A. SIGNIFICANCE

A1. Overview and Specific Aims

Stubbornly low rates of student persistence have been a central concern for administrators and researchers in higher education for many decades. Classic theories emphasize academic and social integration (Tinto, 1993)—the extent to which students interact with people, activities, and other resources in the campus community—as key mediating factors that lead to persistence. In this type of framework, efforts to increase persistence would naturally focus on sites where students spend much of their time and have frequent opportunities to engage with people, activities, and other resources. This logic points to students’ residential settings as a prime locus for intervention strategies to improve persistence and other outcomes, given the concentration of peers, supportive personnel, programs, and activities in these settings.

Despite the intuitive appeal of improving outcomes through residential settings, the empirical evidence is far from conclusive or complete, and much of it is dated. Previous studies demonstrate correlations between campus living settings and outcomes such as persistence, but these studies generally have major limitations. Most studies have not fully addressed selection biases when comparing outcomes for students who choose to live in campus housing (or certain types of campus housing), versus comparison groups such as students who choose to live off-campus. Therefore it is unclear whether differences in outcomes across groups are due to true effects of residential settings, unmeasured differences in student characteristics, or both. In addition, most previous studies have not identified which specific factors in campus residential settings, among the rich array of possibilities, are most responsible for effects that are estimated. Therefore, in sum, there is little definitive evidence about: a) the extent to which residences are supporting positive outcomes; and, b) how they might become more effective in doing so.

Through this proposed Exploration grant, we will take major steps towards addressing these gaps in knowledge. We will collect and analyze primary data from students and staff at 10-12 campuses, using a complementary mix of quantitative and qualitative methods. We will use these unique data to address five interrelated aims:

Specific Aim #1: Compare the availability of resources for students in campus residential settings, versus students living off-campus. We will focus on resources that are most likely to influence persistence and other educational outcomes (learning and academic performance), as determined by our conceptual framework and the first phase of our qualitative analysis. We hypothesize that on-campus students, as compared to off-campus students, enjoy higher availability of a variety of resources such as supportive staff, educational programming, and social opportunities. We also anticipate substantial diversity across institutions in the types, quality, and amounts of resources, in both on-campus and off-campus settings.

Specific Aim #2: Estimate the effects of living in campus residential settings, as compared to living off-campus, on educational outcomes (persistence, learning, and academic performance). We will address potential selection biases by focusing on campuses that resolve excess demand for on-campus housing using random lotteries or a first-come first-serve approach (which we will analyze using a regression-discontinuity design). We hypothesize that campus residences, overall, have positive impacts on each education outcome, due to the greater availability of and proximity to key resources. We also hypothesize that these effects vary
substantially by institution, due to the variation in resources anticipated under the first aim in both on-campus and off-campus settings.

**Specific Aim #3: Identify mediators of the effects of campus residences on educational outcomes.** Based on a conceptual framework building on previous research on student persistence, we hypothesize that social and educational connectedness (akin to integration, as described later), as well as mental health, are key mediators.

**Specific Aim #4: Identify student-level moderators of the effects of campus residences on educational outcomes.** The benefits of residences naturally depend on students’ interest and capacity to use and engage with people, resources, and opportunities in these settings. Accordingly, we hypothesize that the effects of residences will vary by factors such as developmental needs (closely tied to age and year in college) and cultural background.

**Specific Aim #5: Identify features of residences (setting-level moderators) that are integral to any observed effects on educational outcomes.** Under this aim we will focus especially on campuses for which we estimate particularly large or small effects (under aim #2), and we will rely especially on qualitative data and analysis to explore which aspects of residential settings help explain these variations.

Whereas much of the rigorous empirical research on persistence has focused on other factors such as remediation and financial aid, this study will begin to clarify the role of residential settings. By addressing selection biases and understanding key moderators and mediators, the study will provide a clearer and richer picture of how residences can promote educational outcomes. This Exploration project will thus serve as a major building block towards the subsequent development and testing of residence-based interventions.

**A2. Brief Historical Context**

As college enrollment has increased steadily during the past several decades, campus residences have similarly multiplied in number. Over 2,000 colleges and universities nationwide now offer on-campus housing (U.S. Department of Education, National Center for Education Statistics, 2009), and nearly 2.5 million Americans live in college residences, the vast majority (96.5%) of whom are of traditional college ages of 18 to 24 (U.S. Census Bureau, 2009). Many colleges are seeing greater demand for campus housing, likely due to increasing enrollment and concerted efforts by institutions to build and promote residence halls (Hoover, 2008). Institutions continue to invest heavily in both existing and new campus residential settings (Agron, 2009; Hoover, 2008). There has also been an increased interest in residential learning (“living-learning”) communities, with over 180 in a registry (http://pcc.bgsu.edu/rlch/submissions/index.html). These communities integrate educational activities with the living environment more intensively than typical residences.

At the same time, students living off-campus, particularly “commuter students” still living in their home communities, have increased in numbers even more rapidly than residential students (Kim & Rury, 2011). This trend has recently been accelerated by online learning programs, in which students participate remotely in college courses. Collectively these trends raise questions about the added value of face-to-face interactions, particularly considering that campus residential living costs around $9,000 per student at four-year institutions (Baum & Ma, 2010). In this context it is more important than ever for higher education policymakers to have a solid understanding of how residential settings affect key student outcomes.
A3. Conceptual Framework

Overview. Figure 1 illustrates the broad conceptual framework guiding our study. This framework shows an intuitive logic regarding why residential settings may affect persistence and other educational outcomes. In short, this framework posits that: 1) residential settings offer access to a range of resources; 2) use of and participation in these resources increases various dimensions of educational and social connectedness (which we define later in this section); 3) connectedness has direct effects on educational outcomes, as well as indirect effects via improved mental health. Furthermore, the pathways leading to these outcomes are moderated by a variety of student characteristics. This framework draws on classic models of how college affects students, including Astin’s Involvement theory (Astin, 1984) and Tinto’s Student Departure theory (Tinto, 1975). The framework is also consistent with conceptual models of college outcomes that emphasize the importance of the peer environment (Terenzini & Reason, 2005), a central aspect of residential settings. We view this framework as a starting point for the proposed project rather than a definitive model, and we expect that our results will prompt refinements.

Resources and other characteristics of residences. Students living in campus residences have access to a range of resources, some of which may be more difficult for off-campus students to benefit from. There are many resources within residences that are specifically for residents, and campus residences are also typically in close proximity to many other resources in the broader campus community. Many of these resources have the explicit purpose of promoting educational outcomes or potential mediators such as connectedness and mental health.

Education-oriented resources within residences include computer labs, study lounges, and tutoring and advising services. Residential staff members also organize a variety of educational activities and programs, with speakers, discussions, or workshops. Additionally, it may be beneficial to live in proximity to general campus resources such as libraries, advising centers, faculty, and classrooms. On-campus students also live in close proximity to large numbers of peers and have ample opportunities to attend social gatherings within their residence halls or elsewhere on campus. Residence halls typically offer organized social events, and most residents share living space with roommates with whom they have daily contact. Off-campus students may not have comparable access to campus social activities, particularly those who live farther from campus and those who did not live with fellow students. On-campus students may also have access to support for mental health and related issues from residence staff and peer counselors, and they may live near the campus counseling and health services.

Involvement/participation. The opportunities and resources available in campus residential settings are only beneficial to the extent that students use them. Student Involvement Theory emphasizes that the amount and quality of student involvement in college life are crucial to positive academic and social development (Astin, 1984). Students in campus residences may have considerably higher participation in educational and social resources, as compared to off-campus students, for a number of reasons. First, due to their proximity to resources in the residences and in the campus community, on-campus students may have substantially lower time costs. Second, on-campus students may be better informed about the resources, from having more contact with people and organizations in the campus community. Third, on-campus students may have more favorable perceptions of the resources, as a result of positive messages communicated by staff and peers in their residential community and around campus.
Integration/connectedness. In this framework, involvement is primarily meaningful in so much as it leads to an experience of social and academic connectedness with other people and resources in the campus community. The concept of connectedness is related to integration in Tinto’s Academic Departure Model (Tinto, 1993). In that model, students who are academically integrated identify with and feel that they are a part of the campus academic experience.
Similarly, students who are socially integrated feel a strong affiliation with the campus social environment. As some scholars have argued, however, the concept of integration may not apply in the same way to all types of students. For example, for some racial/ethnic minority students, integration with the general campus community may not be realistic or desirable, due to its incompatibility with the students’ culture or values (Tierney, 1992). In recognition of these types of considerations, our framework centers on the concept of connectedness. Although connectedness is closely related to integration, we refer to the former to emphasize that the most productive connection between a student and a campus community may not be complete integration. Our concept of connectedness emphasizes the psychological experience of the student: “a psychological state of belonging in which individuals perceive that they are valued, cared for, trusted, and respected by the individuals and communities with whom they are in regular contact” (Whitlock et al., 2010). This concept is also similar to concepts such as “sense of belonging” (Johnson et al., 2007) and “mattering” (Schlossberg, 2006) in a campus community. In addition, our connectedness incorporates aspects of student “engagement”, which emphasizes participation that feels meaningful to students and has been central in research to advance understanding of student development and success (Kuh et al., 2001).

