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Advancing resilience: An integrative, multi-system model of resilience

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ABSTRACT

In this paper, we examine the dynamic nature of the resilience process as an interaction between individuals and their larger socio-ecological context. We introduce a novel, multi-systems model of resilience that addresses limitations within existing models, clarifies ambiguity brought on by heterogeneous definitions of resilience, and recognizes resilience as a process across the lifespan. This model includes intra-individual, interpersonal, and socio-ecological variables, and highlights the interactive process of resilience that is dynamic and multi-dimensional in nature.

1. Introduction

Bouncing back, recovery, protective factors, individual traits, and positive outcomes have all been used to describe resilience (Fergus & Zimmerman, 2005; Seery & Quinton, 2016). Resilience, and more specifically, psychological resilience, refers to the ability to adapt to stress and adversity (American Psychological Association, 2016). Resilience has traditionally been understood as a trajectory of coping that defies the expectation of negative outcomes (Rutter, 1990; Luthar, Cicchetti, & Becker, 2000; Seery & Quinton, 2016). Its use in traumatic and stressful contexts highlights the utility and importance of this construct to the individual. In addition, resilience has also been applied to larger social contexts and at the community level in response to catastrophic events and tragedies (Savitch, 2008; Sonn & Fisher, 1998). However, research in resilience is limited in scope. Existing models are inadequate in capturing the multidimensional nature of resilience. In this paper, we introduce a novel model of resilience aimed at addressing the current limitations in research. First, summaries of existing approaches to studying resilience will be overviewed, and their limitations in research and application will be highlighted.

2. Studying resilience

The conceptual framework of resilience stems from research with at-risk youths and children (Fergus & Zimmerman, 2005; Rutter, 1987). Developmental trajectories of children exposed to early adversities through various events, traumas, or risk factors were expected to include negative outcomes, such as psychopathology (Garmezy, 1974), poor achievements (Shumow, Vandel, & Posner, 1999), or violence (Borowsky, Ireland, & Resnick, 2002; Madsen & Abell, 2010); yet, studies show that exposure to early life stressors do not result in negative outcomes for all individuals. Instead, some demonstrate positive trajectories and outcomes despite adversity, such as competence, hardiness, or educational achievements (Buckner, Mezzacappa & Beardslee, 2003; Masten, Best, & Garmezy, 1990). The term "resilience" within this framework, thus encompasses alternative trajectories that deviated from the expected maladaptive outcomes after exposure to adversity (Rutter, 1987). For illustrative purposes, we present a hypothetical case of Julia, a conscientious young girl who grew up in a middle-income family. She had experienced extensive bullying as a child and, as a young adult, she continues to experience adversities, including harassment at her workplace. Through various approaches to studying resilience, we show how Julia's experience can be classified on a continuum ranging from resilient to non-resilient.

2.1. Theoretical approaches to resilience

There are competing approaches to understanding the type of resilience described by Rutter (1987). Most approaches conceptualize resilience as a trajectory of recovery following trauma. However, each approach has a distinct emphasis. The variability of these approaches has been the subject of much debate within the literature (Seery & Quinton, 2016; Luthar, Cicchetti, & Becker, 2000). The following section will offer a brief conceptual overview to popular approaches in understanding resilience. Resilience will be discussed as a developmental trajectory, as a coping outcome, and as a personality-correlate or trait.

A popular stance on resilience is the cumulative events-related approaches to understanding adversity, which include the stress-

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inoculation model of resilience. Within these approaches, resilience is seen as the by-product of events of adversity, and shares its relationship with other positive variables, such as well-being and life satisfaction through an inverse U-shaped curve (Seery, Leo, Holman, & Silver, 2010). This curve-linear function represents psychological resilience as a by-product of adversity, whereby moderate exposure to adversity serves to facilitate resilience, and protect individuals against maladaptive outcomes in future trauma or stress (Rutter, 2012). The experience of adversity is thought to partially build an individual's immunity against future adversities. However, towards the extremes, exposure to low and high levels of adversity fail to adequately promote resilience as it does either too little to inoculate or completely overwhelms an individual, respectively. In the case of Julia, growing up with childhood bullying in kindergarten may predispose her to be resilient when overcoming harassment at work as a young adult through the development of specific skillsets and coping abilities, such as interpersonal skills and conflict resolution.

Following this approach, factors that contribute to maladaptive outcomes are also perceived to be factors that may contribute to resilience (Fergus & Zimmerman, 2005). The strength of understanding resilience through events of adversities lays in its emphasis on the person-environmental interaction. This approach understands resilience as a developmental process whereby resilience develops over time. However, it falls short when implemented in research. Individuals that undergo similar numbers of adversities score differently on outcomes of resilience (Seery & Quinton, 2016). Further, there are also difficulties observing a full range of adversity scores within many populations, thereby compounding issues with making any inferences from a limited model. Finally, within this approach, the outcome measures related to resilience or adversity may also be a functional proxy for other related characteristics. For example, it is difficult to disentangle the aversive events that promote resilience from circumstances that facilitate adversity, such as low socio-economic status, or identification with a marginalized racial ethnic group.

