

## Barriers to women's participation, leadership, and empowerment in community-managed water and sanitation in rural Bolivia

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### ABSTRACT

Enabling women to be meaningful participants and leaders in rural community-based water and sanitation governance remains a challenge. While the benefits of and barriers to women's participation and leadership have been reported on, there is limited understanding of the role of empowerment in addressing these challenges. To help bridge this knowledge gap, we used a household survey to measure men and women's empowerment in water and sanitation in the rural Tupiza watershed, Bolivia, and key informant interviews with women leaders to identify barriers to leadership. Overall, among survey respondents, fewer men than women were disempowered. Community-level factors, especially those related to comfort in speaking in community meetings and reporting service problems, contributed more to women's disempowerment, as did household-level factors related to work balance and input into decisions about who participates in community water and sanitation activities. Among interviewed community water leaders, many women felt their positions were costly to their households and reported challenges in obtaining technical training and local government assistance, which not only disempowered them as leaders but also was likely tied to poor service delivery and related health outcomes in their communities. We discuss the implications of our findings for rural Bolivia and future research opportunities.

**Key words:** Bolivia, community-based management, empowerment, leadership, WASH, women

### HIGHLIGHTS

- This study is one of the first to assess the relationship between women's empowerment and participation in community-managed water and sanitation.
- We measured men's and women's empowerment in water and sanitation and examined the associated barriers to women's successful participation and leadership in rural Bolivia with mixed methods.
- Women's discomfort in speaking in community meetings and reporting service problems contributed more to their disempowerment than to men's.
- Women leaders' disempowerment was related to their domestic workloads and challenges in obtaining technical training and local government assistance.
- By focusing on barriers linked to women's disempowerment, we highlighted the central role of empowerment in improving participation and identified barriers that matter most for gender, water, and sanitation goals.

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## GRAPHICAL ABSTRACT

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## INTRODUCTION

Poor water and sanitation access disproportionately affects women, due to both biological needs, such as the need for clean water and sanitation for menstrual hygiene management, and traditionally held roles as household water collectors and managers (e.g., Ray 2007; Caruso *et al.* 2017; Kayser *et al.* 2019). Despite this unequal burden, women are typically excluded from the decision-making process regarding how these services are managed (Adams *et al.* 2018). The inability of women to lead or otherwise meaningfully participate in water and sanitation governance can have significant implications for the success of community-based management models that are prevalent in many low- and middle-income countries (LMICs) (Hutchings *et al.* 2015).

The connection between women's participation and leadership and access to water and sanitation is widely recognized in the sector. Apart from increased women's participation and leadership being a gender equality goal in itself (Sustainable Development Goal (SDG) 5) (United Nations 2021), research continues to show that it is beneficial for improving water and sanitation service delivery and use, albeit with notable exceptions (Prokopy 2004). For community-managed systems specifically, women's leadership and participation have been associated with more effective water management (Mommen *et al.* 2017), improved water system functionality (Kelly *et al.* 2017; Mommen *et al.* 2017), and increased community trust in terms of water fee collection (Kelly *et al.* 2017; Anderson *et al.* 2021). In addition, women have been found to be more effective than men at motivating sustained adoption of and collective action around improved water and sanitation (Dickin *et al.* 2017; Helgeggen *et al.* 2020; Anderson *et al.* 2021). All these benefits and more are unlikely to be realized – which threatens progress toward SDG6 – if women are unable to effectively participate or lead in water and sanitation management.

Despite many years of work, the development sector has not always been successful in helping women in this way (Das 2014), arguably due to the oversimplification of gender relations and roles. It is often assumed that women will be motivated and able to participate in governance, if only they were invited (or mandated) to do so (Cairns *et al.* 2017). In such cases, women's involvement in water and sanitation management may amount to little more than tokenism (O'Reilly 2006; Hannah *et al.* 2021) or may add to their responsibilities without improving their agency (Cleaver & Elson 1995). In reality, women's desires and abilities to participate are constrained by household- and community-level sociocultural norms, such as those surrounding the division of labour and acceptable female behaviour in public; socioeconomic endowments, including women's education and asset ownership (Das 2014); and other practical resource constraints such as time and money (Coulter *et al.* 2018). Indeed, women face a number of challenges to their active participation and leadership.

While both the benefits of and barriers to women's meaningful participation and leadership in water and sanitation have frequently been reported on (though not always used to inform practice), there remains a comparatively limited understanding of the role of empowerment – that is, the expansion of women's abilities to make strategic life choices (Kabeer 1999) – in addressing these challenges (Dery *et al.* 2019). Despite the growing interest in the concept of women's empowerment in the water and sanitation sector (Dery *et al.* 2019; MacArthur *et al.* 2020), its relationship to women's participation is understudied, in part due to the slow emergence of indicators for measuring empowerment in water and sanitation (Kayser *et al.* 2019; Dickin *et al.* 2021). Consequently, the sector has been unable to prioritize the barriers that are most restrictive to women's agency, which may be undermining their impact on women. Beyond its ability to help inform practice, closing this research gap also represents an opportunity for improving the health and development of entire communities, as prior research suggests empowering women can have positive social externalities (Taufkobong *et al.* 2016).

In this paper, we begin to address this knowledge gap with data from communities in the rural Tupiza watershed in Bolivia. We measured women's empowerment in a water and sanitation setting and identified the associated constraints to women's successful participation and leadership in administering these community-based services using a recently created measurement tool mixed with qualitative interviews. More specifically, we asked:

1. What are the driving factors in terms of how men and women in rural Bolivia are (dis)empowered in water and sanitation?
2. What are the barriers to women's meaningful participation and leadership in water and sanitation management?

The article is organized as follows: We first describe our conceptual framing of empowerment and how we operationalize it in terms of water and sanitation. We then present details of our case-study context in the Tupiza River Basin. After describing the quantitative and qualitative methods and results separately, we discuss the implications of our combined findings for rural Bolivian community-managed water and sanitation and future research directions.

