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Religious–Spiritual Stability, Coping Continuity, and Psychological Distress Among Caregivers During COVID-19: A Regularized Network Analysis of Longitudinal Correlations

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ABSTRACT

Caregivers experienced substantial psychological strain during the first year of the COVID-19 pandemic, while religious and spiritual resources were frequently invoked as possible supports for coping. The present study asks a question that is different from directional mediation: when all repeatedly measured constructs are considered simultaneously, which associations remain conditionally connected across the six-month observation period? The analytic input was a published nine-variable correlation matrix for 549 caregivers assessed in May, September, and November 2020. The matrix included initial pandemic disruption, religion/spirituality at the first and third assessments, positive coping at all three assessments, and psychological distress at all three assessments. An extended Bayesian information criterion graphical lasso was used to estimate a sparse Gaussian graphical model. The primary penalty setting retained 22 of 36 possible edges; 13 had an absolute regularized partial correlation of at least 0.05. The conditional structure was dominated by temporal continuity within religion/spirituality ($\rho = 0.901$), coping ($\rho = 0.326$–0.455), and distress ($\rho = 0.203$–0.470). Distress and coping remained inversely connected within every assessment ($\rho = -0.106$ to -0.155). In contrast, marginal religion/spirituality–coping associations attenuated to $|\rho| \leq 0.022$ after simultaneous conditioning. Initial disruption retained conditional links with concurrent distress ($\rho = 0.301$) and November distress ($\rho = 0.138$). The matrix remained positive definite, and all selected edges persisted across 200 perturbations bounded by the reported three-decimal rounding intervals. These findings indicate that temporal stability and the contemporaneous distress–coping relation constitute the principal conditional architecture of the published correlations. They do not establish causal direction and do not invalidate mediation estimates obtained from participant-level longitudinal models. Instead, they identify which relations are unique at the aggregate correlation level and which are largely shared with repeated measurements of the same constructs.

Keywords: caregivers; COVID-19; religion and spirituality; positive coping; psychological distress; Gaussian graphical model; regularized partial correlation

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1. INTRODUCTION

The first year of the COVID-19 pandemic imposed multiple demands on caregivers at the same time. School closures, remote employment, interruption of health and social services, reduced informal childcare, financial uncertainty, illness, and separation from relatives were not isolated events; they often accumulated within the same household. Reviews conducted during the early pandemic documented elevated psychological distress across populations, although prevalence estimates varied with sampling, measurement, and the phase of public-health restrictions.[1,2] Parents and other adults responsible for children faced a distinctive combination of personal anxiety and responsibility for maintaining routines, schooling, safety, and emotional regulation within the family. National and community studies consequently reported deteriorating parental well-being, greater caregiving burden, and close correspondence between adult distress and perceived child difficulties.[3–6]

Caregiver mental health is consequential beyond the individual. Family processes transmit stress through daily exchanges, changes in emotional availability, conflict, and the organization of routines. Pandemic-related disruption could therefore affect children indirectly through the functioning of the adult who coordinates care. A family-systems account of the pandemic emphasized that economic, social, relational, and psychological pressures operate together rather than as separable exposures.[7] Research on loss and family resilience likewise described adaptation as an unfolding process in which meaning, hope, flexibility, and relational support may coexist with persistent adversity.[8] This perspective is important because it does not treat a low distress score as the only marker of successful adjustment. The capacity to maintain useful responses under continuing pressure may have its own temporal pattern and may retain meaningful associations with mental health after the magnitude of disruption is considered.

Positive coping occupies a central position in this literature. The term refers here to perceived capacity to adapt, persist, recover, remain focused, and locate workable responses when circumstances are difficult. It overlaps with resilience but should not be interpreted as an immutable personal trait. Resilience research has consistently warned against attributing adaptation solely to individual strength when social conditions distribute exposure and resources unequally.[9] Economic hardship, social support, community resources, and caregiving conditions shape whether coping capacities can be expressed.[10] The ten-item Connor–Davidson scale provides a concise assessment of perceived ability to recover and persist;[11,12] however, its interpretation depends on the analytic question. Scores may represent relatively stable self-appraisals, time-varying responses to adversity, or a mixture of both. Longitudinal analysis is therefore needed to distinguish continuity from relations that are specific to one assessment.

Religion and spirituality offer another possible resource for adaptation. Religious beliefs can supply meaning, continuity, ritual, social identity, and perceived support, while spiritual commitments may provide a language for hope and transcendence. Clinical and population research has found associations between religious involvement and several health outcomes, but the direction and magnitude are heterogeneous.[13] Positive religious coping can help a person reinterpret uncontrollable events, whereas religious struggle, perceived punishment, guilt, conflict, and exclusion can intensify distress.[14,15] Disaster research similarly indicates that religious resources are neither universally protective nor uniformly harmful; their implications depend on beliefs, practices, social context, and the form of coping they activate.[16,17]

The pandemic made these distinctions especially relevant. Global internet-search behavior showed an abrupt rise in prayer-related activity as COVID-19 spread, suggesting that many people turned toward religious practice under uncertainty.[18] Survey evidence from Palestine linked positive religious coping with lower perceived stress and fewer depressive symptoms, although the cross-sectional design could not establish temporal order.[19] Among Portuguese health-care workers, spirituality and religiosity did not display identical relations with COVID-19 fear and anxiety, illustrating the cost of treating them as interchangeable.[20] A United States survey also showed that adults used diverse strategies, including active coping, distraction, and emotional support, in response to pandemic stressors.[21] Together, these studies support examination of religious, spiritual, coping, and distress variables as an interdependent set rather than as a single unidirectional chain.

Measurement further complicates interpretation. The Kessler-10 captures nonspecific psychological distress with strong emphasis on anxiety and depressive symptoms.[22] Broad religion/spirituality inventories combine beliefs, practices, perceived relationships with the sacred, and subjective spiritual identity, whereas instruments such as the Religious Commitment Inventory or Brief RCOPE distinguish other dimensions.[23] When broad composite measures are correlated, an observed coefficient may reflect several shared processes. Self-report administration can add common response tendencies, and repeated measures introduce substantial construct-specific stability.[24] A marginal correlation between religion/spirituality and coping may consequently arise from a direct relation, indirect routes through earlier coping, connections with distress, stable personal differences, or combinations of these pathways.

