Title: Water Insecurity in a Syndemic Context: Understanding the Psycho-Emotional Stress of Water Insecurity in Lesotho, Africa

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Abstract

Syndemics occur when populations experience synergistic and multiplicative effects of co-occurring epidemics. Proponents of syndemic theory highlight the importance of understanding the social context in which diseases spread and cogently argue that there are biocultural effects of external stresses such as food insecurity and water insecurity. Thus, a holistic understanding of disease or social vulnerability must incorporate an examination

of the emotional and social effects of these phenomena. This paper is a response to the call for a renewed focus on measuring the psycho-emotional and psychosocial effects of food insecurity and water insecurity. Using a mixed-method approach of qualitative interviews and quantitative assessment, including a household demographic, illness, and water insecurity scale, the Household Food Insecurity Access Scale, and the Hopkins Symptoms Checklist-25, this research explored the psycho-emotional effects of water insecurity, food insecurity, and household illness on women and men residing in three low-land districts in Lesotho (n=75). Conducted between February and November of 2011, this exploratory study first examined the complicated interaction of water insecurity, food insecurity and illness to understand and quantify the relationship between these co-occurring stresses in the context of HIV/AIDS. Second, it sought to separate the role of water insecurity in predicting psycho-emotional stress from other factors, such as food insecurity and household illness. When asked directly about water, qualitative research revealed water *availability*, *access*, *usage amount*, and *perceived water cleanliness* as important dimensions of water insecurity, creating stress in respondents' daily lives. Qualitative and quantitative data show that water insecurity, food insecurity and changing household demographics, likely resulting from the HIV/AIDS epidemic, are all associated with increased anxiety and depression, and support the conclusion that water insecurity is a critical syndemic dimension in Lesotho. Together, these data provide compelling evidence of the psycho-emotional burden of water insecurity.

Keywords: water insecurity, food insecurity, Lesotho, syndemic theory

Introduction

In 2008, medical anthropologist Merrill Singer described how food insecurity, HIV/AIDS, and poverty created the “perfect epidemiological storm” in Southern Africa. According to him, the epidemics of food insecurity and HIV/AIDS must be contextualized in the context of high poverty; the three issues work together to create a syndemic, or an epidemic comprised of synergistic or multiplicative effects. He coined the phrase *syndemic* to explain how such “intertwined and mutual enhancing health problems...significantly affect the overall health status of a population within the context of a perpetuating configuration of noxious social conditions” (1996:99). It is not enough to talk of comorbid issues, rather, it is crucial to understand how issues such as food insecurity and HIV/AIDS contribute to and exacerbate each respective epidemic (2008).

While previous research has explored the link between food insecurity and illness, including HIV/AIDS, and anxiety and depression (e.g. Gillespie and Kadilaya 2005; Hadley and Crooks 2012; Weiser et al. 2011), only a few studies, described below, have examined the linkage with water insecurity. These studies suggest that water insecurity is an important consideration since many people in the global south face acute water scarcity.

By situating water insecurity within a syndemic context, this study examined not only the psycho-emotional burden of water insecurity, how it negatively affects peoples’ thoughts and feelings, but how water insecurity interacts with food insecurity, HIV/AIDS, and poverty to increase anxiety and depression among Basotho living in the Maseru District of Lesotho. Through a mixed-method approach, this research sought to uncover the lived experience of syndemic water insecurity, and to determine the statistical

relationship between food insecurity, water insecurity, household illness, and other potential stressors such as poverty.

Syndemic Theory

Arguing against diseases as bounded, discrete entities, syndemic theory holds that diseases and illnesses must be considered in relation to one another and to their context (Singer and Clair 2003). Syndemic theory is thus important here for several reasons. First, syndemic theory situates negative health effects in a social context, thereby positing that food and water insecurity can be treated as epidemic in the same way as HIV/AIDS. Second, syndemic theory holds that these epidemics are all mutually reinforcing and do not occur in parallel. Third, it underscores the importance of psychological and emotional health.

Drawing on a long history of critical medical anthropology and the political economy of health, proponents of syndemic theory argue that “[d]isease and suffering are as much social as they are biological” (Mendenhall 2012:14) and that epidemics “involve the interaction of diseases or other adverse health effects as a consequence of a set of health-threatening social conditions” (Singer and Claire 2003: 428-429). That is, this theory highlights the importance of understanding the social context in which diseases spread and the biocultural effects of external stresses such as poverty.

A syndemic occurs when populations experience synergistic and multiplicative effects of co-occurring epidemics. Many researchers have examined the link between food insecurity and HIV/AIDS (Gillespie and Kadilaya 2005; Hadley and Crooks 2012; Weiser et al. 2011) and have argued that such a relationship should be considered a syndemic (Himmelgreen et al. 2009; Reddi et al. 2012; Singer 2011). Using a similar

explanatory framework entitled *New Variant Famine*, Alex de Waal and Anthony Whiteside (2003) outline how, owing to the interaction of HIV/AIDS, drought and poverty, households in Africa face increasing vulnerability including labor shortages and loss of assets, increased AIDS care for sick family members and orphans, and malnutrition resulting from and contributing to the progression of HIV. In Lesotho, the country's political economic history vis-à-vis apartheid and extensive labor migration to South Africa has resulted in a specific topography (Fassin 2009) of HIV and poverty. It is within this context that David Himmelgreen and colleagues (2009) argue for the incorporation of syndemic theory and new variant famine to understand the complex relationship between HIV, poverty, food insecurity, malnutrition, and gender there.

