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Depression and resilience during the first six-months of internship

A Thesis Submitted to the
Yale University School of Medicine
in Partial Fulfillment of the Requirements for the
Degree of Doctor of Medicine

by

Rachel Esther Laff

2008

DEPRESSION AND RESILIENCE DURING THE FIRST SIX-MONTHS OF

INTERNSHIP. Rachel E. Laff, Srijan Sen, Constance Guille, and Steven Southwick.

Department of Psychiatry, Yale University, School of Medicine, New Haven, CT.

Purpose: To determine the prevalence and severity of depression, the role of resilience upon the development of depression, and rates of mental health service use among interns during the first six-months of internship.

Methods: All consented interns completed online a baseline questionnaire prior to starting internship assessing demographic characteristics, depression-related history, and resilience. Interns completed online follow-up questionnaires at three-months and six-months. Depression was assessed with the Patient Health Questionnaire (PHQ-9). Resilience was assessed with the Connor-Davidson Resilience Scale (CD-RISC). Pearson's correlations and logistic regression analyses were used to determine relationships between variables, and predictors of depression respectively.

Results: The point prevalence of depression (PHQ score ≥ 10) was 2.5% at baseline, 24.9% at 3-months and 24.7% at 6-months. The number of interns who expressed passive suicidal ideation was 2.6% at baseline, 10.3% at 3-months, and 6.6% at 6-months. Compared to U.S. medical graduates, international medical graduates had a significantly lower prevalence of depression at three months (9.1% vs. 25%, $p=0.006$) and six-months (5.9% vs. 24.7%, $p=0.001$). At three-months, both a prior history of depression (Odds Ratio (OR) = 3.3, $p < 0.02$, 95% Confidence Interval (CI) = 1.3 – 8.7)

and a negative response to the CD-RISC item “My past successes give me confidence for new challenges” (OR = 0.32, $p < 0.01$, CI = 0.17-0.62) were significant predictors of depression. At six-months, both female gender (OR = 2.8, $p < 0.02$, CI = 1.1-6.9) and work hours reported the week prior to follow-up (OR = 1.04, $p < 0.01$, CI = 1.01 – 1.04) were significant predictors of depression. Resilience scores at baseline were significantly correlated with depression scores at all time points, however, they were not predictive of depression at either follow-up point. At three-months, only one intern (8.3%) with depression scores necessitating treatment (PHQ ≥ 15 , N=11) had started some form of treatment. At six-months, only one intern (9%) with depression scores necessitating treatment (PHQ ≥ 15 , N=12) had started some form of treatment.

Conclusions: Consistent with prior studies, the prevalence of depression in interns is significantly higher than the general population. There is a significant amount of suicidal ideation among interns during the first three-months of internship. It appears that international medical graduates are significantly less depressed than U.S. medical graduates during the first six-months of internship. A prior history of depression, longer work hours, female gender, and a lack of confidence in coping with challenges are associated with the development of depression during the first six-months of internship. Of greatest concern, very few interns with clinically significant levels of depression are seeking treatment. In order to better address the mental health needs of interns, increasing access to mental health services, and understanding barriers to seeking treatment will be important areas to develop in the future.

Acknowledgments

There are many people to thank in the accomplishment of this thesis project. First I must thank Dr. Jeffrey Shelton, the psychiatry resident I worked with during my psychiatry sub-internship who put me in contact with Drs. Constance Guille and Srijan Sen, the psychiatry residents who initiated and are responsible for this study. I would like to thank both Connie and Srijan for their creativity and ingenuity in designing this study, and for graciously allowing me to participate. I am enormously grateful to Connie who met with me throughout the process and helped me organize and clarify my thesis project, and also to Srijan whose amazing grace with SPSS produced all of the data analysis. I am enormously grateful to Dr. Southwick, my faculty advisor, for working with me throughout the year, providing me guidance in mental health research, and all of his positive encouragement and support along the way. I would like to thank Robb Pietrzak for his tremendous insight and guidance in completing the data analysis. I would like to thank Jan Glover for her patience and kindness in guiding me through End Note and making this paper come together. I would also like to thank the Office of Student Research for endowing me with a research stipend in support of this project, and especially Mae Geter who was extremely helpful in the logistics of needed signatures, forms, and deadlines.

I have many friends and family to thank for supporting me through what was an intimidating, and challenging process for me. I would like to thank my dad for teaching me how to write and for his constant belief in me. I would like to thank my mom for sharing her stories with me about her dissertation writing days, and for her empathy in going through this process. I would like to thank Chris, my step-mom for the inspiring

work she does as a mental health provider. I would like to thank my sisters, Elly and Becky, for their humor and sarcasm which always provide me with a fresh sense of irony and cheer. I am eternally grateful to Julie Doyle-Madrid, my soul sister in this lifetime, who has been at my phone-side every step of the way and who always seems to know what I need to hear. I would like to thank Julie's wife Naomi, and my nephew Will, who both provided me with stimulating conversation and a resilient love for life. I would like to thank my dear friend Emily Futransky for her constant support and confidence in me, and for taking me away on much needed weekend getaways. I would like to thank my long-time friend Christina Jimenez for promising to read every single word of this paper. I would like to thank my therapist, Linda, for helping me work through all of my hang-ups during this process. I would like to thank my fellow New Haven buddy Sarah Kleinman for our café "study" dates and her commiseration and humor through the thesis process. I would finally like to thank my medical school friends Libby Houle, Kiera Levine, and Karen Archabald who provided me with a daily sounding board, and who have kept me sane throughout medical school.

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Introduction:*When doctors need doctors*

There is accumulating evidence in the scientific literature giving credence to the old adage that doctors make the worst patients. Frequently, doctors give advice that they themselves do not adhere to. For example, doctors often counsel their patients to eat healthy meals, exercise regularly, get adequate sleep, don't smoke, don't consume too much alcohol, and take medications as prescribed. However, doctors, especially residents in training, have difficulty following many of these basic recommendations for living a healthy life. For decades, the model for medical training and education has relied upon an unsustainable and taxing working environment that fosters in many an unhealthy and unbalanced lifestyle. In order to adapt to these conditions, residents learn to deny themselves these basic needs, at times to the point of self-neglect. This disconnect becomes particularly apparent when it comes to mental health concerns. The lack of attention towards physicians' mental health is not only to their own detriment, but also impacts patients as physicians' ability to provide effective, compassionate, patient-centered care may become compromised. Although there are many reasons for the growing societal dissatisfaction with the doctor-patient relationship in the U.S., this disregard of mental health problems in physicians only perpetuates these treatable conditions, and in turn further strains these relationships.

Physicians are trained to give treatment and care for others, but they are not well trained in how to receive it or even to recognize when they need it themselves. In his popular book *Complications*, Dr. Atul Gawande illustrates the neglect of physicians' mental health by highlighting the lack of resources available and the lack of awareness of

how to deal with “problem doctors” (1). Gawande describes the case of a well known and highly esteemed orthopedic surgeon who began making reckless decisions and continued down a path of negligent patient care despite the warnings of his colleagues, and the pain and suffering he inflicted upon his patients. Although many doctors report witnessing a colleague engage in substandard patient care, few doctors are equipped to know how to confront or handle such a situation in an effective way (1). Because of what some have called a “conspiracy of silence” or the reactions of “uncertainty, denial and dithering, feckless intervention” among physicians regarding how to deal with problem behaviors in their colleagues, it took several years, and multiple lawsuits for this surgeon to be forced to stop practicing and get the help he needed (1, p.95).

What is striking about this story is that, although it was clear this surgeon must be suffering from some kind of mental illness (how else to explain such a rapid decline in behavior and functional status), there were no organizational or institutional services in place for him to be evaluated to get the proper help he needed. It was only after having his license revoked and contemplating suicide that he finally contacted a psychiatrist who specialized in treating professionals. Ironically, it was his lawyer who gave him the contact information for the psychiatrist.

The scope of the problem

Traditionally, the culture of medicine has not emphasized physicians’ physical or mental health needs, and has not encouraged physicians to admit to their health vulnerabilities. As such, it is not surprising that only approximately 35% of physicians regularly see a health care provider (2). Despite this, physicians have shown appropriate

compliance to their own medical advice over the past forty years in terms of decreasing their risks of cancer and cardiovascular disease; rates of both these categories of disease are now lower among physicians than in the general population (2). Interestingly, however, this is not the case when it comes to seeking treatment for mental health disorders. For depression, in particular, rates among physicians are higher than in the general population (3). Surprisingly, there is very little information on physicians' or residents' use of mental health services. One study of residents in Norway found that over the course of three years, 34% of residents expressed needing mental health treatment at least once, but of that group only 64% had sought treatment (4). In addition, while perceived mental health needs increased from medical school through residency, help-seeking decreased over that same time (4). A recent study on medical students showed that of those who screened positive for depression, only 22% sought mental health treatment (5). Furthermore, for depressed students reporting suicidal ideation, only 42% had received mental health treatment (5). These students reported several barriers to seeking mental health treatment including lack of time, lack of confidentiality, stigma, cost, and fear of documentation (5). It is likely that these findings on medical students are not only relevant to physicians, but also underestimate the problem, given that the time constraints upon physicians and the stigma associated with psychiatric illness only increase with training. This is concerning, as depression is often a chronic, recurrent disease that has become one of the leading causes of disability worldwide and is treatable.

Clinically, major depression manifests as a constellation of symptoms including low mood, sleep and eating disturbances, feelings of worthlessness and guilt, difficulty

with concentration, loss of interests and suicidal ideation that persists for greater than two weeks. Epidemiologic studies estimate that among U.S. community dwelling adults, the point prevalence of depression may range anywhere from 3-5% in men and 8-10% in women (6, 7). The lifetime prevalence of depression among this same population is approximately double the point prevalence, such that up to 10% of men and 20% of women will develop depression at some point in their lives (8). Depression is increasingly recognized as not just an American, but a global public health problem. According to recent surveys by the World Health Organization in 2001, the prevalence of depression worldwide ranges from 2-15% and is associated with significant morbidity accounting for 4.4% of total disability-adjusted life years and up to 12% of total years lived with disability (9). Currently, depression ranks as the leading cause of disability worldwide (global non-fatal disease burden), and the fourth leading cause of overall global disease burden.

Not only does depression account for a significant amount of disease burden worldwide, but rates of depression are increasing. A recent investigation has shown that the prevalence of depression among U.S. adults increased from approximately 3% in 1991-1992 to 7% in 2001-2002 (10). Similarly, estimates by the World Health Organization indicate that unipolar major depression is soon predicted to be second only to cardiac disease in health related morbidity and mortality (11). Depression often coexists with other chronic diseases such as arthritis, diabetes, stroke and ischemic heart disease (12-14), and those who have one or more chronic diseases are at an increased risk of developing depression (12, 15, 16). With an increasing elderly population, rates of chronic disease are expected to rise and it is likely so will the prevalence of depression.