Some researchers also regard resilience as an extension of coping (Bonanno, 2004). In this regard, resilience is defined as a return to homeostasis, or normal, healthy functioning (Bonanno, Westphal, & Mancini, 2011; Garmezy, Masten, & Tellegen, 1984; Southwick, Bonanno, Masten, Panter-Brick, & Yehuda, 2014). In the example of Julia, 'resilience' may be seen as her ability to get over her childhood bullying by moving on with her life. However, this approach also opens researchers up to the identification of many resilient trajectories that can be unmasked through various distinguished standards of healthy functioning or criteria (Bonanno, Westphal, & Mancini, 2011; Southwick et al., 2014). Further, the idea of bouncing back to normal functions is likely over-simplified as it implies that individuals undergoing trauma may have left their symptoms and experiences behind after recovery (Southwick et al., 2014).

As opposed to qualitative distinctions, resilience has also been conceptualized to fall at one end of a continuum, where vulnerability lays on the other (Fergusson, Beautrias, & Horwood, 2003). This framework postulates that resilience can be comprised of protective factors, such as mastery, emotional reactivity/regulation, self-efficacy, interpersonal support, and skills that may protect against, or counteract the potential risks and vulnerabilities (Fergus & Zimmerman, 2005; Prince-Embury, 2014; Prince-Embury, Keefer, & Saklofske, 2016; Prince-Embury, Saklofske, & Keefer, 2017). Past research has linked certain interpersonal characteristics with the lack of maladaptive outcomes in vulnerable populations, thereby asserting their protective qualities within an individual (Hawkins, Catalano, & Miller, 1992).

Rather than approaching resilience as an outcome, some researchers posit that these protective factors may represent an interpersonal trait resilience, much like personality (Block & Block, 1980). In this approach, resilience is regarded as an individual attribute or trait (Block & Block, 1980; Masten & Garmezy, 1985). In earlier research, individuals observed to be adaptive despite multiple adversities were deemed invulnerable, suggesting that resilience may be a component of their psychological identity (Anthony, 1974). Research has since shifted from the discussion of trait resilience to the identification of components of trait resilience, such as the inclusion of competence, resourcefulness, flexibility, and emotion regulation (Block, 1993; Waugh, Thompson & Gotlib, 2011). In the example of Julia through this approach, Julia's mastery over her interpersonal relationships may contribute to her overall resilience. Yet, this framework may be problematic as it fails to recognize the interaction between the individual and his or her societal contexts (Seery & Quinton, 2016).

2.2. Measures of resilience

Currently, there is no golden standard for measuring resilience in research (Windle, Bennett, & Noyes, 2011). This measurement issue is a direct reflection of the ambiguity in construct definition as a result of a lack of a comprehensive and widely adopted model to study resilience. Further, variations in theoretical and empirical approaches result in the use and adaptations of multiple scales in research, with no clear preference of one measurement tool over another (Ahern, Kiehl, Sole, & Byers, 2006; Connor & Davidson, 2003). Based on definitions and approaches to studying resilience, instruments of measurement also take on distinctive emphases. These include assessment of individual capabilities, such as the ability to cope with difficulties, personal or psychological sense of agency, mastery, and competence, or types of individual or interpersonal resources (Prince-Embury, Saklofske, & Vesely, 2015; Windle, Bennett & Noyes, 2011). Instruments used to assess resilience vary widely across sampled populations, age groups, and exposure(s) to trauma.

One characteristic many of the measures share is their emphasis on psychological resilience. Although the emphasis placed on the individual is important in dictating resilient outcomes, it is also an important limitation as these measures assume resilience to be nested within an individual, with little consideration for other variables that may influence the outcome. Additionally, the framework for understanding resilience and the context for which resilience is studied vary widely between measures. Moreover, some measures of resilience are population-specific, making their applicability and findings difficult to generalize across studies.

Based on the diversity of available measures, core questions yet to be resolved include what construct, if any, are these measures probing, and are the tapped constructs indeed substrates or components of resilience? Although a large portion of the self-report measures seem to suggest resilience is a psychological construct, there is still variability in the instruments used to measure it. With the lack of clarity and certainty in construct definitions, variability exists in the measured outcomes of resilience as defined by researchers. For instance, in a review of findings on resilience in at-risk children and youth, the sampled populations were found to be resilient at a range of 25% to 84%, based on variabilities in pre-defined definitions of 'resilience' across different measures; these variations are also likely due to between-study differences in the operationalization of resilience (Vanderbilt-Adriance & Shaw, 2008).