While the impact of these factors has been shown, another important stressor has been under-analyzed: water insecurity. As far back as 2002, Peter Ashton and Vasna Ramasar (2002) warned that the impact of the demographic changes caused by the HIV/AIDS epidemic, such as the loss of skilled water and sanitation workers, would result in increased risk of water-borne diseases in southern Africa. Similarly, Anna Talman and colleagues (2013) discuss the risks associated with lack of sanitation and safe water supply in areas with epidemic HIV. Using syndemic theory to explain the self-reinforcing relationship between HIV/AIDS and ecosystem degradation, they hold that environmental vulnerabilities must be considered in addition to social and economic vulnerabilities.

Finally, proponents of syndemic theory have demonstrated the importance of understanding the psycho-emotional and psycho-social drivers and outcomes of syndemics (c.f. Mendenhall 2012; Singer and Clair 2003). Relationships between psycho-emotional affect and water insecurity have been reported, although they have not been studied in a

syndemic context along with food insecurity and HIV. To understand how water is interacting with food insecurity, HIV, and poverty, we first outline current thinking on measuring water insecurity.

Water Security: Beyond Availability, Access, and Usage

Water security refers to having sufficient access to safe water, which is further explicated along three dimensions: *availability*, *access*, and *usage* (Webb and Iskandarani 1998). Water *availability* refers to how much water is physically available in the environment and how it is distributed to people. *Access* is a demand-side dimension and refers to the control of water as a commodity, for example, whether the water source is close to the home and household members are able to procure enough water for their needs. Water *usage* includes issues of need, knowledge and practice of water safety behaviors, and opportunity costs. Anthropologists working in the area of water insecurity have argued for the need to understand the lived experience of water insecurity in addition to understanding availability and access (Hadley and Wutich 2009; Stevenson et al. 2012, 2016; Wutich and Ragsdale 2008). Qualitative research has described the phenomenological experience of water insecurity (Ennis McMillan 2008; Kane 2012).

However, only a handful of researchers have operationalized water insecurity to quantitatively measure the relationship between water insecurity and stress (Hadley and Wutich 2009; Stevenson et al. 2012, 2016; Wutich 2006; Wutich and Ragsdale 2008). Research addressing the link between water insecurity and common mental disorders draws heavily on studies of food insecurity; social scientists are calling for experiential-based measures of water insecurity to parallel similar measures of food insecurity. Wutich (2006, see also Wutich and Ragsdale 2008) built upon Ennis-McMillan (2001) to quantify

emotional distress from water insecurity using outcome variables specific to Bolivia. Wutich and Ragsdale defined water insecurity along two primary dimensions in their study (2008): inadequate water supply and inadequate water access, to which they added seasonality. Using qualitative methods, Wutich developed a Bolivia-specific psycho-emotional outcome scale and found that water access and gender were significantly associated with emotional distress while water supply and seasonality were not (2006; Wutich and Ragsdale 2008).

Stevenson and colleagues furthered the above research, and conducted a study in Ethiopia which examined the impact of water insecurity on psychosocial distress (2012). Psychosocial differs from psycho-emotional in that it captures the impact of water insecurity on interpersonal and community relationships in addition to stress. Stevenson and colleagues borrowed from the FAO (2004) definition of food security to define water insecurity along three dimensions: *access*, *adequacy*, and *lifestyle*. *Lifestyle* captures the cultural experience of water insecurity, similar to Webb and Iskandarani's (1998) usage dimension, but differs by attempting to measure the phenomenology and social impact of water insecurity. They developed a water insecurity scale that included questions about social effects, feelings of shame, and changes in behavior due to water insecurity. Unlike Wutich (2006), who investigated the effects of water insecurity on psycho-emotional stress, Stevenson and colleagues considered these social aspects of water insecurity, along with access, to be predictors of psycho-emotional outcomes, as measured by the Falk Self-Reporting Questionnaire (SRQ-F). Their aim was to determine the impact of the water-related psychosocial component on the SRQ-F above and beyond access. They found that women's water insecurity scores were significantly associated with psychosocial distress

(2012).

In a follow-up study, Stevenson and colleagues assessed household water insecurity and women's psychological distress in three communities in Ethiopia before and after improvements in water access (2016). They found that while improvements in community water supply reduced household insecurity (as measured by a water insecurity scale developed by the researchers), it did not concurrently reduce women's distress as measured by the SRQ-20. They note, "the single strongest predictor of declines in psychological distress was improvement in harvests between 2013 and 2014, presumably due to increased rainfall" (Stevenson et al. 2016: 10). These findings underscore the difficulty in parsing out the effect of water insecurity from other concomitant issues – specifically food insecurity. Furthermore, the researchers posit that there may be significant dimensions beyond those controlled for in their model (i.e., beyond food insecurity and socio-economic status).

