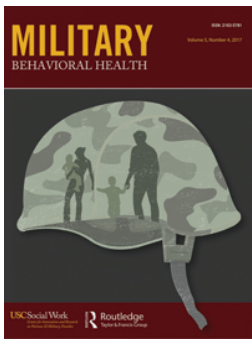


REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE 27-07-2017	3. REPORT TYPE AND DATES COVERED Published Manuscript		
4. TITLE AND SUBTITLE Thinking "Big" About Research on Military Families			5. FUNDING NUMBERS HHSN316201200036W_HHSP233201 400190W		
6. AUTHOR(S) Stacy Ann Hawkins, Kathrine S. Sullivan, Ashley C. Schuyler, Mary Keeling, Sara Kintzle, Paul B. Lester, and Carl A. Castro					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Research Facilitation Laboratory 20 Ryan Ranch Road, Suite 170 Monterey, CA			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) Army Resiliency Directorate 2530 Crystal Drive 6th Floor Arlington, VA 22202-3941			10. SPONSORING/MONITORING AGENCY REPORT NUMBER ARD		
11. SUPPLEMENTARY NOTES This is an Accepted Manuscript of an article published by Taylor & Francis in Military Behavioral Health on 27 July, 2017, available online: http://www.tandfonline.com/10.1080/21635781.2017.1343696 .					
12a. DISTRIBUTION / AVAILABILITY STATEMENT This is an Accepted Manuscript of an article published by Taylor & Francis in Military Behavioral Health on 27 July, 2017, available online: http://www.tandfonline.com/10.1080/21635781.2017.1343696 .			12b. DISTRIBUTION CODE A		
13. ABSTRACT (maximum 200 words) Research examining military families is often limited by data collection challenges. Big data approaches can provide greater data access and a more robust picture of individuals, groups, and systems. In this article, the authors discuss the use of big data for military family research. First, they describe the Person-Event Data Environment, a big data solution currently used by the Department of Defense. Then, they discuss several datasets that incorporate constructs of interest to family researchers, including the Family Global Assessment Tool (GAT), a dataset on psychosocial well-being. Next, the authors describe the sample of spouses who have completed the Family GAT (n = 1250). Finally, they discuss theoretical frameworks that provide a foundation for big data research on military families, noting potential future directions.					
14. SUBJECT TERMS Big data, military families, military spouse, resilience, behavioral health			15. NUMBER OF PAGES 13		
			16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED//FOUO		18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED//FOUO	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED//FOUO	20. LIMITATION OF ABSTRACT UU	



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To cite this article: Stacy Ann Hawkins, Kathrine S. Sullivan, Ashley C. Schuyler, Mary Keeling, Sara Kintzle, Paul B. Lester & Carl A. Castro (2017) Thinking “Big” About Research on Military Families, *Military Behavioral Health*, 5:4, 335-345, DOI: [10.1080/21635781.2017.1343696](https://doi.org/10.1080/21635781.2017.1343696)

To link to this article: <https://doi.org/10.1080/21635781.2017.1343696>



Accepted author version posted online: 19 Jul 2017.
Published online: 27 Jul 2017.



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Thinking “Big” About Research on Military Families

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ABSTRACT

Research examining military families is often limited by data collection challenges. Big data approaches can provide greater data access and a more robust picture of individuals, groups, and systems. In this article, the authors discuss the use of big data for military family research. First, they describe the Person-Event Data Environment, a big data solution currently used by the Department of Defense. Then, they discuss several datasets that incorporate constructs of interest to family researchers, including the Family Global Assessment Tool (GAT), a dataset on psychosocial well-being. Next, the authors describe the sample of spouses who have completed the Family GAT ($n = 1250$). Finally, they discuss theoretical frameworks that provide a foundation for big data research on military families, noting potential future directions.

KEYWORDS

Big data; military families; military spouse; resilience; behavioral health

Daily life for the over 2.8 million military family members can be distinct from the civilian world because of the demands of the military (Department of Defense [DoD], 2014); challenges can include frequent relocations, sometimes to other countries, parents' long working hours, and time apart for training and operational deployments, which place military personnel at risk of injury or death. These demands often happen concurrently and are not optional or negotiable for service members and their families (Dandeker, Eversden, Birtles, & Wessely, 2013; Segal, 1986). Resilience in the face of these challenges, however, can enable military families to effectively cope and rapidly recover during difficult times. Psychological resilience “comprises the sum total of psychological processes that permit individuals to maintain or return to previous levels of well-being and functioning in response to adversity” (Zamorski, 2008). By understanding the process of resilience, effective prevention and intervention strategies can be developed to strengthen individuals and families, particularly military families.

