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Climate justice for persons with disability

Few harmed much, fewer still harmed too much

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Abstract: Building on Rawls' theory of justice and Sen's theory of capabilities, I present an outline of social justice under climate shocks, illustrating it with the experiences of persons with disability. Social justice holds when inequality is responded to by rules that afford more primary goods, such as rights and incomes, to those who have less—the maximin principle of the Rawlsian social welfare function. Climate injustice consists in putting more climate bads, not primary goods, on those with slender shoulders—a maximin social ill-fare function. Cross-country climate injustice is a larger instance of this. The developed world has achieved much economic progress (including more primary goods) on the back of burning fossil fuels, which has put the planet on a heating curve that puts massive climate bads on lives and livelihoods today and in future. Most of these bads are put on the shoulders of developing countries. This work addresses within-country climate injustice, such as when persons with disability shoulder extra losses in capabilities, especially being without drinking water for 24 hours. The significant capability losses estimated to have been endured by persons with disability in Indonesia in 2018 and 2020 should inform a more enlightened and socially just response to climate injustice so that, along a just transition, few are harmed much, fewer still harmed too much.

Key words: social justice, capabilities, social ill-fare function, Rawls, Sen

JEL classification: Q45, D63, D60, D71

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1 From between-countries climate justice to within-country climate justice

More than a decade has passed since the World Bank and the World Health Organization jointly produced the seminal report on disability around the world (WHO–World Bank 2011). Around one in 10 people have disability, it says before laying out recommendations for practice to improve the lives of people with disability. But no one remembered to tell the British organizer of the Conference of the Parties on climate change about the report. At the COP26 in Glasgow, 2021, the host, UK Prime Minister Boris Johnson, had to publicly apologize to Israel's Minister of Energy Karine Elharrar, in front of the Israeli Prime Minister Naftali Bennet (BBC 2021). Elharrar, who has disability and is in a wheelchair, had been prevented from participating in the conference the previous day because the host organization had failed to provide wheelchair ramps. Disability had thus deprived her of valuable functioning, preventing her from negotiating and committing to the world's response to climate change because the required physical arrangements were not in place. Although she was on a par with other ministerial delegates in terms of income and level of education, her disability translated into lower capability. Fortunately for the world, the problem was swiftly rectified.

Figure 1: Boris Johnson apologizes to Karine Elharrar, in front of Naftali Bennett, at COP26, Glasgow

Source: BBC News at bbc.co.uk/news (with permission).

World leaders and negotiators have been meeting in a series of conferences (27 so far) to clarify how much the world is heating and what to do about it, not least because injustice has been perceived. Climate injustice consists in putting more climate harms or bads on those with slender shoulders. The developed world has achieved much economic progress (including higher incomes) on the back of burning fossil fuels, which has put the planet on a heating curve and created massive climate bads on lives and livelihoods. Most of these bads are put on the shoulders of developing countries. The COP27 recognized this with a historic agreement on loss and damage (in effect another term for climate injustice) and its implication for climate financing (BBC 2022; ITV 2022).

The COP26 story illustrates what Sen has signalled as a potential mechanism of injustice, viz. *conversion handicap* (Sen 2009). With the same levels of incomes and other primary goods, two individuals—one with and the other without disability—may yet have different capabilities (things they want to do and be) because the conversion breaks down on account of society's physical arrangements, market structures, and social norms. In this regard, incomes are not the metric we want to use when assessing social progress, but capabilities are. Capabilities (things that people and societies value) such as being hydrated (drinking clean water), being nourished (getting and consuming adequate nutrients), moving freely in and beyond the neighbourhood, and—as the above story illustrates—expressing political views and commitment relate variably to incomes.

Climate change raises many instances where conversion handicap leads to what I shall call climate injustice, an idea building on the works of Rawls (1971) and Sen (2009; see also Peter 2009). It is useful also to recall Sen's early idea of entitlement to food or acquirement of food (Sen 1986) because food insecurity is a major harm caused by climate change, especially in developing countries (IPCC 2022). Losses in food security (being adequately nourished) open an understanding of climate injustice. Sen (1970) showed that severe cases of food insecurity (e.g. famines in developing countries) are not invariably related to food availability. Rather, losses in entitlement arising from the collapse of livelihoods that usually provided incomes to households may result in food insecurity even without a change in the food supply in a particular place. Market arrangement matters: for instance, a monopolist grain supplier can shift the food to another region with higher average incomes. Therefore, public policy and public action may need to change to ensure adequate capabilities for all. Fast-forward to a different place and century. In Glasgow, a very different context, physical arrangements were swiftly corrected to ensure adequate capabilities so that the world could get on with tackling climate change with everyone's contribution.

The list of harms currently wrought by the warming of the planet is amply recorded in every official international report on climate change, the latest of which was released this spring by the Intergovernmental Panel on Climate Change (IPCC 2022). With every lengthening of the list, an awareness is spreading: these climate harms are largely visited on developing countries, although the developed world has reaped the earlier benefits of the industrialization responsible for them. Climate injustice exists when more harms (e.g. drought) are visited on the people and places least capable of surviving them. This is in fact an inversion of a well known maximin principle of Rawls.

Rawls' *Theory of Justice* (1971) holds that a just society affords primary goods such as incomes and rights maximally to the minimally endowed or those in lower social positions—a maximin principle. In such a society, justice is upheld because, although inequality is not eliminated, society's resources—and especially primary goods—are nevertheless distributed in ways that prioritize groups positioned at the bottom of the inequality ladder. The current distribution of climate harms, which predominantly rest on the slender shoulders of developing countries, stands in stark contrast to this maximin principle. But my focus here is on the less well understood phenomenon of within-country climate injustice.

Removing the social injustice whereby harms are disproportionately put on the slimmest of shoulders is an urgent need. Even without a social contract that commands assent from everybody in a country, social injustice is readily identifiable and can be tackled. The recent agreement at COP27 on loss and damage, amounting to a recognition of cross-country social injustice, should inspire agreement on tackling within-country injustice (BBC 2022). Identifying and monitoring social progress towards climate justice requires a descriptive theory of how harms due to climate change are distributed in society and how much vulnerable groups are additionally harmed. The removal of such additional harm constitutes a step towards justice.