3. Issues with the current study of resilience

Various approaches to studying resilience underlie the multi-faceted and multi-dimensional nature of resilience. Current approaches have succeeded in highlighting a diversity of interpersonal characteristics that resilient individuals may embody in different contexts. Yet, when examined independently, individual approaches fall short in capturing resilience in its entirety, limiting their respective applicability. There are several challenges facing research on resilience, including a lack of a clear and accepted operationalization of resilience, which contributes to heterogeneity in the way researchers study and report findings in resilience (Luthar, Cicchetti & Becker, 2000). Such issues within the

resilience literature have led researchers to openly critique its scientific merit and value as a construct (Gordon & Wang, 1994; Kaplan, 1999).

3.1. Ambiguity of definitions

Considerable resources have been dedicated to clarifying the scope and definition of resilience, and yet no consensus in definition has been reached (Southwick et al., 2014; Windle, Bennett & Noyes, 2011). Use of the term in theory and practice can lack precision and intuition (Luthar, Cicchetti, & Becker, 2000). That is, resilience has been defined in numerous ways, including as an outcome, as a coping strategy, and as a trait (Luthar, Cicchetti, & Becker, 2000). For instance, Tarter and Vanyukov (1999) argue resilience is a trait, whereas others consider it a coping outcome (Fergus & Zimmerman, 2005; Seery & Quinton, 2016). Although the trait-based aspects of resilience can explain why only a proportion of the population are found to be resilient, regarding resilience solely as an interpersonal trait could result in blaming the individual for failing to be resilient, and further contribute to the embodiment of potential stigmas of weakness in individuals and in select social groups. Further, framing resilience as a trait leaves little room for intervention or promotion of resilience, as it suggests that resilience is a trait that is either present or absent (Fergus & Zimmerman, 2005; Luthar, Cicchetti & Becker, 2000; Luthar & Zelazo, 2003). On the other hand, defining resilience as a coping outcome assumes resilience is dependent on internal and external factors. Yet, this concept can also be too individualistic, hard to measure, and limiting in predictive validity across contexts and outcomes.

Further complicating the study of resilience is a debate about whether the construct refers to only positive outcomes or extends to include a return to baseline after adversity (Luthar, Cicchetti, & Becker, 2000; Southwick et al., 2014). Individual researchers select specific outcomes to represent their respective approaches, thereby compounding the variability in research design and methodology. Although this diversity is problematic, it is also an important consideration of the multi-faceted nature of resilience itself. Resilience cannot exist in a vacuum, and various approaches, whether trait-based or outcome-based in their definition of resilience may be too narrow, as both are unidimensional in nature.

3.2. Heterogeneity in the study of resilience

Based on the variability in the definition and operationalization of resilience, conditions under which resilience research is undertaken are also variable (Luthar, Cicchetti, & Becker, 2000). Further, resilience is both multi-final, as multiple outcomes could represent a "resilient" outcome in a population, and multi-faceted, as resilience can be achieved in a multitude of ways in the same population with the same exposures to adversity (Cicchetti & Rogosch, 2001; Luthar, Cicchetti, & Becker, 2000). Researchers often focus on single-factor outcomes to represent resilience, choosing outcomes such as competence, well-being, educational achievements, life satisfaction, level of daily stress, or sense of self-efficacy (Atkinson, Martin, & Rankin, 2009; Fergus & Zimmerman, 2005). However, resilience could also be multi-dimensional (Prince-Embury, 2014); an individual may be resilient on one marker or domain, such as educational achievements, while scoring non-resilient on another, such as sense of self-efficacy (Luthar, Cicchetti, & Becker, 2000).

Existing measures of resilience often do not capture the complexity of the construct. Further, there are no optimal indicators delineating the theoretical construct of resilience (Luthar, Cicchetti, & Becker, 2000). This further contributes to the difficulties in determining what is resilient in different populations and across different studies. The heterogeneity in operationalization of resilience is especially problematic in research. Without ways to compare findings, it is difficult to understand truly what events and characteristics contribute to a resilient profile, and why select factors allow for a distinct resilience trajectory of coping compared to maladaptive coping outcomes.

Furthermore, as noted above, resilience can be considered as both a positive or neutral outcome of coping. Masten (2007) recommended that resilience be distinctively used to address only positive adjustments following exposure to stress or adversity, whereas others recommend the consideration of resilience to be of recovery back to baseline (e.g. Bonanno, 2004). Yet, there is often no longitudinal assessment to indicate whether the same level of 'resilience' existed before or after the time of measurement. What is observed or measured as resilient in individuals may simply be a snapshot of functioning at a specific time that is not necessarily temporally related or attributed to a specific event or trauma. Despite a diversity of models and approaches to understanding resilience, a single measure of resilience is not sufficient in differentiating it from coping or functioning. Simply coping with an event is not resilience, as it does not take into consideration the interactive process of the person-environmental nature of resilience.