Traditional longitudinal mediation models are well suited to testing a prespecified directional sequence. They estimate whether an earlier predictor relates to a later mediator and whether that mediator relates to a subsequent outcome while accounting for selected prior variables. A different question concerns conditional architecture: which pairs remain associated after

every other variable in the measured system is held constant? This question can be addressed through a Gaussian graphical model. In such a model, variables are nodes and edges are partial correlations. An absent edge means that two variables are conditionally independent under the multivariate Gaussian model, given all other included variables. Network representations have been used to examine systems of mutually related psychological variables without requiring every association to be assigned in advance to a single latent cause.[25–27] They are particularly useful for separating strong marginal associations from relations that remain unique after correlated measurements are considered simultaneously.

Network analysis does not automatically provide causal explanation. A cross-sectional or correlation-level edge is not an intervention effect, and centrality does not identify a treatment target by itself. Methodological work has emphasized that the meaning of an edge depends on variable selection, measurement quality, temporal design, regularization, and the distinction between within-person and between-person variation.[28,34] Nevertheless, a carefully delimited network analysis can clarify the covariance structure that a causal account must explain. It can show whether religion/spirituality remains connected to coping after repeated coping and distress measurements are conditioned, whether disruption has a unique relation to later distress, and whether the middle assessment occupies a connective position between initial and final states.

The present study analyzes the published correlation matrix for a three-wave caregiver cohort. Its research question is: *After simultaneous conditioning on pandemic disruption, repeated religion/spirituality, repeated positive coping, and repeated psychological distress, which temporal and cross-domain associations remain materially connected?* Four expectations guide interpretation without imposing edge directions. First, repeated assessments of the same construct should retain the largest positive connections because stable individual differences contribute to religion/spirituality, coping, and distress. Second, coping and distress should remain negatively connected within each assessment. Third, the initially positive marginal associations between religion/spirituality and coping may attenuate when earlier and later scores of both coping and distress are conditioned. Fourth, initial pandemic disruption should remain most closely connected to distress, reflecting the concentration of economic, relational, and health-related pressures captured by the disruption scale. The analysis answers these expectations using regularized partial correlations, node predictability, cross-domain connectivity, and a numerical sensitivity test tailored to the rounding of the published matrix.

2. MATERIALS AND METHODS

2.1. Analytic material and sample

The analytic input was the correlation matrix reported for the Child Resilience and Managing Pandemic Emotional Distress in Families cohort.[40] The cohort included 549 caregivers recruited through Prolific in Australia, Canada, the United Kingdom, and the United States. Participants were adults with child-rearing responsibilities for at least two children residing in the household for at least part of the time. The reported mean caregiver age was 41.33 years ($SD = 6.33$); 67.8% identified as female, and 72.3% were classified as White/European or White/North American. Assessments occurred in May 2020 (T1), September 2020 (T2), and November 2020 (T3). Only published aggregate coefficients were accessed. No participant-level records, identifiers, item responses, country indicators, attrition files, or missing-data patterns were available for this analysis.

The nine nodes were pandemic disruption at T1; religion/spirituality at T1 and T3; positive coping at T1, T2, and T3; and psychological distress at T1, T2, and T3. Table 1 presents the symmetric correlation matrix used for estimation. Its smallest eigenvalue was 0.0692 and its condition number was 58.84. These values confirmed that the rounded matrix was positive definite and invertible, while also indicating substantial collinearity arising primarily from repeated measures of the same constructs.

The matrix shows pronounced marginal continuity: religion/spirituality correlated at 0.924 across T1 and T3, coping correlations ranged from 0.753 to 0.791, and distress correlations ranged from 0.693 to 0.765. Coping and distress were negatively correlated both within and across assessments. The high density of these marginal relations makes pairwise interpretation difficult because a single coefficient does not indicate whether the relation survives conditioning on the remaining seven variables.

2.2. Measures represented in the matrix

Pandemic disruption was assessed at T1 with the 16-item COVID-19 Family Stressor Scale. Items addressed financial debt, working from home while meeting family demands, emotional withdrawal, and separation from relatives or loved ones. Responses were summed, and the reported internal consistency was 0.83. The disruption score was included only at T1, so its later connections should be interpreted as associations with the initial accumulation of household stressors rather than as effects of changing disruption.

Religion/spirituality was represented by 14 items adapted from the Brief Multidimensional Measure of Religiousness/Spirituality. Nine items assessed beliefs, four assessed practices, and one assessed spirituality. The composite had reported internal consistency of 0.96 and was administered at T1 and T3. Because religiosity and spirituality were combined, the node represents their

Table 1. Published correlations

Variable	1	2	3	4	5	6	7	8	9
1. Disruption T1	1.000								
2. R/S T1	0.047	1.000							
3. Distress T1	0.545	-0.067	1.000						
4. Coping T1	-0.197	0.188	-0.448	1.000					
5. Distress T2	0.457	-0.040	0.742	-0.387	1.000				
6. Coping T2	-0.148	0.192	-0.388	0.781	-0.449	1.000			
7. Distress T3	0.472	-0.043	0.693	-0.429	0.765	-0.446	1.000		
8. Coping T3	-0.194	0.156	-0.408	0.753	-0.396	0.791	-0.487	1.000	
9. R/S T3	0.083	0.924	-0.046	0.156	-0.047	0.195	-0.068	0.183	1.000

R/S = religion/spirituality. The nominal sample size used for information-criterion calculations was 549.

shared composite score; the analysis cannot separate institutional practice, private devotion, spiritual identity, positive religious coping, or religious struggle.

Positive coping was measured at all three assessments with the ten-item Connor–Davidson scale. Items concern adaptation to change, persistence, recovery after hardship, focus under pressure, and the capacity to perceive strength or humor during adversity. The reported internal consistency was 0.92. Although the instrument is frequently labeled a resilience measure, the cohort investigators operationalized it as positive coping. This manuscript retains that operational definition while recognizing that the measure includes relatively enduring self-appraisals and a faith-related component.