As an instance of such a harm I take the capability of being hydrated in Indonesia, a very basic capability indeed, and investigate the extent to which persons with disability are at additional risk of being harmed in a future where floods, droughts, heatwaves, and other climate harms will be more frequent and more severe. If such climate injustice, as expressed in the disability marginal effect, increases over time, then the world weakens its claim to a just transition—in fact, it is moving away from climate justice. As surely as the planet is warming, developing countries will want to develop using available energy sources. This climate injustice marginal effect can be a diagnostic to measure the trade-offs between primary goods and climate bads.

This work makes several contributions to the literature. First, it proposes a descriptive theory of climate justice in which principled thinking is required to offer clarity as to the nature and urgency of the problem (Sen 2021). This amounts to raising awareness of the magnitude of climate injustice experienced by people with disability—an awareness that would preclude future prime ministers from needing to apologize to COP delegates with disability. In this descriptive theory I offer a small set of general propositions capable of suggesting new testable propositions in new settings, preferably unreachable from other comparable sets. The new settings can include new countries or other capabilities. The descriptive theory emphasizes two existing features together in a new combination, viz. capability instead of other primary goods that have been the focus of the theory of justice *and* distribution instead of averages.

Climate injustice is fruitfully seen as losses of capabilities rather than lack of incomes, and is sensitively tuned to distributions either vertically along spines of incomes or other primary goods or horizontally between groups in society such as women and men or those with disability and without or children and adults. Climate injustice is defined as the uneven distribution of losses in capability, in fact an excess of losses in capability falling on disadvantaged groups, be they the income poor or persons with disability. The distribution of capability losses follows a convex maximin ill-fare function. It is assumed or argued separately that the most disadvantaged here are also less responsible for the climate harms to begin with, as in the case of developing countries vis-à-vis developed countries (BBC 2022) or those with disability vis-à-vis those without or children vis-à-vis adults.

Second, this descriptive theory is practically applied to the case of the capability of being hydrated and specifically its loss, i.e. being parched, rendering adults ≥15 years of age without drinking water for 24 hours or more in Indonesia in 2018 and 2020 (N=1,709,573). Thus, this work contributes to the theory's external validation. And by choosing this basic capability this work points to further avenues of investigation where more complex yet equally valuable capabilities are put in focus, such as being nourished or having food security.

Last, because the theory describes how this specific instance of climate injustice arises from a breakdown in the link between incomes and capabilities and in turn how such breakdown is engendered by the social and physical arrangements of society, it also applies to other instances of climate injustice. For example, from the estimate of marginal losses in the capability of being hydrated, one can suggest a priori the magnitude of marginal losses in the more complex capability of being food secure. Given that food security is one of the Sustainable Development Goals (2.1.2), this is an invaluable contribution to the understanding of world development. In addition to contributing to the monitoring of such goals (in terms of averages and prevalence), this work helps to identify groups in society that require extra support in the struggle for climate justice.

2 A descriptive theory of climate injustice and a hypothesis of exposure handicap

Climate injustice or social injustice under climate shocks consists in putting more harms on the shoulders of those less able to carry them—in short, climate harms or bads as a function of social position, both vertical and horizontal:

$$f_b = \max\{min\{p_i\}\} \quad (1)$$

where the function f maps individual social position p_i to climate bads b, a convex function: $f' < 0$ and $f'' > 0$. A comparison between the rich world and the developing world (vertical inequality) shows that the developing world is exposed to more climate harms. This is despite the limited role of the developing world in the industrialization that has put the planet on the curve of warming and the major role of the developed world in reaping the benefits of that industrialization. Moreover, the developing world is less able to respond adequately to this exposure for two reasons. First, developing countries rely much more on nature services (e.g. agriculture) in their economic structure. Second, these countries are less able to set aside funds for mitigation and adaptation to climate change due to the primacy of other claims on development funds, such as primary and secondary education and primary health care. This received world recognition in the last COP with the agreement on climate financing to the worst-hit countries to compensate for loss and damage, i.e. climate injustice (BBC 2022).

A similar structure holds within-country in terms of horizontal social position, in particular when comparing people with and without disability. When climate shocks hit because of the warming planet, people with disability are at increased exposure to harm, despite being less responsible for it and less able to respond adequately, for instance by moving swiftly out of harm's way.

In his *Theory of Justice*, Rawls (1971) famously limited his discussion of justice to people without disability. In contrast, Sen (2009) in his *Idea of Justice*, which builds on his much earlier work on capability, the conditions of people with disability animate the argument (see below). This starting point is only one of the differences in the two theories of justice. Two other differences are discernible. Rawls' theory of justice is in the Kantian tradition of philosophy, which is concerned with devising a social contract that delivers a just society, whereas Sen's theory is in the Smithian tradition concerned with comparing different social arrangements with a view to identifying injustices and removing them. Sen is less concerned with an ideal social contract than with examining social orders that are perfectible in a certain direction with some reasonable basis to be called 'more just'.

The last relevant difference reflects these different orientations. Rawls' theory of justice listed as primary goods incomes and rights, among others, which are to be distributed according to the maximin rule—i.e. affording more of those primary goods to those less endowed or in lower social positions. Economists, not surprisingly, welcome the focus on incomes in Rawls' theory (Peter 2009; Stark 2020). But Sen focuses instead on capabilities or things that people value being or doing. Although Rawls' metric of progress in the form of incomes has much appeal (often transparent, convertible, intuitive), it is evident that incomes are not the good that we primarily look to for a reasonable conception of a good life or a worthwhile life. The metric of progress in Sen's idea of justice is capabilities or those things we have reason to value, such as being seen in public with dignity or without shame. This may require a linen shirt, which in turn is affordable with a certain income, but it is the being and doing that is the metric and not the command of income.

This is because incomes do not translate to capabilities unproblematically. Sen makes this case with the experience of people with disability. The conversion of incomes to capabilities such as being able to move about or to voice a view on climate commitment can be broken because of disability (the case of Elharrar at COP26). Sen notes the conversion handicap faced by people with disability: for the same levels of income, a person with disability might attain a lower level of capability than a person without, because for the conversion a wheelchair is needed. Physical arrangements in society or their lack can thus break the conversion from income to capability (Kuklys 2005; Morris and Zaidi 2020; Zaidi and Burchardt 2003). Using the ongoing Survey of Health, Ageing and Retirement in Europe, Morris and Zaidi (2020) showed that conversion handicap can equate to 44 per cent of income for a household with a member reporting a disability.