The above research demonstrates that water insecurity, measured along both access and experiential dimensions, significantly predicts psycho-emotional outcomes; however, very little work has been done addressing the intersection of water insecurity in syndemic settings and how it affects people psycho-emotionally. The data presented in this paper reflect an important step in disentangling the complex relationships between stressors in a syndemic setting.

Study Site: Lesotho, Africa

According to the World Bank, three-quarters of Basotho living in rural areas have access to "improved" water sources, such as a community water tank, standpipe, borehole, protected well or spring (World Bank 2012). Our research supports this, where only 16%

of all respondents, all of whom lived in a sub-village, had access only to unprotected springs. However, the World Bank statistics do not capture ecological issues such as drought or technical issues such as broken taps that were routinely described by research participants.

At the time of this research in 2011, Lesotho had the third highest HIV/AIDS prevalence in the world estimated at 23.3% of the adult population (USAID 2010). In addition to the HIV/AIDS epidemic, Lesotho had, and continues to face, acute geographic pressures. Soil erosion and soil degradation are critical problems that have plagued the agricultural sector, contributing to reduced yields. Only about 10% of the land is arable (CIA 2012), with most people in rural areas dependent on rain-fed subsistence agriculture.

Such reliance on subsistence farming is problematic given that Lesotho faced drought in 2001-2004 and again in 2006-2007. These droughts were so severe that Lesotho declared a state of emergency in 2007 and then again in 2012. The Basotho were unable to effectively recover from this almost decade-long drought, especially as the decade came to a close with a season of particularly heavy rains that washed away fertile topsoil and ruined crops (December 2010 to February 2011). The Lesotho Food Security and Vulnerability Monitoring Report estimated that 514,000 Basotho required humanitarian assistance (LVAC 2011). Given the lack of opportunity for farming, Lesotho relies heavily on remittances from migrant labor and imports. Where male migration to South African mines once supported families in rural areas by way of remittances, recent retrenchment from the mines is crippling the economy, contributing to Lesotho's 45% unemployment rate (CIA 2012).

It is within this syndemic context that this study explored the psycho-emotional

effects of water insecurity, food insecurity, HIV/AIDS, and poverty.

Method

Participants

This mixed-method study was conducted between February and November of 2011 in three villages in the Maseru District of Lesotho. A convenience sampling method was used, with oversampling of women respondents because women are primarily responsible for water procurement in Lesotho. The survey and additional components were administered to 75 participants, 25 from each of the three villages included in this study. Of the 75 survey respondents, 56 were women and 19 were men. Fifty-six of the survey respondents also participated in the qualitative interview, 35 of which were women and 21 men. Table 1 provides additional descriptive information about the sample's household composition, and Table 2 summarizes information about overall levels of reported food insecurity, water insecurity, anxiety and depression.

[INSERT TABLE 1 HERE]

Interview Administration

Researchers went door to door in the village to ask the female head of the household to participate in the assessment, although male household heads were not excluded if the woman was unavailable or if it was a sole-male headed household. A convenience sample was employed due to the high rates of labor migration to South Africa as well as to Maseru for work. Thus, many households were unoccupied as the primary breadwinner was away. All consenting households participated in the household survey and other quantitative assessments, and a sub-sample was asked to participate in the qualitative interview. Ethical approval for this study was obtained from the Lesotho

Ministry of Health as well as the Institutional Review Board at [redacted for review], and all research participants provided informed oral consent.

The in-depth, structured qualitative interview protocol was developed to explore the lived experience of water insecurity. Since research on the experiential basis of water insecurity has demonstrated that water insecurity is multidimensional and extends beyond traditional measures of access, a major focus of the interview guide was to adequately cover each of these dimensions (i.e., *availability*, *access*, and *usage*). Additional questions about shortages and the stress associated with water insecurity were also included.

Addressing food insecurity in the interview was also critical so that a qualitative understanding of the lived experience could contextualize the quantitative results from administering the Household Food Insecurity Access Scale (HFIAS). Finally, interview questions explored respondents' primary concerns for their households to determine the degree to which water insecurity would emerge spontaneously, without prompting.

Survey Administration

The survey research goals were two-fold: to assess baseline water insecurity, including measuring water availability, access and usage, and to establish the relationship between water insecurity and psychological distress as measured by the Hopkins Symptoms Checklist controlling for factors such as poverty, food insecurity, and HIV/AIDS.

The assessment battery administered for the quantitative component of this research comprised a water insecurity scale developed for this research, a standard depression and anxiety assessment (Hopkins Symptoms Checklist-25), a food insecurity

scale (HFIAS), and a household demographic survey to approximate poverty and capital.

Water insecurity. Water insecurity was the primary variable of interest in the study. The water insecurity scale used in this research was developed specifically for this purpose, and was grounded in both an extensive review of the literature regarding the measurement of this issue, and by the qualitative interview phase of the study. The three dimensions of water security outlined by Webb and Iskandarani (1998) – access, availability, and usage – were evaluated individually, along with questions about perceived water safety and sanitation, which constitutes a fourth dimension of *water cleanliness* for the purposes of this research. Questions for availability addressed the number of sources in the community (e.g., rivers, community taps, unprotected springs, private wells). Access was assessed by questions concerning problems with sources, amount of water procured, and the time required for water-related activities. Usage was captured through questions about day-to-day water-related activities and the specific amounts used for activities including personal hygiene, cooking, drinking, laundry, and gardening. Perceived water cleanliness explicitly refers to a person's perception of the cleanliness of their drinking water.