The impact of mental health upon an individual's overall level of health function and upon the health care system is finally starting to get its much deserved and long overdue attention. A recent study found that worldwide when compared to angina, arthritis, asthma, and diabetes, depression produced the greatest decrement in health (17). In fact, people who had depression comorbid with one or more chronic diseases had the worst health scores (17). Furthermore, the comorbid state of depression when compared with depression alone, any of the chronic diseases alone or any combination of the chronic diseases without depression, has the worst health outcomes (17). As part of the effort to tackle this newly recognized burden of disease, more researchers are uncovering the relationships between depression and its impact upon chronic diseases such as heart disease and diabetes (12, 14, 18-20). It is now becoming more established that recognizing and treating underlying mental health issues may be just as important as treating the physical aspects of disease in terms of patients' overall mortality and disease co-morbidity, not to mention quality of life.

Several studies have shown that doctors suffer from depression, divorce, substance abuse and suicide at rates higher than the general population. In particular, for the past 150 years, it has been noted that the suicide rate is higher among physicians than among the general population (2). In contrast to the general population in which males are four times more likely than females to complete a suicide attempt, among physicians (21), completed suicide rates in women are equal to men (2). Similar to the general population, depression and substance abuse are the major risk factors for suicide in physicians, and unfortunately, these issues are less likely to be addressed (2).

Identifying and treating mental health disorders in physicians are important not just for the sake of physicians themselves, but also for protecting patient care. Physicians who suffer from mental health disorders, specifically depression and substance abuse, report being more irritable with both their colleagues and their patients, and admit to at times lowering standards of care (22). Furthermore, it is becoming increasingly recognized that physicians own health habits affect the preventive health counseling they provide for their patients (23, 24). If physicians are unable or unwilling to confront their own depression, they will be less likely to do so for their patients. For example, although depression is one of the most common problems in primary care, studies estimate that physicians fail to adequately diagnose or treat between 40-60% of cases (25, 26). Of further concern, research has shown that physicians are generally ineffective at screening for suicide risk in patients who present with depressive symptoms (27, 28). In effect, one study found that among patients who committed suicide, over 40% had visited their primary care provider in the month prior (28). It stands to reason that if physicians are unable to recognize their own mental health needs, they will be less able to recognize those of their patients.

Physicians have been institutionally and systematically discouraged from recognizing and addressing their mental health needs with examples of both overt and covert discrimination in the issuing of medical licenses, hospital privileges, health insurance and/or malpractice insurance (2). In acknowledgement of the need to change this denial and neglect of physicians' mental health within the medical culture, a consensus statement was released in 2002 by a panel of experts advocating for the transformation of professional attitudes and institutional policies regarding physician

impairment such that mental health concerns should no longer be stigmatized and that physicians are supported in seeking treatment (2). In concordance with these principles, several of the aims of this thesis project are to make physicians more aware of the rates of depression that begin to develop during post-medical school training, the severity of depression that exists, the utilization of mental health services among depressed interns, and any identifiable risk and protective factors in the development of depression among interns.

The trials and tribulations of residency

It has long been recognized that residency is a time of high levels of stress which many doctors look back on as some of the most difficult years of their lives. The long working hours, the steep learning curve transitioning from medical student to physician level responsibility, the intensity of the work itself including end of life issues and complicated chronic disease management, and the lack of personal time all contribute to making residency training challenging and at times overwhelming (29, 30). Fortunately, most residents in training make it through this difficult period and go on to have productive careers. For others, however, residency training may be the beginning of a lifetime of psychological distress, and poor coping mechanisms.

A quarter century ago, Reuben described the psychological tendencies of residents toward “dependency, pessimism, passivity, and self-doubt” – characteristics that are not so unfamiliar today (31). In examining the “psychology of residency” he further illustrated the perceptual distortions residents create upon comparing themselves to their colleagues. These comparisons perpetuate the feeling that exists among many residents

that “everyone knows more than I do” and serve as a major source of inadequacy and guilt (31). In addition, there is evidence that residents possess personality traits that may further predispose them to the development of depression in the face of stress (32). One group described the process of medical internship as having seven psychological steps: “anticipation and excitement, self-doubt, depression, stabilization, recurrent depression, success, and elation” (33). There was even believed to be a “syndrome of dysphoria and impaired mentation” thought to be nearly universal among residents, although the manifestations varied individually (31). Consistent with this model, other researchers have found that for many interns, there is a peak in depressive symptoms around the 8th month of internship that then slowly returns back towards baseline levels by the end of residency training (34, 35). In looking at changes in mood that occur throughout internship among a small group of internal medicine residents, Bellini found significant increases in depression-dejection, anger-hostility, and fatigue-inertia categories that persisted significantly throughout internship year (36). By the end of residency, these mood disturbances had mostly returned to baseline levels (35). While it seems these residents were able to recover emotionally from the initial strains of internship, levels of empathic concern that had significantly decreased during internship were never restored (35). Although information on mood fluctuations during internship has been somewhat inconsistent, several other studies have found a sharp increase in anger-hostility scores that persisted throughout internship year (37-39).

Studies over the past thirty years consistently demonstrate the prevalence of depression among residents to be higher than the general population (35, 40-42). In 1975, a study reported that 30% of interns had a major depressive episode and that of

those who were depressed, 25% had suicidal ideation (40). Consistent with these findings, many studies since then have found that today anywhere from 18-33% of residents have clinically significant levels of depressive symptoms (41-47). While research consistently shows a high prevalence of depressive symptoms during the first year of internship, there is conflicting evidence about whether these symptoms persist through residency training or resolve with time (34, 35, 47). There are relatively few large, prospective studies identifying predictors of developing depression during residency. The findings from most studies to date are limited by small sample sizes with questionable representativeness, varying and limited measures in terms of the sensitivity and specificity of identifying mental health problems, and a narrow spectrum of variables to accurately delineate the relationship between residency and the development of mental health problems (47).

In contrast to the general population where the prevalence of depression in women is nearly twice that in men, this relationship is less clear among residents (39, 45, 48-53). There is some evidence that gender may have more of an influence upon the development of depression with increasing age (47). Both a family history of depression and a personal history of depression have been found to be predictive of developing depression during residency, however, not all studies have confirmed these findings (39, 45, 50, 54). The personality trait of neuroticism has consistently been found to be predictive of depression among residents (45, 47). Work-related factors such as “feeling overwhelmed,” intensive care unit rotation, and job stress have all been identified as predictors of depression (41, 50, 53). Research seems to indicate that it is the perceived stress at work that has been associated with mental health problems and not the actual

number of hours worked (47, 52). Sleep deprivation during residency has been associated with depression (55). However, because of the complex relationship between sleep disturbance and depression, it remains unclear how sleep loss during residency may impact the development of depression or vice versa.

In the hospital, it is not uncommon to hear residents complain that they feel “burnt out,” especially after working several consecutive on-call months. Burnout is commonly experienced in the healthcare profession where workers are likely to have numerous intense interactions managing patients with multiple demanding issues and concerns. Burnout is estimated to affect anywhere from 25% to 60% of practicing physicians (56). In comparison to other health care providers in the U.S., residents suffer from higher levels of burnout that often begins during internship (57). Burnout is a well described syndrome thought to consist of three separate dimensions: 1) emotional exhaustion, 2) depersonalization or cynicism, and 3) feelings of inefficacy or lack of personal accomplishment (56, 58). In contrast to depression, which has a more global impact upon a person’s functioning, burnout is considered to primarily affect a person’s work-life experiences.

Residents work in an environment with high demands and conflicting levels of dependency, responsibility and autonomy (57, 59). Because residents are in the process of acquiring the knowledge and skills they need to effectively do their job, there are often high levels of internal strife and feelings of inadequacy in addition to the challenges of caring for very sick patients. Depending on the criteria used, studies indicate that the prevalence of burnout among residents ranges anywhere from 18-82% (56-58). Most studies indicate that in residents, burnout manifests as emotional exhaustion and

depersonalization with the sense of personal accomplishment remaining relatively well intact (56, 57, 59). In the general population, emotional exhaustion is the principal component of the burnout syndrome that is associated with job absenteeism (60). Among residents, associations have been found between burnout, poor health, and psychiatric disturbances including psychotic depression, somatization, dysthymia, alcohol abuse, and anxiety (57, 58). Furthermore, residents with burnout report higher levels of suboptimal patient care (57, 59, 60).

Although burnout and depression are strongly correlated, a causal relationship has not been determined as there is relatively no longitudinal data to assess how the timing of these two syndromes may overlap. In one survey of 115 internal medicine residents, only 51% who met criteria for burnout also screened positive for depression (56). Another study found that interns who have high scores of depression also reported higher levels of perceived stress associated with being overworked than interns who were not depressed (52, 58). It is possible that depression may predispose individuals to burnout by lowering the stress perception threshold. It is also possible that burnout may deplete positive coping mechanisms over time, thus lowering the threshold towards the development of depression. Although these two syndromes are conceptualized as being separate, there is likely some overlap that is captured by the measures used to identify them.

Residency is a time during which long work hours and overnight call are viewed as an inherent part of the rite of passage towards becoming an attending physician. There is no longer any doubt that sleep deprivation can take a heavy toll on cognitive functioning (including reduced vigilance, verbal processing, complex problem solving, and learning), physical performance (including procedural tasks, and manual dexterity),

and mood (including depression, burnout, and decreased empathy) (55, 61). Research shows that cognitive deficits can become apparent in healthy adults who receive on average less than five hours of sleep a night (61-63). In addition, research has revealed that the effects of chronic partial sleep loss (<6 hours of sleep per night for >1 week) are not only cumulative, but may be just as detrimental as the effects of acute sleep deprivation (recent 24-hour sleep loss) (61). Contrary to the belief that individuals can learn to adapt to chronic sleep deprivation, some studies indicate that post-call performance deficits are similar among junior and senior housestaff (64). Many residents report that the effects of chronic sleep loss have a tremendous impact upon both their professional and personal lives, including the ability to effectively do their work and to pursue meaningful social activities (65).

In recognition of the negative impact residency training has had upon residents' physical and mental health, and consequently on patient care, the Accreditation Council for Graduate Medical Education (ACGME) mandated work hour limitations in all residency training programs across the United States as of July 1, 2003. The new rules state that residents can work no more than 80 hours per week averaged over a four week period, no more than 24 hours on call with an additional 6 hours to accommodate educational and patient transfer needs, must have at least 10 hours of rest between shifts, at least one day in seven off, and may not take call more frequently than every third night (66). Other workplace reforms such as eliminating overnight call, and limiting the number of new patient admissions are further attempts to decrease the amount of work stress encountered during residency. It is important to point out that the impetus behind

these changes was poor patient care outcomes secondary to mistakes made by overworked residents.

