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# THE PSYCHOLOGICAL EFFECT OF 2023-2024 DZUD ON YOUNG CHILDREN IN RURAL MONGOLIA

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# THE PSYCHOLOGICAL EFFECTS OF 2023-2024 DZUD ON YOUNG CHILDREN IN RURAL MONGOLIA

## Abstract

In 2023-2024, one of the worst Dzuds in recent Mongolian history occurred, affecting herders' psychological and physical well-being. Existing research suggests that the psychological impact of the Dzud on young children and the associated factors in herding communities remain understudied. Therefore, this study employed a retrospective cohort design with a mixed-methods approach, combining qualitative findings with quantitative results, to examine the psychological effects of the 2023-2024 Dzud on 61 children aged 3-6 years, as well as caregivers' mental health and Dzud-induced household disruptions as associated factors. Validated measures, including the Strengths and Difficulties Questionnaire (SDQ) to measure children's psychological outcomes, the Depression Anxiety Stress Scale 21 (DASS-21) to assess caregivers' mental state, and the Household Disruption Questionnaire (HDQ) to evaluate Dzud exposure, were used. Results indicated that children affected by the Dzud showed elevated psychological difficulties, as shown in the SDQ Total Difficulties Score (TDS) ( $M = 19.15$ ,  $SD = 5.97$ ). Among the SDQ subscales, conduct difficulty scored highest in the clinical range (65.6%). Compared with community norms in Mongolia, the sample's TDS was significantly higher ( $M$  diff: 6.25). Caregivers of these children also experienced increased psychological distress, as indicated by the DASS-21, and the Stress ( $r = .611$ ,  $p < .001$ ) and Depression ( $r = .595$ ,  $p < .001$ ) scales exhibited significant correlations with SDQ TDS. Additionally, the level of Dzud exposure, as indicated by the HDQ, significantly influenced children's SDQ results ( $F(2, 58) = 16.38$ ,  $p < .001$ ), with each HDQ domain positively correlating with SDQ TDS. These findings highlight implications for children and their caregivers affected by disasters, who are at risk of developing long-term psychological issues.

**Keywords:** *Dzud, Rural Mongolia, Nomadic Herders, Child Mental Health, Caregiver Distress, Household Disruptions*

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# 1. INTRODUCTION

There is a unique winter disaster in Mongolia called a Dzud (“Зүд” in Mongolian), characterized by extreme cold, heavy snowfall, blizzards, and ice cover, leading to livestock starvation and loss. ([Hahn, 2016](#)). Generally, at the beginning of winter, temperatures drop dangerously low, and heavy snowfall is followed by blizzards, putting both humans and livestock at risk of freezing in rural Mongolia ([Hahn, 2016](#)). Notwithstanding the historical recurrence of Dzud, the frequency and prevalence of Dzud disasters significantly intensified in the previous century ([Hahn, 2016](#)). Furthermore, one of the worst Dzuds in recent decades occurred in the 2023-2024 winter ([UNICEF, 2024](#)). The latest report suggests that this Dzud affected over 188,300 people, including 80,215 (40,830 girls and 39,385 boys), and even took the lives of twenty people, including two children ([UNICEF, 2024](#)). Domestic scholars and multilateral organizations have extensively studied the economic and socio-ecological impacts of this Dzud, with particular emphasis on 10.3 million livestock losses ([UNOCHA, 2024](#)), which are considered a critical disruption to the livelihoods of nomadic herders. However, little has been discovered about the psychological toll on young children and their contributing factors following the Dzud event. This gap is alarming as 47% of children in Dzud-affected areas previously exhibited signs of psychological distress and had higher school dropout rates ([ACAPS, 2021](#)). The review of the global literature also suggests that young children are especially vulnerable to various natural disasters due to their early developmental stage, and their disaster-induced distress can be further exacerbated by witnessing their caregiver’s stress and disruptions in their house and community ([Kousky et al., 2016](#)).

In an attempt to address these gaps, this study employed a retrospective cohort design with a mixed-methods approach to investigate the psychological effects of the 2023-2024 Dzud on children aged 3-6 years in Khentii and Arkhangai, two of the most severely Dzud-affected provinces, by analyzing 61 quantitative surveys and 14 qualitative interviews. In doing so, we also explored whether caregivers’ stress and household disruptions during Dzud are associated with children’s psychological outcomes, as established in the global literature.

Findings from this study will provide in-depth, practical data to inform both domestic and global policymakers, NGOs, and educators. Results of this research will also serve as a cornerstone for targeted mental health interventions for vulnerable herding households, the initiation of support programs, and disaster preparedness policies that include young children’s mental and physical well-being.

## 1.1. Research Questions

1. Do children aged 3-6 years exhibit signs of psychological difficulties after the 2023-2024 Dzud in Mongolia?

2. Was caregiver mental distress due to Dzud associated with children's psychological outcomes?
3. Were household disruptions (e.g., livestock loss, food shortages, displacement) during the 2023-2024 Dzud associated with reported psychological difficulties in children?

## 1.2. Research Hypothesis

**H1:** Dzud-affected children aged 3-6 years in Khentii and Arkhangai provinces will exhibit high levels of total emotional difficulties (TDS) as measured by the Strengths and Difficulties Questionnaire (SDQ), and the results will be relatively higher than the known Mongolian normative SDQ means.

**H2:** Dzud-affected caregivers will present elevated psychological distress as measured by the Depression, Anxiety, and Stress scale (DASS-21), which will be positively and strongly correlated with their children's psychological outcomes.

**H3:** Levels of household disruption, as measured by the Household Disruption Questionnaire (HDQ), during Dzud will significantly affect children's psychological outcomes, and household disruptions will be positively and strongly correlated with SDQ TDS.

## 2. LITERATURE REVIEW

This review synthesizes both domestic and global literature to identify crucial findings and insights on Dzud-related damage to herding communities, the effects of natural disasters on young children in the context of ECD, and the influence of household disruption and caregivers' mental health on children's psychological outcomes, while also identifying gaps in the literature. These topics were framed by [Bronfenbrenner's Ecological Theory \(1994\)](#) (**Figure 1**), which emphasizes the interconnected layers of the environment that influence early childhood development, including the microsystem, mesosystem, exosystem, and macrosystem.

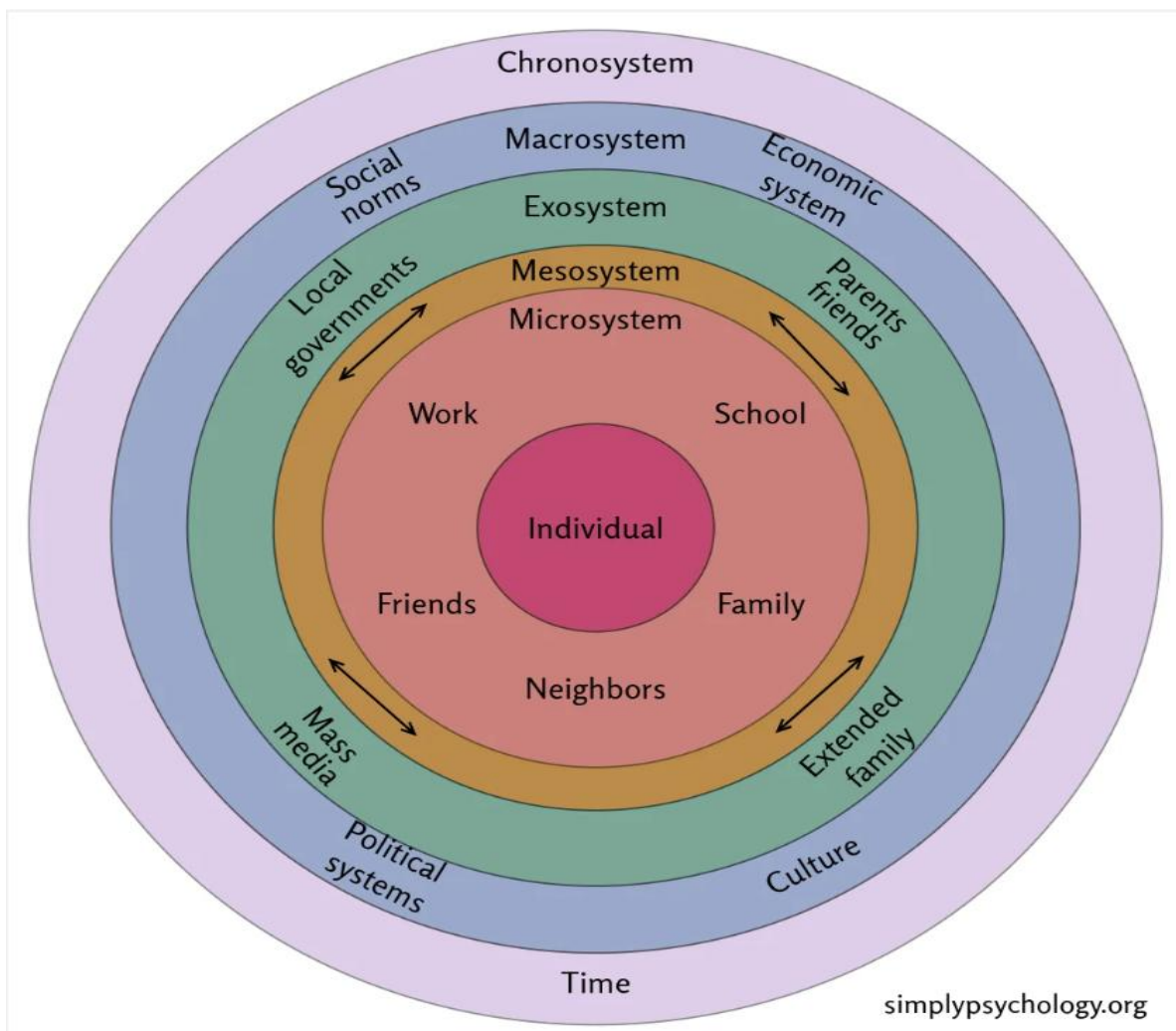


**Figure 1: Bronfenbrenner's Ecological Theory.** Source: [Guy-Evans, O \(2020\)](#). Bronfenbrenner's ecological systems theory. Simply Psychology. <https://www.simplypsychology.org/bronfenbrenner.html>

## 2.1. Dzud and Its Socio-economic and Health Impact on Nomadic Herding Communities (Macrosystem and Exosystem Contexts)

In Mongolia, the Dzud appears to be a frequent natural disaster, exacerbated by documented climate change and extreme weather conditions over the past 60 years, and it has been causing significant livestock loss and socio-economic difficulties, leading to a negative impact on household well-being along with the local and national economy ([Fernández-Giménez et al., 2012](#)). However, several other studies highlighted the Dzud's impact on herding households at scales far beyond the socio-ecological. According to [Erdenebileg et al. \(2018\)](#), the cumulative impact of repeated Dzud events increases herder families' vulnerability, leading to mass migration to urban areas and constituting the phenomenon referred to as "*pastoralist dropout*." This

phenomenon is defined as “a general trend of herder families being forced to displace their traditional residence and migrate to urban areas due to the livestock loss and increased barriers to social services during Dzud” ([Erdenebileg et al., 2018](#)). Another study by [Otani et al. \(2015\)](#) showed a positive correlation between nutritional deficiency, potentially caused by livestock loss and reduced dairy product intake among herding households, and the increased infant mortality rate during the Dzud period. Otani et al.’s (2015) study highlights the crucial public health implications of Dzud for herders, as epitomized by the infant mortality rate.

