



## Psychological resilience: an update on definitions, a critical appraisal, and research recommendations

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### ABSTRACT

**Background:** The ability to resist adverse outcomes, or demonstrate resilience after exposure to trauma is a thriving field of study. Yet ongoing debate persists regarding definitions of resilience, generalizability of the extant literature, neurobiological correlates, and a consensus research agenda.

**Objectives:** To address these pressing questions, Drs. Christy Denckla and Karestan Koenen (co-chairs) convened a multidisciplinary panel including Drs. Dante Cicchetti, Laura Kubzansky, Soraya Seedat, Martin Teicher, and David Williams at the 2019 annual meeting of the International Society for Traumatic Stress Studies (ISTSS). Questions included (1) how have definitions of resilience evolved, (2) what are the best approaches to capture the complexity of resilience processes, and (3) what are the most important areas for future research?

**Methods:** The proceedings of this panel are summarized in this report, and prominent themes are synthesized and integrated.

**Results:** While different definitions emerged, all shared a focus on conceptualizing resilience at multiple levels, from the biological to the social structural level, a focus on the dynamic nature of resilience, and a move away from conceptualizing resilience as only an individual trait. Critical areas for future research included 1) focused efforts to improve assessment that has international and cross-cultural validity, 2) developing within-study designs that employ more intensive phenotyping strategies, 3) examining outcomes across multiple levels and domains, and 4) integrating conceptualizations of resilience from the individual-level to the larger social context at the population health level.

**Conclusion:** Increasingly sophisticated and nuanced conceptual frameworks, coupled with research leveraging advances in genetics, molecular biology, increased computational capacity, and larger, more diverse datasets suggest that the next decade of research could bring significant breakthroughs.

### Resiliencia psicológica: Una actualización en las definiciones, una valoración crítica, y recomendaciones para la investigación

**Antecedentes:** La capacidad de los sujetos para resistirse a resultados adversos – o demostrar resiliencia – luego de la exposición al trauma es un campo de estudios creciente. Sin embargo, persiste el debate en las definiciones de resiliencia, en cuáles son sus sustratos neurobiológicos, en qué medida los hallazgos de la literatura existente pueden ser generalizados, y en la dirección que debe tomar la investigación futura.

**Objetivos:** Para abordar estas preguntas urgentes los doctores Christy Denckla y Karestan Koenen (copresidentes) convocaron un panel multidisciplinario que incluyó a los doctores Dante Cicchetti, Laura Kubzansky, Soraya Seedat, Martin Teicher y David Williams, en el encuentro anual de la Sociedad Internacional para los Estudios del Estrés Traumático (ISTSS por sus siglas en inglés) del 2019. Las preguntas incluyeron (1) cómo han evolucionado las definiciones de resiliencia, (2) cuáles son los mejores enfoques para capturar la complejidad de los procesos de resiliencia, y (3) ¿cuáles son las áreas más importantes para la investigación futura?

**Métodos:** Las actas de este panel se resumen en este informe, y los temas destacados se sintetizan e integran.

**Resultados:** Si bien surgieron diferentes definiciones, todas compartían el enfoque de conceptualizar la resiliencia en múltiples niveles, desde el nivel biológico hasta el nivel social estructural, el enfoque de la naturaleza dinámica de la resiliencia, y el dejar de conceptualizar la resiliencia como un rasgo individual. Las áreas álgidas de investigación a futuro incluyen 1) esfuerzos enfocados en mejorar la evaluación de la resiliencia con validación internacional e intercultural, 2) desarrollar diseños de estudio que utilicen estrategias de fenotipificación más intensivas, 3) evaluar los resultados a lo largo de múltiples niveles y dominios, y 4) integrar

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### 关键词

韧性; 应激; 创伤; 创伤后  
应激障碍

### HIGHLIGHTS:

- The field of psychological resilience is characterized by ongoing debate over definitions, generalizability, and a research agenda.
- Evolving definitions share a focus on conceptualizing resilience at multiple levels, a focus on dynamic processes, and moving away from individual trait conceptualizations.
- Future research recommendations include improving assessment cross-culturally, employing within-study designs, and examining outcomes at multiple levels and domains.

conceptualizaciones de la resiliencia desde el nivel individual hacia el contexto social en niveles de salud poblacionales.

**Conclusión:** Los marcos conceptuales cada vez más sofisticados y matizados, junto con la investigación que aprovecha los avances en genética, biología molecular, mayor capacidad computacional y conjuntos de datos más grandes y diversos, sugieren que la próxima década de investigación podría traer importantes avances.

### 心理韧性：定义、严格评价和研究建议的更新

**背景:** 在暴露于创伤后，抵抗不良后果或表现出韧性的能力是一个蓬勃发展的研究领域。然而，关于韧性的定义、现有文献的概括性、与神经生物学的相关性以及共识研究议程仍存在持续争议。

**目的:** 为解决这些紧迫问题，在2019年国际创伤应激研究学会（ISTSS）年会上，Christy Denckla和Karestan Koenen博士（联合主席）召集了包括Dante Cicchetti、Laura Kubzansky、Soraya Seedat、Martin Teicher和David Williams博士在内的多学科专家组。问题包括：（1）韧性的定义如何演变；（2）捕捉韧性复杂过程的最佳方法是什么；（3）未来研究最重要的领域是什么？

**方法:** 本报告总结了该专家组的会议记录，并对主要主题进行了综合整理。

**结果:** 尽管出现了不同的韧性定义，但所有定义都关注从生物结构到社会结构对韧性进行多水平的概念化，都关注韧性的动态性质，以及都不再仅仅将韧性概念化为个体特质。未来研究的关键领域包括：1）集中精力改进具有国际和跨文化有效性的评估；2）开发采用更深入的表型分析策略的研究设计，3）考查跨多个水平和领域的结果，以及4）整合从个体水平到更大的人群健康水平的社会背景的韧性概念。

**结论:** 越来越复杂和细致的概念框架，结合促进了遗传学、分子生物学、增强的计算能力以及更大、更多样化数据进步的研究，表明未来十年的研究可能会带来重大突破。

**关键词:** 韧性；应激；创伤；创伤后应激障碍

## 1. Introduction

The most comprehensive assessment of exposure to traumatic events (defined as threatened death, serious injury, or sexual violence) conducted to date found that worldwide, over 70% of respondents ( $n = 68,894$ ) reported exposure to at least one traumatic event in their lifetime, with nearly a third reporting exposure to four or more traumatic events (Benjet et al., 2016; Kessler et al., 2017). This extraordinarily high rate of exposure to traumatic events is even more profound when other adverse experiences are taken into account including chronic childhood maltreatment (Kessler et al., 2010), economic marginalization (Patel et al., 2018), racism (Williams, 1999), and climate change (Doherty & Clayton, 2011). The neurotoxic effects of exposure to such experiences are far-reaching and range from compromised neurocompetence (Teicher, Samson, Anderson, & Ohashi, 2016), psychopathology including PTSD (McLaughlin et al., 2013) and depression (Mandelli, Petrelli, & Serretti, 2015), to adverse physical effects acting at molecular (Esteves et al., 2020; Pitman et al., 2012) and systemic levels (Sumner et al., 2015).