Prior to work hour reforms, the Institute of Medicine estimated that more than 100,000 U.S. patients die every year due to medical errors (67). Depending on exactly how it is defined, studies indicate that anywhere from 18-47% of residents admitted to committing some type of medical error (67). Although patients are obviously the primary victims of these mistakes, it is now recognized that physicians themselves may also become “second victims” in dealing with the consequences of such events. It is common for physicians to react with feelings of “distress, guilt, shame, and depression” after committing a medical error (67). Despite work hour reforms, West et al. found that consistent with other studies roughly one third of residents reported making at least one major self-perceived medical error over the three year study period (67). Residents who reported self-perceived medical errors had decreased quality of life scores, higher scores of burnout and were more than three times as likely to screen positive for depression (67). Of particular note, residents who had worsening scores of burnout and reduced empathy were more likely to report self-perceived medical errors in the future, indicating a possible negative spiral of poor coping mechanisms. That is, the distress of committing an error leads to increased burnout and depression which in turn may make residents more vulnerable to committing more errors.

In a study of burnout and depression in residents after the implementation of work-hours limitations, Goitein et al. found in comparison to Shanafelt’s prior study on residents within the same institution and using nearly the same measures, that the proportion of residents who met criteria was somewhat lower although not statistically

significant (66). Residents scored significantly lower on the scale of emotional exhaustion since the work hours reduction. However, scales of depersonalization and personal accomplishment remained the same (66). Interestingly, there was no difference in the frequency of residents who screened positive for depression since the work hour limitations, further supporting the distinction that depression is a different syndrome than burnout. In a similarly designed study comparing resident burnout before and after the 80 hour work week, Gopal et al found that scores of emotional exhaustion were significantly decreased after the work hours reduction but that scores of depersonalization and depression while also decreased were not significantly reduced (60).

Prior to work hours restrictions, over 10% of residents reported a lack of sleep on a daily basis with some studies reporting acute sleep deprivation in up to 34% of housestaff and chronic sleep deprivation in up to 64% of house staff (68, 69). In particular, one study found that in 149 residents across all major disciplines, 84% scored within the range of clinical intervention on the Epworth Sleepiness Scale (65).

Compliance with work-hours restrictions has been a challenge and often unmet goal for many residency programs. One year after regulations were in effect, one study revealed that roughly 84% of interns reported violations of standards during at least one month (70). In particular, 67% of interns reported working more than 30 hours on call and 43% reported working more than 80 hours per week (70). Furthermore, another recent study found that despite work-hours limitations and a sleep hygiene intervention, medical interns continued to be significantly sleep deprived (71). Although there is debate among house staff and faculty about the impact of work hour restrictions on the quality of patient

care and resident education, most residents agree that the implementation of work-hours restrictions has improved overall quality of life (59, 72-74).

In one of the only studies to examine specifically the effects of sleep deprivation upon the psychological functioning of interns, Rosen et al found that by the end of internship year, 43% reported high levels of chronic sleep deprivation, and that the prevalence of moderate depression increased from 4.3% prior to starting internship to 29.8% at the end of the year (55). Of particular note, they found that interns who were chronically sleep deprived were seven times more likely to become depressed (OR = 7, $p = 0.014$) (55). Interestingly, they did not find an association between chronic sleep deprivation and burnout or decreased empathy (55). Because sleep disturbance and depression are inherently interconnected, it is difficult to draw any conclusions of causality from this study. However, it is possible that sleep deprivation and depression perpetuate one another in a downward spiral. In other words, these findings imply that chronic sleep deprivation may predispose some interns towards depression, and it is probable that once they have become depressed interns have even more difficulty regulating their sleep cycle.

Resilience

Although the prevalence of depression in residents is higher than the general population, the majority of residents exposed to the same levels of high chronic stress during residency don't become depressed. An individual's vulnerability to developing a psychiatric disorder, namely depression, is determined by a combination of factors including genetics, early life stressors, current ongoing stress, personality traits, and

social supports, to name a few. Although no distinct genetic pathway has been identified, family, twin and adoption studies indicate that mood disorders do have a significant familial contribution (75-78). In addition, research has shown that stressful life events such as being the victim of a crime, financial crisis, divorce, physical or sexual abuse have been strongly associated with the subsequent development of depression, especially the initial episode of major depression (79-82). Highlighting the relationship between genetics and life stress in the development of depression, a recent landmark study by Caspi et al. found that when exposed to life stressors, individuals who possessed the short allele polymorphism in the promoter region of the serotonin transporter gene were more likely to develop depression (83). Certain personality traits such as neuroticism (characterized by high levels of negative emotionality such as anxiety, hostility and depressed mood) have also been associated with a predisposition towards developing depression (84-86). In addition, there is evidence indicating a strong genetic association between neuroticism and depression (85-87). While researchers have become more adept at describing the characteristics of people who do become depressed, the attention has begun to shift over the past twenty years towards identifying the qualities of individuals who, when exposed to the same life stressors, don't become depressed. From this endeavor, the concept of resilience has emerged in describing individuals who are somehow less vulnerable to the psychiatric sequelae of chronic or acute stressful events (88, 89).

According to the Merriam-Webster's online medical dictionary resilience describes both "the capability of a strained body to recover its size and shape after deformation caused especially by compressive stress" and "an ability to recover from or

adjust easily to misfortune or change < emotional resilience >” (90). The term resilience has been applied in fields ranging from ecology, microbiology, engineering, business and economics. In terms of humans, the concept of resilience has been studied mostly within the realms of psychiatry and psychology. Originally, resilience research was done mostly in children growing up in disadvantaged situations to describe those who, despite multiple risk factors such as poverty, abuse, and neglect, were somehow able to continue functioning normally (91, 92). In adults, resilience research has focused primarily on survivors of extremely stressful life events such as war, near-fatal accidents or illnesses, or the loss of a loved one (91).

Resilience is defined as the ability to cultivate positive adaptation to a challenging or adverse situation. In contrast to hardiness which describes the ability to endure significant adversity, resilience encompasses the ability to not just survive, but to thrive in the face of adversity (92). In contrast to recovering from a traumatic event which may take a variable length of time and may encompass a period during which normal functioning is lost, the manifestation of resilience to a traumatic event “reflects the ability to maintain a steady equilibrium” (91). Over the past twenty years, researchers and theorists have come to understand resilience as a dynamic developmental process, and no longer as just a static personality trait (93). For example, resilience may vary with “context, time, age, gender, and cultural origin, as well as within an individual subjected to different life circumstances” (88). Specific attributes associated with resilience include positive emotions, cognitive flexibility, spirituality, social supports, and active coping styles (94). For each individual, resilience depends upon a number of interrelated factors

including an individual's neurobiological make-up, psychological profile, personal trauma history, and social support network (95).

Research is beginning to uncover some of the many neurobiologic mechanisms involved in depression and stress resilience including the role of serotonin in the learned helplessness model, the role of norepinephrine and neuropeptide Y in the sympathetic nervous system, the role of dopamine in reward system pathways, and the roles of corticotropin releasing hormone, cortisol and DHEA in the hypothalamic-pituitary-adrenal axis (94). While it is beyond the scope of this text to explore these physiologic factors, it is recognized that they are inherently involved in the perceptions, behavioral reactions, and coping mechanisms involved in the management of stress.

Positive emotions refer to joy, gratitude, interest, contentment, pride, and love and along with humor and optimism are considered to be highly characteristic of resilient individuals (94, 96). These types of emotions provide a hopeful psychological framework from which to draw upon, and are associated with overall greater life satisfaction, increased psychological well-being and health (96, 97). Several researchers have found that coping strategies focusing on enhancing positive emotionality (such as positive reappraisal, problem-focused coping, and infusing ordinary events with positive meaning) lead to increased tolerance of stress and decreased depression (96, 98-100). For example, in a study on college students following the September 11th terrorist attacks, the experience of positive emotions following the attack significantly mediated the relationship between pre-crisis resilience and post-crisis development of depression (98). This example demonstrates that positive emotions can serve as an important reservoir of

psychological resources from which resilient individuals can draw upon to maintain a high level of functioning while managing a high amount of stress.

It is theorized that during times of acute or chronic stress when negative emotionality is high, positive emotions may provide a hiatus during which depleted resources can be replenished and meaning restored (94). According to Fredrickson's broaden-and-build theory, which has garnered substantial empiric support, negative emotions serve to increase autonomic activity, and narrow attention to focus on a specific task such as attack or escape (96). In contrast, positive emotions serve to counterbalance these effects by calming autonomic activity and redirecting attention, cognitive and behavioral processes in a more creative, exploratory and flexible manner, encouraging the development of physical, psychological, intellectual and social resources (96). As such, positive emotionality is an important component of resilience and one that may be fostered as a means of coping with chronic stress.

Humor, long considered one of the most mature of defense mechanisms, is also associated with positive psychological well-being (94, 101). Laughter, the physical manifestation of humor, is correlated with improved immune functioning, and increases in positive emotion (94, 96, 101). By encouraging a positive outlook and diffusing tension, humor may make it easier for individuals to embrace problem-focused behavior and attract social support (94). Indeed, many resilient individuals facing various stressors including combat veterans, cancer patients, surgical patients, and at-risk children have cited humor as an important coping mechanism (94).

Cognitive flexibility, an inherent component of resilience, encompasses the three dimensions of positive explanatory style, cognitive reappraisal, and acceptance.

Explanatory style reveals the way individuals make sense of themselves in their surrounding world. In effect, explanatory styles demonstrate how individuals explain the “why” of their situations or how they attribute meaning to certain outcomes. People who are depressed tend to exhibit negative or pessimistic explanatory styles in which they see themselves as blameworthy (102). They tend to view difficult situations as unsolvable, hopeless, and pervasive, affecting all areas of their lives (102). In contrast, positive explanatory styles are characterized by two essential traits: transience and specificity (102). When faced with a difficult situation, most resilient individuals make use of positive explanatory styles to reorient themselves to perceive a difficult situation as transient and confined to a specific setting within their lives, with some sort of foreseeable solution (94, 102).

Researchers have demonstrated that explanatory styles can change from pervasive and universal when individuals are depressed to more temporary and specific as depressive symptoms subside (102). Explanatory style has been shown to be predictive of the development of depression in children, however these findings do not seem to hold true for older adults (103). Preliminary data on a cognitive behavioral intervention focused on improving explanatory styles in college students at risk for depression indicates that these techniques may have some value in preventing depressive symptoms (104). One study of 45 internal medicine and family medicine residents evaluating explanatory style, emotional distress, and performance found that most residents displayed a positive explanatory style. Interestingly, although performance was not related to explanatory style, there was a significant correlation between positive explanatory style and decreased levels of emotional distress (105).

Cognitive reappraisal involves the ability to take an adverse event and reframe it as less threatening in order to derive positive meaning from it. This is a skill that has been found to be highly characteristic of resilient individuals (97). Finding positive meaning from the challenges of daily stressors or from adverse events can generate stress-related positive growth and can actually lead to an enhanced sense of well-being, faith and trust in oneself and in others (94). The ability to reframe and to alter the perception of difficult situations gives individuals a greater sense of control and enables them to create meaning. For many people, religion and spirituality provide an outlet through which they can find positive meaning from adverse events (94). In effect, religion and spirituality can offer a theoretical framework through which cognitive reappraisal may be accomplished. Many studies have confirmed that religion and spirituality may have a protective effect on an individual's well being and are consistently associated with lower levels of depression (94).