In light of [Bronfenbrenner’s Macrosystem theory \(1994\)](#), the nomadic lifestyle and social values rooted in household mobility and dependence on livestock shape their (herders’) resilience; however, this also leaves them vulnerable to disruptive natural disasters such as Dzud. Existing studies provide in-depth information and robust evidence on the displacement, health, and mortality implications of the Dzud disaster among herding communities.

## **2.2. Caregiver Mental Health and Household Disruptions as Contributors to Child Psychological Outcomes in Global Literature (Mesosystem and Microsystem)**

### **Household Disruption Mechanisms (Mesosystem)**

Among the Dzud-affected nomadic communities, livestock loss, displacement, food insecurity, and caregiving strains are perceived as significant household stressors. [UNOCHA \(2024\)](#) reported that the 2023-2024 Dzud resulted in the loss of about 10.3 million livestock, severely impacting herders’ household incomes and heightening food insecurity. These disruptions compel herding families to implement various coping mechanisms, including reduced household expenditure, dietary restrictions, and prolonged outdoor labor ([UNICEF, 2024](#)), thereby increasing the risk of social isolation and psychological distress. For young children, such household disruptions can destabilize their microsystem, affecting daily routines and caregiver availability, both of which are crucial to their emotional well-being ([Masten & Narayan, 2012](#)). Research on other disasters shows that household disturbances are linked to higher child anxiety and behavioral problems ([Kousky et al., 2016](#)). However, Dzud-specific studies rarely examine these effects on young children, focusing mainly on socio-economic losses or adult health outcomes. As a result, this gap limits understanding of how household stressors influence psychological health in Mongolia’s nomadic setting.

### **Caregiver Mental Health Link to Child Outcomes (Microsystem)**

[Bronfenbrenner’s Ecological Theory \(1994\)](#) posits that the microsystem, including the child’s immediate family, serves as a foundation for early psychological resilience and behavioral development. In the post-disaster context, caregivers’ mental health is among the most important factors influencing a child’s emotional and behavioral development ([Cobham et al., 2016](#); [Masten](#)

[& Narayan, 2012](#)). [Cobham et al. \(2016\)](#) also highlighted that the link between caregivers' and children's psychological outcomes after a disaster is well established, as evidence shows that parent distress is directly connected to predicting children's posttraumatic stress syndrome (PTSS). He examined pathways that increase children's vulnerability after a disaster, including, but not limited to, hostile parenting, increased anxiety, excessive or insufficient discussion of the disaster, conflicts within the family (involving children), and changes in family dynamics ([Cobham et al., 2016](#)). Similarly, [Bornheimer et al. \(2021\)](#) found a clear connection between caregiver stress and psychological issues in children, such as attention problems and Oppositional Defiant Disorder (ODD), among 287 caregiver/child pairs in New York City. Although [Bornheimer's \(2021\)](#) study did not provide specific data on natural disasters, it further reinforces the idea that caregivers' mental distress affects children's psychological outcomes. In the context of Dzud, caregivers face financial hardships due to heavy livestock losses, social isolation from severe weather, and exhaustion from long hours of outdoor labor in livestock management—all of which worsen their mental health and reduce the quality of their caregiving ([UNICEF, 2024](#)). However, domestic studies show limited evidence on the connection between caregiver mental health and children's psychological outcomes in Dzud-affected nomadic communities.

### **2.3. Psychological Disruption Pathways of Natural Disasters on Young Children in Global Literature (Children's Psychological Outcome).**

Despite extensive global research on the vulnerability and psychological effects of natural disasters on young children, as discussed in this paragraph, there remains a limited understanding of the psychological impact on children in post-dzud situations.

According to [Kousky et al. \(2016\)](#), natural disasters impact children in three interconnected areas: (1) "Physical Health" due to direct injury or malnutrition; (2) "Mental Health" potentially caused by damage to their home, property, and community, as well as increased caregiver mental distress; (3) "Educational Needs" resulting from post-disaster destruction, child labor, and displacement. This review will specifically examine the mental health impacts on young people after natural disasters that are somewhat similar to Dzud. Research indicates that children face a higher risk of post-traumatic stress disorder (PTSD) and behavioral issues following events like hurricanes, bushfires, and floods ([Kousky et al., 2016](#); [Masten & Narayan, 2012](#)). Furthermore, longitudinal studies after destructive natural disasters show that the prevalence of lifelong PTSD is evident in disaster-exposed children even during their adolescence ([Masten & Narayan, 2012](#)), highlighting the long-term cumulative impact of climate emergencies on young people. [Baran & Suicmez \(2024\)](#) argue that children exposed to natural disasters may display a wide range of responses in post-disaster settings, including psychological, psychophysiological, cognitive, and behavioral reactions. These frameworks include emotional distress (e.g., anxiety, fear, and grief), physiological disruptions (e.g., sleep and eating irregularities), cognitive difficulties (e.g., reduced

attention span and learning difficulties), and observable behavioral challenges (e.g., regression in development, expression of aggression, and withdrawal) ([Baran & Suicmez, 2024](#)). Furthermore, [Nagae & Nagano \(2023\)](#) studied the mental health of young children following the Kumamoto earthquake using the Strengths and Difficulties Questionnaire (SDQ) and found that children experienced significant psychological distress, with a substantial percentage scoring in the clinical range for conduct problems and hyperactivity even 15 months after the disaster.

The global literature suggests that young children exposed to various types of natural disasters tend to exhibit both short-term and long-term responses. These responses include, but are not limited to, PTSD, psychological, psycho-physiological, cognitive, and behavioral difficulties, as well as conduct problems and hyperactivity, as shown in the clinical survey. Despite the likelihood that Dzud events will become more frequent in the coming years ([Fernández-Giménez et al., 2012](#)), the current body of Dzud disaster impact studies in Mongolia lacks strong evidence on the psychological aftermath among young children and the factors that contribute to it.

## **2.4 Conclusion**

At the macro and exosystemic level, Mongolian herding communities, as a vulnerable social group, faced severe socio-economic and health implications due to Dzud in the past, including nutritional deficiencies, displacement, and higher mortality rates. The existing global studies further suggested that, within the micro and mesosystem, the caregiver's mental distress and recorded household disruptions were found to influence children's psychological outcomes. Furthermore, children exposed to a wide range of natural disasters within their microsystem are highly vulnerable to various psychological complications, such as PTSD, psychological, psycho-physiological, cognitive, and behavioral difficulties, as shown in the global disaster studies. However, upon reviewing both global and international literature, we found that these findings have not yet been applied to the Dzud context. Guided by [Bronfenbrenner's Ecological Systems Theory \(1994\)](#), this review emphasizes the need for targeted, in-depth research on the psychological effects of the 2023-2024 Dzud on young children, whilst exploring the relationship between children's outcomes and their contributing factors.

## **3. METHODOLOGY**

### **3.1. Study Design**

This study employed a retrospective cohort design with a mixed-method approach, collecting 61 quantitative survey responses and 14 qualitative semi-structured interviews in Khentii and Arkhangai provinces, 17 months after the 2023-2024 Dzud. This approach was selected for this study because it effectively examines the prevalence of Dzud-related psychological issues among

caregivers and their children, describes sample trends, and explores relationships between variables and Dzud exposure groups ([Figure 4](#)).

### 3.2. Study Site

The study sites, Khentii and Arkhangai, were selected for their high exposure to Dzud, significant livestock losses, and substantial child populations. Khentii is in north-eastern Mongolia (406 km from the capital), while Arkhangai is in north-western Mongolia (520 km from the capital) ([Figure 2](#)).

As of 2024, Khentii experienced livestock loss (39.7% of total livestock) due to Dzud, while Arkhangai accounted for 31.3% (Center for Policy Research Mongolia, 2024). This data shows that these provinces, the second (Khentii) and third (Arkhangai), are among the most Dzud-affected regions with high livestock losses, making them suitable disaster-exposed study sites. Furthermore, population data show that these provinces are highly dispersed, with 136,794 residents in Khentii (land area: 80,325 km<sup>2</sup>) and 94,205 residents in Arkhangai (land area: 55,300 km<sup>2</sup>) ([Association of North East Asia Regional Governments, n.d.](#)). The child population data in the selected provinces include 24,756 children (aged 0-14) in Khentii and 29,419 children (aged 0-14) in Arkhangai ([National Statistical Office of Mongolia, 2023](#); [Khentii Province Statistical Office, 2023](#)), providing sufficient participant numbers and accurate sampling for the study.