Finally, some potentially relevant research reports do not label and discuss their findings or outcomes as resilient. Instead, distinctive terminologies are used to label their construct of interest, such as grit (Duckworth & Quinn, 2009) and hardiness (Kobasa, Maddi, Puccetti and Zola, 1985). Individuals and communities may be engaged in resilient activities, such as overcoming obstacles, or thriving post-trauma, but not interpreting or labelling them as such. As a result, these findings are rarely discussed within a resilient paradigm (Borowsky, Ireland, & Resnick, 2002).

4. A novel model of resilience: A multi-systems approach

The construct of resilience carries important implications in theory and in applications. Yet, existing approaches to researching resilience are inadequate in capturing the extent of the construct. The lack of a cogent definition for resilience carries over to research findings. This is largely due to the variations in what may be considered "resilient" across studies, the stringency of criteria used to assess resilience, and the outcome measures that may or may not represent resilience. Additionally, although often measured at a single time point, resilience may not remain static over time (Luthar, Cicchetti, & Becker, 2000). Moreover, the use of event-specific markers as set-points for measuring resilience is inherently problematic as resilience becomes associated with only abnormal markers or events nested within an individual. Yet, how an individual interacts with his or her larger community or environment would largely influence, if not help dictate outcomes in multiple ways. Researchers have generally failed to combine socio-ecological factors with intra-individual variables, such as physiology or health behaviors, which likely contribute to one's overall resilient profile (Seery et al., 2010).

Despite shortcomings in the literature, resilience remains an important construct to be studied. Thus, capturing resilience in its interactive and dynamic nature requires a novel model that is multi-dimensional and multi-system. The proposed Multi-System Model of Resilience (MSMR) is aimed to address these concerns. The MSMR represents resilience as a tiered system sourced from multiple dimensions, akin to that of the spheres of control as proposed by Paulhus and Van Selst (1990), or the biopsychosocial factors that relate to trauma recovery, as identified by Monson, Fredman, and Dekel (2010). This model consists of a core resilience, comprised of intra-individual factors, or trait-like characteristics within an individual that inherently facilitate resilience; internal resilience, highlighting inter-individual and inter-personal differences and personality characteristics developed or acquired over time; and finally, external resilience, which contextualizes each individual's unique circumstances from a larger socio-ecological milieu (Fig. 1).

The overarching goal of the MSMR is to capture within-individual variations, between-individual factors, and larger socio-political aspects that influence the dynamic relationships and outcomes of resilience.

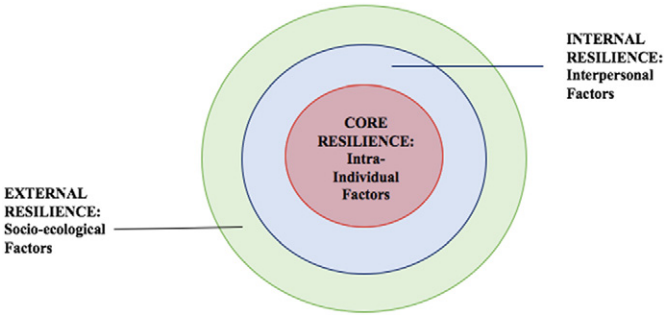

Fig. 1. Multi-systems model of resilience. Depiction of the Multi-System Model of Resilience (MSRM). Intra-individual factors consist of characteristics within an individual representative of trait-resilience; interpersonal factors consist of personality correlates developed or acquired over time through social interactions and experiences representative of psychological resilience; socio-ecological factors consist of larger formal and informal institutions that facilitate coping and adjustment representative of community resilience.

Rather than trauma-contingent, the current model includes a global and comprehensive scope of resilience that is not conditional to any event or outcome, thus enabling a broad and multi-dimensional model of resilience as part of everyday functioning, while taking into consideration dynamic systems of factors. This model enables the appreciation and examination of both situational and global resilience that is not risk-driven and predicated on the experience of trauma. The MSMR builds on previous models that are more grounded in the individual by providing a unique integration that characterizes resilience in multiple levels. Thus, this model will have predictive validity in understanding the multi-dimensional nature of resilience, and has the potential to advance future research in resilience. In the following sections, each system of resilience will be discussed in detail.