One of the many complaints residents have is that they feel a lack of control over their time (58). This sense of a lack of control may contribute to the development of burnout and depressive symptoms during residency. In this sense, cognitive reappraisal could be used as a protective skill for residents against development of depressive symptoms. By redefining or reorienting themselves in difficult situations in which they feel powerless, residents may be able to regain a sense of control and in effect find an increased sense of ability and confidence.

Positive and adequate social support serves an important role in coping with stressful events. In general, people across the age spectrum with a strong social support network report less stress and have a decreased risk of developing depression (94, 106).

Research on burnout in residents has demonstrated that residents who are single, are experiencing family-related stress or who report less satisfaction with their support systems have higher levels of burnout (57). Mentors, in particular, can serve as positive role models in teaching or illustrating effective coping techniques and providing a stress outlet, all of which may foster resilience and may help alleviate depressive symptoms in many at-risk populations (94). In the medical field, mentorship has a long established tradition, and is recognized as a valuable source of support and guidance for young physicians (107). However, with increased clinical and research responsibilities, and a lack of value placed on the mentorship role for faculty advancement, faculty have become less available to residents over the past quarter century (107). This has resulted in a decline in mentorship and a corresponding decrease in career satisfaction, particularly within the field of internal medicine (107, 108). In response to these disappointments, a call to increase mentorship in residency training programs has been initiated, citing the important role mentors can provide in helping residents learn how to manage the high levels of stress during residency (107, 108).

In a study of 329 medicine residents in the five affiliated Harvard programs, 93% of residents felt that mentorship was an important component to their training (108). However, only half were able to identify a current or past mentor (108). Interns, in particular, were significantly less likely to have established a mentoring relationship (108). Of the 50% of residents who had an established mentor, only 60% reported being satisfied with their mentoring experience (108). There is no data to support that mentorship may be able to prevent the development of depression or burnout. In fact, a small study of 21 orthopedic residents, all of whom had mentors, showed that residents

still had high levels of burnout and reported little benefit from their mentor (109). The effectiveness of mentorship is variable, and dependent upon a number of personal and interpersonal characteristics. It is likely though that mentorship could provide increased social support during residency which in turn could offer residents another tool with which to manage the daily stressors of training.

Although several hundred different coping styles can be found in the scientific literature, there are two basic categories of coping style that have been correlated with resilience and depression respectively: 1) active coping mechanisms, including seeking social supports, adopting a fighting spirit, and using cognitive reappraisal and 2) passive coping mechanisms including denial, behavioral and mental disengagement, and alcohol use (94). In both adolescents and adults, active coping styles have been associated with higher levels of resilience, psychological well being and ability in managing stressful circumstances and lower levels of depression (94). In contrast, passive coping styles have been associated with higher levels of depression and psychological distress (94). Because coping styles are often learned within family environments, children may adopt the passive coping skills from a depressed parent, which in turn, may predispose them to depression later in life (110). This is another example of how family history, through environmental and not necessarily genetic mechanisms, may predispose an individual towards depression. The relationship between depression and coping style is unclear as there is evidence to suggest that passive coping style may predict the development of depression, but that in turn, depression itself may also predict a negative coping style. Therefore, it is unclear the extent to which coping style when targeted alone may be able to prevent the development of depression.

Exercise is an active coping mechanism that is particularly associated with lower levels of depression in both healthy subjects and among patients with a variety of medical conditions (94). Aerobic training increases levels of B-endorphins, plasma monoamines and free tryptophan, promotes neurogenesis and neuroplasticity, and attenuates the hypothalamic-pituitary-adrenal axis stress response. In comparison with sertraline as a treatment for depression, exercise was found to have a slower response rate. However, it was overall nearly as effective as medication, and had a significantly lower relapse rate in subjects who continued to exercise independently (111, 112).

Time constraints during residency can make it difficult for residents to find time for exercise. A survey of 51 medical residents found that fitness levels were below average for 60%, average for 25% and above average for only 15% (113). Less than half (41%) met national guidelines for recommended physical activity (113). Given the benefits of exercise on mood and as a healthy coping mechanism, the lack of physical activity among residents could directly impact their mental health. In addition, lack of exercise may be indirectly affecting patient care as studies indicate that doctors who don't exercise are poorly equipped to properly counsel their patients on increasing physical activity (113, 114). Increasing residents' physical activity could be one way to improve residents' mental health and overall psychological well-being.

Although there is little to no prospective, longitudinal data directly examining the relationship between resilience and the development of psychiatric morbidity, specifically depression, research is starting to demonstrate clear associations between the two. Connor and Davidson found distinct differences in levels of resilience among different groups of the population according to psychiatric morbidity (88). In comparison to the

general non-help seeking population, primary care patients, psychiatric outpatients, patients with generalized anxiety disorder, and patients with post-traumatic stress disorder all had significantly and progressively lower levels of resilience respectively (88). There were no significant differences in resilience scores between psychiatric outpatients, patients with generalized anxiety disorder or patients with post-traumatic stress disorder (88). In a recent study of college students, resilience scores were shown to moderate the relationship between retrospective reports of childhood abuse and current psychiatric symptoms (115).

In the only studies looking at the relationship between resilience and suicidal behavior, Roy et al. examined a population of abstinent substance dependent patients with a high percentage of attempted suicide (41%) and found that those who had attempted suicide had significantly lower resilience scores (116). Despite the fact that scores of early childhood emotional and physical abuse were significantly higher among suicide attempters, resilience scores were not correlated to a prior history of abuse (116). In other words, resilience scores in this population were independent of a childhood history of trauma. In fact, logistic regression models revealed that only levels of resilience and not a prior history of childhood abuse were predictive of having attempted suicide (116). Levels of depression were also significantly inversely correlated with resilience scores (116). While it may not be feasible to generalize findings from this particular population onto residents, given the increased risk of depression and suicide among physicians, assessing resilience levels could be an important area for further investigation and directed intervention.

Residency is a time filled with high levels of chronic stress that for many residents leads to varying degrees of sleep deprivation, burnout and depression at rates much higher than the general population. Year after year, interns learn how to cope and adapt with these stressors amid a culture of medicine that for centuries has been in denial of the physical and especially the mental health vulnerabilities of its own members. Perpetuating and concealing this neglect, doctors are generally thought of, by the both the public and themselves, to be a rather resilient group of people, capable of functioning at high levels despite a tremendous amount of stress and adversity. In order to better understand the scope of mental health issues interns are facing, one of the purposes of this study is to determine both the prevalence and severity of depression that occurs throughout internship. Given that the majority of interns do not become depressed, it is worthwhile to try to understand what characteristics this group possesses that enable them to cope with the chronic stress of residency, namely resilience. This is the first study of its kind to examine the degree of perceived resilience among interns and to see how resilience may moderate the relationship between the chronic stress of internship and the development of depression. Given the lack of data regarding mental health service utilization among residents, this study also aims to provide a sense of how many interns who meet criteria for clinically significant depression are getting the treatment they need.

Hypotheses:

Given the high level of chronic stress experienced during internship and a review of the relevant literature, it was hypothesized that the point prevalence of depression among interns would increase from baseline to the three-month and six-month intervals,

and be overall higher than the general population at both time points. Theoretically, interns who have higher levels of resilience at baseline will have an enhanced ability to cope with the chronic stressors of internship, and therefore it was hypothesized that interns with higher baseline resilience would be less likely to develop depression at three-months and six-months. Given the findings from other studies, it was hypothesized that gender, social supports, personal history of depression, family history of depression, levels of resilience, and sleep deprivation would be positive predictors of the development of depression at three-months and six-months.

Specific Aims:

- 1) To determine the point prevalence and severity of depression among interns at baseline (prior to starting residency), and at the three-month and six-month follow up.
- 2) To determine possible predictive variables for the development of depression in interns (gender, marital status, prior history of depression, family history of depression, resilience, exercise, social supports, hours worked, sleep deprivation, specialty).
- 3) To assess levels of resilience among interns at baseline and determine if a correlation exists between levels of resilience and the development of depression at three-months and at six-months.
- 4) To report the number of interns who sought some form of mental health treatment (medication, counseling or both) at the three month and six month follow up.

5) To determine if interns with clinically significant levels of depression are seeking appropriate treatment.

Methods:

The data for this study was collected as part of a larger ongoing prospective, longitudinal multi-center study entitled Investigation into the Interaction Between Genes and Stress in the Etiology of Depression in Interns that is being led by Drs. Srijan Sen and Constance Guille both third year residents in the Department of Psychiatry. This study has been approved by the Yale University Internal Review Board. Eligible subjects included all incoming interns in the traditional and primary care internal medicine, general surgery, pediatrics, obstetrics/gynecology and psychiatry residency programs at Yale University, University of Connecticut, the Hospital of St. Raphael, Mount Sinai School of Medicine Hospital, Bridgeport Hospital and Greenwich Hospital. Interns were recruited through their respective residency program directors and were sent an invitation by e-mail to participate in the study. All interns were eligible to participate, and after obtaining informed consent they were enrolled.

Participants completed online a baseline questionnaire, and follow-up questionnaires at three-months, and six-months into their internship year. All questionnaires were anonymous and all identifying information was removed. The baseline questionnaire assessed general demographic information, sleep patterns over the week prior, work hours during the week prior, exercise habits during the week prior, resilience (through the Connor-Davidson Resilience Scale), lifetime history of major

depression (using DSM-IV criteria), family history of major depression (using DSM-IV criteria) current depressive symptoms (through the Patient Health Questionnaire, PHQ-9), and social supports (through the Sarason's Social Support Questionnaire – short form). The questionnaires administered at the three-month and six-month follow up measured current depressive symptoms (through the PHQ-9), the number of hours of slept during the prior week, the number of hours worked the week prior, and queried if the participant had started taking a psychotropic medication or seeing a therapist during the previous three month interval. Upon completion of the questionnaire at each time point participants were provided with general information about depression as well as a list of resources for mental health counseling and treatment.

Measurements

Prior history of depression was assessed retrospectively by asking participants if they had experienced an episode of depression in the past consistent with a provided description of DSM IV diagnostic criteria. Participants were then asked if they had ever received treatment for depression in the past including medications or psychotherapy. Family history of depression was similarly assessed by asking participants if a first degree relative had experienced an episode of depression consistent with the provided description of DSM-IV diagnostic criteria. All responses to these questions were either yes or no.

The Patient Health Questionnaire is a nine item inventory with scores that range from 0-27 that has been validated by multiple studies as an effective diagnostic, severity, and treatment outcome measure for depression (117-119). In general, scores from 1-4

indicate minimal to no depression, 5-9 indicate mild depression, 10-14 indicate moderate depression, 15-19 indicate moderately severe depression, and 20-27 indicate severe depression (120). A single cutoff score of ≥ 10 is recommended as it has a sensitivity and specificity of 88% for major depression and a positive likelihood ratio of 7.1 (120). Scores less than 10 rarely occur in people without major depression, and scores ≥ 15 usually identify people with major depression (120). Treatment recommendations according to PHQ score are as follows: 1) For mild depression (PHQ 5-9), watchful waiting with repeat PHQ at follow up. 2) For moderate depression (PHQ 10-14), treatment planning, consider counseling and/or pharmacotherapy, assertive follow up. 3) For moderately severe depression (PHQ 15-19), immediately begin pharmacotherapy and/or psychotherapy. 4) For severe depression (PHQ ≥ 20), immediately begin pharmacotherapy and if there is severe impairment or poor treatment response, then an expedited referral to a mental health specialist for psychotherapy and/or collaborative management is advised (120).

