

ANTICIPATORY ACTION AND DISASTER PREPAREDNESS FOR RESILIENCE BUILDING: ASSESSING THE ROLE OF INSTITUTIONAL INTEGRATION IN DISASTER GOVERNANCE

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Abstract

Anticipatory action seeks to reduce disaster impacts before hazards occur, but its contribution to household resilience also depends on how it is organized and implemented through disaster-governance arrangements. This study examines the relationship between anticipatory action, institutional integration, and household disaster resilience. Data were collected from 720 households across five disaster-exposed districts and analyzed using partial least squares structural equation modeling. The results show a strong positive association between institutional integration and disaster resilience and a positive direct association between anticipatory action and disaster resilience, while the association between anticipatory action and institutional integration is weak and not statistically significant. The findings suggest that institutional integration is closely associated with household disaster resilience, whereas the direct relationship between anticipatory action and resilience remains substantial. The study contributes to disaster-governance research by showing how institutional integration relates to anticipatory action and household resilience.

INTRODUCTION

Disaster governance increasingly depends on whether institutions can convert information about impending hazards into timely action before losses occur. Anticipatory Action (AA) embodies this shift: it links forecasts, warnings, set thresholds, resources, and prearranged measures to guide decision-making before a hazard strikes hardest (Coughlan de Perez et al., 2015).

Therefore, it matters less that a forecast exists than whether institutions can respond. Findings from anticipatory-action programs indicate that even when the technical forecasts and resource mechanisms are in place, weaving them into existing systems, local capacities, physical infrastructure, data, and partnerships remains hard (Tozier de la Poterie et al., 2023). AA should be treated not just as an action taken before a

disaster hits, but as an ongoing process that converts hazard data into coordinated policy and attainable protection.

The critical point is the warning-to-action relationship. A warning has limited protective value when households cannot interpret it, institutions cannot communicate it effectively, or resources and responsibilities are not mobilized in time. Because of this, early-warning work argues that producing a forecast cannot be the final technical step; it must feed directly into how people communicate, make decisions, and respond (Basher, 2006). Through an institutional lens, disaster-management studies show that an organization's ability to act amid uncertainty depends on how it shares information, coordinates, and manages relationships with partner groups (Kapucu, 2006). AA effectiveness depends partly on what happens between producing risk information and implementing it at the community level.

This makes institutional integration central to governing anticipatory action. Because disaster governance operates across public bodies, humanitarian agencies, local communities, and multiple tiers of administration, it creates mutual dependencies that no single organization can manage alone (Tierney, 2012). Previous studies highlighted coordination, information sharing, participation, learning, and network ties as significant elements of governance aimed at resilience (Djalante et al., 2011; Waugh & Streib, 2006). Institutional integration builds on this by asking whether those ties are woven into day-to-day operations, specifically, whether groups share information, know their roles, link anticipatory steps to disaster response plans, pull together resources, and include affected communities. Studies on integrating disaster-risk reduction and climate adaptation likewise show that effective governance hinges on coherent policy, organizational capacity, communication, coordination, and accessible resources (Nemakonde & Van Niekerk, 2023). Recent studies on hybrid and cross-sector crisis governance reinforce this point, indicating the

need to study how organizations relate to one another rather than viewing institutional moves in a vacuum (Thygesen et al., 2026; Zhang & Borden, 2026).

These setups matter more when resilience is viewed as a multi-dimensional outcome. Disaster resilience goes well beyond absorbing an initial hit; it also takes in preparation, coping, recovery, long-term adaptation, social assets, information, and community capacity (Cutter et al., 2008; Norris et al., 2008). Households' access to resources before and after a disaster can also be shaped by their social ties and ties to institutions (Aldrich & Meyer, 2015). For this reason, measurement studies advise against relying on any single physical or socioeconomic metric for resilience, instead pointing to multidimensional frameworks that track how different capacities interact (Cai et al., 2018; Saja et al., 2019). Field data from households in Pakistan similarly points to preparedness, coping, recovery, and a mix of social, economic, and institutional capacities as meaningful facets of resilience (Sadia et al., 2020; Shah et al., 2018; Ullah et al., 2021). Therefore, AA builds resilience not just because families get assistance or early warnings, but because the surrounding institutions make it possible to turn those inputs into actual protection.

