Climate change, vulnerability, and the role of social and built environment

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Panel discussion: *Air pollution, heat, and climate vulnerability in Latin American cities: Lessons from SALURBAL*

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SALURBAL
Urban Health in Latin America

Climate change in Latin American cities

What we know:

- Climate change has direct and indirect impacts on human and environmental health
- Cities in Latin America are particularly vulnerable to these impacts
- Climate change and vulnerability is interconnected with the social determinants of health
- Responses have been developed at the national and subnational level across the region

What we need:

- Greater understanding of climate hazards, impacts, and responses at different levels
- Improved assessments of the role of the urban social and built environment in determining climate vulnerability

Why?

- Improved our understanding can provide insights to support climate adaptation and risk reduction

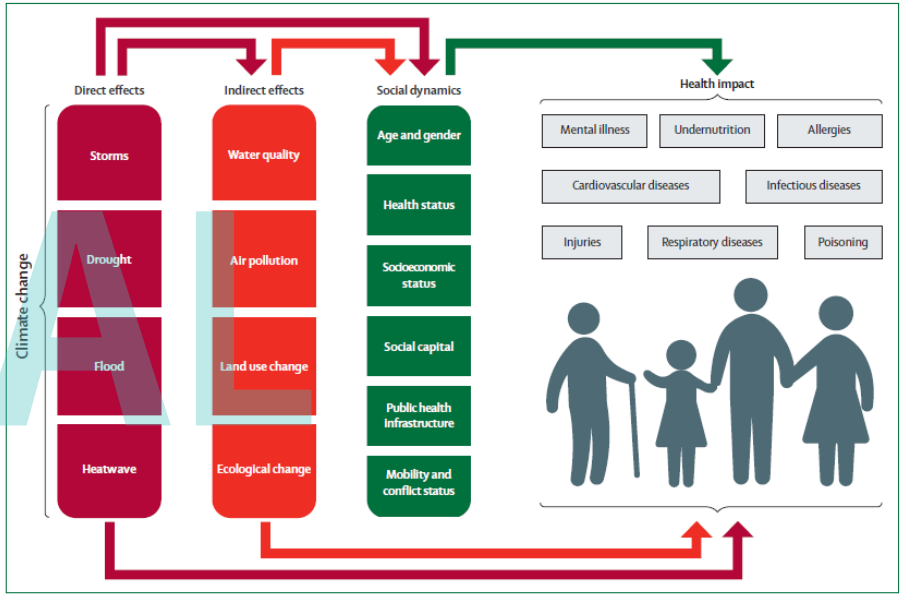


Figure 2: **The direct and indirect effects of climate change on health and wellbeing**
There are complex interactions between both causes and effects. Ecological processes, such as impacts on biodiversity and changes in disease vectors, and social dynamics, can amplify these risks. Social responses also ameliorate some risks through adaptive actions.

CDP (formerly the Carbon Disclosure Project)

- **CDP** is an international non-profit organization that coordinates a **global carbon emissions disclosure system for cities** and **private sector actors**
- An **annual survey** with local officials tracks climate impacts and adaptation and mitigation action
- Scoring for cities and companies highlights progress and incentivizes **climate action**

Survey covers		
1.Governance and Data Mgt	6.Opportunities	11. Urban Planning
2.Climate Hazards and Vulnerability	7. Local government emissions	12. Food
3.Adaptation	8. Energy	13. Waste
4.City-wide emissions	9. Buildings	14. Water Security
5.Emissions Reduction	10. Transport	