### **Conceptual framework: empowerment in water and sanitation**

In this paper, we define empowerment as a process by which people expand their abilities to make strategic life choices to produce desired outcomes, particularly in contexts in which they were previously restricted from doing so (Kabeer 1999). Empowerment is concerned with power relations (Rowlands 1995) and bringing people who are outside decision-making into the process in a way that encourages them to perceive themselves as able to participate. We think it is important to recognize that this definition is largely based on social-liberal, feminist thinking (e.g., Rowlands 1995; Nussbaum 2000) that, while foundational to the development sector, is not universally normative. In Bolivia, where 77% of the population identifies as Roman Catholic (United States Department of State 2020), men and women are believed to be equal in dignity and worthwhile being distinct in their purpose and roles (John Paul 1997). Despite this complementarian perspective not always being the reality in Bolivia (e.g., as evidenced by the problem of intimate partner violence (Camargo 2019)), it does not follow that Bolivia would benefit from having their cultural structure of gender subverted by western ideology. Cultural sensitivity is therefore key to empowerment being a constructive framework.

Context is also critical to empowerment research. Apart from geographical differences, domain-specific factors, especially gender roles and responsibilities, govern how empowerment is understood, experienced, and sought (Doneys *et al.* 2020). For these reasons, it is useful to define measures of empowerment not only in ways that

make sense to a particular culture but also in ways that reflect the priorities of a given field (Alkire 2005; Alkire *et al.* 2013). In the context of water and sanitation, we view individuals as empowered if they can use water and sanitation in ways that they value and that contribute to well-being. Empowerment in water and sanitation at the individual level refers to whether individuals feel they can decide to participate in water and sanitation decisions and activities in or outside of the household (e.g., community planning of water facilities and personal decisions about expenditures related to latrine emptying). Household-level empowerment in water and sanitation relates to the power to make decisions about water and sanitation roles (e.g., who shares good water practices with the household), responsibilities (e.g., who normally makes decisions about toilet maintenance), and participation in community activities (e.g., who normally makes decisions about who participates in community water planning). Community-level empowerment in water and sanitation involves the ability of individuals to lead in water and sanitation planning (e.g., active membership in a water user's group), implementation (e.g., comfort in speaking up in public on community sanitation implementation), and accountability (e.g., comfort in making a complaint to community leaders about community water services) (Dickin *et al.* 2021).

### Case-study context: rural Bolivia and the Tupiza River Basin

Our research takes place among the red rocks of Bolivia's southwestern highlands. The Tupiza River, muddy and rainfed, winds for nearly 100 km through the lower portion of the basin (Vezzoli *et al.* 2013). The entire basin is approximately 2,018 km<sup>2</sup>, with an average elevation of 3,864 m. Many communities are clustered along the river and rely on its floodplains for their agricultural livelihoods (Garrido *et al.* 2017), with some of their primary crops being corn, onions, and flowers (Burstrom 2020). The livelihoods of the relatively few settlements that spread throughout the upper basin are based on mining and agriculture (Villaruel *et al.* 2006). This mining activity dates back to the eighteenth century and has been associated with heavy metal pollution of the Tupiza River (Vezzoli *et al.* 2013). While the watershed typically experiences severe drought due to the arid climate, in recent years the frequency of flooding has increased, likely due to land-use changes (Vezzoli *et al.* 2013) and more extreme precipitation (World Bank Group 2017). Severe floods, such as the one in 2019, can damage infrastructure and agricultural land (Burstrom 2020).

In general, water and sanitation conditions in Bolivia are improving. From 2000 to 2020, the percentage of the country's population using at least basic drinking water services<sup>1</sup> increased from approximately 80–94% (WHO/UNICEF Joint Monitoring Programme 2021). Recent estimates suggest that the rural drinking water coverage of basic services is approximately 80%, while urban is nearly 100%. Across the country, the average open defaecation rate has declined from 15 to 10% since 2015; however, in rural areas, the rate remains around 33% (WHO & UNICEF 2021).

Currently, the water and sanitation governance arrangement in Bolivia emphasizes the dual management roles of the state and society, a consequence of previous attempts to privatize the country's water services (Gutiérrez *et al.* 2013). Bolivia's Ministry of Environment and Water supervises the creation of water policies, plans, and investments with support from the Vice Ministry of Drinking Water and Basic Sanitation, which also assists in the development and implementation of water and sanitation policies and plans, as its name implies. Notably, as one of its supervisory roles, the Ministry of Environment and Water maintains a set of guidelines to promote social participation and empowerment through community development (Ministerio de Medio Ambiente y Agua 2017). This aim echoes Bolivia's long tradition of community initiatives (Albro 2006; Helgegren *et al.* 2020), particularly its Law of Popular Participation (LPP), which has sought since the mid-1990s to devolve power from the national to local level and increase women's participation across both levels (Clisby 2005).

In addition to Bolivia's main ministries, the Water Supply and Sanitation Taxation and Social Control Authority (AAPS) grants drinking water and sewerage service providers (EPSA) the right to use water resources and to provide services through registers or licences. EPSA can be larger providers such as municipalities or smaller, more local water committees, Indigenous communities, peasant unions, or neighbourhood associations (Razavi 2019).

Within the Tupiza River Basin specifically, there are several different types of EPSA. In the rural areas, sanitation is typically not managed by any particular committee or person. Drinking water services are typically community managed by volunteers on a water committee and, in some cases, by a water judge. The water

<sup>1</sup> Basic drinking water is an improved source from which collection time is less than or equal to 30 min roundtrip. Basic sanitation is an improved facility that is not shared with other households (WHO and UNICEF 2021).

committee president manages the services, and the committee plumber is in charge of maintenance. In the absence of a plumber, the president will oversee maintenance, or other community members will assist with maintenance. If the community does not have a water committee, a water judge may be elected by his/her community to resolve issues related to water management (Aliaga 2021), often those related to irrigation water for the *chacras*, or agricultural land (e.g., maintenance of *acequias*, or irrigation canals). If there is no water committee and the water source is used for irrigation and consumption, the water judge is also responsible for managing drinking water. This integrated management is a unique feature of rural Bolivia and reflects the fact that rural households throughout Bolivia often use irrigation canals as their drinking water sources (Perreault 2008).

Our study was conducted as part of the Bolivia WATCH (Water, Sanitation, and Hygiene (WASH) Thinking Connected to Hydrology) project led by the Stockholm Environment Institute since 2018. The project aims to support Bolivia's Ministry of Environment and Water through research and measurement tool development for integrated water, sanitation, and hygiene (WASH) planning and watershed management across three basins, including the Tupiza River Basin.

