (Domene & Saurí, 2006; Fox, McIntosh, & Jeffrey, 2009). Other factors related to social and urban dynamics may influence this consumption as well. Some studies have analyzed how socio-demographic differences among water users may become relevant

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factors to explain users' consumption. Therefore, the socio-demographic characteristics of residents can improve our understanding of the relationships between dispersed urban forms and domestic water consumption (March, Perarnau, & Saurí, 2012). One aspect little explored in the literature is the geographical origin of residents within the context of the history of urban growth in a particular area.

The migration of the rural Spanish population to Barcelona and its metropolitan area in search of better work conditions and quality of life peaked in the period 1950–1975. During this period, Catalonia received one-and-a-half million people from the rest of Spain, contributing 44% to the overall growth of the Catalan population (Miret, 2001). This demographic boost quickly situated the Metropolitan Area of Barcelona (MAB) as one of the largest metropolitan areas in southern Europe (4,239,000 inhabitants in 1981; 4,777,000 in 2011).

In the early 1980s, the first signs of a territorial redistribution of the population from compact cities to the suburbs were identified, while at the same time, a new, still incipient, wave of immigration arrived from developing countries (Durà, 2003). The causes of this redistribution include increasing population pressure in compact cities as the numerous children of the "baby boom" of the 1960s reached adulthood, lack of land, rising housing prices, and an increasing demand for more living space coupled with increasing household incomes (Durà, 1997; Durà, 2003; Monclús, 1998; Nel lo, 2001). The demographic evolution also witnessed the arrival of populations from rich countries, generally Europeans, who primarily settled in mainland or coastal second homes after their retirement or looked for good investment opportunities (EEA, 2006). Because of these changes, between 1987 and 2002, compact residential urban land in Catalonia rose from 379 to 409 km^2, a 7.92% increase. In contrast, low-density urban land area increased from 271 to 581 km^2, which represents an increase of 114.39% in the same period.

To plan for water supply and sanitation in areas under urban sprawl, it is crucial to know the socio-demographic profiles of residents and to incorporate an estimation of their demographic evolution (EEA, 2012). This knowledge, coupled with information regarding land-use changes related to urbanization (Tong, Sun, Ranatunga, He, & Yang, 2012), is particularly useful within the context of increasing climate uncertainties and its connection to water-resource availability (IPCC, 2007). Climatic threats in the form of droughts and floods appear more acute in the coastal Mediterranean areas of the Iberian Peninsula and may affect populations with different socio-demographic characteristics and, therefore, with different vulnerabilities and adaptive capacities.

With all the above considerations in mind, the aim of this paper is to determine whether population and household dynamics that have occurred in Catalonia, particularly in low-density residential areas, are important factors in understanding and predicting the attitudes and behaviors of residents regarding water use. In this study, we first explore the profiles of various population groups based on their socio-demographic characteristics according to their birthplace. Subsequently, and based on the existing literature, the interaction between these social groups, their socio-demographic characteristics, and their attitudes and behaviors regarding residential water use is analyzed. Finally, a Generalized Linear Mixed Model (GLMM) is applied using panel data of 77 respondents to examine whether the birthplace of the household sample and their attitudes toward residential water use are factors influencing their water consumption.

The paper is divided into 6 sections. First, we present the socio-demographic factors that, according to the literature, most influence the residential water demand. Subsequently, we present the main urban dynamics and demographic changes that occurred in the study area. The following section briefly introduces the most determinant characteristics in relation to water management in the same area, such as the main water-supply sources, management and service rates, and water prices. The fourth section is devoted to explaining the survey design used to obtain data, the data treatment, and statistical analyses. The results are presented and discussed in the fifth section. The last section is dedicated to conclusions and closes with a brief reflection on the relevance that urban and demographic dynamics have for water consumption and the implications for the management of the resource.

Socio-demographic characteristics and residential water consumption

The main socio-demographic factors shown to influence domestic water use include household size, the age of residents, household income, and the residents' birthplace.

Household size

Most studies addressing the effects of socio-demographic variables on domestic water demand usually include a variable that takes household size into account (Agthe & Billings, 1987; Arbués, Barberán, & Villanúa, 2008; Dandy, Nguyen, & Davies, 1997; Höglund, 1999; Martínez-Espiñeira, 2002; Nieswiadomy & Cobb, 1993). With household water consumption as a dependent variable, increasing household size should produce an increase in the demanded water. However, due to household-scale economies, an increase in the demand for water may be proportionately less than the increase in household size (Höglund, 1999). Still, as shown by Arbués et al. (2008), there is a size threshold beyond which household economies of scale vanish and the rising demand for water is proportional to the increase in the number of people per household.

Age of residents

The age of the residents is also a considerably powerful explanatory variable for modeling domestic water consumption, but it is not always used in studies that address this subject. Nauges and Thomas (2000), in their study conducted in eastern France, found that residential areas with a higher proportion of a young population are likely to be greater water consumers due to a higher frequency of laundering and outdoor water use for recreational purposes. The opposite behavior occurs in the case of residential developments designed predominantly for an elderly population, whom the authors identified as much thriftier water consumers. Similar results were shown by Martínez-Espiñeira (2003) in the case of municipalities in Galicia (Spain), who concluded that the residential population over 64 years of age had a more austere water consumption compared with the younger population. In contrast, municipalities with a higher proportion of the population less than 19 years old observed higher domestic water consumption. After this general trend, however, some caveats are in order. Mayer et al. (1999) found in different cities of the USA and Canada that children consume less tap water than teenagers and adults. Moreover, older people tend to spend more time at home and engage in gardening practices, as shown by Lyman (1992), which may lead to greater water consumption.

In their research in Shoalhaven (Australia), Gregory and Di Leo (2003) found that residents with below the minimum billable water consumption were older, had a lower educational level and were prone to have habits related to water conservation. The authors argued that this generation of elderly people did not usually enjoy a high purchasing power and, therefore, were forced to save