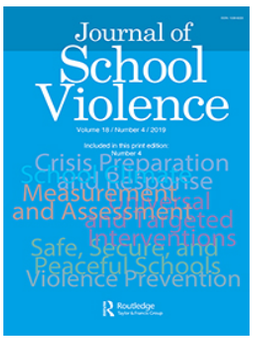

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Resident Students' Perception of Safety in On-Campus Residential Facilities: Does Crime Prevention through Environmental Design (CPTED) Make a Difference?

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ABSTRACT

One practical, yet less touted, approach to school safety is the use of security provisions that conform with the principles of Crime Prevention through Environmental Design (CPTED). Beyond preventing crime, the approach offers the potential benefit of improving perceptions of safety among campus occupants which is important for revenues and establishing effective learning environments. Although CPTED has shown promise in reducing crime elsewhere, research has only begun to empirically assess the extent to which it is compatible with campus facilities and whether it improves students' safety perceptions. This study reports on a quantitative comparative assessment of student (N = 100) safety perceptions from two, differently designed residential facilities on a large public research university in the Southeastern United States. Findings indicate that residents of the high CPTED facility had higher safety perceptions than the low CPTED facility's residents. Site observations supported differences between design features of the two facilities.

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Perception of safety; fear of crime; school safety; campus safety; school design; crime prevention through environmental design; CPTED

Introduction

In the aftermath of sensationalized incidents of school violence, proposals of extreme responses intended to prevent future incidents often take center stage in public discourse. Policy suggestions like permitting the use of Federal educational grant provided by Every Student Succeeds Act (2015) to purchase firearms for schools have been criticized by associations representing American educators (National Education Association [NEA], 2018; Klein, 2018). A more feasible approach to improving campus safety is the implementation of various situational security measures which mostly align with the principles of Crime Prevention through Environmental Design (CPTED). The CPTED approach seeks to improve the design features of school campuses in a way that promotes pro-social intended activities and makes schools less attractive for criminal behavior.

Certain CPTED measures such as access control are appealing to school administrators since they can be implemented relatively quickly and done so internally without requiring external governmental approval. The precise extent of CPTED use to safeguard college campuses is largely unknown, but a reasonable assessment is that some CPTED techniques are present to varying degrees within most educational campuses, albeit not as part of a comprehensive CPTED plan (Shariati, 2017).

CPTED measures not only promote safe campuses but also can satisfy the need for "an effective, and ideally inspiring, learning environment" (Atlas, 2013, p. 507). Higher educational institutions have a critical need to establish a safe learning environment for two primary reasons. First, schools

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must demonstrate that they maintain a safe and crime-free environment in order to attract and retain prospective students. This serves to sustain sufficient enrollments and accompanying revenues. Second, it is equally important that institutions establish a campus climate where students feel safe and free to engage in curriculum, contemplate new ideas, and develop the "life of the mind" inherent to higher learning. Campus-wide fear of victimization undermines the very basis of the educational agenda. Complicating matters, within the criminological literature there has been an established disconnect between levels of fear of crime and actual incidents of victimization (Dugan, 2014; Rader, 2017). While statistically school campuses may be among the safest places, students may continue to feel vulnerable and at risk for being victimized. Thus, understanding and influencing students' perceptions of safety or the inverse, levels of fear of crime, are of vital significance.

Although assessments of CPTED have shown its promise in reducing crime opportunities (Armitage, 2000; Armitage & Monchuk, 2011; Pascoe, 1999; Poyner, 1993; Teedon, Reid, Griffiths, & McFadyen, 2010), research has only begun to empirically assess the extent to which environmental design is associated with residents' fear of crime. It is even less clear if the compatibility of campus design with CPTED standards affects students' safety perception. While some research has assessed the environmental determinants of fear of crime among university communities generally (Fernandez, 2005; Fisher & May, 2009; Fisher & Nasar, 1992; Nasar & Fisher, 1993; Petherick, 2000; Siegel & Raymond, 1992), the influence of CPTED on students' fear of crime remains an understudied area. Given national concern regarding campus violence, it is important to understand whether CPTED can effectively improve campus design and reduce students' fear of crime. This study seeks to contribute to that understanding through a comparative assessment of student residents' perceptions of safety on a public, research university campus, located in the Southeast United States. The comparison is drawn from surveys administered at two dormitories, one with high and one with low CPTED design.