I add that, when exposed to climate shocks, people with disability are likely to suffer extra losses in capability, an exposure handicap. It is notable that $f' < 0$ (or climate harms) are not evenly distributed. I hypothesize that more of the harms or losses in capability are suffered by people who were initially disadvantaged, such as those with disability, making them less able to respond. If, in addition to being less able to respond, they were also initially less responsible for the climate harms, then this is an instance of climate injustice. In this sense, although we are on the same planet, we are not in this together. In fact, at the same levels of income a person with disability is at higher probability of being parched for 24 hours compared with a peer without disability, all else being equal. This is the *exposure handicap hypothesis*.

The convexity binds, $f' < 0$: the lower one's social position, the greater the harms one suffers. The convexity guarantees that the social ill-fare function will deliver a negative marginal effect f'. Naturally, if social position is coded in reverse, then the ill-fare function will guarantee instead a positive marginal effect f'.

The climate harm function or social ill-fare function, capturing capability losses under climate shocks, is convex. This convexity is not an outworking of some grand or maximizing principle—e.g. Matthew's effect, where more is given to those who already have more, or its perverse inverse, where more harm is given to those who already suffer more harm. Instead, it is social, physical, and market arrangements that are critical. For instance, social norms about gender roles distribute harms differently in different societies across South Asia and South America. In South Asian societies (e.g. rural Bangladesh) the capability for women of leaving their neighbourhood unaccompanied by an adult male is either restricted or attained with additional risk (Das and Tampubolon 2021; Tampubolon 2020). In South America such a restriction on women's mobility is not part of the social norms, which affords a more capable response to climate shocks (e.g. extreme heat).

In the context of these social positions, what is the object of theorizing on climate injustice? It is not to remove all social position distinctions or to remove all disabilities, but to remove capability losses experienced by people with disability. This has an implication for econometric estimation. The predominant causal framework for the estimation of causal effect is the counterfactual framework of Holland (1986) as practised by its foremost proponents such as Banerjee and Duflo (2011), who championed randomized experiments. If the causal effect of a treatment is positive, we want to scale up the treatment by having every unit receive it (in effect removing all social position distinctions). The estimator must deal with imperfection in randomization to ensure consistent estimates of causal effect, often by way of estimating the propensity scores of being treated, then matching, weighting, or some combination in a doubly robust estimator (Imbens and Rubin 2015).

The object in this climate injustice theory is not to counterfactually imagine curing those with, say, Down's syndrome, although that is a critical object of biomedical investigations. Instead, it is to counterfactually imagine physical, market, and social arrangements that expose people with disability to fewer capability losses under climate shocks. Climate shocks such as devastating heatwaves are not the monopoly of developing countries. The summers of 1995 in Chicago and of 2003 in Europe took massive tolls (Klinenberg 2002 and Fouillet et al. 2006, respectively). In the aftermath of the Chicago summer, Klinenberg's *social autopsy* was especially damning of the social norms and arrangements partly responsible for the devastation.

If indeed the losses are estimated to be considerable (i.e. the disability marginal effect is significant), then the focus can shift to these arrangements. The estimator therefore conditions on disability status, not a change in status from with disability to without disability, counterfactually. This obviates the need for a propensity score regression of disability (on other covariates) when testing the exposure handicap hypothesis.

The hypothesis is tested on the loss of capability in relation to being hydrated or the probability of being parched, i.e. without clean water for 24 hours or more. There are several reasons for this. First, water is critical to our organ functions (biologically): it is needed by the brain to manufacture neurotransmitters, which enable the billions of neurons to communicate; it absorbs shocks to the brain and spinal cord; it forms saliva, which helps digestion, and keeps mucosal membranes moist; it regulates body temperature by respiration and sweating—a critical function in a warming climate; it helps to deliver oxygen all over the body, converts food to digestible components, lubricates joints throughout the body, and allows the body's cells to grow, reproduce, and survive; and it flushes waste through urine. These are among the mechanisms implicated in the devastations during the summers of 1995 and 2003 in Chicago and Europe. Second, water being biologically fundamental, it is no surprise that its provision is widespread in any well functioning society. If a society systematically fails to provide clean water, the chances are that the provision of more complex capabilities such as food security will suffer too. Last, predictions of future climate bads include droughts and heatwaves—both of which seriously threaten the capability of being hydrated.

3 Data and model

The Indonesian socio-economic surveys of 2018 and 2020, known as Susenas (Surbakti 1995), are used to test the exposure handicap hypothesis as an instance of climate injustice, and specifically the additional losses of capability experienced by persons with disability. The surveys are cross-sectional and representative of each of the 514 districts and cities (hereafter districts) across the archipelago. As a maritime continent stretching the distance between Dublin and Tehran, Indonesia is extensively studied by climate scientists because of its geographic and climate variations.

The dependent variable is derived from information on households experiencing loss of drinking water for 24 hours or more in the past year, which, in the absence of specific information on intra-household resource allocation, is assigned to all household members. The Indonesian wording of the question eliciting clean water loss information— 'In the past year, did the household experience water loss for household needs for at least 24 hours?'—strongly suggests that all household members are included, i.e. asks whether all members were deprived of clean water for at least 24 hours. It is a binary indicator/variable. The key independent exposure is disability status, elicited using the World Bank–WHO short questionnaire (six questions or domains) to derive a binary indicator (with disability or without) according to the accompanying guide (see World Report on

Disability 2011 (WHO–World Bank 2011) and Disability Data Report 2021, 2022 (Mitra and Yap 2021, 2022)). The six domains are vision, hearing, mobility, cognition, communication, and self-care. The exposure handicap hypothesis conditions on incomes or consumption; being in the lowest consumption group (bottom fifth) is included for this test.

Because climate shocks or variations are correlated with household decisions on residence, entering a climate shock variable such as a flood in the estimation will render it endogenous. Therefore, a fixed effects probit estimator is used.

$$\mathrm{P(Parched)} = \Phi(X\beta + a_j + \epsilon_{ji}) \qquad (2)$$

In the conditioning set X, apart from disability status and consumption, are age, education in years, household demographic, gender of household head, education of the head, whether the household sources water from municipality-piped water or uses rainwater or other natural sources, and residence (urban or rural). The a_j are fixed effects of location which can be correlated with idiosyncratic unobserved errors ϵ_{ji}, capturing the decision to move to a different place to avoid being parched due to possible climate shocks in place j. A fixed effects estimator with hundreds of fixed effects, as here (from 514 districts), raises the problem of incidental parameters for inference. Here, the approach of Fernandez-Vals and Weidner (2016) is used to adjust the standard errors.