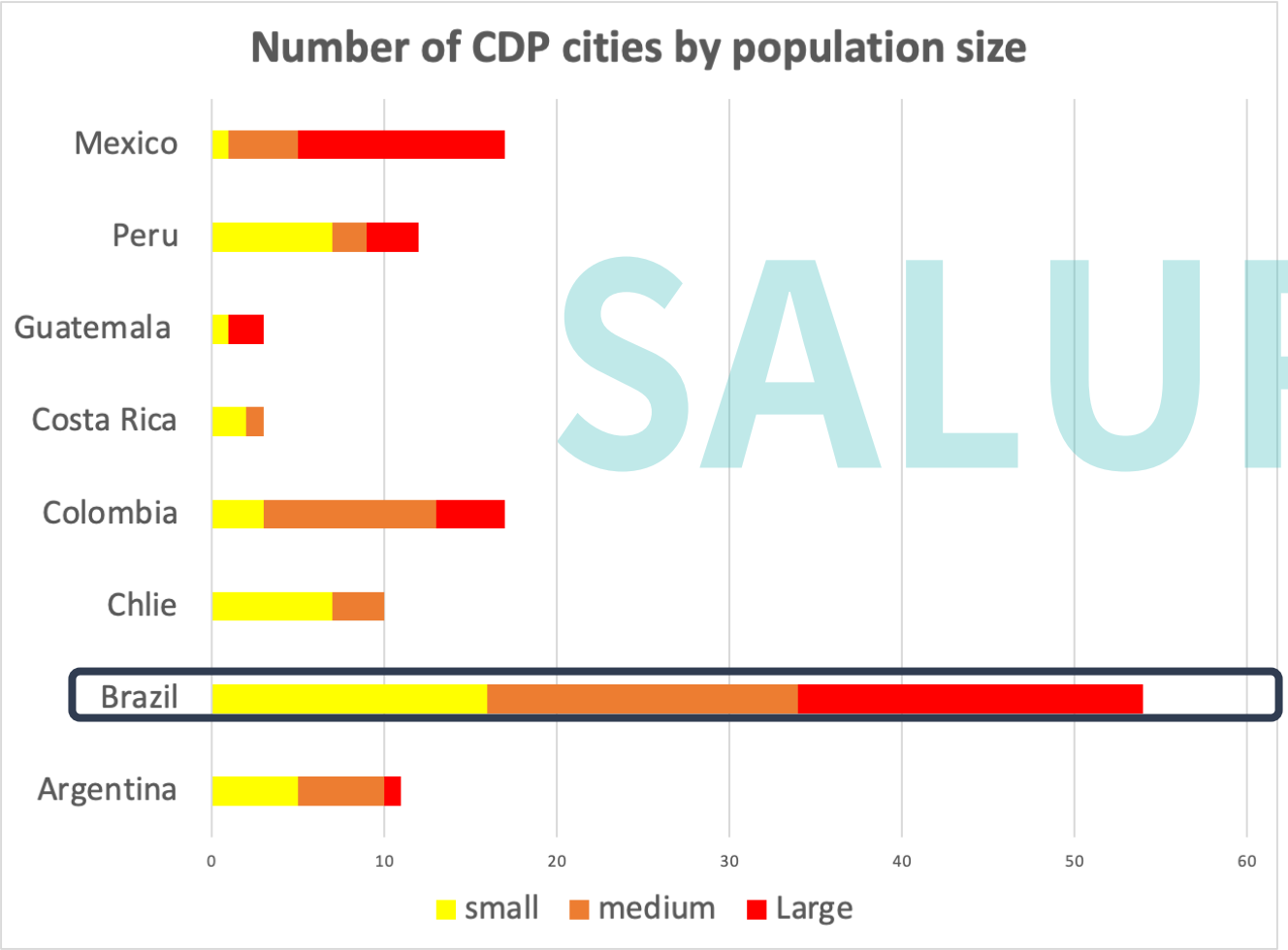
Research overview

- **Leverages self-reported CDP** data (from questionnaire) to characterize climate vulnerability and action across SALURBAL cities

- **Explores the role of social and built environment factors** as predictors of climate vulnerability and action

- **Methods:**
  - Frequency analysis for hazards, actions, and barriers
  - Univariate regression for social and built environment

CDP cities population profile – Our sample



- Data collected for cities from Salurbal countries
- **127 cities** matched Salurbal territories
- Looked at population size

Population Size	N Obs	Minimum	Median	Maximum
Small	**42**	24,853	133,730	234,782
Medium	**43**	250,696	393,788	568,266
Large	**42**	572,603	996,863	12,022,916

- Over representation of Brazilian cities
- Mexico and Brazil highest number of cities with large population
- Low number of city respondents for Guatemala (country size) and Costa Rica