Literature

Crime prevention through environmental design (CPTED)

CPTED is defined as "The design, manipulation, and management of the built environment to reduce crime and the fear of crime and to enhance sustainability through the process and application of measures at the micro (individual building or structure), meso (neighborhood), and macro (national) level" (Armitage, 2013, p. 23). It comprises a series of principles or components which inform the development of strategies to decrease crime opportunities through modifying physical and social features of the environment. These principles generally focus upon improving surveillance, restricting intruders' access, creating and maintaining a pleasant image, enhancing territorial reinforcement, and ensuring legitimate use of environment. While discrepancy continues to exist regarding the exact number and descriptions of CPTED principles (see Armitage & Monchuk, 2017; Ekblom, 2011), the following five are commonly recognized and were used as the conceptual framework in the present study.

Natural surveillance

The principle of natural surveillance refers to the capacity of an environment to provide opportunities for people to watch over one another (Johnson, Gibson, & McCabe, 2014). Several studies have shown that fostering natural surveillance encourages the use of areas by authorized people and increases the inherent risk and difficulty of crime (Armitage, 2006; Bennett & Wright, 1984; Brown & Altman, 1983; Reynald, 2015; Welsh & Farrington, 2009)

Access control

The access control component presumes that regulating entry and exit of visitors and commuters can reduce the possibility of criminal activities (Zahm, 2007). This can be accomplished with locks, gates, doors, and traffic controls. The majority of empirical studies suggest that crime is more likely

in highly accessible areas (Beavon, Brantingham, & Brantingham, 1994; Johnson & Bowers, 2010; Poyner & Webb, 1991; Wiles & Costello, 2000; for an exception see Hillier & Sahbaz, 2009).

Maintenance

The maintenance element focuses on maintaining a pleasant image for an area to protect ownership and improve quality of life. The appealing image of a well-kept area enables residents to develop attachments to their neighborhood and strive for its safety (Johnson et al., 2014). On the other hand, poor maintenance (e.g., presence of graffiti, litter, and broken fixtures) could attract potential criminals to the area, and alienate responsible residents (Lewis & Maxfield, 1980; Perkins, Meeks, & Taylor, 1992; Reynald, 2011; Skogan, 1990).

Territoriality

The territoriality element allows owners to define their property and to restrict intruders' access using physical barriers (e.g., fences and hedges) or symbolic barriers (e.g., signage and landscaping). While some research has confirmed that territorial reinforcement would discourage motivated offenders from their potential targets (Armitage, 2000; Perkins et al., 1992; Taylor, Gottfredson, & Brower, 1984), other studies have found that excessive use of barriers might encourage more unlawful activities through obstructing surveillance and creating opportunities for concealment (Bennett & Wright, 1984; Coupe & Blake, 2006; Reynald, 2015).

Activity support

The activity support principle aims to increase community interaction using a variety of passive or active strategies. Passive design elements are those that attract legitimate users (e.g., proper landscaping, gathering areas). Active examples involve strategies such as holding cultural events, which increase the presence of people – making the area less desirable for offenders (Fritz, 2009). Evaluation research on the effectiveness of this element is scarce.

The substantial research investigating the empirical evidence on CPTED as a general crime prevention strategy is equally important. CPTED, which originated in the writings of Jacobs (1961), Jeffrey (1971), and Newman (1972), achieved popularity within the policy arena in the ensuing decades, and numerous evaluations confirmed its potential to reduce crime (Gardiner, 1978; Newman, 1996; Wallis & Ford, 1981). Several reviews of place-based crime prevention interventions provide support for CPTED effectiveness generally (Eck, 2002; Poyner, 1993; Schneider & Kitchen, 2002; Sherman, MacKenzie, Farrington, & Welsh, 2002) as well as for reducing robbery (Casteel & Peek-Asa, 2000), burglary (Armitage & Everson, 2003; Kushmuk & Whittemore, 1981; Sorensen, 2003), and theft (Morgan, Boxall, Lindeman, & Anderson, 2012). Despite these promising findings, some claim that lack of clarity in the construction and measurement of CPTED concepts threatens their merit (Armitage & Monchuk, 2017; Cozens & Love, 2015; Ekblom, 2011). Even so, in the U.K., evaluations of the Secured by Design (SBD) program which "encourages the building industry to design out crime through CPTED use at the planning stage" (Armitage & Monchuk, 2011, p. 323) have consistently found such properties to be less vulnerable to crime (Armitage, 1999; Brown, 1999; Cozens, Pascoe, & Hillier, 2007; Pascoe, 1999; Teedon et al., 2010).