Indeed, Army parents, spouses, and children face both benefits and challenges unique to being an Army family. Given the recent history of military operations in Afghanistan and Iraq, it is not surprising that current research on military families has largely focused on the impact of deployment. Overall, this research reveals that

deployment can be a stressful time for spouses and children (e.g., Chandra, Burns, Tanielian, Jaycox, & Scott, 2008; Huebner, Mancini, Wilcox, Grass, & Grass, 2007; Schlomer, Hawkins, Wiggs, & Borden, 2012; Warner, Appenzeller, Warner, & Grieger, 2009). Still, many military family members appear to thrive, even in the midst of such challenges (e.g., Huebner & Mancini, 2005; Jensen, Martin, & Watanabe, 1996; Meadows, Tanielian, & Karney, 2016; Orthner & Rose, 2005; Rosen, Teitelbaum, & Westhuis, 1993).

Despite extensive previous research, clinical practices, programs/interventions, and military policies related to Army families require a deeper understanding of the factors that differentiate families who are able to adapt to stressors from those families who find the impact of military life more challenging. New knowledge that offers social workers and other front-line clinicians concrete strategies to identify the service members and families in greater need of support and intervention is critically needed. There are a number of methodological approaches that could produce deeper and more meaningful research in this area. For example, using dyadic data to study family resilience and psychological health from the perspective of both the service member and their spouse has dramatic potential to increase our understanding. Likewise, being able to integrate and investigate a wide array of constructs can serve to

increase the depth and breadth of this line of inquiry. For example, integrating both subjective reports (e.g., survey data) with objective reports (e.g., medical records) can provide more robust measurement of key concepts. This article discusses the methodological movement toward big data, how big data can be leveraged to better understand military families, and the implications of this effort for social work research and practice.

A move toward “big data”

The exponential growth in the accumulation and utilization of massive quantities of data over the last several decades has illuminated its potential benefit across many domains. The term *big data* was coined by computer scientists to characterize the evolving technology and science of data management and analysis, given the vast amount of digital data being collected across the globe (Murdoch & Detsky, 2013). Although there is no consensus around a single definition of big data (Manyika et al., 2011; Mayer-Schönberger & Cukier, 2013), in practical terms, big data is the collection and integration of datasets from multiple disparate sources, covering various unique topics, to provide a more rich and robust picture of individuals, groups, and systems. Big data provide a breadth and depth of information that allows us to answer complex questions that a single data source could not. Boyd and Crawford (2012), for example, describe big data as:

a cultural, technological and scholarly phenomenon that rests on the interplay of: 1) technology (maximizing computation power and algorithmic accuracy to gather, analyze, link, and compare large data sets); 2) analysis (drawing on large data sets to identify patterns in order to make economic, social, technical, and legal gains); and 3) mythology (the widespread belief that large data sets offer a higher form of intelligence, and knowledge that can generate insights that were previously impossible, with an aura of truth, objectivity and accuracy). (p. 663)

Thus, big data represents the ever-evolving reciprocal relationship between the plethora of new information being received, and the technological advancements being made which incorporate and perpetuate data growth. The end result is informed, data-driven decision-making, problem-solving, and best practices. Big data is becoming ubiquitous within modern society, increasingly used and embedded within the fields of corporate business, retail, sports, internet search engines, and politics (Lohr, 2012; McAfee & Brynjolfsson, 2012; Murdoch & Detsky, 2013). Big data approaches have also been noted for their predictive potential in the areas of public health and economic development and forecasting. The cultural and scientific movement toward big

data represents an opportunity for social and behavioral science to use such resources to answer critical research questions that have implications for practice, programs, and policies.

Although concerns about confidentiality and other barriers have prevented some organizations from adopting big data as readily as others, the potential benefits of its use are widespread. Importantly, it allows for the expansion of knowledge generation and dissemination, as large, observational evidence bases are constructed and offer support for clinical questions or concerns that may otherwise prove difficult or impossible. Such evidence-based decision-making is beneficial for individual outcomes, future research and development, and programmatic and intervention development. It also allows for the empowerment of individuals through direct information delivery, as well as the integration of medical data with other types of social or economic data to guide health care in a patient-oriented manner (Murdoch & Detsky, 2013).

Big data in social work and the military

The benefits of using big data have previously been viewed primarily from medical and economic perspectives, yet they can also be seen within social and behavioral sciences. In the social work field in particular, research efforts are driven by the profession's focus on the person in their environment, which inherently requires an integrative approach that embraces complexity. Further, social workers are concerned with outcomes for vulnerable populations, such as military families, who tend to be more difficult to reach through traditional research methods (Brekke, 2014). Both of these aspects of social work science can be addressed using big data methods, which offer the opportunity to explore more complex and nuanced experiences through the linkage of previously disparate data sources. Big data approaches can also be uniquely valuable to examine outcomes for vulnerable populations through the use of existing de-identified data that does not pose the same ethical barriers as original data collection.