Self-identified climate hazards

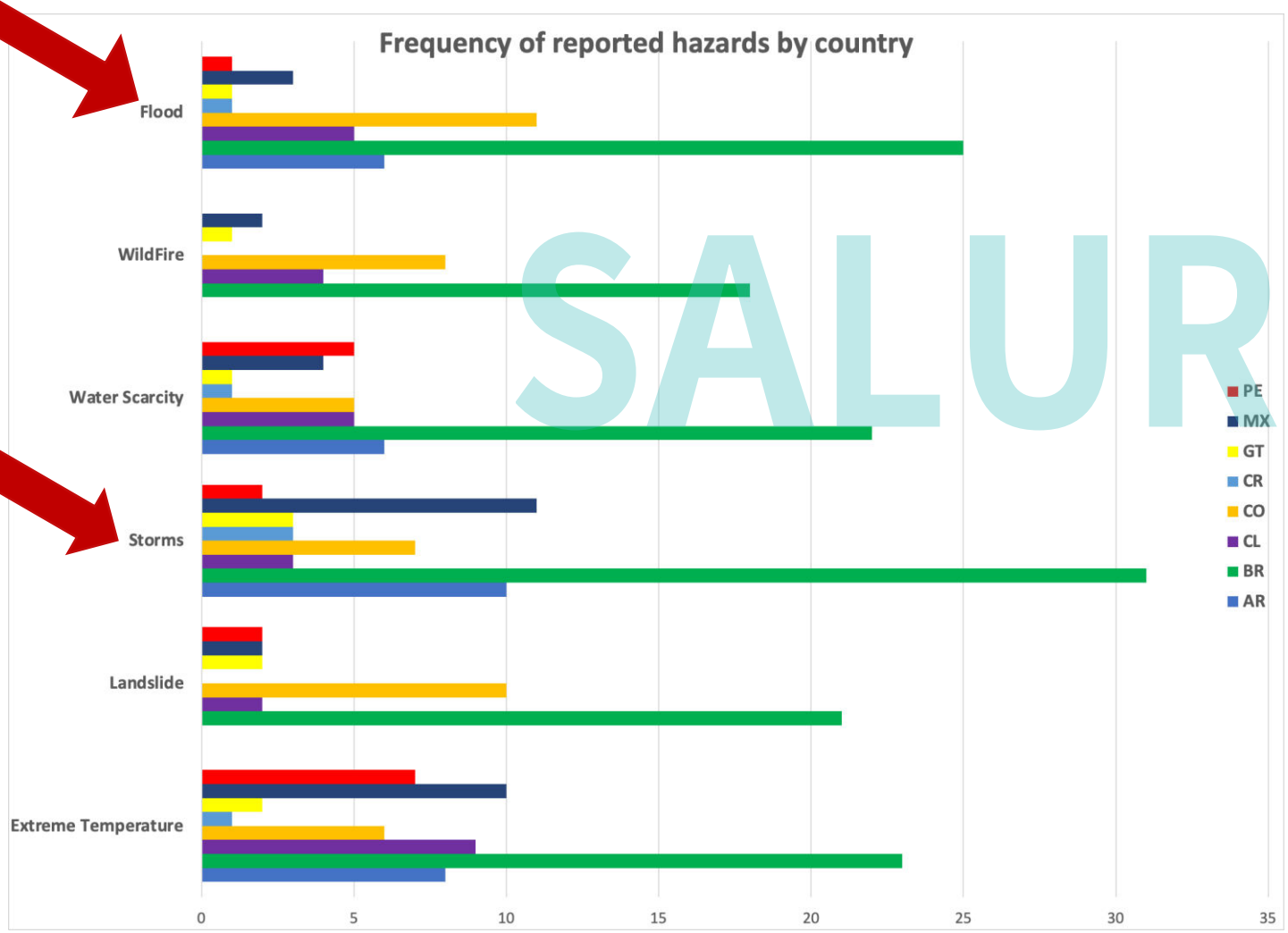
Hazard	N Accounts Reporting Hazard
Water scarcity - Drought	58
Ext. prec - Rainstorm	52
Ext. temp - Heat wave	48
Mass movement - Landslide	40
Flood and sea level rise - Surface flood	36
BioHaz - Vector borne disease	36
Ext. Temp - Hot days	35
Storm and wind - Severe wind	31
Flood and sea level rise - River flood	30
Wildfire - Forest fire	27
Chem. Change - CO2 concentration	18
Flood and sea level rise - Coastal flood	17
BioHaz - Water borne disease	13
Wild fire - Land fire	12
Storm and wind - Lightning thunder	8
Storm and wind - Tropical storm	8
Ext. temp - Cold wave	8
BioHaz - Air borne disease	7
BioHaz - Insect infestation	7
Ext. prec - Fog	7
Mass movement - Rock fall	6
Ext. temp - Cold days	6
Storm and wind - Avalanche	4
Ext. temp - Winter conditions	4
Storm and wind - Cyclone	3
Storm and wind - Storm surge	3
Ext. prec - Heavy snow	3
Ext. prec - Monsoon	3
Flood and sea level rise - Permanent inundation	2
Flood and sea level rise - Groundwater flood	2
Mass movement - Subsidence	2
Chem. change - Saltwater intrusion	2
Storm and wind - Extra trop storm	1