Psycho-emotional distress. This represents the major outcome of interest and was assessed using the Hopkins Symptom Checklist (HSCL), a 90-item scale measuring psycho-emotional distress. This research used the shortened 25-item version with anxiety and depression sub-scales, as those are the most relevant to the research questions (Derogatis et al. 1974). The anxiety and depression sub-scales include 10 and 15 items, respectively.

The HSCL has been validated in a variety of African countries (Bass et al. 2008;

Ertl et al. 2011; Kaaya 2002; Mels et al. 2010; Onyut et al. 2009; Tsai et al. 2013). The somatic sub-scale from the full-length HSCL was validated in Lesotho (Hollifield et al. 1990), and some of those questions are also featured in the anxiety and depression sub-scales used in this research. It was not within the scope of this research to validate the depression and anxiety sub-scales in Lesotho. This tool was not used for diagnostic purposes but rather to gauge distress, as has been demonstrated in previous studies. However, previous validation in this geographic context supports the appropriateness of its use in the current research.

Food insecurity. Disentangling the role of food insecurity from water insecurity in psychological stress is a critical step in fully evaluating the effects of an insecure water supply in a syndemic environment. To do this, food insecurity must also be adequately quantified. The HFIAS was developed by the Food and Nutrition Technical Assistance Project (FANTA) in collaboration with Cornell and Tufts Universities (Coates, Swindale and Bilinsky 2007). This instrument was selected for its ease in administering and it has been validated in studies throughout Africa (Gebreyesus et al. 2015; Kneuppel et al. 2010; Maes et al. 2010). The HFIAS is a 30-day food access recall scale comprised of nine individual yes/no items with corresponding Likert-type scale. Questions concern having enough food, having a variety of food, and worry over food supply.

Capital and socioeconomic status. Hadley and Patil (2008) found that the association between food insecurity and anxiety and depression was significantly correlated with seasonality and robust to the inclusion of financial assets. This highlights the assertion put forth by Webb et al. (2006) that financial capital may not be as important in determining food insecurity or resultant emotional distress in developing countries as

initially thought. This, along with the fact that water is not a saleable good in Lesotho, suggests that financial capital may not prove to be an important variable in determining water insecurity, or in determining an association between water insecurity and anxiety and depression, at least in the Lesotho environment. As such, the scope of assessing financial assets is more focused than that found in many of the household vulnerability indices (e.g., those that count total number of household items owned or materials used in household construction). Four types of capital were assessed: financial, human, social, and natural. Financial capital was addressed by questions related to household contributions, both of household members in Lesotho and those working abroad, and assets (i.e., gardens, farms, and animals). Human capital refers to family demographics, and was captured by determining who lives in the home, whether the head of household is female, and whether there are orphans or vulnerable children at home. Social capital was captured by asking questions regarding assistance in gardening, assistance with water procurement (including assistance with fetching water and giving/receiving water), and whether the respondent shared a farm or participated in practices such as *mafisa* (the practice of loaning a cow in return for future offspring). Finally, natural capital concerns environmental stability and was addressed by questions regarding the respondent's ability to garden or farm. These capital constructs, taken together, are used as proxy measures for socio-economic status (SES) or poverty.

Special considerations for HIV/AIDS. The Ethics Board of the Government of Lesotho does not approve research that asks direct questions about a person's HIV status. In light of this, overall household and individual illnesses, as well as questions about recent deaths in the family and cause of death, were used as proxy indicators.

Specifically, the number of recent deaths in household and/or recent addition of members in the form of orphan or vulnerable children were queried. The basis for this proxy measure is the hollowing of the distribution curve for the adults in their 20s through 40s, leaving the elderly and young children in the population. Thus, the composition of households affected by HIV were likely to reflect such changes in the epidemiologic curve. This methodology is in line with accepted vulnerability indices (e.g. FANRPAN, n.d.). Given the high prevalence of HIV at the time of this research as well as the observed weekly funerals in the communities, it was assumed that the populations were HIV-affected.

Syndemic theory has demonstrated the complexity of syndemic environments, where multiple stresses each exacerbate their respective effects. The following data represent a step towards such an understanding of the relationship between food insecurity, water insecurity, HIV/AIDS, and poverty.