Psychological distress was measured at all three assessments using the Kessler-10. The items ask how often respondents experienced symptoms closely related to depression and anxiety during the previous 30 days. Higher values indicate greater nonspecific distress. The reported internal consistency was 0.93. The network treats the composite score as a continuous variable and does not infer clinical diagnosis.

2.3. Gaussian graphical estimation

Let $\mathbf{R}$ denote the 9×9 published correlation matrix and let $\mathbf{\Theta} = \mathbf{\Sigma}^{-1}$ denote a precision matrix. Under a multivariate Gaussian model, the partial correlation between variables i and j, conditioning on every other node, is

$$\rho_{ij \cdot -ij} = -\frac{\theta_{ij}}{\sqrt{\theta_{ii}\theta_{jj}}}. \tag{1}$$

The coefficient in Equation 1 measures the remaining linear association after the other seven variables have been held constant. It is undirected: the same edge connects i to j and j to i. Tutorials on psychological networks recommend partial-correlation models when the analytic purpose is to display conditional rather than marginal relations.[29,30]

Direct inversion of a highly correlated sample matrix can produce numerous unstable nonzero partial correlations. The graphical lasso addresses this problem by estimating a positive-definite precision matrix while imposing an ℓ_1 penalty on off-diagonal elements.[31] Larger penalties set more edges to zero. Candidate penalties from 0.008 to 0.050 were evaluated in increments of 0.001. Selection used the extended Bayesian information criterion,

$$\mathrm{EBIC}_\gamma = -2\ell(\widehat{\mathbf{\Theta}}) + |E| \log N + 4\gamma |E| \log p, \tag{2}$$

where ℓ is the Gaussian log-likelihood, $|E|$ is the number of retained edges, $N = 549$, $p = 9$, and γ controls the additional penalty for model complexity. The primary analysis used $\gamma = 0.50$, a conservative setting commonly employed for psychological networks, and repeated selection at $\gamma = 0$ and 0.25.[32,33] The diagonal precision terms were not counted as edges because they are present in every candidate model.

Two distinctions were applied to the resulting coefficients. A *selected edge* was any off-diagonal partial correlation not reduced to zero by the graphical lasso. A *material edge* had $|\rho| \geq 0.05$. The second threshold was not used for statistical significance; it prevented visual emphasis of coefficients whose magnitudes were negligible even though the penalized algorithm retained them. Every selected coefficient remains available in the project results file.

2.4. Node summaries

Strength was calculated as the sum of the absolute regularized partial correlations incident on a node. Expected influence was the signed sum. Because centrality indices can be misleading when interpreted as causal importance, neither quantity was described as an intervention ranking.[35] Cross-domain strength was defined as the sum of absolute edges connecting a node to nodes outside its measurement domain. Four domains were used: disruption, religion/spirituality, coping, and dis-

tress. For disruption, which had one node, every incident edge was necessarily cross-domain; its value is therefore descriptive but not directly comparable with the repeated domains. Bridge summaries were included to identify where coping, distress, and religion/spirituality remained conditionally linked after their internal stability connections were removed.[36]

Node predictability was computed from the regularized precision matrix as

$$R_i^2 = 1 - \frac{1}{\theta_{ii}}, \tag{3}$$

because all variables had unit variance in the correlation matrix. This value represents the proportion of a node's variance accounted for by all other nodes under the fitted Gaussian model.[37] High predictability does not imply that the node is easily changed; it indicates that the node is closely reconstructed from the remaining variables.

2.5. Sensitivity to rounding and reporting boundaries

Published coefficients were rounded to three decimal places. To determine whether edge selection depended on an arbitrary final digit, 200 perturbed matrices were generated. Each off-diagonal correlation was independently varied within ± 0.0005, the interval consistent with rounding to the printed value. Symmetry and unit diagonals were preserved, and every generated matrix was checked for positive definiteness. The primary graphical-lasso penalty was then applied to each matrix. Selection frequency and the 2.5th, 50th, and 97.5th percentiles of each edge were recorded. This exercise measures numerical sensitivity to reporting precision; it is not a bootstrap and does not quantify participant-sampling uncertainty.

The analysis was performed in Python using NumPy, pandas, scikit-learn, and Matplotlib. The complete correlation matrix, analysis script, numerical output, and figures accompany the manuscript. Participant-level inference was deliberately excluded. Consequently, no subgroup comparisons, country effects, latent measurement models, item-level reliability analyses, attrition models, multiple imputation, or case-resampling intervals are reported. The nominal $N = 549$ supports the information criterion but may overstate effective information if individual correlations were computed from different available cases. These boundaries are retained throughout the interpretation.

3. RESULTS

3.1. Penalty selection and network sparsity

The $\gamma = 0.50$ EBIC selected a penalty of 0.019 and retained 22 of the 36 possible edges. Thirteen retained edges met the materiality criterion of $|\rho| \geq 0.05$. The same penalty and edge count were selected at $\gamma = 0.25$, whereas $\gamma = 0$ favored the lower penalty of 0.008 and retained 29 edges (Table 2). The agreement between the two positive γ settings indicates that the conservative solution was not confined to one exact hyperparameter value. The denser $\gamma = 0$ solution was treated as a sensitivity result because it placed less protection against weak, potentially spurious connections.

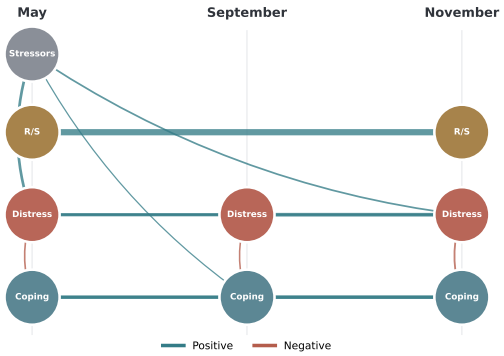

Figure 1. Conditional association map

The information-criterion comparison demonstrates that additional penalization primarily removed small coefficients rather than changing the dominant organization of the matrix. The primary model retained all same-construct temporal continuities, the three within-assessment distress–coping relations, and the largest disruption–distress relations. The resulting graph was sparse enough to identify an interpretable conditional structure while preserving the longitudinal backbone.