The field of social work has already begun reaping the benefits of big data approaches both in terms of basic knowledge generation and actionable findings for clinical social workers and policy-makers. Efforts undertaken by the Children's Data Network to link and analyze child welfare data, education records, and vital birth and death records offer one example of the value of this approach to address social work questions (Putnam-Hornstein, Webster, Needell, & Magruder, 2011). For example, by linking disparate administrative datasets, an examination of 4.3 million children born in California between 1999

and 2006 indicated that a history of prior reports of maltreatment was the single strongest predictor of intentional injury death among children in this group, over and above poverty and other sociodemographic indicators (Putnam-Hornstein, 2011). Further, a history of a prior child protective services (CPS) report also significantly increased these children's risk of death from unintentional injuries and sudden infant death syndrome (Putnam-Hornstein, Cleves, Licht & Needell, 2013). These findings, generated through data linkage, illustrate the potential of this approach to produce immediate applicable knowledge both for policy-makers and for CPS social workers on the front lines.

Although big data methods are already in use in other areas of social work research, these methods have yet to be applied to military-specific research. Within a military context, and the Army specifically, big data has the potential to unite previously segregated data from various places across the Army in order to create a more complete depiction of the lives of Army soldiers and their families. In addition, it allows for direct access to near real-time data, paving the way for rapid decision-making by front line social work and clinical staff, program managers, and policy chiefs. In terms of research, examining the health and well-being of military families requires a vast array of data from a population that is often difficult to access. Because of military laws and unit command influence, service members, in fact, are typically classified as a vulnerable population that requires special oversight and review by institutional review boards (IRBs; DoD, 2011). In addition, accessing data related to family members can be extremely difficult due to an abundance of caution focused on privacy protections by those who control data access, thus impeding the feasibility and timeliness of studies. Novel data can be challenging to collect from this niche population, and existing data can be very challenging to acquire because these are sensitive data from a carefully protected population. Although the military collects and maintains a wide variety of data on service members and dependents (e.g., spouses and children), these data are typically controlled by a number of different organizations, held in different databases, and have multiple and often conflicting and time-consuming access limitations. As a result, studying military families is often more time-consuming, expensive, and cumbersome than other kinds of research. Yet, solutions using big data methodologies and large, integrated database repositories have recently emerged that take the considerations above into account. These solutions offer the opportunity to generate rich, contextualized knowledge useable by clinical social workers and other providers to improve the services they offer to military families.

The current study

In this article, we present one approach to using big data to study military families. First, we describe a mechanism that offers a big data solution to research on military families, the Person-Event Data Environment (PDE). Then, we discuss a variety of datasets and sources that could be integrated to examine many of the key constructs of interest to military family researchers. Following this, we take a closer look at one data source that provides rich data on resilience and psychosocial well-being, the Family Global Assessment Tool (GAT). We present demographic information about the Army spouses who have completed the Family GAT, and draw implications for outreach and resources available to family members. Finally, we conclude with a discussion of theoretical frameworks relevant to big data research on military families, and we highlight potential future directions of this kind of work.

The PDE: Big data solution for studying Army families

As documented by Vie et al. (Vie, Griffith, Scheier, Lester, & Seligman 2013; Viet et al., 2015), the DoD—and more specifically U.S. Army—has made major strides to alleviate problems related to data access within the military and to improve accessibility of data for research efforts. To this end, the DoD created a cloud-based, virtual enclave that integrates data from many disparate sources, providing data and analytic tools for research studies, program evaluations, and other relevant data-driven efforts. This enclave, called the PDE, provides a consolidated repository for manpower, service, personnel, financial, behavioral health, and medical data that brings the researcher to the data. In the PDE, a wide range of person-related data can be accumulated, quality-controlled, de-identified to protect privacy information, shared, and utilized for operational support and research. Using strong security protocols, the PDE encodes personally-identifiable information (PII), thereby providing an integrated solution to significantly enhance access to manpower, personnel, and medical data (see also Vie et al., 2013, 2015, for additional descriptions of the PDE).

The PDE contains over 350 datasets related to DoD employees and service members (past and present), as well as their family members or dependents; and the US Coast Guard, past and present, and their families or dependents. The PDE also includes a number of specific tools and a project management suite that allows users to create a study, invite team members to join the study, request datasets from a data catalogue, conduct statistical

analyses, and share results amongst team members. The system is designed as a self-service and collaborative environment, allowing those who need such data to retrieve and analyze the data with minimal support, and give DoD senior leaders and clinical social workers providing services to military families timely and actionable information.