Given the high likelihood of exposure to trauma, coupled with the known downstream toxic consequences to health and well-being, understanding the mechanisms that might mitigate these effects is a critical area of inquiry that can inform intervention, prevention, and public health policy efforts (Magruder, McLaughlin, & Elmore Borbon, 2017). In this respect, research on psychological resilience has become a promising area of discovery. The commonly made observation that not all individuals exposed to trauma and adversity experience negative outcomes suggests the presence of processes that may attenuate or disrupt the adverse effects of trauma exposure. Indeed, the

remarkable ability of individuals to resist adverse outcomes or to demonstrate resilience after highly adverse exposures has become a major field of study (Bonanno, 2004; Masten, 2001). This proliferation of interest in resilience in recent decades is evidenced by the results from a PubMed search suggesting a fourfold increase in research using the keyword ‘resilience’ between 2008 and 2018, compared to only a 1.7-fold increase in research focused on ‘trauma and stress’ during that same time period (see also Kalisch et al., 2017). This growing body of research holds the promise of filling the prevention gap and suggests an emerging paradigm shift away from disease-focused to health-focused research (Kalisch et al., 2017; Murrough & Russo, 2019; Ungar & Theron, 2019), offering new insights into the mechanisms of stress resilience likely to yield novel therapeutics and prevention strategies (Dudek et al., 2020; Feder, Fred-Torres, Southwick, & Charney, 2019; Iacoviello & Charney, 2014; Mary et al., 2020; Moreno-Lopez et al., 2019).

However, the field is not without controversy. Major concerns raised include (1) a lack of consensus on the definition and significant variation on operationalization of the construct, (2) discrepancies and confusion around trait vs. dynamic conceptualization, and (3) methodological limitations in the extant literature that limit inferences of causality and generalizability. To contribute to the effort of continued growth in resilience research, a multidisciplinary panel convened to discuss the current state of resilience research at the 2019 Annual International Society for Traumatic Stress meeting (ISTSS). This proceedings paper summarizes and reports on the content of that panel, and was conceptualized as a follow-up to the first plenary panel on resilience held in

2013 at the ISTSS annual meeting (Southwick, Bonanno, Masten, Panter-Brick, & Yehuda, 2014). The discussion was co-chaired by Christy Denckla, PhD and Karestan Koenen, PhD. Panelists included Dante Cicchetti, PhD, Laura D. Kubzansky, PhD, Soraya Seedat, MBChB, MMed (Psych), PhD, Martin Teicher, MD, PhD, and David R. Williams, M.P.H., PhD

## 2. Panel discourse

### 2.1. Dr Koenen: update on resilience research since the 2013 panel

Six years ago when I was president of ISTSS in 2013, the theme of our meeting was resilience after trauma from surviving to thriving. I have been asking my colleagues, 'Have we learned anything about resilience in the past six years?' People seem unsure. For example, I actually had the opportunity just moments ago. I saw Murray Stein out in the hall, so I asked him and he said, 'I am not sure actually we have. Maybe we know more about – we have more clarity about the problem.' I started thinking about this and what I have noticed in the last six years is certainly the interest in resilience has grown exponentially in six years, to the point where it is beyond research.

It is a term, if you have a kid in school, you hear it in schools, you hear it in common lingo all the time. The growing interest has brought new challenges. I think it has further challenged our definition of what resilience is and it has also brought some specific challenges to my own work. For example, I do work in the psychiatric genomics consortium with large amounts of genetic data. There are people like Karmel Choi who work with me and other people who are really interested in the genetics of resilience. But if we do not know how to define resilience, then how are we going to look at the genetics of resilience? Today I was on a call and people were talking about how do you look at resilience using electronic medical records or digital phenotyping? Or other ways of using big data that are really current?

The other question that comes up for me, which I hope the panel will answer is, how do you look at resilience in different contexts? A lot of us do work around the globe. Do we have definitions of resilience or can we operationalize it in ways that we can look at it? For example, I can look at it in the US, but I can also look at in Africa, or Mexico, where I also work. I am really looking forward to hear what the panelists have to say and to addressing some of these questions. I hope they will set us in a better course for the next six years.

### 2.2. Dr Denckla: contemporary definitions of resilience

Resilience as a domain of study was first most broadly defined in the 1970s as the capacity to maintain health, or

adaptive outcomes, even in the presence of adversity (Garmezy, 1974). Nearly 5 decades later, the American Psychological Association's perspective is closely aligned with Garmezy's earlier conceptualization and defines resilience as 'the process of adapting well in the face of adversity, trauma, tragedy, threats, or significant sources of stress' (para. 4, American Psychological Association, 2014). Though useful as a broad framework, leading thinkers in the field agree that there is an ongoing need to establish a definition that supports clear hypothesis testing, falsifiable theory building, and comparison of findings across studies. In the following section, five scientists from different disciplines reflect on how their definitions of resilience have evolved over the course of their career.

### 2.3. Dr Seedat: resilience as mutable, scalable, dynamic and fluid

It is a pleasure to be on this panel and to share my own reflections on a theme that runs deep at this meeting. I think that resilience has gained traction in large part because of the potential to intervene with therapeutically effective treatments that are mechanistically informed. I have been working in the field of post-traumatic stress disorder for more than 20 years, but I started off, as many researchers have done, thinking about resilience as being a trait, a process, and outcome and wondering whether it was a convergence of all of these. Also, thinking about resilience in a binary way and coupled to diagnosis-based binary metrics, as well as thinking about resilience as reflecting resistance to psychopathology or recovery from psychopathology, either spontaneously or in the context of treatment. I think we have made a significant shift in terms of our understanding. We think of resilience now more as an effective adaptation to, or a navigation (or management) of, significant sources of traumatic stress or adversity and the capacity to absorb disturbance to harness resources effectively.

Resilience can be thought of as a process of relatively stable trajectories of well-being, but it is also characterized by 'dips' or periods of instability. I think that, for me, I consider resilience to be a mutable, scalable, dynamic, and fluid characteristic. It needs to be considered in terms of the lifespan of an individual, and it is largely context-dependent. An optimal trajectory really requires homeostatic adaptation, both on neurobiological and psychosocial levels. There is growing evidence to support the distinction between passive resilience and more active resilience (Rakesh et al., 2019). There are many mechanisms at play. These can be considered as allostatic load, stress inoculation, contribution of developmental factors, epigenetic factors, and transgenerational factors, that come into play and affect multiple interdependent systems (Southwick & Charney, 2012).

#### **2.4. Dr Kubzansky: expanding the conceptualization of resilience to include well-being and thriving**

When I think about the research on resilience that is emerging and also about my own work, I think we have done an excellent good job of understanding the questions we should be asking about resilience, but I am not sure how many answers we have as yet. In part, this may be due to a continued lack of conceptual clarity. To illustrate this, I will review some of the issues I have been mulling over as I think about how can we might want to study resilience and move the field forward. One issue I think is becoming increasingly clear is that resilience is a dynamic process. Trying to measure it as a static trait or a static experience has been challenging and may not be as useful for answering some of our key questions of interest. Thus, we often rely on people to self-assess their own resilience and tell us the extent to which they believe they can ‘bounce back’ after stressful events. This can be problematic because it is not clear how much people are able to predict how they are going to respond to unexpected circumstances, or how much self-insight people have. However, if you cannot simply ask people to self-report on their own resilience, it can be difficult to ascertain and quantify levels of resilience. Even the most simple definitions of resilience include exposure to adversity as part of the definition, that then also includes being able to bounce back or thrive even in the fact of such an exposure. If we also believe resilience is a process rather than a trait, then to assess the presence of resilience, you have to wait for some kind of stressful experience to happen and then see how people respond; only then can a researcher ascertain if the overall process indicates resilience or not.

I was particularly struck by this measurement challenge recently. I teach a social science research methods class, and as part of the class, we ask the students to develop a questionnaire-based measure of a construct of interest, that we assign. One year, I assigned students the task of developing a measure of resilience. I thought, ‘Well, this will a good exercise since many people are interested in resilience.’ It turned out to be a complete disaster, trying to have them measure resilience. They could not figure out how to do it because they kept running into questions about whether and how to measure stress. So they would say, ‘Well, I have to measure stress. I have to find out if they had stress, but then I have to have some way of figuring out how they responded to stress and I do not know how to measure that. And, what if my respondents did not experience any significant stress? In that case, I cannot measure resilience.’ Perhaps not surprisingly, the measures they developed were problematic in all sorts of ways. It was probably one

of the worst constructs that I ever assigned my students to measure and I vowed I would never do it again. I was really struck by this challenge in both conceptualizing and measuring the construct of resilience.