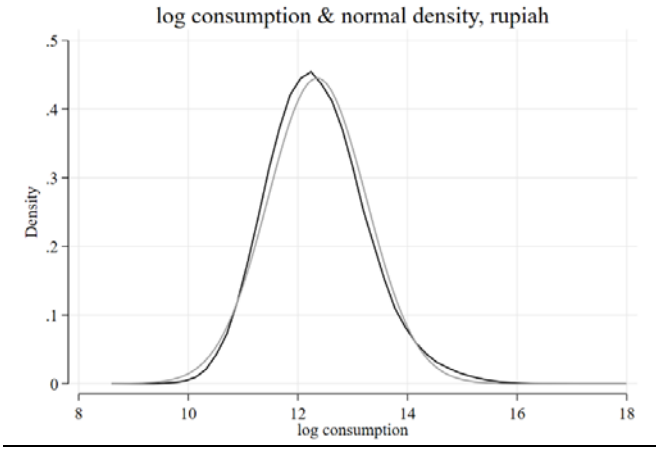
Much is made of social norms that can break the conversion from income or consumption to capability. Like physical norms, such as those that broke the conversion from Elharrar's command of primary goods to her political capability, social norms can break the conversion for some social groups but not others. Under climate shocks, a social norm that frowns upon women who go outside their neighbourhood unaccompanied by an adult male can break the conversion for women but not for men. Even with her own command of income a woman may not respond adequately or swiftly when climate shocks arrive, e.g. by moving to higher ground or to public air-conditioned spaces to escape a heatwave, which puts her capabilities at risk. Such norms are observed in Bangladesh and other South Asian societies (Das and Tampubolon 2021; Tampubolon 2020). To reflect the fact that social norms play such a role, the estimation is stratified or separated for men and women.

4 Results

The distribution of log-consumption shows a nearly normal distribution, suggesting that there is no need for finite mixture estimation, but only standard estimation (Figure 2). Because the focus of the theory is on those who are less able to respond and were less responsible for climate shocks to begin with, I created an indicator variable to express this: being in the bottom fifth of the consumption distribution.

Results of the analytic sample are shown in Table 1 (averages and standard deviations, or tallies and percentages). This shows that the prevalence of the loss of the capability to access clean water for 24 hours is 5 per cent for men, for women, and in total.

Figure 2: Smoothed density of log consumption



Source: author's construction based on Susenas (2018, 2020).

Table 1: Features of the analytic sample

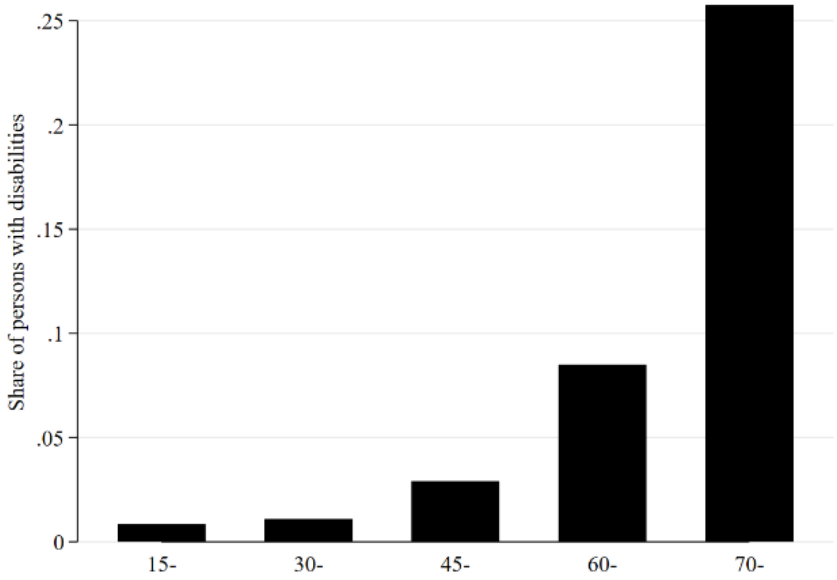
	Men	**Women**	**Total**
	N=844,596	N=864,977	N=1,709,573
Parched (without water ≥24 hours)			
No	802,284 (95.0%)	821,913 (95.0%)	1,624,197 (95.0%)
Yes	42,312 (5.0%)	43,064 (5.0%)	85,376 (5.0%)
Disability			
No	819,966 (97.1%)	834,279 (96.5%)	1,654,245 (96.8%)
Yes	24,630 (2.9%)	30,698 (3.5%)	55,328 (3.2%)
Water source			
River, well, rain	682,838 (80.8%)	694036 (80.2%)	1,376,874 (80.5%)
Water firm	161,758 (19.2%)	170,941 (19.8%)	332,699 (19.5%)
Age	39.6 (16.3)	40.3 (16.5)	40.0 (16.4)
Education			
Up to primary	297,620 (35.2%)	338,503 (39.1%)	636,123 (37.2%)
Junior high	179,600 (21.3%)	176,110 (20.4%)	355,710 (20.8%)
Senior high	242,251 (28.7%)	203,747 (23.6%)	445,998 (26.1%)
College	125,125 (14.8%)	146,617 (17.0%)	271,742 (15.9%)
Log consumption, rupiah	1.2 (1.0)	1.2 (1.1)	1.2 (1.0)
Marital status			
Single	243,332 (28.8%)	165,714 (19.2%)	409,046 (23.9%)
Married	562,575 (66.6%)	572,986 (66.2%)	1,135,561 (66.4%)
Separated	38,689 (4.6%)	126,277 (14.6%)	164,966 (9.6%)
Head of household			
Men	784,289 (92.9%)	713,235 (82.5%)	1,497,524 (87.6%)
Women	60,307 (7.1%)	151,742 (17.5%)	212,049 (12.4%)
Head, year of schooling	8.1 (4.2)	8.1 (4.3)	8.1 (4.3)
Head, age	49.8 (12.5)	50.0 (12.8)	49.9 (12.7)
Under-fives hhold members	0.3 (0.6)	0.4 (0.6)	0.4 (0.6)
Older ages hhold members	4.1 (1.7)	4.0 (1.7)	4.0 (1.7)
Residence			
Urban	358,647 (42.5%)	371,494 (42.9%)	730,141 (42.7%)
Rural	485,949 (57.5%)	493,483 (57.1%)	979,432 (57.3%)

Note: N = 1,709,573 adults ≥15 years.

Source: author's construction based on Susenas (2018, 2020).

