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Multisystemic approaches to researching young people's resilience: Discovering culturally and contextually sensitive accounts of thriving under adversity

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Abstract

As our understanding of the process of resilience has become more culturally and contextually grounded, researchers have had to seek innovative ways to account for the complex, reciprocal relationship between the many systems that influence young people's capacity to thrive. This paper briefly traces the history of a more contextualized understanding of resilience and then reviews a social–ecological model to explain multisystemic resilience. A case study is then used to show how a multisystemic understanding of resilience can influence the design and implementation of resilience research. The Resilient Youth in Stressed Environments study is a longitudinal mixed methods investigation of adolescents and emerging adults in communities that depend on oil and gas industries in Canada and South Africa. These communities routinely experience stress at individual, family, and institutional levels from macroeconomic factors related to boom-and-bust economic cycles. Building on the project's methods and findings, we discuss how to create better studies of resilience which are able to capture both emic and etic accounts of positive developmental processes in ways that avoid the tendency to homogenize children's experience. Limitations to doing multisystemic resilience research are also highlighted, with special attention to the need for further innovation.

Keywords: cultural; mixed methods; multisystemic; Resilient Youth in Stressed Environments; resilience

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Introduction

The study of childhood resilience has been slowly evolving from its original emphasis on person-centered variables and the neo-liberal accounts of positive development they created which described resilience as a trait-based quality of individuals (e.g., Anthony, 1987). As resilience scholarship diversified, engaging multiple disciplines from psychology to epigenetics, public health, social work, and psychiatry, and later urban planning, architecture, economics, anthropology, and sociology (to name just a few), descriptions of resilience shifted to a process that was contextually and culturally responsive (Bonanno, 2021; Masten & Cicchetti, 2016; Masten et al., 2021; Motti-Stefanidi et al., 2021; Ungar & Theron, 2020). Reflecting this broader, more contextualized understanding of resilience, the concept can be defined as follows: "In the context of exposure to significant adversity, resilience is both the capacity of individuals to navigate their way to the psychological, social, cultural, and physical resources that sustain their wellbeing, and their capacity individually and collectively to negotiate for these resources to be provided and experienced in culturally meaningful ways" (Ungar, 2008, p. 225). This definition emphasizes the processes which make the experience of resilience possible, shifting attention away from the discourse of personal grit or mindfulness as the lynchpins of successful development, to a more culturally inclusive understanding of positive development in contexts of adversity. It also, however, brings with it epistemological and methodological challenges when conducting research which accounts for the fluidity of multisystemic processes that are common to complex systems like feedback loops, cascade effects, and redundancies (Masten & Cicchetti, 2010; Ungar, 2018). It also creates challenges for study design (i.e., which of the many possible proximal and distal factors does one include in a study? Which are most relevant to a particular population? Who decides?), sample size (more variables require larger samples to ensure sufficient power for analysis), and data analysis (how can a single analysis combine multiple data sources across different systems?).

In this paper, we briefly review these difficulties and the ongoing problem of finding solutions. To illustrate what a multisystemic study of resilience might look like, a longitudinal mixed methods study of adolescents and emerging adults living in an economically and socially stressed community that depends largely on the oil and gas (O&G) industry for its sustainability is used as an exemplar of the emerging trend in resilience research toward more systemic thinking. Building on this example, we explore how studies of resilience can capture both emic and etic accounts of positive developmental processes in ways that avoid the tendency to homogenize young people's experience of positive development

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under stress (e.g., defining biological parents as the most important caregiver; assuming education is a necessary pathway to success; privileging specific behavioral outcomes without sensitivity to their function in different contexts, etc.). We will also explore how studies of resilience can erroneously attribute processes of change to just one or two systems when the locus of change is actually occurring across multiple systems simultaneously or sequentially. Limitations to conducting multisystemic resilience research will also be discussed, with suggestions for further innovation.

Who decides what resilience is, and what factors predict it?

Resilience is a negotiated social construct that is responsive to cultural and contextual factors at multiple systemic levels (Ungar, 2011). As just one of many examples of this way of understanding resilience, Anderson and Stevenson (2019) have shown in the US context that an important mechanism for positive psychosocial, physiological, academic, and identity outcomes among African American youth is, in part, their racial socialization and the resulting racial coping and self-efficacy when confronting discriminatory racial encounters (DREs). The advantage of this work is that it posits a multisystemic approach to racial coping that includes the child's appraisal of their experience of DREs, as well as the capacity of adult caregivers to provide the child with racial socialization competency that builds the skills and confidence the child needs to deal with racially motivated aggression. The resulting racial coping and self-efficacy is hypothesized to improve the child's ability to navigate DREs and potentiates positive developmental outcomes overall. In this instance, a contextual risk with historical roots in systemic oppression implicates cognitive (appraisal style) and relational systems (interactions with caregivers and what they teach the child about racial socialization) as well as meso-systemic and macrosystemic institutional factors ranging from efforts to change policing practices to addressing the higher rate of exposure to violence that African Americans experience. Indeed, addressing the racial socialization stress caregivers have experienced is suggested as a strategy to enhance their ability to teach coping strategies to their children and decrease the negative sequelae of exposure to racism (Evans et al., 2012).

Research like this by Anderson and Stevenson is noteworthy for its attention to a source of stress that is often overlooked in studies of resilience. However, it is also an example of the cultural specificity of protective processes which are responsive to social and cultural contexts. It is this specificity and engagement with multiple systems that is becoming characteristic of the emerging science of resilience and its implications for policy and practice. For example, growing awareness of the impact of racism across multiple systemic levels (from the experience of race related micro-aggressions in schools to structural oppression related to housing and employment; Reskin, 2012) has made it possible to consider family-based interventions to empower youth to cope better with confrontations with authority figures. Even this protective mechanism, however, is subject to the vagaries of cultural norms. To illustrate, Hordge-Freeman (2015), an African American anthropologist, is among a group of researchers investigating colorism (Dixon & Telles, 2017; Glenn, 2009). Hordge-Freeman found in Brazil among people of Afro-Brazilian descent who have family members with a significantly different skin tone from their own, a relatively common experience of children being treated differently by their parents depending on how dark-skinned they are, an artifact of Brazil's racial diversity and history of colonization, structural violence, and institutionalized white supremacy. With remarkable honesty, Hordge-Freeman's study participants reported that their darker skinned children experience far more punitive parenting practices. While examples of such overt prejudice and internalized racism may seem like a risk factor, families themselves explained their parenting practices as protective of children who would need to be better able to deal with adversity and racism because of how they looked to others.

Here again, multiple systems converge to create a pastiche of factors associated with coping under stress, except in the Brazilian context there was far less of a popular discourse to affirm positive racial socialization or to challenge the premise of colorism. In its absence, and in response to a specific set of risks, caregivers as a system do what they can to bolster the instrumental and cognitive coping capacity of their children. In this sense, not only is resilience multisystemic, it is also the result of discursive power with different populations having more or less say over the processes that enable resilience at personal, relational, and institutional levels.

These examples are typical of a growing number of studies which are now addressing culturally nuanced ways that childhood resilience manifests. Immigrant youth, for example, display significant diversity in how they adapt to resettlement (Motti-Stefanidi et al., 2021), indigenous youth cope with structural oppression by maintaining cultural continuity (Hopkins et al., 2012), and demobilized child soldiers resist a return to the status as child (Betancourt et al., 2013). None of these very specific patterns of coping are common enough to be generalizable but they do reflect a set of core developmental processes in response to experiences of adversity (including systemic and historical oppression) that implicate multiple biological, psychological, social, institutional, and environmental systems in concurrent processes that are associated with resilience, whether a child is a member of the minority (e.g., white, educated, middle class, and living in a country that is economically advantaged) or majority world.

The problem for researchers when resilience depends on multiple systems

Bonanno (2021) reminds us that our models which explain resilience tend to be inadequate to account for the amount of variance in outcomes among populations under unusual stress. While many psychological and social factors are now included in studies of resilience, their predictive power remains wanting. As Bonanno explains, "Together, these factors would seem to adequately explain resilient outcomes. Surprisingly, they do not. It turns out that the empirical relationships between individual predictors and resilient outcomes are uniformly modest. This creates a paradox: Even though we can identify correlates of resilient outcomes, we still cannot predict who will be resilient and who not with much accuracy" (p.2). Bonanno goes on to explain that "any attempt to build or enhance resilience that focuses on one or even a few of the known correlates will likely be inefficacious" (p.2). The problem is not overstated, with many studies of resilience predicting outcomes for only a small number of participants with accuracy. This is not necessarily a sign of failure, only an indication that many more factors at different systemic levels need to be accounted for when modeling a process as complex as resilience in contexts where risk exposure and desired outcomes are likely to vary over time and place.