Another issue that I have been mulling over is that resilience, of course, implies adversity, and so anytime we talk about resilience, we are also talking about what happens in the context of adversity. I sometimes wonder if that is really the best way to think about this, given that all living organisms are going to encounter challenges and threats throughout their life and the goal is to be able to adapt appropriately to both small and larger challenges in order to be able to meet them effectively. If this is the case, then should we in fact think of resilience as occurring only in the context of trauma or major adversity (which is how it is most commonly conceptualized) or more as a capacity that is perhaps most evident in the context of major adversity but is exercised just in the process of living and making one’s way through the world. In some ways, I wonder if thinking about resilience primarily in the context of trauma or major adversity ends up leading us to a more narrowly focused or narrowly defined construct than would be ideal.

Another issue related to this concern about how narrowly we think about this construct is how we think about *effects* of resilience. Conceptualizing effects in the context of adversity can draw attention to how one might reverse damage or restore function (i.e. after damage has been incurred via exposure to adversity), rather than thinking about how one might build reserves or capacities that allow people to withstand and meet threats effectively, thereby preventing damage from occurring. This type of focus may be seen as after the fact-rather than preventive or health promotive (i.e. considering how people are functioning prior to confronting adversity) and changes the kinds of issues that you might examine or hypotheses you would generate.

A key question that often comes up when studying resilience is who should we consider as forming an appropriate comparison group? Of course, in part that is going to depend on your research question, but at the most general level, it is not clear whether the most appropriate comparison for people who faced adversity and then went on to function well in spite of it, is the people who never experienced stress or trauma at all, or the people who experienced stress or trauma and then went on to experience psychological or other difficulties. I have been working closely with a wonderful doctoral student, Kristina Nishimi, to try to figure out how to characterize these phenotypes. If you are willing to do the most simplistic version, you would say there are four groups. First, you have people who confront adversity and then do poorly. Then, you might have another group of

people who confront adversity and then have healthy psychological functioning in spite of that. You could have a third group people who do not seem to have confronted major adversity, but they are still not functioning well, for whatever reason (or maybe they really did experience adversity, but we just were not able to capture it). Then, you would have a fourth group that we could call a thriving group – these are the people who do not appear to have confronted major adversity and are still doing really well psychologically. As a sidebar, we have sometimes wondered if the people in this fourth group are somehow weird because there are not very many of them in the world. Moreover, who somehow manages not to confront major adversity in over the course of their lives? In any case, given even these four admittedly oversimplified phenotypes, it is not immediately clear who is the appropriate comparison group – those who never face adversity or those who do but seem to function well regardless? Moreover, to be able to create these phenotypes, one needs to decide what the thresholds should be for ascertaining if individuals are doing well or not psychologically, and for how to characterize whether individuals have indeed confronted major adversity (i.e. what constitutes major adversity, is one's experience enough or would we only characterize exposure when individuals have confronted two, three, or more of these types of events?). We probably all agree that these kinds of experiences and types of functioning really are on some kind of a continuum but it can be hard to define a construct across two continuums. Thus, we still have many questions about how best to conceptualize resilience and how to operationalize and measure it.

Another issue related to how we conceptualize resilience with which I have wrestled and sometimes been troubled by is this notion of 'bouncing back.' A basic premise of our work in this area is often that one faces some kind of adversity and then bounces back from and manages to recover in some way. However, what does it mean to bounce back and recover? To what are individuals bouncing back? I am always stuck on this thinking, 'What if you were not in a good place to begin with? Then what are you bouncing back to and do you want to bounce back to that place?' Most likely the people who are not in a good place are less likely to bounce back anywhere, but if they do bounce back, are they coming back to some kind of healthy place or not? As a result, I have not always found the notion of 'bouncing back' to be very helpful in terms of conceptualizing how we think about resilience. It seems to me that our understanding of resilience should account in some way, for where people start the process of confronting adversity – that is where they functioning well to begin with.

Another issue in which I have been really interested (which anyone familiar with my work will know) is regarding the relationship between psychological resilience and physical health, and thinking of resilience not as an outcome necessarily, but as a predictor. The central question here asks if people who are more psychologically resilient less likely to experience adverse effects of facing trauma, adversity, or life difficulties in terms of physical health? If so, what are the mechanisms by which that would happen? If you are going to think about resilience as a predictor, then the measurement becomes even more crucial in terms of thinking about how you define your comparison groups and how you can look at this in a way that allows you to characterize resilience as a process but still measure it in some kind of meaningful and reliable way.

Finally, an issue that I have spent a lot of time thinking about is, whether we can and should distinguish between positive functioning or thriving or positive psychological well-being (or whatever term you prefer that suggests people doing well regardless of whether they have confronted adversity) and resilience. As an aside, not long ago, I attended a meeting at the National Institute of Health (NIH) to discuss research priorities on resilience, and I made quite a few comments about this issue, but found many folks just gave me a blank stare, implying this is not an issue with which other people have been much concerned. However, I think we should be concerned with this, so I am going to put the issue out here and try again. Resilience implies that one is confronting adversity, trauma, stress, distress in some form. In contrast, the concept of thriving does not rely on the notion that you have to confront some kind of difficulty. So, an important question is what is the relationship between those two concepts? I would argue they are different but related. For instance, you might expect that people who have the skills and the capacities that enable them to do well in life are probably the same people who are more likely to be resilient and to do well in the face of adversity. As noted earlier, measuring resilience is challenging because we are forced to try to assess how people are doing in the context of adversity. While this is doable when measuring post-traumatic stress, which is defined by the fact that someone experienced a specific trauma and had a negative psychological response to that trauma, in many other situations, it can be difficult to tie psychological functioning to the occurrence of adversity specifically. Trying to do this raises some difficult questions – would we think only about a discrete event, or could that include for instance, ongoing social disadvantage or discrimination, and so forth. Another approach is to consider positive functioning regardless of adversity experiences. This leads us to ask what is positive psychological functioning or

thriving and what are key elements that characterize these experiences? Once we achieve an understanding of this concept, we may also be able to understand resilience better as well as bring insight into ways in which we might help people to be more resilient. If we are explicit about the conceptual distinctions and similarities between thriving (or positive psychological well-being) and resilience, it makes it a little bit easier to think about how we identify more broadly what it means to be doing well, key components of each concept, as well as antecedents and consequences of these psychological experiences of doing well.

### **2.5. Dr Teicher: resilience and brain network organization**

I come at the question of resilience from a more narrow framework. I am not particularly interested in resilience per se, I am more interested in the effects of childhood maltreatment, and correspondingly a specific type of resilience, characterized by individuals who experienced a moderate to high level of exposure to childhood maltreatment and who are doing much better than you would expect in comparison to other people who have had comparable levels of exposure. These are individuals who may show no signs of psychopathology in either the internalizing or externalizing domains. You observe them, you observe them clinically, you observe them in terms of your research studies and the big question for me is mechanistically, how do these individuals differ from individuals who are more vulnerable or more susceptible?

We have been looking at this from a brain imaging standpoint, and initially, our thinking was that if you are exposed to maltreatment and you develop certain psychiatric symptoms, and we look at your brain, we are going to see all sorts of alterations in susceptible structures. We will see reduced hippocampal volume, we will see alterations in amygdala function. We will find effects on your prefrontal cortex and your corpus callosum and there will be changes in your brain network organization and architecture. The assumption will be, well, if you have these experiences, and you are doing pretty close to fine, indistinguishable from an unexposed control group, then your brain is likely spared and you probably have some mechanism going on that enables your brain to be more resistant to the effects of stress hormones or something. That is how we started looking at this in terms of the brain imaging data, and it turned out that I was, as often as the case absolutely wrong.