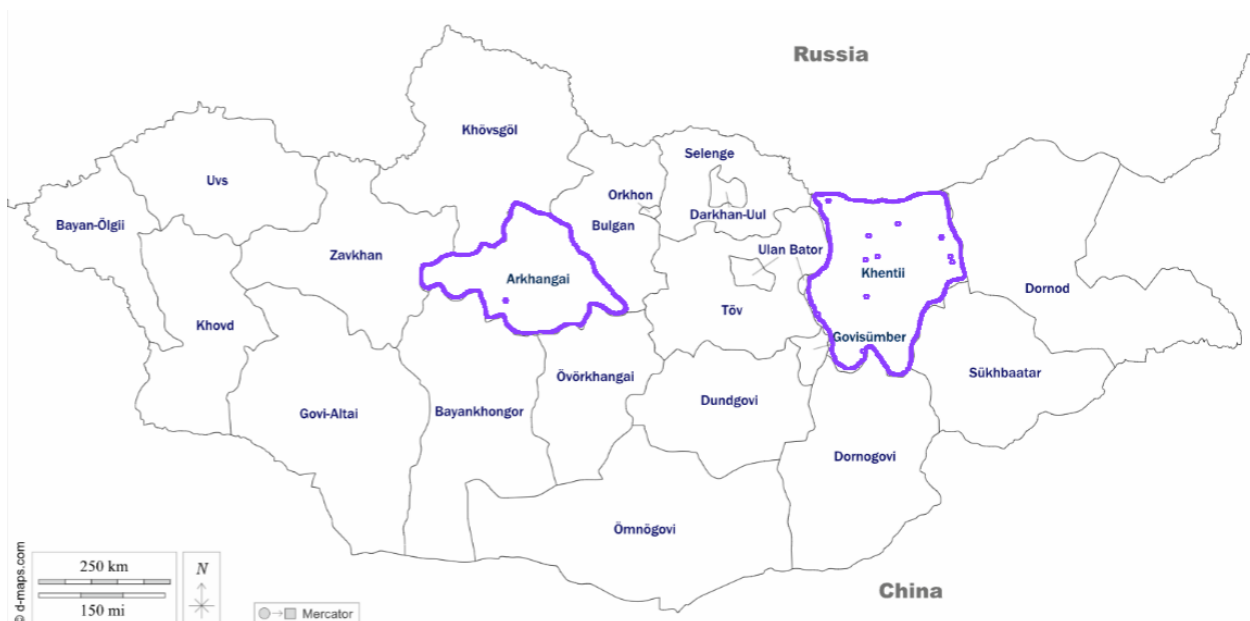


**Figure 2.** Map of Mongolia (Khentii and Arkhangai highlighted). Source: D-maps.com, <https://www.d-maps.com/m/asia/mongolie/mongolie/mongolie18.svg>

### 3.3. Population Size and Sampling

## Population Size

Herders make up about 35-40% of Mongolia's total population ([Gardelle & Zhao, 2019](#)). They maintain a nomadic lifestyle by living in yurts, traditionally known as *gers* in Mongolia, and grazing their livestock on the expansive grasslands of Mongolia's steppes ([The Asia Foundation, 2024](#)). Our study specifically focuses on roughly 188,300 herders, including 80,215 children affected by the 2023-2024 Dzud ([UNICEF, 2024](#)).

## Sampling

This research used nonprobability sampling to select participants. The eligibility criteria for children included exposure to Dzud, ages 3-6, and living with primary caregivers at research sites. For caregivers, eligibility criteria included Dzud exposure, a primary caregiving relationship with children, and records of living with their children during Dzud.

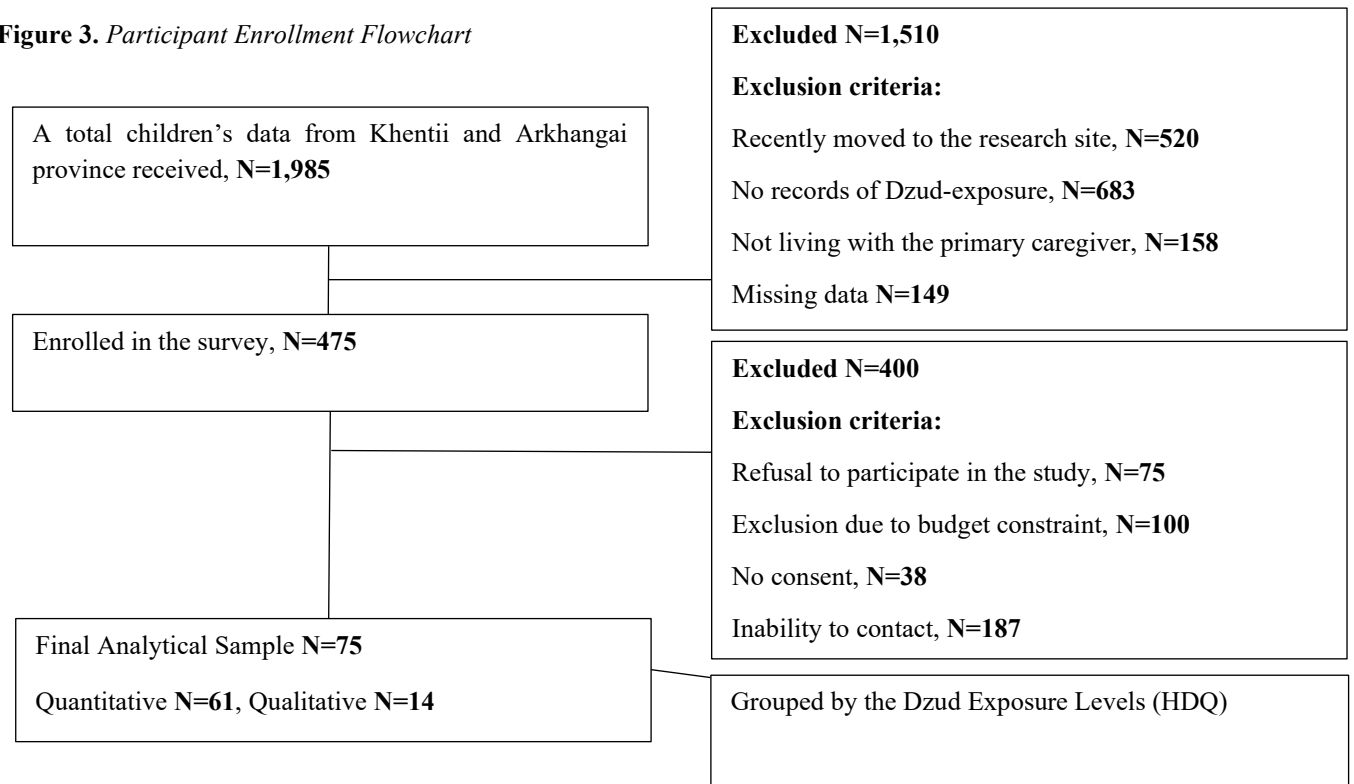
The Children and Family Development and Protection Agencies in Arkhangai and Khentii provided data on 1,985 children who met the study's initial eligibility criteria. After multiple rounds of elimination<sup>1</sup> following the exclusion criteria<sup>2</sup>, as shown in [Figure 3](#), we recruited 75 children aged 3-6, represented by their primary caregivers, in Khentii and Arkhangai for the survey and data analysis.

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<sup>1</sup> The rounds of elimination were conducted through (1) reviewing background information of each individual, provided by the Children and Family Development and Protection Agencies, and (2) mobile outreach to confirm the eligibility status and personal information.

<sup>2</sup> The first-round exclusion was determined through a simple "YES or NO" questionnaire conducted by mobile outreach to confirm the candidate's records of living in Dzud-affected regions, and their relationship with the targeted age group of children (whether the candidate is the primary caregiver of children). The second round of exclusion included a research participation consent questionnaire administered via mobile outreach and research budget constraints to access participants in isolated regions.

**Figure 3. Participant Enrollment Flowchart**



### 3.4. Instruments

|                            | <b>SDQ</b>                                                                                                                               | <b>DASS-21</b>                                                    | <b>HDQ</b>                                           |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------|
| <b><i>Purpose</i></b>      | Measure the psychological difficulties of children affected by Dzud                                                                      | Measure the psychological distress of caregivers affected by Dzud | Measure household disruptions in herding communities |
| <b><i>Respondent</i></b>   | Caregivers of children                                                                                                                   | Caregivers of children                                            | Caregivers of children                               |
| <b><i>Version used</i></b> | 2-4 years old version was used by 3 years old participants; 4-17 years old versions were used by 4-6 years old participants <sup>3</sup> | Single versions (shortened version of DASS-41)                    | Custom-developed <sup>4</sup>                        |

<sup>3</sup> The 2-4 year-old version of the SDQ is scored the same way as the 4-17 year-old versions (Goodman et al., 1997). Therefore, we combined the two age groups of the SDQ by adjusting the wording of items 18 and 22 from the Conduct Difficulties scale and item 21 from the Hyperactivity scale to make them suitable for 3-year-old children.

<sup>4</sup> HDQ was developed as no 2023-2024 Dzud-specific tools were available for assessing household disruptions

|                        | <b>SDQ</b>                                                                                                                                                                                                                                                                                       | <b>DASS-21</b>                                                                                         | <b>HDQ</b>                                                                                                                                                      |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Structure</b>       | 25 items, 5 subscales (5 items each)                                                                                                                                                                                                                                                             | 21 items across three scales, with each scale containing 7 items                                       | 16 items and 6 domains: livestock loss (2), food insecurity (3), displacement (2), access to basic services (2), caregiver burden (4), and social isolation (3) |
| <b>Scoring details</b> | <p>Subscale total score is the sum of each of the five items (with 0-2 points)</p> <p>The total difficulties score (TDS) is the sum of 4 subscale difficulties, except the prosocial subscale.</p>                                                                                               | A total score for each scale is calculated by multiplying the sum of 7 items (0-3 points each) by two. | Total score summed across all domains. <sup>5</sup>                                                                                                             |
| <b>Banding</b>         | A Mongolian context-validated normative SDQ scores from <a href="#">Aoki et al. (2021)</a> were used with a TDS mean of 12.9 (SD=4.8) and higher cutoff scores (TDS 0-16 Normal, 17-19 Borderline, 20-40 Abnormal) than the international standards ( <a href="#">see Annex 1</a> ) <sup>6</sup> | International cut-off scores were used for banding ( <a href="#">see Annex 2</a> )                     | Total score for categorizing Dzud exposure levels: 0-20 for low exposure, 20-29 for moderate exposure, and 29-40 for high exposure                              |
| <b>Validation</b>      | <a href="#">Becker et al., 2004</a> ; <a href="#">Nagae &amp; Nagano, 2023</a>                                                                                                                                                                                                                   | <a href="#">Lovibond &amp; Lovibond (1995)</a> .                                                       | Pilot testing, institutional review, and criterion validity (F=16.38, p<.001) <sup>7</sup>                                                                      |

<sup>5</sup> Individual domains were not scored separately because the number of questions and conditional-response questions remained consistent across the food insecurity and displacement subdomains. Total scores across all domains were summed to categorize Dzud exposure levels

<sup>6</sup> We selected this normative banding because it is the first clinically reliable Mongolian-validated SDQ, and they closely examined the accuracy of international banding in Mongolia using ROC curves.