4.11. Core resilience: Intra-individual indicators of resilience

The MSMR can be best illustrated and understood through spherical layers (Fig. 1). At the innermost layer lies core resilience. This layer consists of intra-individual factors, or factors that are sourced within the individual, such as physiology or stress-reactive systems that respond to trauma and adversity, health behaviors, and other key biological indicators that make up one's core resilience profile. At the core, physiological and health indicators could serve as a robust foundation for an individual's overall resilience across their lifespan.

Individual resilience has great implications for health and physiology (Obradovic, 2012). According to Selye's General Adaptation Syndrome (GAS; Selye, 1978) the long-term effects of chronic stress manifest in stages, and can include changes in health and behavior, such as sleep and diet (McEwen & Seeman, 1999). Often, resilience researchers capture only a single snapshot of one's functioning and coping. However, coping is not synonymous with resilience. Simply coping with adversity on a day-to-day basis does not equate to resilience in the adaptive sense. In some instances, coping can result in the perpetuation of maladaptive or negative outcomes (Thompson, Mata, Jaeggi, Buschkuehl, Jonides, & Gotlib, 2010). Further, an individual may function well and exhibit no signs of ill health, and yet is susceptible to maladaptive health outcomes because of exposure to adversity and trauma. Thus, simply observing “coping” via the absence of health problems is inadequate in identifying those with compromised overall functioning. Further, a snapshot of resilience fails to generate an understanding of why certain factors distinguish those who adapt and function at a healthy level versus those who do not (Luthar, Cicchetti, & Becker, 2000).

To date, little attention has been focused on using measures of resilience that deviate from event-based outcomes and account for physiological measures of health and functioning (Obradovic, 2012). However, important contributions can be made to the resilience literature through the additions of physiological markers. The autonomic nervous system and the hypothalamic-pituitary-adrenal axis are important physiological systems that guide short and long-term responses to stress, trauma, and adversity. Examination of the reactivity of these physiological systems can inform the underlying biological functioning embedded in resilience (Hertzman, 1999; Obradovic, 2012). Indeed, previous research has documented abnormal functioning that includes hyper-responsivity in the form of elevated baselines, as well as hypo-responsivity in the form of desensitization in biological systems (Burgess, Marshall, Rubin, & Fox, 2003; Cicchetti & Rogosch, 2001; Tarullo & Gunnar, 2006). To better understand resilience at its core, baseline representative measures could inform an individual's physiological functioning in order to better elucidate the types of physiological reactivity that may be representative of resilience. We argue that hyper- and hypo-reactivity may be adaptive and resilient in different contexts. One suggested method would be to adapt the use of allostatic load to better understand physiological profiles in resilience (McEwen, 2000; Obradovic, 2012). In addition, epigenetics, or expression of genes in the form of DNA methylation because of exposure to trauma, has also been used to document changes post-adversity (McGowan, Sasaki, D'Alessio, Dymov, Labonte, Szyf, Turecki, & Meaney, 2009). For example, telomeres may offer a useful tool in understanding cellular resilience while mapping physiological profiles of resilience (Obradovic, 2012; Puterman & Epel, 2012).

Further, health behaviors, such as sleep, exercise, and diet can also be key indicators of well-being, overall functioning, and physiological resilience. Indeed, following exposure to trauma or extreme stress, a primary indicator of maladaptive outcome can be the disruption of sleep, or changes in sleep behavior as part of ongoing coping (DeJonckheere, 2016). The inclusion of physiological functioning and health behaviors share theoretical importance with resilience (Kim, Hershner, & Strecher, 2015). Thus, their inclusion in the current MSMR strengthens the model applicability. Rather than focusing only on abnormalities or deficits in health, adding behavioral and health measures is a positive conceptual shift towards understanding resilience that defies the more prominent deficit-orientation in the literature to date.

In addition to health behaviors, epigenetics, and physiological profiles, demographic and biological profiles of an individual may also lay at the core of resilience, including sex, age, and ethnicity. In the example of Julia, her youthful age, healthy lifestyle, balanced diet, and her high conscientiousness and openness all contribute to act as a foundation for her level of resilience in life. At its core, this layer of resilience embodies the ‘trait’ characteristics of resilience in that it is relatively stable throughout one's life, and serves as a foundation for which inter-individual and socio-ecological systems interact with various traumas to facilitate resilience and coping. It is also important to note that although core resilience is more trait-like, these elements are also dynamic throughout one's life, analogous to the developmental course of an individual.

4.12. Internal resilience: Interpersonal indicators of resilience

Internal resilience reflects the interpersonal personality-correlates primarily associated with resilience research. Factors within this layer borrow from the strengths of existing models to include robust individual-level determinants of resilience used in psychological resilience research (Southwick et al., 2014). It is also important to distinguish these factors as non-trait-like variables that have been observed to affect resilient outcomes. Rather, the internal resilience consists of factors that can be fostered, developed, or acquired over time from inter-personal sources, such as family, friends, and personal experiences and encounters.