Findings

Qualitative Interview Results

While Lesotho is at the center of one of the worst HIV/AIDS epidemics in the world, when asked about the health of their families, most respondents said that they were all generally in good health (n=34). Many mentioned illnesses such as colds or influenzas, or diarrhea among children, but very few mentioned significant illnesses that they or their families were currently suffering from. When asked about the most common diseases in the community, HIV/AIDS was mentioned by only half of the respondents, possibly reflecting continued stigma, as HIV/AIDS health messaging is ubiquitous in Lesotho and funerals were common during this research. Rather, HIV/AIDS manifested as a major

stressor for families who had lost loved ones. This was particularly true for older respondents who were now charged with caring for orphaned children. One interviewee described how she had recently – and suddenly – lost a son, his wife, and a daughter leaving six single or double orphan grandchildren in her care. Over half of all respondents (n=44) reported having lost a child, with a quarter (n=17) of the parents reporting that at least one of their children was contributing financially. Providing food and paying school fees were the two biggest concerns for grandmothers taking care of their grandchildren who had lost one or both parents. While all deaths were clearly not attributable to HIV, these numbers nonetheless demonstrate the economic impact of a death in the family. As one 81-year-old grandmother recounted about her limited ability to provide, “I would love for them to grow up strong and healthy but sometimes there isn’t enough [food]...”

Indeed, the interviews revealed that food insecurity is a daily stress for people in Lesotho. When asked about their greatest concerns, 60% of respondents reported that it is food insecurity. This is not surprising given the results of the HFIAS, which indicate high levels of food insecurity: 82% reported not having enough food, and of the 10 respondents who said that they had enough food, five of them said their diets were very limited and there was little variety in their choices.

In contrast, water was mentioned as a primary daily stressor only five times, and all by respondents living without improved water sources (i.e., reliant on natural springs). While water did not often emerge unprompted, 80% of respondents lost crops, either in gardens or farms, because of problems with water availability and access. These problems included dry taps, lack of sufficient rainfall, or during the summer of 2010-11, too much water and poor soil quality resulting in significant run-off and loss of topsoil. When

people discuss problems with water it is often in relation to other, more immediate problems. As one woman mused, “you can’t cook the food if you don’t have the water.” Water insecurity prevents families from growing enough to eat; the link between water insecurity and food insecurity in Lesotho cannot be overstated.

However, water insecurity affects more than food security – water insecurity affects many aspects of daily life, from having safe water to drink to having enough water to maintain the home. In this study, most respondents experienced problems across all three dimensions; insufficient and unsafe water was a stress that affected many different aspects of people’s daily lives. The two biggest problems with water sources cited by participants were insufficient supply, cited by over half of the respondents (n=36), and contamination (n=25). During the interviews, participants routinely talked about how scarce their water was, mentioning that tanks were regularly empty or they would have to wait in long queues for the little water that was there. “It’s a mission to get water” was how one respondent described the struggle to secure enough water for all their daily needs. Despite the presence of community tanks, half of all respondents reported that there were times that they would go without water in their household, sometimes a day or two when the tanks were closed or ran dry. In terms of water safety, half the respondents reported having fallen ill from drinking dirty water.

Together, these findings suggest water as the distal cause of the proximal stress of food insecurity. Within the context of HIV/AIDS, both food and water insecurity contribute to increased vulnerability to infection and illness, to poverty, and to poor psycho-emotional health. To further investigate the relationships apparent in these interviews, we present the results of our survey research.

Survey Results

Correlates of psycho-emotional distress. Household demographics, SES, HIV/AIDS, food and water insecurity were correlated with psychological distress, as measured by the Hopkins anxiety, depression, and total scores (see Table 2). Household demographic measures indicated that females and respondents from female-headed households scored significantly higher on both the anxiety ($r=.33$, $r=.23$) and depression ($r=.24$, $r=.28$) sub-scales, respectively, as well as on the overall distress score ($r=.30$, $r=.28$). SES proxy *assets* correlated significantly anxiety ($r=-.32$), depression ($r=-.33$) and overall distress ($r=-.35$), indicating that the fewer household assets, the higher levels of reported psycho-emotional distress. SES proxy *farm sharing* was also significantly correlated with depression ($r=.34$) and overall distress ($r=.34$), although in an unexpected direction. An increase in farm sharing is associated with greater levels of reported psycho-emotional distress. *Changes in household demographics*, used as the proxy measure for HIV/AIDS as it measures recent death in the family and addition of household members, was positively significantly correlated with the Hopkins total ($r=.29$) as well as the anxiety subscale ($r=.35$). Although considered a proxy for HIV/AIDS in this initial analysis, change in family structure was included with SES in the subsequent regression analyses with other measures of capital, as qualitative studies demonstrated the financial consequences (in addition to emotional consequences) of changes in the family structure. *Food insecurity*, as measured by the HFIAS, was also significantly positively correlated with the total Hopkins outcome ($r=.32$), as well as the anxiety ($r=.30$) and depression ($r=.29$) subscales. Finally, the relationship between psycho-emotional distress and *water insecurity*, as measured by *access, usage and perceived water cleanliness*, was

evaluated. All three water insecurity indicators correlated significantly with reported levels of depression ($r=-.33$, $r=-.29$, $r=-.30$), with access and cleanliness also exhibiting significant relationships with anxiety ($r=-.27$, $r=-.36$) and overall reported levels of distress ($r=-.33$, $r=-.35$). These results provide initial evidence for the relationships between SES, food and water insecurity, and psycho-emotional distress. Further analysis explored the additive impact of water insecurity on distress not accounted for by SES and food insecurity.