The problems, though, that systemic thinking causes resilience research goes even further. Studies predicting resilient outcomes have typically relied upon the independent functioning of one

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or more factors, searching for the factor with the strongest effect on its own. However, multisystemic resilience stresses the dynamic interactions within and between systems (i.e., interdependency rather than independence). From this perspective, multisystemic resilience challenges conceptualizations of resilience as a mereological construct. Rather than focusing on single predictors of positive outcomes, it is necessary to investigate the resilience-supporting interplay of resources that gives rise to positive development under conditions of adversity. No single resource on its own can sufficiently predict outcomes. Hence, measuring multisystemic resilience is not only complicated by the need to select the most culturally and contextually relevant factors, but also identifying meaningful interrelations between these factors that explain the most variance to resilience. Indeed, it is possible that resilience-enabling resources are part of positive and negative feedback loops that foster or hinder each other's effectiveness. Not surprisingly, then, identifying a catalytic factor that produces a significant change in outcome might require attention be placed on a different system altogether from the one that is already being measured.

Perhaps this is why the processes that contribute to resilience are thought to be relatively common (usually between 60 and 80% of a sample have access to the experiences required to thrive under stress [Bonanno, 2021; Masten, 2014b]) even though the experience of resilience itself tends to be over-estimated. Indeed, by disaggregating data from studies using growth-mixture modeling that groups individuals by their growth trajectories, Infurna and Luthar (2016) showed that far fewer individuals are likely to demonstrate patterns of positive growth associated with resilience. The cause of this difference in estimates of positive development is partly attributable to the presence of multiple, co-occurring systems that influence outcomes. As Infurna and Jayawickreme (2019) explain, "Because of the substantial variation in adjustment across outcomes, researchers should not 'diagnose' resilience on the basis of a single outcome. This underscores the need for a multidimensional operationalization of resilience and a more comprehensive theory about what the key outcomes should be" (p.153). This caution is important to a multisystemic perspective of resilience as it decenters the focus of research from individual success to the availability and accessibility of resources, whether internal or external. Indeed, the problems facing resilience researchers are both conceptual and methodological. Traditionally, narrow epistemological and ontological assumptions have influenced which processes are assumed to be associated with positive development under stress.

How, then, do we account for the potential for people to overcome adversity even when facing multiple complex stressors (e.g., high adverse childhood experience scores do not predict adult depression in more than 50% of cases; Anda et al., 2006). To achieve this level of prediction, we will need to investigate multiple systems at the same time. Children with histories of trauma, for example, are very likely to experience resilience when their environments provide minimally acceptable levels of daily routines, school engagement, and continuity in attachments with caregivers (Nuñez et al., 2022). If we still struggle, though, to predict who is resilient and who is not, perhaps that is because there is so much heterogeneity to how people find the resources they need to cope, and the malleable nature of the resources that are available (e.g., protective factors like a minimally acceptable level of school engagement can depend for its definition on local norms). Closing one opportunity for support may stimulate access to another. Hence, even though studies can identify a "homogenous" group of resilient individuals, this seemingly uniform group will show large within-group heterogeneity in how they cope with adversity and the systems they rely upon.

Given all this complexity, it is to be expected that the dose effect of any single resilience-enabling resource may be inconsistent. Studies from different disciplines show that the principle of "more the merrier" might not always be the best solution when it comes to supporting resilience. Studies in positive psychology, for example, show that when a single system is too strong, detrimental effects can follow. For example, studies of stress have produced consensus that too much risk has mainly negative developmental effects (with the exception of posttraumatic growth), but no stress at all can also undermine children's psychosocial development (e.g., as occurs with over-protective parenting practices). While stress is perceived as a negative event, increasingly nuanced investigations of perceived stress and performance suggest a u-shaped association, with low-moderate levels of stress enhancing cognitive and physical performance, and high levels of stress, or no stress, diminishing performance. This emerging theory of stress, initially described by Rutter (2012) as a steeling effect, and more recently expressed as hormesis, a concept borrowed from the field of toxicology (Oshri et al., 2022; Oshri, 2022), is providing a more contextualized understanding of the interactions between individuals and their environments, suggesting that even external stressors can benefit human development when delivered in manageable amounts.

This results in the following complications: (1) finding the specific range of resilience-enabling effects for each protective factor across multiple systems can never be pre-determined when context is accounted for; and (2) interrelations between protective factors means that any one source of support for positive development may become a threat to psychosocial well-being when context changes and new meaning is attributed to the original protective function of the factor.

To some extent, these problems are being addressed by mixed methods studies that account for heterogeneity through design. However, even qualitative data and mixed methods do not necessarily solve the problem of prediction or understanding phenomenologically the intersecting influence of multiple systems on positive developmental processes. Take for example, a recent multi-phase mixed methods study by Zeldin et al. (2018) of students in high schools in Wisconsin. Quantitative data showed that school climate related to instructional quality and teacher–student relationships were more important to student engagement than sociodemographic factors, suggesting the compensatory nature of the everyday schooling a child receives. A second phase qualitative study showed that for students with patterns of chronic absence and other learning needs, an empowering environment in which students felt they had a say over their learning plans was a key pathway to engagement. While the study is noteworthy for its design and thoroughness, even the most phenomenologically grounded qualitative work can still only suggest how a few of the many possible systems implicated in resilience interact. Family variables, community factors, and race were all identified as confounders in the research but more detailed exploration across systems would have been needed to fully account for non-school protective factors and their interactions.

Methodologically, then, the solution to the problem of accounting for heterogeneity in how multiple systems influence resilience seems to be to build multidisciplinary teams with the capacity to rigorously assess many different systems in order to observe the possible cascade of effects as one or more systems experiences resilience. This is difficult for a number of reasons. First, one still needs to be cognizant of which systems are the most relevant to a

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particular population at a specific point in time. For example, studies of vaccine efficacy and population resilience during a pandemic would have needed to account for discourses surrounding vaccine hesitancy and children's health (the anti-vaxxer movement started years before COVID-19 when parents began to refuse routine vaccinations such as polio and measles for their children), as well as the politics of equitable access to vaccines by those populations at heightened risk for disease because of historical injustices and lack of access to health care (Lazarus et al., 2022). In other words, which systems to assess and model is a question of both scientific acumen, feasibility, and access to researchers with complementary areas of expertise (in the case of vaccine efficacy for children, this implies a need for sociologists, epidemiologists, and medical biologists to work together).

Second, one needs to include in studies of resilience sufficient data gathering to monitor change and influence within and between systems. There are, though, serious challenges to measuring the impact of different systems in the same study. It is typical of resilience research to account for one dimension of children's resilience in great detail (cognitions surrounding school engagement; relationships with peers; social media use) but ask very few questions about co-occurring systems that could be exerting an influence over results. For example, the protective capacity of streetscapes and blue and green spaces have until only recently been largely overlooked in studies of resilience even though we know from a robust literature in the field of environmental psychology that their influence on rates of physical activity and community cohesion is likely to predict population resilience (Vanaken & Danckaerts, 2018). All of this highlights the need for studies which account for multiple systems at the same time and the need for ways to analyze data from multiple sources.

The Resilient Youth in Stressed Environments (RYSE) study

In an effort to address these epistemological and methodological challenges associated with a multisystemic model of resilience, a diverse team of scholars joined with community stakeholders to design a study of youth developmental processes in communities that are highly dependent on O&G industries (the RYSE study). These communities have experienced extreme economic fluctuations given the boom–bust cycle caused by the changing world price for carbon-based energy. These changes have caused challenges for young people in these communities with disruptions to the presence of caregivers (working hours, location of work), financial opportunities for recreation (participation fees), educational aspirations (career pathways that reflect economic opportunities), as well as exposure to domestic problems like violence between caregivers and alcohol and drug abuse both at home and in the community. In the RYSE study, these communities have provided a geographic location to study the intersection of macrosystemic, meso-systemic, microsystemic, and biological systems in a context where a macroeconomic stressor (the world price of oil) creates an objective measure of risk exposure in the lives of children, their caregivers, and communities. While that study has been taking place in Canada, South Africa, and Russia, only the Canadian data will be reported here.