The PDE is composed of three physically separated, wholly independent computer systems: Staging enclave, Analysis enclave, and Web Portal. Together, these enclaves protect, de-identify, encode, and ultimately provide access to administrative, operational, and research data. The PDE Staging enclave (PDE-S) is the environment in which bulk datasets are stored and prepared for researchers' use. Extract, Transform, and Load specialists who are not part of any research team review each dataset in PDE-S, with the purpose to scan and identify format errors, conduct data integrity checks, de-identify PII data, and complete data quality and completeness checks. The data transformation process encodes social security numbers with randomly generated 12-character alphanumeric characters and transforms other sensitive PII information to provide studies with cleaned, de-identified, ready-to-use data. All data processing follows a standard that meets federal requirements, including the Privacy Act of 1974 and HIPAA, and members of research teams are never granted access to PDE-S.

Once data are encoded and processed in the PDE-S, the file is transmitted to the PDE Analysis enclave (PDE-A). This environment provides a secure means for researchers to manage data and conduct statistical analyses, and includes a variety of analysis programs and tools. Given the high levels of security and protections required for the PDE, only aggregate-level data and statistical results can be extracted from the PDE-A (i.e., analysis results and not individual-level data). This policy ensures that data files are never transferred to researchers for use on their own computers, and thus not subject to loss of control. Instead, the data are housed within PDE-A and researchers are "brought" to the data via virtual machines operating within the IT cloud that is the larger PDE system.

Finally, the Web Portal serves several service and governance functions. The Web Portal provides researchers with a detailed data catalogue documenting key data quality metrics, and a workspace for each project team. Within the Web Portal, researchers can collaborate with other team members, track project progress, request new data, and share their research findings with other researchers from across the PDE user community. In addition, governance documents (e.g., protocols, IRB approvals) are stored in each workspace and the PDE governance team audits each project annually to ensure

that the conduct of work is compliant with federal law, DoD regulations, and all applicable IRB determinations and reviews.

Access to each of the PDE enclaves is restricted, and each enclave has a separate firewall, physical database space, access list, and set of data governance rules (where applicable). No researchers have access to PII at any time, nor are they able to re-identify any participant within the dataset. The PDE is currently used to support a number of large- and small-scale research studies, program evaluations, and analysis efforts supporting military operations (Vie et al., 2013, 2015). This work is conducted by a mix of civilian and military researchers from a broad array of scientific disciplines, including social work. As such, this system represents an appropriate big data solution for addressing social work research questions related to military families.

In short, the PDE provides

- direct access to both datasets and analysis tools;
- capability to import and merge additional data to supplement existing sources;
- a data catalogue containing metadata and data quality metrics for pde datasets; and
- a governance process to ensure data protection and security as well as compliance with DoD regulations 6025.18-R for human subjects' assurances.

Together, the tools of the PDE can address some of the major challenges of conducting research on military service members and their families, improving the feasibility and rigor of this field of research.

Potential big data sources available for military family research

The PDE offers a big data approach to conducting social work research, yet it is crucial to consider the data that forms the basis of this effort. As social workers (both researchers and practitioners) shape the key questions that research seeks to address, relevant and appropriate data must exist to answer those questions. While social work researchers play a key role in the analysis of big data, social work practitioners are often at the forefront of the collection of big data sources. For the PDE, these data sources span a variety of domains, including resilience and psychosocial well-being, demographics and family characteristics, medical health outcomes, and military life transitions.

Resilience and psychosocial well-being

There are a number of potential sources of Army data related to the resilience and well-being of soldiers and family members. For example, the Soldier and Family

GATs are two Army-sponsored online surveys that include a variety of psychosocial well-being measures (Peterson, Park, & Castro, 2011). Whereas the Soldier GAT is a mandatory online survey that soldiers complete each year, the Family GAT is completely voluntary—any interested Army family member can complete the Family GAT by visiting the website hosting the survey. Family members may learn about the Family GAT in a number of ways, including from their soldiers, or Family Readiness Group leaders. After completing the GAT, individuals receive feedback about their general scores (e.g., high, medium, low) and links to online learning modules and articles to help improve their health and well-being.

The Soldier and Family GATs were designed as self-development tools, neither were intended to be used for researcher purposes (Lester, McBride, & Cornum, 2013). As such, for both of these surveys, an opt-in or permissions statement is included at the end; all men and women completing either the Soldier or Family GAT can indicate whether to allow their GAT data to be used for research. Soldiers and family members may complete their respective GAT surveys as many times each year as they prefer, and may change their permission each time. This permissions procedure provides soldiers and family members the opportunity to voluntarily make a decision about their participation in research studies through prospective informed consent.