The Connor-Davidson Resilience Scale is a 25 item self-report scale that has been validated as a measure of resilience or the ability to cope and adapt to stress and adversity (88, 121). Each item is rated on a 5 point Likert scale from 0-4. Total scores range from 0-100, with higher scores indicating greater resilience. In their initial study, Connor and Davidson reported significant differences in total resilience scores among different clinical segments of the population (please refer to Introduction or to reference for more details) (88). Connor and Davidson also performed an exploratory factor analysis of their scale based on data collected in the general population that revealed five significant factor loadings which they interpreted as: Factor 1: the notion of personal competence,

high standards, and tenacity, Factor 2: trust in one's instincts, tolerance of negative affect, and strengthening effects of stress, Factor 3: positive acceptance of change, and secure relationships, Factor 4: control, Factor 5: spirituality (88). Campbell-Sills and Stein performed another exploratory analysis of Connor and Davidson's original 25 item resilience scale on a population of undergraduates and were unable to replicate these results. After remodeling the scale and dropping several items, they found a two factor model they described as 1) hardiness and 2) persistence that best fit (please refer to reference for full explanation) (121).

The short form of Sarason's Social Support Questionnaire is a six item inventory that has been validated as a measure of both an individual's perceived number of social supports and the degree of satisfaction with social supports (122, 123). Higher scores indicate positive social supports in both quantity and satisfaction and are correlated with higher self-esteem, and greater optimism (122). Lower scores have been correlated with a relative dissatisfaction with life and difficulty with tasks that don't offer an immediate solution (122).

Statistics

All statistics were performed using SPSS. The paired Student's t-test and chi square analysis were used to compare baseline data from the three and six-month time points. The prevalence of depression severity and chronic sleep deprivation were determined based on validated cut off points (35, 120). Pearson's bivariate correlations were performed to assess for significant relationships between variables. Linear regression was used to determine significant correlates of the development of depression

(as change in PHQ score from baseline to three-months or baseline to six-months). A logistic regression model was created based on the significant correlates for developing depression to determine predictors for depression (using PHQ \geq 10 as the validated cutoff for depression as the dependent variable) (120).

Results:

General characteristics

Of the 390 interns who were invited by email to participate, 241 consented and completed the baseline assessment (61.8% response rate). Of these 241 intern participants, 185 interns (76.8%) completed the 3-month online questionnaire, 182 interns (75.5%) completed the 6-month online questionnaire, and 153 interns (63.5%) completed the questionnaire at all three time points.

Table 1 outlines the demographic characteristics of interns at baseline. Of the 241 participants, 56.8% were female and 43.2% were male. The ages ranged from 22 - 44 years old with a mean age of 28 ± 3.3 years. The ethnic make-up of the group was 56.4% Caucasian, 24.9% Asian, 6.2% Latino, 2.1% African-American, and 10.4% mixed ethnic identities. At baseline assessment, approximately 55.5% of interns reported they were single, 32.1% were married, 10.7% were engaged, and 1.7% were divorced. There were no significant differences in age, sex, ethnicity or marital status between the groups of respondents at any of the three time-points. Prior to starting internship, 60 interns (24.9%) had moved to the U.S. from a foreign country. In terms of residency program, 58.5% were in Internal Medicine, 11.1% in Surgery, 10.6% in Pediatrics, 8.1% in Obstetrics/Gynecology, 6% in Emergency Medicine, 5.5% in Psychiatry. Table 2

outlines the depression related characteristics reported by interns at baseline. At this time point, 110 interns (45.6%) reported a prior history of depression, 43 interns (17.8%) reported prior treatment (medication or therapy) for depression, and 124 interns (51.5%) reported a family history of depression.

Depression in Interns

The prevalence of depression (PHQ score ≥ 10) increased from baseline to three-months (2.6% to 24.9%; $\chi^2=19.5$, $p=0.0001$) and baseline to six-months (2.6% to 24.7%; $\chi^2=19.2$, $p=0.0001$), but did not change significantly from three-months to six-months (24.9% to 24.7%; $\chi^2=0.02$, $p=0.89$). Table 3 outlines the number of interns who met criteria for mild, moderate, moderately severe, and severe depression. The number of interns who expressed passive suicidal ideation by responding positively to the question of having “Thoughts that you would be better off dead or hurting yourself in some way?” was 2.6% (N=6) at baseline, 10.3% (N=19) at 3-months, and 6.6% (N=12) at 6-months. There was a significant increase in suicidal ideation among interns from baseline to three-months (2.6% to 10.3%; $\chi^2=4.8$, $p=0.03$), but not from baseline to six-months (2.6% to 6.6%; $\chi^2=1.05$, $p=0.31$). There were no significant differences in terms of age, gender, ethnicity, or marital status between those who reported suicidal ideation and those who didn't. Of the 33 interns who were depressed (PHQ ≥ 10) at 3-months, 18 (54.5%) were still depressed at 6-months. However, 15 (45.4%) were no longer depressed at 6-months.

Table 4 outlines the differences in rates of depression between international medical graduates and U.S. medical graduates. Compared to U.S. medical graduates, international medical graduates had significantly lower scores of depression at three

months (mean PHQ=3.6 vs. 5.2, $p=0.002$) and at six months (mean PHQ= 3.7 vs. 5.7, $p=0.001$). Accordingly, international medical graduates had a lower prevalence of depression (PHQ ≥ 10) at three months (9.1% vs. 25%, $p=0.006$) and six-months (5.9% vs. 24.7%, $p=0.001$).

Table 5 outlines the significant correlates for developing depression (change in PHQ score from baseline to 3-months, or baseline to 6-months). Age was an inconsistent correlate with the development of depression. At 3-months older interns were more likely to be depressed, however, this relationship was no longer a significant at 6-months. Similarly, gender was also an inconsistent correlate with developing depression. At 6-months women more likely to be depressed, however, this relationship was not significant at 3-months. A history of prior depression and a family history of depression at baseline were significant correlates with developing depression at both the 3-month and the 6-month follow-ups. At three-months, interns reported working an average of 68.3 ± 22.9 hours/week (range = 0-120 hours) the week prior to follow up. At six-months, interns reported working an average of 69.4 ± 18.7 hours/week (range 0-110) the week prior to follow up. Work hours the week prior to follow-up were significantly correlated with developing depression at both time points. That is, interns who reported higher numbers of work hours the week prior to follow-up at both time points were significantly more likely to be depressed at each follow-up. Neither acute nor chronic sleep deprivation (as determined by established cutoff levels of <6 hours of sleep per night and <42 hours of sleep per week respectively (55)) was correlated with a change in depression scores at 3-months or at 6-months. Although total resilience score was not correlated with the development of depression at either time point, when all 25-items of

the Connor-Davidson Resilience Scale were analyzed, there were two items that were found to be significantly correlated with the development of depression at both three-months and six-months: 1) the statement “My past successes give me confidence for new challenges” and 2) the statement “I like challenges.” Interns who responded negatively to these two items were significantly more likely to be depressed at three-months and six-months. Neither marital status, ethnicity, number of social supports, satisfaction with social supports, total resilience score, exercise or specialty were predictive of developing depression at the 3-month or 6-month follow up.

Table 6 outlines the significant predictors for depression using a validated cutoff score of PHQ ≥ 10 at each time point (120). The variables selected for the logistic regression model were based on the significant correlates for developing depression previously determined. At three-months, both a prior history of depression (Odds Ratio (OR) = 3.3, $p < 0.02$, 95% Confidence Interval (CI) = 1.3 – 8.7) and a negative response to the CD-RISC item “My past successes give me confidence for new challenges” (OR = 0.32, $p < 0.01$, CI = 0.17-0.62) were found to be significant predictors of depression. The CD-RISC item was a continuous variable from 0-4 with decreasing negativity in response to the question. Taking the inverse of the odds ratio as 3.13, this result indicates that with each increasing interval of negativity in response to this question at baseline, interns were over three times more likely to be depressed (PHQ ≥ 10) at three-months. For example, at three months, 14% who responded “true nearly all the time” were depressed, 21% who responded “often true” were depressed, 40% who responded “sometimes true” were depressed and 66% of interns who responded “rarely true” were depressed.

At six-months, both female gender (OR = 2.8, $p < 0.02$, CI = 1.1-6.9) and work hours reported the week prior to follow-up (OR = 1.04, $p < 0.01$, CI = 1.01 – 1.04) were found to be significant predictors of depression. For every one hour more worked, interns were roughly 4% more likely to be depressed at six-months. The relationship between work hours and PHQ scores fits an exponential model more closely than a linear model. Therefore, increasing from 40-41 hours is likely to be less than a 4% increased likelihood of depression, and an increase from 80-81 hours is likely to be more than a 4% increased likelihood of depression.

Resilience in Interns

At baseline measurement, interns had an overall mean resilience score of 76 (s.d. 11) with a range of 44-100. Connor and Davidson's reference scores of resilience among a sample of the non-help seeking general population showed a mean of 80.4 (s.d. 12.8) and among a sample of a primary care patient population a mean of 71.8 (s.d. 18.4). Analysis shows that the mean resilience among interns is significantly different from both the general non-help seeking population and the primary care population. While this finding is unexpected, it is unclear if it has any clinical relevance. Resilience scores at baseline had a significant inverse correlation with depression scores at baseline, 3-months and 6-months (-0.41, -0.31, -0.23 respectively, all $ps < 0.002$). Interns who were not depressed at any time point (N=53; PHQ <5) had significantly higher resilience scores than interns who were depressed at 3-months and at 6-months (N=4, PHQ >14) (mean: 79.3, s.d. 9.9 vs. mean: 64.8, s.d. 10.6). Total resilience scores at baseline, however, were not significantly correlated with developing depression (change in PHQ score) at

three-months or at six-months. In comparing the interns who were depressed at 3-months and not at 6-months (N=15) to the interns who were depressed at both time points (N=18) there was no significant difference in resilience scores between the two groups. Interns who came from a foreign country prior to starting internship had significantly higher resilience scores than interns who came from the U.S. (mean: 79, s.d. 10.2 vs. mean: 75.9, s.d. 11.8, $p < 0.05$).

Both the number of social supports and satisfaction with social supports correlated positively with resilience (0.359, 0.367 respectively, both $ps < 0.01$). Neuroticism had a strong negative correlation with resilience (-0.581, $p < 0.0001$). Overall there were no associations found between resilience scores and exercise, gender, age, or ethnicity. None of Connor-Davidson's five factor subscales for resilience was predictive of developing depression (88). Neither of the two factor subscales for resilience developed by Campbell-Sills and Stein was predictive of depression (121).