## METHODS

We took a mixed-methods approach to answer our research questions. The quantitative and qualitative data were collected separately during 2020 from the same basin region. After analysing and reporting on the data independently, the authors discussed the results to understand how the qualitative evidence might expand on the quantitative empowerment measurements (Creswell & Plano Clark 2018). Though the two data sets complement one another, the quantitative analysis primarily answers our first research question, and the qualitative component addresses the second question. By using mixed methods, we not only support improvements in the cross-cultural measurement of empowerment but also provide rich, culturally specific insights into Bolivia's understudied water, sanitation, and empowerment conditions.

### Quantitative data collection

This study uses data from three surveys collected in January and early February 2020 from rural households in the Tupiza River Basin in southwest Bolivia. All surveys were conducted in Spanish (except one, which was conducted in Quechua) by Bolivian enumerators who were hired by the survey company Quatrim and trained in collaboration with our research team. Prior to deployment, the second and third surveys were piloted (by Quatrim and our research team) in a community outside of the Tupiza River Basin, and the first survey was discussed during a workshop with local community authorities. See Supplementary Material, Tables S1–S3 for a selection of survey questions.

For the first survey, a census was done to identify community leaders (or another authority figure if the community leaders were absent) in all the rural communities in the Tupiza River Basin. The survey collected information about the general characteristics of the community, its economic activities, and its water and sanitation services. Thirty-eight community leaders (both men and women) were surveyed out of the 40 target communities.

For the second survey, participants were identified as the heads (both men and women) of rural households. At the community level, households were selected through convenience sampling, with the number of households surveyed in each community being proportional to the size of the community. The second survey was structured similarly to the first but included questions about the households' WASH conditions, broader characteristics, and roles and responsibilities relating to household management and economic production. In total, 513 household heads were surveyed.

The third (Empowerment in WASH Index (EWI)) survey was administered to every fifth household that was listed as having participated in the second survey and was co-habited by a pair of male and female adults who self-identified as the primary members responsible for decision-making in the household. The EWI survey was administered separately to the male and female respondents and conducted by a surveyor of the same sex. If one of the household heads were not present at the time of the survey, the community authority (*corregidora*) or a family member would contact the person to have him/her return home to take the survey. A total of 59 households (118 surveys) were surveyed in the rural areas.

### Quantitative data analysis

We first quantified empowerment across multiple levels and across sex using the EWI created by Dickin *et al.* (2021). The index is comprised of 12 indicators (Supplementary Material, Table S4) that capture information on attitudes, roles, and responsibilities surrounding WASH at the individual, household, and community

levels. For each of the 12 indicators, a respondent achieves a particular indicator if he/she reaches a certain threshold. Constructing the EWI involves calculating several components, including an empowerment ratio (proportion of respondents achieving 75% of the indicators); disempowerment ratio (1 – empowerment ratio); the average level of achievement among disempowered individuals; the proportion of parity inadequate households (in which the adult with lower empowerment is both disempowered and has a higher percentage of unachieved indicators compared to the adult with higher empowerment in a dual-adult household); the average empowerment gap between the two adults among parity inadequate, dual-adult households; and the intra-household parity index, which is a combination of the two previous parity sub-indices. These calculations are provided in greater detail in [Dickin \*et al.\* \(2021\)](#).

A strength of the EWI is its ability to uncover who is disempowered and how, which can facilitate targeting of WASH programming efforts ([Dickin \*et al.\* 2021](#)). By measuring the empowerment levels of both men and women in the same households, the EWI is able to account for the complexities of the social relationships between men and women, such as how WASH priorities of men and women are balanced – and are sometimes but not always contested ([Coulter \*et al.\* 2018](#)) – in the household. However, by comparing men and women’s empowerment, we are not implying that women are necessarily most empowered when they are most like men.

To further understand how water and sanitation access related to empowerment, we used Fisher exact *t*-tests (Bonferroni-corrected  $p < 0.001$ ) to explore relationships between sex-specific empowerment and household- and community-level water and sanitation conditions. We also examined the associations between sex-specific empowerment and community leader sex; household- and community-level water and sanitation conditions and community leader sex; and sex-specific empowerment and demographic characteristics (i.e., age and education).

All data cleaning and analysis was done in RStudio (Version 1.2.1335) ([RStudio Team 2018](#)).

### Qualitative data collection

Qualitative data collection consisted of focus groups and semi-structured interviews. Prior to recruitment and data collection, the second author followed local customary ethics review processes and received approval from a faculty member with qualitative research expertise at the Universidad Católica Boliviana ‘San Pablo.’ Eligible women were contacted through community gatekeepers and included women living in the middle or lower rural areas of the Tupiza River Basin who had previously or were currently (at the time of data collection) occupying leadership positions such as community authority (*corregidora*) or water judge positions. Informed consent was obtained from all participants (verbal for focus groups and written for interviews). A total of eight women participated in the focus groups, and five women were interviewed; all 13 women were between the ages of 23 and 60 (no other demographics collected). Two focus groups (five and three women per group) were held in September 2020 through audio conferencing. Interviews were conducted by the second author in-person during October 2020. All focus groups and interviews were conducted in Spanish and audio-recorded and transcribed verbatim.

The focus group and semi-structured interview questions were based on community social psychology ([Montero 2003](#)) and empowerment ([Rowlands 1997](#)) theories. The semi-structured interview guide was approved by the Universidad Católica Boliviana faculty member. The focus group guide was piloted with several undergraduate students at the university prior to deployment. Focus group questions centred on concepts of empowerment (at the individual and community levels) and water and sanitation management and its related problems. For example, women were asked, ‘What responsibilities do you have as leaders of your communities?’; ‘Are you comfortable being leaders in your communities?’; ‘In what situations do you feel that you are empowered?’; and ‘How is water managed in the community, and what are the problems you have with this resource?’ The semi-structured interview questions focused on relating women’s definition of empowerment with a sense of community (e.g., group membership and community advocacy). For example, women were given a definition of empowerment and asked, ‘What do you think about empowerment? What can it be useful for?’ Other questions included, ‘How would you describe your community?’ and ‘What is the best thing about your community? And what do you like the least?’