Differently, research examining the relationship between fear of crime and CPTED has produced mixed findings. While prevailing research generally suggest that CPTED interventions were associated with low levels of risk perception and self-reported victimization (Armitage & Monchuk, 2011; Cozens & Tarca, 2016; Pascoe, 1999; Robinson, 1998), other studies found no direct significant relationship between CPTED and fear of crime (Marzbali, Abdullah, Razak, & Maghsoodi Tilaki, 2012; Minnery & Lim, 2005; Schweitzer, Kim, & Mackin, 1999).

Given this disparity, further scrutiny of the relationship between environment and fear of crime is needed. CPTED program evaluations support the effectiveness of this approach in reducing crime,

while the findings are mixed as they relate to fear of crime. Beyond this, a clear gap exists in the previous research literature which has yet to focus on the influence of CPTED in addressing fear of crime in educational settings.

Campus safety research

Two important predictors of on-campus victimization that have been extensively assessed are students' characteristics and institutional features. These studies have revealed that students' lifestyles and routine activities, such as their relationship behaviors and alcohol drinking habits, are important determinants of their victimization (Dowdall, 2013; Fisher, Sloan, Cullen, & Lu, 1998; Henson & Stone, 1999; Mustaine & Tewksbury, 2013; Volkwein, Szelest, & Lizotte, 1995). Additionally, a large-scale study by Siegel and Raymond (1992) conducted in 400 U.S. institutions revealed that ecological features of campus, together with students' characteristics, are correlated with campus violent crime.

A subset of the studies that investigated determinants of fear of crime on college campuses assessed the influence of the level of CPTED on students' fear of crime. Three correlates of crime and fear: prospect, refuge, and escape were examined (Fisher & May, 2009; Fisher & Nasar, 1992; Nasar & Fisher, 1993; Petherick, 2000). Their findings demonstrated that higher levels of fear of crime on campus are associated with locations' poor visibility, victims' lower chance of escape, and areas offering more hiding places for offenders. Each of these are design features which are minimized or eliminated in high CPTED facilities.

Similarly, three case studies provided further empirical support for the use of CPTED on college campuses. Tseng, Duane, and Hadipriono (2004) evaluated the perception of safety at two different parking garages of Ohio State University following a 2-year implementation of a CPTED program. Findings confirmed the positive relationship between CPTED modifications and respondents' perception of safety, with lighting being the most significant factor affecting perceptions. Fernandez (2005) surveyed students' perceptions of safe and unsafe exterior sites on Louisiana State University campus finding that visibility, clean and well-kept areas, and proper landscaping increase students' perception of safety. More recently, Cozens and Sun (2018) examined students' perception of safety in relation to the level of CPTED finding that lower levels of CPTED were associated with higher fear of crime.

Understandings of the influence of CPTED features on student perceptions of safety in school settings have just begun. While these findings have generally shown it to be effective at improving safety perceptions, they are few in number and they stand in stark contrast to other research which has found no connection between CPTED characteristics and perceptions of safety within other environmental settings. Much remains to be known regarding the ability to "crime proof" educational facilities through design and whether this results in students feeling safe in the campus setting.

The current study

This study aimed to narrow this research gap by comparing the perception of safety at two on-campus residence halls which varied significantly in terms of environmental design. The intention was to go beyond an examination of official campus crime rates to obtain a tangible understanding of the impact of CPTED. One high-CPTED and one low-CPTED facility at a large public research university were identified and their inhabitants' safety perceptions were compared. Other factors that may contribute to criminal offending, including urban/rural setting, community characteristics, and university's macro-level security policies were held constant by examining two sites of the same campus.

Methodology

Two research questions were examined: (1) whether there was a significant difference between the perceptions of safety of students residing in the two facilities and (2) whether their safety perceptions were influenced by the design of their residence. Resident students were selected as study participants as they spend a considerable amount of time at or near their campus residences. They have a good assessment of the area – compared to other frequent users or commuters to campus. Thus, their perception of safety is greatly affected by the social and environmental characteristics of their living quarters. Two housing facilities on the campus of a large public university, located in the Southeast United States were selected for this study. One was a much newer facility which was more likely to meet CPTED criteria – herein referred to as *High Conformity* (*HC*); and the other one was an older facility that appeared less compatible with CPTED standards – herein referred to as *Low Conformity* (*LC*).

The LC structure, built in 1986, comprises a series of two-story buildings in a courtyard style located in the eastern part of campus while the HC facility, constructed in 2000, is a complex of apartment buildings with a more modern design and landscaping situated in the center of the campus as a part of a residential quad. LC accommodates 537 individuals and HC houses 481 students. Residents of both halls are mostly upper-classmen (junior/senior students). Figure 1 provides two pictures to allow a comparison of the facilities.