Our framework posits that, due to the opportunities for increased involvement with people and other resources, students in campus residences will generally feel more connected to the institution’s educational and social communities. As noted by Astin (1984), “simply by eating, sleeping, and spending their waking hours on the college campus, residential students have a better chance than do commuter students of developing a stronger identification and attachment to undergraduate life (p. 523).” More frequent interactions with people and resources yield higher comfort, affinity, and connections to those resources and the broader communities of which they are part.

Impact of connectedness on educational outcomes.

The quantity and quality of interactions with peers, faculty, and other members of campus communities have been shown to correlate highly with a variety of positive educational and developmental outcomes, including persistence, GPA, adjustment, and cognitive development (Pascarella & Terenzini, 2005; Tinto, 1993). Students’ subjective experience of connectedness with their campus community (e.g., social connectedness) is also significantly correlated with persistence and other educational outcomes (Allen et al., 2008). Students who are more integrated and connected are more likely to have positive views about their institution and education, are more motivated to learn and perform well, and are more motivated to remain at their institution (Pascarella & Terenzini, 2005; Tinto, 1993).

There may also be an indirect pathway, via mental health, between connectedness and educational outcomes. Our conceptual framework proposes that students who experience higher levels of connectedness will be better able to cope with the stress that comes with meeting developmental and academic challenges in college. There is considerable evidence that strong social networks can buffer against the impact of stress (Cohen & Wills, 1985). Individuals with strong social networks are able to rely on social resources during difficult times, reducing the stress experienced or providing adaptive ways of managing stress. Not surprisingly, there is ample research demonstrating that college students with low levels of social connectedness and support are at increased risk for mental health problems (Detrie, 2002; Hefner & Eisenberg, 2009; Lee et al., 2002). In turn, mental health problems such as depression and anxiety are predictive of student departure and lower grades, as we have found in prior work (Eisenberg et al., 2009). It is also important to note that, beyond its apparent impact on educational outcomes,
mental health is a significant outcome in college populations from a broader perspective. Among adolescents and young adults in the U.S., mental disorders account for a larger burden of disease than any other class of health conditions (Michaud et al., 2006). The prevalence of mental health problems among college students appears to be increasing, based on student assessments (Twenge et al., 2010) and reports from campus counseling directors (Gallagher, 2008).

**Moderating Impact of Student Characteristics.** A number of student-level variables are likely to moderate the impact of campus residential settings, as shown in the framework diagram. The extent to which campus residences are beneficial for students likely depends on how well the residential environment fits with the individual student’s developmental needs. Three of the most important developmental mandates for late adolescents and young adults in the college setting are: 1) acquisition of occupational skills and interest; 2) social competence; and 3) the self-efficacy required to support independent living (Chickering & Reisser, 1993; Havighurst). In general, younger students in their first years of college may benefit more from a nurturing on-campus residential environment, whereas more mature students may benefit from the challenges of living in an off-campus setting with less structure.

The impacts of residential settings may also vary by racial/ethnic background, or other important aspects of students’ social and cultural identity. As noted earlier, integration into a campus community may be more difficult and feel less supportive for students with cultural backgrounds and values that differ significantly from those of the majority of their peers (Tierney, 1992). On the other hand, many scholars have concluded that there are important benefits, including cognitive development and learning, stemming from interactions with other students with very different backgrounds (Denson & Chang, 2008). These complicated and sometimes opposing factors underscore that there is probably heterogeneity in effects not only across groups of students but also across individuals within groups.

**A4. Previous Empirical Studies**

There is a longstanding interest among education researchers and practitioners in how campus residential settings affect student well-being, development, and success. The base of knowledge includes not only academic publications but also many unpublished, internal evaluations conducted by residential life and student affairs professionals. Previous studies have examined outcomes including academic performance, persistence, social and academic involvement, values and attitudes, and cognitive outcomes (Kuh et al., 2001; Pascarella et al., 1994)). Despite these considerable research efforts, however, firm answers about the effects of living in campus residences remain elusive. This is largely due to the difficulties with estimating causal effects from observational data, which have been acknowledged since the beginnings of this literature (Astin, 1970). Most previous studies compare students who chose to live on campus versus those who chose to live off campus. This approach is subject to selection biases from omitted variables—students who choose to live on campus may be different in ways that are not controlled for and that lead to different outcomes.

The potential biases due to selection may go in either direction, implying that previous estimates may either overestimate or underestimate the true effects of campus residential settings. On one hand, on-campus students may have higher pre-existing motivation to participate in social and academic activities, and to use campus resources. This difference may account at least partially for better outcomes as compared to off-campus students, rather than actual causal effects of where students live. On the other hand, many students may choose to
live on-campus because they have greater needs for supportive resources. These students may have a higher pre-existing risk for departure and poor academic performance, which would induce a negative bias in the estimated effects of campus residences. Also, on-campus students may have different socioeconomic backgrounds than off-campus students, particularly because the cost of campus housing may be higher or lower than off-campus housing, depending on the local cost of living. For reasons such as these, previous findings should generally be viewed with the caveat that they reflect correlations but not necessarily definitive causal estimates.

Effects on Educational Outcomes. The literature provides mixed evidence as to whether living in campus residential settings leads to better educational outcomes, and most studies have focused on GPA as the key outcome. Most studies have found that students living in campus residential settings perform better academically than students living in off-campus housing (de Araujo & Murray, 2010; Flowers, 2004; Hountras & Brandt, 1970; Nicpon et al., 2007), but some studies have found no differences or that off-campus students actually perform better (Blimling, 1989; Grayson, 1997). A recent national study found that African American students living on campus had a higher GPA than those living off campus, but there was no such differential in the overall sample (Turley & Wodtke, 2010). When the outcome is persistence, on the other hand, the clear majority of studies find that on-campus students do “better” (higher persistence) than off-campus students (Pascarella et al., 1994). Astin (1973) found that students living in campus residential settings are less likely to drop out of college and are more likely to complete their degree in four years, and subsequent studies have also found higher persistence among on campus students (Bozick, 2007; Herndon, 1984; Thompson & And Others, 1993). Previous studies also suggest that academic involvement and social integration mediate this relationship (Liu, 2010; Skahill, 2002). Data from the National Survey of Student Engagement (NSSE) also indicate that on-campus students, compared to commuter students, have significantly higher academic challenge, active and collaborative learning, and enriching educational experiences (Kuh et al., 2001).

Effects on Social and Educational Connectedness. Many studies find that students in campus residential settings are more involved in campus activities and have an easier time forming meaningful relationships on campus than those living off campus (Astin, 1973; Buote et al., 2007; Chickering, 1974; Pascarella et al., 1994). Although on-campus and off-campus students may have similarly sized social networks, on-campus students are more likely to form new social acquaintances, and interactions with their social network are more likely to take place on campus (Hays & Oxley, 1986). A recent mixed-methods study found that on-campus students made far more friendships during their first semester than commuters, and these friendships played a larger role in their college social adjustment (Buote et al., 2007). These differences in the development of social networks could make it difficult for commuters to become integrated into campus. In addition, recent evidence from the NSSE indicates that on-campus students have significantly higher levels of engagement in academic activities, particularly compared to off-campus students who live farther away from campus (Kuh et al., 2001).