The research employed a six-phase transformative sequential mixed methods design to facilitate data collection across multiple human and ecological systems (Ungar et al., 2021). Research activities included: (1) community engagement and identification of research and health priorities that may contribute to young people's resilience; (2) in-depth qualitative inquiry (using visual methods and interviews) with young people to understand their experience of health-related factors in an economically and socially volatile community; (3) a quantitative longitudinal assessment of psychosocial resilience (2 years) using both standardized measures and supplementary questions developed during activity 2; (4) collection of biological markers of stress over two time points (hair cortisol and Dehydroepiandrosterone (DHEA); (5) assessment of the ambient environment using (a) secondary analysis of government and industry data including economic data, geographic information systems (GIS) data related to blue and green spaces, and (b) citizen scientists (youth) to collect original data on variables of local concern (e.g., air quality; access to recreational services, etc.); and (6) a survey of community assets and stressors including interviews with elders. Data was collected during a prolonged economic downturn caused by a dramatic drop in the world price of oil starting in 2014 (T1 data was collected in 2018), a situation which was only accentuated by the COVID-19 pandemic (T2 data was collected in 2020). We hypothesized that a multisystemic understanding of how O&G industries affect the social and physical determinants of youth health could help to mitigate the negative consequences of O&G production and the looming need to diversify the economies of such towns as we decarbonize the economy. All phases of the research were approved by the lead author's Institutional Research Ethics Board.

The context: Maple Hill

Maple Hill[1] was established in 1957 following the discovery of a large oil field which made it the largest oil producer in North America at the time. It currently has over 7,000 residents and is situated amid a landscaped dotted with more than 15,000 oil wells, 7,000 of which still remain operational. Twenty percent of the town's labor force works directly in O&G industries, mining, or quarrying, with the rest largely dependent upon the high paying jobs in the O&G sector which support local businesses and community and government services. With the precipitous drop in the world price of oil starting in 2014, unemployment in the O&G sector rose to 17.1% and the number of businesses in Maple Hill declined steadily from 909 in 2013 to 762 in 2020, mirroring all economic indicators.

Qualitative data sources and findings

During Phases 1, 2 and 5, youth participated in a series of workshops to identify factors associated with well-being in an economically volatile environment, as well as semi-structured interviews, photovoice, digital story-telling, transect walks (observation and elicitation of data by moving physically through the community), and engaged in both arts-based participatory action experiences and knowledge mobilization activities to support data analysis and translation of findings back to the community (for a full description of these methodologies, see Ungar et al., 2021). A total of 50 youth between the ages of 13 and 24 (52% female; $M = 20.0$ years old, SD = 2.9) participated in Phase 2 qualitative interviews. To examine the impact of boom and bust cycles on resilience, questions were asked about a wide range of topics relating to social identity (e.g., "Are there gender or other socio-demographic differences in the way people experience and adapt to the impact of oil extraction?"), future orientation (e.g., "If there were no oil and gas here, what would Maple Hill be as a town?"), and place-

[1]The town's name has been changed to maintain the anonymity of participants

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based experience (e.g., "What is your favorite thing about living in Maple Hill? What would be special about Maple Hill if it did not produce oil and gas?"). Timelines were used to help participants discuss critical turning points in their life and that of their families, such as their relationships with caregivers, education and career pathways, access to recreational spaces, use of social media, and engagement with local institutions (school, sports, faith communities) and community and mental health and social services. Stipends were paid for participation.

Data analysis. The qualitative data were subjected to an applied thematic analysis (Guest et al., 2012) with later analysis informed by Charmaz's approach to Constructivist Grounded Theory. All interviews were transcribed, then reviewed and coded line-by-line by at least two members of the research team. All team members had experience living in the communities where the data originated or had lengthy periods of engagement with youth and community leaders. To manage the possible influence of this positioning on data analyses, local advisory committees were also involved in developing the codebook for the project and added their perspectives to the analysis of anonymized transcripts of the data to ensure trustworthiness. ATLAS.ti 8 software (Muhr, 2017) was used to facilitate the coding process and to maintain a single data set for all interviews and artifacts (visual data). Findings were member-checked with both participants during follow-up interviews and a Local Advisory Committee of youth and adults (Creswell & Miller, 2000).

Qualitative findings. The qualitative data provided a unique insight into the lives of youth in a town experiencing the stress of extreme economic volatility, with many youth showing awareness of boom-bust economic cycles (Höltge et al., 2021; Mahdiani et al., 2021; Theron et al., 2021). With regard to well-being, youth reported changes to their use of recreational spaces depending on their family's financial situation, as well as shifts in their preferred career paths. Economic busts tended to open possibilities for a wider range of careers in the human services (nursing, homecare, mortician, social worker, educator) while boom periods tended to create conditions for young people to preference careers in construction or chemical engineering. Both young men and women perceived opportunities for high salaries from O&G industries, with young women describing themselves as needing to have "thick skins" to survive the rampant sexism they encounter finding employment in the sector and on the job (Murphy et al., 2021). Rather than challenging the culture of these workplaces, young women tended to adapt to it and excuse the behaviors of their male co-workers.

Qualitative data also focused on coping strategies, with many participants providing accounts of stressed families during both economic booms and busts (Höltge et al., 2021). During better economic times, caregivers were often away from home for long periods each day, while economic busts brought with them the likelihood of one parent leaving the community for employment elsewhere. Alcohol and drug abuse and domestic violence were present in the lives of these youth as well. Accounting for the stressors at home, youth reported experiences of depression and anxiety, themes consistent with the quantitative data. Very few youth perceived much hope that the community would survive given changing energy consumption patterns, though an emerging conversation about economic diversification was taking place, with new industries like legal marijuana production facilities starting to provide young people with new economic opportunities.

Despite these challenges, youth found ways to cope with the economic turmoil. Their responses reflect the multisystemic themes of this research and include cognitive strategies (not blaming themselves for their families' problems), personal agency (holding down more than one job), making use of community recreational spaces, both formal like libraries and pools, and informal like parks and playgrounds, seeking the support of friends and extended family, as well as engaging with human services if and when available (Theron et al., 2021). Still, given the situational context of attenuating material resources, we were not surprised when youth emphasized the importance of accessible recreational spaces and services (i.e., financially affordable, geographically proximate, and open 7 days a week; Theron et al., 2021). Many youth also expressed a desire to move away from Maple Hill and find stable income by pursuing post-secondary education elsewhere. On a more optimistic note, young people identified with their community and its rural lifestyle which provided a set of cultural practices related to being outdoors or reminiscent of a small town with agricultural roots and a strong sense of community cohesion. The problem, however, is that the community is struggling to diversify its economy quickly enough to retain its young people, with O&G workers who come to the community during boom times being a transient population which does not contribute to the community's social stability (with these workers comes spikes in alcohol and drug abuse, prostitution, upward pressure on housing costs, and threats to community safety).

Cumulatively, young people's narratives whether through interviews or visual artifacts conveyed a story of macroeconomic and social change affecting every part of their lives, from choices in school to gender-based experiences of employment, family dynamics, and individual mental health. Young people, however, experienced economic changes as a potential catalyst for transformation, reminiscent of a ball and basin model of resilience first developed by C.S. Holling (1996) (see Figure 1). Adapting the model, our qualitative data showed that each economic period results in habituation to patterns of individual and collective coping, with a concurrent set of values (often individualistic, as might be expected of a majority White Canadian youth sample; Russell et al., 2015) and beliefs justifying choices (e.g., during economic busts, youth leave the community to pursue a wider range of training). A crisis, whether social or economic, tended to be accounted for as an opportunity to find a new "normal" with its own pattern of habituation that integrates previous iterations of normative functioning but adds elements of adaptation and transformation that are responsive to new circumstances (e.g., economic diversification). While the cycle could be seen as productive and positive, each new "normal" can also bring greater exposure to family and community risk.