Variables and constructs included on the GATs are largely consistent for soldiers and family members. Both GATs include questions related to resilience and psychological health across five dimensions: emotional, family, social, spiritual, and physical. The emotional resilience dimension of the Family and Soldier GATs measures participants' emotional well-being, with scales that assess constructs such as coping skills, positive and negative affect, optimism, and depression symptoms. The family dimension varies between soldiers and families; soldiers provide information about their perceptions of the support their family receives from the military and their satisfaction with relationships. Family members answer several additional items assessing relationship quality, family functioning and cohesion, and children's well-being. The social dimension items measure family members' and soldiers' adjustment with those around them, including friendship, loneliness, and social support. Soldiers, but not family members, also complete scales related to work engagement and organizational trust. The spiritual dimension focuses on how individuals make meaning of their experiences and how they might see themselves as serving a greater purpose. Finally, physical fitness measures include a variety of indicators, such as diet, exercise, sleep habits, alcohol and tobacco use, and basic diagnostics (e.g., weight and height).

Demographic and family characteristics

Many demographic datasets exist within the Army, including the Master Personnel File and Family File datasets. The Family Files are databases that track and manage dependent information, and the Master Personnel Files contain human resources data and additional demographic data. Both of these datasets are managed through the Defense Manpower Data Center. Together, they include demographic information about soldiers and family members such as their legal relationship (e.g., spouses, parent), age, gender, and parental status. In addition, other soldier personnel records, such as Military Occupational Specialty and Duty Station, are also included.

The ability to unite these objective demographic records with other types of data, such as resilience measures, can be invaluable to researchers. Including correct and extensive demographic data in analyses examining military families strengthens the rigor and quality of social science, allows for finer-grained analytical approaches, and increases generalizability to appropriate samples. Access to this information is of particular use to social work scientists who are concerned with how subgroups and marginalized populations, including racial and ethnic minorities, are uniquely impacted by stressors.

Medical health outcomes

A wide variety of datasets related to medical health could also be beneficial for measuring physical health and well-being of soldiers and family members. Data provided by the Defense Health Agency, for example, can provide information about medical health care utilization, health history, and current health experiences. For instance, there is data about soldiers' and spouses' visits with military health care providers, including the date of the encounter/visit, the appointment type (e.g., acute appointment, emergency room visit, etc.), and International Statistical Classification of Diseases codes for the primary and any secondary diagnoses made. Parallel data is also available for visits made with civilian health care providers, if the costs were paid for by TRICARE. This information, when combined with datasets that provide information on military life transitions and resilience and psychological health, could be of particular use to social work researchers and practitioners, as these variables represent actual service utilization.

In addition to medical health records from health care systems, there is also information about soldiers' physical health in terms of their Army Physical Fitness Test (APFT) scores, which can be used as proxies for soldiers'

overall health. For instance, the Army's Digital Training Management System (DTMS) manages and stores a variety of soldier data, including APFT scores, height, and weight. Soldiers are generally required to complete the APFT twice per year, and all APFT scores are included in DTMS. Height and weight are standard metrics that are taken at various times (e.g., during physical health assessments); these metrics are then entered into DTMS manually at the unit level.

Another example of medical health data potentially useful to researchers is eProfile data, which provides information about a soldier's injury status. All soldiers who are put on profile are included in the eProfile data. Any profile data for participating soldiers is provided by Patient Administration Systems and Biostatistics Activity. Data in this dataset include the date the profile was submitted, approved, and terminated, the profile type (i.e., temporary or permanent), and any required accommodations to the APFT.

Military life transitions

There are a number of characteristics that are unique to military life, many of which may be stressful to spouses and families. Frequent moves related to permanent change of station, family separation due to training or deployment, and transitions out of the Army (or into the Reserve component) are just a sample of the common transitions that military families experience. Data related to these transitions are available from a number of sources within the Army and could be united with other types of data (e.g., demographic data, medical health, psychosocial functioning) to examine these transitions and their impact on soldiers, spouses, and children. For instance, Army Personnel Transaction data can provide information on soldiers' discharge or separation from the Army. Along with these datasets, the Contingency Tracking System Deployment data provides basic, unclassified information about soldiers' deployment experiences. This data is managed by Defense Manpower Data Center and is matched to the Personnel Master Files to ensure that deployment and demographic information are accurate. Although some elements of this dataset are classified or sensitive and are not available for research use, the timing and length of deployment, along with several other key features can be used in studies.

As we consider the many potential data sources available within the Army, it becomes clear that access to big data across Army organizations can greatly improve the quality of research on military families. By integrating psychosocial, demographic, and medical health data, researchers can capitalize on existing data to increase the complexity of their potential research questions. This

opportunity is of particular utility for social work scientists whose research efforts often focus on capturing the complexity of individuals and families embedded in their social environments. In addition, having access to these diverse datasets simultaneously eases the potential burden on researchers who otherwise have to collect or acquire such data, and minimizes the requests for participation and burnout of military families. Finally, the rich and contextualized knowledge generated through these efforts has the potential to inform the efforts of social workers and other front line clinical staff serving military families.