Effects on Health. To the extent that this literature has addressed health-related outcomes, most studies have focused on alcohol and other drug use. The findings have been mixed, and it is hard to know how to interpret the results given the possible selection biases described above (Cashin et al., 1998; Cooney & Nonnamaker, 1992; Gfroerer et al., 1997; Glicksman et al., 1997; Harford et al., 2002). In addition, there is ambiguity on a conceptual level about how living in campus residences would affect health-related behaviors. Many of these behaviors are social, and may actually increase with the higher availability of peers and social activities in campus residences.
On the other hand, the supportive staff and services in campus residences typically attempt to mitigate these behaviors, and the availability of alternative activities that do not involve substance use may also mitigate such behaviors.

As posited in our framework, there is a more clear-cut conceptual relationship between mental health and campus residential settings, due to the fundamental link between social connectedness and mental health (Whitlock et al., 2010). Thus, our study emphasizes mental health, while also including brief measures of health behaviors such as alcohol and substance use. Mental health has been largely ignored in previous studies of campus residential settings. In the Preliminary Studies section below we describe our preliminary data that support the potential importance of mental health.

Effects of Living-Learning (Residential Learning) Communities. Colleges and universities are increasingly adopting living-learning programs that are explicitly designed to integrate academic and residential life to a much greater extent than conventional campus residences (Pascarella et al., 1994). These communities are part of a broader movement towards learning communities of various kinds, in which specific groups of students within institutions participate in a common curriculum and activities that promote academic and social integration in the campus community (Smith et al., 2004). The research evaluating living-learning programs has yielded positive results, with apparent benefits for a variety of educational and developmental outcomes, as compared to students in conventional residence halls (Brower et al., 2003; Enochs & Roland, 2006; Inkelas, Vogt et al., 2006; Inkelas et al., 2007; Pike et al., 1997; Wawrzynski & Jessup-Anger, 2010). Though these studies must be interpreted with caveats about self-selection, the positive results underscore the potential benefits from modifying specific features of residential environments.

Although living-learning communities represent an important movement in higher education, our focus in the present study is on campus residences more generally, as compared to off-campus settings. There are three main reasons for our more general focus: 1) conventional (i.e., non-living-learning) residences still represent the vast majority of campus residences (and, to some extent, this might be taken as a “revealed preference” that many students prefer a less intense integration of their living setting and their educational activities); 2) as discussed already, there are conceptual and empirical reasons to believe that on-campus residences, whether living-learning or not, may have substantial benefits relative to off-campus settings; 3) there is considerable heterogeneity in the characteristics of on-campus residences, and this offers an opportunity to understand specific factors within that spectrum that promote positive outcomes.

A5. Preliminary Studies
Each of the five members of our research team has been a principal investigator on one or more large, multi-campus studies of college student development and wellbeing. Our previous work thus supports the feasibility and significance of the present study in many respects.

Healthy Minds Study. Dr. Eisenberg directs this online survey study of student mental health and help-seeking behavior. The study has been fielded at over 50 campuses nationwide since 2007, and is continuing as an annual national survey in 2011 and beyond. The data have been used to explore a range of research topics, and campuses in the study have used the data about their student populations for a number of practical purposes, such as advocating for resources from higher administration and external grants, evaluating programs, and planning service needs. One of the notable research findings is the connection between mental health and academic outcomes. We found that depressed students have substantially lower GPAs and are approximately twice as
likely to drop out as non-depressed students (Eisenberg et al., 2009). Also, we compared students living in campus residences to those living off campus using the Healthy Minds data from 2007 and 2009, with over 14,000 participants randomly selected from 26 institutions across the U.S. (Brunwasser & Eisenberg, 2010). Students living in campus residences were less likely to screen positively for depression and anxiety disorders, in a propensity score analysis controlling for background variables \( t = 2.19, p = .04 \). Students living on campus also reported higher levels of social support and social connectedness than those living off campus \( t = -2.12, p = .04 \) and \( t = -2.68, p = .01 \), respectively. Both social connectedness and social support mediated the relationship between residential setting and mental health. We also found that on-campus students were more likely to use campus mental health services. Although these findings are consistent with our conceptualization of how campus housing may be beneficial, the study shares the limitations related to self-selection as in other studies in this literature.

Peers in campus residences. In an ongoing study funded by the W.T. Grant Foundation, Dr. Eisenberg, Dr. Whitlock and other colleagues are analyzing how first-year college students are affected by the roommates and resident advisors (RAs) to whom they are assigned (Eisenberg et al., 2010). This study focuses on mental health, help-seeking behavior, and health behaviors, and upcoming analyses will also examine academic performance. Our preliminary results suggest that binge drinking is significantly affected by roommates, whereas mental health and help-seeking exhibit only small peer effects with notable variation across subgroups. Our upcoming analyses will also examine the effects of RAs’ characteristics on student outcomes. In another study focused on campus residences, Dr. Eisenberg is the co-PI of an evaluation of a mental health training program (Mental Health First Aid) for RAs in residences. This NIH-funded study involves a randomized control trial across 33 campuses nationwide. The primary objective is to measure how this training for RAs affects referrals and receipt of mental health care among students with significant symptoms of depression or anxiety. Preliminary results indicate that the training program leads to modest increases in the use of supportive services.

Wabash National Study. The proposal also builds on Dr. King’s experience as a co-PI of the Wabash National Study of Liberal Arts Education. This is a large-scale, multi-institutional, longitudinal, mixed methods study; its purpose is to examine the effects of institutional practices and conditions on learning outcomes, psychological well-being, and the development of self-authorship (Baxter Magolda, 2001; Kegan, 1994). Analyses of differences across residential settings are ongoing, but more broadly, WNS findings to date affirm the importance of looking at students’ social environment and their effect on well-being. For example, Baxter Magolda, King, and colleagues (2010) found that — consistent with prior studies — most students entered college using ways of making meaning and interpreting their experiences that relied heavily on external sources for their beliefs, identities and relationships, making them vulnerable to stress and negative peer pressure. This study also found that anxiety could both enhance and detract from students’ capacity to benefit from diverse interactions, many of which took place in their living environments. Throughout this project, researchers have identified factors that help students develop internally grounded capacities to make meaning and develop an internal voice to guide decisions and be academically successful (Baxter Magolda et al., 2010; King et al., 2009).

Connectedness and wellbeing. Dr. Whitlock has considerable experience in conceptualizing and measuring “connectedness” in relation to mental health and wellbeing in educational settings, using both quantitative and qualitative methods (Whitlock, 2007; Whitlock et al., 2010;
Whitlock, 2006). In a study of connectedness in secondary school settings, she found that perceived connectedness resulted from provision of key developmentally appropriate supports, such as available adults, opportunities for exercising decision making power in the social and academic environment, creative engagement, and academic engagement (Whitlock, 2006). Later studies of the relationship between connectedness and mental health on college campuses showed that both perceived isolation and number of confidants are both strongly linked to mental health outcomes in the expected direction. For example, in one of our studies, the number of confidants to whom one turns when sad, anxious or depressed moderated the relationship between self-injury and suicide in the expected direction (Whitlock & Knox, 2007). Similarly, unpublished data from a study of mental health and wellbeing on eight college campuses and an on-going single campus study of freshmen indicate a strong relationship between fewer confidants and suicide ideation or action.

*National Study of Living-Learning Programs (NSLLP).* Drs. Inkelas and Brower are Principal Investigator and Co-Investigator, respectively, of this multi-wave, multi-institutional, longitudinal mixed methods study of the contributions of living-learning programs to undergraduates’ learning and development. The NSLLP has received financial support over the past decade by the National Science Foundation, the Association of College & University Housing Officers International, the American College Personnel Association, and the National Association of Student Personnel Administrators. Since 2001 this study has included 50 postsecondary institutions, 600 different living-learning programs, and nearly 50,000 undergraduates. The primary purpose of the study is to examine the impact of living-learning programs on student outcomes, and its quasi-experimental design includes a comparison sample of nearly 25,000 undergraduates who live in traditional residence hall arrangements. The study has found that living-learning and traditional residence hall students alike demonstrate increased sense of civic engagement with their communities, self-reported gains in appreciating new or different perspectives, and reports of the enjoyment of challenging intellectual pursuits when they more often participate in discussions with peers regarding social and cultural topics (Inkelas & Weisman, 2003; Rowan-Kenyon et al., 2007). Moreover, students’ perceptions of a healthy academic and social climate in their residence halls was related to outcomes as diverse as perceived growth in liberal learning, the academic and social transition to college, sense of belonging to their institutions, and making healthier choices about alcohol use (Brower, 2008; Inkelas & Weisman, 2003; Inkelas et al., 2006; Johnson et al., 2007). Finally, engagement with various residential and broader campus environments appears to vary by race/ethnicity and socioeconomic status. Specifically, Asian American students are more likely to find their residence climates to be socially supportive than Hispanic students, and first-generation college students are more likely to engage with faculty than with their peers or with residence resources (Inkelas et al., 2007; Johnson et al., 2007).