### Qualitative data analysis

The two types of qualitative data were analysed separately using directed qualitative content analysis ([Holsti 1969](#); [Porta & Silva 2003](#); [Montero 2004](#)). Prior to the analyses, key concepts and variables were established

as the initial coding categories based on Rowlands' (1997) empowerment theory and Montero's (2003) community social psychology theory; separate sets of categories were created for the focus group and interview data. Prior to coding, the sampling unit was designated as a single response to a focus group or interview question; the context unit as a statement (could be several sentences in length) that captured a complete thought; and the recording unit (the unit of analysis) as the chief idea/theme of a participant's response. After coding, the second author organized the context units into recording units and grouped recording units into broader categories called generic units (Supplementary Material, Tables S5–S7). The focus group data were further analysed through tree diagrams, which were used to examine complementary, contradictory, and causal relationships between recording units (Penalva-Verdú 2007; ATLAS.ti 2021). All data cleaning and analysis was done manually. Concurrent to the primary analysis, three groups of five undergraduate students from the second author's department coded the transcripts using the initial coding categories. Upon completion, categories were compared and found to be sufficiently similar, especially at the generic and recording unit levels.

## RESULTS

### Quantitative findings

This section presents the quantitative findings, which focus on how men and women are disempowered. We begin by describing our sample. Table 1 outlines the sample characteristics, disaggregated by sex. Over one-half of the respondents were Quechua (approximately 57% of the women and 55% of the men). The proportions of single and married women were nearly equivalent (44 and 40%, respectively), while the proportion of married men was over twice as large as the proportion of single men (25% compared to 57%). The distribution of household sizes was roughly uniform across the two- to four-person membership categories (approximately 15–20%). Most men and women were between 26 and 45 years (38 and 27%, respectively). Most respondents were able to read, though the proportion of literate men (94%) was larger than the proportion of literate women (77%). For the respondents who were literate, most had only completed primary school (approximately 54% of both men and women). The most common occupations were agricultural (38%) and domestic (31%) work for women and agricultural work (52%) and metallic mining (16%) for men. Most respondents had piped-to-yard (approximately 30–37%) or piped-to-household (approximately 35–40%) water as their primary sources. Most respondents practiced open defaecation (55–60%). See Supplementary Material, Table S8 for the characteristics of the EWI sample only. Figure 1 presents the distribution of men and women leaders across communities (displayed tabularly in Supplementary Material, Table S9). There were seven communities with women community authorities (*corregidoras*) (18%) and eight communities with women water judges (21%), and these communities were mostly clustered near Tupiza.

As indicated in Table 2, male respondents were found to be more empowered than female respondents. Specifically, 51% of women were empowered compared to 73% of men. Among the disempowered individuals, the average level of achievement of the indicators was approximately 58% for women and 62% for men. The raw EWI score based on the 12 indicators was approximately 0.79 for women and 0.90 for men.

When the empowerment of men and women within the same household was compared (with the assumption that men are more empowered than women, which the raw EWI score supports), 46% of households were parity inadequate, with an average achievement gap of approximately 21% between co-habiting men and women. Taken together, these statistics form the Intra-Household Parity Index (IHPI), which was calculated to be 0.91. Using the raw EWI score and the IHPI, the combined EWI for the full sample was 0.85.

Figures 2 and 3 provide further details on the relative contributions of each indicator and its corresponding level to the respondents' disempowerment. Men and women's individual-level intrinsic attitudes about WASH roles and responsibilities contributed to their disempowerment and was the level at which men were the most disempowered. At the household level, women's work balance and input into decisions about involvement in community WASH activities were the indicators that contributed most to their disempowerment. At the community level, the level at which women were most disempowered, group membership conditions contributed substantially to both men and women's disempowerment, while leadership in WASH implementation and accountability contributed noticeably more to women's than men's disempowerment.

Among the variables we tested, we did not find any statistically significant relationships between empowerment, community leader sex, demographics, and household- and community-level water and sanitation conditions.

**Table 1** | Descriptive characteristics of survey respondents, disaggregated by sex

Characteristic	Category	Women		Men	
		n	%	n	%
Ethnic group	Aymara	2	0.7	4	1.8
	Chicheño(a)	108	37.9	89	39.0
	Quechua	163	57.2	125	54.8
	Other	12	4.2	10	4.4
	Total	285		228	
Household type	Man with wife away from home	0	0.0	6	2.6
	Man divorced, single, or widowed	0	0.0	57	25.0
	Woman with husband away from home	5	1.8	0	0.0
	Woman divorced, single, or widowed	126	44.2	3	1.3
	Married couple, man and woman	114	40.0	129	56.6
	Partners, man and woman	40	14.0	33	14.5
	Total	285		228	
Household size	1	23	8.1	25	11.0
	2	58	20.4	60	26.3
	3	42	14.7	38	16.7
	4	52	18.2	35	15.4
	5	39	13.7	19	8.3
	6	23	8.1	21	9.2
	7	17	6.0	13	5.7
	8–11	31	10.9	17	7.5
	Total	285		228	
Age	19–25	14	4.9	8	3.5
	26–45	107	37.5	62	27.2
	46–55	65	22.8	45	19.7
	56–65	57	20.0	57	25.0
	>65	42	14.7	56	24.6
	Total	285		228	
Literacy	Yes	220	77.2	213	93.4
	No	65	22.8	15	6.6
	Total	285		228	
Level of education achieved if literate	Primary	120	54.5	115	54.0
	Secondary	84	38.2	79	37.1
	Technical school	2	0.9	4	1.9
	University	13	5.9	12	5.6
	Post-graduate	1	0.5	1	0.5
	Other	0	0.0	2	0.9
	Total	220		213	
Principal activity	Arts/crafts	5	1.8	0	0.0
	Commerce	15	5.3	4	1.8
	Construction	3	1.1	19	8.3
	Food product preparation to sell	13	4.6	2	0.9
	Metallic mining	7	2.5	37	16.2
	Non-metallic mining	0	0.0	2	0.9
	Other	37	13.0	31	13.6
	Teacher	2	0.7	2	0.9
	Public server	4	1.4	5	2.2
	Agricultural work	108	37.9	118	51.8
	Housework	88	30.9	1	0.4
	Transportation	1	0.4	6	2.6
	Tourism	1	0.4	0	0.0
	Sale of agricultural products	1	0.4	1	0.4
	Total	285		228	
	Wall material	Adobe	233	81.8	189
Brick/concrete		48	16.8	32	14.0
Wood		1	0.4	1	0.4
Stone		1	0.4	0	0.0