<sup>7</sup> We pilot-tested HDQ with three herding families from Khentii, and local experts from the Mongolian National Institute for Educational Research evaluated its cultural appropriateness and content relevance. Additionally, HDQ exposure levels significantly predicted SDQ outcomes (F=16.38, p<.001), supporting the tool's validation.

### 3.5. Data Collection Procedure

A researcher administered the surveys (SDQ, DASS-21, and HDQ) by phone (n=50) and in person (n=11) in Ulaanbaatar to Dzud-affected caregivers of children aged 3-6<sup>8</sup>. The semi-structured interviews (n=14) were conducted during field visits to the Arkhangai and Khentii provinces. The data were collected 17 months after the 2023-2024 Dzud disaster, and informed consent was obtained from all participants before data collection.

The study's purpose, survey content, voluntary participation, procedures, and participant rights were thoroughly explained to participants at the start of each data collection session. For telephone surveys, the researcher read the questions and answer options aloud and instructed participants to respond verbally. In-person survey collection in Ulaanbaatar city took place at a local high school facility, following the same process: procedures were explained, paper surveys were distributed, and surveys were later collected ([Picture 1](#)). Additionally, field visits followed the same procedures, and semi-structured interviews were conducted in Mongolian at the research sites, lasting an average of 15-20 minutes. All interviews were audio-recorded with participants' consent and later transcribed ([Picture 2](#)).



**Picture 1.** *In-person Setup Survey Collection in Ulaanbaatar*

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<sup>8</sup> These data collection methods were chosen owing to the difficulties in visiting scattered herding families, research budget limits, participants' preferences, and the displaced status of eligible participants.



**Picture 2.** Field Visit for Semi-structured Interviews (Khentii Province)

\*Photos were taken and used with participant consents

### 3.6. Statistical Analysis

All quantitative analyses were performed using SPSS version 31.0.0.0, with statistical significance set at  $p < 0.05$ . To assess the children's psychological difficulties, SDQ scores were categorized into Normal, Borderline, and Clinical ranges based on the banding scheme of [Aoki et al. \(2021\)](#). Relatedly, caregivers' DASS-21 scores were categorized into Normal, Mild, Moderate, and Severe ranges based on [Lovibond & Lovibond \(1995\)](#) banding. HDQ total scores were used to categorize participants into three Dzud exposure groups: Low, Moderate, and High. For qualitative analysis, interview audio recordings were transcribed into Mongolian using Chimege Writer 2022 and analyzed on the Taguette web-based platform ([Figure 4](#)).

| Hypothesis          | Descriptive (Including Categorization)                                                     | Inferential analysis (Excluding Correlations)                                                                                                                  | Pearson Correlations |
|---------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <i>Hypothesis-1</i> | (1) Each SDQ subdifficulty variable was computed, and the normal distribution was assessed | A one-sample t-test was conducted using the sample's SDQ TDS and the known Mongolian TDS normative mean of 12.9 reported by <a href="#">Aoki et al. (2021)</a> | X                    |

| Hypothesis                        | Descriptive (Including Categorization)                                                                                                                                                                                                                                                                                                                                                                                                                        | Inferential analysis (Excluding Correlations)                                              | Pearson Correlations                                                                      |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
|                                   | (2) To categorize SDQ scores, a crosstabulation was performed. Categorized SDQ scores were then stratified by gender                                                                                                                                                                                                                                                                                                                                          |                                                                                            |                                                                                           |
| <i>Hypothesis-2</i>               | <p>(1) Each DASS-21 scale was computed, and the normal distribution was assessed</p> <p>(2) To categorize the DASS-21 scales, a simple cross-tabulation was conducted, which was stratified by province</p>                                                                                                                                                                                                                                                   | X                                                                                          | Pearson correlation analysis was conducted between all three DASS-21 scales and SDQ TDS.  |
| <i>Hypothesis-3</i>               | <p>(1) HDQ total scores were initially analyzed to assess the appropriateness of their distributions</p> <p>(2) Based on the sample's total score distribution, visual binning was used to categorize</p>                                                                                                                                                                                                                                                     | A one-way ANOVA was performed to compare SDQ TDS scores across other Dzud-exposure groups. | A Pearson correlation analysis was conducted between the six HDQ domains and the SDQ TDS. |
| <i>Semi-structured interviews</i> | The researcher inductively coded interview transcripts, identifying recurring patterns and trends in the answers. The codes were then grouped into broader themes, including household disruption, the child's emotional and behavioral observations, and the caregiver's distress following the Dzud. Thematic findings relevant to each hypothesis were integrated with quantitative results to provide context and explanations for the observed patterns. |                                                                                            |                                                                                           |

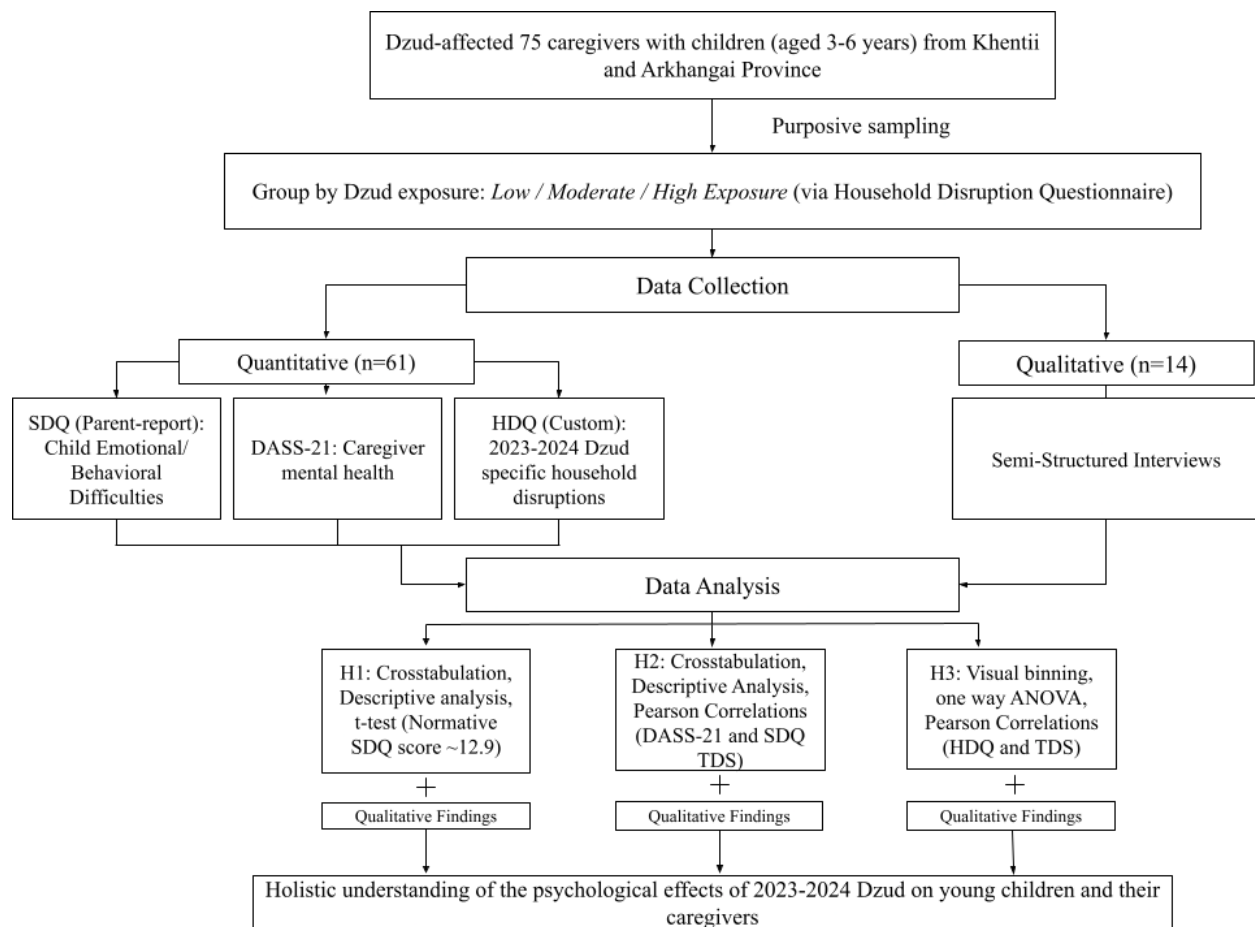


**Figure 4.** *Research Design and Data Analysis Framework*

## 4. RESULTS

### 4.1. Demographic characteristics

As shown in [Table 1](#), participants came from diverse backgrounds across the targeted provinces of Arkhangai (49.2%;  $n=30$ ) and Khentii (50.8%;  $n=31$ ). The gender distribution among children was 30 males (49.2%) and 31 females (50.8%), with ages ranging from 3 to 6 years ( $M = 4.36$ ,  $SD = 1.02$ ). Notably, the 5-year-old age group (36.1%;  $n=22$ ) was the largest, while 6-year-olds (13.1%;  $n=8$ ) had the lowest participation. Caregiver relationships with the target children showed that the majority were the biological parents (78.7%). Furthermore, stratifying the variables by total HDQ score, which was distributed into three Dzud exposure groups, revealed that the majority of children aged 3 years (43.8%) and 4 years (46.7%) experienced moderate Dzud exposure, while most 5-year-olds were in the high-exposure group. Female children (35.5%) had higher Dzud exposure than Male children (26.7%). Additionally, Khentii province had a significantly higher Dzud exposure rate (45.2%) than Arkhangai (16.7%).