However, even with these overlaps, researchers have mostly treated AA and institutional integration as distinct tracks. Studies on AA have mainly focused on early interventions, triggers, resources, and forecasts, while the disaster-governance literature has focused on interorganizational ties, institutional capacity, and coordination. Studies increasingly agree that AA belongs within established governance structures (Alcayna et al., 2025; Tozier de la Poterie et al., 2023). Far less is known about whether institutional integration actually explains how anticipatory action translates into stronger household resilience. That creates an analytical blind spot: the governance arrangements wrapped around AA might shape not just how interventions get rolled out, but the actual resilience dividends they produce.

This relationship can be examined against an especially relevant policy context in Pakistan. Recently, initiatives at federal and provincial levels have tried to embed anticipatory action into formal systems by linking disaster-management bodies, humanitarian groups, and development partners, with greater emphasis on early warning, preparedness, financing, and pre-agreed action (NDMA, 2024; FAO, 2023; WFP, 2026). These developments examining institutional integration become directly useful for assessing whether anticipatory setups actually build stronger household resilience.

This study addresses this gap by positioning institutional integration as the mechanism through which anticipatory action may translate into household-level disaster resilience. Rather than treating coordination, information sharing, institutional responsibilities, and resource arrangements as background conditions of anticipatory action, the study examines their role within the AA resilience relationship. The focus shifts: the question is no longer just whether an anticipatory measure happened, but how its governance was set up and whether institutional integration helped that early response to deeper resilience capacities.

2. Literature Review

2.1 Anticipatory Action and the Warning-to-Action Problem

AA shifts disaster intervention from responding to impacts toward acting within the period between credible risk information and hazard onset. The approach helps forecasts lead directly to agreed-upon decisions, resources, and protective steps, reducing the lag between seeing a risk and acting on it (Coughlan de Perez et al., 2015). Current AA has extended that same logic across humanitarian organizations and governments, gradually establishing early action as standard policy before disasters occur (Mena, 2025; Uwantege Hart et al., 2024).

The real sticking point is whether that information can actually be turned into practical, well-timed action. Good early-warning systems demand far

more than solid forecasting; people must receive the warning quickly, trust and understand it, and see a practical path to act on it (Basher, 2006). As a result, AA functions as a chain from warning to action, depending on whether risk data can trigger decisions, mobilize resources, and prompt protective measures before time runs out. Even a technically sound alert yields little practical benefit if it is poorly communicated or if families cannot afford to act on it.

Because of this translation breakdown, AA cannot be separated from the institutional setting it sits in. Studies across varied implementation environments show that anticipatory programs face persistent challenges with institutional capacity, local ownership, infrastructure, data systems, and fit with existing setups (Tozier de la Poterie et al., 2023). For anticipatory action to outlast one-off projects, triggers must be linked directly to preparedness mechanisms, resource streams, assigned duties, and established response systems (Alcayna et al., 2025).

AA is framed as a governance process that links risk information with coordinated efforts, not merely as an early intervention. How far it builds resilience may depend, at least in part, on whether the bodies involved are linked closely enough to turn early decisions into actions communities can take. That connection provides an analytical foundation for asking whether institutional integration bridges anticipatory action and disaster resilience.

2.2 Institutional Integration in Disaster Governance

Disaster governance is inherently distributed: disaster governance is fragmented across agencies and tiers of government, with tasks like forecasting, early warnings, preparedness, resource allocation, assistance delivery, and on-the-ground execution rarely handled by the same body. Disaster response succeeds or fails not purely through an organization's standalone capacity, but through the relational channels that carry resources, formal authority, and information across institutional divides (Tierney, 2012). In anticipatory action, this

mutual reliance matters even more, since actors face a narrow window to align decisions before a hazard's effects worsen.