Treatment for Depression in Interns

Table 7 identifies the number of interns with clinically significant depression who sought some type of treatment at three-months and six-months. At three-months, two interns reported starting an antidepressant, and four interns reported starting therapy for a total of four interns (6% of all depressed interns ($PHQ \geq 10$, N=50)) who started some form of treatment (two of the interns started a medication and psychotherapy at the same time). Three out of this total group of four interns (75%) who started some type of treatment met criteria for depression ($PHQ \geq 10$). Of the four interns who started some form of treatment, two (50%) had had prior treatment for depression.

At three-months, there were 11 interns (22% of all depressed interns (PHQ \geq 10, N=50)) with depression severity scores for which guidelines recommend treatment (PHQ \geq 15). At that time point, one intern (9%) with moderately severe to severe depression (PHQ \geq 15, N=11) had started some form of treatment. This one intern who started treatment at three-months had a PHQ = 20, indicating severe depression. Upon reassessment at six-months, this same intern had a PHQ = 10, indicating significant improvement and good response to treatment. The ten other interns with clinically significant depression who did not start treatment at three-months had an average PHQ of 18.8 at three-months. Upon reassessment at six-months, their average PHQ score was 15, still consistent with clinically significant levels of depression for which treatment is advised.

At six-months, one intern reported starting an antidepressant, one intern reported starting a mood stabilizer, and seven interns reported starting therapy for a total of seven interns (7.2% of depressed interns (PHQ \geq 10, N=55)) who started some form of treatment (two of the interns started a medication and psychotherapy at the same time). Four out of this total group of seven interns (57%) who started some form of treatment at six-months met criteria for depression (PHQ \geq 10). Of the seven interns who started some form of treatment, four (57%) had had prior treatment for depression.

At six-months, there were 12 interns (21.8% of all depressed interns PHQ \geq 10 (N=55)) with depression severity scores for which guidelines recommend treatment (PHQ \geq 15). At that time point, only one intern (8.3%) with moderately severe to severely depression (PHQ \geq 15, N=12) had started some form of treatment.

Of the 19 interns who indicated some type of passive suicidal ideation (positive response to having thoughts they would be better off dead or hurting themselves in some way) at three-months, only one (5.3%) started some form of treatment. Of the 12 interns who indicated some type of passive suicidal ideation at six-months, three (25%) had started some type of treatment.

Discussion:

The prevalence and severity of depression in interns

Consistent with findings from prior studies, this study found the prevalence of depression in interns to be significantly higher than the general population (35, 40-42). The overall prevalence of depression, including severity subtypes, remained consistent between the three and six months of internship at nearly 25%. Prior studies have demonstrated a peak in depressive symptoms around the 8th month of internship (34, 35). As this study only evaluates the first six months of internship, it is possible that these results are revealing a build-up towards a peak in the prevalence of depression among this cohort. It will be interesting to follow up results at both the nine-month and 12-month intervals to verify if this same trend exists.

It was alarming to note that 10% of interns at three-months, and nearly 7% of interns at the six-months reported suicidal ideation. Although these rates are somewhat consistent with age-matched peers in the general population estimated at 6.9% (124), they are less than the prevalence reported by Tyssen et al. from a sample of Norwegian interns at 14% (51). There is very little information about suicidal ideation or suicide attempts among residents. In Tyssen et al.'s study specifically examining suicidal ideation in the

first year of residency, the most important predictor of suicidal ideation was mental distress (defined as symptoms of anxiety and depression during the previous two weeks measured by a five item symptom check list) (51). When controlling for mental distress, they found that perceived job stress, single status, and the personality traits of neuroticism and reality weakness (a measure of severe personality pathology) were found to be predictive of suicidal thoughts (51). Because depression is a known risk factor for both suicidal ideation and suicide attempts, and both the prevalence of depression and completed suicide among physicians are higher than the general population, these findings are concerning and warrant intervention as well as further investigation.

Of the group of residents who were depressed at three-months, almost half were no longer depressed at six months. Prior models outlining the psychological course of internship indicate that many interns may experience a depressive episode early in the course of internship that then remits and is followed by a second depressive episode during the second half of internship (31). Again, it will be interesting to note if a recurrence of depressive episodes occurs throughout the rest of internship year. It is also important to point out that it is not known how treatment for depression could alter the psychological course of internship as previously described (31). It is possible that interns who receive appropriate treatment for depression initially might not suffer from a recurrence later during internship year. That being said, the fact that so few interns did seek treatment and yet nearly half seemed to get better regardless may indicate that many episodes of depression may be frequent, sporadic and remit independently.

It was unexpected to find that the prevalence of depression among international medical graduates (IMGs) was significantly lower than among U.S. graduates at both

three and six-months. Because there is no country specific data, speculations about these results will have to remain general. International medical graduates (IMGs) make up roughly 25% of practicing physicians in the U.S (125). The prevalence of IMGs is even higher in underserved areas (rural and urban) and in underrepresented specialties (internal medicine, psychiatry, family medicine) (125). It is estimated that IMGs provide nearly two thirds of the care for minorities and socio-economically disadvantaged in the U.S. (125).

There is an incredible amount of work and effort involved in obtaining a U.S. residency position for international medical graduates, including extensive examinations, travel arrangements, financial strains, and leaving behind family and loved ones. In short, it takes very strong and committed individuals to make it through this process, and make the adjustments necessary to participate in residency training in the U.S. In addition, prior to starting internship in the U.S., many IMGs have already been practicing physicians in their home countries. The confidence and knowledge many of these IMGs have attained from their former experiences may buffer some of the internship stress that are associated with depression in many U.S. medical graduates. It is also likely that just possessing the confidence and wherewithal to move to another country, adapt to a foreign medical system, and, for some, practice medicine in a foreign language, select for an especially robust type of individual who is less vulnerable to the impact of stress upon the development of depression. In support of this notion, IMGs did have significantly higher resilience scores than U.S. medical graduates. It is also possible that some IMGs may come from countries where they already experience high levels of chronic daily stress in the form of war, political and economic instability, extreme poverty, and both endemic

and epidemic diseases. Individuals exposed to these types of stressors may not feel as burdened by the demands of internship in the U.S. or may have already adapted to high levels of chronic daily stress (also supported by the higher resilience scores among this group). Finally, although the Patient Health Questionnaire has been validated in several different languages and cultures, it is possible that there are some cross-cultural limitations in its ability to detect depression among this sample (126, 127). For example, there are cultural differences that exist in the self-conceptualization, acceptance, and manifestation of depression that could lead to underreporting of depressive symptoms (125). One study found that even when controlling for specialty, physician characteristics, patient age and gender, IMGs were significantly less likely to diagnose depression or initiate treatment for depression when given practice patient scenarios (125). It is therefore possible that cultural differences in the conception of depression impact IMGs' self-recognition and self-perception of depressive symptoms or their willingness to report such symptoms.

Correlates of depression in interns

In many people depression is considered to be a chronic disease with recurrent episodes throughout the lifespan. In addition, it is now known that there are both genetic and environmental familial risk factors associated with the development of depression (75, 77). In our study, over 45% of interns indicated a prior history of depression, which puts this group at an increased risk of experiencing another episode. In addition, over 50% of interns indicated a family history of depression, which also increases this groups' risk of developing depression. Although these rates were higher than expected, two other

studies found similarly high rates of prior mental health problems (45, 50), and one other study found a similarly high rate of a family history of depression in interns (45).

Consistent with other studies, it is therefore not surprising that both a prior history of depression and a family history of depression reported at baseline were correlated with developing depression at both the three and six-month follow-up (45, 50, 52, 54). Given the high prevalence of these risk factors and the subsequent development of depression associated with these risk factors among interns, residency programs must be proactive in encouraging interns to seek proper treatment and support.

While in the general population, the prevalence of depression among women is nearly twice that in men, it seems this distinction does not necessarily hold true in the distribution of depression among physicians. There has been conflicting evidence regarding the association between gender and depression among residents and physicians (45, 47, 52, 53). Similarly, the results from this study do not indicate a clear relationship between gender and depression, and more data will be needed in order to better delineate what association, if any, exists between gender and the development of depression.

There has also been contradictory evidence regarding the relationship between age and the degree of mental distress among house officers (47). While some researchers have found that emotional distress declines with increasing age and level of training, other studies have found levels to be high across the age and training spectrum (47). In this study, increasing age was associated with the development of depression but was not a consistent correlate at both time points. More data is therefore needed to clarify this relationship.

Prior research has found that it is perceived work stress rather than the actual number of hours worked that was associated with mental distress among house staff (47, 51-53). In contrast to these findings, our study found that work hours were significantly correlated with the development of depression among interns at both three and six-months. While the numbers of hours worked may not always correlate with the intensity of the work experience, as many can attest, the nature of work performed during residency, internship in particular, is inherently stressful. It is likely, therefore, that the numbers of hours worked during internship is highly correlated with the intensity of the perceived work experience. This may not be true for all years of residency as residents become more confident in their skills and adapt to working conditions over time. It will be interesting to see if the association between work hours and depression continues to exist by the end of internship year when interns will have had more time to adjust to their working environments and the nature of their work.

Although neither total resilience scores nor any of Connor-Davidson's five factor resilience subscales were correlated with the development of depression at three or six-months, two items of the CD-RISC were significantly correlated with the development of depression at both time points. The first item that was correlated with developing depression was the statement, "My past successes give me confidence for new challenges." The second item that was correlated with developing depression was the statement, "I like challenges." Interns who responded negatively to these statements were more likely to become depressed at both time points. Of all 25 items on the CD-RISC, the only two statements that included the word "challenges" were the ones that were correlated with depression in interns. It is interesting to remember that the negative

responses to these statements were recorded at baseline just prior to starting internship. In other words, interns who from the beginning were uncomfortable with challenges were more likely to become depressed during internship. In support of these findings, another study found that when compared to a nationwide sample of 188 physicians selected as “positive role models in medicine,” residents were “less eager to face challenges” and “less able to cope with adversity” (32). Given the inherent challenges encountered during internship, it is understandable that interns who dislike dealing with challenges will be more resentful, less satisfied, feel more burdened by their work and therefore be more likely to become depressed.

While a negative response to the second item indicates that interns may be averse to challenges in general, a negative response to the first item indicates that the aversion to challenges may possibly be more of an issue of confidence or self-esteem. It is well known that interns suffer from high levels of insecurity and self-doubt that often perpetuate the perceptual distortion that others are somehow more knowledgeable and competent (31). This type of low self-esteem and low self-confidence are closely related to higher levels of depression (128, 129). A study on senior house officers found that those who had higher levels of psychological distress also had significantly lower levels of self-confidence (54). A lack of confidence in the ability to handle future challenges, and the inability to recognize past successes could also be a sign of the “imposter phenomenon” which has been found to be highly prevalent among residents and medical students alike (130). Individuals with the “imposter phenomenon” think that their prior successes were achieved only by fooling others into believing they are intelligent and capable (130). Despite their proven successes, these individuals believe they are

intellectual frauds and are fearful of being discovered (130). As such, individuals who suffer from the imposter phenomenon also have high levels of anxiety and depression (130). It is understandable that interns, who prior to starting internship had little capacity to see themselves as successful and competent, would then during internship, be more likely to become overwhelmed, have fewer internal resources to draw upon to cope with stress, and as a result be more likely to become depressed.