**Table 1. Demographic Characteristics of Participants**

|                                        | Exposure Low<br>(34.4%) |       | Exposure<br>Moderate<br>(34.4%) |      | Exposure High<br>(31.1%) |      | Total ( $n = 61$ ) |      |
|----------------------------------------|-------------------------|-------|---------------------------------|------|--------------------------|------|--------------------|------|
|                                        | $n$                     | %     | $n$                             | %    | $n$                      | %    | $n$                | %    |
| Child age ( $M = 4.36$ , $SD = 1.02$ ) |                         |       |                                 |      |                          |      | s                  |      |
| 3                                      | 3                       | 18.8  | 7                               | 43.8 | 6                        | 37.5 | 16                 | 26.2 |
| 4                                      | 5                       | 33.3  | 7                               | 46.7 | 3                        | 20.0 | 15                 | 24.6 |
| 5                                      | 8                       | 36.4  | 5                               | 22.7 | 9                        | 40.9 | 22                 | 36.1 |
| 6                                      | 5                       | 62.5  | 2                               | 25.0 | 1                        | 12.5 | 8                  | 13.1 |
| Child gender                           |                         |       |                                 |      |                          |      |                    |      |
| Male                                   | 9                       | 30.0  | 13                              | 43.3 | 8                        | 26.7 | 30                 | 49.2 |
| Female                                 | 12                      | 38.7  | 8                               | 25.8 | 11                       | 35.5 | 31                 | 50.8 |
| Province                               |                         |       |                                 |      |                          |      |                    |      |
| Arkhangai                              | 15                      | 50.0  | 10                              | 33.3 | 5                        | 16.7 | 30                 | 49.2 |
| Khentii                                | 6                       | 19.4  | 11                              | 35.5 | 14                       | 45.2 | 31                 | 50.8 |
| Caregiver relationship                 |                         |       |                                 |      |                          |      |                    |      |
| Biological parent                      | 18                      | 37.5  | 17                              | 35.4 | 13                       | 27.1 | 48                 | 78.7 |
| Siblings                               | 1                       | 100.0 | 0                               | 0.0  | 0                        | 0.0  | 1                  | 1.6  |
| Grandparents                           | 2                       | 22.2  | 3                               | 33.3 | 4                        | 44.4 | 9                  | 14.8 |
| Other                                  | 0                       | 0.0   | 1                               | 33.3 | 2                        | 66.7 | 3                  | 4.9  |

*Note.* The study had a total sample size of 61, with 0 missing values.

#### 4.2. Hypothesis-1

##### Children's Emotional and Behavioral Difficulties (Sample SDQ Score and Comparison with Mongolian Normative Mean)

[Table 2](#) summarizes the SDQ scores and shows that our sample's Total Difficulties Score (TDS) has a mean of 19.15 and a standard deviation of 5.97, which falls within the borderline range ([Aoki et al., 2021](#); [Annex 1](#)). This TDS indicates an elevated risk of clinically significant emotional

and behavioral difficulties among Dzud-affected children. When TDS scores were categorized, the majority (57.4%;  $n=35$ ) of participants were classified in the clinical range, indicating an uneven distribution with a concentration toward the elevated range. Subscale difficulty scores suggest that conduct difficulty was the most elevated ( $M=3.95$ ,  $SD=2.01$ ), with 65.6% of participants falling within the clinical range. Additionally, stratifying SDQ scores by gender revealed that female children had the highest proportion of clinical-range scores in TDS (61.3%;  $n=19$ ) and emotional difficulties (48.4%;  $n=15$ ), whereas male children had higher clinical-range scores in conduct difficulties (70.0%;  $n=19$ ).

As shown in [Table 3](#), comparing the sample's SDQ TDS with the Mongolian normative value ( $M=12.9$ ,  $SD=4.8$ ) ([Aoki et al., 2021](#)) yielded a mean difference of 6.25 (95% CI [4.72, 7.78]). This indicated that our sample's TDS was significantly higher than Mongolia's normative TDS. Furthermore, Cohen's  $d$  (1.05) indicated a large effect size, indicating a clinically meaningful difference.

In semi-structured interviews, participants generally reported that their children exhibited noticeable emotional and behavioral changes following the 2023-2024 Dzud. Our qualitative thematic analysis revealed trends of conduct difficulties and social withdrawal as the main emotional and behavioral issues observed in children, consistent with the SDQ descriptive findings. These patterns were illustrated by a parent's quote (Mother, ID: Khe\_\_056, residing in Khentii):

*"... During Dzud, I had to care for our livestock by myself while taking care of my 3-year-old boy. The winter of 2024 was extremely tough, during which we faced heavy livestock losses due to heavy snowfall and ice cover. I had to bring my boy all the way to our winter settlement, where we feed the livestock, because there was no one at our home to look after him. Because the outside was unbearably cold and dangerous for young children to roam around, I often left him in the car for extended periods without enough food or water while I was working. My child often became unusually angry at that time and had severe temper tantrums with others. Even after the Dzud, he still sometimes shows intense hot tempers, struggles to express himself to those around him, prefers to play alone in his kindergarten, and does not follow what I say at all..."*

**Table 2. SDQ Descriptive Analysis**

|                                                                        |                  |  |  | All<br>( <i>n</i> = 61) |      | Male<br>( <i>n</i> = 30) |      | Female<br>( <i>n</i> = 31) |      |
|------------------------------------------------------------------------|------------------|--|--|-------------------------|------|--------------------------|------|----------------------------|------|
|                                                                        |                  |  |  | <i>N</i>                | %    | <i>N</i>                 | %    | <i>N</i>                   | %    |
| Total difficulty score<br>(TDS)<br>( <i>M</i> =19.15, <i>SD</i> =5.97) | Normal range     |  |  | 17                      | 27.9 | 10                       | 33.3 | 7                          | 22.6 |
|                                                                        | Borderline range |  |  | 9                       | 14.8 | 4                        | 13.3 | 5                          | 16.1 |
|                                                                        | Clinical range   |  |  | 35                      | 57.4 | 16                       | 53.4 | 19                         | 61.3 |
| Emotional difficulties<br>( <i>M</i> =5.70, <i>SD</i> =2.56)           | Normal range     |  |  | 28                      | 45.9 | 16                       | 53.3 | 12                         | 38.7 |
|                                                                        | Borderline range |  |  | 6                       | 9.8  | 2                        | 6.7  | 4                          | 12.9 |
|                                                                        | Clinical range   |  |  | 27                      | 44.3 | 12                       | 40.0 | 15                         | 48.4 |
| Conduct difficulties<br>( <i>M</i> =3.95, <i>SD</i> =2.01)             | Normal range     |  |  | 13                      | 21.3 | 6                        | 20.0 | 7                          | 22.6 |
|                                                                        | Borderline range |  |  | 8                       | 13.1 | 3                        | 10.0 | 5                          | 16.1 |
|                                                                        | Clinical range   |  |  | 40                      | 65.6 | 21                       | 70.0 | 19                         | 61.3 |
| Hyperactivity<br>( <i>M</i> =5.57, <i>SD</i> =1.91)                    | Normal range     |  |  | 40                      | 65.6 | 23                       | 76.7 | 17                         | 54.8 |
|                                                                        | Borderline range |  |  | 12                      | 19.7 | 2                        | 6.7  | 10                         | 32.3 |
|                                                                        | Clinical range   |  |  | 9                       | 14.8 | 5                        | 16.7 | 4                          | 12.9 |
| Peer difficulties<br>( <i>M</i> =3.92, <i>SD</i> =1.89)                | Normal range     |  |  | 35                      | 57.4 | 16                       | 53.3 | 19                         | 61.3 |
|                                                                        | Borderline range |  |  | 13                      | 21.3 | 8                        | 26.7 | 5                          | 16.1 |
|                                                                        | Clinical range   |  |  | 13                      | 21.3 | 6                        | 20.0 | 7                          | 22.6 |
| Prosocial<br>( <i>M</i> =6.79, <i>SD</i> =1.89)                        | Normal range     |  |  | 47                      | 77.0 | 24                       | 80.0 | 23                         | 74.2 |
|                                                                        | Borderline range |  |  | 8                       | 13.1 | 5                        | 16.7 | 3                          | 9.7  |
|                                                                        | Clinical range   |  |  | 6                       | 9.8  | 1                        | 3.3  | 5                          | 16.1 |

**Table 3. One-Sample *t*-test Results of Comparing SDQ Total Difficulties Score with Normative Mean**

| Variable                       | <i>t</i> | Sample<br><i>M</i> | <i>SD</i>     | <i>M</i> diff. | <i>df</i> | Sig. (2-<br>tailed) | Cohen's<br><i>d</i> | <i>CI</i> |      |
|--------------------------------|----------|--------------------|---------------|----------------|-----------|---------------------|---------------------|-----------|------|
| Total difficulties score (TDS) | 8.17     | 19.15              | 5.97<br>(.76) | 6.25           | 60        | <.001               | 1.05                | 4.72      | 7.78 |

*Note.* The Mongolian normative mean value was set at 12.9 ([Aoki et al., 2021](#)). Statistical significance was set at  $p < 0.05$

### 4.3. Hypothesis 2

#### Caregiver Mental Distress

The DASS-21 descriptive analysis showed that caregivers affected by Dzud experienced increased mental distress, with most participants exhibiting moderate anxiety (31.1%; n=19) and depression (32.8%; n=20). Aside from a balanced distribution in the stress scale (36.1%; n=22 in the normal range), anxiety and depression scales were unevenly distributed toward the moderate-to-extremely severe levels. This indicates that anxiety and depression were the main psychological distress symptoms among caregivers in Dzud-affected areas. Furthermore, when DASS-21 scores were broken down by province, participants from Khentii had higher scores in the moderate-to-severe range across all three scales than those from Arkhangai ([Table 4](#)).