3.2. Conditional temporal organization

The regularized map in Figure 1 displays the 13 material edges. Line width represents absolute magnitude, teal lines are positive, and rust lines are negative. No arrowheads are used because the partial correlations do not encode direction. The largest coefficient connected religion/spirituality at T1 and T3 ($\rho = 0.901$). Coping continuity remained substantial from T1 to T2 ($\rho = 0.430$), T2 to T3 ($\rho = 0.455$), and T1 to T3 ($\rho = 0.326$). Distress continuity was also pronounced from T1 to T2 ($\rho = 0.400$), T2 to T3 ($\rho = 0.470$), and T1 to T3 ($\rho = 0.203$).

The temporal map answers the first expectation: construct continuity accounts for the strongest unique relations. The direct T1–T3 coping and distress edges remained nonzero even after their respective T2 scores were conditioned, indicating that adjacent-wave paths did not absorb all long-interval stability. Religion/spirituality showed a particularly concentrated pattern. Its two scores were almost entirely connected to each other, with only small residual links to other domains. Because two assessments cannot describe the shape of change, the coefficient should be understood as rank-order continuity rather than evidence that mean religion/spirituality remained unchanged.

Within each wave, distress and coping were negatively connected: $\rho = -0.122$ at T1, -0.106 at T2, and -0.155 at T3. The recurrence of this relation indicates that caregivers reporting stronger coping tended to report less

Table 2. Penalty selection

γ	Selected penalty	Retained edges	EBIC
0.00	0.008	29	1479.327
0.25	0.019	22	1537.200
0.50	0.019	22	1585.539

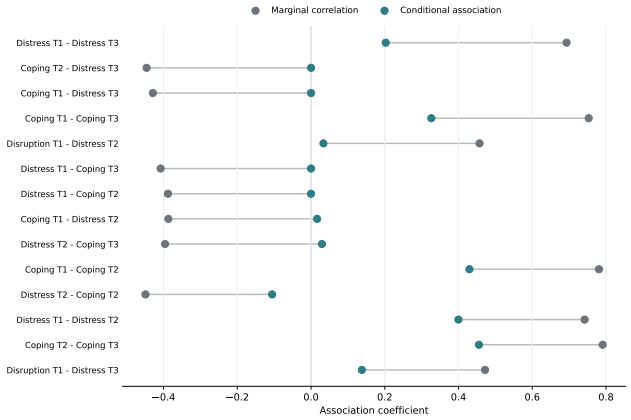

Figure 2. Marginal-to-conditional attenuation

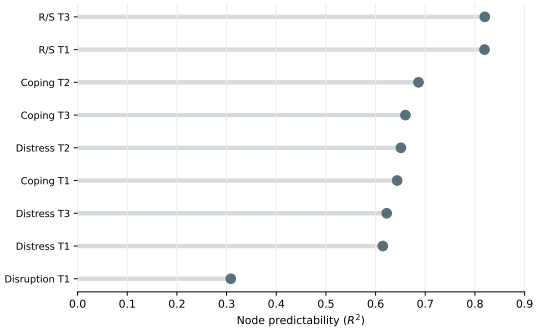

Figure 3. Node predictability

distress at the same assessment even after initial disruption and all other repeated scores were conditioned. The November coefficient was largest in absolute value, but no formal equality test was possible from the printed matrix. The pattern supports a stable inverse coupling, not a conclusion that coping caused the reduction in distress.

The coefficients in Table 3 show that 10 of the 13 material edges belonged to one of three forms: repeated-measure continuity, contemporaneous distress–coping coupling, or disruption–distress association. Only the small positive disruption T1–coping T2 edge did not fall into these forms. Its sign differs from the negative marginal correlation ($r = -0.148$), a pattern consistent with statistical suppression under simultaneous conditioning. The coefficient is close to the interpretive threshold and should not be assigned a substantive explanation without participant-level verification.

3.3. Marginal-to-conditional attenuation

The comparison in Figure 2 shows how selected marginal correlations changed after conditioning. Repeated-measure correlations remained large but were reduced: coping T1–T2 declined from 0.781 to 0.430, coping T2–T3 from 0.791 to 0.455, distress T1–T2 from 0.742 to 0.400, and distress T2–T3 from 0.765 to 0.470. Long-interval marginal associations showed stronger attenuation because much of their covariance was shared with the intervening assessment. Coping T1–T3 declined from 0.753 to 0.326, while distress T1–T3 declined from 0.693 to 0.203.

Cross-time coping–distress correlations were largely absorbed by within-construct continuity and contemporaneous relations. For example, coping T2 correlated with distress T3 at $r = -0.446$, but its regularized partial correlation was zero. Coping T1 correlated with distress T3 at $r = -0.429$ and likewise declined to zero. These changes do not show that earlier coping lacks prospective relevance. They show that, once earlier distress, later coping, and all remaining variables are included, those particular pairs contribute no separate undirected edge to the sparse network.

Religion/spirituality displayed the clearest attenuation. The marginal T1 religion/spirituality correlations with coping were 0.188 at T1, 0.192 at T2, and 0.156 at T3. Their regularized partial correlations were 0.022, 0.002, and zero, respectively. Coping T2 and T3 correlated marginally with T3 religion/spirituality at 0.195 and 0.183; their conditional coefficients were 0.020 and 0.015. None reached the material threshold. The network therefore provides little evidence for a large *direct conditional* religion/spirituality–coping connection once the highly stable religion/spirituality pair, coping continuity, distress continuity, and disruption are simultaneously held constant.

3.4. Predictability

Node predictability ranged from 0.308 for initial disruption to 0.820 for T3 religion/spirituality (Figure 3). The two religion/spirituality nodes had almost identical values (0.819 and 0.820), largely because of their strong mutual edge. Coping predictability ranged from 0.643 to 0.686, and distress predictability ranged from 0.615 to 0.651. The middle-wave coping score was the most predictable non-religion/spirituality node ($R^2 = 0.686$), followed by T3 coping ($R^2 = 0.660$) and T2 distress ($R^2 = 0.651$).