*Communications with prospective schools.* Finally and perhaps most importantly, in preparation for this proposal our research team has been in contact over the past two years with housing officers from over 50 colleges and universities across the United States, as well as leaders in the primary professional association for campus residences, the Association of College and University Housing Officers – International (ACUHO-I). We have had three main purposes for these correspondences: 1) to gauge interest in the study from practitioners who would be likely to use the eventual results; 2) to solicit input on our research questions and design; 3) to identify an initial list of campuses that could be in our sample. Our contacts have been consistent in
expressing great support and enthusiasm for the proposed study. Many of them have commented that this type of study is long overdue. We have also received feedback that has helped refine our conceptual framework and research design, and we have identified many campuses as potential participants (see later section on this).

A6. Summary of New Contribution
Although researchers have been studying the effects of college residential settings for many decades, there are still major gaps. As described earlier, selection bias is perhaps the most notable limitation in previous studies. This methodological challenge is common not just in this literature on college students but also in the general literature on residential settings (e.g., neighborhood effects). In addition, many previous studies have focused on one outcome domain at one time, rather than interrelationships among outcomes, and have largely ignored potentially important factors such as mental health. Finally, there is little information on the importance of specific residential resources and student level moderating factors, which must be understood in order to optimize intervention strategies.

In the context of these gaps, our proposed mixed methods study will contribute new knowledge in five main respects, corresponding to the five specific aims. First, the study will provide detailed descriptive information about resources and other characteristics of campus residential settings, both on-campus and off-campus, that may be relevant to positive outcomes. Second, the study will address potential selection biases and yield plausibly unbiased causal estimates of the effects of campus residential settings. Third, our study will carefully examine factors that are likely to mediate effects on educational outcomes, including social and academic connectedness and mental health. Fourth, the study will reveal how student-level characteristics moderate the impact of the residences. Fifth, the study will improve understanding of which particular resources or other residential characteristics are instrumental for positive outcomes.

Collectively, our findings will provide some of the richest evidence to date on the effects of campus residential settings, with implications for both research and practice. Consistent with the purpose of Exploration grants, the knowledge from this study will help refine conceptual frameworks and provide a building block for the subsequent development of more effective intervention strategies. In particular, the results will quantify the effectiveness of current residential settings and help identify the most promising features to include in developing more effective settings.
B. RESEARCH METHODS

B1. Overview of Research Design
The proposed study is a mixed method sequential design, with qualitative and quantitative methods blending exploratory and confirmatory approaches (Creswell & Plano-Clark, 2006; Tashakkori & Teddlie, 1998). Our sample will include 10-12 campuses in the U.S. The sequence of data collection will be: phase I of qualitative data (interviews and focus groups), then quantitative data (surveys and administrative data), then phase II of qualitative data (interviews). Table 1 shows the timeline for the main activities, particularly data collection and analysis.

Table 1. Timeline of main project activities

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<td>Select 12 campuses</td>
<td>IRBs, prep for data collection</td>
<td>Qual. data (I)</td>
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Our qualitative-quantitative-qualitative sequence is a blend of two common sequential designs highlighted in a recent report by the National Institutes for Health on best practices for mixed methods research (Creswell et al., 2011): 1) using qualitative data to inform and refine the quantitative data collection; 2) using qualitative data to understand the context and mechanisms behind the results of the quantitative analysis. The qualitative data will be used inductively to explore associations presumed by our overarching framework (grounded theory) (Glaser et al., 1968) and to understand student residential phenomena (Reid et al., 2005) as they relate to key study outcomes. The phase I qualitative data from interviews and focus groups will assist in identifying salient factors and processes not sufficiently captured in the initial survey instruments. The surveys will be refined accordingly. Following the preliminary quantitative analysis (using survey data and administrative data on persistence and GPA), we will use interviews in phase II of the qualitative study to understand variations in effects across campuses and mechanisms behind the effects. Table 2 below further illustrates how the pieces fit together in the research plan. This figure is organized by the five specific aims, and shows how the qualitative and quantitative approaches combine to address the aims.
Table 2. Summary of data and methods by specific aim

<table>
<thead>
<tr>
<th>Aim #1</th>
<th>Qual</th>
<th>Phase I qual data (interviews and focus groups)</th>
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<tr>
<td></td>
<td>Quant</td>
<td>Baseline survey data</td>
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<td>Aim #2</td>
<td>Quant</td>
<td>Survey data (learning), admin. data (GPA &amp; persistence)</td>
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<td>Random lotteries: regression-adjusted comparison of means</td>
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<td>First-come first serve: regression discontinuity design</td>
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<td>Meta-analysis methods to combine across campuses</td>
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<td>Aim #3</td>
<td>Quant</td>
<td>Data as in aim#2 &amp; survey data on connectedness, mental health</td>
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<td>Approaches in aim #2, supplemented with mediator variables</td>
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<td>Qual</td>
<td>Phase II qual data (interviews and focus groups)</td>
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<td>Aim #4</td>
<td>Quant</td>
<td>Data as in aim#2 &amp; survey data on connectedness, mental health</td>
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<td>Approaches as in aim #2, supplemented with interaction terms</td>
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<td>Qual</td>
<td>Phase II qual data (interviews and focus groups)</td>
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<td>Aim #5</td>
<td>Qual</td>
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<td></td>
<td>Quant</td>
<td>Compare resources at campuses with higher/lower effects</td>
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B2. Sample

Campuses. The first level of sample selection is the campus (the institution). The key inclusion criterion is that the campus must yield meaningful comparisons between students who live on-campus and those who live off-campus. In particular we will focus on campuses that have an identifiable group of students who request on-campus housing, among whom some but not all receive on-campus housing. A key advance in the study we propose, relative to prior studies, is that our comparison group will not simply be students who choose to live off-campus. Rather, our comparison group consists of students who are essentially assigned to live off-campus, by virtue of the fact that their request to live on campus is not fulfilled. This mitigates the possibility that differences in outcomes across groups are driven by selection rather than true effects of residential settings. Another inclusion criterion is that the campus must use either a random lottery or a first-come first-serve approach to resolve excess demand for campus housing. These allocation schemes are especially amenable to research designs that address selection biases, as described later in this proposal. Finally, we will focus on campuses that have large enough “treatment” and “control” groups (at least 200 students in each) to warrant the considerable time investment required to engage a campus in the study.

A key question in the study design is how many campuses to include. We propose to include 10-12 campuses, based on a number of considerations. Most importantly this number will provide a diversity of settings and will yield total sample sizes sufficient to have statistical power to detect even small effects in our quantitative analysis, as described later in this proposal. The main reasons to consider a larger number of schools would be to allow for more precise quantitative analysis of campus-level factors and to obtain a more nationally representative sample. Both of these goals are beyond the scope of the present exploratory project, however. The first goal would require a several-fold increase in the number of campuses, which would increase the cost of the project almost proportionally and would compromise our ability to
establish strong collaborations with each campus. The second goal is not feasible regardless of the number of campuses in the study, due to the inclusion criteria noted above.

In preparation for this proposal we have identified a preliminary pool of campuses that meet our key inclusion criterion. We identified these campuses through extensive web searching followed by email and phone correspondences. Our preliminary list of institutions includes: Pennsylvania State University, University of Wisconsin, University of South Carolina, University of California San Diego, University of Alabama, Kennesaw State University, State University of New York Albany, North Dakota State University, Keene State College, University of Maryland Baltimore County, Valdosta State University, East Stroudsburg University of Pennsylvania, and Indiana University Southeast. These are mostly large and medium-sized public universities, but are diverse geographically and include a mix of assignment methods (lottery versus first-come first-serve).