Psychosocial resilience in individuals incorporates elements from many constructs. Within the proposed MSMR, existing psychosocial constructs acting as measurements of resilience are incorporated

based on their scientific merits. Factors that can be considered for inclusion include autonomy (Masten & Garmezy, 1985), self-control and regulation (Blair, Granger, & Razza; 2005), hardiness (Kobasa, Maddi, Puccetti & Zola, 1985), psychological toughness (Gucciardi, Gordon, & Dimmock, 2009), coping style and appraisal (Chen, Langer, Raphaelson, & Matthews, 2004; Obradovic, 2012), past experiences with adversity (Seery et al., 2010), interpersonal skills such as resourcefulness (MacKinnon & Derickson, 2012), social competence (Griffin, Botvin, Scheier, Epstein, & Doyle, 2002), and grit (Duckworth & Quinn, 2009).

Many of the commonalities of these above-listed constructs rests with their ability to correlate positively with adaptive outcomes to adversity, and are thus considered "resilient" based on this correlation. As such, much of the debate in the literature focuses on whether one construct may be a more robust predictor of resilience versus another (Smith-Osborne & Bolton, 2013; Windle, Bennett & Noyes, 2011). However, as resilience is not consistent between or within an individual over time, it is important that a model can test the aforementioned constructs and examine their scientific merit for inclusion across multiple events and populations. Continuing with the example of Julia, her strong relationship with her parents and friends, the interpersonal support and social relatedness she embodies from those relationships, and the emotion regulation and communication skills she acquires from mastering interpersonal relationships enable her to be resilient. Yet, some of those same conditions that facilitate her resilience also contribute to trauma and adversity, such as compromised self-esteem and social-relatedness experienced throughout her harassment. In the MSMR, the inclusion of a diverse set of psychosocial attributes will help researchers assess for their influence during the measurement of resilience in order to capture and understand the manifestations of unique and individual resilience and its course and purpose in trauma and adversity.

4.13. External resilience: Socio-ecological indicators of resilience

Another important consideration in the existing literature is that measures of resilience are not always predictive of resilient outcomes, and are constrained by their failure to address multiple contexts within an individual's lifespan development (Kaplan, 1999; Luthar, Cicchetti, & Becker, 2000). Coping and the experience of adversity does not exist within a vacuum. Rather, it is an interactive process, with an individual's intra-individual characteristics, interpersonal factors, and finally, with one's socio-ecological context. This socio-ecological context includes larger socio-environmental institutions, both informal and formal, such as socioeconomic status, income, or geographical location. This system of external sources of resilience is perceived to be available at times of need, and interact with core and internal resilience to determine functioning and outcome.

External sources of resilience consist of socio-ecological factors that facilitate resilience throughout one's lifetime. Elements within this system can include access to healthcare, social services, and other resources that interact with an individual. Thus far, only limited research in resilience has suggested that social connectedness may buffer against maladaptive outcomes in at-risk populations (Lloyd-Richardson, Papandonatos, Kazura, Stanton, & Niaura, 2002). In addition, research studies looking beyond family and school systems are sparse, and often do not directly relate to resilience. Further, one socio-ecological domain may compensate for another, whereby an individual may be resilient in one domain, such as school, while at-risk in another, such as social relationships (Lloyd-Richardson et al., 2002).

In a review of literature on socio-ecological resilience to date, various efforts made to study community-based resilience networks have focused exclusively on responses to, and preparations for natural and man-made disasters (Berkes & Ross, 2013). For example, a typical examination of sociological resilience highlights a community's disaster awareness and mitigating strategies (Andrew, 2012). Attempts to move beyond natural and manmade disasters have not exceeded past a community's capacity to respond to various events (Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). Indeed, even in government-commissioned social initiatives, community resilience is much about the development of primary response efforts rather than looking at processes that facilitate coping with adversity on an individual level (Magis, 2010). Yet, resilience is experienced and dependent on more than a community's readiness to address systemic and global disasters.

When considering the case of Julia, some factors within the external resilience system that may play a role in the outcome of her adversity include her employment and whether or not her workplace has anti-harassment policies in place to remedy individual cases, whether her level of education and social economic status place her in an environment that tolerates harassment or overlooks them, and whether or not she has access to formal and informal care to deal with the stress of the harassment, and the monetary resource to pay for these services. Within the external resilience system of the MSMR, typical socio-ecological aspects of resilience will consider what, if any, social political structures and institutions exist to help facilitate coping. These may include community outreach programs, victim support services, and transitioning/reintegrating back into society. In addition, socio-ecological indicators of resilience could also consider factors that are larger in relation to the individual, such as perceived social status (Prinstein, Boergers & Spirito, 2001), socioeconomic status (Folke, Carpenter, Walker, Scheffer, Chapin, & Rockstrom, 2010), access to services, geography, and socio-geographical identity, cultural ideology, and spiritual or religious community (Kirmayer, Sehdev, Whitley, Dandeneau, & Issac, 2009; Smith, Webber, & DeFrain, 2013; Ungar, 2008) all of which may affect an individual's adjustment and coping over time.