A focused look at the Family GAT

The PDE and its associated data are relevant for research on military service members and their families across many disciplines. Several efforts have used the PDE capabilities for health and prevention science research, program evaluation, and Army command surveillance (e.g., Harms, Herian, Krasikova, Vanhove, & Lester, 2013; Lester, Harms, Bulling, Herian, & Spain, 2011; Lester, Harms, Bulling, Herian, Spain, & Beal, 2011; Lester, Harms, Herian, Krasikova, & Beal, 2011; Vie et al., 2013). We propose that the relevance of the PDE extends beyond soldiers to research on Army spouses and families. Although the Army data on spouses is not as extensive as that for soldiers, theory and extant research evidence clearly indicate that spouses and families play a critical role in the experiences and functioning of soldiers (Blaisure, Saathoff-Wells, Pereira, Wadsworth, & Dombro, 2015; Meadows, Tanielian, & Karney, 2016; Wadsworth et al., 2013). In this report, we take a first step toward research on spouses and families with the PDE, by describing the men and women who complete the Family GAT and the patterns of their use of that survey.

Demographic characteristics

The men and women that complete the Family GAT survey and agree to allow their data to be used in research (referred to here as the "Family GAT sample") represent a specific subgroup of the Army family population. Between October 2013 and July 2016, there were 3,498 men and women who completed the Family GAT and consented for their data to be used for research.

By uniting the Family GAT data with Army Family File datasets, we can take a closer look at these men and women (see Table 1). Among the sample, most individuals were married to a soldier (their sponsor), although some were soldiers themselves, and approximately 20% were not able to be tied to a specific soldier or sponsor.

Table 1. Demographic characteristics of Family Global Assessment Tool (GAT) spouses.

Characteristic	Family GAT respondents
Age	
Range	18–60 years
<i>M (SD)</i>	31.14 (8.84)
Mode	23
Respondent	
Spouse	65.44%
Soldier	14.46%
Unknown	20.10%
Spouse gender: Women	88.81%
Soldier gender: Women	16.75%
Sponsor component (<i>n</i> = 672)	
Active duty	98.80%
Sponsor rank (<i>n</i> = 614)	
Enlisted	83.55%
Warrant officer	4.24%
Officer	12.21%
Parent status/has children	70.76%
Number of children (<i>n</i> = 277)	
Range	1–8
<i>M (SD)</i>	2.55 (1.24)
Median and mode	2
Age group of oldest child (<i>n</i> = 277)	
0–2 years old	7.65%
3–5 years old	9.18%
6–11 years old	22.45%
12–15 years old	21.43%
16–19 years old	28.06%
20+ years old	11.22%

These respondents were largely women (65.44% of spouses), with a mean age of about 31 years. Of the spouses with available data on the component and rank of their sponsor (including those who were their own sponsor), nearly all were associated with active duty, and the vast majority were associated with an enlisted sponsor. In terms of family composition, 71% of participating spouses were parents, with most parents having two children (mode = 2). Demographic data also included the age group for a spouse's oldest child. Among this sample of parents, most had oldest children between sixteen and nineteen years old (28%), with nearly equal percentages having pre-teenagers (21%) or children ages six to eleven (22%).

Procedure details for Family GAT

The Family GAT survey has been available online for six years for family members to complete, however, the current opt-in consent procedures began in September 2013. This change limits potential research samples to only those men and women who completed a Family GAT after September 2013 and agreed to allow their data to be used. If participants allow, researchers can access data from previous completions of the Family GAT, which can provide longitudinal data for some participants. It is important to note, however, that any

Table 2. Frequency of Family Global Assessment Tool (GAT) surveys completed.

Family GAT surveys completed	Total number of spouses
1	2111
2	318
3	135
4 or more	78

participants who only completed the Family GAT prior to September 2013 will not be included in the sample.

Although the Family GAT survey is available for Army family members to complete as often as they wish, the majority of spouses who completed the Family GAT did so only one time (see Table 2). Approximately 20% of the participants completed the Family GAT more than once during the specified time window. Of these, 318 men and women completed the survey twice, 135 completed it three times, and 78 completed it four times or more (up to eight times).

Implications of the sample details

The demographic composition of the Family GAT sample and their patterns of completing the survey have important implications for the Family GAT. First, the majority of participants were women in their mid-thirties with two children, the oldest of which was school-aged. There were many groups, however, who were not well-represented in this sample. For instance, given the typically younger marrying age among military couples, it might be beneficial to adjust the outreach strategies to better reach younger spouses. These spouses might also experience greater benefits from resources related to social support as they experience their first deployment separations, PCS moves, or other stressors. Along with this, while most of the parents who completed the Family GAT had elementary school-aged children, there may be a need to reach parents of younger children. Revising the recruitment or outreach strategies used to draw people to the Family GAT should result in a more diverse sample and improved targeting of potentially at-risk family members.