What we hypothesized was not the way it looked at all. If you measured hippocampal, prefrontal cortical, cerebellar, and corpus callosum volumes as well as amygdala response and brain network architecture, you found basically the exact same effects in individuals who were exposed to maltreatment and had

serious psychopathology and comparably exposed individuals who had no diagnosable psychiatric disorders and were asymptomatic on every scale that we have given them. Nevertheless, they had the same array of brain changes. For years, I had this data in front of me and it was well – I am trying to build a model to understand how maltreatment by affecting the brain leads to psychopathology, but every brain change that we saw in individuals with psychopathology we also observed in maltreated individuals without psychopathology. It is only recently, within the last year, that we developed an explanation for what we were observing that makes neurobiological and clinical sense and this required an examination of brain network architecture.

We were looking at the interconnections of 90 different brain regions to specify how the brain is organized. Basically, the brain has a small-world organization that consists of modules or communities of closely interconnected brain regions that are connected to other modules through hubs. The maltreated and non-maltreated brain networks are very different. It turns out that the modules have the same local connectivity patterns in maltreated and non-maltreated individuals, but there are fewer interconnections between these modules in maltreated individuals. The maltreated brain network in particular is missing a number of frontal hubs that you normally see in a non-maltreated group, so there is a different organization. The maltreated group has a sparser network organization with fewer interconnections between modules and it is correspondingly more vulnerable. That is, it has less ability to compensate for an abnormality in a module because of its sparse connections. So we have figured what is going on in the vulnerable individuals is that you have an abnormality in a brain region or a series of brain regions and you then have a brain network organization that cannot compensate. Hence, you will wind up with symptoms and these symptoms may wax and wane in a quasi-random fashion as your brain network tries to organize to effectively compensate, but may not be able to do so due to the fewer interconnections between modules. Further, this process will have a developmental time course because network vulnerability likely increases in maltreated individuals from 15 to about 21 years of age as a consequence of pruning processes that largely occur post pubertally and the failure to develop these frontal hubs which occurs during adolescence. So psychiatric disorders in maltreated individuals will often emerge during the adolescent period as your brain network reaches a point of vulnerability is then no longer able to compensate for abnormalities in specific brain regions and you start to develop symptoms. That is what we believe is occurring in maltreated individuals who are susceptible to psychiatric consequences.

In the resilient individuals, we hypothesized that maybe they are doing better because problematic brain regions are exerting less influence on the

network and that they can continue compensating for a brain region that is functioning abnormally during this period of increasing network vulnerability is its volume is turned down to a certain degree. I am doing this work with Kyoko Ohashi, PhD in the lab, and we found that, yes, if you looked at the right amygdala, which is often abnormal in these individuals, it is less connected to the network in maltreated individuals without psychiatric symptoms. We then identified eight other brain regions that were less connected to the network in the resilient individuals. In the controls and in the susceptible individuals, it was equally connected, but in the resilient group, it was diminished. Well, diminished by perhaps by only 5% to 10%, but that may enable the network to fully compensate. We found that this model, using just 14 brain measures, we could classify our 300 plus individuals successfully into maltreated, non-maltreated, resilient, or susceptible with 80% cross-validated accuracy. This therefore seems to be a pretty decent model for understanding what is going on in terms of brain network organizations and resilience. That is what we have learned in this particular time. It then opens up all questions. Were these resilient individuals blessed with reduced connectivity in these regions to begin with, and does that lead to say a minimal impact pattern, as described by Bonanno and Diminich (2013), where they were exposed to adversity and never develop much in the way of symptoms? Or do these alterations in connectivity of these 'resilient nodes' emerge over time and led to an emergent or recovery pattern in terms of the resilience? We need to answer that question.

It seems like some of these regions may be more associated with the minimal impact and some more with an emergent resilient pattern and whether properties that you can identify beforehand that would predict that somebody would have this response. I am not sure if that is the case, how much is their psychological makeup versus how much is their neurobiology. Are there indeed protective factors, and do protective factors work by facilitating this kind of compensatory change in certain regions that will enable you to compensate?

Then, finally the big question is when you are looking at individuals who are maltreated and have serious symptomatology and you treat them, does treatment work by reversing the brain changes that you see with maltreatment or does it work by moving the nodal network architecture connections of the susceptible individuals more into the line with the more atypical network architecture of resilient individuals. So does effective treatment lead to changes in the connection of some of these nine brain regions associated with resilience, or is it undoing the early

damage? So those are the questions that we are currently pondering.

## **2.6. Dr Cicchetti: resilience as multidimensional spanning psychosocial and neurobiological factors**

I am going to begin by reminiscing about my childhood. When I was a child, I resided in a poor Italian community that was characterized by a high incidence of domestic violence, child maltreatment, poverty, and the like. Residents were all aware from things their parents had told them, articles in the newspapers, and the way in which society portrayed folks in their community, that families in the community were not expected to do well because they were poor and less educated. Poverty is considered to be one of the most ubiquitous, intractable, deleterious risk factors for individual, family, and population health.

Upon my graduation from college, I left home for the University of Minnesota where I was accepted into their PhD programme in clinical psychology. One of my professors and mentors there was Norman Garnezy, a major progenitor of early resilience theory and research (Masten & Cicchetti, 2016). At first Garnezy and other prominent systematizers, such as E. James Anthony and Emmy Werner, conceptualized children who experienced great adversity but exhibited normal or super normal functioning as invulnerable. Subsequently, Garnezy, Michael Rutter, and other scientists conducted hi-risk longitudinal studies, the results of which suggested that the term resilience best captured the phenomenon of functioning well in the face of serious adversity. Byron Egeland and Alan Sroufe, based on the results of their Minnesota Parent-Child Longitudinal Study (Sroufe, Egeland, Carlson, & Collins, 2005), concluded that resilience was a dynamic developmental process. Resilience is multi-dimensional; it is not static or trait-like. Although the pathways leading to resilient outcomes are often complex, Masten (2001) has described it as a type of 'ordinary magic.'

Research on resilience is rooted in the field of developmental psychopathology. Scientists adhering to a developmental psychopathology framework emphasize the importance of incorporating multiple levels of analysis into their research. This approach states that different systems contribute to development and that these systems bidirectionally influence each other to contribute to outcomes.

The role of biological factors in resilience is suggested by evidence on neurobiological and neuroendocrine function in relation to stress regulation and reactivity, by behavioural genetics research on non-shared environmental effects, and by molecular research in the field of epigenetics. One of the mechanisms through which

individuals might be able to acquire resilient functioning happens on a neurobiological level, through the process of neural plasticity. Neural plasticity can be framed as a process by which experience results in the reorganization of neural pathways across the course of development (Cicchetti, 2016; Cicchetti & Curtis, 2006). Thus, experience can result in physiological and structural changes in the brain. The relationship between the brain and experience is bidirectional. Experience helps shape the neural pathways in the brain, and the newly shaped brain seeks out different experiences which further alter neural pathways. Consequently, neural plasticity should ultimately be conceptualized as a process that encompasses the dynamic and continuous relationship between the brain and the environment that changes over time (Cicchetti & Curtis, 2006; Cicchetti & Tucker, 1994).

Resilient functioning is more than a product of biological systems. Psychosocial systems are equally important. Biology and psychology are so interactive that it is difficult to distinguish the unique effect of each system on resilient outcomes (Cicchetti & Curtis, 2006). Examples of such psychosocial factors that have been found to be linked to resilient outcomes include secure attachment relationships, an autonomous self, close friendships, supportive parenting, neighbourhood characteristics, and variation in personality types (Masten & Cicchetti, 2016).

Some researchers have questioned why the term resilience is necessary when we already have the term positive adaptation. We contend that resilience adds something that positive adaptation does not – namely resilience is reserved for individuals who do well in the throes of significant adversity (Luthar, Cicchetti, & Becker, 2000). Resilience has been conceptualized as the capacity to withstand or recover from significant disturbances that threaten its adaptive function, viability, or development. Development derives from the interaction of many systems across levels. Individual resilience depends on the resilience of other systems (Masten & Cicchetti, 2016).