4.2. Model aims

The MSMR aims to capture the complexity of resilience as construct (Windle, Bennett & Noyes, 2011). The model builds on the strengths of past models and rests on the belief that resilience should not exist within a vacuum; rather, it is an interactive process between trauma and intra-individual, inter-individual, and socio-ecological factors. The MSMR intends to forward research in resilience, with the intention of offering a novel way to conceptualize and measure it that is distinct from past trauma-contingent and time-contingent models. While existing literature has measured resilience in its absolute terms, a clear shortcoming is the lack of contextual specificity that can be facilitated through measurement. Some researchers have recommended the addition of physiological and biological mechanisms in the study of resilience (Cicchetti & Curtis, 2006; Curtis & Cicchetti, 2003; Obradovic, 2012). However, a simple addition of biological and physiological mechanisms is not adequate in capturing resilience in different contexts. Instead, the MSMR regards resilience as a multi-layered construct that consists of core resilience: fundamental and trait-like factors that are less susceptible to changes, such as individual biology, health, and health behaviors; internal resilience: personality correlate factors that researchers often study, and that can be sourced from interpersonal relationships and built with experience and exposure, such as competence, past experiences and exposures, education, knowledge, and skills and resources; and external resilience: socio-ecological factors that help facilitate coping and adaptation, such as formal and informal institutions, group membership, socio-economic status, and access to services.

The MSMR recognizes resilience as more than a trait, an absolute term, or an event-specific outcome. The model can be applied to any event or timeframe whereby resilience may or may not be typically observed in research. For example, if the goal is to observe differences in resilience trajectory after the occurrence of childhood abuse, a comprehensive model of resilience would be able to maintain measurements of resilience across multiple domains. At its core, strengths within the individual, such as robust health and immunity may foster healthy coping with abuse. At the interpersonal level, skills that promote positive

outcomes, such as emotional regulation and hardiness may facilitate recovery from abuse. Finally, at the external level, presence of protective personnel, membership in social groups that foster protection and social connectedness, and access to formal and informal infrastructures may all facilitate adaptive coping.

The use of the MSMR enables distinguished pathways of resilience that differ from the simplistic notion of positive or negative resilient outcomes in a single domain. When using this model, the MSMR identifies the conditions in which an individual, such as Julia, may or may not be resilient under a given circumstance. Under this model, Julia can be thought of as resilient in terms of her achievements in school, her employment opportunity, and her ability to cope with past adversities. Yet, the MSMR will also capture sources that negate resilience, such as if Julia experiences deficits in sleep, or lacks access to support services at her workplace to combat ongoing harassment. The proposed model is unique in the consideration of multidimensional factors when examining one's global resilience across all systems. As Julia continues to encounter adversity throughout her lifetime, the MSMR model can adapt to and identify distinct factors that contribute to each circumstance in understanding and predicting multiple pathways to resilience over time, and further help facilitate resilience in individuals. Fig. 2 illustrates the interactive properties within this model.

The MSMR is a direct extension and integration of existing models and approaches to studying resilience. Borrowing from the events-related adversity approach to resilience, the current model can also be used to understand the accumulation of knowledge and tools that may strengthen one's resilience following previous exposures to adversity or exposures to positive events. Analogous to the stress inoculation model of resilience, the proposed model can illustrate how an event may interact with existing core, internal, or external factors of resilience to foster or enhance an individual's overall resilience.

4.3. Challenges and future directions

Despite the integrative advantages of the MSMR, there are several important considerations to be made. The proposed MSMR intends to forward ideas around resilience. It offers an opportunity to examine resilience through multiple evolving systems, and has the potential to advance research in resilience. However, these same advantages of inclusiveness may also serve as potential downfalls in that it may lack distinctions and specificity under various conditions. Important considerations need to be taken in future model development stages in order to extract key factors at each level of this multi-systems approach.

Further, it is crucial not to assume that all system layers and factors within the MSMR are of equal weight. The relative extent to which each system may be of importance is still vastly unknown. In a review of multiple outcomes of resilience, Luthar et al. (2000) highlighted that no single area or domain may be of more importance than another universally across times. It can be expected that the significance of each system would vary based on the event or timeframe for which resilience is observed. However, we predict that the innermost layers hold more weight, given the emphasis on these factors to date. Nonetheless, the fluidity of this model to adjust based on demands over an individual's lifetime should be the primary emphasis.