Quantitative data sources and findings

Data from Phase 3 of RYSE provided quantitative measures of multisystemic risk, resilience and outcomes for an initial sample of 456 participants (age $M = 18.49$, $SD = 3.00$; female $n = 252$; White $n = 364$) in Maple Hill, with sample size decreasing between Time 1 (T1-when the full measure and a hair sample was taken), Time 1A (T1A-at one year a shortened version of the measure was administered, no hair sample), and Time 2 (T2-when the full measure and a second hair sample was taken) due to attrition of a highly mobile population (participants were also contacted every 6 months to update their contact information). Participants had to be a resident of Maple Hill between 14 and 24 years of age at T1 and proficient in English. Online and paper-pencil surveys were administered in 2018, 2019, and 2020. Stipends were paid for each

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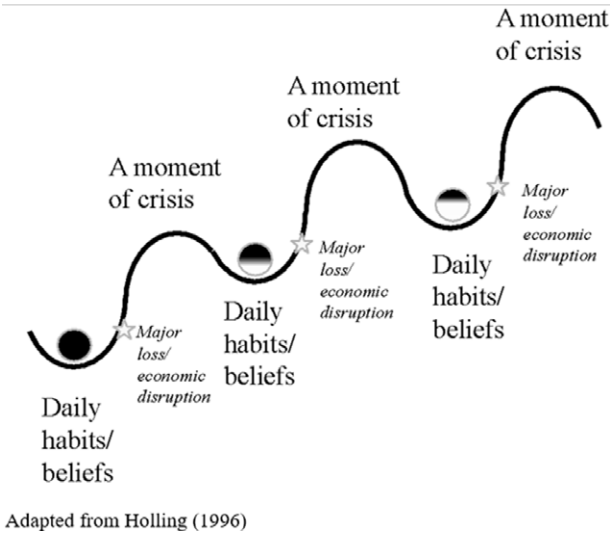

Figure 1. Ball and Basin Model of the economic diversification process.

survey completed. The survey included two broad constellations of data: external resources and internal qualities associated with personal ruggedness (for further distinction between the two concepts, see Ungar et al. 2020). For the present analysis, data from 2018 and 2020 were used.

The quantitative analysis was used to gain insight into the following questions:

1. Are more multisystemic resources related to positive outcomes for resilient than non-resilient youth?
2. Do resilient and non-resilient youth differ in how their resources are related across systems?

Self-reported measures via survey

Social-ecological resources: The *Child and Youth Resilience Measure* (CYRM-28; Ungar & Liebenberg, 2011) was used to assess 28 resources of young people aged 11–23 years that have been shown to be relevant across cultures and risk contexts. The CYRM-28 covers three broad resource systems which can further be grouped into more specific sub-systems: individual (personal skills, peer support, social skills), caregiver (physical and psychological caregiving), and context (spiritual, educational, and cultural/community resources). Higher scores indicate higher levels of each resource system. The respective reliabilities were: personal skills ($\alpha = .76$), peer support ($\alpha = .90$), social skills ($\alpha = .66$), physical caregiving ($\alpha = .57$), psychological caregiving ($\alpha = .84$), spiritual and religious resources ($\alpha = .76$), educational resources (single item), and cultural/community resources ($\alpha = .84$).

Physical health: The *20-item version of the Medical Outcomes Study questionnaire* (MOS-20; Stewart et al., 1988) was used to assess an individual's physical health. To derive a physical health component, the 14 items of the MOS-20 that indicate different aspects of physical health were first transformed to have a range from 0 to 100 and then averaged. These 14 items encompass physical functioning (6 items), role-physical functioning (2 items), current health perceptions (5 items), as well as pain (1 item). Higher scores indicate better physical health ($\alpha = .86$).

Engagement: Engagement was indicated (a) via the *School Engagement Scale* (32 items; Lam et al., 2014) for participants who were only at school, or (b) via the *Work Engagement Scale* (9 items; Schaufeli et al., 2006) for participants who were either at school and had a job or who only worked. To derive a single factor for engagement to include in the final analysis, the items for each scale were summed first to derive each respective scale's sum-score, then standardized for comparability, and then merged into one variable. Higher scores indicate higher levels of engagement. The reliability of the School Engagement Scale was *Cronbach's* $\alpha = .93$, and *Cronbach's* $\alpha = .95$ for the Work Engagement Scale.

Perception of Neighborhood scale: This scale was used in a 2004 US study with a Cronbach's alpha of .82 (Ruchkin et al., 2004). The original scale comprised 7 positively worded items that form an Attachment to Neighborhood subscale and 3 negatively worded items concerned with "racial conflict." To be more inclusive, "neighborhood" was changed to "neighborhood/community" (e.g., "In my neighborhood/community there are problems because of racial or cultural differences"). Higher scores mean a more positive perception.

Objective environmental resources

Active Living Environment (ALE): The ALE is a national data set of GIS data which indicates a community's encouragement for active living, also referred to as the "walkability" of a community (Herrmann et al., 2019). Communities with favorable ALE scores are those where the built environments support physical activity outdoors and the use of public transit. Specifically, ALE scores provide a composite measure of active living environments (the ALE Index of communities) which is the sum of the z-scores for each ALE measure and references intersection density, dwelling density, and points of interest. The summed z-scores provide dissemination area (DA) level data, with each DA based on a one-kilometer, circular (Euclidean) area around its center. Each DA is a small geographic unit used by national bodies like Statistics Canada, typically with a population of between 400 and 700 persons. Since not all participants provided their home address (due to privacy concerns), the sample size for this data is lower compared to sample size for the measures above (see Table 1).

Natural Environment – blue and green spaces: Using open-access satellite data (ABMI.ca), the study included the joint percentage of green and blue spaces within a 1 km radius around a participant's home address. The data was prepared using ArcGIS (Steinberg & Steinberg, 2015). The sample size for this data was also lower for the same reason as for the ALE data.

Outcomes/risk indicators

Depression: Depression was indicated via self-report using the *Beck Depression Inventory-II* (BDI-II; Beck et al., 1996). The BDI-II asks about experiences of 21 symptoms of depression over the past 2 weeks using symptom-specific statements. Higher scores indicate higher levels of depressive symptomatology. The reliability of the scale was *Cronbach's* $\alpha = .96$.

Cortisol: When activated, the stress response system produces a cascade of hormonal responses including the release of the glucocorticoid hormone cortisol which can be measured in hair. Environmental stressors like socioeconomic status (Li et al., 2007; Lupien et al., 2000) influence cortisol secretion patterns. In combination with measurements of DHEA, a neurosteroid (i.e., produced both in the brain and the adrenal gland) which can also be assessed through hair samples, DHEA has anti-glucocorticoid (cortisol) properties that may protect the body from high levels of cortisol (Charney, 2004) and the negative effects of stress

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Table 1. Sample description

	2018			2020		
	All	Non-resilient	Resilient	All	Non-resilient	Resilient
N	456	149	307	228	66	162
Age	*M* = 18.49 *SD* = 3.00	*M* = 18.54 *SD* = 2.96	*M* = 18.46 *SD* = 3.03	*M* = 20.25 *SD* = 3.10	*M* = 19.80 *SD* = 3.02	*M* = 20.44 *SD* = 3.12
Sex	Female: 252 Male: 201 Other: 3	Female: 92 Male: 54 Other: 3	Female: 160 Male: 147	Female: 140 Male: 86 Other: 2	Female: 49 Male: 15 Other: 2	Female: 91 Male: 71
Race	White: 364 Indigenous: 61 Other: 31	White: 120 Indigenous: 17 Other: 22	White: 244 Indigenous: 44 Other: 19	White: 183 Indigenous: 30 Other: 15	White: 51 Indigenous: 8 Other: 7	White: 132 Indigenous: 22 Other: 8
In school (Yes)	65.10%	67.10%	61.10%	52.20%	51.50%	52.50%
School part-time job (Yes)	25.00%	26.10%	30.20%	22.40%	22.70%	22.20%
Work in O&G (Yes)	60.10%	61.20%	59.10%	59.90%	45.50%	63.60%
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Physical health (PH)	74.57 (18.09) *n* = 455	64.22 (17.72)* *n* = 306	79.39 (16.03)* *n* = 306	48.14 (9.28)	62.00 (22.27)* *n* = 161	80.81 (17.58)* *n* = 161
Personal strength (I1)	20.90 (3.41) *n* = 455	18.11 (3.35)* *n* = 306	22.26 (2.50)* *n* = 306	20.53 (3.25) *n* = 226	17.96 (3.28)* *n* = 160	21.59 (2.58)* *n* = 160
Peer support (I2)	7.96 (2.10) *n* = 455	6.86 (2.24)* *n* = 306	8.50 (1.80)* *n* = 306	8.01 (2.03) *n* = 226	6.95 (2.12)* *n* = 160	8.45 (1.82)* *n* = 160
Social skills (I3)	15.81 (3.08) *n* = 455	14.08 (3.20)* *n* = 306	16.66 (2.64)* *n* = 306	15.85 (2.90) *n* = 226	14.02 (3.21)* *n* = 160	16.60 (2.39)* *n* = 160
Engagement (Engage)	.02 (.98) *n* = 419	−.43 (.98)* *n* = 128	.21 (.92)* *n* = 291	0.00 (1.03) *n* = 188	−.64 (1.11)* *n* = 52	.25 (.89)* *n* = 136
Physical caregiver support (CG1)	8.81 (1.55) *n* = 455	7.86 (1.81)* *n* = 306	9.27 (1.15)* *n* = 306	8.66 (1.60) *n* = 226	7.86 (1.79)* *n* = 160	8.99 (1.39)* *n* = 160
Psychological caregiver support (CG2)	19.93 (4.61) *n* = 455	17.02 (5.04)* *n* = 306	21.34 (3.63)* *n* = 306	19.85 (4.17) *n* = 226	17.36 (4.40)* *n* = 160	20.87 (3.62)* *n* = 160
Context: Spirituality and religion (C1)	4.90 (2.68) *n* = 455	4.33 (2.30)* *n* = 306	5.18 (2.81)* *n* = 306	5.32 (2.14) *n* = 226	4.05 (2.53)* *n* = 160	4.72 (2.62)* *n* = 160
Context: Education (C2)	4.35 (.93) *n* = 455	4.15 (1.07)* *n* = 306	4.45 (.83)* *n* = 306	7.47 (1.68) *n* = 226	4.05 (.98)	4.27 (.88) *n* = 160
Context: Culture/community (C3)	31.04 (5.84) *n* = 455	27.37 (5.68)* *n* = 306	32.82 (5.03)* *n* = 306	19.22 (3.70) *n* = 226	26.74 (5.98)* *n* = 160	31.85 (4.93)* *n* = 160
Neighborhood (Neigh)	22.14 (1.68)	21.50 (1.72)*	22.45 (1.57)* *n* = 306	21.90 (4.26)	19.48 (4.11)*	22.88 (3.92)* *n* = 160