While such measures rely on coordination as a starting point, institutional integration requires more than temporary teamwork. Frequently, communication channels can support emergency decision-making, just as strong leadership and working partnerships help distribute scattered duties and assets (Kapucu, 2006; Waugh & Streib, 2006). When crises cross borders, competing jurisdictions make mechanisms that bridge otherwise isolated pockets of authority even more necessary (Ansell et al., 2010). Institutional integration denotes a deeper and more enduring alignment of planning, resources, information, duties, and participation right across the governance structure (Nemakonde & Van Niekerk, 2023).

Work on adaptive governance supports this relational view, linking resilience-based governance to multilayered institutions, networks, collaboration, participation, and learning (Djalante et al., 2011). Recent literature similarly shows that cross-sector networks shape how information, trust, and resources move, and that hybrid arrangements blend top-down authority with networked collaboration as crises shift (Thygesen et al., 2026; Zhang & Borden, 2026). Even so, fragmented setups and disparities in resource access can erode these ties and limit what coordinated efforts can achieve (Damaschin et al., 2026).

Pakistan clearly illustrates the challenges of this institutional integration. National coordination arrangements set up by NDMA bring federal and provincial officials, UN bodies, humanitarian agencies, and other partners together on anticipatory action (NDMA, 2024). PDMA in Sindh has worked with FAO, WFP, and other counterparts to strengthen anticipatory action through early-warning systems, preparedness, and inter-institutional coordination, running efforts in vulnerable districts as part of this work (FAO, 2023; PDMA Sindh, 2026). These changes show that anticipatory action increasingly rests on

connection across administrative and organizational lines, rather than on what one agency can manage alone.

For AA, integration matters because early action leaves little time to resolve institutional uncertainty. Before impacts reach their peak, decision-makers must receive forecasts, roles must be unambiguous, resources must be marshaled, and relief must reach communities. Institutional integration offers a credible governance channel for turning forward-looking data and decisions into coordinated action, which makes it analytically useful for studying AA alongside disaster resilience.

2.3 Disaster Resilience as the Outcome of Anticipatory Governance

Disaster resilience is better understood as a multidimensional capacity than as recovery from a single event. It spans how well people prepare, absorb hits, cope, recover, adapt, and learn, though what actually happens depends on economic, social, institutional, infrastructural, and environmental factors (Cutter et al., 2008, 2010; Manyena, 2006; Norris et al., 2008). This broader view pays off for AA, since warnings and early relief can shape not just immediate survival, but how well households absorb disruption and rebuild their lives. Resilience, then, serves as a sensible benchmark for assessing whether anticipatory governance achieves more than immediate risk reduction.

The relational dimensions of resilience are particularly relevant. Social networks can provide access to information, assistance, and collective resources, while institutional support can shape households' preparedness and capacity to respond (Aldrich & Meyer, 2015). Still, because frameworks and metrics vary widely across the literature, researchers must evaluate resilience across multiple, setting-specific dimensions rather than relying on a single metric (Cai et al., 2018; Ostadtaghizadeh et al., 2015; Saja et al., 2019).

Findings from Pakistan further support this institutional angle. In their assessment of household resilience, Shah et al. (2018) identifies

warning information, preparedness measures, government and NGO assistance, and capacity-building as key elements alongside physical, social, and economic assets. Work on household adaptation likewise points to accessible capacities as central to managing disaster risk (Ullah et al., 2021). Recent studies highlight communication channels, social ties, participation in preparedness, and emergency planning (Sadia et al., 2025). Resilience works well as an outcome for evaluating AA precisely because families encounter anticipatory governance through the practical resources institutions supply: early warnings, direct assistance, preparedness training, and coping support.

2.4 Institutional Integration as the Link between Anticipatory Action and Resilience

Earlier research indicates AA as a way to build resilience, though its effectiveness may depend on how well institutions organize early action. When anticipatory measures give households the time and means to protect themselves, institutional integration connects forecasts, formal decisions, designated roles, and assistance programs across agencies (Alcayna et al., 2025; Tozier de la Poterie et al., 2023). If those connections are weak, early action may deliver little in practice; when they are solid, risk data turns much more reliably into organized help, and steps families can take themselves.