The high values for repeated constructs reflect shared temporal information rather than exceptional explanatory breadth. A node can be predictable because its earlier or later measurement is strongly connected, even

Table 3. Material conditional associations

Node 1	Node 2	Regularized ρ
R/S T1	R/S T3	0.901
Distress T2	Distress T3	0.470
Coping T2	Coping T3	0.455
Coping T1	Coping T2	0.430
Distress T1	Distress T2	0.400
Coping T1	Coping T3	0.326
Disruption T1	Distress T1	0.301
Distress T1	Distress T3	0.203
Distress T3	Coping T3	-0.155
Disruption T1	Distress T3	0.138
Distress T1	Coping T1	-0.122
Distress T2	Coping T2	-0.106
Disruption T1	Coping T2	0.056

if its links to other domains are weak. This distinction is most visible for religion/spirituality: its predictability exceeded 0.81, but almost all of that reconstruction arose from the corresponding religion/spirituality score. Predictability should therefore be read alongside cross-domain connectivity.

The node summaries place coping T2 and distress T2 at the center of temporal continuity, with total strengths of 1.069 and 1.054. This result is structurally plausible because a middle assessment can connect to both earlier and later scores. It should not be converted into a claim that September was the optimal intervention time. The analysis contains three unequal calendar intervals, no experimental manipulation, and no evidence that altering one composite would propagate along an edge.

3.5. Cross-domain connectivity

Cross-domain strength was greatest for disruption T1 (0.569), but every disruption edge was cross-domain by definition because disruption was measured once. Among repeated domains, distress T1 had the largest value (0.426), followed by distress T3 (0.293), coping T3 (0.200), distress T2 (0.185), coping T2 (0.184), and coping T1 (0.161). Religion/spirituality had substantially lower cross-domain strength: 0.027 at T1 and 0.076 at T3.

The ordering in Figure 4 identifies distress as the principal interface between initial household disruption and the repeated coping domain. Distress T1 connected to disruption, coping T1, distress T2, and distress T3, while distress T3 connected to disruption, distress T1, distress T2, and coping T3. Religion/spirituality, despite high total strength and predictability, was conditionally isolated from the other domains. This contrast demonstrates why total centrality alone would mischaracterize the role of religion/spirituality in the network.

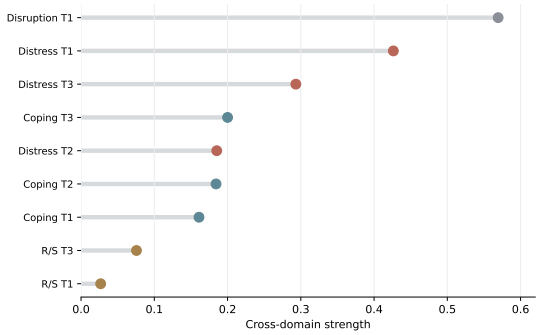

Figure 4. Cross-domain connectivity

3.6. Rounding sensitivity

All 200 matrices generated within the three-decimal rounding intervals remained positive definite. At the primary penalty, every one of the 22 selected edges was retained in every perturbation. Material edge estimates varied only in the third decimal place. For example, the T1–T3 religion/spirituality coefficient ranged from 0.900 to 0.901, coping T2–T3 from 0.454 to 0.457, distress T2–T3 from 0.468 to 0.471, and disruption T1–distress T3 from 0.137 to 0.139. Thus, the reported network is not an artifact of choosing the midpoint of a printed rounding interval.

This numerical stability must be distinguished from sampling stability. The perturbation exercise cannot reproduce variation caused by participant selection, attrition, missingness, scale measurement, or model specification. Its narrow intervals were expected because the maximum perturbation of any correlation was only 0.0005. The result nevertheless establishes that the primary edge pattern is reproducible from the published table and does not change when the unknown fourth decimal digits are varied.

Table 4. Node-level summaries

Node	Strength	Expected influence	Cross-domain strength	R^2
Disruption T1	0.569	0.569	0.569	0.308
R/S T1	0.928	0.922	0.027	0.819
Distress T1	1.029	0.778	0.426	0.615
Coping T1	0.917	0.672	0.161	0.643
Distress T2	1.054	0.843	0.185	0.651
Coping T2	1.069	0.858	0.184	0.686
Distress T3	0.965	0.655	0.293	0.622
Coping T3	0.982	0.671	0.200	0.660
R/S T3	0.976	0.976	0.076	0.820

4. DISCUSSION

The research question asked which temporal and cross-domain relations remain after simultaneous conditioning of the nine published variables. The answer is specific. The conditional network is organized principally by three features: strong rank-order continuity within religion/spirituality, coping, and distress; a recurrent negative relation between coping and distress within each assessment; and persistent connections between initial household disruption and psychological distress. Marginal links between religion/spirituality and coping became very small once this organization was taken into account. The evidence therefore favors a structure in which religion/spirituality is highly stable but conditionally peripheral, coping and distress are moderately stable and locally coupled, and initial disruption is connected most clearly to distress.

4.1. Temporal continuity as the dominant structure

The strongest edges linked repeated assessments of the same construct. This observation may appear unsurprising, but it has important consequences for interpretation. When a construct is highly stable, its marginal correlations with other variables can be carried forward through its own earlier score. A later religion/spirituality–coping correlation, for example, can reflect the persistence of earlier religion/spirituality, the persistence of coping, and correlations already present at T1. The GGM removes shared linear information across all nodes and leaves only the residual pairwise association. The collapse of several cross-time coefficients toward zero therefore indicates redundancy in the covariance structure rather than an absence of all temporal processes.

Religion/spirituality had exceptional stability. A regularized partial correlation of 0.901 between T1 and T3 means that the two composite scores retained a close conditional relation despite adjustment for disruption, distress, and coping. This result is consistent with religious and spiritual beliefs and practices functioning partly as enduring orientations. It does not demonstrate invariance of scale measurement or mean levels. Item-level responses would be needed to test whether the same latent construct was measured across time, and means and variances would be required to evaluate average change. The aggregate correlation matrix supports only a conclusion about relative ordering.