### **2.7. Dr Williams: resilience as a property of a larger social context and policies**

I most often think of resilience within a very narrow area, one area of my research, which is focused on understanding the ways in which racism might affect health. I started out by thinking of what are the resilience factors that protect from the negative effects, for example, exposure to racial discrimination? I will illustrate a couple of studies that reflected where my thinking was. There is a study by Gene Brody and colleagues that showed among African-American adolescents who experienced discrimination consistently at three points during their teen years have higher levels of allostatic load (stress hormones, inflammation, blood pressure, and BMI) by age 20 (Brody et al., 2014). However, this association

between discrimination and biological dysregulation was not evident among those who received high levels of emotional and instrumental support from their families and peers. A similar pattern has been documented in two cohorts of African American teens with social relationships reducing the negative effects of high levels of discrimination as a teen on epigenetic ageing at age 20 or 22 (Brody, Miller, Yu, Beach, & Chen, 2016). These findings suggest that the quality of social support is a resilience resource in the face of discrimination. Similarly, the work of Christopher Ellison and colleagues, in prospective analyses of the National Study of Black Americans found that religious variables (religious attendance, church-based social support, and seeking religious guidance in everyday life) reduced the negative effects of experiences of racial discrimination on mental health (Ellison, Musick, & Henderson, 2008). Here again, religious involvement, measured at the individual level is a resilience resource.

However, I have been increasingly thinking of resilience, not just as an attribute of individuals, but also as a property of social policies and a property of larger social context. For example, think of the social safety net as a potential resilience resource. To illustrate my point, I want to take you on a quick walk down memory lane. In 1981, the newly elected President Ronald Reagan got the US Congress to pass the Omnibus Reconciliation Act of 1981. What did this legislation do? Some 500,000 people lost eligibility for welfare (Aid to Families with Dependent Children), a million people were dropped from food stamps (a nutrition supplementation programme for low-income families) and 600,000 lost Medicaid (health insurance for the poor) (Mundinger, 1985). Those funding cuts closed 250 community health centres across the USA, a million children lost access to reduced-priced school meals, and the WIC (Women's Infant and Children) supplemental nutrition programme only had enough funding to serve a quarter of those eligible. What happened in the wake of this weakening of the social safety net? Studies showed there were increases in anaemia in pregnant women, in babies born low birth weight, in infant mortality in poor areas in 20 states, in preventable childhood diseases evident in multiple cities, in children with elevated blood lead levels and lead poisoning, and in chronic disease among adults who were dropped from Medicaid (Mundinger, 1985). Thus, dramatic negative effects on population health were evident from the cradle to the grave.

Another example of how I think of how we need to expand the definition of resilience to include social policies is related to child poverty. The USA has a poverty rate among children that ranks around 35th in the world with 29% of American children growing up poor (UNICEF Office of Research, 2017). That is a strikingly high rate of child poverty. However, if you look at UNICEF data, there are many other countries that have poverty rates produced by their economic system even higher than the



US. But after transfers and taxes, the child poverty rates are dramatically reduced. Social policies could be a resilience strategy.

For example, in the country of Ireland, the economy produces a child poverty rate of 44%. After transfers and taxes, that child poverty rate is reduced to 18%, indicating that policies have made an enormous difference. In contrast, for the USA the child poverty rate produced by the economy is 36%, but after taxes and transfers, it is reduced to 29% (UNICEF Office of Research, 2017). So the policies that we could implement that would dramatically reduce poverty and change trajectories of economic and health outcomes for children living in poverty are resilience strategies as well. A recent National Academy of Sciences report outlines the strategies that can reduce childhood poverty by 50% in a decade (National Academies of Sciences, Engineering, and Medicine, 2019).

### **2.8. Dr Denckla: are there costs and/or benefits associated with resilience?**

A theme that is emerging in these discussions on the definitions of resilience is that resilience may entail a dynamic unfolding of protective strategies to resist mental and physical health consequences, but that these strategies are complex and can come with some costs, for example as illustrated in the discussion of reduced nodal connectivity in brain architecture. How would you think about approaches that might capture these complex interacting processes between costs and benefits associated with resilience?

### **2.9. Dr Seedat: resilience as engendering benefits and costs**

I think that there has been a huge drive to think about resilience in a more objective and quantifiable way. To think about endpoints in the pursuit of predicting resilience following exposure to trauma. One could think about the interplay between biological and environmental factors, but latent factors and unmeasured factors also are important in determining outcomes to trauma exposure, or experiences of adversity.

There is also cost to being resilient. We can think of resilience as being on a favourable continuum in that it mitigates the vulnerability to adversity and reduces emotional and cognitive sensitivity, but there is also a trade-off with sensitivity. Resilience can, in fact, reduce sensitivity to beneficial opportunities (Belsky & Pluess, 2013; Crespi, 2015).

There is good evidence for that particularly at a genetic level where cognitive trade-offs are strongly supported by evidence that particular genotypes can increase liability to psychopathology, particularly in poor environments, but

that these same genotypes can be beneficial individuals who are exposed to good environments. Resilience then engenders benefits in poor environments, but can be costly in good ones.

### **2.10. Dr Kubzansky: importance of examining multiple domains**

Well, I had a related point, although it is not quite exactly on cost, and I will come back to this issue of costs. In some of our work, we have looked at how resilience might affect subsequent physical health among people who are exposed to adversity in some fashion. We have identified individuals who appear to be psychologically resilient, in that they seem like they are doing better than you would expect based on their exposure to adversity. We then look at their physical health later on in life. One of the findings that we have had fairly consistently is that the folks who seem like they are doing better than you would expect psychologically given they were exposed to adversity are also doing better in terms of physical health outcomes. This is in comparison folks who were exposed to adversity and do not seem to be doing well psychologically. However, also of interest is that we have consistently found a residual effect of exposure to adversity on physical health, so that the psychological resilient individuals do not have quite as good subsequent health outcomes as the individuals who did not confront adversity. This suggests there is a cost involved – not so much the cost of resilience as much as the cost of adversity. It suggests to us at least so far that you cannot fully undo or unroll or reverse the potentially harmful effects of adversity exposure; you may be able to mitigate them, but you may not be able to make them go away.

Now, it is also worth mentioning there are some interesting animal studies that suggest you can make harmful effects of adversity ‘go away’ in the context of some facets of functioning, but not others. You might not be able to change certain molecular changes that occur, but you can sometimes change effects on behaviour. This also suggests a cost of adversity even among those demonstrating resilience; you cannot fully undo harm, really, truly, but you can potentially mitigate effects and possibly substantially mitigate them.

To answer your question more directly vis-a-vis the cost of resilience is as follows: I feel like the jury is still out because I do sometimes wonder if we have the right comparison groups, in terms of are we really comparing apples to apples? I feel like we need to make sure that we know enough about the people who look like they are doing better initially, to say they look just like the people who are not doing better. In that way, we can make a better assessment of whether there is truly a cost of resilience or if there might be something else going on that is driving the apparent differences down the road.

I think that as we have a better hand handle on the definitions and how we characterize people who are more or less resilient or who confronted adversity in various ways, it will get easier to do those studies in a really more rigorous way. I would also pose the question of whether there might be costs in some domains, but not in others. Also, while all of us have our silos or our domains of where we do research, and often it is easier to look at a single outcome or a single domain of outcomes, it will be important not to focus on a single domain, but rather try to take account of the whole picture. For example, suppose there are some costs evident at the molecular level but you are able to mitigate behavioural harms, and that in turn means there are multiple downstream outcomes that truly look better than if you had not changed behaviour. In that case, we would argue resilience is highly beneficial even if it does not fully mitigate the effects of initial exposure. And in that case, mitigation is certainly worth thinking about and striving for.