Disability is reported slightly more by women than men. Its prevalence increases at an increasing rate with age: negligible to begin with, sizable by age 60 and older (Figure 3).

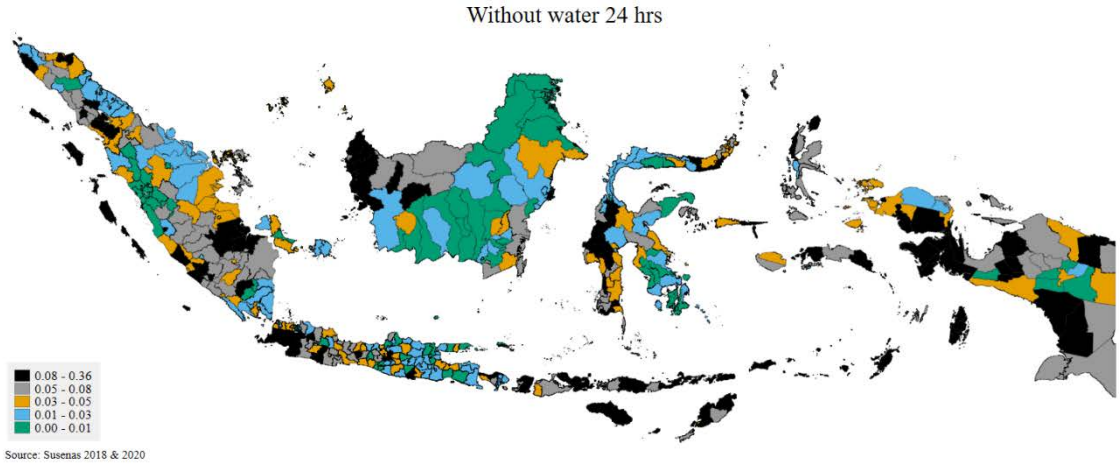
Figure 3: Disability by age in Indonesian adults ≥15 years



Source: author's construction.

The map in Figure 4 shows the distribution of prevalence of capability loss throughout the archipelago, which suggests ample variation. Such a variation across the 514 districts in the maritime continent is enough to condition different probabilities of response (being parched for 24 hours or more) for the groups distinguished by disability status. If the geography (hence climate shock effects) were limited to any given district or province (13 districts on average), there may not be enough statistical power to detect whether climate shocks relate to personal capability loss. But because of the continental geography, there is enough variation to estimate its link to capability loss. The map also shows a typical feature of Indonesia, that is geographical variation across regions: the eastern islands lag behind Java, Bali, and Sumatra in the west. For instance, the capital, Jakarta in the north-west of Java, reports a negligible proportion of less than 1 per cent.

Figure 4: Capability loss (without clean water for 24 hours or more) across 514 districts in Indonesia 2020.



Source: author's construction based on Susenas (2018, 2020).

Because non-linear models such as the probit model do not allow a direct reading of coefficients as marginal effects, I produce separate plots for the marginal effects (for the main model and supplementary ones). The coefficients of the main results are collected in Table 2. The marginal effects plot (Figure 5) shows that persons with disability have an additional 1.5 per cent probability of being parched. At the same levels of income and other features, the exposure handicap is 1.5 per cent and statistically significant, lending support to the descriptive theory of climate injustice. However, there is no discernible difference in the effect of disability among women compared with men in avoiding capability loss by being parched.

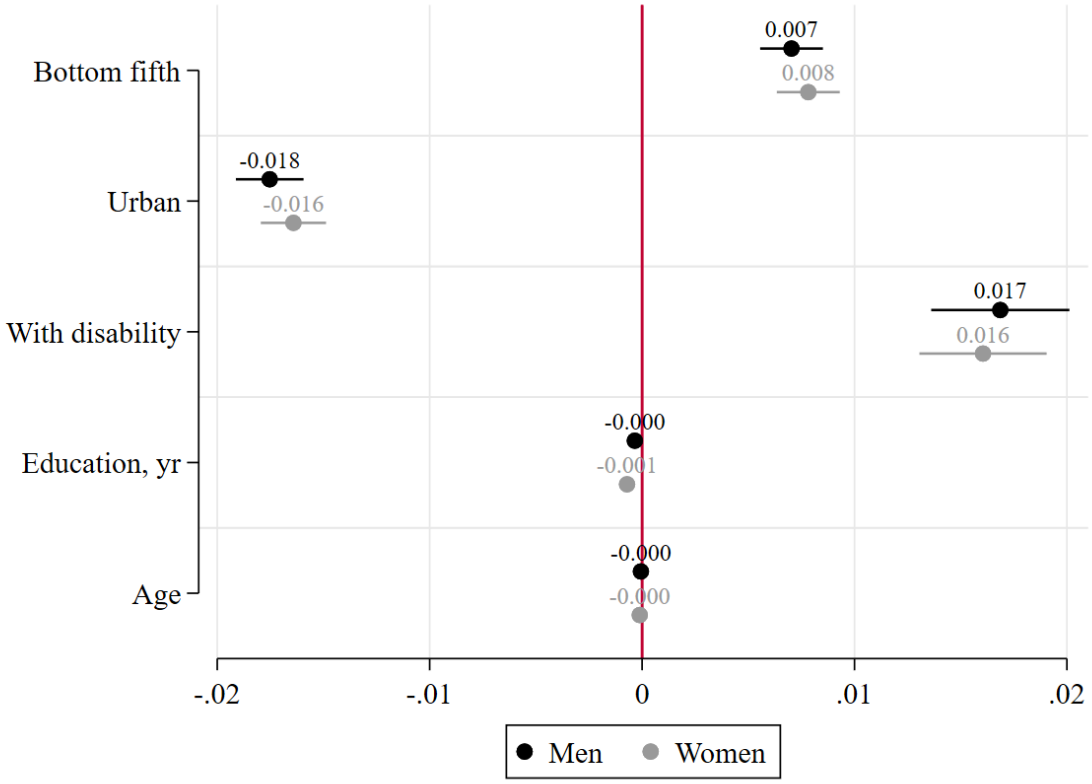
Table 2: Coefficients of the effects of disability and other controls on the likelihood of being parched

	Women	**Men**
With disability	0.157***	0.163***
	(0.000)	(0.000)
Age	-0.001***	-0.001*
	(0.000)	(0.029)
Education year	-0.008***	-0.004***
	(0.000)	(0.000)
Bottom-fifth	0.082***	0.074***
	(0.000)	(0.000)
Married/union	0.023**	0.012
	(0.007)	(0.165)
Divorce/widow	0.016	-0.007
	(0.222)	(0.632)
Female head	-0.010	0.010
	(0.239)	(0.304)
Head education year	-0.019***	-0.019***
	(0.000)	(0.000)
Head age	-0.002***	-0.002***
	(0.000)	(0.000)
Under-fives	0.003	0.002
	(0.454)	(0.621)
Five to ten	-0.001	0.001
	(0.744)	(0.746)
Teenage & adult	0.002	0.004
	(0.690)	(0.404)
Rain, river, well water source	-0.032***	-0.032***
	(0.000)	(0.000)
Urban	-0.184***	-0.196***
	(0.000)	(0.000)
Year 2020	0.170***	0.160***
	(0.000)	(0.000)
N	803,795	785,881

Note: *p*-values in parentheses in all tables * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, district fixed effects included.