*(Continued.)*



Table 1 | Continued

Characteristic	Category	Women		Men	
		n	%	n	%
Primary water source	Other	2	0.7	6	2.6
	Total	285		228	
	Bottled water	2	0.7	2	0.9
	Surface water (river, lake, dam, stream, irrigation canal)	34	11.9	31	13.6
	Piped water to yard	104	36.5	67	29.4
	Piped water to household	106	37.2	82	36.0
	Public tap	16	5.6	22	9.6
	Unprotected pit	1	0.4	1	0.4
	Covered well	3	1.1	3	1.3
	Drilled or cased well	0	0.0	3	1.3
	Rainwater	1	0.4	0	0.0
	Unprotected spring/vein	9	3.2	7	3.1
	Protected spring/vein	5	1.8	5	2.2
	Other	4	1.4	5	2.2
	Total	285		228	
Sanitation type	Bucket	1	0.4	4	1.8
	Dry composting toilet	10	3.5	0	0.
	Urine-diversion ecological dry toilet	1	0.4	2	0.9
	Toilet with water cistern	32	11.3	23	10.2
	Flush toilet	72	25.4	54	23.9
	Improved dry latrine (with ventilation and slab)	3	1.1	2	0.9
	Simple dry latrine without slab	7	2.5	4	1.8
	Open defaecation	157	55.5	137	60.6
	Total	283		226	

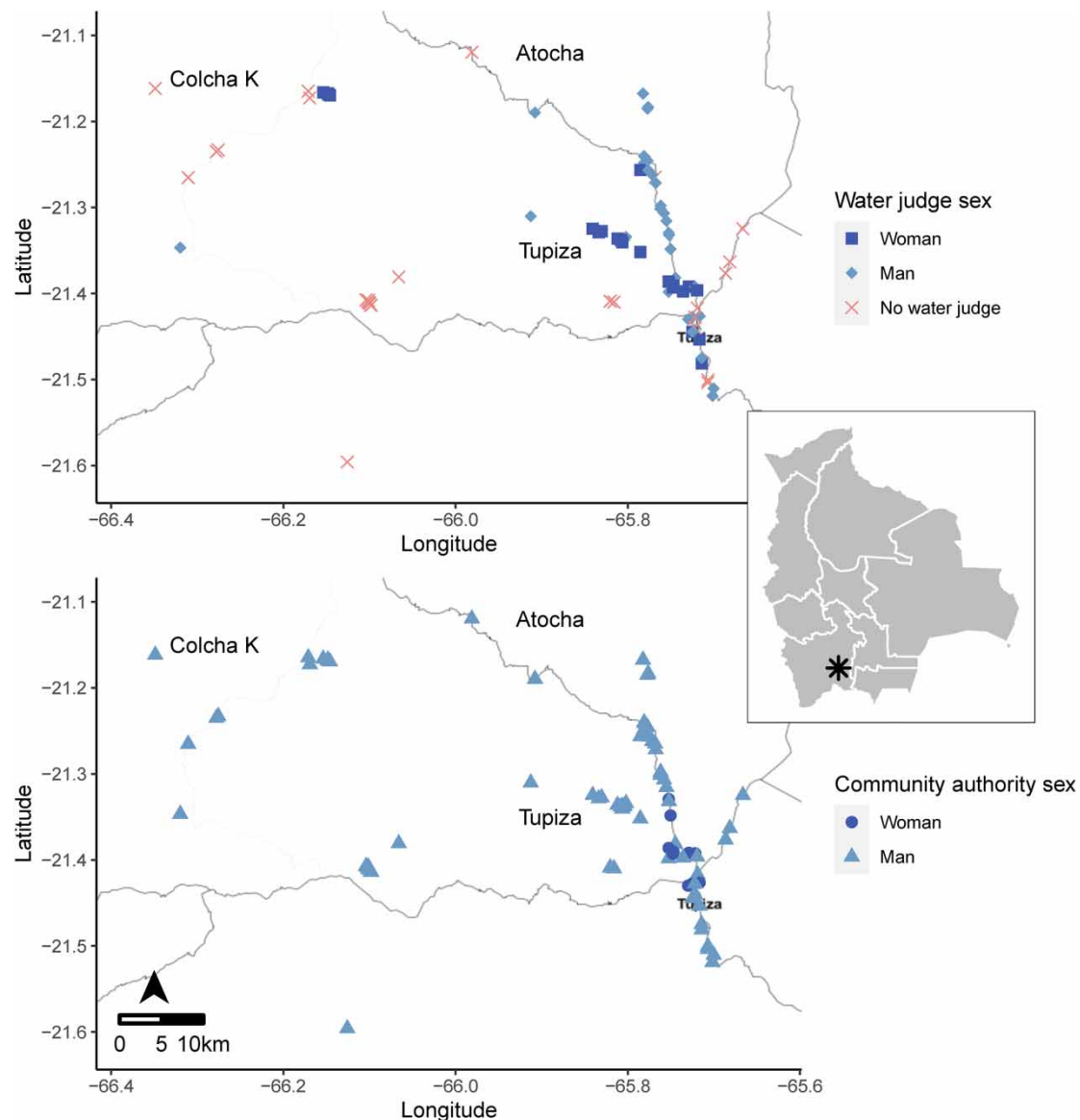
Note: The respondent is one of the heads of the household.

### Qualitative findings

This section details the qualitative findings, describing the barriers to women's successful leadership that contributed to their disempowerment as leaders. We found that in many ways, women's leadership roles were costly. Due to the gendered division of labour within the household (supported by the EWI results), the role of community leader represented an additional time burden to women's heavy domestic workload. If women became leaders, it was to the neglect of their households. For example, one important trade-off for many women was between their caretaking and leadership roles: *'When you are a leader, an authority or you are taking on a role in the community, you always have to go manage project paperwork and sometimes the children are left a bit abandoned at home then they change their attitude'* (participant in Focus Group 2). In addition, women also found themselves unable to tend to necessary economic activities: *'The jobs are ad honorem, as it is ad honorem then you necessarily have to give yourself time for that, right? And sometimes you forget about your income that you have to have per month, sometimes you don't go to the fairs to sell or sometimes you don't do what you have to do to survive. Why? Because work consumes you...'* (participant in Focus Group 2).