Increasingly, especially with more and more big data available, we probably will have the opportunity to look at multiple domains and across many different facets of functioning. Again, this will guide us to thinking in a more comprehensive way about costs and tradeoffs and so forth. I will say that from the work we have done so far, and from the animal models I have seen, I am not convinced that one can fully undo, serious exposure to adversity fully. I would love to be wrong on that.

The other thing I will say is that most of the studies that look at this are often not looking at concerted efforts to undo the adversity, they are looking at the natural course of things where some people seem to do better and some people seem to do worse. We do not really know how different it would look if we were intervening and doing something actively to change the course of things versus just relying on naturally occurring events to try to get a sense of how these things play out. I think these are really important and interesting questions. As we have more granularity on the different components, I think we will be able to look at them a little more clearly.

### **2.11. Dr Teicher: domain-specific resilience**

I guess just following up on your point, I think another way of expressing it, is to talk about it from the idea of domain-specific resilience. Individuals are very rarely universally resilient, they tend to be resilient in some specific domain. The cost of adversity may be an example of two groups with different domain-specific resilience. One group may be resilient in terms of their academic performance or occupational performance, but not resilient in terms of their physical health while another group may be resilient in terms of physical health, but not in terms of occupational performance.

I think you can look at that in terms of cost and we can look about it in terms of specific domains. I think the model that we have, where these brain regions are less connected that provide a basic resilience, those provide the context in which you will have a cost, that there is going to be a downside of not having these brain regions connected as well. It may be protective and will enable you to not experience certain things, but you also may be limited in terms of things that are positive that you may want to experience. What we find is that if we look at a rating scale, our resilient group do not differ from controls, unexposed controls in their mean level. If you do something more sophisticated, like ecological momentary assessment, and look at the regulation of affect from hour to hour across days, what you see is they do not regulate their moods as well. Their mean level manages to come out normal, but the negative moods and more persistent than their positive moods and more variable. It is not exactly the same, but it is a fair compensation. I think that is a real important concern about these domains.

### **2.12. Dr Seedat: resilience as a multiple outcome concept**

I agree. I think in addition to assessing domain-specific aspects of resilience, where we have fallen short in the field is that research on resilience domains has not been coupled to multiple outcomes – so much of the research focuses on PTSD and depression as compared to other psychiatric disorders. We also have not looked deeply across both psychiatric outcomes and very important physical health outcomes, some of which David has spoken to.

### **2.13. Dr Williams: identify under what conditions, do some resilience resources have negative effects**

Dr Seedat noted the cost of resilience and that is one aspect of resilience that I have also been giving increased attention. I want to illustrate that by describing the findings from three studies that show exactly the same pattern (Brody et al., 2013; Chen, Miller, Brody, & Lei, 2015; Miller, Yu, Chen, & Brody, 2015). These are studies all followed Black adolescents, over time. They have all focused on low-SES African-American adolescents who have high levels of self-control self-regulation at age 11. We think of these psychological characteristics as resilience resources for youth in a difficult context – they are low SES, but they have high self-control and self-regulation and we would expect these resources to pay off. The studies find that by age 20, these students do have higher academic performance and they are doing better emotionally and have low levels of substance use (drugs and alcohol). These are all great outcomes for these youth

from a poor background. At the same time, at age 20, these same youth have greater obesity, higher blood pressure, higher stress hormone levels, and higher epigenetic ageing profiles than their peers who were low SES but low on self-control, or than their peers who are higher on SES. In other words, the resilience resource that they have (self-regulation), that has provided positive benefits for mental health and socioeconomic success but is also linked to having some negative effects on multiple indicators of physical health. So our challenge is how do we begin to unpack the costs of resilience and identify under what conditions, do some resilience resources have negative effects, and what are the intervention strategies that might minimize the likelihood of observing these adverse effects. Those are critical issues that we need to better understand.

### **2.13.1. Dr Cicchetti: fostering resilience across developmental contexts**

Psychosocial factors are particularly relevant to informing intervention efforts to promote resilience across developmental contexts. Investigations of psychosocial systems can help to identify ways in which interventions might be able to alter the environment to introduce protective factors that will increase the likelihood that individuals will have resilient outcomes. Community or school-level interventions can be designed to promote factors that are linked to resilient functioning (such as community parenting classes or fostering peer relationships in classrooms). Although it is valuable to integrate biological systems when conducting psychosocial studies to help inform social interventions (Cicchetti & Gunnar, 2008), it is most practical for interventions to target social systems.

### **2.13.2. Dr Denckla: can resilience be thought of as the inverse of risk?**

In response to a question from the audience, as well as a commonly asked question central to the resilience field, is whether resilience is simply the inverse of risk. Is resilience the opposite of vulnerability, or is something distinct from vulnerability?

### **2.13.3. Dr Teicher: resilience as a separable mechanism from risk**

Yes, I think it is an interesting point. I do think about it from the standpoint of vulnerability or susceptibility and thinking about, what about these individuals who have low vulnerability? I would agree if everything lined up in a particular way so that if their neurobiology and their psychiatric symptomatology lined up, I would say, 'These individuals are just less vulnerable, that their brains were not affected, that their mental health was not affected.' Then I say, 'we have a group that is relatively immune to these consequences,' but we wind up in a very different situation. We wind up that susceptible and resilient individuals are equally vulnerable in terms of their brain, but

not equally vulnerable in terms of their psychiatric outcome. This then leads me to the idea that you can not simply talk about their outcomes in terms of overall vulnerability that you need another way of understanding it. Then, it leads to a question of what enables this group to be able to have a different kind of outcome. I think that the concept of resilience does have some use.

I see this tautology more in terms of the idea between risk factors and protective factors. There you do not want to define protective factors as the opposite of a risk factor. I think that there is real value in the concept of resilience in terms of understanding the mechanisms that lead to reduced vulnerability because two different mechanisms may come into play. There may be one mechanism that generally leads to bad outcomes, and a separate mechanism that is protective that comes into play. You cannot just think about it in a unidimensional way. That is where resilience comes in and adds value to our understanding of risk and vulnerability.

### **2.13.4. Dr Seedat: resilience as a combination of stress vulnerability and post-traumatic growth**

I do not think that resilience is the flip side of vulnerability or that resilience is the opposite of stress or that resilience is stress invulnerability. I think that to get back to your question, resilience is probably one of stress vulnerability plus post-traumatic growth. I think of resilience as encompassing both positive and negative factors and attributes, with post-traumatic growth reflecting positive adaptation in the face of adversity, as measured over time. Resilience also encompasses stress vulnerability and so I do not agree that resilience is the flip side of stress vulnerability – rather it encompasses both stress vulnerability and post-traumatic growth.

### **2.13.5. Dr Kubzansky: resilience and optimal functioning**

I have a lot of thoughts about that. I think it is a really interesting and provocative question. It is something we wrestle with a lot when we are trying to think about what it means to be functioning. One of the arguments we have made about the importance of studying optimal functioning or healthy functioning is that if you only ever look at what happens when things go wrong, you will never really know what it looks like when things go right or how to make that happen. Put another way, we often identify risk factors or experiences and environments that harm health or make things go wrong. These findings can generally be interpreted as the presence of a risk factor is harmful, while the absence of a risk factor is not. However, if you are trying to ascertain how to make things go right, or help individual to function, not just without obvious disease, disorder, or disability, but actually to be well, then it is not clear that the absence of a risk factor leads to positive functioning. It just means things did not go wrong. We have said

in other work, ‘the absence of something negative is not the same as the presence of something positive.’

More concretely, the fact that someone is not depressed does not necessarily mean that they are functioning at a high level and doing really well. It means they are not depressed but then there is a whole spectrum there of folks who are not depressed and just trundling along and they look quite different from the folks who are doing really, really well. Maybe you would say these latter individuals are in optimal health. Distinguishing factors that promote truly healthy functioning or doing really well in the face of challenges may be a very different task from identifying factors that predict doing more or less badly. If you only assume that they are just the inverse of each other, you will never know what it looks like to get to the other end of the spectrum.