[INSERT TABLE 2 HERE]

Unique Impact of Water Insecurity on Distress

Hierarchical multiple regressions were conducted to evaluate the contribution of water insecurity to psycho-emotional distress. Not surprisingly, it was anticipated that food insecurity and SES would be significant predictors of overall psycho-emotional distress. Furthermore, it was predicted that water insecurity, as measured by access, usage and cleanliness, would account for additional variance in overall distress, beyond what can be explained by food insecurity and SES.

The data were evaluated to determine if they met the assumptions for regression analysis. No multicollinearity between independent variables was found. The distribution of residuals appeared to be heteroscedastic in some cases. As a result, the data were transformed into z-scores.

A regression analysis for each of the water insecurity predictors was conducted individually. Based on the pattern of correlational relationships found between water and distress, the overall Hopkins score was used in the models for water access and water cleanliness, while only the depression score was used in the model for water usage. In all

models, the analysis was conducted in three steps. Food insecurity (FIS) was entered in the model first, as the literature indicates it was likely to account for the most variance in distress. SES variables were added in a second step (change in family and assets). Finally, for each model, one water insecurity variable (access, use, or cleanliness) was added as the final step in the model, to determine the extent to which water insecurity would account for additional variance over food insecurity and SES in psycho-emotional distress.

Water insecurity: access. The first steps of the analysis revealed that food insecurity and SES accounted for a significant amount of variance in overall distress, such that increased levels of food insecurity, changes in the family structure and a reduction in assets all predicted increased overall psycho-emotional distress (see Table 3). The introduction of water access as the final step in the model yielded a significant increase in the variance accounted for ($\Delta R^2=.047, p<.05$). The negative beta weight associated with access indicated that limited access to water predicted increased levels of distress. In addition to water access, food insecurity and assets remained significant predictors of distress when all three elements were included in the model.

[INSERT TABLE 3 HERE]

Water insecurity: cleanliness. The first steps of the analysis revealed that food insecurity and SES accounted for a significant amount of variance in overall distress, such that increased levels of food insecurity, changes in the family structure and participation in farm share all predicted increased overall psycho-emotional distress (see Table 4), similar to what was found in the previous model. The introduction of perceptions of water cleanliness as the final step in the model also yielded a significant increase in the variance

accounted for ($\Delta R^2=.071, p<.05$). The negative beta weight here indicated that negative perceptions of water cleanliness predicted increased levels of distress. In addition to water access, all food insecurity and SES proxies remained significant predictors of distress when all three elements were included in the model. The significance of water cleanliness was also supported by the qualitative research; many respondents felt their water sources were unsafe, and it was one of the two most commonly reported concerns with water.

[INSERT TABLE 4 HERE]

Water insecurity: usage. Water usage amount had a much more limited explanatory capacity than either access or cleanliness. Food insecurity and SES proxies remained significant predictors of depression, as they did in the previous models (see Table 5). However, the addition of water usage amount in the final step of the regression did not account for a significant increase in variance over household demographics or food insecurity ($\Delta R^2=.018, ns$).

[INSERT TABLE 5 HERE]

These findings support the contention that water insecurity cannot be measured by water access alone. Perceived water cleanliness, or worrying that one's water source is contaminated, also accounts for a significant amount of psycho-emotional distress beyond that which can be explained by food insecurity or SES.

Discussion

These results indicate the importance of understanding the effect of water insecurity on psycho-emotional health in addition to socioeconomic and household effects. Water insecurity, together with poverty and food insecurity, was significantly associated with increased anxiety and depression. These relationships extended beyond the

traditional interpretation of water insecurity as limited access, to include perceptions of water cleanliness, and to a lesser degree, water usage amount. Furthermore, this research is an important step in understanding the complex relationship between stressors in syndemic settings.

In a country such as Lesotho, with the third highest rate of HIV/AIDS at the time of this study, one must consider the impact of this epidemic on the research participants. The HIV/AIDS epidemic exacerbates, and is exacerbated by, both food and water insecurity. As evidenced from the qualitative and quantitative data, death in the family, and the resultant addition of orphan or vulnerable children, was associated with higher anxiety scores and significantly predicted overall levels of distress. The qualitative results also reveal anxieties concerning vulnerability to increased food insecurity and an inability to pay for school fees for grandchildren. The loss of a family member or addition of a dependent creates a financial shock from which few households can easily recover.

Relatedly, asset ownership, including owning a garden, farm and/or animals did buffer against higher scores on the HSCL. However, being food and water insecure accounted for more unique variance in distress than did asset ownership. This supports the findings by Hadley and Patil (2006), as well as the assertion by Webb (2006), that financial capital and asset ownership may not be as important for psychological well-being in settings such as Lesotho. However, the significant statistical relationship found between traditional farm sharing and increased depression and anxiety scores suggests that there are larger societal forces at play, such as interpersonal relations and community norms regarding land tenure and use. Thus, the role that asset ownership plays in overall emotional health may be intricately related to other factors, such as the ability to withstand

shocks like a loss of income due to death in the household and social expectations.