These institutions meet our key criteria, and their residential life administrators have expressed significant interest in the study. It would be premature at this point to settle on a final sample of schools, however, because there are frequent changes from year to year in which campuses meet our key inclusion criteria. Most commonly, a campus could exit our potential sample if it addresses its excess demand with new (or temporary) campus housing or if it experiences decreased demand. On the flip side, a campus could enter our potential sample if it experiences increased demand for housing, as many campuses have recently experienced. We are continuing to identify and monitor potentially eligible campuses, and much of our effort during the first few months of the grant period will be devoted to settling on a group of 12 campuses. We will focus on campuses where institutional support for the study is clearly present, and we will maximize the diversity of our sample in terms of geographic location (region and urbanicity), student demographic characteristics, and institutional characteristics (e.g., research orientation and level of competitiveness). As in our previous multi-campus studies, we expect that many campuses will be eager to participate, for both altruistic reasons (contributing to general knowledge) and self-beneficial reasons (receiving data reports specific to their campus, which we have provided in all of our studies). Because we will need to choose campuses several months before data collection (in order to secure appropriate IRB approvals), it is possible that some campuses will no longer have excess demand for housing by the time we begin data collection. We will avoid this to the extent possible by selecting campuses that appear unlikely to experience such changes, based on their trends on the demand and supply sides. We will also leave some margin for attrition by starting with a number of campuses (12) that is slightly higher than we absolutely need to accomplish our study aims.

**Students.** At each campus, sample students will be identified from databases, which are maintained by housing offices, of students who request on-campus housing for the upcoming year. For the quantitative analyses we will restrict the sample to students who are not guaranteed to receive campus housing, which will provide diversity across institutions (e.g., this pool of students includes mainly first-year students at some institutions, but mainly higher year students at others). This pool of students is unlikely to be representative of full campus populations on some dimensions (such as year in school), but this is not a major limitation for two reasons: 1) these students could be considered the most policy-relevant group, in that they would be most affected by changes in housing availability on the margin; 2) our careful examination of student-level moderators will provide information about heterogeneity of effects across student types. We will collect administrative data (housing information and academic information) for all students eligible for our sample, and we will recruit a random sample of 450 of these students for
our surveys. At campuses that allocate housing on a first-come first-serve basis we will oversample students who request housing shortly before and after the cutoff point at which spaces are filled. For phase I of the qualitative study, we will focus on more experienced students (second year and higher), particularly students who have lived both on-campus and off-campus. For phase II of the qualitative study, on the other hand, we will recruit a random subset from the survey sample, to maintain the close link with the quantitative analysis.

Staff. We will collect interview and survey data from three levels of housing staff: resident advisors (RAs), resident directors (RDs), and administrators with overall leadership for campus residential life. Resident advisors (RAs) are typically upper-year students who live in residences and provide support and leadership for approximately 20-40 students. We will interview 5-7 RAs per campus in each phase of the qualitative study (phase I and II). We will specifically select more experienced RAs, who are more likely to have insights about our conceptual framework and measures (phase I) and the context of mechanisms for the effects (phase II). We will also survey a random sample of 25 RAs per campus, in order to gain a more quantitative picture of resources and activities in the residences. Resident directors (RDs), sometimes called Resident Deans or other titles, are typically professional staff members or faculty who live in or near the residences, where they provide leadership and support to the team of RAs and the student residents. We will interview five experienced RDs per campus. Finally, we will interview three key housing and student affairs administrators at each campus. This will include the person with overall leadership for campus residential life (typically with a title of Director of Residential Life or something similar), as well as two other administrators in residential life. We will include directors of “commuter centers” or other programs for students living off-campus, at campuses that have such programs.

B3. Data collection

Student survey data. We will conduct online surveys of students at two time points during the second year of the project: a baseline survey at the beginning of the academic year (August/September 2013) and a follow-up survey approximately six months later (February 2014). The baseline survey will help us establish comparability of on-campus and off-campus groups, improve statistical power by controlling for baseline measures, and examine potential student-level moderators. The follow-up survey will allow us to measure key outcomes after students have been in their current residential settings for several months. We will use recruitment methods similar to those that we have employed successfully in previous survey studies. In particular, we will first mail an introductory letter with a $2 cash “pre-incentive,” and we will follow with email invitations linking to the online survey. Students who complete the survey will also receive a $10 cash reward via a second mailing. We anticipate survey participation levels around 70%, which was the level in each of two recent multi-institution survey studies in which we used $10 incentives. The surveys will take 10-15 minutes to complete on average, and will contain measures described in the next section.

Staff survey data. The staff members in campus residential settings represent an important, complementary source of information. We will collect survey data from resident advisors (RAs) at one time point, concurrent with the follow-up survey for regular students. This survey will focus on the availability of and participation in programs, activities, and resources in the residential settings, as well as efforts to enhance involvement. The RAs will be recruited in the
same way as the regular students, and we will also ask residential life administrators to help emphasize the study’s value (while reiterating that participation is voluntary).

Administrative data. Student-level administrative data from institutional databases will also be essential for our study. Information on housing applications, assignments and placements will be obtained from housing administrators. Information on course credits, grades, enrollment status, and graduation will be obtained from academic information offices. Guidelines in the Federal Education Rights and Privacy Act (FERPA) Section 99.31 specify that institutional data may be used for the purpose of research studies, provided that data confidentiality is protected and that the studies are being conducted by or on behalf of the institution in order to administer predictive tests or help improve their programs. In our previous studies we have entered into this type of data agreement with participating institutions, and we will do so again in the proposed study.

Qualitative data collection (focus groups and interviews). Qualitative data will be collected in two phases, one before and one after the surveys. Phase I interview and focus group data will be collected in year 1 of the project as a means of identifying and refining key setting and student level variables and related hypotheses. Phase II interviews and focus groups will be held after preliminary analysis of the survey data, as a means of explaining mechanisms and distinctive findings in the preliminary quantitative analysis. All qualitative data collection will be conducted by study personnel and individuals trained by study personnel to collect data. Focus groups will occur in person, while interviews will occur in person when possible or else by phone.

For phase I, aimed at refining survey constructs, we will use interviews to explore students’ (particularly more experienced students who have lived in multiple residential settings) and staff members’ perceptions of how residential settings may affect educational outcomes. These data will be used to refine the set of variables in the surveys and to identify themes for further exploration in the later phase of the qualitative data collection. We will also conduct focus groups, as a complementary, interactive approach to collecting these data. Interview participants will receive $15 and focus group participants will receive $10. We anticipate asking no more than an hour of each participant’s time.

Areas of specific focus in phase I data collection will include questions related to each study objective and will be intended to refine and inform the overarching conceptual framework and key survey variables. It will also be used to identify gaps in the model or survey constructs. More specifically, this phase will be used to: 1) understand student experiences in residential settings and to identify key resources that students think are likely to differ in availability for on-campus versus off-campus students (e.g., asking which resources on our preliminary list seem more or less likely to be important, and whether we are missing important resources); 2) assess student perceptions of educational outcomes associated with living on versus off-campus; 3) assess student perceptions of mediators and pathways by which educational outcomes are likely to be influenced by residential settings; 4) assess student perceptions of student characteristics likely to moderate the effects of where one lives on educational outcomes; 5) assess student perceptions of which resources in residential settings are more likely to be important and whether we are missing important factors. We will use semi-structured interview formats to initiate questions in each of these key areas, with allowances for more detailed discussion in areas of particular relevance to the individual and school setting. Some of the questions will be made more concrete through scenario prompts. A basic example would be, “Think of a few friends you know who live on campus. Now, think of a few friends you know who live off campus in houses or apartments on their own or with friends. How do you think living on versus off
campus might affect how students do in school?” In each case, interviewers will probe responses with a focus on surfacing specific conditions and factors that they believe may have bearing on our main research questions and how we address them.

Phase II interviews will be held after preliminary analysis of the survey and administrative outcome data as a means of exploring striking or unexpected results. Using a grounded theory approach in which theory emerges from or is refined by our empirical data, we aim to elucidate the mechanisms and context behind the effects that are estimated. We anticipate oversampling students from the campuses in which we estimate the largest and smallest effects in our quantitative analysis of the survey data, and our interviews at these campuses will focus especially on elucidating possible explanations for these observed effects (e.g., distinctive resources or other characteristics of residences). Student interviewees will be recruited as a randomly selected subset from the pool of survey responders. As in phase I, recruitment of staff members will be based on purposeful selection criteria and will include experienced personnel likely to have the most insightful perspective on emergent trends. Sample sizes for these investigations will depend on the nature of the cases, but will be based on convergence from within group and then across group thematic analysis and will utilize sampling wisdom from grounded theory research (until theme saturation is reached). Overall we expect this phase to include 40-80 interviews, depending on the factors just described.