A related issue we have thought a lot about concerns biological factors that may either be underlying these propensities or sequelae of them. In parallel to the issues I described above, thinking about risk versus lack of risk, true positive functioning versus absence of negative, in the context of biology we almost do not know how to talk about positive biological factors. Most of the biology that we think when we think about health is negative biology. We think about processes like inflammation or stress axis or stress hormones, and so forth. It is really hard to think of processes that are related to things like regeneration, repair, and rest, and what those look like. In fact, there is a terrific article that somebody called Farrelly (2012) wrote some years back now on positive biology. In it, he made the case that all we ever look at is negative biology. It is really hard to understand how to achieve biological health if you only ever define processes that range from bad to not bad, i.e. having versus not having inflammation or having versus not having high blood pressure. Is there some biological set of conditions that really define functioning well? The only example people can usually come up with is physical activity – it seems to change biology in really meaningful ways that result in people are functioning much better than they were. It is hard to get your head around, trying to identify what some other positive processes might be? This seems like an important question and a really fair one. I would strongly make the case that will be critical to distinguish positive processes from just those that are not bad or those that are downright negative or harmful.

#### **2.13.6. Dr Denckla: can the term resilience be misused?**

An individual in the audience stated that in her Native American community, she had observed that among some young adults experiencing psychopathology, there was a self-perception of failure if

one experienced mental health effects after exposure to trauma or adversity. Can the term resilience be misused or misunderstood, resulting in an adverse impact on individuals?

#### **2.13.7. Dr Teicher: the importance of context**

My comments on this is it makes me think of something else I have seen over the course of time in hearing about resilience and resilience research. I remember when I first start hearing Dennis Charney talk about resilience that he was talking about resilience in the context of individuals who had been prisoners of war and dealt with torture on a near daily basis, who managed to preserve some reasonable degree of mental wellbeing. These individuals were superheroes and resilience was something seen in a small minority of remarkable people. Now, over the course of time, it seems like we have gone to the Lake Wobegone School of resilience where every child is above average and everybody is resilient. In that context, resilience loses any scientific meaning.

I see this in the tendency of talking about everybody who is a survivor as being resilient. I think we need a better word to describe survivors, they are remarkable and they are amazing but do not call all of them resilient because it loses any meaning. So, I think that the danger of trying to approach everything from a resilience standpoint is that some people are definitely going to be excluded and that is going to be a problem.

#### **2.13.8. Dr Kubzansky: resilience from a population health perspective**

I think this is a really interesting point and I will come back to something that I thought David was saying related to the context in which people are living. We so frequently talk about resilience as an individual-level trait or an individual-level experience and yet there are all kinds of factors that contribute to or make it more or less likely that people will be able to do well in spite of all kind of circumstances. I think one of the dangers of looking at resilience at the individual level and failing to contextualize the larger circumstances in which people are living their lives means we miss out on potentially identifying possible community-, organizational-, and policy-level levers by which we might make it more possible for more people to do better. If it becomes all about the individual and the individual not somehow rising above things and heroically achieving, that becomes a really easy discussion point and perhaps even a distraction. Because, with a focus on the individual, larger entities and social structures do not have to take responsibility. This results in the thinking that it is not the government’s job, it is not an organization’s job, it is not a community’s job, to think about why are people not doing better.

There is an important discussion we should have frequently and repeatedly, with regard to where you locate the responsibility for how to help a population to be more resilient or how you help a population to be more likely to thrive to enable them to then face all kinds of challenges that might come up. These issues are especially important as you start thinking from epidemiologic perspective and thinking at the population level – they highlight questions like: what are the ways in which you are going to shift the population distribution at this experience? Such a perspective may also make it easier to remember that when studying resilience, it occurs in a social context and many structural factors come into play with regard to who achieves resilience and how well it serves them. We want to be really mindful of these issues when discussing resilience, also to make sure that we are not telling people that somehow they are at fault if they are not able to be more resilient.

### **2.13.9. Dr Seedat: critical need for improved phenotyping and biotyping in future research**

We have done quite well in terms of enumerating many of the biological determinants of resilience, but our knowledge is quite disparate today because I think that we have, to a large extent, failed to meaningfully integrate and organize the multi-level data that has been gathered over the years and to distinguish between different resilience trajectories. This is really important if we want to be at a point in time where we can inform targeted treatment and resilience supporting strategies. I think that the field has also been plagued by accurate quantification of the phenotype of resilience. We have measures that are largely inaccurate and suffer from issues of internal consistency and validity. Commonly used scales like the Connor-Davidson Resilience Scale, for example, have not been shown to have good internal consistency or validity in cross-cultural populations.

Many factor analytic studies of adapted versions of resilience measures have also not been shown to have good reliability and validity. We now need to focus efforts on assessment in resilience research. As Karestan alluded to, there have been concerted efforts to gather very large-scale data to do well-powered longitudinal studies, but I think that more international and interdisciplinary investment is needed to conduct studies where we can do really good phenotyping as well as biotyping.

In addition, we need to have studies that will allow us to do within-study comparisons of resilience trajectories and identify mechanisms that are operational across different age groups (i.e. across the lifespan) and aimed at identifying a predictive biomarker panels using large data and machine learning approaches to facilitate identification of high-risk individuals. These studies should also include detailed assessment of potentially modifiable protective factors that are linked to psychological resilience.

Because as I alluded to at the outset, I think there have been two quite divergent streams of research and less attention paid to identifying a psychological, psychosocial, and other environmental factors that contribute to resilience.

In addition, I think that there have not been good well run randomized control trials (RCTs) of both intervention and prevention approaches. Many of the RCTs that have been conducted have been plagued by poor operationalization of the construct of resilience as well as by the problems that we have with measuring resilience. In order to disseminate and implement novel interventions, we first need to have these methodologically robust RCTs.

In addition to validated resilience measures, it is important to include in studies measurement of factors that could actually mediate the effects of intervention – to try and parse out the specific components of the intervention that may account for the positive effects of the intervention, as well as to look at the relative contributions of non-specific factors to outcomes, both in terms of psychopathology, and in terms of resilience trajectories.

## **3. Discussion**

In this plenary panel held at the 2019 annual meeting of the International Society for Traumatic Stress plenary panel discussion, five interdisciplinary experts from psychiatry, social epidemiology, developmental psychiatry, and psychiatric epidemiology discussed complex and dynamic current topics in resilience research. Four core themes emerged including (1) considerations related to the definitions of resilience, (2) approaches to considering domain-specific resilience, (3) population-level health perspectives, and (4) suggestions for charting a research agenda. Each theme is discussed in more detail in the following discussion.

### **3.1. How have definitions of resilience evolved?**

Since the term psychological resilience came into common usage in the 1970s, debate surrounding the definition and rigour of the construct has permeated the field. In some respects, the same concerns addressed by Luthar & Cicchetti (2000). continue to define the debate 20 years later, including a lack of consensus on the definition, significant variation on the operationalization of the construct, discrepancies and confusion around on trait vs. dynamic conceptualization, and little consensus on the deflection of terms such as ‘protective’ and ‘vulnerability.’

These sentiments were echoed by each of the panellists, and each offered their perspective on evolving definitions and conceptualizations of the term resilience. Proposed definitions included (1) an effective adaptation to or a navigation (or management) of

significant sources of traumatic stress or adversity and the capacity to absorb disturbance to harness resources effectively, (2) a dynamic process or capacity that is perhaps most evident in the context of major adversity but is exercised just in the process of living and making one's way through the world and includes some aspect of positive functioning or well-being, (3) a brain-based mechanism of compensating for the adverse impact caused by exposure to maltreatment or trauma (4) an interdependent, multi-level, multi-systemic system that drives the capacity to withstand or recover from significant disturbances that threaten its adaptive function, viability, or development, and 5) an individual attribute as well as a property of social policies and the larger social context that protects from the negative effects of adversity exposure, for example to racial discrimination. All definitions shared a focus on conceptualizing resilience at multiple levels, from the biological to the social and policy level, a focus on the dynamic nature of resilience itself as a fluid, interacting process of adaptation, and a move away from conceptualizing resilience as an individual trait. Perspectives also diverged in some areas. For example, should resilience only be considered as observable in the aftermath of a specific trauma, given that stressors are nearly ubiquitous in everyday living? Alternatively, should resilience be considered only an individual factor, or more powerfully at the social and policy level?