In their leadership positions, women reported feeling unsupported by the Tupiza municipal government. They felt the authorities were unwilling to listen to them if they had a water or sanitation problem to report. As explained by one woman, *'Yes, we always go to Potosí [254 km away from Tupiza], to Tupiza. In Potosí they tell us, "You depend on the Autonomous of Tupiza [Municipal Government, there you have to resort to, through them you have to come to complain," they tell us in Potosí. But as in Tupiza, you cannot speak or we are denied all the time to address a word...'* (Interviewee 5). Even in the event of a natural disaster, local governments may not assist communities. One woman recounted the past flooding events and subsequent pollution of the Tupiza River from the nearby wastewater recovery facility: *'We have these kinds of problems with the mayor's office and the mayor's office does nothing to protect this wastewater, the river is being polluted'* (participant in Focus Group 1).

Women also reported a lack of technical training and technological resources to solve problems, particularly those issues related to drinking or irrigation waters that could affect the health of their community members. For example: *'...They have installed us piped water in the houses but it is not drinkable because it is not being treated,*



**Figure 1** | Distribution of communities with women versus men leadership. There were seven communities with women community authorities (corregidoras) (18%) and eight communities with women water judges (21%). *Note:* The general regions of the three main municipalities of Tupiza, Atocha, and Colcha K are labelled. The map is confined to the area of the watershed in which households were surveyed.

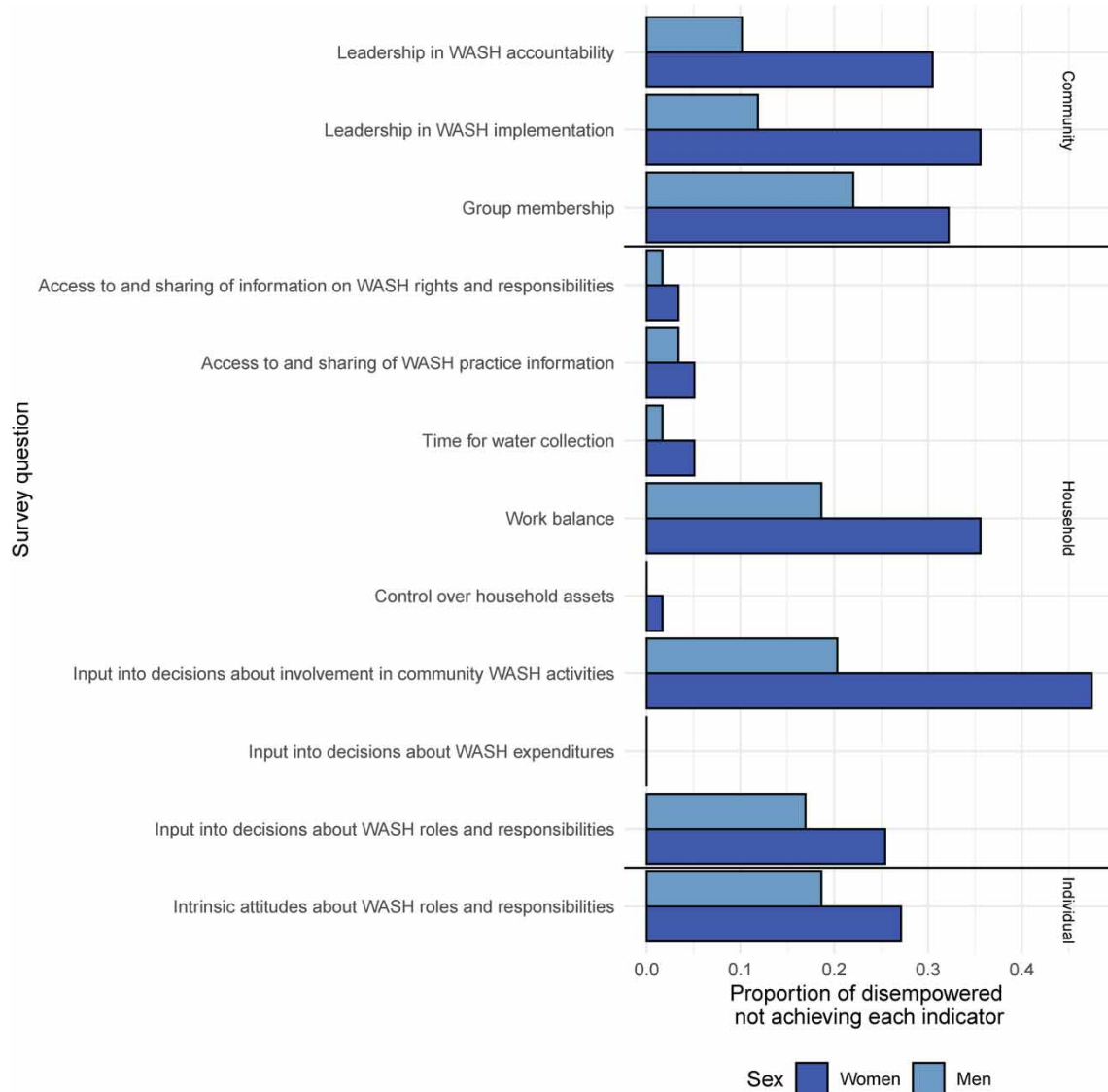
*nothing, they have just captured it from the irrigation canal I do not know, from Monterrico to Tupiza they have captured it from there, you see? but it is not purified....What they would have to teach us here is to make water drinkable in the field, right? What for? Because a consequence of drinking that water [water from irrigation canals], sometimes children drink it then diarrheal diseases come, and other physical discomforts'* (participant in Focus Group 2). In addition to wanting their own training, participants emphasized the need for a new generation of leaders to be trained to succeed them in their positions: *'To bring out new leaders, for young people to train in communities, because that's what we're missing, at least I see that in our communities there are young people who are no longer interested in community work'* (participant in Focus Group 1).