Source: author's construction.

Figure 5: Marginal plot of effects on being parched in Indonesia (extracted from Table 2)



Source: author's construction.

Although the marginal effect or exposure handicap is only 1.5 per cent, it holds substantive significance in several respects. First, it is widely accepted that droughts, floods, and heatwaves are likely to increase in frequency and severity (IPCC 2022). A 1.5 per cent increase in exposure handicap where exposure is more frequent and more severe therefore translates to immense suffering. Second, the capability in this estimate is limited and well delineated: use of clean water. If we consider broadening it to the capability of being well nourished or food-secure, the descriptive theory suggests an equally significant but larger effect. This is because, relative to use of clean water, use of food is subject to more physical, market, and social norms and arrangements that may shape the distribution of climate harms across society. Put simply, more things can break down on the way from incomes to capabilities of being well nourished or food secure. For example, norms about appropriate food for pregnant women are not unheard-of, less so norms about drinking water for pregnant women. Similarly, the hoarding of grain by market players during food shortages has often featured in the literature; less so the hoarding of drinking water by water firms. In sum, the mere 1.5 per cent exposure handicap may not be the tip of the iceberg but is certainly a conservative estimate of the capability losses shouldered by people with disability.

A battery of supplementary analyses is run to check whether these results are robust, and indeed they are. The analyses include whether, instead of the person, the household is made the unit of analysis; whether, instead of all household members, only the household informant (one person) is made the unit of analysis; whether the disability effect is primarily a low-income effect (by including both main and interaction terms); whether the disability effect is primarily driven by poorer water sources (by including both main and interaction terms); and whether the gender composition of households drives the results on gender (see Appendix).

5 Discussion

Climate injustice is considerable in Indonesia, where capability losses—especially being parched (without clean water for 24 hours or more)—disproportionately affect people with disability. This is evidence of the magnitude of the injustice that needs to be redressed. Compared with those without disability, people with disability have a 1.5 per cent higher probability of being parched irrespective of their income or consumption and other features. How significant is this in practice? Recall that this capability—having access to and use of clean water at least once every 24 hours—is a basic one. Such a basic capability should be readily available to anyone anywhere in the world, let alone in middle-income countries like Indonesia. But it evidently is not. Put differently, the exposure handicap is significant and critical because clean water is fundamental to the functioning of our organs and this functioning is compromised by the loss of access to clean water. Moreover, this loss is experienced by a group who are already disadvantaged in many dimensions, adding to the sense that the small magnitude carries significance as an indicator of other possible capability losses.

Given the vast size of Indonesia, there are sufficient weather variations at any one time that will be captured in hundreds of fixed effects. An alternative identification strategy might be to use specific weather shocks, such us the recent floods in Pakistan, and estimate the distribution of capability losses, comparing those with and without disability before and after the floods in a heterogeneous difference-in-differences with continuous treatment design, using, for example the Living Standards Measurement Surveys routinely carried out in many countries. The disadvantage of this strategy is acute, as it is at the mercy of double serendipity because the surveys must be fielded before and after such a shock.

The estimation of the exposure handicap, being positive and significant, validates the descriptive theory of climate injustice. Practically, it offers a ready input to the design of disability benefits under conditions characterized by more frequent and more severe climate shocks.

The results are robust to a battery of variables on whether the household or the person is measured, whether disability is confounded by low income, or analogously whether disability is confounded by poorer water sources, and whether the gender composition of households explains the results on gender. By eliminating various competing explanations, these results narrow potential explanations to some that can be investigated in future work through qualitative exploration. Chief among them is the working of social norms. For example, five days of extreme heat in Chicago in July 1995 killed 739 elderly poor residents:

> The impact of heatwaves on life […] depends upon a variety of […] social conversion factors: social isolation, fear of crime, neighbourhood decline, all had major impacts on death rates. Old people died alone, *in rooms with windows closed and doors locked, fearful of crime and without social connections of support.* The climate has become disastrous partly because the emerging isolation and privatization […] create hazards for vulnerable residents in all seasons […] The [heatwave] expressed and exposed conditions that are always present but difficult to perceive. (O'Neill 2017, my emphasis).

The deadly effects of the social norm of isolation arising from fear of crime which (1) prevented vulnerable elderly people from sleeping outside or opening their windows while sleeping inside and (2) prevented residents from knocking on neighbours' doors to check on them were cruelly exposed by the climate shock.

Having validated the theory with this outcome of being parched, one can extend the reach with other outcomes or capabilities, taking guidance from the theory's main tenets. As an example, the capability of being nourished or food-secure has theoretical/intrinsic and pragmatic interest. Intrinsic, since food security is acutely threatened by the increasing flooding and drought as well as other climate harms around the world. Pragmatic, since food security is one of the Sustainable Development Goals. Because physical and market arrangements and social norms can shape the conversion of primary goods such as incomes to capabilities such as food security, a priori one can suggest some expected associations. Compared with clean drinking water, food is more subject to the effects of physical, social, and cultural arrangements. For instance, norms about food deemed appropriate for pregnant women are less likely to apply to clean drinking water. Therefore, one can immediately expect that the conversion handicap or exposure handicap under climate shocks is likely to be larger than that found by this study. This enhances the significance of the above finding.

Now that exposure handicap in Indonesia has been demonstrated, one can similarly investigate exposure handicaps elsewhere in the world where one in ten people with disability live (WHO–World Bank 2011). This will show how much social progress has been achieved in each country and, consequently, how much physical, market, and social arrangements need to be scrutinized. As to the question 'What is the mechanism that will break the link between climate shocks and the capability of being hydrated in Indonesia?', Klinenberg's (2002) report on Chicago suggests that separate research on this is needed for the archipelago that stretches as far as from Dublin to Tehran.