When respondents were asked to share their stressful experiences during and after the Dzud disaster, each response was categorized into the following themes: depression, increased anxiety about the future, and hopelessness. One respondent (Mother, ID: Khe\_\_058, living in Khentii province) described her lived experience related to the Dzud exposure:

*"... We lost nearly 80-90% of our livestock within two or three months. We worked so hard for over 10 years to raise 400 animals from nothing and almost lost them all in such a short time [...] During Dzud, when we woke up in the morning, we saw that over 40 cows had died overnight in the winter building, and we spent the whole morning pulling their bodies out and burying them. It was unimaginably hard for us, especially when we thought about our children's future and how we would feed ourselves, since we had lost our only source of income [...] I could not sleep most nights, worrying about our family's future. My husband had an even tougher time because he developed alcoholism after the Dzud, and he often said something negative like our lives are already over, and we have nothing left..."*

**Table 4. DASS-21 scores Cross-Analysed by Province**

|                                                               |                  | Province              |       |                     |       | All      |       |
|---------------------------------------------------------------|------------------|-----------------------|-------|---------------------|-------|----------|-------|
|                                                               |                  | Arkhangai<br>(n = 30) |       | Khentii<br>(n = 31) |       | (n = 61) |       |
|                                                               |                  | N                     | %     | N                   | %     | N        | %     |
| <b>Stress</b><br>( <i>M</i> = 17.31,<br><i>SD</i> = 7.21)     | Normal           | 17                    | 56.7% | 5                   | 16.1% | 22       | 36.1% |
|                                                               | Mild             | 6                     | 20.0% | 7                   | 22.6% | 13       | 21.3% |
|                                                               | Moderate         | 4                     | 13.3% | 11                  | 35.5% | 15       | 24.6% |
|                                                               | Severe           | 3                     | 10.0% | 8                   | 25.8% | 11       | 18.0% |
| <b>Anxiety</b><br>( <i>M</i> = 13.38,<br><i>SD</i> = 7.55)    | Normal           | 8                     | 26.7% | 5                   | 16.1% | 13       | 21.3% |
|                                                               | Mild             | 5                     | 16.7% | 1                   | 3.2%  | 6        | 9.8%  |
|                                                               | Moderate         | 8                     | 26.7% | 11                  | 35.5% | 19       | 31.1% |
|                                                               | Severe           | 2                     | 6.7%  | 4                   | 12.9% | 6        | 9.8%  |
|                                                               | Extremely severe | 7                     | 23.3% | 10                  | 32.3% | 17       | 27.9% |
| <b>Depression</b><br>( <i>M</i> = 17.87,<br><i>SD</i> = 8.37) | Normal           | 7                     | 23.3% | 2                   | 6.5%  | 9        | 14.8% |
|                                                               | Mild             | 8                     | 26.7% | 1                   | 3.2%  | 9        | 14.8% |
|                                                               | Moderate         | 9                     | 30.0% | 11                  | 35.5% | 20       | 32.8% |
|                                                               | Severe           | 4                     | 13.3% | 9                   | 29.0% | 13       | 21.3% |
|                                                               | Extremely severe | 2                     | 6.7%  | 8                   | 25.8% | 10       | 16.4% |

*Note.* Normative banding of [Lovibond, S.H. & Lovibond, P.F. \(1995\)](#) was used.

### **Association of Caregivers' Mental Stress with Children's Psychological Outcomes.**

The results of the Pearson correlation analysis between the DASS-21 subscales and the SDQ TDS are presented in [Table 5](#). Significant positive correlations were found among all variables, with the strongest being between TDS and the DASS-21 stress scale ( $r = .611, p < .001$ ). Additionally, the depression scale showed a strong correlation with TDS ( $r = .595, p < .001$ ), while the anxiety scale indicated a moderate correlation ( $r = .384, p = .002$ ). Based on these findings, caregiver stress and anxiety are most likely associated with children's psychological difficulties.

In the thematic analysis of interviews, caregivers actively described their significantly worsened mental state caused by Dzud. However, they were relatively hesitant to share whether

any reciprocal emotional or behavioral responses from children in response to their distress and Dzud had been observed. A parent (Father, ID: Ark\_\_025, living in Arkhangai) further offered detailed insight into a pattern by sharing his personal experiences during Dzud:

*“...Interviewers’ rapport:*

*In connection to your own mental distress during Dzud, do you think it somehow affected your own child’s mental and behavioral well-being? If so, could you share with us the specific behavioral and emotional changes you observed in your child in connection with your distress?*

*Interviewee response:*

*I am not that sure about that. Well, during Dzud, I rarely spent time at my home and looked after my children as I was busy digging out of the snow and feeding the livestock. [...] of course, we have experienced a serious financial loss due to Dzud, and to make things worse, we got completely cut off from the nearest village administration due to the heavy snowfall. It made us really nervous, and I, in particular, was in despair over the loss of my livestock, which I have worked so hard to grow, and what I will do from now on. Because of that stress, I had trouble communicating with my wife, and we argued often. At the time, our children were not in the best state either. They could not sleep at night, cried frequently, and often behaved mischievously. We are not really sure if Dzud or our mental stress directly caused such changes in our children. We did not pay much attention, as we thought this was how children behave, after all. The most concerning thing was our financial burden...”*

**Table 5.** *Pearson Correlation of SDQ Total Difficulties Score and DASS-21 Subscale Scores*

| Variables                       | 1               | 2               | 3               |
|---------------------------------|-----------------|-----------------|-----------------|
| 1. SDQ total difficulties score |                 |                 |                 |
| 2. DASS-21 stress               | .611**<br><.001 |                 |                 |
| 3. DASS-21 anxiety              | .384**<br>.002  | .657**<br><.001 |                 |
| 4. DASS-21 depression           | .595**<br><.001 | .779**<br><.001 | .533**<br><.001 |

*Note.* All correlations were statistically significant at the  $p < 0.05$  level.

#### 4.4. Hypothesis-3

##### Difference of Children's Psychological Outcomes Across Dzud Exposure Groups

As shown in [Table 6](#), SDQ TDS varied significantly across the three Dzud exposure groups (Low, Moderate, High),  $F(2, 58) = 16.38, p < .001$ . An effect size was measured using omega squared ( $\omega^2 = .34$ ), indicating a large effect size and suggesting that approximately 34% of the variance in SDQ TDS is explained by Dzud exposure group levels. This result indicates that levels of Dzud exposure have had a significant impact on the children's psychological difficulties as measured by SDQ.

**Table 6.** *One-way ANOVA Analysis Result Between Dzud Exposure Groups and SDQ Total Difficulties Scores*

|                | <i>SS</i> | <i>df</i> | Mean Square | <i>F</i> | <i>p</i> | $\omega^2$ |
|----------------|-----------|-----------|-------------|----------|----------|------------|
| Between groups | 773.16    | 2         | 386.58      | 16.38    | <.001    | .34        |
| Within groups  | 1368.52   | 58        | 23.60       |          |          |            |
| Total          | 2141.67   | 60        |             |          |          |            |

*Note.* Statistical significance was set at  $p < 0.05$ .

##### Association of Dzud Household Disruptions with Children's Psychological Outcomes

An analysis of the association between HDQ subscales and SDQ TDS showed positive correlations across all variables, as presented in [Table 7](#). Specifically, HDQ social isolation ( $r = .472, p < .001$ ) and caregiver burden ( $r = .411, p = .001$ ) had the strongest links with TDS, suggesting primary mechanisms of household disruptions affecting children's psychological outcomes. Other HDQ subdomains, such as food insecurity ( $r = .356, p = 0.005$ ) and livestock loss ( $r = .361, p = 0.004$ ), were also significantly correlated with TDS. In contrast, Displacement ( $r = .205, p = .113$ ) and basic service access ( $r = .249, p = .053$ ) showed weaker correlations.

The thematic analysis indicated a pattern in which caregivers generally believed that livestock loss, household isolation, and the challenges of nurturing negatively affected their children's mental well-being during Dzud. This framework was developed by reviewing each participant's responses to identify overlapping themes, while considering dzud exposure, livestock loss, and the consistency of the stories with participants' lived experiences. One parent (Father, ID: Khe\_\_060, living in Khentii) shared his household disruption caused by Dzud and his children's reactions:

*"...Interviewer's rapport: Could you please share with me what specific household challenges your family faced during Dzud?"*

*Interviewee's response:*

*[...] I think one of the biggest challenges for us was the isolation. There was no way we could help or get help from our neighbors a couple of kilometers away because the heavy snow reached 2 or 3 meters in height. An ordinary vehicle had no use to mobilize in that snow, nor the horse or motorcycle. It was extremely isolating, as only five of us (she and her husband, and her three young children, ages 2, 3, and 6) were surrounded by deep snow, with nowhere to go and no one to meet with. As you can imagine, the regular food supply or hospital access was completely cut off for two or three months at the beginning of 2024, and our children were extremely vulnerable as they experienced livestock loss, extreme coldness without enough warmth, and parents' shock of the disaster..."*

**Table 7.**

*Pearson Correlation Analysis Result of HDQ Domains and SDQ Total Difficulties Score*

| Variables                       | 1               | 2             | 3             | 4               | 5            | 6            |
|---------------------------------|-----------------|---------------|---------------|-----------------|--------------|--------------|
| 1. SDQ Total difficulties score |                 |               |               |                 |              |              |
| 2. HDQ Livestock loss           | .361**<br>.004  |               |               |                 |              |              |
| 3. HDQ Food insecurity          | .356**<br>.005  | 0.07<br>0.61  |               |                 |              |              |
| 4. HDQ Social isolation         | .472**<br><.001 | .327*<br>0.01 | .290*<br>0.02 |                 |              |              |
| 5. HDQ Displacement             | .205<br>.113    | -0.12<br>0.36 | 0.22<br>0.1   | 0.233<br>0.071  |              |              |
| 6. HDQ Basic service access     | .249<br>.053    | .268*<br>0.04 | .287*<br>0.03 | .342**<br>0.007 | 0.2<br>0.12  |              |
| 7. HDQ Caregiver burden         | .411**<br>.001  | 0.19<br>0.15  | 0.25<br>0.05  | 0.245<br>0.057  | 0.24<br>0.07 | 0.05<br>0.72 |

*Note.* Statistical significance was set at  $p < 0.05$ .

## 5. Discussion and Recommendations

### 5.1. Child Psychological Outcomes (SDQ findings)

The current findings of Hypothesis 1 indicate that the sample experienced increased emotional and behavioral distress, as shown by the SDQ. Among the five SDQ subscales, the conduct scale had the highest prevalence in our sample, with over 65.6% of participants falling within the clinical range. Additionally, when comparing the sample's SDQ TDS scores with the Mongolian normative mean, we observed that children affected by Dzud were more likely to have elevated emotional and behavioral difficulties than non-Dzud-affected children.