Institutional integration is treated here as far more than background. Cross-sector networks guide the flow of information and supplies between governance bodies, just as hybrid setups dictate the balance of top-down command and joint work in an emergency (Thygesen et al., 2026; Zhang & Borden, 2026). For households, these institutional mechanisms show up in tangible ways: receiving early warnings, relief, opportunities to prepare, and other assistance (Shah et al., 2018). Institutional integration could thus credibly bridge the practical gains of AA and the capacities that constitute disaster resilience.

The specific gap is that these three dimensions have rarely been examined together in a

household-level empirical model. While previous studies show that anticipatory action, institutional coordination, and multidimensional resilience all matter, far less is known about whether institutional integration explains the link between AA and resilience. To address that gap, this study treats II as a governance mechanism connecting AA to DR, without removing the direct AA-DR relationship. As a result, the framework tests not only the connection between early action and resilience, but also whether the institutional arrangements behind it help explain that relationship.

3. Methodology

3.1 Research design and study setting

This study used an explanatory, cross-sectional quantitative design to assess the association between AA, II, and DR. This study was conducted in five districts of Sindh, Pakistan: Badin, Dadu, Khairpur, Tharparkar, and Shaheed Benazirabad- which were purposively chosen to capture distinct hazard profiles: floods, droughts, heatwaves, heavy rainfall, and cyclones or storms. District selection depended on specific hazard contexts and does not claim statistical representation for all of Sindh. While the analysis centered on households as the main unit, institutional stakeholders provided supplementary context on how local disaster governance operates.

3.2 Sampling and participants

Data were collected from August 2025 to February 2026 through household surveys conducted across the five selected districts. The study used multistage sampling across five districts. Overall, 720 household respondents were surveyed, with 144 per district across 5 districts $\times$ 8 community clusters $\times$ 18 households = 720 households. This variation ensured households were distributed evenly across all 40 clusters. Eligible respondents were adults aged 18 years or older who had lived in the area for at least two years, had encountered or been exposed to a relevant hazard, and were adequately informed about their household's preparedness, early warning reception, disaster

history, and interactions with institutions. The study also consulted about 50 institutional stakeholders from government, local government, humanitarian agencies, nongovernmental groups, and community bodies. The study used their responses for contextual interpretation and triangulation and did not include them in the household-level structural model.

3.3 Measures and instrument development

The study used a structured questionnaire as the data collection tool, drawing on existing studies of AA, disaster governance, II, and resilience, and tailoring it to the study context. Experts reviewed the instrument before translation and back-translation, followed by pilot testing. The study used a five-point Likert scale to score the construct items.

The AA measure comprised eight items addressing warning accessibility and timeliness, warning comprehension, early preparedness and protective action, anticipatory assistance, and the link between warnings and action. Seven items made up II, evaluating coordination, information sharing, how clearly institutional roles were defined, the incorporation of AA into disaster plans, coordination between government and humanitarian bodies, resource support, and community participation. DR consisted of 10 items addressing preparedness, response, coping, recovery, adaptation, and community/social capacity. The questionnaire also included factual measures to record disaster exposure and recent anticipatory-action experiences, such as receiving warnings, taking protective steps, and getting early assistance.

3.4 Data analysis

Data were first screened for completeness, coding consistency, and response quality, then descriptively analyzed for sample characteristics and disaster exposure. The measurement model was assessed using PLS-SEM, testing internal consistency with Cronbach's alpha and composite reliability (CR), and convergent validity via indicator loadings and average variance extracted

(AVE). The structural model mapped the hypothesized links between AA, II, and DR, specifically AA to II, II to DR, and AA to DR, with R^2 used to evaluate explanatory power. To assess the proposed mediation pathway, we generated bootstrapped confidence intervals for the indirect effect of AA on DR through II and interpreted those results alongside the direct effects. The study relies on a cross-sectional design; these estimated relationships reflect associations rather than cause-and-effect links. Differences across districts and hazard types were evaluated purely descriptively for background context, not to support population-level comparisons.

3.5 Ethical considerations

Participation was voluntary and based on informed consent. We ensured respondents understood the study and that they had the right not to take part. We handled data confidentially and published only aggregate results, ensuring no individual could be identified in the analysis or the write-up.