Limitations

Although the results of this study are obtained from a cross-section of adults, preventing causal interpretations, the theory is amenable to causal estimation using the design presented above. It should, however, be noted that, first, it is not straightforward or ethical to run randomized experiments when the treatment is climate shocks or disability. Inevitably, some descriptive theory with a clear deductive structure such as one giving rise to conversion handicap and exposure handicap is needed. Second, a difference-in-differences design (panel or repeated cross-section) of the kind illustrated above is still subject to the whim of the weather. Also, not all places visited by shocks, for instance by floods or droughts, are serendipitously ready with representative surveys before the shocks. All this means that a cross-sectional fixed effects design should not be dismissed out of hand.

Choice of vulnerable group

The maximin rule or social ill-fare function is built on the recognition of pre-existing disadvantages—for instance, that engendered by disability. Having shown that the theory is effective, it is important to note that other groups can be considered. Take the example of children. Clearly, they have contributed the least to climate change. If they suffer disproportionately more losses in capability under climate shocks—say, by losing adequate nutrition—then a climate injustice has been perpetrated. Its magnitude and remedy can be considered, proceeding as above. Without evidence that a maximin bads distribution prevails, however, it is unclear how far to proceed to restore justice. It is nevertheless clear that Sen's idea of justice, which focuses on identifying injustices with a view to rectifying them, is a practical guide to public policy and public action.

The array of groups disproportionately affected by climate shocks which entail losses in capabilities serves to emphasize that this view of climate injustice can be called a bottom-up view, as distinct from climate injustice pertaining to between-country distinctions or the 'loss and damage'

conception which serves as a background to the climate-financing deal concluded at the recent COP27 in Sharm el-Sheikh. That can be called a government-to-government view. It is complementary to the bottom-up view, which lends itself to a consideration of persons and groups at increased risk of harm from climate change. The two views can proceed without distraction; in fact, as shown here, they share an underlying structure of maximin distribution of bads. With climate harms likely to increase, the less able in society will be exposed even more. This is an unfolding climate injustice foretold. Social progress can be made only if this exposure handicap is reduced to zero, where disability matters not at all in determining the capabilities attained. The evidence and the theory presented here can raise awareness and guide action to monitor and avert this injustice.

Developing countries will rightly continue to improve the welfare of their citizens using various sources of energy. Along the way, climate justice theory can help guide the assessment of climate bads and their magnitude, such as floods and heatwaves, which tend to cause most harm to the most vulnerable. In so doing, the theory can help in adjudicating the trade-offs that are likely to arise.

In conclusion, the increasing frequency of climate shocks and their devastating impacts around the world should not lead us into thinking that we are in this together. We are not. Just as the benefits have been unevenly distributed, so will the harms also be. But this uneven distribution clearly matches the theory or idea of injustice expounded in the works of Rawls and Sen. This current work proposes a social ill-fare function to capture climate injustice and applies it to the capability of being hydrated, comparing the achievements of those with disability and those without. The results strongly show that persons with disability who were less responsible for climate shocks are nevertheless exposed to extra losses in their capability of being hydrated, a clear instance of climate injustice within a country.

This has validated the descriptive theory of climate injustice and thereby paved the way to voicing the plight of vulnerable groups such as people with disability or children who are exposed to disproportionate harms visited by climate shocks. It is to be hoped that the world will respond by eliminating climate injustices so that, to invert a Danish saying on equality, few are harmed much and fewer still are harmed too much, or *få straffes hårdt, færre straffes for meget*.

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Appendix: Robustness checks

It may be argued that persons with disability are disadvantaged in other ways that are consequential, such as being at the bottom of the consumption distribution, and that, consequently the disability effect is not genuine but stands for other disadvantages. Our first concern is that persons with disability may live further from public facilities or rely more on natural water sources than commercial water supplies. Failing to account for this by omitting access to water sources from our calculations may confound the disability effect. Our main results therefore include access to a water source. Nevertheless, persons with disability may be found to be disproportionately using natural water sources. I therefore add to the main terms an interaction term between disability and water source. Table A1 shows that the main results stand: the possibility that persons with disability disproportionately use natural water sources does not change the results.

Table A1: Coefficients of fixed effects estimates of being parched on disability, interaction between disability and water source, and other controls

	Women	**Men**
With disability	0.209***	0.197***
	(0.000)	(0.000)
Age	-0.001***	-0.001*
	(0.000)	(0.029)
Education year	-0.008***	-0.004***
	(0.000)	(0.000)
Bottom-fifth	0.082***	0.074***
	(0.000)	(0.000)
Married/union	0.023**	0.012
	(0.007)	(0.166)
Divorce/widow	0.016	-0.007
	(0.222)	(0.630)
Female head	-0.010	0.010
	(0.238)	(0.305)
Head edu year	-0.019***	-0.019***
	(0.000)	(0.000)
Head age	-0.002***	-0.002***
	(0.000)	(0.000)
Under-fives	0.003	0.002
	(0.453)	(0.619)
Five to ten	-0.001	0.001
	(0.744)	(0.746)
Teenage & adult	0.002	0.004
	(0.692)	(0.406)
Rain, river, well	-0.029***	-0.031***
	(0.000)	(0.000)
Disability × rain, river, well	-0.063	-0.040
	(0.057)	(0.284)
Urban	-0.184***	-0.196***
	(0.000)	(0.000)
Year 2020	0.169***	0.160***
	(0.000)	(0.000)
N	803,795	785,881

Note: *p*-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; district-fixed effects included.

Source: author's construction.

Another concern that may be raised is that the disability effect is essentially an income or consumption effect: that, since persons with disability are found predominantly in the low consumption group (for instance, the bottom fifth), the disability effect is not genuine. I have, of course, already provided evidence against this, since consumption (i.e. being in the bottom fifth) is included and thus the disability effect is purged of this concern. Nevertheless, to check whether the results are still robust to the possible interaction with consumption, I included an interaction term to complement the main terms of low consumption and of disability. Table A2 shows that that the main results stand: acknowledging the preponderance of persons with disability in the bottom fifth of the consumption range does not change the story.