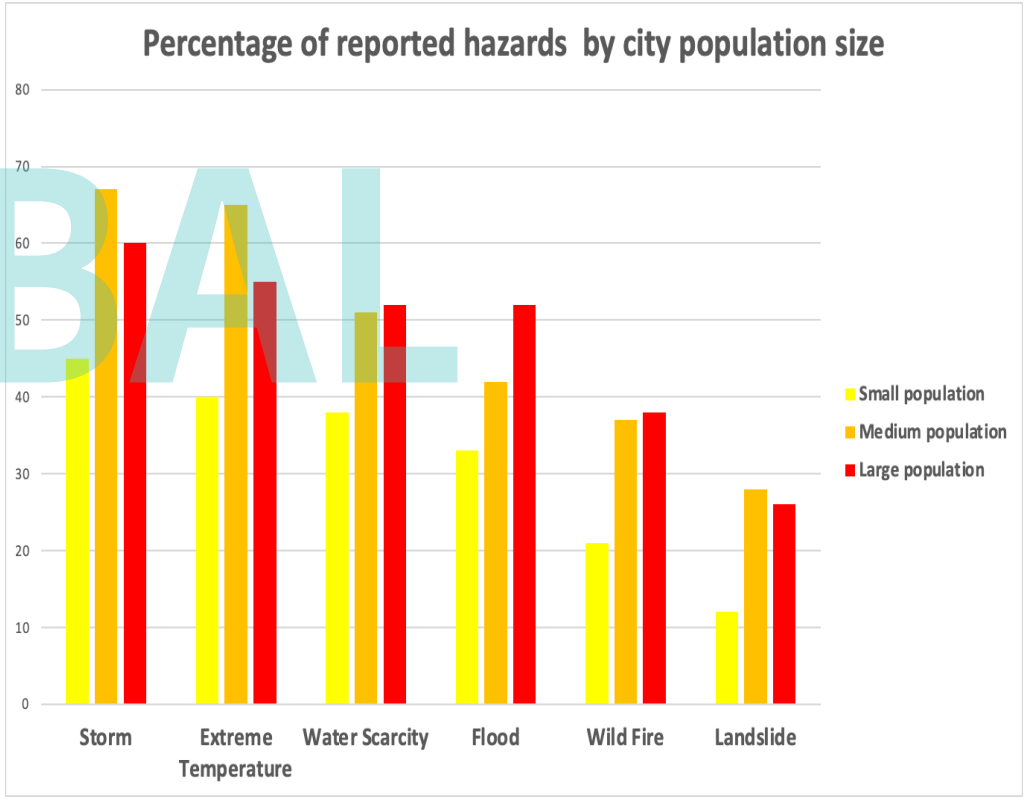
"Please list the most significant climate hazards faced by your city"

- Frequency calculated for all hazards
- Similar hazards grouped
- Frequency calculated for grouped hazards
- "Top" hazards identified (6)
  - Storm
  - Extreme temperatures
  - Flood
  - Water Scarcity
  - Wildfire
  - Landslide

Reported hazards

"Please list the most significant climate hazards faced by your city "