Many respondents were stressed by water in terms of scarcity and anxiety over cleanliness. Participants reporting limited water access amounts had higher anxiety and depression scores. This was supported by the qualitative interviews and participant observation, as respondents described not having enough water for their daily needs, and the researchers saw long queues of water containers lined up at taps. However, stress over water cleanliness proved to cause the most negative emotional consequences of all the water dimensions investigated in this study. These findings mirror those of Wendy Jepson (2014), who reported individuals worrying over water quality and experiencing water distress. The results from this research advance her assertion that water quality is an important dimension of water insecurity by quantifying the additional stress caused by perceived water safety beyond other stressors and other dimensions.

In terms of water usage amount, those without enough water for their chores reported greater levels of depression than those whose activities were not constrained. However, decreased water usage amount did not result in increased anxiety or overall HSCL score. Having enough water for daily needs is subjective; as with food insecurity, water insecurity is a “managed process” through which individuals assign meaning to their experiences. Individuals must decide on appropriate amounts and prioritize their water uses. As such, the variable for water usage amount misses many of these subjective processes; an acceptable amount for one person may be greater or lesser than that for another. Thus, this dimension has less explanatory capacity than the others.

As evidenced by these data, water insecurity is an important variable in understanding the experience of anxiety or depression among people living in rural

Lesotho. However, as evidenced by our data, and as argued by others (Hadley and Crooks 2012; Wutich and Brewis 2014), how people respond to and cope with insecurity is equally important to consider. We hold that current measures do not adequately assess this, as demonstrated by our finding regarding adequate water usage amount. Individuals with whom we spoke stated that water procurement was incredibly stressful due to scarcity and that they would prefer to have more water. Yet total water usage amount had limited significance in the models, perhaps reflecting behavioral modification in light of scarcity. Additionally, a more comprehensive measure of this dimension may result in increased importance vis-à-vis other dimensions of water insecurity. Thus, in a comprehensive definition of water insecurity we recommend the inclusion of a dimension that captures cultural processes, such as the *lifestyle* dimension used by Stevenson and colleagues (2012). However, such a dimension has proven difficult to assess (see Stevenson et al. 2012 for a discussion on unidimensionality and scales) and more work is needed to refine these methods.

Syndemic theory posits that co-occurring epidemics or stresses such as food and water insecurity act together to create complex vulnerabilities, and that they act in concert to exacerbate the effects of each individual stressor. This research supports the assertion that the presence of one or more stressors puts individuals and households at increased risk for others. For example, households impacted by HIV/AIDS through the loss of a household member were more likely to be food insecure. Water insecurity further exacerbated this risk by causing families to lose gardens, in turn limiting the available food or surplus to sell. While our regression analyses did not find a multiplicative effect between stressors in predicting the outcome, it is nonetheless important to note that the

effects are additive. In many of the models, the addition of an additional stressor accounted for additional unique variance in reported distress. However, the exact process through which this occurs is worth elaborating upon. Not all stressors acted equally on anxiety, depression or overall levels of distress. Certain stressors, and even certain dimensions of individual stressors, differentially predicted higher scores (e.g., differential impacts of SES proxies). Thus, interactions are complex processes not explained entirely as a statistical effect.

Theoretically and methodologically, researchers must understand the role water insecurity plays in exacerbating other vulnerabilities. As argued by Wutich and Brewis (2014), anthropologists are tasked with identifying the causes and consequences of food and water insecurity in order to develop a broader anthropology of resource insecurity. This research furthers this work by underscoring the difficulty in understanding the exact mechanisms through which water insecurity is experienced since people often worry about more immediate, day-to-day concerns such as having enough to eat, and yet water remains the distal cause of the proximate experience of food insecurity.

Moreover, these data echo Stevenson and colleagues' (2016) findings that water insecurity and food insecurity are complexly intertwined and that there might be additional dimensions not being measured that act to distort the relationships between independent and dependent variables. Our data suggest that in order to understand the role of individual stressors in syndemic settings, one must understand the bi-directional relationship between individual stressors and also individual stressors and psycho-emotional outcomes. In other words, we must understand how multiple and co-occurring stresses contribute to increased vulnerability and also how these together contribute to

psycho-emotional distress.

It is important to note that given the small sample size, the generalizability of these findings is limited. Rather, this study is a necessary preliminary step in understanding a theoretical and methodologically challenging issue. These data evince the importance of water insecurity as a non-redundant predictor of stress in a syndemic environment and underscores the need for more in-depth studies in varied geographies with varied syndemic stresses. Specifically, more research is needed to understand the linkages between and among stresses in syndemic settings, as this research found that co-occurring stresses create an environment of enhanced vulnerability and contribute to increased negative emotional affect; however, we found no effect mediation resulting in a multiplication effect. Finally, better measures of each dimension of water insecurity are necessary to more accurately quantify the subjective experience of insecurity and to better assess how individuals respond to and cope with such insecurity.

Conclusion

These findings demonstrate the importance of understanding the psycho-emotional experience of water insecurity. When asked directly about water, water *availability*, *access*, *usage*, and *perceived water cleanliness* emerge as important dimensions of water insecurity and together create stress in the daily lives of the respondents. The quantitative research demonstrates that several of those very same dimensions of water insecurity increase anxiety and depression symptoms for people living in Lesotho. Specifically, both the qualitative and quantitative data speak to the importance of understanding perceptions of water insecurity and highlight the psycho-emotional burden of water insecurity.