Women leaders also associated their disempowerment with a lack of knowledge of their legal rights. Many expressed wanting to learn more about women's rights. As explained by one woman, *'[Women] they have to know the rights that they have with the laws, sometimes they do not know their rights, that is why they do not know, that is why they are afraid to give an opinion'* (participant in Focus Group 2). However, it has been challenging for women to find this type of training: *'We always need training and we as leaders seek to be trained through training that is so much needed but that in our municipality or the SLIM [Municipal Integral Legal*

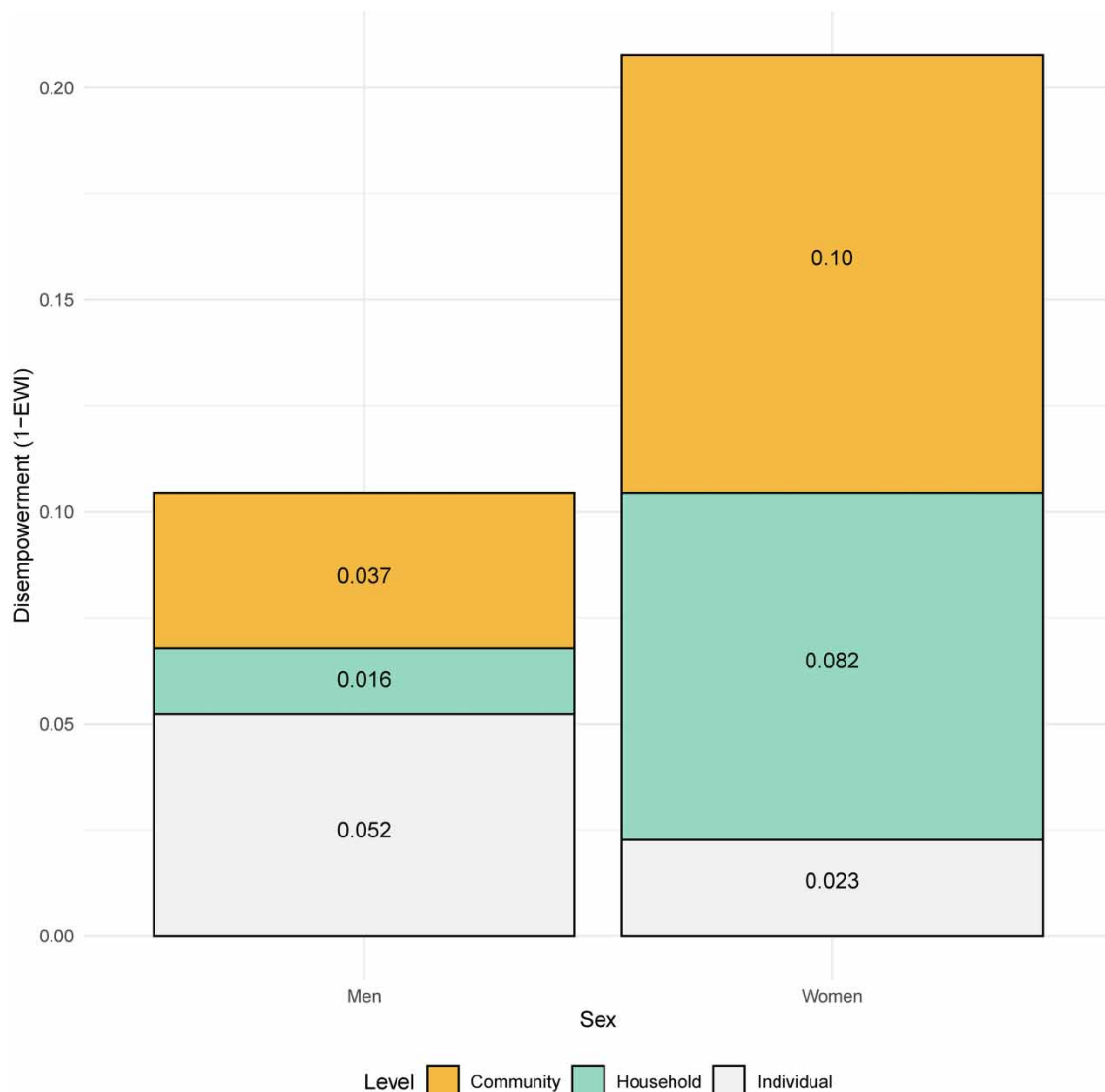
**Table 2** | Summary of EWI and its sub-indices

	Women	Men
<b>Index or sub-index</b>		
Disempowerment ratio (DR)	49.2%	27.1%
Empowerment ratio (ER)	50.8%	72.9%
Level of achievement of disempowered respondents (LA)	57.8%	61.5%
<b>EWI</b>	0.79	0.90
Households without parity between men and women (PIH)		45.8%
Average empowerment gap between men and women in a household (AEG)		20.5%
Intra-household parity index (IHPI)		0.91
<b>Combined EWI</b>		0.85

Note: EWI = ER + (DR \* LA); Combined EWI = 0.9EWI \* 0.1IHPI. Combined EWI weights are based on the Women’s Empowerment in Agriculture Index construction approach (Alkire *et al.* 2013). The sub-indices (regular font) are the components of the EWI and Combined EWI (bolded font). See Dickin *et al.* (2021) for full calculation instructions.



**Figure 2** | Proportion of disempowered men and women who do not achieve each EWI indicator. Note: The higher the proportion of disempowered not achieving an indicator, the more that indicator contributes to disempowerment.



**Figure 3** | Comparison across sex (of EWI survey participants) of the contribution of indicators at each level of disempowerment. *Note:* The longer the bar, the greater the contribution to disempowerment.

Service], *I do not know through what institutions we have to look for, and we look for but they do not provide it to us*' (participant in Focus Group 1).

## DISCUSSION

Although there is growing interest in the concept of women's empowerment in the water and sanitation sector (Dery *et al.* 2019; MacArthur *et al.* 2020), to our knowledge this study is one of the first to consider the role of women's empowerment in overcoming constraints to their participation and leadership in community-based water and sanitation. Our analysis is also one of the few that examines empowerment in water and sanitation outside of South Asia and sub-Saharan Africa. Beyond its novelty, our paper's strengths lie in the use of mixed methods, particularly the application of a new empowerment measurement tool, and the practical relevance of the findings, as they align closely with the government's goals of social participation and empowerment through community development (Ministerio de Medio Ambiente y Agua 2017) and women's increased community participation (Clisby 2005).