(*Continued*)

Table 1. (*Continued*)

	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Active living environment (ALS)	−1.17 (.72) *n* = 144	−1.15 (.70) *n* = 48	−1.19 (.73) *n* = 96	−1.12 (.71) *n* = 114	−1.07 (.72) *n* = 35	−1.13 (.71) *n* = 79
Green and blue spaces (GBS)	14.61 (20.92) *n* = 144	17.58 (26.62) *n* = 48	12.13 (17.35) *n* = 96	11.72 (16.61) *n* = 114	14.59 (19.71) *n* = 79	10.44 (15.00) *n* = 79
Cortisol (Cort)	5.68 (3.58) *n* = 361	5.84 (4.17) *n* = 123	5.59 (3.24) *n* = 238	5.87 (3.54)	6.30 (4.47)	5.69 (3.08)
Depression (Depr)	15.40 (13.26)	31.26 (9.86)*	7.70 (5.70)*	14.94 (12.71)	31.18 (9.83)*	8.33 (6.04)*

Note. n indicates the sample size that was used for the analyses due to missing data. Data from all participants was available for variables where a specific *n* is not given. * $p < .05$ using *Mann-Whitney U* test.

(Kalimi et al., 1994; Kaminska et al., 2000). Therefore, measurement of the cortisol/DHEA ratio is better at accounting for the impact of stress on human biology. To collect our sample, all participants in the survey were asked to provide a hair sample at T1 and T2. Hair cortisol and DHEA were analyzed using kits obtained from Salimetrics.

Data analysis

Data preparation: Participants were grouped into resilient and, for the sake of definitional simplicity, what we will refer to as non-resilient (e.g., less resilient) based on their individual BDI-II score (Beck et al., 1996). Participants with a BDI-II score of 20 and higher (which corresponds to moderate and severe depression) were grouped into the non-resilient group, and participants with a BDI-II score lower than 20 (which corresponds to no and mild depression) were grouped into the resilient group. This grouping was done separately for 2018 and 2020 to respect potential changes in depressive symptomatology over time (Höltge et al., 2021).

All descriptive and inferential statistics were performed using R. Due to unreliable cortisol values (i.e., due to the use of corticosteroids and/or having a standard deviation three time higher than the sample's mean), $n = 36$ participants were excluded from the analysis. Furthermore, due to missing items on the BDI-II, $n = 8$ participants were excluded because they could not be assigned to one of the BDI-II groups. Data was imputed for a scale when a participant had less than 30% missing values in that scale using the R-package *missforest*. In order to have overall normally distributed data, all variables were transformed using non-paranormal transformation via the R-package *huge*.

Network analysis: To investigate multisystemic relations between all protective factors as well as resilient outcomes/risk indicators in the resilient and non-resilient group, a network analysis was conducted using *bootnet* (Epskamp et al., 2018) and *qgraph* (Epskamp et al., 2012). A network consists of nodes (i.e., the variables of interest) and edges that indicate relations between the nodes (Costantini et al., 2015). Basically, a network is based on pairwise partial correlations between its nodes which indicate significant conditional associations. Based on cross-sectional data, such a network indicates the valence and strength of the connection between two variables by controlling for all other variables in the network. Hence, it can be used to derive hypotheses about causal relationships (Fried et al., 2018). The analysis was conducted using full information maximum likelihood estimation.

The EBIC graphical least absolute shrinkage and selection operator (EBICglasso) was used to avoid dense networks with a risk of false-positive associations. The EBICglasso is based on a tuning parameter that limits the sum of absolute partial correlation coefficients and minimizes the information criteria (EBIC) so that estimates shrink and some become zero, thereby creating sparser and more interpretable networks (Costantini et al., 2015; Epskamp & Fried, 2018). Hence, edges that are present in an EBICglasso network represent reasonable relations between two variables. At T1, the tuning parameter was set to the standard of .5. At T2, however, the tuning parameter was set to 0 for all three groups due to the low sample size of the non-resilient group in 2020 which led to empty networks at higher tuning parameters. Hence, the results for T2 are more explorative than the results for T1.

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In network analysis, usually two kinds of results are used to interpret the data. First, the graphical representation of a network which gives a visual insight into how the variables of interest are related. In the context of this study, a network that depicted only significant relations between protective individual and contextual resources and outcomes/risk indicators separately for each group was chosen to address the first research question. For the second research question, each resource's cross-system degree centrality and strength centrality were investigated separately for each group. Cross-system degree centrality indicates the total number of connections a resource has to resources of other system (Costantini et al., 2015). Cross-system strength centrality, also known as bridge strength (Jones et al., 2021), shows how strong a resource is related to its connected resources of other systems. It is the sum of all absolute partial correlations of a resource with all resources of other systems to which it is connected. In network science, centrality is often used to identify the node with the most influence on other nodes for treatment purposes. The following eight resource systems were used for this analysis: (a) physical health, (b) individual (CYRM sub-systems: personal strength, peer support, social skills), (c) work/school engagement, (d) caregiver (CYRM sub-systems: physical support, psychological support), (e) context (CYRM sub-systems: spirituality/religion, education, culture/community), (f) neighborhood, (g) active living environment, and (h) green and blue space around the person's place of residence.

Quantitative results

Descriptive Statistics: As seen in Table 1, the resilient group differed significantly in its BDI-II scores from the non-resilient group as well as showed significantly higher levels of most protective resources in both 2018 and 2020.

Network analysis: We first analyzed if the non-resilient and resilient groups differed in how the assessed multisystemic resources were connected to the outcome/risk indicators in 2018 (Figure 2) and 2020 (Figure 3). Because two negative outcome/risk indicators were used in the analysis (i.e., depressive symptomatology and cortisol), negative relations are indicative of resilience-supporting effects of the resources, while positive relations indicate that a higher level of a resource leads to a higher level of the outcome/risk indicator. Put simply, a negative sign before a relation (provided below in brackets) suggests a better outcome (less depression, lower cortisol), while a positive relation indicates higher levels of problem symptoms.

In 2018, the depressive symptomatology of the non-resilient group was significantly and negatively related with individual-level resources in support of the hypothesized relationship between resources and their protective functioning: physical health (−.14), engagement (−.10), personal strength (−.14), and social skills (−.10). Additionally, depression was, counter to our expectations, positively related with active living environment (.06). Similarly, and contrary again to our hypotheses, a higher level of cortisol was significantly and positively related with the contextual resource of spirituality and religion (.04), meaning that as these resources become more available, individuals report higher levels of stress.