4. Results

A total sample of 720 households was divided among the five study districts. Respondents averaged 40.28 years of age, with 6.29 members per household, and 74.0% were male. Most of the sample was rural (75.7%), alongside 11.1% living in urban areas and 13.2% in peri-urban settings. In terms of education, 30.7% had secondary or higher-secondary education, 25.8% had primary schooling, and 18.2% had no formal education. The leading sources of income were agriculture (26.9%), daily wage labor (20.0%), and livestock (19.7%). Flooding was cited most often as a major hazard (39.4%), followed by drought (25.4%), heavy rainfall (13.6%), heatwaves (13.3%), and cyclones or storms (8.2%). For the most recent serious disaster, 48.5% of households reported receiving an early warning, 38.9% mentioned they received none, and 12.6% did not know. Among those warned, 156 households reported taking protective steps, and 25.8% across the entire

sample reported getting help before the main impact occurred.

Table 1. Sample and disaster-exposure profile

Characteristic	Category	n	%
Settlement	Rural	545	75.7
	Urban	80	11.1
	Peri-urban	95	13.2
Most impactful hazard	Flood	284	39.4
	Drought	183	25.4
	Heavy rainfall	98	13.6
	Heatwave	96	13.3
	Cyclone/storm	59	8.2
Warning before recent serious event	Yes	349	48.5
	No	280	38.9
	Do not know	91	12.6

The measurement model demonstrated acceptable reliability and convergent validity across all three constructs. Indicator loadings ranged from 0.645 to 0.731 for AA, 0.707 to 0.765 for II, and 0.716 to 0.771 for DR. Cronbach's alpha values ranged from 0.839 to 0.908, while composite reliability

ranged from 0.877 to 0.924, indicating satisfactory internal consistency. AVE values were 0.547 for AA, 0.535 for II, and 0.549 for DR, supporting convergent validity. Overall, the measurement model adequately supported proceeding to the structural model assessment.

Table 2. Measurement model assessment

Construct	Items	Loading range	Cronbach's α	CR	AVE
AA	8	0.645-0.731	0.839	0.877	0.547
II	7	0.707-0.765	0.855	0.890	0.535
DR	10	0.716-0.771	0.908	0.924	0.549

The structural model showed different levels of association across the specified paths. AA showed a small positive but statistically non-significant association with II ($\beta = 0.058$, $p = .062$). II showed a strong positive association with DR ($\beta = 0.689$, p

$< .001$), while AA retained a strong positive direct association with DR after II was included in the model ($\beta = 0.645$, $p < .001$). The model explained 0.3% of the variance in II and 94.2% of the variance in DR (Table 3).

Table 3. Structural model results

Path	β	SE	t	P
AA $\rightarrow$ II	0.058	0.031	1.87	.062
II $\rightarrow$ DR	0.689	0.035	19.69	<.001
AA $\rightarrow$ DR	0.645	0.034	18.97	<.001

Figure 1 presents the structural model with AA as the antecedent, II as the intervening construct, and DR as the outcome. The model shows a weak association between AA and II ($\beta = 0.058$), alongside stronger positive

associations between II and DR ($\beta = 0.689$) and between AA and DR ($\beta = 0.645$). Indicator loadings for each construct are reported in the same figure.