Coping and distress displayed a different pattern. Their adjacent-wave continuity was substantial but lower than that of religion/spirituality, leaving more room for association with conditions at a given assessment. The middle-wave nodes had the greatest total strength among these constructs because they connected both backward and forward. This pattern aligns with the conception of coping and distress as mixtures of stable disposition and context-sensitive response. Yet the present coefficients cannot decompose between-person stability from within-person change. A random-intercept longitudinal model would require participant-level scores and, for religion/spirituality, preferably at least three assessments.

4.2. The recurring distress–coping relation

The negative coping–distress edge appeared at every wave after full conditioning. This repetition is more informative than any one coefficient because it shows that the inverse relation was not confined to the acute initial phase. Caregivers with stronger positive coping scores tended to report less distress concurrently in May, September, and November, even after the preceding and subsequent measurements were included. The conditional magnitudes were modest, which is expected when stable components of both measures have been removed through the remaining network.

The finding is compatible with several processes. Effective coping may reduce exposure to rumination, helplessness, or escalating family conflict; lower distress may allow a caregiver to appraise their behavior more positively; or an unmeasured resource such as social support, health, income, or household cooperation may affect both. Reciprocal influence is also possible. The undirected network cannot distinguish these explanations. Its contribution is to show that the local relation persists after extensive statistical conditioning, whereas many cross-time coping–distress correlations do not.

The measure itself also deserves caution. The coping composite includes recovery, adaptation, persistence, focus, and a faith-related element. Some items resemble broad positive self-evaluation rather than a discrete behavioral strategy. Negative correlations with distress may consequently include semantic and response-style overlap. Multi-method assessment, behavioral indicators, and reports from other family members would reduce reliance on a single respondent. The present result is therefore best described as a robust conditional relation between two self-reported composites, not as direct evidence that a particular coping technique improves clinical mental health.

4.3. Religion/spirituality after simultaneous conditioning

The most consequential finding is the attenuation of religion/spirituality–coping edges. At the marginal level, the coefficients were consistently positive and ranged from 0.156 to 0.195. After conditioning, all corresponding edges were 0.022 or smaller in absolute value. The network thus indicates that these pairwise associations contain little information unique from the stability of religion/spirituality, the stability of coping, repeated distress, and initial disruption.

This result should not be framed as a failed replication of a longitudinal mediation model. Mediation and GGM coefficients answer different questions. A mediated effect is a product of directional regression paths under a specified temporal ordering. A GGM edge is an undirected residual association after every included node—including potential mediators, outcomes, and later measurements—is conditioned. Conditioning on variables downstream in a directional model can remove associations that are meaningful within that model. The network therefore cannot decide whether a causal religious or spiritual process improves coping, nor can it invalidate an indirect effect estimated from participant records.

The result does, however, narrow the interpretation of the aggregate evidence. Religion/spirituality does not function as a broad, independently connected hub in the printed correlation structure. Its high total strength and predictability arise mainly from temporal self-continuity. Any claim that religion/spirituality conveys benefit through coping must therefore rest on temporal assumptions, participant-level regression estimates, measurement validity, and theoretical specification rather than on a large unconditional bridge in the correlation matrix.

The distinction between religion and spirituality remains unresolved. A composite can combine communal participation, private practice, perceived support from the sacred, meaning, and spiritual identity. Positive and negative religious coping can also have opposing relations with distress. Combining them may conceal subgroup-specific or dimension-specific associations. Religious denomination, frequency of participation, congregation access during restrictions, and religious struggle were not nodes in the matrix. The conditional peripherality of the composite should not be generalized to all forms of religious or spiritual experience.

4.4. Pandemic disruption and distress

Initial disruption retained a substantial concurrent connection with distress T1 and a smaller connection with distress T3. These edges suggest that the accumulation of financial, relational, occupational, and separation-related stressors carried unique information about distress beyond coping and religion/spirituality. The T3 edge is notable because distress T1 and T2 were also conditioned; initial disruption therefore remained associated with residual November distress not represented by prior distress scores.

Causal language is still unwarranted. The disruption score was measured once and could be influenced by contemporaneous appraisal. A distressed caregiver may evaluate household changes more negatively, while objective disruption may elevate distress. The retained long-interval edge could reflect continuing exposure, unequal recovery, or unmeasured socioeconomic conditions. Repeated disruption scores and administrative indicators would be needed to distinguish these possibilities. Nevertheless, the network places household adversity, rather than religion/spirituality, at the strongest cross-domain entry point to distress.

The small positive disruption T1–coping T2 coefficient emerged only after conditioning and reversed the negative marginal sign. Such reversals are characteristic of suppression when predictors share extensive covariance. Assigning a resilience narrative to this coefficient would be premature. It may reflect a residual subgroup, a numerical consequence of correlated repeated measures, or a substantive process in which some caregivers mobilized coping under adversity. Participant-level diagnostics are necessary before selecting among these interpretations.

4.5. Methodological contribution

The analysis demonstrates what can and cannot be learned from a published correlation matrix. A positive-definite matrix permits exact reconstruction of unregularized partial correlations and approximate regularized model selection using the nominal sample size. It also permits transparent comparison between marginal and conditional structures. The project files make every coefficient and plotting decision reproducible. This form of summary-statistics analysis can add value when individual records are unavailable, particularly by exposing covariance that is difficult to read from a dense table.

At the same time, regularization is not a substitute for data access. Critiques of psychological networks have shown that estimated structures may change across samples, methods, and tuning rules.[38] Replicability studies likewise caution against treating a visually persuasive

network as a fixed property of a population.[39] The γ comparison and rounding perturbation address only limited numerical choices. They cannot provide nonparametric confidence intervals, case-dropping stability, group comparisons, or tests of edge equality. The network should therefore be viewed as a reproducible description of the reported correlations, not a definitive population graph.

4.6. Practical implications

The results support three restrained practical observations. First, caregivers' distress and coping remained locally related throughout the observation period, making both constructs relevant for monitoring family well-being. Second, initial household disruption retained connections with later distress, underscoring that support cannot be restricted to individual cognitive skills while financial, caregiving, and relational demands remain unresolved. Third, religious and spiritual commitments were highly stable but not broadly conditionally connected. Clinicians and community organizations should therefore avoid assuming either benefit or harm from a high composite score. Assessment should ask how beliefs and practices are being used, whether they generate support or struggle, and how they interact with the caregiver's circumstances.