Data will be recorded using multiple methods. All focus group and interview data will be audio recoded. In addition to audio recordings, on-site team members will take detailed electronic notes during the focus groups in order to identify initial themes and other aspects of the interactions not readily captured by the audiotapes.

B4. Key Constructs and Measures

Educational outcomes. We will focus on three educational outcomes: persistence, grade point average (GPA), and learning. Persistence and GPA will be measured using administrative data maintained by academic information offices. Persistence will be measured as remaining enrolled at the same institution during the study period. Our primary measure of persistence will be a binary measure equal to 1 if the student remains enrolled at the institution, or graduates, during the two academic years that follow the baseline survey, and 0 otherwise (i.e., if the student departs without graduating). This measure has the well-known limitation that it considers leaving the institution an “unsuccessful” outcome, even though some of those students go on to complete additional college education. Nevertheless, leaving an institution is typically disruptive to a student’s academic progress, and retaining students is a primary goal of most institutions (Laanan, 2007; Skahill, 2002). When measuring GPA, we will convert raw scores to percentiles within each institution, in order to standardize this variable across institutions.

Learning is probably the most difficult construct to measure in this study, due to its broadness and complexity. Our challenge will be to identify aspects of learning most plausibly affected by residential settings, and measure these as part of the brief online surveys. Due the complexity of this challenge, we will devote a segment of the phase I qualitative interviews and focus groups to asking specifically about the types of learning that are most likely to be promoted by residential settings. The types of measures we will consider for our surveys include: 1) the Need for Cognition scale (Cacioppo et al., 1984), which was used in the Wabash National Study; 2) a learning-gains survey under development by our consultant Dr. Brower, based on the Association of American Colleges and Universities’ “Essential Learning Outcomes”; 3) the Global Perspectives Inventory (Braskamp, 2009), which includes cognitive, intrapersonal, and interpersonal domains; 4) brief assessments of self-perceived learning as in
NSSE and Cooperative Institutional Research Program Your First College Year (CIRP YFCY) surveys, which address dimensions such as critical thinking, ability to consider different perspectives, and understanding of self. In-depth feedback from people immersed in residential life, as part of phase I of our qualitative study, will be valuable for selecting among these and other possibilities.

Social and academic connectedness. In our conceptual framework social and academic connectedness are key mediators leading to successful educational outcomes. To measure social connectedness, we will use a combination of measures: the Social Connectedness Survey—Revised (Lee et al., 2001), which assesses one’s sense of closeness with other people and community, and the General Mattering Scale (Marcus, 1991), a 5-item measure of the extent to which respondents feel that they are important to others. To measure academic connectedness, we will use the Academic and Intellectual Development subscale of a larger instrument developed by Pascarella and Terenzini (1980). This subscale had acceptable internal reliability ($\alpha = .74$) and was significantly related to academic persistence in a large sample of undergraduate students.

Mental health. Our primary measure of mental health will be a general measure of psychological distress, the K-6 score, which has been validated in a wide range of populations (Kessler et al., 2003) and has been included in our previous studies of college students (Eisenberg et al., 2010; Whitlock & Barreira, 2008). We will supplement this with other brief measures: Satisfaction with Life scale (Diener et al., 1985); PHQ-9 depression score (Kroenke & Spitzer, 2002); anxiety symptoms in the GAD-7 (Spitzer et al., 2006); symptoms of eating disorders in the SCOFF scale (Parker et al., 2005); and questions about suicidal ideation and self-injury (Gollust et al., 2008).

Health behaviors. Measures of health behaviors relevant to college students will also be included as exploratory outcomes. These will include substance use (alcohol, smoking, marijuana, and other drugs), physical activity, and nutrition. We will use measures querying about past-month behavior, as in our previous studies (Cranford et al., 2008).

Participation/Involvement. As illustrated in our conceptual framework, participation in and involvement with resources (including people, activities, and programs) is a key intermediate step towards connectedness and positive educational outcomes. In the follow-up survey we will measure participation and involvement on a number of dimensions. We will use items from the Peer Involvement and Faculty Involvement subscales of the involvement questionnaire described by Berger & Milem (1999). Additionally, we will use items from the College Students Experience Questionnaire (Pace & Kuh, 1998) regarding use of campus facilities, as well as questions from our consultants’ NSLLP about discussions with peers (about academic, career, and socio-cultural issues) and interactions with and mentorship from faculty. We will ask about use of supportive services (e.g., mental health, tutoring, advising) and participation in social and educational groups, events, and activities.

Student level moderators. In the baseline survey we will measure several student level constructs that we expect to moderate the effects of residential settings on the key outcomes. We will measure key aspects of development including autonomy and independent goal attainment (Bieling et al., 2000), self-efficacy (Chen et al., 2001), and vocational identity and development (Jones, 1989). To pare these scales to fit into our brief survey, we will pilot-test them and select subsets of items based on principal component analysis. We will also include questions about
race/ethnicity and age. Baseline academic preparedness will be proxied using administrative data on college GPA, high school GPA, and admissions test scores.

Residential resources/characteristics. As noted previously, we expect that the availability of key resources will vary significantly between institutions, and also between on-campus and off-campus settings within institutions. We will measure both objective levels of resources, as well as perceived availability of resources, because we expect that both types are important. The objective availability of resources will be measured primarily via the staff surveys and interviews, and will include resources such as: 1) per student number of various types of supportive personnel within residences (RAs, academic and health advisors/counselors, computing/technology support staff); 2) number and types of communal spaces within the residence; 3) number and types of organized social events within the residence; 4) number and types of organized educational events; and, 5) number and types of other special programs or initiatives. The objective availability of resources is only likely to matter to the extent that students are aware of the resources and view them as accessible and appealing. Therefore we will ask about awareness and perceptions of the setting resources noted above. In addition we will measure proximity and convenience of classes and other key campus resources, based on self-reported average travel time and typical mode of transportation (from the student surveys). To our knowledge there are no pre-existing measures that fit our needs in this area, so we will develop and pilot-test these questions during the first year of the project.

Student level covariates. In our quantitative analysis we will use a number of covariate variables to confirm the comparability of groups at baseline and to improve the fit of the analytic models. These covariates will include academic background (high school standardized test scores and GPA; college GPA to date; field of study), age and year in school, family socioeconomic status (measured as parents’ educational attainment), race/ethnicity, and gender.

B5. Quantitative analysis

Aim #1. Compare the availability of resources for students in campus residential settings, versus students living off-campus. To address our first aim, we will calculate both absolute and relative (on-campus versus off-campus) levels of setting resources, overall and separately by campus. For measures based on aggregating individual data (e.g., perceived availability of resources), we will calculate means and standard errors, and we will also characterize the fuller distributions (graphically and by percentiles). We will use two-tailed t-tests and chi-square tests to compare means between campus residents and non-residents for continuous and binary variables, respectively. For measures based on survey data, we will adjust for survey non-response using sample probability weights equal to the inverse of the probability of response, estimated using logistic regressions of response on characteristics that are available in administrative data for all potential respondents (at most campuses these characteristics will include gender, academic level, race/ethnicity, age, and GPA).

Aim #2. Estimate the effects of living in campus residential settings on educational outcomes (persistence, learning, and academic performance). To address our second aim, we will evaluate a separate “natural experiment” at each campus in the sample. The evaluation method at each campus will depend on the process by which limited slots in campus housing are assigned. At campuses that use random lotteries, we will evaluate the effects using intention to treat (ITT) methods as in randomized trials. At campuses that allocate slots on a first-come first-
serve basis, we will use a regression discontinuity (RD) approach. It is important to note that at each campus our evaluation will be a comparison of on-campus housing, which is a composite mix of a variety of specific residences, versus off-campus housing, which is also a composite mix of settings. Although it would be ideal also to quantify the effects of more specific residential settings within campuses, in most cases there is no credible analytical strategy to do so. Sorting into specific residential settings is determined largely by choice, not assignment.