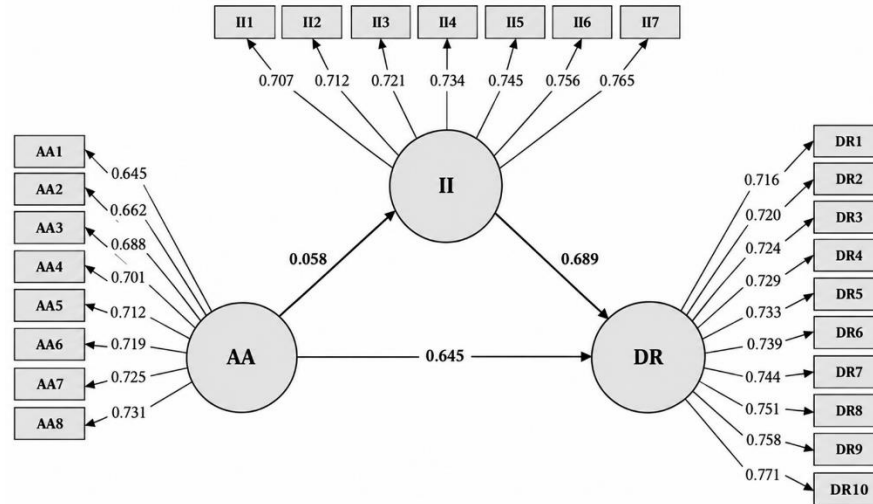


Figure 1 presents the structural model with AA as the antecedent, II as the intervening construct, and DR as the outcome. Indicator loadings for every construct are reported in the same figure.

The mediation results indicate that the indirect association between anticipatory action (AA) and disaster resilience (DR) through institutional integration (II) was small ($\beta = 0.040$). The bootstrap 95% confidence interval ranged from -0.002 to 0.082 and included zero, indicating that the indirect effect is not statistically supported.

The direct association between AA and DR remained strong ($\beta = 0.645$, $p < .001$), while II was strongly associated with DR ($\beta = 0.689$, $p < .001$). These findings therefore provide stronger evidence for the direct AA-DR relationship and the II-DR relationship than for the proposed mediation pathway.

Table 4. Direct, indirect, and total effects

Effect	β
Total effect: AA $\rightarrow$ DR	0.685
Direct effect: AA $\rightarrow$ DR	0.645
Indirect effect: AA $\rightarrow$ II $\rightarrow$ DR	0.040

5. Discussion

The findings place anticipatory action within an institutional rather than purely operational framework. The strong association between AA and DR suggests that anticipatory measures support household resilience beyond the immediate delivery of warnings or assistance. At the same time, the weak and statistically non-significant association between AA and II

indicates that the relationship between anticipatory action and institutional integration should not be assumed. The strong association between II and DR nevertheless highlights the relevance of institutional arrangements for understanding household resilience.

The link between AA and DR matches earlier evidence that early warnings only help if people

can actually turn risk data into prompt, workable protection (Basher, 2006; Coughlan de Perez et al., 2015). Previous studies show that anticipatory action relies on organizational capacity, local buy-in, and help to existing preparedness structures (Alcayna et al., 2025; Tozier de la Poterie et al., 2023). These findings apply that line of reasoning to household resilience measured across multiple dimensions, rather than treating anticipatory action as an isolated intervention. The findings suggest it functions as an ongoing process: households draw on information, preparedness options, and tangible resources before a hazard hits.

The association between AA and II should be interpreted cautiously. Although the coefficient is positive, the relationship is small and does not reach conventional statistical significance ($\beta = 0.058$, $p = .062$). This suggests that household experiences of anticipatory action were not strongly associated with perceptions of institutional integration in the present sample. That pattern aligns with disaster-governance literature highlighting institutional assistance, networks, shared communication, and interagency collaboration (Djalante et al., 2011; Kapucu, 2006; Waugh & Streib, 2006). It also tracks with disaster risk reduction scholarship on institutional integration, where good governance hinges on communication, shared resources, coordination, and aligned policy (Nemakonde & Van Niekerk, 2023). Work on hybrid and cross-sector crisis governance points in the same direction: mounting an effective response depends on linking resources, authority, and information across organizational lines (Thygesen et al., 2026; Zhang & Borden, 2026). The current data trace that institutional argument down to the household scale.

The association between II and DR also suggests that resilience is shaped in part by the governance settings households live under when facing disaster risk. Early warnings, preparation support, relief supplies, and access to public agencies are not things a family can provide on its own; they depend partly on how effectively institutions organize themselves and reach people on the ground. These observations line up well with studies that frame resilience around social, informational, institutional, and community assets (Aldrich & Meyer, 2015; Norris et al., 2008; Saja et al., 2019) as well as field data from Pakistan connecting household recovery to warning messages, institutional aid, and adaptive capacity (Shah et al., 2018; Ullah et al., 2021).