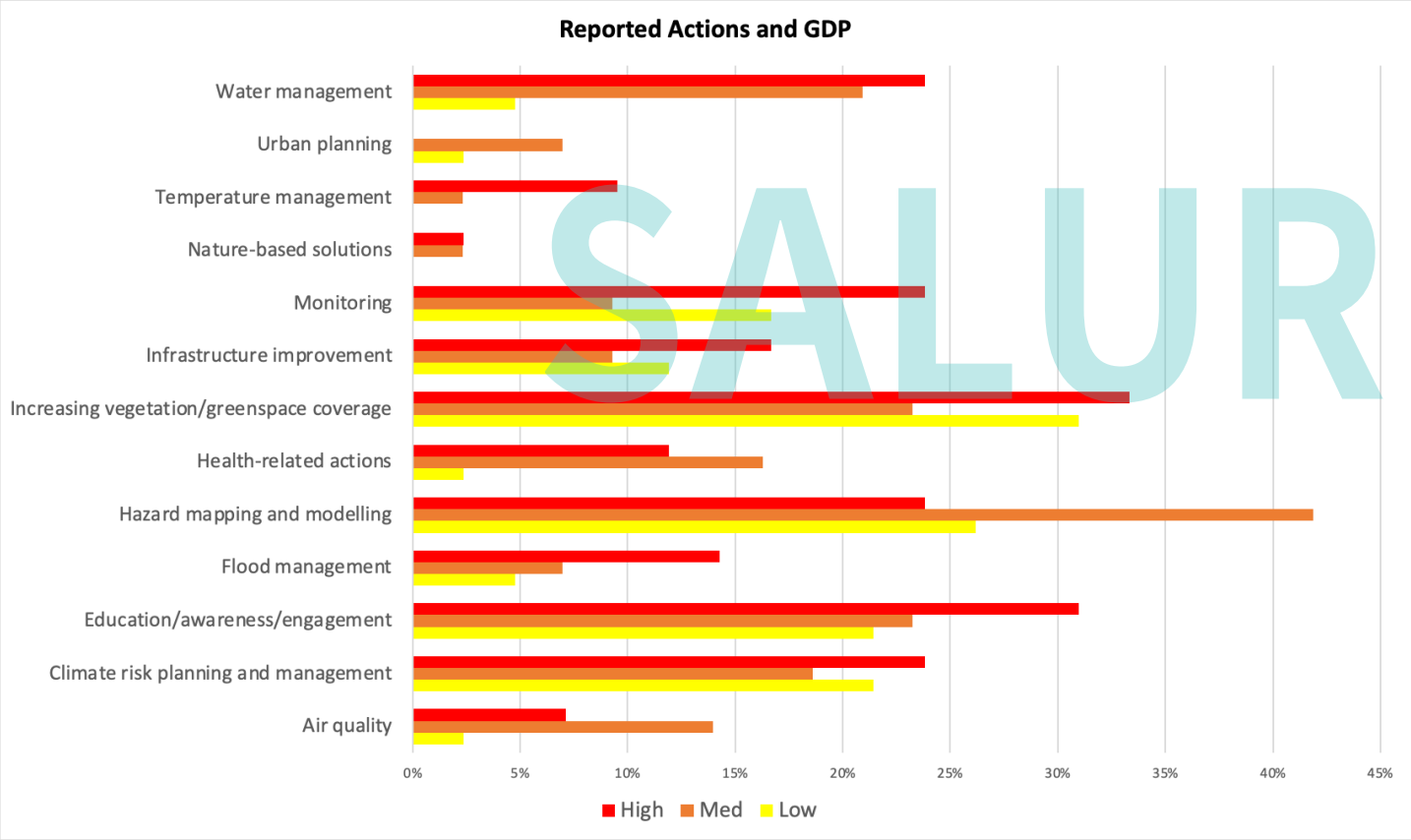




Challenges that affect ability to adapt

Reported Challenges	Freq	PCT of Accounts Reporting
Urban environment and development	36	27.91%
SES - living conditions	32	24.81%
Financial/resource availability	29	22.48%
SES - services	27	20.93%
SES - economic	22	17.05%
SES - governance	15	11.63%
Community engagement	11	8.53%
Migration	5	3.88%
Access to quality/relevant data	4	3.10%
Safety and security	3	2.33%
Public health	2	1.55%

Adaptation actions and GDP



GDP	N Obs	Minimum	Median	Maximum
Small	42	952	9,812	13,145
Medium	42	13,284	18,336	22,013
Large	43	22,181	26,141	36,236