Applying the EWI, we identified to what extent and how men and women were disempowered. Per our definition of empowerment, among survey respondents, fewer men than women were found to be disempowered. Notably, men and women's disempowerment at the community level stemmed from their lack of participation in community organizations, which may suggest that there are few opportunities to build social capital and

collective action among communities in the Tupiza River Basin. Community-level factors such as leadership in water and sanitation implementation and accountability contributed more to women's disempowerment than to men's, which means that women are less comfortable than men in participating in and facilitating community WASH activities and reporting service problems to local authorities. At the household level, women's disempowerment was largely defined by heavy domestic and productive workloads – which previous literature has also found to significantly limit Bolivian women's community participation (Ashwill *et al.* 2011; Cairns *et al.* 2017) – as well as their input into household decisions about participation in community water and sanitation activities, both of which may constrain their ability to participate as leaders.

Nevertheless, there are women in water management leadership roles in the Tupiza River Basin, indicating that opportunities to participate exist. Yet, these women leaders do not always feel empowered. According to our qualitative analysis, many women reported challenges in seeking technical training and local government assistance, which disempowers women from fulfilling their roles as leaders, including helping their communities obtain access to adequate services to protect their health. Similarly, Davis *et al.* (2008) found that external support and training were essential for service delivery (performance and user satisfaction) among rural water systems in Cochabamba and Chuquisaca, Bolivia. In addition to external support, if women are to be leaders, they should have the support of their husband or partner, which may require changing harmful gender norms, especially those associated with domestic violence (Camargo 2019). Intra-household support would help ensure children, the generations of future leaders, are not abandoned if their mothers are leaders. Women should be supported so they can participate in water and sanitation governance, not to reluctantly replace competent men but to add value to the systems' governance and improve water and sanitation access.

Given the unique nature of the water judge position in the rural Tupiza River Basin, external support and training could be especially targeted to women in this role. As previously mentioned, the water judge's responsibilities are highly integrated, involving the management of irrigation canals as both an agricultural and drinking water resource; however, currently water judges are not responsible for or trained in sanitation management, which could increase the risk of water contamination due to poor sanitation (especially with increasing flood risk (World Bank Group 2017)), an ongoing concern elsewhere in Bolivia. For example, Cossio *et al.* (2021) found that locally managed wastewater treatment systems in Cochabamba faced challenges due to a lack of operational expertise and financial resources for operation and maintenance. Clearly, any community-managed approach requires technical training and regular support (Moriarty *et al.* 2013). Expanding the activities typically associated with water judges and more broadly with WASH governance could present an opportunity to improve the collective functionality of water, irrigation, and sanitation services, especially given the poor access to sanitation in rural Bolivia (WHO and UNICEF 2021). Based on our findings, this type of capacity building among women water judges might not only help them to lead effectively but also contribute to their empowerment.

In addition to supporting current women leaders, there could be efforts focused on inspiring young women toward active participation and leadership. As expressed by our participants, there is a lack of community engagement among young adults in the Tupiza River Basin, suggesting that sustaining community-managed services will require deliberate preparation and motivation. Local leadership may consider creating opportunities for young women to shadow and be trained by current female leaders, taking care not to increase leaders' time commitments. In addition, women may be more likely to succeed women in leadership (Beaman *et al.* 2009), which may further strengthen water and sanitation systems by helping to create continuity in management practices over time (Hellegren *et al.* 2020).

### Limitations

As with any research, there are limitations to our study. First, as the EWI is a novel tool, it has not been validated in many contexts, and as a result, some of the constructs were not as relevant for Bolivia as the original EWI study context. In addition, measuring empowerment in terms of decision-making power has its limitations, as, practically speaking, decisions have to be made and someone has to make them; who makes them, particularly within households, may or may not be an issue of power but rather an issue of who values the decision (Maiorano *et al.* 2021). However, the fact that the EWI was created from the highly developed Women's Empowerment in Agriculture Index that has been used in Bolivia (Alkire *et al.* 2013) lessens these concerns. Second, as the quantitative results from the second and third (EWI) surveys were drawn from a convenience sample, the results may not be representative of the entire Tupiza River Basin rural population. Third, because male leaders were not interviewed, we are unable to compare the barriers to leadership and empowerment across gender. Nevertheless,

we know from the EWI that the ways in which men and women are disempowered are categorically different in many ways, and even if men were to face similar barriers, it would not mean our findings were less meaningful in understanding women's empowerment.

## CONCLUSIONS

This paper addressed the lack of knowledge on women's empowerment as it relates to their participation and leadership in community-managed water and sanitation. By focusing on barriers linked to women's disempowerment – among both residents and leaders – we highlighted the central role of empowerment in improving women's successful participation and identified barriers that matter most for achieving gender, water, and sanitation outcomes. In other words, this paper offers an entry point for the sector to understand how to target resources so as to strengthen women's participation in ways that empower them. There remain many research gaps in understanding women's empowerment and participation in community-managed water and sanitation – both in rural Bolivia and in the other LMICs in which community-based management models are implemented. Based on our findings, we offer several potential areas to explore.

In Bolivia specifically, one potential avenue of future exploration is a study of the intersectional differences in women's leadership roles and empowerment across Indigenous and non-Indigenous communities. In Bolivia and other LMICs, to help elucidate the links between gender, empowerment, and leadership, further qualitative research should be done among male leaders in community-managed water and sanitation. The need for better access to water and sanitation is ubiquitous across many LMICs, and understanding how to promote women's empowerment only addresses part of the problem. By documenting the different roles and levels of empowerment across leaders of diverse demographic backgrounds, these recommended lines of research may aid Bolivia and other LMICs in effectively targeting resources and promoting empowerment across all of their rural communities.

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## AUTHOR CONTRIBUTIONS

S.D. and A.S. conceptualized the whole article. S.D., A.S., V.B.G., and L.H. conducted data curation. V.B.G. and L.H. were involved in formal analysis. S.D., A.S., and L.H. performed funding acquisition. S.D., A.S., V.B.G., and L.H. developed the methodology, wrote the original draft and the review, and edited the article.

## DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

## CONFLICT OF INTEREST

The authors declare there is no conflict.

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