These observations do not identify an intervention target. Centrality and predictability summarize associations within the chosen node set; they do not reveal the outcome of manipulating a node. The apparent importance of middle-wave coping and distress partly follows from their position between two assessments. Effective services require evidence from intervention studies, natural experiments, or stronger longitudinal designs. The present analysis instead clarifies where the aggregate associations are concentrated and where broad claims exceed the available evidence.

5. CONCLUSION

After all nine variables were conditioned simultaneously, the published caregiver correlations were governed by temporal stability, recurrent inverse distress–coping relations, and links from initial household disruption to distress. Religion/spirituality was highly stable across six months, but its marginal associations with coping did not remain materially connected in the regularized conditional network. The paper's research question is therefore answered by a distinction: religion/spirituality was prominent as a persistent personal orientation, whereas coping and distress formed the principal cross-domain psychological interface. Initial disruption entered that interface primarily through distress.

This conclusion is deliberately limited to the aggregate correlation structure. It does not establish causal direction, estimate within-person change, or contradict participant-level mediation. Its value lies in showing which associations contribute unique covariance once repeated measurements are considered together. Future research should test the same conditional pattern with de-identified participant records, repeated measures of specific religious and spiritual processes, culturally diverse samples, and models that separate stable between-person differences from within-person change.

CONFLICT OF INTEREST

The author declares no conflict of interest.

BIBLIOGRAFIA / REFERENCES

1. J. E. Cooke, R. Eirich, N. Racine, and S. Madigan, Prevalence of posttraumatic and general psychological stress during COVID-19: A rapid review and meta-analysis, *Psychiatry Research* 292 (2020) 113347. https://doi.org/10.1016/j.psychres.2020.113347.
2. J. Xiong, O. Lipsitz, F. Nasri, L. M. W. Lui, H. Gill, L. Phan, et al., Impact of COVID-19 pandemic on mental health in the general population: A systematic review, *Journal of Affective Disorders* 277 (2020) 55–64. https://doi.org/10.1016/j.jad.2020.08.001.
3. S. W. Patrick, L. E. Henkhaus, J. S. Zickafoose, K. Lovell, A. Halvorson, S. Loch, et al., Well-being of parents and children during the COVID-19 pandemic: A national survey, *Pediatrics* 146 (2020) e2020016824. https://doi.org/10.1542/peds.2020-016824.
4. B. S. Russell, M. Hutchison, R. Tambling, A. J. Tomkunas, and A. L. Horton, Initial challenges of caregiving during COVID-19: Caregiver burden, mental health, and the parent–child relationship, *Child Psychiatry & Human Development* 51 (2020) 671–682. https://doi.org/10.1007/s10578-020-01037-x.
5. M. Wade, H. Prime, D. Johnson, S. S. May, J. M. Jenkins, and D. T. Browne, The disparate impact of COVID-19 on the mental health of female and male caregivers, *Social Science & Medicine* 275 (2021) 113801. https://doi.org/10.1016/j.socscimed.2021.113801.
6. M. Spinelli, F. Lionetti, A. Setti, and M. Fasolo, Parenting stress during the COVID-19 outbreak: Socioeconomic and environmental risk factors and implications for children emotion regulation, *Family Process* 60 (2021) 639–653. https://doi.org/10.1111/famp.12601.
7. H. Prime, M. Wade, and D. T. Browne, Risk and resilience in family well-being during the COVID-19 pandemic, *American Psychologist* 75 (2020) 631–643. https://doi.org/10.1037/amp0000660.
8. F. Walsh, Loss and resilience in the time of COVID-19: Meaning making, hope, and transcendence, *Family Process* 59 (2020) 898–911. https://doi.org/10.1111/famp.12588.
9. S. S. Luthar, D. Cicchetti, and B. Becker, The construct of resilience: A critical evaluation and guidelines for future work, *Child Development* 71 (2000) 543–562. https://doi.org/10.1111/1467-8624.00164.
10. C. E. Hostinar and G. E. Miller, Protective factors

for youth confronting economic hardship: Current challenges and future avenues in resilience research, *American Psychologist* 74 (2019) 641–652. https://doi.org/10.1037/amp0000520.