**Random lotteries.** Some campuses in our sample will be using a random lottery system to allocate limited spaces in campus residences. In these systems, students interested in campus housing are entered into a lottery, and they receive a randomly generated number that determines their priority order. Students with the lowest numbers are offered spaces until all spaces are filled. Based on our conversations with campus administrators, we know that the lottery number is not a perfect predictor of whether a student ends up in campus housing, because some students decline their slots, which then get offered to students with higher lottery numbers. To account for this “noncompliance” with assignment, we will use an instrumental variables (IV) analysis, which is equivalent to scaling up the intention-to-treat (ITT) estimate (difference in outcomes for students with high versus low lottery numbers). The IV estimates will be calculated using two-stage regressions, with the first-stage predicting whether a student lives on-campus, and the second stage predicting the outcome variable.

*First-come first-serve (regression discontinuity).* At other campuses in our sample the allocation of limited spots in campus housing will occur on a first-come first-serve basis. Students submit housing applications at various times, and the spaces are filled by the housing office in the order in which applications were received. Because there are year-to-year variations in the demand for housing spaces and the timing of the applications, the “cut-off” date when the spaces are filled is not known a priori. As noted by Cook (2008), a first-come first-serve allocation scheme lends itself to regression discontinuity (RD) analysis. RD analysis is based on the premise that a “treatment effect” is present if outcomes are modeled as a function of the assignment variable (date of application in our context) and there is a sharp discontinuity in expected outcomes at the cut-off point. In recent years the RD design has gained popularity, particularly among education researchers, and in many contexts is considered the best alternative to a randomized experiment. In our context we anticipate a “Type II fuzzy” RD design (Bloom, 2009), in which there are both “no-shows” (in our case, people who submit their applications before the cut-off, but end up choosing not to live in campus housing) and “crossovers” (people who submit their applications after the cut-off but still receive a space). This situation requires additional assumptions beyond those in a sharp RD design (in which the cut-off is a perfect predictor of receiving treatment), but can still be analyzed in the same type of IV framework described earlier (in which the ITT estimate is scaled up by the difference in probability of living on-campus).

One of the main critiques of the RD design is that the estimated effects only apply to the sample with assignment variable values close to the cut-off value. This limitation is offset by several considerations in our context: 1) students near the cut-off are arguably the most policy-relevant group, because they are the students whose living location is most likely to be affected by increases or decreases in the supply of campus housing; 2) we will implement the RD design at multiple campuses, and thereby observe estimates at different cut-offs; 3) it is not obvious that the treatment effects should necessarily vary significantly by the assignment variable in this RD context (in contrast to other RD designs where the assignment variable is a baseline outcome.
value or a proxy for “need,” which is likely to moderate the effects); 4) we will examine heterogeneity of effects across a range of student-level moderators under specific aim #4.

**Aggregating results across campuses.** Our analysis of each campus’s sample will yield a set of campus-specific estimates. Considering the heterogeneity that we anticipate in residential settings across campuses, these campus-specific estimates will be meaningful in their own right (particularly from the standpoint of participating institutions). We will also aggregate these estimates across campuses, using standard meta-analytic methods to generate overall estimates. Calculating an aggregate effect of living on versus off campus will require conversion of campus estimates into standardized effect size scores (e.g., Cohen’s $d$ for continuous outcomes and odd ratios for categorical outcomes). We will use the Cochran $Q$ test and the $I^2$ statistic to assess the level of heterogeneity across campus effect size estimates (Higgins et al., 2003). We will combine campus level effect sizes using a mixed-effects modeling approach, which assumes that there is heterogeneity in the mean effect size estimate beyond sampling error that is attributable to both systematic sources of variance (i.e., observable moderators) and additional random error (Lipsey & Wilson, 2001). As compared to the campus-specific estimates, these overall estimates will have higher statistical power and will likely be more representative of the average effects of campus residential settings in the overall population of campuses.

**Accounting for multiple hypothesis testing.** Because we will analyze a variety of outcomes, it is important to account for multiple hypothesis testing. We follow the recommendation of Schochet (2008) to distinguish between a small number of primary outcomes, versus other exploratory outcomes. Our primary outcomes are persistence, GPA, and learning. We are thinking of these three domains as separate hypothesis tests, but we will also apply an adjustment for false discovery rates (Benjamini & Hochberg, 1995) for a global hypothesis test of whether campus residential settings have any positive impacts across the domains. We will also apply this adjustment when testing the effects on learning, as this is a multi-dimensional construct.

**Sensitivity analyses.** We will examine the sensitivity of our results to alternative approaches to accounting for missing survey data. One approach would be to treat the missing information as missing at random. We will evaluate the plausibility of this assumption by comparing average characteristics from administrative data (which will be complete for all students) between survey responders and non-responders, and we will also conduct these comparisons separately by on-campus and off-campus student samples (and compare the differentials across those two groups). Sensitivity analyses will also include the use of response propensity weights (based on logistic regressions using the administrative data) and multiple imputation methods.

We will also use propensity score matching (Austin, 2008) as an alternative analytic approach for campuses with first-come first-serve allocation schemes. Propensity score matching is less likely than regression discontinuity to account for unobserved differences across groups due to selection, but it has offsetting advantages: higher statistical power (as it does not depend heavily on the subset of observations near the cut-off point), and a transparent, composite way to examine the balance of characteristics across groups (and limit the analysis to the region of “common support,” if necessary). Kaplan-Meier survival analysis will also be used as an alternative approach to analyzing persistence. This approach will model persistence continuous (duration of persistence), and thus may have higher statistical power.
Aim #3 (Identify mediators of effects on educational outcomes). The quantitative analysis of mediators will consist of two stages. First, we will use our hypothesized mediators (social and academic connectedness) as dependent variables, using the same empirical models as in aim #2. Second, we will replicate the analyses under aim #2, except with the mediators added iteratively as right-hand-side variables. The results will be consistent with the hypothesized mediating pathways if: 1) the first stage of this analysis indicates that the connectedness measures are significantly predicted by living on-campus; and, 2) controlling for the connectedness measures significantly reduces the estimated direct effect of living on-campus on educational outcomes.

Aim #4 (Identify student-level moderators of effects). The impact of living in campus residential settings is expected to vary depending upon student characteristics, as described in our conceptual framework. To test whether student level factors moderate the effect of residential setting on our outcome variables, we will include interaction terms between the dichotomous residence variable (on versus off campus) and student-level moderators, in the analyses described for aim #2.

Aim #5 (Identify key residential resources/characteristics, i.e., setting-level moderators). Our quantitative analysis of setting level moderators is limited by the modest number of campuses in the sample, and, in fact, quantitative multi-campus studies have generally been unable to explain much of the variance in student outcomes with institutional characteristics, according to Astin and Denson (2009). Nevertheless, the quantitative analysis will provide important preliminary information to guide the exploration of setting moderators in the second phase of the qualitative analysis. Through the quantitative analysis we will identify campuses for which on-campus settings have notably large or surprisingly small (and possibly negative) effects, and these findings will then be a focus of the qualitative data collection and analysis. In addition, we will test for bivariate relationships between campus-level effect sizes and the presence or level of various resources.

Power analyses. We first calculated power for detecting effects of living on-campus on the likelihood of persistence, a binary outcome (persist or not persist), within individual campuses. Approximately 35% of first-time undergraduates do not persist at the institution where they initially enrolled (Berkner et al., 2008). Estimates of the differential persistence rates between on- an off-campus students range considerably—for example, from 12% (Astin, 1977) to 41% (Bozick, 2007). Using Astin’s more modest estimate that living on-campus leads to a 12% increase in persistence, we project that 29% of on-campus students will not persist compared to 41% of off campus students (a 12% difference averaging to the national mean of 35%), an odds ratio of 0.59. Assuming 300 participants in each group (on and off campus) and $\alpha = .05$, we would be powered at 0.85 to detect an odds ratio of 0.59, and this power may be higher after adjusting for baseline covariates. Assuming a 20% benefit for on campus students in terms of persistence (odds ratio = 0.41), we would be powered to 0.99 to detect a significant difference. An important caveat is that these power calculations apply to campuses using random lotteries to assign housing; the power in regression discontinuity analyses depends on a number of unknown assumptions about the data, but is likely to be lower (Bloom, 2009). As noted earlier, this is one reason why the propensity score approach will be a useful supplement for campuses that use first-come first-serve schemes. Precision will not be an issue for the aggregated effects across
campsusses, however; when aggregating effects using procedures described by Hedges and Pigott (2004), our power exceeds 0.99 even for the modest 12% differential in persistence.