- **High** and **low** GDP cities tend to opt for increasing vegetation and greenspace coverage
- **Medium** GDP cities prioritize mapping and modelling

Built environment factors

Hazard	Sub-city greenness (median NDVI)	Sub-city population density in built up areas (n/km2)	City fragmentation (Patch density)	Per capita CO2	PM2.5
Storm	0.88 (0.48 - 1.60)	0.79 (0.50 - 1.24)	1.39 (0.79 - 2.45)	1.03 (0.70 - 1.50)	0.74 (0.50 - 1.09)
Extreme Temperature	0.70 (0.45 - 1.08)	1.30 (0.92 - 1.83)	0.99 (0.66 - 1.49)	1.44 (0.89 - 2.32)	1.42 (0.87 - 2.32)
Flood	**1.57 (1.06 - 2.34)**	1.45 (0.91 - 2.32)	1.52 (0.96 - 2.42)	**0.72 (0.49 - 1.05)**	**0.57 (0.37 - 0.89)**
Water Scarcity	0.80 (0.52 - 1.22)	0.80 (0.55 - 1.17)	0.97 (0.66 - 1.43)	1.22 (0.85 - 1.77)	0.86 (0.66 - 1.12)
Landslide	1.85 (0.99 - 3.45)	**1.92 (1.05 - 3.51)**	1.36 (0.77 - 2.38)	**0.38 (0.21 - 0.70)**	0.62 (0.33 - 1.17)
Wildfire	**1.68 (1.01 - 2.82)**	1.02 (0.58 - 1.78)	0.78 (0.42 - 1.43)	0.76 (0.50 - 1.17)	0.73 (0.43 - 1.25)
Reported more than 3 Hazards	1.04 (0.71 - 1.53)	1.35 (0.82 - 2.21)	1.00 (0.64 - 1.57)	0.74 (0.48 - 1.15)	0.91 (0.68 - 1.22)
Reported more than 2 Hazard Groups	1.19 (0.82 - 1.71)	1.19 (0.79 - 1.80)	1.23 (0.81 - 1.86)	0.78 (0.55 - 1.12)	**0.73 (0.56 - 0.95)**

Social environment factors

Hazard	Population Growth	Population Size	Population educational attainment	GDP
Storm	0.79 (0.52 - 1.19)	1.67 (0.96 - 2.89)	1.06 (0.53 - 2.12)	0.98 (0.58 - 1.65)
Extreme Temperature	0.80 (0.53 - 1.20)	**2.13 (1.01 - 4.49)**	1.31 (0.83 - 2.05)	1.10 (0.77 - 1.56)
Flood	1.18 (0.87 - 1.60)	**1.87 (1.09 - 3.21)**	0.69 (0.51 - 0.92)	0.70 (0.46 - 1.05)
Water Scarcity	0.96 (0.63 - 1.47)	1.29 (0.87 - 1.90)	0.94 (0.69 - 1.29)	0.93 (0.68 - 1.26)
Landslide	0.63 (0.37 - 1.07)	**2.19 (1.19 - 4.02)**	0.94 (0.54 - 1.65)	0.64 (0.37 - 1.09)
Wildfire	0.99 (0.62 - 1.59)	1.16 (0.74 - 1.83)	0.92 (0.55 - 1.54)	1.05 (0.60 - 1.81)
Reported more than 3 Hazards	**0.65 (0.46 - 0.93)**	**1.81 (1.06 - 3.10)**	1.13 (0.73 - 1.76)	0.96 (0.66 - 1.39)
Reported more than 2 Hazard Groups	0.85 (0.57 - 1.27)	**1.99 (1.11 - 3.59)**	0.99 (0.65 - 1.49)	0.88 (0.62 - 1.25)

Limitations, next steps, and relevance

- These are self-reported hazards; results can therefore help us understand:
  - city characteristics that may predict how vulnerability is perceived
  - identification of priorities and risks

- Next steps will focus on observed hazards and impacts:
  - gaps in self-perceived vulnerabilities
  - what issues cities prioritize and how these compare to the most common or destructive hazards
  - what adaptation actions are/are not being prioritized

- Support better adaptation planning and more effective communication of climate risks and adaptation needs
- Research process is informing CDP survey development and administration

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