As expected, however, the resilient group showed overall more multisystemic relations between their resources and outcomes/risk indicators compared to the non-resilient group in 2018. Their depressive symptomatology was significantly and negatively connected with the individual-level resources of physical health (−.17), personal strength (−.08), peer support (−.06), and social skills (−.10), as well as both physical (−.01) and psychological (−.09) caregiver resources, and the quality of their neighborhood (−.08). Furthermore, and this time in keeping with our hypotheses, their cortisol showed negative relations with psychological support by their caregivers (−.03), educational resources (−.05), active living environment (−.02), and the percentage of green and blue spaces around their home (−.19). Oddly, however, cortisol was positively related with engagement (.02), suggesting that for this sample engagement may be a source of stress rather than protective.

In 2020, the depressive symptomatology of the non-resilient group showed similar patterns to 2018 as well as a few differences. It was still negatively connected with physical health (−.03) and personal strength (−.21), and additionally with peer support (−.08) and physical resources by the caregivers (−.07). Furthermore, it was positively related with active living environment (.12) and cortisol (.04). Cortisol showed several additional relations in comparison to 2018. It was still positively related to spirituality and religion (.09), and additionally with engagement (.23) and cultural resources (.05). Also, cortisol showed negative connections with peer support (−.12), social skills (−.03), and educational resources (−.10).

The resilient group also showed similar patterns in 2020 compared to 2018. Depressive symptomatology was still negatively related with physical health (−.21), personal strength (−.08), social skills (−.13), both physical (−.05) and psychological (−.07) resources of caregivers, and neighborhood (−.03). Additionally, it was negatively connected to engagement (−.01) and cultural resources (−.07) in 2020. Furthermore, it was also positively connected with educational resources (.09) and active living environment (.14). Cortisol was still negatively related with educational resources (−.03) and the percentage of green and blue spaces in proximity to a participant's home (−.10). It was now also negatively connected with peer support (−.04) and physical resources of caregivers (−.02).

Overall, both groups show similarities and differences over time. In comparison, the non-resilient group seems to have less access to multisystemic resources, especially in relation to depression at both timepoints. Also, the non-resilient group shows more positive relations between its resources and outcome/risk indicators than the resilient group at both timepoints. By comparing these cross-sectional networks at two different timepoints, it seems that while certain resources maintain their effects on the studied outcome/risk indicators, changes also occur, possibly explainable by the severity of the economic downturn and changes in social interactions which occurred in Maple Hill as a result of the pandemic in 2020.

Relations between multisystemic resource systems: To explore further the pattern of cross-system relationships, Figure 4 provides the number of cross-system interactions for each resource for the non-resilient and resilient groups in 2018 (Figure 4A) and 2020 (Figure 4B). As expected, the resilient group shows more cross-system relations than the non-resilient group for most systems at both timepoints, even though the number of cross-system connections varies for most resources between the two timepoints. Generally, the resources of the resilient group are connected to more resources of other systems than the resources of the non-resilient group (2018: $t = 2.35$, $p < .05$; 2020: $t = 3.77$, $p < .05$).

While Figure 4 focuses on the total number of cross-system connections for each resource, Figure 5 investigates how strong each resource is connected to resources of other systems in total. Even though Figure 5A shows a trend that the resilient group has

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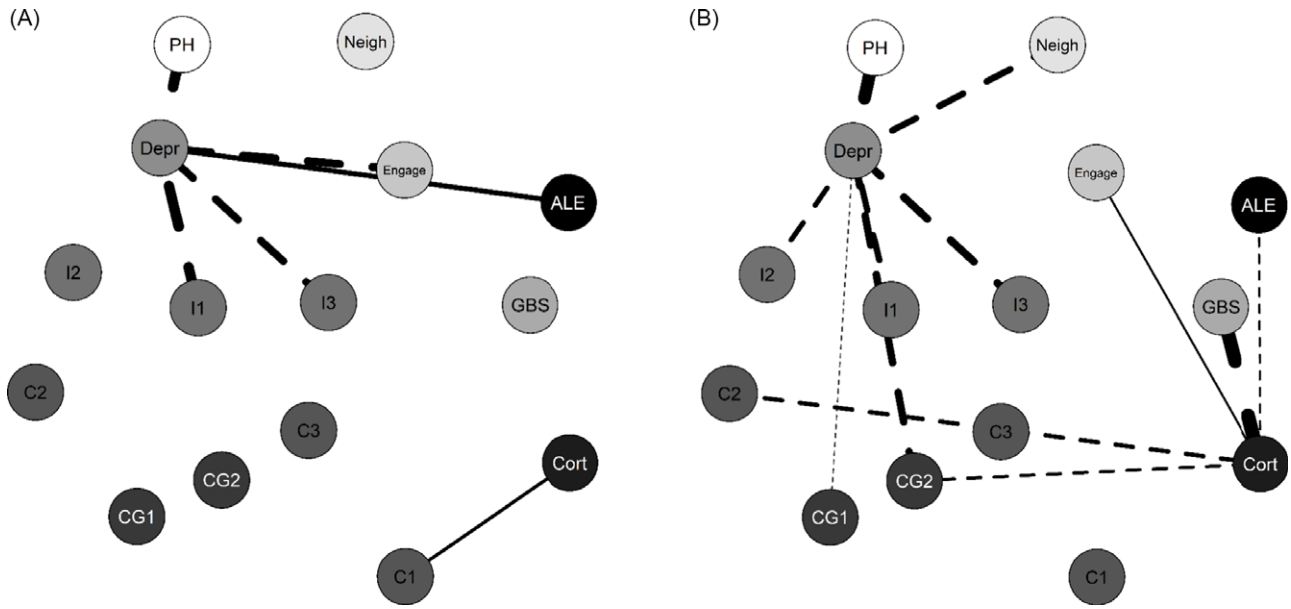
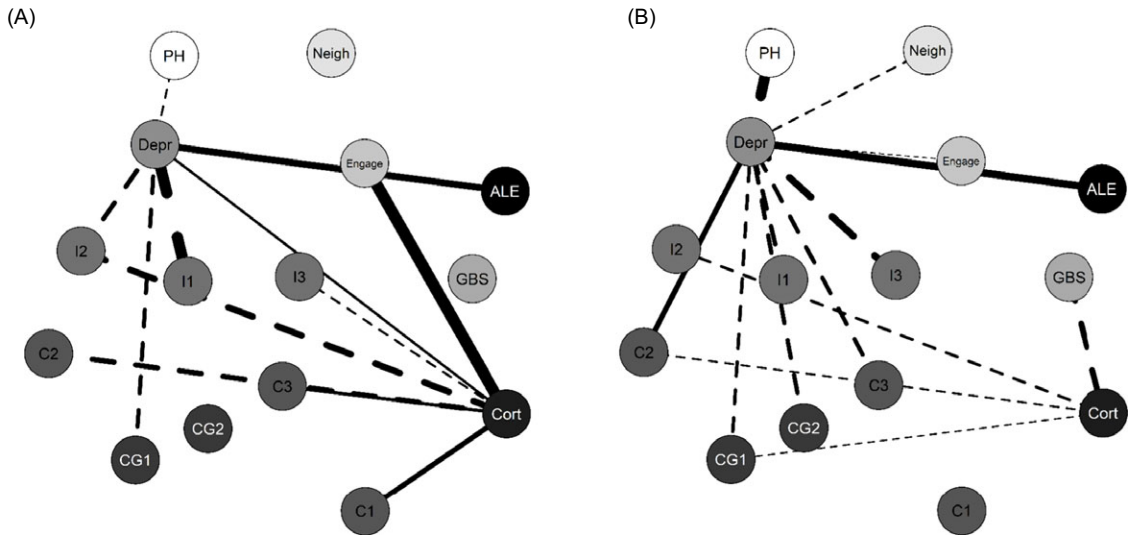


Note. Edge thickness indicates edge weight, solid edges indicate positive partial correlations, and dashed edges indicate negative partial correlations. The color-coding of the nodes indicates if a resource belongs to a certain resource system (e.g., I1, I2, I3) or is a system on its own (e.g., GBS). Key: PH = Physical Health (MOS-20); I1 = CYRM individual subscale – personal strength; I2 = CYRMindividual subscale – peer support; I3 = CYRM individual subscale – social skills; CG1 = CYRM caregiver subscale – physical support; CG2 = CYRM caregiver subscale – psychological support; C1 = CYRM Context subscale – Spirituality/Religion; C2 = CYRM Context subscale – Education; C3 = CYRM Context subscale – Culture; Engage = Engagement at work or at school (if person is not working but at school); Neigh = Perception of Neighborhood Scale; Cort = Hair cortisol; Depr = Depression; ALE = Active Living Environment; GBS = Percentage of Green and Blue Space within a 1000m radius around a person's living area.