Similar to conclusions gleaned in 2014 (Southwick et al., 2014), panellists agreed that resilience is best conceptualized as a multi-level, dynamic process of adaptation to stress and trauma exposure. Panellists went further to suggest that the construct of resilience might also encompass both positive and negative factors and attributes given that some adaptive response are protective in some contexts, but are liabilities in others. For example, resilient individuals who do not demonstrate symptoms but have experienced childhood maltreatment experience alterations to brain network architecture that can have negative implications for brain health, yet these alterations might also protect against psychiatric burden. Panellists also suggested that it is increasingly important to clearly define the construct given the spread of the construct wherein the risk lies that resilience might be characterized so generally such that it ceases to have specificity.

#### **4. Next steps in resilience research: multi-level, systemic domain-specific frameworks**

The idea that resilience spans multiple levels of functioning and ultimately reflects the interaction across these multiple systems from the molecular to the

community level has been highlighted in the extant literature (Ungar & Theron, 2019). Panellists added to this conceptualization by discussing an emerging theme in their own perspectives that converged on observing the latent tradeoffs that can accompany observed resilience. For example, panellists suggested that resilience might be on a favourable continuum in that it mitigates the vulnerability to adversity, but that such a strategy may also reduce emotional and cognitive sensitivity, thereby reducing sensitivity to beneficial opportunities (Belsky & Pluess, 2013; Crespi, 2015). In other areas of research, studies have shown that psychosocial competence in highly adverse settings can be accompanied by decrements in cognitive and physical health. For example, studies have shown that developing psychosocial competence under adverse conditions associated with low socioeconomic status is associated with markers of accelerated ageing and reduced neurocompetence (Brody et al., 2013; Chen et al., 2015; Denckla et al., 2017).

Panellists suggested a conceptual framework that considers resilience as a domain-specific construct could be a fruitful research agenda. For example, brain-based research has shown that reduced network connectivity is associated with resilience, but that there is a downside of not having these brain regions connected as well that might affect functioning in specific domains. That is, this reduced connectivity may be protective in the prevention of negative affect, but it may also limit the experience of positive affect.

#### **4.1. Moving towards structural and population-level perspectives**

Panellists agreed that a great deal of the research on resilience is conducted either solely at the individual level (i.e. considering the trait of resilience or individual trajectories of functioning after experiencing adverse events), or at the community level in the context of disaster-related research. In contrast, there is less work that considers resilience at the population level, with limited data on either the distribution and determinants of resilience in populations or the downstream effects of resilience on population health. Such insight is critical for understanding how to build resilience in public health interventions. Relatedly, viewing resilience as only an individual-level factor neglects the important role of social determinants on resilience, introducing ethnocentric bias and risking misunderstanding the strength of the effect of social disadvantage on well-being (Schwarz, 2018).

These issues are especially important from the epidemiologic perspective with respect to population-level key questions. For example, how is it possible to shift the population distribution towards resilience? Such a perspective crucially requires a focus on social context and structural factors that are associated with resilience to

develop equitable prevention and intervention and to prevent downstream stigma associated with adverse outcomes following exposure to trauma. Finally, a focus on individual-level resilience factors must not distract from the enormous good that can come from proactive social policy that reduces exposure to adversity in the first place.

#### 4.2. A research agenda

Although the surge of interest in resilience has generated a significant body of literature and important conceptual foundations for the field have been established, methodological limitations including the limited number of longitudinal, prospective studies, a lack of consensus on operational definitions of resilience, and a focus on resilience as a single stable trait rather than the product of complex interacting behavioural, genetic, psychological, and social factors suggest opportunities for continued growth. To illustrate, a recent systematic review found that among 43 randomized control trials on training programmes designed to foster psychological resilience, the lack of consistent definition of resilience, limited comparison between studies given the variability in outcomes and assessment instruments used, and major technical design problems rendered limited capacity to properly assess the efficacy of resilience-building interventions (Chmitorz et al., 2018). These areas represent critical areas to overcome if effective intervention and prevention strategies are to be discovered.

Several panellists agreed that an important area for future research is to integrate conceptualizations of resilience from the individual-level to the larger social context at the population health level. In terms of measurement, panellists highlighted the need to focus efforts on improving assessment in resilience research. For example, factor analytic studies of adapted versions of some resilience measures have not been shown to have good reliability and validity cross-culturally (Jorgensen & Seedat, 2008), and other work suggests that self-rated resilience does not demonstrate concordance with functional ascertainment (Sheerin et al., 2019; Nishimi et al., 2020). This becomes particularly problematic when considering interpreting the results of prior RCTs (see for example Chmitorz et al., 2018). In order to disseminate and implement novel interventions, methodologically robust definitions and measurement strategies must be in place with thorough cross-cultural validation (see for example, van der Meer et al., 2018). This is a critical next step to informing targeted treatment and resilience supporting strategies. There have been concerted efforts to gather very large-scale data to do well-powered longitudinal studies, but more international and interdisciplinary investment is needed to conduct studies characterized by very good phenotyping and biotyping.

In terms of study design, panellists discussed the advantages of employing within-study comparisons of resilience trajectories. This approach could identify mechanisms that are operational across different age groups (i.e. across the lifespan). This could also be done by integrating and organizing the multi-level data that has been gathered to facilitate distinguishing between different resilience trajectories. These larger datasets will potentially catalyse the identification of predictive biomarker panels using large data sets and machine learning approaches. Secondly, within-study designs that employ more intensive phenotyping strategies such as ecological momentary assessment can provide a more granular look at aspects of emotional regulation that mechanistically drive resilience. The variability that would normally be lost in averaging moment-to-moment mood shifts could then be quantified. This might show, for example, that resilient vs. unexposed individuals phenotyped using a rating scale do not differ in mean levels of negative mood, but on an hour-to-hour basis, we might find that resilient individuals have more persistent negative moods compared to positive moods. Finally, more caution is urged in selecting comparison groups in within-study designs. A key question that often comes up when studying resilience is whom should we consider as an appropriate comparison group?

In terms of considering outcomes, strategies that examine outcomes across multiple levels and domains are a critical area for growth. These approaches will offer a more nuanced understanding of the benefits vs. tradeoffs of a particular adaptation, and help critically delineate domain-specific areas of resilience. That is, by clearly defining the domain of interest (e.g. intimate partnerships vs. occupational functioning), a more specific understanding of the mechanisms that are associated with resilience is possible. This approach could also expand the scope of resilience research beyond PTSD and depression to other psychiatric disorders. Finally, outcome-wide approaches could also facilitate a better understanding of the interplay of psychological factors, social determinants, and molecular and physical factors.

Researchers interested in resilience ultimately seek to reduce the adverse health effects of exposure to trauma and adversity and even to eradicate exposure to trauma itself. In this effort, these five panellists identified emerging definitions, significant opportunities for discovery, methodological and conceptual limitations that currently exist, and directions for future research. Panellists agreed that one of the main challenges in the field is how to identify the conditions under which resilience has positive and negative effects, and what intervention strategies most optimally minimize the adverse effects of exposure to trauma and adversity. The trend of exploding

interest in resilience research, coupled with advances in genetics, molecular biology, increased computational capacity, and larger, robust datasets, suggest that the next decade of research could bring significant breakthroughs.

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