In addition, it is important to note that over the course of almost 3 years, there were approximately 3,500 spouses who completed the Family GAT and provided consent for their data to be used. Previous estimates with the Soldier GAT indicate that the consent rate is around 65%, which we can extrapolate to suggest that just over 2,000 spouses complete the Family GAT each year. This represents just a fraction of the over 500,000 men and women who are Army spouses. Improved recruitment and outreach strategies could help increase the number

of men and women that use the Family GAT and its related resources to improve their resilience. Along with this, although we only examined a 1-year period, very few participants completed the survey more than once. Providing encouragement on the Family GAT website or through outreach efforts to complete the Family GAT regularly could increase the number of spouses using this valuable resource to monitor and track their health and well-being.

Studying the Army's resilient families

The resilience and psychological health of Army spouses and families is a key factor in the resilience and readiness of Army soldiers. Thus, the Army's Resilient Families (ARFam) project aims to examine the resilience of Army families and the factors affecting their well-being, including both general family functioning and the resilience of individual family members (e.g., spouses, children). This project will leverage the big data approach of the PDE to answer key questions about military families and provide evidence to the scientific community, Army decision-makers, and clinical/care providers, including social workers and other front-line staff.

Theoretical orientation

To approach and test relationships between the variety of constructs available in a systematic way, we look to established theory for a foundation. Many theories attempt to explain family process and function, including several specific to the military (e.g. Bowen & Martin, 2011; Bowles et al., 2015; Segal, Lane, & Fisher, 2015), as well as many describing families and their environments more broadly (e.g. Olson, Sprenkle, & Russell, 1979; Greenhaus & Buetell, 1985). Theories that focus specifically on stress and coping are of particular utility to understanding Army families and guiding development of best clinical practices and effective programs to support them. Since the 1950s, many theories of family stress have been proposed to explain why some families adapt well to stressors while other families experience crisis (Boss, 2002; Hill, 1958; McCubbin & Patterson, 1983; Patterson, 1988). For our purposes, the contextual model of family stress and coping (Boss, 2002) serves as an overarching conceptual framework, while the family adjustment and adaptation response model (FAAR; Patterson, 1988; Patterson, 2002) will guide hypotheses and variable selection. Both of these models are described in more detail below.

The central building blocks of all family stress theories include (a) *stressors*, which are defined as events or

transitions that have the potential to produce change in the family system; (b) *resources*, which are defined as the tangible or psychological capabilities which a family leverages to meet the demands of stressors; and (c) *definition*, which is the subjective meaning that a family assigns to the stressor or stressors they experience (Boss, 2002; Hill, 1958; McCubbin & Patterson, 1983; Patterson, 1988). Resources and definition are conceptualized as mediating or moderating the relationship between stressors and eventual family outcomes. Importantly, these mediating and moderating constructs provide the greatest opportunity to develop and employ effective interventions. Outcomes are variably defined across specific family stress models but are generally considered to be positive adaptation to stress or potential crisis and reorganization toward improved or poorer functioning (Boss, 2002; Hill, 1958; McCubbin & Patterson, 1983; Patterson, 1988).

The contextual model of family stress and coping is a useful guiding framework for work with Army families because this theory situates family stress inside an internal context, which includes structural and psychological aspects of the family system, and an external context, which includes broad societal factors, like culture and historical events (Boss, 2002). This model recognizes that culture is a crucial aspect of family functioning, allowing for the exploration of important variables unique to the military family. Specifically, this framework accounts for the impact that military culture has on family processes as well as the influence of historical events, such as current overseas conflicts, which may impinge on the military family's ability to manage stressors. In addition, this framework is most closely aligned with the social work perspective as it incorporates the person-in-environment framework and views military families as existing at the center of a many-layered social system.

The FAAR model, also a family stress theory, includes the central constructs mentioned above. In contrast to the contextual model of family stress, which provides a useful orientation but would be difficult to test empirically, the FAAR model involves a concrete set of relationships that help guide variable selection and hypothesis generation. The FAAR model builds on other family stress theories in a number of important ways. This model accounts for normative stressors, including ongoing strains and daily hassles, in addition to the nonnormative and potentially traumatic stressors that are the focus of other family stress models (Patterson, 1988, 2002). This is a particularly useful perspective for military families who experience non-normative stressors like combat exposure or frequent relocations against the backdrop of typical struggles faced by most families

(McCubbin & Lavee, 1986). Further the FAAR model describes family capabilities as both what the family has (e.g. resources) and what the family does (e.g. coping skills); capabilities can exist at the individual, family, or community level (Patterson, 1988). The FAAR model uses the term *adjustment* to describe relatively stable patterns of managing normative stressors. By contrast, *adaptation* is used to refer to the process of reorganization when a family's demands exceed their capabilities (Patterson, 1988). This process of adaptation toward improved functioning, as described in the FAAR model, is similar to process-oriented definitions of resilience (Patterson, 2002).