11. K. M. Connor and J. R. T. Davidson, Development of a new resilience scale: The Connor–Davidson Resilience Scale, *Depression and Anxiety* 18 (2003) 76–82. https://doi.org/10.1002/da.10113.
12. L. Campbell-Sills and M. B. Stein, Psychometric analysis and refinement of the Connor–Davidson Resilience Scale: Validation of a 10-item measure of resilience, *Journal of Traumatic Stress* 20 (2007) 1019–1028. https://doi.org/10.1002/jts.20271.
13. H. G. Koenig, Religion, spirituality, and health: The research and clinical implications, *ISRN Psychiatry* 2012 (2012) 278730. https://doi.org/10.5402/2012/278730.
14. K. Pargament, M. Feuille, and D. Burdzy, The Brief RCOPE: Current psychometric status of a short measure of religious coping, *Religions* 2 (2011) 51–76. https://doi.org/10.3390/rel2010051.
15. J. J. Exline, A. M. Yali, and W. C. Sanderson, Guilt, discord, and alienation: The role of religious strain in depression and suicidality, *Journal of Clinical Psychology* 56 (2000) 1481–1496.
16. J. D. Aten, W. R. Smith, E. B. Davis, D. R. Van Tongeren, J. N. Hook, D. E. Davis, et al., The psychological study of religion and spirituality in a disaster context: A systematic review, *Psychological Trauma: Theory, Research, Practice, and Policy* 11 (2019) 597–613. https://doi.org/10.1037/tra0000431.
17. K. E. Cherry, L. Sampson, P. F. Nezat, A. Cacamo, L. D. Marks, and S. Galea, Long-term psychological outcomes in older adults after disaster: Relationships to religiosity and social support, *Aging & Mental Health* 19 (2015) 430–443. https://doi.org/10.1080/13607863.2014.941325.
18. J. S. Bentzen, In crisis, we pray: Religiosity and the COVID-19 pandemic, *Journal of Economic Behavior & Organization* 192 (2021) 541–583. https://doi.org/10.1016/j.jebo.2021.10.014.
19. F. A. Mahamid and D. Bdier, The association between positive religious coping, perceived stress, and depressive symptoms during the spread of coronavirus (COVID-19) among a sample of adults in Palestine: A cross-sectional study, *Journal of Religion and Health* 60 (2021) 34–49. https://doi.org/10.1007/s10943-020-01121-5.
20. F. Prazeres, L. Passos, J. A. Simões, P. Simões, C. Martins, and A. Teixeira, COVID-19-related fear and anxiety: Spiritual-religious coping in healthcare workers in Portugal, *International Journal of Environmental Research and Public Health* 18 (2021) 220. https://doi.org/10.3390/ijerph18010220.
21. C. L. Park, B. S. Russell, M. Fendrich, L. Finkelstein-Fox, M. Hutchison, and J. Becker, Americans' COVID-19 stress, coping, and adherence to CDC guidelines, *Journal of General Internal Medicine* 35 (2020) 2296–2303. https://doi.org/10.1007/s11606-020-05898-9.
22. R. C. Kessler, P. R. Barker, L. J. Colpe, J. F. Epstein, J. C. Gfroerer, E. Hiripi, et al., Screening for serious mental illness in the general population, *Archives of General Psychiatry* 60 (2003) 184–189. https://doi.org/10.1001/archpsyc.60.2.184.
23. E. L. Worthington Jr., N. G. Wade, T. L. Hight, J. S. Ripley, M. E. McCullough, J. W. Berry, et al., The Religious Commitment Inventory–10: Development, refinement, and validation of a brief scale for research and counseling, *Journal of Counseling Psychology* 50 (2003) 84–96. https://doi.org/10.1037/0022-0167.50.1.84.
24. P. E. Spector, C. C. Rosen, H. A. Richardson, L. J. Williams, and R. E. Johnson, A new perspective on method variance: A measure-centric approach, *Journal of Management* 45 (2019) 855–880. https://doi.org/10.1177/0149206316687295.
25. D. Borsboom and A. O. J. Cramer, Network analysis: An integrative approach to the structure of psychopathology, *Annual Review of Clinical Psychology* 9 (2013) 91–121. https://doi.org/10.1146/annurev-clinpsy-050212-185608.
26. E. I. Fried and A. O. J. Cramer, Moving forward: Challenges and directions for psychopathological network theory and methodology, *Perspectives on Psychological Science* 12 (2017) 999–1020. https://doi.org/10.1177/1745691617705892.
27. D. J. Robinaugh, R. H. A. Hoekstra, E. R. Toner, and D. Borsboom, The network approach to psychopathology: A review of the literature 2008–2018 and an agenda for future research, *Psychological Medicine* 50 (2020) 353–366. https://doi.org/10.1017/S0033291719003404.
28. S. Epskamp, L. J. Waldorp, R. Mõttus, and D. Borsboom, The Gaussian graphical model in cross-sectional and time-series data, *Multivariate Behavioral Research* 53 (2018) 453–480. https://doi.org/10.1080/00273171.2018.1454823.
29. S. Epskamp and E. I. Fried, A tutorial on regularized partial correlation networks, *Psychological Methods* 23 (2018) 617–634. https://doi.org/10.1037/met0000167.
30. D. Hevey, Network analysis: A brief overview and tutorial, *Health Psychology and Behavioral Medicine* 6 (2018) 301–328. https://doi.org/10.1080/21642850.2018.1521283.
31. J. Friedman, T. Hastie, and R. Tibshirani, Sparse inverse covariance estimation with the graphical lasso, *Biostatistics* 9 (2008) 432–441. https://doi.org/10.1093/biostatistics/kxm045.
32. R. Foygel and M. Drton, Extended Bayesian information criteria for Gaussian graphical models, in: *Advances in Neural Information Processing Systems 23*, Curran Associates, 2010, pp. 604–612.

33. S. Epskamp, D. Borsboom, and E. I. Fried, Estimating psychological networks and their accuracy: A tutorial paper, *Behavior Research Methods* 50 (2018) 195–212. https://doi.org/10.3758/s13428-017-0862-1.
34. D. R. Williams and P. Rast, Back to the basics: Rethinking partial correlation network methodology, *British Journal of Mathematical and Statistical Psychology* 73 (2020) 187–212. https://doi.org/10.1111/bmsp.12173.
35. L. F. Bringmann, T. Elmer, S. Epskamp, R. W. Krause, D. Schoch, M. Wichers, et al., What do centrality measures measure in psychological networks? *Journal of Abnormal Psychology* 128 (2019) 892–903. https://doi.org/10.1037/abn0000446.
36. P. J. Jones, R. Ma, and R. J. McNally, Bridge centrality: A network approach to understanding comorbidity, *Multivariate Behavioral Research* 56 (2021) 353–367. https://doi.org/10.1080/00273171.2019.1614898.
37. J. M. B. Haslbeck and L. J. Waldorp, How well do network models predict observations? On the importance of predictability in network models, *Behavior Research Methods* 50 (2018) 853–861. https://doi.org/10.3758/s13428-017-0910-x.
38. M. K. Forbes, A. M. Wright, S. N. Markon, and R. F. Krueger, Evidence that psychopathology symptom networks have limited replicability, *Journal of Abnormal Psychology* 126 (2017) 969–988. https://doi.org/10.1037/abn0000276.
39. E. I. Fried, M. B. Eidhof, S. Palic, G. Costantini, H. M. Huisman-van Dijk, C. L. H. Bockting, et al., Replicability and generalizability of posttraumatic stress disorder networks: A cross-cultural multisite study of PTSD symptoms in four trauma patient samples, *Clinical Psychological Science* 6 (2018) 335–351. https://doi.org/10.1177/2167702617745092.
40. H. E. Sen, L. Colucci, and D. T. Browne, Keeping the faith: Religion, positive coping, and mental health of caregivers during COVID-19, *Frontiers in Psychology* 12 (2022) 805019. https://doi.org/10.3389/fpsyg.2021.805019.