We also conducted analyses to estimate our power to detect between-group differences (on- vs. off-campus students) on continuous outcome variables (such as GPA, learning, and connectedness scales) using G*Power version 3.1.2 (Faul et al., 2009). We estimated that both comparison groups would have 146 participants ($N = 292$) per campus, which is conservatively based on our projection that we would have an average response rate of 65% when sampling 450 students from each of 10 campuses. We calculated our power to detect small to moderate standardized effects of $d = 0.35$, using assumptions about standard deviations from data in our previous work. For continuous outcomes, our power to detect this effect size with $\alpha = .05$ is above 0.80 in all cases, indicating high power even for within-campus estimates.

**B6. Qualitative analysis**

Qualitative data analysis will be in line with grounded theory and conducted using the constant comparative method advocated by Glaser and Strauss (1968). This analytical method, which uses inductive latent analysis to identify emergent themes, will be used to analyze areas where working hypotheses are incomplete or unclear, and to identify topics where additional data are needed. The analytical focus for phase I data will be to understand student perceptions of, experiences in, and understanding of the way where they live affects academic and mental health outcomes. Not only will this provide a “thick” (rich and detailed) description of the phenomena of interest, but it will permit refinement of the overarching framework and survey measures. Analysis of phase II data will elucidate emerging trends and themes (particularly campuses with distinctive findings, such as very large effects on educational outcomes) as a means of identifying and understanding novel associations and cases. The qualitative data will identify key similarities and differences, such as the role and value of particular resources and social processes, in producing these notable outcomes.

Qualitative analysis software (Atlas.ti) will be used to classify, categorize, integrate and interpret data using a method that blends variable-oriented and case-oriented methods consistent with those described by Denzin and Lincoln (1998)) and Corbin and Strauss (1990). This requires a layered approach to analysis that consists of multiple successive readings of each transcript by independent coders. The first reading typically entails identification of broad themes for development of open coding. Once a comprehensive set of themes emerge, coders independently create coding dictionaries to assign broader thematic classifications to the data during the second reading process. Following the second round of coding and classification, coders approach the data to determine how the categories are linked, a process sometimes called “axial coding” (Corbin & Strauss, 1990).

Standard criteria will be used to judge reliability and validity of these data. Lincoln and Guba (1985) posit four criteria for this purpose, which Trochim (2000) likens to traditional criteria for judging internal validity, external validity, reliability, and objectivity. These are: a) **credibility**: the degree to which findings are plausible, credible or believable from the perspective of the participant in the research; b) **transferability**: the degree to which the results of qualitative research can be generalized or transferred to other contexts or settings; c) **dependability**: the need for the researcher to account for the changing context within which research occurs and account for the way these changes may have affected how the study was conducted; and d) **confirmability**: the degree to which there is an internal logic or validity throughout the findings as a whole such that the results could be confirmed or corroborated by others. This study will endeavor to meet each of these criteria through use of member checks, sharing emergent findings
with key stakeholder groups at multiple junctures, assessment of transferability to other similar contexts, inquiry audits, and researcher commitment to remain conscious of potential biases.

C. PERSONNEL
The study PI is Daniel Eisenberg, Associate Professor of Health Management and Policy at the University of Michigan. Dr. Eisenberg will have overall leadership of the study and will ensure that all steps are carried out as planned. He has substantial experience with multi-institution studies on college student health and well-being, including two ongoing studies of how students influence each other’s health and related behaviors in campus residential settings (see Preliminary Studies). His training and expertise in applied empirical economics are suited to the quantitative design and analysis in this proposal, and his experience with large interdisciplinary projects will enhance his overall leadership of the study. He has also contributed to qualitative research as part of the Healthy Minds Study. The proposed study will significantly advance his research agenda to identify and evaluate promising strategies for investing in health and development of young people in the college setting.

The qualitative component of the study will be jointly led by Janis Whitlock, Research Scientist in the Bronfenbrenner Center for Translational Research at Cornell University, and Patricia King, Professor in the Center for the Study of Higher and Postsecondary Education at the University of Michigan. Dr. Whitlock’s training is in human development and public health, and she has worked with Dr. Eisenberg in the previously described study of peer effects in campus residences. She has directed several studies, both qualitative and quantitative, on the development, wellbeing, and social connectedness of adolescents and college students. Dr. King will contribute an understanding of educational practices that affect college student development across several domains of development (King et al., 2009). This perspective will be especially valuable for guiding not only the qualitative data collection and analysis, but also its synergy with the quantitative analysis. Dr. King has been a lead investigator on a multi-institution mixed methods study of practices and environments that promote learning in college, the Wabash National Study. She has also served in leadership roles in higher education research and practice, and has published extensively on the academic development of college students.

The study will also draw upon the expertise of two consultants. Dr. Karen Kurotsuchi Inkelas is Associate Professor and Director of the Center for Advanced Study of Teaching and Learning in Higher Education (CASTL-HE) at the Curry School of Education at the University of Virginia. As the Principal Investigator of the National Study of Living-Learning Programs for the past 10 years, Dr. Inkelas has been studying how living-learning and residential environments lead to student outcomes through survey research and multiple case study site visits. She has published extensively on living-learning programs, including a comprehensive review of living-learning research in Higher Education: A Handbook for Research. In addition, Dr. Inkelas has experience working in the research and assessment of residence halls through her work in both developing and directing the Housing Research Office in University Housing at the University of Michigan. Aaron M. Brower is professor of Social Work, Educational Leadership & Policy Analysis, and Integrated Liberal Studies, and is Vice Provost for Teaching & Learning at the University of Wisconsin, Madison. Dr. Brower has published widely on college student success and the transition to college, including classroom reforms and other ways to structure college environments that enhance student learning. His research and practice focuses on blending in-class and out-of-class learning and experiences to create communities of students, faculty, and staff who share common learning goals (i.e., learning communities). He has been
instrumental in the creation of many residential and curricular learning communities at UW-Madison and across the U.S., including first-year student transition programs, summer "bridge" and orientation programs, undergraduate research scholars programs, and living-learning programs. In addition to being co-Investigator on the National Study of Living-Learning Programs, he was P.I. on a 10-year Robert Wood Johnson Foundation project addressing high-risk college student drinking, and co-P.I. for the Center for the Integration of Research, Teaching, and Learning—a $10 million, NSF-funded national higher education center that is infusing learning community principles into the training of graduate students.

Given that the study will involve mixed methods and multiple stages of data collection and analysis, seamless coordination and communication among team members will be essential. We will hold weekly conference calls including the PI, co-Investigators, and their supporting personnel, as well as monthly calls that also include both consultants. Our core research team will also meet in person at least twice per year, and our consultants will meet in-person with the core team at least twice during the project.

D. RESOURCES
The University of Michigan serves as an ideal base for this multi-institutional study, due to its rich resources and interdisciplinary environment. We will benefit especially from discussions and presentations with colleagues in the School of Education, School of Public Health, School of Public Policy, Department of Economics, and Institute for Social Research. Cornell University similarly provides a wealth of resources that will benefit our study.

Perhaps the most important resources, however, will be strong relationships with the institutions participating as study sites. These relationships are crucial for the feasibility and success of the study. Institutional engagement is needed to gain access to administrative data and to recruit individual participants on campuses, and also to enhance the likelihood that our findings are eventually used by practitioners. We are ideally poised to establish and enhance strong relationships with participating institutions. All three members of our core research team, as well as our two consultants, have a highly successful record of recruiting and engaging large numbers of campuses in multi-institution studies of college student outcomes. One of the main reasons for this success has been our ability to offer campuses data that they view as valuable and practical. In particular, we have provided each campus with a data report and data set specific to their students. Campuses have used this information to understand their student populations, compare their situation to other institutions, and evaluate progress in key outcomes that may be related to recent policies and practices. In the present study we will continue this approach by providing simple, user-friendly data reports and data sets, which campus administrators can use to examine their residential students and how they compare to students living-off campus. We will also continue our discussions and involvement with key national organizations of practitioners, such as the Association of College and University Housing Officers—International (ACUHO-I), Student Affairs Administrators in Higher Education (NASPA), the American College Personnel Association (ACPA), and the American College Health Association (ACHA). In recent years we have presented findings from our studies at national conferences for each of these organizations, and we have also established relationships with leaders in the organizations. Overall, our commitment to sharing and discussing our work with practitioners in higher education will enhance our ability to engage institutions in the study, and will ultimately lead to stronger research with sustained impact.
Bibliography


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