The following SDQ findings align well with established research on the psychological effects of various natural disasters on children. Specifically, our SDQ results showed that young children exposed to Dzud experienced significant psychological stress, aligning with studies by [Masten & Narayan \(2012\)](#) and [Nagae & Nagano \(2023\)](#). The higher SDQ scores relative to community norms further support the idea that Dzud has a negative psychological impact on young children in nomadic households. This also offers the insight that Dzud, like other hydrological or geological disasters, can affect young children's mental health despite its gradual and disruptive nature. The prevalence of conduct difficulties as a primary psychological symptom is consistent with [Baran & Suicmez's \(2024\)](#) argument. Despite the young age of the sample and parents' limited observations, children consistently showed aggression, temper tantrums, rule-breaking, and disobedience, helping us identify potential primary diagnostic indicators of slow-onset disasters in Mongolia.

### 5.2. Caregiver Mental Health (DASS-21 findings) and Caregiver-Child Relationship (Correlation)

The findings of Hypothesis 2 indicate that Dzud-affected caregivers experienced significant psychological distress, as evidenced by the DASS-21 Anxiety and Depression scale. These descriptive findings were further supplemented by the thematic analysis of interviews, which pointed to depression, increased anxiety about the future, and hopelessness as the primary psychological issues caused by Dzud in caregivers. Additionally, parental psychological problems were found to be positively linked to children's psychological outcomes.

The descriptive findings from the DASS-21 reveal the negative psychological effects of Dzud on caregivers and herders. Although the emotional impact on herders after the Dzud disaster has been overlooked in existing domestic studies, our findings highlight the specific mental health pathways—such as depression, increased anxiety about the future, and hopelessness—that Dzud causes in caregivers.

Moreover, the correlational findings between DASS-21 and SDQ TDS reinforced [Bronfenbrenner's Ecological Theory \(1994\)](#). In line with this theory, which emphasizes the microsystem's foundational role in early childhood development, the positive relationship

between herders' emotional states and their children's psychological outcomes supported the theoretical expectation. It was a primary factor influencing children's psychological well-being. Furthermore, our findings suggest that the stress and depression experienced by caregivers after the Dzud can be seen as significant psychological challenges that markedly affect children's emotional well-being in nomadic household settings.

### **5.3. Dzud Exposure Impact and Household Disruption Mechanisms (HDQ)**

The findings of Hypothesis 3 include household disruption levels measured by the HDQ, which indicated a significant impact on children's psychological outcomes. The HDQ subscale difficulties were linked to the SDQ TDS, with social isolation and caregiver burden identified as key mechanisms.

The literature review confirmed that many household disruptions are major stressors affecting both children's and caregivers' mental health. Similarly, in our study, disruptions related to the Dzud and levels of exposure likely influence the severity of children's psychological outcomes, consistent with [Bronfenbrenner's Ecological Theory \(1994\)](#). This suggests that, alongside caregiver mental health, household disruptions can serve as a pathway for assessing young children's well-being. Moreover, the mechanisms by which household disruption impacts children's psychological health, identified in our research, include social isolation and caregiver stress. These findings match the [UNICEF \(2024\)](#) report; herding families used various coping strategies to deal with the Dzud disruptions, which increased their risk of social isolation and psychological distress, ultimately harming their children's emotional well-being. Social isolation was especially significant, considering that the Dzud's nature segregates basic social services for herders and the remote communal structures they depend on, as mentioned in our interviews. In such isolated settings, children are particularly vulnerable and more prone to emotional and behavioral issues ([Kousky et al., 2016](#)). In the context of the Dzud, herders faced serious livestock losses, reduced income, food insecurity, and the need for disaster response. As a result, caregivers' mental stress was an inevitable outcome of the Dzud disruptions, which ultimately affected children's psychological health.

### **5.4. Limitations & Strengths**

The strengths of this study include a mixed-method design that contextualizes quantitative data with lived experiences from semi-structured interviews, ensuring the findings align with herders' experiences during and after the Dzud. Additionally, we developed a household disruption questionnaire specific to the 2023-2024 Dzud, enabling precise capture of household difficulties during the Dzud and their association with children's psychological well-being. Furthermore, applying [Bronfenbrenner's Ecological Theory \(1994\)](#) when interpreting the results provided a theoretical framework that enhanced the study's findings by illustrating how environmental factors influence children's psychological outcomes.

Although this study's findings offer crucial insights into the psychological impact of Dzud on young children and its links to caregivers' stress and household disruptions, several limitations remain. These include a small sample size, retrospective cohort design, parent-report bias, and recall bias in the post-Dzud period.

The sample size of 75 participants was chosen based on the participant enrolment process ([Figure 3](#)), research budget limitations, and participant accessibility. The limited number of research participants limits how broadly we can apply the findings on the psychological impact of Dzud on young children and its contributing factors to the over 188,300 people affected by the 2023-2024 Dzud ([UNICEF, 2024](#)). However, this study aims to provide initial evidence of Dzud's psychological impact rather than to draw population-wide conclusions

This research employed a retrospective cohort design and, as a result, lacked pre-Dzud baseline data to accurately compare the present results with the past and identify the disaster's effects. This lack of comparative data may yield findings linked to stressors unrelated to Dzud. Furthermore, we collected data at a single point in time, which prevented us from establishing causality between the variables.

Reporting bias may have occurred because the main respondents to our survey were caregivers of children aged 3-6 years. When we used the parent-report SDQ, some caregivers admitted to being inattentive to their children's emotions, suggesting the risks of under- or overreporting. Additionally, the DASS-21 findings showed that most caregivers experienced increased distress, which could influence how they perceive and report their children's behavior. However, this limitation suggests an imperative, given that 3-6-year-old children are unable to self-report.

The data were collected approximately 1 year and 5 months after the 2023-2024 Dzud event. Therefore, some participants had difficulty recalling the specific Dzud-related difficulty that colored their current mental state. This may have occurred due to memory distortion over time, in which caregivers shape their past Dzud-related memories based on present events. This limitation was especially significant in DASS-21 findings, as some caregivers may unconsciously attribute their current psychological distress to Dzud when other irrelevant factors may have contributed.

## **5.5. Recommendations**

In light of the research findings, we recommend a holistic, risk-based mental health response program ([Figure 5; Annex 3](#)) to minimize Dzud's psychological impact on vulnerable children and to be later integrated into disaster risk management policy. It is also recommended that governmental organizations, NGOs, mental health organizations, and practitioners collaborate to prevent further psychological and social complications in vulnerable young children and their caregivers in the event of future Dzud disasters. The detailed description of the holistic risk-based

mental health response approach was given in [Annex 3](#), along with resource allocation and potential constraints.

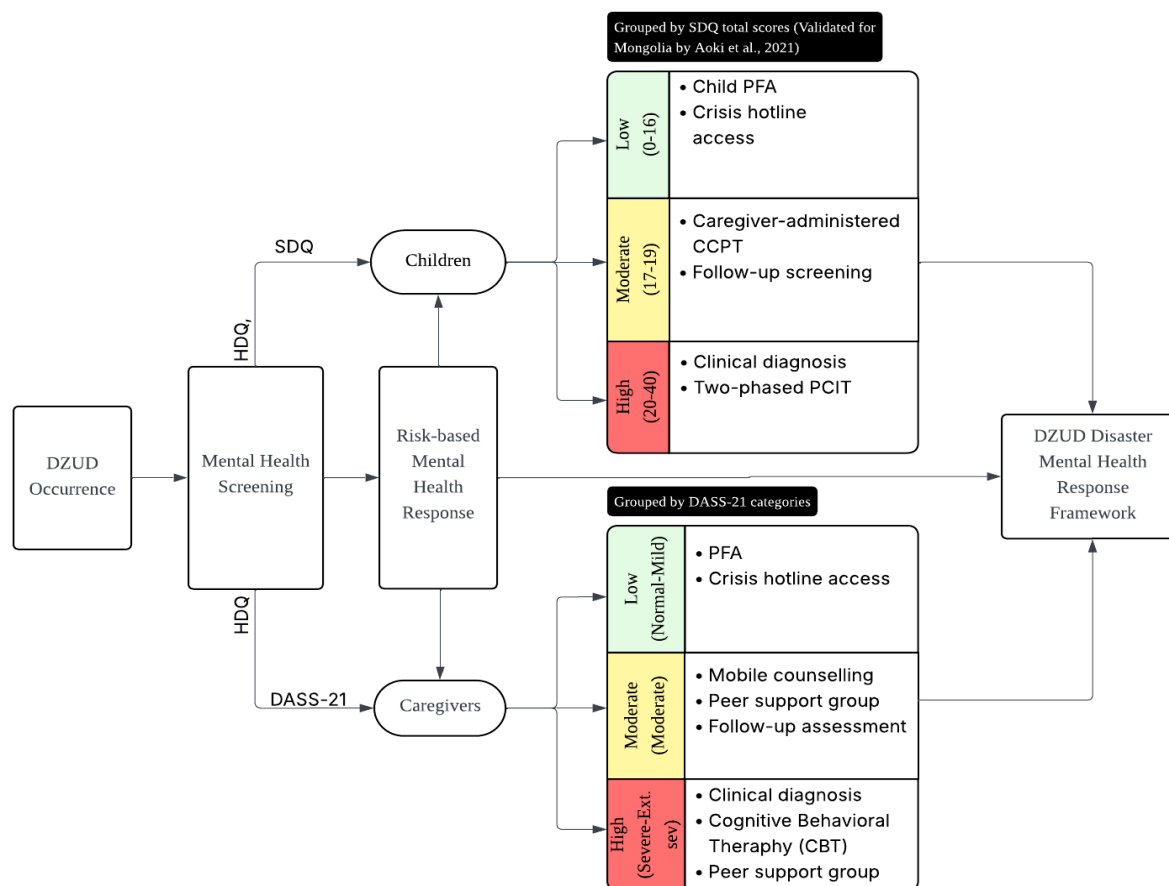


**Figure 5.** A holistic Risk-based Mental Health Response Recommendation Model

## 6. Conclusions

This study applied [Bronfenbrenner's Ecological Theory \(1994\)](#) in a nomadic disaster context for the first time, demonstrating that disruptions to children's primary environment influence their emotional and behavioral outcomes. In light of this application, dzud causes psychological harm to young children and their caregivers in nomadic households, and our study provides the first empirical evidence of this previously hypothesized idea. In particular, children exposed to the 2023-2024 Dzud exhibit increased emotional and behavioral difficulties, and when compared with the normative mean data, the Dzud-affected children showed clinically elevated results. Likewise, caregivers of these children also experienced significant emotional distress, which was strongly correlated with their children's outcomes. Furthermore, household disruptions, especially social isolation and caregiver burden, and their severity were found to worsen children's psychological outcomes. Although there are several limitations, including a small sample size and a retrospective

cohort design, the findings contribute to existing knowledge of Dzud and its harmful impact on herding communities in Mongolia, particularly among young children. The recommendations from this study support practical risk-based early intervention programs for Dzud-exposed children and mental health support for their parents, as well as the establishment of structured mental health response frameworks for future Dzud disasters.