Predictors of depression in interns

The logistic regression model based on the significant correlates for developing depression yielded different predictors of depression at each time point. At three months, interns who had a prior history of depression were over three times more likely to be depressed. However at six-months, this variable was no longer predictive of depression. It is understandable that interns who have previously suffered from depression are at an increased risk of developing another episode especially during a time of acute stress. It was surprising that this risk was no longer apparent at six-months. In turning to the literature, one study that looked at depression during internship similarly found that prior mental health problems were not predictive of depression at six-months (45). Another study that looked at depression in internship found that prior mental health problems were predictive of depression at the end of internship year (50). Findings from this study indicate that a prior history of depression increases interns' vulnerability to developing depression during the acute phase of adaptation to internship stress (i.e., the first three-months). However, perhaps once interns have learned to cope with the stress of internship (after the first three-months), it seems that a prior history of depression no

longer predisposes them towards depression by six-months. Given the fluctuations of mood and stress that occur throughout internship, and prior models of the course of psychological distress that demonstrate recurring bouts of depressive symptoms throughout the year (31), it is possible that interns with a prior history of depression may be more likely to suffer from an acute episode of depression at the beginning of internship and could also be more likely to suffer a recurrent episode later in the year. It will be interesting to see how these patterns evolve throughout the rest of internship year. It will also be interesting to examine whether treatment for depression could alter the course of psychological distress that occurs during internship.

At three-months, increasingly negative responses to the CD-RISC item “My past successes give me confidence for new challenges” were predictive of depression. In fact, interns were over three times more likely to be depressed at three-months with each increasingly negative interval response to this item. In other words, the more strongly interns disagreed with this statement, the more likely they were to be depressed at three-months. This finding underscores the idea that it may be the lack of confidence in one’s ability to manage challenges that is the predisposing trait towards developing depression, rather than the challenges themselves. That is, it is not necessarily that interns don’t like challenges, but that they don’t believe they can handle them. Furthermore, this finding suggests the possible presence of cognitive distortions that may be more prevalent among depressed interns at three-months, as anyone who has made it into a residency position has clearly proven that he or she is more than capable of success with challenges. These are important distinctions as they could be incorporated into more effective treatment interventions. For example, cognitive behavioral therapy tailored towards increasing

recognition of prior successes or towards unraveling the cognitive distortions present in the imposter syndrome may be highly effective in combating the cognitive processes specific to internship-related depression. It is also interesting to note that this factor was not predictive at six-months. It is possible that a lack of confidence in one's ability to handle challenges may predispose to depression only during initial period of internship when stress levels and the number of challenges are at their highest. Despite the lack of initial confidence prior to internship, it is possible that some levels of confidence are attained through the process of internship, and why subsequently, this factor is no longer predictive of depression at six-months.

While in the general population, it is established that women are nearly twice as likely to suffer from depression as men, there is conflicting evidence regarding the relationship between gender and depression among physicians and residents (45, 47, 52, 53, 131). According to findings from this study, at six-months women were nearly three times more likely to be depressed than men. Interestingly, however, gender is not a significant predictor of depression at three-months. It is possible that when exposed to chronic levels of high stress during internship, women become more susceptible to developing depression than men. If this is true, then it will be important to investigate how environmental or social factors may be mediating the gender difference in the development of depression. Women who are married or especially who are mothers may feel an increasing level of internal conflict between work and home which may be more likely to manifest as depression in women than in men. Women may be more likely to face overt or covert forms of sexual discrimination in the workplace, or sexual harassment in the workplace which may also predispose them towards depression. Prior

studies have found specifically that women physicians report stress arising from family-home conflict, prejudice, and the lack of women role models (131). A study that looked at the relationship of particular stressors and depression in women junior house officers found that the stressors of feeling overworked, negative effects on personal life, poor relationships with consultants and senior house officers, sexual harassment, work-home conflict, and prejudice from patients were significantly related to depression (131). It will be interesting to see how the relationship between gender and depression evolves throughout internship year. Given the increasing prevalence of women in medicine, it will be important to alert women residents of their possible increased risk of developing depression during internship and to make sure there is appropriate access to treatment.

At six-months, increasing work hours were found to be predictive of developing depression. For instance, for each hour more worked, interns were roughly 4% more likely to be depressed at six-months. Because the relationship between work hours and depression scores fit more closely an exponential model, the likelihood of being depressed only becomes greater the more hours worked. Although average work hours during the week prior to follow-up reported at both three-months and six-months was roughly the same, work hours were not predictive of depression at three-months. It is possible that the impact of work hours upon the development of depression in interns has a cumulative effect. That is, it seems that roughly half-way through internship year, the strain of longer work hours begin to take a toll on interns' mental health. Other studies have found that it is not work hours per se, but the perceived stress of the working environment that have been predictive of mental health problems (47, 51-53). In particular, studies have cited stressful working conditions such as intensive care unit

settings with high intensity and urgency, feeling overworked, high time pressure, frequent interruptions, and settings of high demand and low control to be more related to emotional disturbances among interns (47). There are similar findings in the literature between work hours, perceived stress and the development of the burnout syndrome (58). It is likely that given the inherent intensity of internship, the concepts of work hours and perceived stress are nearly identical. Therefore, work hours during internship may mirror the amount of stress interns are encountering and thus be directly related to the development of depression. This relationship may be less straightforward with time as residents acquire skills and knowledge that will hopefully decrease the amount of daily stress experienced at work. It will be interesting to see how the relationship between work hours and depression continues to evolve throughout the rest of internship year as interns become more adapted to the working conditions and increasingly efficient and competent.

Treatment of depression in interns

Results from this study indicate that mental health treatment seeking among interns is extremely low. Researchers estimate that over half of adults in the community suffering from major depression do not seek help, with reluctance in particular to seeking help from mental health professionals (132-137). Consistent with this, at baseline prior to starting internship, only 39% of interns who reported a prior history of depression (N=110) had sought treatment. Although these findings are retrospective, they are lower in contrast to Tyssen et al.'s study of Norwegian interns that found that 50% of interns who believed they needed help sought treatment (4). Even more striking, in contrast to

Givens study that found that 22% of depressed U.S. medical students sought treatment (5), results from this study showed that only 6-7% of all depressed interns sought treatment. The majority of interns who were depressed met criteria for depression at levels not necessitating treatment. Surprisingly, however, they were the ones who were significantly more likely to seek treatment. At both three and six-months, only one intern (between 8-9%) with levels of depression that met criteria for treatment actually got it. Unfortunately, it appears that the interns who were most depressed were the least likely to get help. Of the few interns who did seek help, roughly 50% had sought treatment for depression in the past. It is likely the having had prior treatment for depression eases some of the burden and skepticism of seeking treatment again.

One of the great ironies of depression is that it is when people are suffering the most and need help the most that they are in the worst position to seek it out. The sense of self-alienation and withdrawal that accompany depression make it difficult for its sufferers to reach out and explore treatment options. Unlike other medical conditions, both the self and perceived social stigmas that surround mental illness may further prevent many people from recognizing and treating their mental health problems (136). In addition, depression severity may heighten the sense of perceived stigma surrounding mental health care, making it even more difficult for those who are suffering the most to seek help (138). The lack of care depressed interns are receiving is concerning given the chronic, relapsing course depression may take, and that recurrence of depression is higher when it is inadequately treated. The findings from this study indicate that this population is underutilizing needed mental health services and may well be at an increased risk for recurrent episodes of depression throughout their careers and their lifetime.

In general, people who don't seek help for mental health problems may be in one of three states: complete denial, partial denial, or inertia (4). People in complete denial do not even recognize that they have a mental health problem, let alone that they need treatment. People in partial denial may recognize that they have a mental health problem, but they don't believe they need treatment. People who are trapped in a state of inertia recognize they have a mental health problem, believe they need treatment for it, but for various reasons don't get it, such as a lack of access, a belief that treatment will not help, or various forms of stigma. There are many possible reasons interns are not seeking mental health treatment including denial, lack of awareness of the problem, lack of time, lack of energy, lack of available resources, or lack of knowledge of available resources. A study on barriers to mental health services among depressed medical students found that the most frequently identified barriers to care were lack of time, lack of confidentiality, stigma associated with use of mental health services, cost, fear of documentation, and fear of unwanted intervention (5). Tyssen et al.'s study on help-seeking for mental health problems in interns, found that high levels of perceived mental health problems and neuroticism were predictive of seeking treatment (4). In addition, high levels of reality weakness (a personality measure associated with paranoid traits, identity insecurity and difficulty with relationships) were related to lower levels of help-seeking (4). Results from this study indicate that interns who needed help most according to depression severity did not seek care. However, the amount of insight these interns had into their level of mental distress cannot be determined. It is possible that interns who are most impaired are also the least aware of the degree of their dysfunction. It is also possible that some interns are aware of their mental distress but are unwilling to

seek treatment for reasons that remain unknown. In order to better address the mental health needs of interns, understanding barriers to seeking treatment will be an important area to explore in the future.

Resilience in interns

According to Connor and Davidson's reference scores, as a whole interns reported themselves as being more resilient than a sample of the primary care patient population, but slightly less resilient than a sample of the general non-help seeking population. Given the lack of information on resilience scores in other age and peer group matched samples of the population for comparison, it is unclear if there is any clinical relevance to these findings. Resilience scores at baseline were strongly inversely correlated with PHQ depression scores at both three-months and six-months. That is, interns who perceived themselves to be less resilient at baseline, were more likely to have higher depression scores at each follow-up point. Consistent with this, interns who had no depression at either time point had significantly higher levels of resilience than interns who were depressed at both time points. Despite this general association, resilience was not found to be a significant moderator of stress in the development of depression at each time point. In other words, low resilience at baseline was not predictive of developing depression (change in PHQ score) in the face of internship stress at either of the follow-up points.

Other studies have found resilience to be a significant moderator of life stress in the development of psychiatric syndromes, particularly that of PTSD and depression (88, 89, 115). However, in these studies the stressful event is retrospective and a significant

subjective recall bias could be clouding these findings. It is unclear how resilience moderates the relationship between stress and the subsequent development of psychiatric sequelae when measured prospectively. For example, it is possible that interns with high levels of resilience at baseline will be overall better able to cope and adapt to the stress of residency and their careers as a physician and less likely to develop depression during the course of their lives. However, during the acute phase of stress encountered during internship, they may still suffer just the same. In other words, it may be that interns with high resilience may suffer from periods of depression, but be better able to bounce back from these episodes. In addition, as resilience is considered to be a dynamic process and not necessarily a stable personality trait, it may be how interns cope with depression that is more representative of their degree of underlying resilience than the fact that they suffer from depression at all. Furthermore, given the subjective nature of resilience as measured by the CD-RISC, it is unclear how perceived resilience may change with mood, fatigue, psychiatric illness, and time. It has been shown that resilience scores can increase in adults in treatment for PTSD (89). However, there is relatively little data following changes in perceived resilience in adults over time while acutely exposed to varying stressors. For example, as a whole interns reported relatively high levels of resilience at baseline, but it is unknown if these levels of resilience remain steady throughout internship or if interns who become depressed subsequently report lower levels of resilience. To better assess the relationship between resilience and stress in the development of depression in interns, repeated assessments of perceived resilience throughout internship year would provide a more comprehensive picture of how resilience may vary over time.