The mediation finding provides the principal contribution. Institutional integration accounts for part of the relationship between anticipatory action and resilience, while the remaining direct relationship indicates that AA also operates through mechanisms beyond institutional integration. Institutional integration, in other words, is more than just a background condition under which anticipatory action takes place. Instead, it serves as a specific route linking anticipatory setups to household resilience. Still, because that direct link persists, protective actions and preparedness at the household level may well do their own work outside the institutional route. Therefore, this study links two strands of literature that are often examined separately: the operational literature on anticipatory action and the governance literature on institutional coordination.

The descriptive data show warnings and resource points in the same direction. Not everyone received a warning, and even fewer surveyed households received early assistance. It is not just

a question of whether risk information exists, but of whether administrative systems actually funnel it into decisions, resources, explicit duties, and tangible help. That aligns with recent arguments against running anticipatory action as an independent track, urging instead that it be built directly into existing disaster-management bodies (Alcayna et al., 2025; Tozier de la Poterie et al., 2023).

This governance view is central to the anticipatory-action system taking shape in Pakistan. Across the country and provinces, efforts increasingly link early-warning systems to preparedness, financing, coordination, and field delivery, drawing in groups like NDMA, PDMA, FAO, and WFP (NDMA, 2024; FAO, 2023; WFP, 2026). Our findings bring household data to this policy shift, showing a strong association between institutional integration and household resilience, while the observed association between anticipatory action and institutional integration is comparatively weak.

Nevertheless, interpret the findings within the study's boundaries. The districts were purposively selected and are not statistically representative of all of Sindh. Instead of evaluating the organizations directly, we captured II through how households encountered these institutions, and the single-point-in-time survey cannot prove causation or confirm what came first. Later work could evaluate this mechanism by tracking households over time and across levels, pairing their responses with administrative and organizational records.

Overall, the study shifts attention from whether anticipatory action occurs to how institutions organize it. The main contribution is to show that the relationship between anticipatory action and household resilience is associated not only with early action itself, but also with the institutional connections through which information,

responsibilities, resources, and community action are coordinated.

6. Conclusion

This study assessed the relationships among AA, II, and DR using household data from five disaster-exposed districts. AA showed a weak positive but statistically non-significant association with II, while both II and AA showed positive associations with DR. The findings therefore provide stronger evidence for the relationship between institutional integration and household resilience and for the direct association between anticipatory action and resilience than for the proposed indirect pathway.

The study contributes by bringing anticipatory action, institutional integration, and household resilience into a single empirical model. It shifts attention from anticipatory action as the delivery of warnings or pre-disaster assistance toward the institutional arrangements through which information, resources, coordination, and early action reach affected households.

7. Policy and Governance Implications

The findings support connecting anticipatory action to established institutional responsibilities, resources, and decision processes before hazards occur. The study's measure of institutional integration highlights the relevance of coordination, information sharing, role clarity, planning, government, humanitarian coordination, resource support, and community participation.

A clear implementation gap is also evident: 48.5% of respondents reported receiving an early warning before their most recent serious disaster, while only 25.8% reported receiving assistance before the main impact. Therefore, policy efforts should focus not only on issuing warnings but also on ensuring they reach exposed households and are linked to feasible protective measures and timely support.

The national, provincial, and district authorities pre-agreed warning-to-action arrangements covering institutional responsibilities, information sharing, resource activation, and community-level implementation. Such actions can strengthen the connection between anticipatory systems and household- or community-level resilience.

8. Limitations and Future Research

The study has a few limitations. The five districts were purposively selected to capture contrasting hazard contexts. However, the findings are not statistically representative of Sindh as a whole. Second, the study assessed II through household experiences rather than direct organizational or administrative measures. Third, the cross-sectional design identifies associations but cannot establish causal relationships or temporal ordering. Future research should use longitudinal and multilevel designs that combine household, organizational, and administrative data. This would allow evaluation of how changes in institutional coordination and resource arrangements relate to AA and resilience over time and across different hazards and governance levels.

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