Future research should focus on conducting longitudinal studies that assess children's psychological consequences in greater depth using clinical tools in the post-Dzud context to identify causal and contributing factors. Larger, representative samples should be used to conduct psychological studies across other provinces in Mongolia to establish pre-Dzud mental health data for herders and their children. As Dzud disasters continue to worsen and become more frequent due to climate change, protecting the psychological well-being of Mongolia's youngest individuals and their parents, who are guardians of the country's unique nomadic culture, must become an urgent national and international priority.

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## ANNEX 1

### *SDQ Normative banding*

| SDQ Variables              | Mongolia     |               |              | UK           |              |              |
|----------------------------|--------------|---------------|--------------|--------------|--------------|--------------|
|                            | Normal       | Borderline    | Abnormal     | Normal       | Borderline   | Abnormal     |
| Total difficulties score   | 0-16 (78.5%) | 17-19 (12.0%) | 20-40 (9.5%) | 0-13 (82.1%) | 14-16 (8.2%) | 17-40 (9.8%) |
| Emotion Subscale           | 0-5 (80.5%)  | 6 (9.8%)      | 7-10 (9.8%)  | 0-3 (80.8%)  | 4 (7.8%)     | 5-10 (12.4%) |
| Conduct Subscale           | 0-2 (72.2%)  | 3 (15.5%)     | 4-10 (12.3%) | 0-2 (76.4%)  | 3 (10.9%)    | 4-10 (12.7%) |
| Hyperactivity subscale     | 0-6 (81.3%)  | 7 (8.3%)      | 8-10 (10.4%) | 0-5 (77.9%)  | 6 (7.4%)     | 7-10 (14.7%) |
| Peer relationship subscale | 0-4 (83.7%)  | 5 (8.8%)      | 6-10 (7.5%)  | 0-2 (78.0%)  | 3 (10.2%)    | 4-10 (11.7%) |
| Prosocial subscale         | 6-10 (85.4%) | 5 (8.5%)      | 0-4 (5.7%)   | 8-10 (79.5%) | 7 (10.0%)    | 0-6 (10.6%)  |

*Note.* The Mongolian normative banding, compared with international standards, was developed by [Aoki et al. \(2021\)](#).

## ANNEX 2

### *Dass-21 Normative Banding*

| Categories       | Depression | Anxiety | Stress |
|------------------|------------|---------|--------|
| Normal           | 0-9        | 0-7     | 0-14   |
| Mild             | 10-13      | 8-9     | 15-18  |
| Moderate         | 14-20      | 10-14   | 19-25  |
| Severe           | 21-27      | 15-19   | 26-33  |
| Extremely Severe | 28+        | 20+     | 34+    |

*Note.* Source: [Lovibond, S.H. & Lovibond, P.F. \(1995\)](#). Manual for the Depression Anxiety & Stress Scales. (2nd Ed.) Sydney: Psychology Foundation.

## ANNEX 3.

### *A Holistic Risk-based Mental Health Response Program Description* ([Figure 5](#))

#### 1. Mental Health Screening for Dzud-affected households

It is highly recommended for local government organizations and educational institutions to implement mandatory mental health screening for herders in rural Mongolia following the Dzud event.

- **Tools:** HDQ was recommended for use alongside “Accelerated Dzud Risk Assessment,” which is currently employed in provincial administrative offices, to evaluate difficulties faced by Dzud-affected households as a factor affecting children’s mental health. Meanwhile, the SDQ and DASS-21 are recommended instruments for assessing the mental health of children and caregivers.
- **Mobile outreach:** Due to the widely spread nomadic households in rural Mongolia, it is advised to carry out these interventions through mobile outreach.
- **Banding and risk classifications:** (1) When conducting the SDQ, it is recommended to use Mongolian context-validated banding ([Aoki et al., 2021](#)) to score TDS for determining psychological difficulty risk levels (Low, Moderate, and High), (2) When administering DASS-21 to caregivers, the use of normative banding and categorization ([Lovibond & Lovibond, 1995](#)) is also advised to classify risk levels of Dzud-affected caregivers.

#### 2. Risk-based Mental Health Response for Children

##### Low risk

- **Child Psychological First Aid (PFA):** Children who are classified as low risk for developing psychological difficulties must receive PFA services to stabilize their emotional and behavioral development, foster emotional resilience, and prevent Dzud-induced psychological issues.
- **Crisis hotline access:** The public mental health hotline services are recommended to establish a Dzud-specific crisis hotline to advise herder caregivers on communicating with their children, thereby reducing psychological risks and providing guidance on post-disaster caregiving practices.

##### Moderate risk

- **Child-Centered Play Therapy (CCPT):** Children at moderate risk are advised to receive CCPT to reduce emotional distress and regulate behaviors. Given the difficulty in reaching herding families, it is also recommended that psychologists train and supervise caregivers through mobile outreach to administer CCPT to their children.

- **Follow-up screening:** Specialists are expected to conduct follow-up screening for children with moderate risks using SDQ and HDQ.

### High risk

- **Clinical diagnosis:** For children at high risk, it is recommended that local psychologists and behavioral therapists further evaluate severe cases through mobile outreach, in collaboration with local administrative and healthcare facilities.
- **Parent-child Interaction Therapy (PCIT):** Young children aged 3-6 exhibiting higher levels of clinical distress are recommended to undergo two-phase PCIT therapy, as conduct problems are identified as the primary behavioral symptoms. Psychotherapists and behavior specialists from NGOs and the National Center for Mental Health are advised to conduct standard 1-hour PCIT sessions over 4-10 weeks through regular outreach visits or at local hospitals, educational, and administrative facilities, as appropriate.

## 3. Risk-based Mental Health Response for Caregivers

### Low risk

- **Psychological First Aid (PFA):** Caregivers identified as low risk must receive PFA services to reduce mental distress caused by livestock loss and prolonged labor, and to help manage emotions following livelihood disruptions.
- **Crisis hotline:** Low-risk caregivers are recommended to be advised to call the Dzud-specific crisis hotline for receiving support in herding animals during severe winter conditions, supporting young children in climate emergencies, and promoting healthy coping strategies amid Dzud disruptions.

### Moderate risk

- **Mobile counseling:** Mental health specialists should offer mobile counseling services to caregivers with moderate risks due to difficulty accessing health services in rural Mongolia. The counselors should provide psychological support, reduce social isolation, and help prevent the development of severe psychological issues.
- **Peer support group:** Social workers and local mental health specialists are recommended to establish a peer support group among the moderate-risk caregivers. Led by the specialists, the group should aim to provide a mental space for herders to process the economic crisis, livelihood disruptions, and social isolation, while helping herders manage anxiety, hopelessness, and signs of depression.
- **Follow-up screening:** Specialists are expected to conduct follow-up screening for parents with moderate risks using DASS-21 and HDQ.

### High risk

- **Clinical diagnosis:** Local psychologists and behavioral therapists are recommended to conduct clinical examinations for high-risk caregivers through mobile outreach, utilizing local administrative and healthcare facilities
- **Cognitive Behavioral Therapy (CBT):** Psychotherapists and behavior specialists from NGOs and the National Center for Mental Health are recommended to conduct standard 6-20 weeks of CBT for high-risk caregivers to treat depression, anxiety, and improve emotional health.
- **Peer support group:** Caregivers with high risks are also recommended to participate in a peer support group, led by the social workers and local mental health specialists.

#### 4. Dzud disaster mental health support response framework establishment

- **Policy Integration:** The government's Dzud-disaster preparedness protocols, mitigation measures, disaster risk management policies, and aid packages should include the elements of Dzud Disaster Mental Health Support, such as Psychological First Aid (PFA), to reduce initial distress among vulnerable children and caregivers effectively, meet basic mental health needs, and promote emotional well-being.
- **Dzud-disaster Mental Health Support System:** To reduce the psychological impact of the Dzud on young children, all relevant stakeholders should work together to establish a strong mental health support system for nomadic herders. This should include the steps mentioned earlier, such as systematically maintaining mental health screening and coordinated risk-based response programs, and fostering a culturally adapted and geographically appropriate mental healthcare network in rural Mongolia.

#### 5. Resource Allocation and Constraints

- **Government grants:** It is recommended that relevant government agencies (such as the National Emergency Management Agency and the Ministry of Labor and Social Protection) allocate adequate funding for comprehensive mental health response programs for herding households impacted by Dzud and provide financial incentives for private entities, practitioners, psychologists, and specialists who collaborate with these initiatives.
- **Multilateral Donors:** Local NGOs and Mental Health Associations of Mongolia should consider developing grant proposals to multilateral donor agencies to secure funding for Dzud-disaster mental health support programs targeting herding communities in rural Mongolia. Additionally, implementing organizations may seek technical assistance from donor agencies to effectively deliver high-impact, tailored programs in the Mongolian context.
- **Resource constraints:** Although access to mental health facilities and specialists remains largely concentrated in urban areas, leaving rural regions with shortages of the mental health workforce ([WHO, 2006](#)). Therefore, we recommend cost-effective alternatives to

Mental Health Associations and clinics, such as training community social workers and support personnel to deliver basic psychological support and therapeutic services under the supervision of qualified specialists.