It was interesting to note that international medical graduates had slightly higher resilience scores than interns from the U.S. Intuitively, this is understandable as anyone taking on the challenges of moving to a foreign country in addition to starting internship is likely to possess a large reservoir of coping and adaptation skills. Consistent with findings from other studies, resilience was positively associated with both the number and satisfaction with social supports, and negatively associated with neuroticism (93, 97, 115). This was not surprising given that a well established attribute among resilient individuals is the ability to foster and draw upon a healthy social support network and to make use of positive emotionality (97, 115). Although, it would seem that exercise, as an active coping mechanism that has been shown to improve overall mental health, would be associated with higher resilience in interns, this relationship was not significant in our group of interns who did not have much time for exercise.

Limitations and suggestions for future research

There are several limitations to the findings generated from this study. First, the data collected are based on self-report questionnaires and as such are inherently limited by subjective reporting bias. Second, the results are limited by an initial response rate of roughly 60%. There is no way of knowing why nearly 40% of interns chose not to participate in the study or if there are any characteristics particular to interns who chose not to participate, such as higher rates of depression or psychopathology at baseline. At both the three and six-month follow up there was a 75% response rate yielding somewhat consistent results in terms of the prevalence of depression at both time points. However, it remains unknown how the prevalence of depression would have been affected by the

25% of interns who agreed to participate initially, and didn't respond at either time point. Given findings from other studies showing an even higher prevalence of depression than what this study found, it is possible that these results underestimate the prevalence of depression in interns. In addition, these results may underestimate the prevalence of depression severity as interns who are more severely depressed may be less likely to participate. The lack of information in the literature on depression severity in interns makes it difficult to speculate on that matter. In terms of longitudinal data, only roughly 60% of the participants responded at all three time points. To really understand the manifestation and impact of depression upon interns throughout the course of the year, it will be important to maximize the number of respondents at every time point.

In terms of fully understanding the role of resilience in the development of depression in interns, these results are limited by having only one measurement of resilience at baseline. There has been little research done on resilience in adults, especially using the CD-RISC as a validated measure. Most of the research to date on resilience in adults involves the recall of retrospective stressors on those who have already manifested some sort of psychopathology. It is not well understood how resilience moderates the relationship between acute or chronic ongoing stress and the development of depression. This is one of the first studies to prospectively evaluate how resilience at baseline moderates the relationship between stress and depression. As such, it would be interesting to re-measure resilience levels throughout the course of internship to see how it may or may not vary in relation to the current stress experienced and the presence of depression that developed throughout the year. Because of the subjectivity of

the resilience measure, it would be interesting to see if self-perceived resilience levels vary with the degree of depressive symptoms, sleep deprivation, or work load.

Finally, one of the most alarming results from this study was the lack of mental health treatment received by interns with clinically significant levels of depression. In order to better meet the needs of this group some of whom are clearly suffering and for unclear reasons are not getting access to care they need, more research is needed to clarify what potential barriers to care interns are facing. For many, depression can be a chronic, recurrent syndrome, but it can also be effectively treated. Doctors have a tremendous amount of responsibility in caring for and in influencing the lives of their patients, and we, as a society, expect them to be functioning at their best. Depression can significantly burden an individual's ability to learn, to manage and tolerate stressful situations, not to mention worsen disease co-morbidities, and quality of life. It is therefore in both society's and physicians' best interests to make sure physician's are receiving appropriate mental health care.

Table 1. Demographic characteristics (N=241)

Variable	No (%)	
Gender	Female	137 (56.1)
	Male	104 (42.6)
Age	≤30	203 (84.2)
	>30	38 (15.8)
Ethnicity	Caucasian	136 (56.4)
	Asian	60 (24.9)
	Latino	15 (6.2)
	African-American	5 (2.1)
	Other	25 (10.4)
Specialty	Internal Medicine	141 (58.5)
	General Surgery	27 (11.2)
	OB/Gyn	19 (7.9)
	Pediatrics	25 (10.4)
	Psychiatry	14 (5.8)
	Emergency Medicine	15 (6.2)
Relationship Status	Single	133 (55.5)
	Engaged	26 (10.5)
	Married	77 (32.0)
	Divorced	5 (2.0)

Table 2. Depression related characteristics at baseline (N=241)

	No (%)
Prior history of depression	110 (45.6)
Prior treatment for depression	43 (17.8)
Family history of depression	124 (51.5)

Table 3: Prevalence and severity of depression among interns at baseline (prior to starting internship), three-months and six-months into internship year.

	Baseline (N=234)	3-months (N=185)	6-months (N=182)
Minimal to no depression (PHQ ≤ 4)	197 (84.2%)	81 (43.8%)	75 (41.2%)
Mild depression (PHQ 5-9)	31 (13.2%)	58 (31.4%)	62 (34.1%)
Moderate depression (PHQ 10-14)	4 (1.7%)	35 (18.9%)	33 (18.1%)
Moderately severe depression (PHQ 15-19) ^A	2 (0.9%)	6 (3.2%)	9 (4.9%)
Severe depression (PHQ ≥ 20) ^A	0	5 (2.7%)	3 (1.6%)

^A PHQ scores ≥ 15 indicate need for treatment.^B

PHQ scores of 10-14 correlate approximately with a diagnosis of minor depression, dysthymia, or mild form of major depression and recommended treatment includes consideration of counseling or pharmacotherapy and assertive follow up.^B

PHQ scores of 15-19 correlate approximately with a diagnosis of major depression or moderately severe major depression and recommended treatment includes initiation of pharmacotherapy and/or psychotherapy.^B

PHQ scores ≥ 20 correlate approximately with a diagnosis of severe major depression and recommended treatment includes immediate initiation of pharmacotherapy and/or psychotherapy. If there is severe impairment or poor treatment response, then immediate referral to a mental health specialist for psychotherapy and/or co-management is advised.^B

^B Kroenke K, Spitzer RL. The PHQ-9: A new depression diagnostic and severity measure. *Psychiatric Annals* 2002;32(9):509-15.

Table 4: Differences in depression between international medical graduate and U.S. medical graduate interns

	Baseline (PHQ \geq 10)	3-months^A (PHQ \geq 10)	6-months^B (PHQ \geq 10)
International medical graduates	1.7% (N=60)	9.1%	5.9%
U.S. medical graduates	2.8% (N=181)	25%	24.7%

^A Difference between the two groups is significant at $p=0.006$.

^B Difference between the two groups is significant at $p=0.001$.

Table 5: Significant correlates of depression (change in PHQ from baseline) in interns at three and six-months of Internship

	Depression at 3-months	Depression at 6-months
Age	0.174 ^B	0.050 ^C
Gender	0.102 ^C	0.158 ^B
Prior history of Depression	0.244 ^A	0.251 ^A
Family history of Depression	0.184 ^B	0.167 ^B
Work hours	0.197 ^A	0.258 ^A
CD-RISC item: “ <i>My past successes give me confidence for new challenges.</i> ” ^D	-0.288 ^A	-0.162 ^B
CD-RISC item: “ <i>I like challenges.</i> ” ^D	-0.254 ^A	-0.193 ^A

^A Correlation is significant at the 0.01 level (2-tailed).

^B Correlation is significant at the 0.05 level (2-tailed).

^C Correlation is not significant.

^D CD-RISC: The Connor-Davidson Resilience Scale is a 25 item questionnaire designed to measure resilience. Please refer to methods section for further details. Negative responses to these two items at baseline were predictive of developing depression.

Table 6: Predictors of depression (PHQ \geq 10) at three and six-months of internship

	Depression at 3-months OR (95% CI) ^A	Depression at 6-months OR (95% CI) ^A
Age	1.1 (0.96 – 1.2)	1.1 (0.99 – 1.3)
Gender	1.3 (0.53 – 3.2)	2.8 (1.1 – 6.9) ^B
Prior history of depression	3.3 (1.3 – 8.7) ^B	2.2 (0.93 – 5.2)
Family history of depression	2.5 (0.94 – 6.7)	1.9 (0.79 – 4.6)
Work hours	1.02 (0.99 – 1.04)	1.04 (1.01 – 1.07) ^{C, E}
CD-RISC item: “ <i>My past successes give me confidence for new challenges.</i> ”	0.32 (0.17 – 0.62) ^{C, D}	0.62 (0.35 – 1.1)
CD-RISC item: “ <i>I like challenges.</i> ”	0.65 (0.35 – 1.2)	0.95 (0.57 – 1.6)

^A OR = Odds Ratio; CI = Confidence Interval

^B $p < 0.02$

^C $p < 0.01$

^D The CD-RISC item was a continuous variable from 0-4 with decreasing negativity in response to the question. Taking the inverse of the odds ratio as 3.13, this result indicates that with each increasing interval of negativity in response to this question at baseline, interns were over three times more likely to be depressed (PHQ \geq 10) at three-months. For example, at three months, 14% who responded “true nearly all the time” were depressed, 21% who responded “often true” were depressed, 40% who responded “sometimes true” were depressed and 66% of interns who responded “rarely true” were depressed.

^E For every one hour more worked, interns were roughly 4% more likely to be depressed at six-months. Because work hours were a continuous variable, a plot analysis of work hours versus PHQ depression score was performed that revealed more of an exponential versus linear relationship. Therefore, increasing from 40-41 hours is likely to be less than 4% increased likelihood of depression, and an increase from 80-81 hours is likely to be more than 4% increased likelihood of depression.

Table 7: Treatment patterns among clinically depressed interns^A

	3-months: interns with PHQ 15-19 (N=6)	6-months: interns with PHQ 15-19 (N=9)	3- months: interns with PHQ ≥ 20 (N=5)	6- months: interns with PHQ ≥ 20 (N=3)	3-months: interns with suicidal ideation (N=19)	6-months: interns with suicidal ideation (N=13)
Medication	0	0	1	1	1	2
Therapy	0	0	1	1	1	3
Total (some form of treatment)^B	0	0	1 (20%)	1 (33%)	1 (5.3%)	3 (23.1%)

PHQ scores of 15-19 correlate approximately with a diagnosis of major depression or moderately severe major depression and recommended treatment includes initiation of pharmacotherapy and/or psychotherapy.^A

PHQ scores ≥ 20 correlate approximately with a diagnosis of severe major depression and recommended treatment includes immediate initiation of pharmacotherapy and/or psychotherapy. If there is severe impairment or poor treatment response, then immediate referral to a mental health specialist for psychotherapy and/or co-management is advised.^A

^A Kroenke K, Spitzer RL. The PHQ-9: A new depression diagnostic and severity measure. *Psychiatric Annals* 2002;32(9):509-15.

^B Some interns started both medication and therapy at the same time.

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