Table A2: Coefficients of fixed effects estimates of being parched on disability, interaction between disability and being in the bottom fifth of the income distribution, and other controls

	Women	**Men**	**Men**	**Men**
Age	-0.001***	-0.001*		
	(0.000)	(0.030)		
Education year	-0.008***	-0.004***		
	(0.000)	(0.000)		
Married/union	0.023**	0.012		
	(0.007)	(0.166)		
Divorce/widow	0.016	-0.007		
	(0.224)	(0.630)		
Female head	-0.010	0.010		
	(0.235)	(0.303)		
Head edu year	-0.019***	-0.019***		
	(0.000)	(0.000)		
Head age	-0.002***	-0.002***		
	(0.000)	(0.000)		
Under-fives	0.003	0.002		
	(0.454)	(0.621)		
Five to ten	-0.001	0.001		
	(0.743)	(0.746)		
Teenage & adult	0.002	0.004		
	(0.685)	(0.403)		
Rain, river, well	-0.032***	-0.032***		
	(0.000)	(0.000)		
With disability	0.160***	0.164***		
	(0.000)	(0.000)		
Bottom-fifth	0.083***	0.074***		
	(0.000)	(0.000)		
Disability × Bottom-fifth	-0.013	-0.006		
	(0.647)	(0.844)		
Urban	-0.184***	-0.196***		
	(0.000)	(0.000)		
Year 2020	0.170***	0.160***		
	(0.000)	(0.000)		
N	803,795	785,881		

Note: *p*-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; district-fixed effects included.

Source: author's construction.

Because the loss in capability was elicited for the household and then assigned to all members, a concern remains that between-person variation is eliminated. In response, it should be noted that the Indonesian wording suggests that *all* household members must meet the condition for an affirmative answer to be given. Nevertheless, as an additional robustness check, a household-as-unit of analysis is done where the outcome is the same and the key exposure is whether *any* member has a disability. Table A3 shows that the main results stand: disability increases the probability of being parched by a significant magnitude, quantifying the exposure handicap to climate shocks experienced by persons with disability.

Table A3: Coefficients of fixed effects estimates of being parched on any member with disability and other controls

	Household
With disability	0.137***
	(0.000)
Bottom-fifth	0.076***
	(0.000)
Female head	-0.011
	(0.206)
Head edu year	-0.020***
	(0.000)
Head age	-0.003***
	(0.000)
Under-fives	0.006
	(0.272)
Five to ten	0.005
	(0.292)
Teenage & adult	-0.000
	(0.969)
Rain, river, well	-0.024**
	(0.010)
Urban	-0.187***
	(0.000)
Year 2020	0.161***
	(0.000)
N	584903

Note: *p*-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, district fixed effects included.

Source: author's construction.

The main results show that gender difference is negligible. A concern may be raised because the main results were obtained from assigning all household members, regardless of gender, the same value for loss of capability. To check the robustness of the main results I add the share of women in the household by means of a 'proportion of women' variable that will give a stronger indication of the effect of gender difference in the overall disability effect. Table A4 shows a similar story to the main results and supports the evidence of little difference in gender inequality in the loss of this basic capability.

Table A4: Coefficients of fixed effects estimates of being parched on disability, the proportion of women in the household, and other controls

	Women	Men	Men	Men
With disability	0.157***	0.163***		
	(0.000)	(0.000)		
Age	-0.001***	-0.001*		
	(0.000)	(0.031)		
Education yar	-0.008***	-0.004***		
	(0.000)	(0.000)		
Bottom-fifth	0.083***	0.074***		
	(0.000)	(0.000)		
Married/union	0.015	0.006		
	(0.092)	(0.501)		
Divorce/widow	0.013	-0.004		
	(0.322)	(0.781)		
Female head	0.001	0.005		
	(0.937)	(0.663)		
Head edu yeaer	-0.019***	-0.019***		
	(0.000)	(0.000)		
Head age	-0.002***	-0.002***		
	(0.000)	(0.000)		
Under-fives	0.004	0.002		
	(0.385)	(0.727)		
Five to ten	-0.001	0.001		
	(0.802)	(0.840)		
Teenage & adult	0.000	0.004		
	(0.928)	(0.392)		
1.rainRiver	-0.032***	-0.032***		
	(0.000)	(0.000)		
Urban	-0.184***	-0.196***		
	(0.000)	(0.000)		
Proportion women in hhold	-0.054**	0.040*		
	(0.003)	(0.037)		
Year 2020	0.169***	0.160***		
	(0.000)	(0.000)		
N	803,795	785,881		

Note: *p*-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, district fixed effects included.

Source: author's construction.

As we have seen, the Indonesian wording of the question eliciting clean water loss information strongly suggests that all household members are included and asks whether all members were deprived of clean water for at least 24 hours: 'In the past year, did the household experience water loss for the household's needs for at least 24 hours?' Therefore, each member was assigned the same value for 'being parched'. This may raise the concern that some members may nevertheless differ from other members in their loss of capability. It is not possible to ascertain this because the survey did not ask each member individually. Nevertheless, to check the robustness of the main results to this concern I use only one person per household, that is the informant. Unless it is suspected that the informant systemically answered the opposite of the truth regarding the loss of capability, then this is a reliable robustness check. Table A5 shows a similar story to the main results despite a much-reduced sample, further demonstrating the robustness of the main analysis.

Table A5: Coefficients of fixed effects estimates of being parched on disability and other controls using only the informant adult per household

	Women	**Men**	**Men**
With disability	0.202***	0.211***	
	(0.000)	(0.000)	
Age	-0.000	-0.000	
	(0.300)	(0.973)	
Education year	-0.008***	-0.001	
	(0.000)	(0.454)	
Bottom-fifth	0.083***	0.067***	
	(0.000)	(0.000)	
Married/union	0.053*	0.093***	
	(0.020)	(0.000)	
Divorce/widow	0.027	0.042	
	(0.265)	(0.145)	
Female head	0.017	0.054	
	(0.267)	(0.129)	
Head edu year	-0.019***	-0.019***	
	(0.000)	(0.000)	
Head age	-0.002***	-0.003***	
	(0.000)	(0.000)	
Under-fives	-0.003	0.014	
	(0.724)	(0.144)	
Five to ten	0.004	-0.000	
	(0.554)	(0.972)	
Teenage & adult	-0.000	0.011	
	(0.994)	(0.245)	
Rain, river, well	-0.032**	-0.018	
	(0.004)	(0.254)	
Urban	-0.158***	-0.229***	
	(0.000)	(0.000)	
Year 2020	0.173***	0.170***	
	(0.000)	(0.000)	
N	380,652	199,023	

Note: *p*-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, district fixed effects included.

Source: author's construction.