To test the cogency of this model, several steps need to be taken. First, multiple factors within each system that promote resilience should be tested in a comprehensive measure. Factors of resilience within each system are not exhaustive of the examples stated in this paper. Important constructs such as spirituality and cultural identity, as well as types of trauma need to be tested and fitted into both the overall model as well as within each individual system. As such, scale development and validation is a critical next step in the testing of this proposed model. The systems within this model are framed based on their theoretical significance. However, a factor analysis during scale testing would confirm the structure of this model statistically.

Further, it is important to consider how the outcomes of the current model would be organized, whether it's a classification of resilient versus non-resilient or a score on a continuum (e.g., Chang, Downey, Hirsch, & Lin, 2016; Luthar, Cicchetti, & Becker, 2000). In the MSMR, outputs need to be carefully considered for interactive properties and appropriateness. Once factors are distinguished, the next step would be to map them onto the model using mapping sentence (Hackett, 2016). This will help clarify distinct factor structures within each system of the model. Finally, to assert the model advantages, the current model of resilience would need to be considered simultaneously with existing approaches to define and measure resilience. It is also important at this step to test the current model in different populations. This can be done first through the development of a measurement instrument that

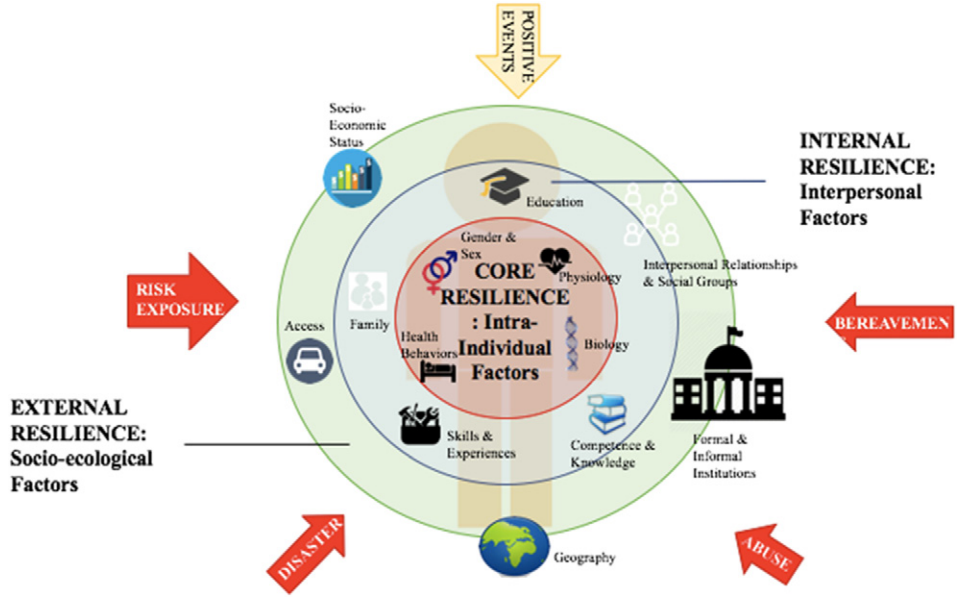

Fig. 2. Interactions of potential external events with the multi-systems model of resilience. Conceptual MSMR with examples of elements within each system. Core resilience consists of trait-like factors that are internal to the individual, internal resilience consists of variables and inter-personal resources that can be acquired and developed over time, and external resilience consisting of factors external to the individual that contextualize and facilitate coping and adaptation over time. Illustrated conceptual model as interactive with external events, which includes both positive and negative events. These events then interact with various factors of resilience at each system within the model.

conforms to the proposed model, then through its validation in relation to multiple measures of resilience in various populations.

4.4. Summary and conclusion

The MSMR recognizes the interactive nature of resilience through three-tiered spherical structures; core resilience focuses on the physiological basis of resilience, and trait-like characteristics of an individual that remains relatively static over time; internal resilience recognizes the individual factors that are often attributed to psychological resilience within an individual, as well as skills and resources sourced from interpersonal experiences and exposures with adversity; finally, external resilience highlights the larger socio-ecological contexts from which resilience is developed and facilitated over time. This model extends upon previous research in resilience, and aims to fill the gaps in bridging several compartmentalized areas of resilience research. A question that continues to plaque the resilience literature is whether resilience should be categorized as an outcome, a coping strategy, or a trait. Within the MSRM, it can be understood as all of the above, enabling researchers to understand and study both isolated factors and their broader context. Moreover, while instances of resilience may form a research focus, we stress the dynamic nature of the larger contextual model and encourage the importance of tracking the development of resilience over time.

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Conflict of interest

The authors of this manuscript declare that there are no conflicts of interest associated with the publication of this manuscript.

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