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Advancing methods for research on household water insecurity: Studying entitlements and capabilities, socio-cultural dynamics, and political processes, institutions and governance

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ABSTRACT

Household water insecurity has serious implications for the health, livelihoods and wellbeing of people around the world. Existing methods to assess the state of household water insecurity focus largely on water quality, quantity or adequacy, source or reliability, and affordability. These methods have significant advantages in terms of their simplicity and comparability, but are widely recognized to oversimplify and underestimate the global burden of household water insecurity. In contrast, a broader definition of household water insecurity should include entitlements and human capabilities, socio-cultural dynamics, and political institutions and processes. This paper proposes a mix of qualitative and quantitative methods that can be widely adopted across cultural, geographic, and demographic contexts to assess hard-to-measure dimensions of household water insecurity. In doing so, it critically evaluates existing methods for assessing household water insecurity and suggests ways in which methodological innovations advance a broader definition of household water insecurity.

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1. Introduction

Household water insecurity (HWI) has serious implications for the health, livelihoods and wellbeing of people around the world. Recent scholarship challenging the World Health Organization's metric of "access to an improved water source" suggests that water insecurity is far more pervasive than official estimates suggest, particularly in low and middle income countries [99,98,80,84,124]. There is an emerging consensus that HWI is much more than "access to an improved water source," and must be measured as such. The tasks of accurately defining and measuring water insecurity are critically important for challenging the social, cultural, economic and political processes that marginalize communities and ultimately undermine development efforts to reduce household water insecurity [66,143].

The concept of water insecurity has gained much traction in both academic literature and global development institutions in recent years. HWI has been defined as "inadequate, unreliable, and unaffordable water for a healthy life" [54]. However, a definition of water insecurity that focuses *solely* on availability or quality may obscure other important dynamics [80,83,114], including social, cultural, and political relations [56], as well as the ecological processes upon which they draw (e.g., [59,101,41]). Scholars increasingly emphasize the importance of conducting research on water in the context of relational frameworks, such as the hydrosocial cycle [64], and complex frameworks such as coupled social-ecological systems [65] and sociohydrology [106]. Recently Jepson et al. [56] argued that a "human capabilities" approach offers a useful conceptual advance on the current preoccupation with physical access. While researchers are creating more comprehensive metrics to measure HWI (e.g., [11,119,109]), in general they do not yet properly address the socio-economic, cultural, and political relations at work in producing household water insecurity. To accomplish this, we suggest that researchers must develop robust methods for more comprehensively assessing HWI, its causes, and its effects.

Household-level research is notoriously complicated by the problem of defining the "household", and most social science disciplines have developed well-established approaches to address this. Following Netting et al. ([79]: xxii), we define a household as "a fundamental social unit…for pooling and sharing of resources." Yet, households vary in their capacity to access water based on factors such as family size, acute/chronic illness and disability, and age composition [37]. Further, the negative physiological impacts of water insecurity, such as dehydration, might be felt more acutely by some demographic subgroups, or by some individuals within the household [96,97,132]. Factors operating at other scales of analysis shape HWI as well. At the societal level, cultural and political structures embed social relations with power dynamics that in turn may expose otherwise similar households to different levels of water insecurity. For example, processes of land tenure, disinvestment, spatial exclusion, and dispossession can increase racial/ethnic-minority households' risk of experiencing water insecurity [67,117]. HWI research thus requires attention to complex interacting processes at multiple levels of analysis, and with attention to socio-spatial differentiation.

In this paper, we articulate household water insecurity as a concept that comprises both a *state* and a *relation*, which in turn requires a holistic approach to assessment and measurement. Our review of existing and emergent methods in this piece focuses primarily on economic, socio-cultural, and political dynamics important for a relational understanding of water insecurity. We have three goals. First, we review current HWI measurement methods, assessing their utility for evaluating water quality, quantity (or adequacy), sources (or reliability), and affordability. Second, we identify opportunities for methods that better assess the entitlements and capabilities, social and cultural dynamics, and political institutions and processes influencing HWI. Third, we draw attention to the need for methods that facilitate systematic, cross-cultural and cross-site comparative analysis in order to identify and address global patterns in HWI.

2. Established methods for assessing household water insecurity

For 20 years, household water insecurity researchers have largely followed some variant of Webb and Iskandarani's [123] definition: "water security is access by all individuals at all times to sufficient safe water for a healthy and productive life" (e.g., [72,110,44]). Four derivative concepts—water quality, quantity or adequacy, source or reliability, and affordability—have subsequently been included in most definitions of HWI [54]. Leading international and national agencies have also set standards for approaches to assess human water requirements, including the United Nations, World Health Organization, U.S. Environmental Protection Agency, and American Public Health Association (e.g., [14,127]), although guidelines, recommendations, and legislation vary widely. Here, we review established methods linked to the four concepts identified above, as well as opportunities to better assess HWI related to each concept.

2.1. Water quality

For domestic purposes, water quality typically refers to the safety of water for direct human consumption (i.e., ingestion) and, in some cases, washing and hygiene (considering water-borne and water-washed diseases, respectively). Water quality is measured by microbiological and physico-chemical contaminants that either pose direct health risks, or are indicative of a risk to human health (e.g., turbidity). Microbiological water quality is most commonly assessed by testing for the presence of fecal indicator bacteria such as *Escherichia coli* or thermo-tolerant coliforms. Fecal contamination in low- and middle-income drinking water supplies is often seasonal [58], and persists globally despite concerted efforts to address it since the first International Drinking Water and Sanitation Decade in the 1980s [7]. The physico-chemical quality of drinking water is commonly assessed using metrics such as total dissolved solids, pH, turbidity, concentrations of specific heavy metals, and levels of residual/free chlorine. Both types of water quality are traditionally tested by sampling and measuring indicators of contamination at a point of consumption