In addition to theoretical orientations to family stress processes, we will draw on theoretical perspectives on family resilience. Resilience is a nuanced concept that has alternately been treated as an inherent trait possessed by an individual or family system, as a process of overcoming adversity, and as an outcome of that process (Black & Lobo, 2008; Patterson, 2002). For our purposes, we will adapt Zamorski's (2008) definition of resilience, namely that resilience includes all the processes that support consistent and/or quick return to positive well-being after adversity. Although this definition refers to individual psychological processes, we can draw a parallel to families and suggest that family resilience comprises the total of psychological and social processes that enable families to maintain or return to positive functioning in response to adversity. This definition reflects our position that resilience is a process-oriented, latent construct, which can only be inferred after exposure to some form of adversity. This perspective on resilience, in addition to conceptual models of family stress, will guide future work.

Future directions

Examinations of the concept of resilience have been approached using two distinct methods: (a) variable-focused models, which characterize the relationship between variables for an entire sample; and (b) person-focused models, in which relationships are examined at the person or family level, rather than at the variable level (Masten, 2001; Nurius & Macy, 2008; Rosato & Baer, 2012). Most research conducted with military families takes a variable-oriented approach, which includes analytic tools that are particularly useful for describing general trends and may point to important explanatory processes (e.g., correlation, regression, and structural equation modeling; Nurius & Macy, 2008; Rosato & Baer, 2012). In contrast, person-centered approaches are particularly useful for capturing differences within a sample and examining outcomes for different subgroups.

Conceptually, person-centered approaches recognize that not all families are alike and different families face unique challenges that they must overcome. Together, these approaches may shed light on outcomes for families with different profiles of risk and protective factors (Nurius & Macy, 2008; Rosato & Baer, 2012). Future analyses using the Family GAT data, and other Army data, will use both variable-focused and person-focused models to capture the heterogeneity in military families, which may account for different outcomes, as well as explore underlying explanatory processes.

In addition to these overarching approaches, the ARFam project will focus on several objectives. First, we will demonstrate a number of the particular relationships specified in our conceptual model in order to examine the feasibility of this theoretical framework as a foundation for all future variable-focused approaches. In addition, using exploratory and confirmatory factor analysis, we will explore the underlying structure of the Family GAT with the eventual goal of operationalizing military family resilience using GAT survey items.

Finally, we will focus on using linked soldier and spouse data as a means to triangulate perspectives on the family system. Dyadic data can provide a novel perspective on family-level variables, which are a crucial ingredient in defining family resilience. For instance, dyadic data allows us to examine the impact of concordance/discordance between spouses on outcomes for families or individuals within these family systems. Perhaps the most important aspect of studying the dynamics of the soldier-spouse dyad will be determining the degree to which military couples are in agreement on how the family is doing and whether their families' needs are being met. Knowing this critical information will indicate how existing programs targeted at meeting specific needs of the military family can be improved and/or whether new programs should be developed to meet these needs.

Implications for social workers and other professionals

We have argued that social work researchers and practitioners should find particular value in a big data approach to studying military families, as these methods allow for integration of information across disciplines and offer feasible, ethical opportunities for studying vulnerable populations. In fact, where military families are concerned, social workers participate in the life cycle of big data: as generators of clinically relevant information (e.g. medical data) that can be linked with other data sources to provide a more nuanced picture of military families, as researchers whose person-in-environment focus drives the need for integrative methods, as

consumers of research who embrace and seek to understand the complexity inherent in social contexts, and as end users who are ethically bound to provide high quality care to families whose experiences and needs may be better represented by a big data approach.

The results of the effort described here will inform both military leadership and the academic community about the health and functioning of soldiers, spouses, and Army families. Ultimately though, these findings will provide actionable recommendations to clinicians serving this population regarding specific prevention and intervention efforts that can increase military family wellbeing. Social workers and other professionals are on the front lines meeting the health and mental health needs of military families. However, these needs are readily impacted by world events and often change more rapidly than clinicians can develop and implement high quality, evidence-based interventions. ARFam is just one example of how big data within the Army context can improve the quality, timeliness, and applicability of social and behavioral science research with the ultimate goal of providing useful information to clinicians on the ground. As opportunities to use big data increase, applied research efforts will continue to provide richer and more complete answers to critical and complex questions.

Funding

This study was supported with funding from the U.S. Army Resiliency Directorate.

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