Figure 2. Resource-outcome relations for the non-resilient (A) and resilient (B) groups in 2018.



Note. Edge thickness indicates edge weight, solid edges indicate positive partial correlations, and dashed edges indicate negative partial correlations. The color-coding of the nodes indicates if a resource belongs to a certain resource system (e.g., I1, I2, I3) or is a system on its own (e.g., GBS). See Figure 2 for abbreviations.

Figure 3. Resource-outcome relations for the non-resilient (A) and resilient (B) group in 2020.

somewhat stronger absolute cross-system relations of its resources compared to the non-resilient group, Figure 5B shows no pattern that distinguishes the two groups on this metric. Hence, both groups do not significantly differ in their overall cross-system resource relations in 2018 ($t = 1.59$, $p > .05$) and 2020 ($t = .47$, $p > .05$).

In sum, the resilient group has shown a higher number of cross-system relations between its resources, but how strongly a resource is connected to resources of other systems has not been able to distinguish between the non-resilient and resilient group. Furthermore, cultural and community resources (C3) seem to

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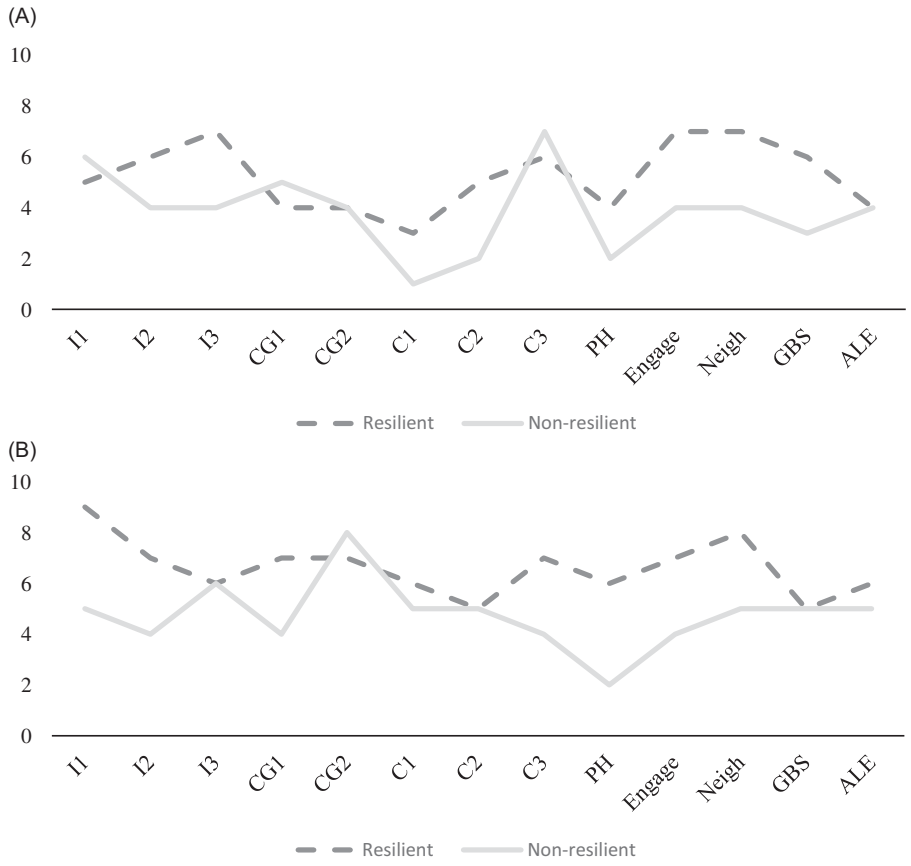

Figure 4. Number of cross-system resource relations in (A) 2018 and (B) 2020.

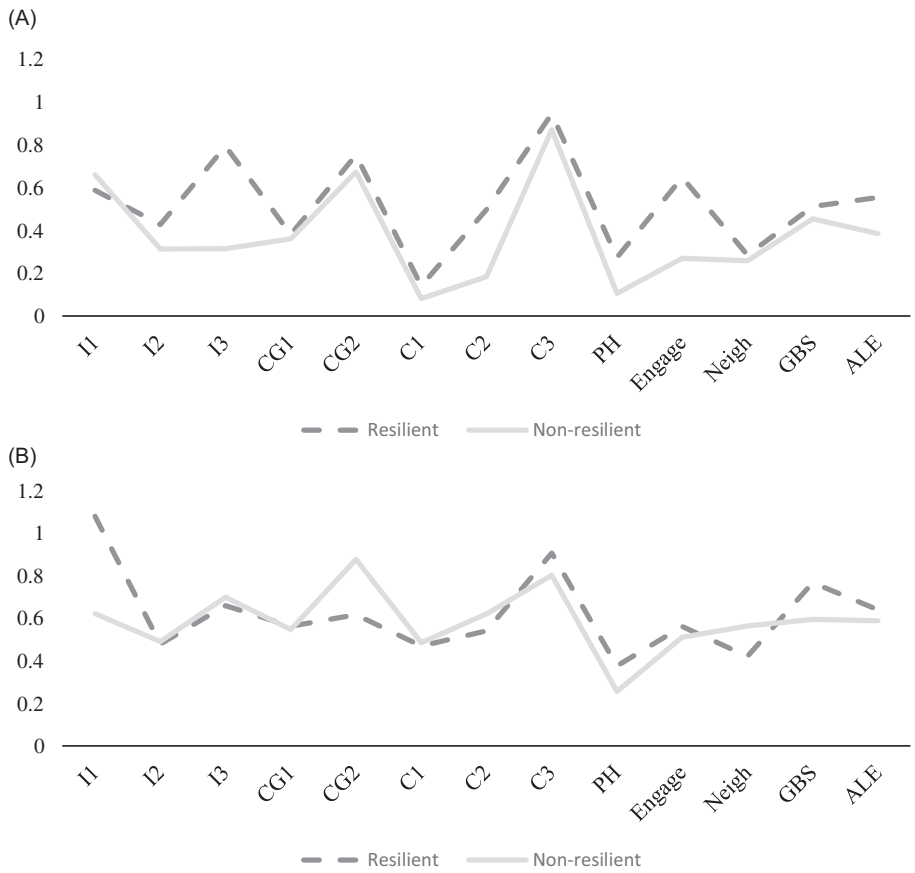

Figure 5. Strength of cross-system resource relations in (A) 2018 and (B) 2020.

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consistently show a high connectivity with resources of other systems across time in both measures and groups.

Discussion

When results from both the qualitative and quantitative analysis of the RYSE data are combined, findings suggest that for young people experiencing life in economically volatile environments, like a community that is economically dependent on O&G industries, there are constellations of biological, psychological, social, institutional, and environmental factors which support or hinder resilience. Predicting which systems are most likely to influence one another, and the potential direction of the cascade effects from one system to another remains a difficult problem for resilience researchers. Even with a moderately large sample of 456 young people at T1, followed for 2 years, and with attention paid to the measurement of multiple systems at play in young people's lives, it remained difficult to predict how one system's resilience could enable positive development of another system. Doing so will require tracking changes and engaging in analyses that employ data that is sufficiently robust from multiple sources. While we were only able to manage cross-sectional analysis of our data at T1 and T2, our qualitative data was sufficiently trustworthy to identify patterns to identity formation, attitudes toward diversification, family relationships and educational and career pathways that can help us interpret our quantitative findings. Our quantitative findings, meanwhile, offer tentative support for patterns suggested by our qualitative data.

At T1, as economic conditions in Maple Hill were worsening there were distinct patterns to the networks of resilient and non-resilient individuals. Young people with lower depression scores (and therefore assessed as more resilient to economic and social stressors) seemed to have a more diverse set of resources available to cope with their stress than the non-resilient sample. Furthermore, while there was no distinction in the overall strength of cross-system connectedness between the resilient and non-resilient groups, the resilient group reported a more connected network of individual, relational, contextual, and environmental resources as indicated by the total number of connections. This was consistent across both time points and might suggest support for young people's positive developmental processes as being dependent on the number of different resources available to them at multiple systemic levels rather than a single protective factor being able to explain positive development in the context of community adversity (Theron et al., 2021). Hence, it might be more important that a multisystemic resource network is available with many different types of supports than the strength of the connections between the resources themselves. Put simply, more may be better when considering the factors that contribute to a young person's positive development under stress.