Water insecurity predicts increased self-reports of anxiety and depression. Both

decreased water access amount and decreased perception of cleanliness significantly predicted increased overall levels of stress. Decreased total water usage amount predicted increased depression scores. Water insecurity could also explain additional variance above and beyond food insecurity and SES measures in a number of instances.

Additionally, these results demonstrate the importance of water insecurity beyond the access dimension, or the need to broaden the current definition to include cultural understandings of water safety and other cultural processes. Perception of water cleanliness was important in understanding the relationship of water insecurity and increased negative psycho-emotional effects, particularly anxiety. Researchers have argued for the importance of understanding the experiential basis of water insecurity, and these quantitative data support the qualitative findings. These data highlight the need for additional research into measuring water insecurity.

Finally, these data are an important first step in understanding synergistic relationship among poverty, food insecurity, water insecurity, and HIV/AIDS. While a country like Lesotho reported one of the highest HIV prevalences in the world, people were simultaneously affected by other environmental, economic, and social stresses. Methodologically, water research remains difficult as people often worry about more immediate, day-to-day concerns such as having enough to eat and non-significant findings may reflect methodological shortcomings.

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Table 1. Participant characteristics

	Average	Min	Max
Household Composition			
Total household size	5.6	1	13
Number residing presently	4.0	1	9
Respondent Characteristics			
Age	51.0	18	92
Water Availability			
Number of water sources	2.7	1	8
		Yes	No
Additional Household Characteristics			
Latrine		52	23
Household garden		69	6
Access to farm (own/share)		45	30
Sell surplus yield - garden		10	65
Sell surplus yield - farm		5	70
Orphan or vulnerable child		39	36

Table 2: Correlations among Major Study Variables

Variable	<i>M</i>	<i>SD</i>	Sex	Female Head of House	Change in Family	Assets	Farm Share	Water Access Amount	Water Usage Amount	Clean Drinking Water	HFIAS	HSCL Anxiety	HSCL Depress
Sex	.76	.43											
Female Head of House	.530	.50	.538**										
Change in Family	1.41	1.22	-.014	.032									
Assets	2.29	0.84	-.065	-.120	-.107								
Farm Share	.40	0.49	.014	.225	.306*	-.022							
Water Access Amount	27.21	41.78	-.034	.073	-.172	.092	-.144						
Water Usage Amount	139.81	131.13	.032	-.078	-.056	.274*	-.114	.536**					
Clean Drinking Water	.39	.49	-.131	.139	-.113	.016	.054	.291*	.008				
HFIAS	16.17	5.45	.231*	.104	.131	-.091	-.197	-.207	-.076	-.319**			
HSCL Anxiety	19.47	6.52	.325**	.233*	.353**	-.316**	.187	-.269*	-.093	-.362**	.298**		
HSCL Depress	34.64	8.64	.238*	.278*	.201	-.326**	.407**	-.331**	-.286*	-.302**	.290*	.709**	
HSCL Total	54.11	14.03	.298**	.279*	.288*	-.348**	.341*	-.329**	-.219	-.354**	.317**	.901**	.945**

Note: *p<.05; **p<.001

Table 3: Hopkins Total Score Regressed on SES, FIS, and Water Access Amount

Variables		<i>b</i>	<i>SE b</i>	β	R^2	ΔR^2
Step 1					.100	
	FIS	.317	.111	.317*		
Step 2					.251	.150*
	FIS	.260	.104	.260*		
	Change in Family Assets	.221	.104	.221*		
		-.300	.104	-.300*		
Step 3					.298	.047*
	FIS	.291	.103	.291*		
	Change in Family Assets	.190	.103	.190		
		-.287	.101	-.287*		
	Water Access Amount	-.224	.104	-.224*		

Note: *p<.05; **p<.001

Table 4: Hopkins Total Score Regressed on SES, FIS, and Water Cleanliness

Variables		<i>b</i>	<i>SE b</i>	β	R^2	ΔR^2
Step 1					.100	
	FIS	.317	.133	.317*		
Step 2					.361	.261**
	FIS	.369	.117	.369*		
	Assets	-.305	.115	-.305*		
	Farm Share	.406	.117	.406**		
Step 3					.433	.071*
	FIS	.278	.117	.278*		
	Assets	-.309	.109	-.309*		
	Farm Share	.404	.111	.404**		
	Water Cleanliness	-.282	.115	-.282*		

Note: *p<.05; **p<.001

Table 5: Hopkins Depression Score regressed on SES, FIS, and Water Usage Amount

Variables		<i>b</i>	<i>SE b</i>	β	R^2	ΔR^2
Step 1					.084	
	FIS	.290	.134	.290*		
Step 2					.388	.303**
	FIS	.357	.115	.357*		
	Assets	-.283	.112	-.283*		
	Farm Share	.471	.114	.471**		
Step 3					.406	.018
	Assets	.346	.114	.346*		
	Farm Share	-.246	.116	-.246*		
	FIS	.454	.114	.454**		
	Water Usage Amount	-.141	.117	-.141		

Note: *p<.05; **p<.001