Two years later, as the world price of oil was approaching zero and the pandemic had shuttered most industries in Maple Hill, the resilient participants still showed denser networks, suggesting that their successful adaptation was enabled by these multiple sources of support. However, the resources that were connected to the outcome/risk indicators and the resources that had the most cross-system connections showed some change over time indicating that adaptations were necessary in order to stay resilient. Also, when multiple systems are accounted for in a single analysis, it is noteworthy that there is more complexity introduced to how protective factors function. Contrary to our expectations, the resilient group showed a cortisol-enhancing effect of school/work engagement in 2018. This might be an artifact of the cultural dynamics at play in Maple Hill, including the fiercely competitive nature of O&G industries and youth socialization processes that encouraged robust individualism and personal ambition (Murphy et al., 2021; Theron et al., 2021). The resilient group also showed increases to depression when there was a better active living environment and more educational resources in 2020. This series of complex associations needs further exploration but likely illustrate the way young people's lives changed early during the pandemic. Thus, both the resilient and non-resilient groups showed patterns that were indicative of resilience-hindering effects of certain resources that we had hypothesized would be resilience-enabling. Specifically, higher depressive symptomology and cortisol were related to active lifestyle engagement, spirituality, and cultural resources. These results suggest that those youth who are most at risk may use the resources around them to cope with stress, rather than being debilitated by that stress. This same pattern has been found in studies of other populations under stress, including Black children in the United States who experience higher levels of stress but still perform well in school (Spencer et al., 1997). Clearly, such findings indicate a range of divergent responses to stress that are dependent on multisystemic factors like individual coping strategies and the availability of community and institutional supports. Despite a few unexpected findings like this, however, overall the resilient group's denser connected network and availability of a more diverse set of resources appeared to help them deal better than the non-resilient group with depression amid a very difficult economic and social context.

Implications for resilience research

Consensus is growing that resilience should be understood multisystemically, whether in the field of child development or dozens of other disciplines which use the concept to describe a dynamic process of positive adaptation under stress. Masten (2014a) has been notable in this regard for the field of developmental psychology, recognizing that it is a system's adaptive capacities distributed across networks of interconnected systems which make it possible for a child who is developmentally disrupted to return to optimal functioning. The challenge, however, is to identify which systems (from genes to neighborhoods, and beyond) are most relevant to an individual's successful coping, and to create the methodological tools necessary to capture resilience-enabling factors occurring at different systemic levels with very different (and often non-comparable) indices.

Though the task of creating a comprehensive systemic model of resilience is daunting, many disparate efforts can be screened for their contributions to this emerging understanding of coping under stress. For example, as Choi et al. (2022) have shown in their integrative analysis of genomic and exposomic data gathered from a large sample of youth in the Adolescent Brain and Cognitive Development Study, the more models of mental health integrate a wider range of factors, the better their predictive power. To illustrate, Choi et al., included in their analysis as many as 133 variables encompassing family, peer, school, neighborhood, and environmental systems, as well as life events and genome-by-exposome effect calculations. While studies like this imply resilience as the null hypothesis (the absence of disorder when these multiple systems provide an individual with the resources they need to maintain functioning), their innovation is in the inclusion of data from an increasing number of systems in the same analysis.

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This greater focus on environments, especially, is becoming more commonplace in studies of resilience globally. For example, a birth cohort study from South India (Koshy et al., 2022) with 9-year-olds showed that cognitive performance on an intelligence test could be predicted by a range of factors at age two, including biological (growth stunting), family (maternal depression), environmental (quality of stimulation at home), and socioeconomic status. Like other studies from other countries, resilience was associated with a unique and contextually specific constellation of factors, in this instance the quality of the home environment and verbal intelligence, though not the other systemic factors. Such findings are part of an emerging discourse that suggests many different systems are interacting to produce positive developmental outcomes in culturally and contextually nuanced ways.

Even when one or more systems are found to be non-significant to a hypothesized model, the field of resilience is increasingly moving toward looking at the systems which were not assessed (e.g., in the Koshy et al., [2022] study, one could assume that access to a supportive educational system, exposure to domestic violence, and other stressors and resources may have influenced findings). Indeed, to fully capture the many systemic interactions associated with resilience, evidence is needed from many different studies, each focused on a different set of systems with some overlap. For example, contrast Koshy et al.'s study in South India with a study during the Covid-19 pandemic in Greece where results showed that the persistence of a child's positive school adjustment during the pandemic could be accounted for by the resources available to the child before the pandemic, suggesting that family economic stability, parental education, and parental engagement in their child's learning can moderate the impact of future stress and produce a pattern of sustainable coping.

Cumulatively, studies of resilience from many countries (including the RYSE project) are piecing together a more comprehensive portrait of the many different systems that contribute to resilience in contexts of adversity, though the expanding list of factors needs to grow further as we decolonize the sources of knowledge and place more emphasis on local discourses of thriving (see, e.g., Cluver et al.'s [2019] study of UN Sustainable Development Goals and adolescent development in South Africa). The impact of this resilience-focused scholarship is suggesting a wider net needs to be cast when understanding patterns of interaction between individual and collective resources that predict positive development in contexts of exposure to atypical stress. Regardless, then, of a study's specific findings, by assessing multiple systems and their patterns of mutual influence we arrive at a more nuanced picture of resilience as a multisystemic construct.

There are several implications of this work for researching the multisystemic processes associated with childhood resilience.

1) Which resilience-enabling factors are measured and how our choices influence the patterns of interaction we can identify across networks is an increasingly important consideration to research design. The more systems we account for in our research, the more likely we are to identify the hidden processes behind resilience and better explain results that support null hypotheses or negative findings. Thus, diversity of variables is critical to resilience research.

2) Using a diversity of methods creates better resilience studies when exploring multiple systems. Selecting the appropriate methodology requires access to experts with a range of experience with mixed methods, novel statistical approaches to analysis, community-based/participatory research, environmental systems mapping, and other innovations emerging in the field.

3) It is important to track changes to a network of resilience-enabling resources over time, especially when new resources may become relevant and earlier resources show fewer protective effects. To account for the feedback loops and cascade effects common to complex systems, resilience researchers will, however, need to ensure sufficient sample size to conduct analyses with a larger number of variables. This problem is just as relevant to longitudinal qualitative research which must also be interactive in its design and the questions it poses to participants over time. Small sample sizes run the risk of false-positive results, but there are also issues of feasibility to consider. By its nature, studies of resilience engage populations experiencing a great deal of risk and as such tend to be smaller in size and contextually specific. Such populations are also routinely difficult to reach and ethically challenging to engage in research in ways that prevent harm. All of this combines to suggest the need for further innovation in the use of mixed methods that allow insightful work with smaller samples but still includes many different variables in their analyses that are relevant to an entire population. One possibility is purposeful sampling that targets resilient and non-resilient populations based on objective indicators of functioning, then uses data-rich approaches to investigate outcomes at many timepoints over a shorter period of time to monitor change in a sub-sample of the original population. More intensive data collection like this, now easier with the availability of smartphone applications, can increase the predictability of results, especially when trustworthiness is checked through qualitative follow-up investigations.

4) We need to track changes to the systems that surround individuals in order to understand individual patterns of change. Systems themselves transform over time and at different rates, typically described by those who study ecological resilience as change that occurs either fast and slow (Walker & Salt, 2012). We can assess systems that have the potential to change fast like relationships, income and health as well as systems that are more stable such as the natural and built environment (the RYSE study's ALE and GBS variables). In general, the slower a variable is to change, the more difficult it can be to see its influence on individuals. And yet, despite this, our growing interest in phenomena like climate change, migration, and community-wide pathogens is requiring resilience researchers to account for slow changes that accumulate over time. Likewise, even stability has the potential to undermine resilience. This paradoxical situation reminds us that the stability of one resource system might compromise the capacity of other resource systems to transform themselves as circumstances change.

Conclusion

This focus on multiple systems is likely to provide better data for program and policy design. In general, the more diverse a child's resource "portfolio" (Hamby et al., 2018) and the more contextually meaningful it is, the more the child will have the resources required to deal with complex stressors as conditions change. Indeed, as our RYSE data shows, resources that might function well in one context (like engagement at school or work) may become a deficit under different circumstances. Of course, though diversity is key, we will never be able to assess every system in one study. Perhaps the goal with thinking more multisystemically about resilience is to aspire to better research rather than to ever fully arrive.

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