Data and variables

Study data were collected in a three-step process. First, the authors' initial observation of the noticeable distinctions between the two facilities was the catalyst of choosing them as the study sites. Second, a survey questionnaire was administered to estimate safety perceptions of the dorms' residents. Third, a series of in-site observations were conducted to further investigate differences in the design features of the two facilities.

Surveys were given during a three-week period from May 3 to 28, 2015. This time frame was selected due to higher presence of on-campus residents during a regular semester which helped obtain sufficient participation and increase the sample representativeness. Respondents were selected using a convenience sampling technique – applied while walking around each facility and asking passersby to participate, 91% of those who identified themselves as residents agreed. The sample

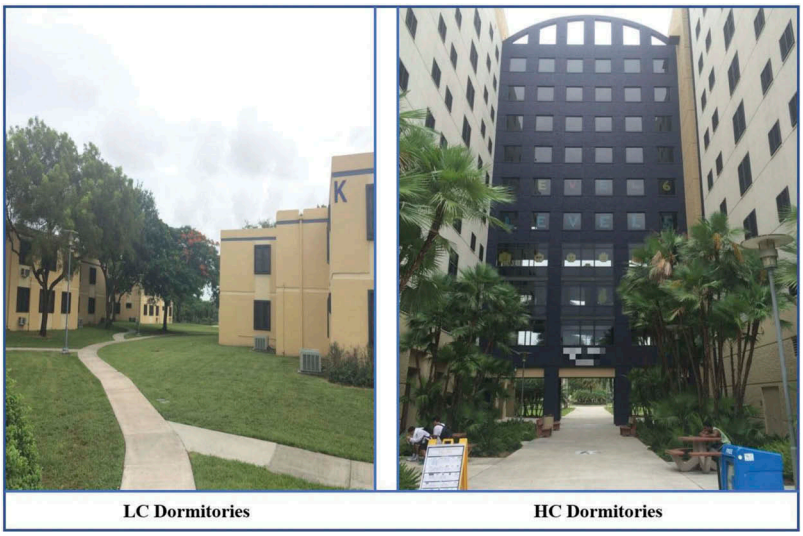

Figure 1. Pictures displaying the two facilities.

consisted of 50 LC residents and 50 HC residents. Participants' verbal consent was obtained at the start of each conversation following an explanation of the study's purpose, and a description of the potential risks and benefits of participation.

The buildings' environmental features were observed through active looking, informal conversation, and field notes during a two-week period from July 15 to 28, 2015. This time period was selected because researchers' access to these data was independent of the availability of on-campus residents. Observations were conducted in mornings, afternoons, and evenings on a rotating schedule to better capture the design features at various times of the day and identify dark areas and vulnerabilities. Each observation lasted about 2 hours and entailed three spatial assignments: facilities' common areas, dormitories' surroundings, and buildings' exteriors.

A check-list of CPTED principles and their indicators were used to guide the observations and establish the CPTED levels. Composite measures (scales) were developed for each CPTED concept, based on their definitions in the research literature. Similar procedures have been used in urban planning research to grade urban design qualities. Through developing operational definitions, physical features can be measured and their statistical relationships can be analyzed (Ewing, Handy, Brownson, Clemente, & Winston, 2006).

Table 1 presents the indicators used to operationalize CPTED concepts and the scores assigned to each facility, based on the presence of the indicators. The total CPTED score for each facility ranges from 0 to 15 and the total possible value of each CPTED strategy ranges from 0 to 3.

As can be seen in Table 1, the HC complex entailed a higher level of natural surveillance compared to LC. The sense of safety around these buildings is evoked by the presence of well-lit walkways, luminous building exteriors, and large windows and proper visibility in the area enclosing the HC buildings. In contrast, LC lacked most of the indicators of a standard visible housing district. Weak visibility in the surrounding areas (e.g., walkways and nearby parking lots) evoked a feeling of insecurity in the area, particularly after dark.

The HC apartments have a greater level of access control. Exterior doors are always locked and could only be opened using electronic key cards. HC residents reported that a guest policy restricting guest-access to specific days of the week and limited hours of the day is enforced at the front desk. Resident-hosts are required to escort their guests to their rooms as a further safety measure. In contrast, LC buildings are weak in access control and easily accessible to outsiders. These courtyard style residences

Table 1. Observation-based measures of CPTED levels of the two dormitories.

CPTED Principles	Composite Measures (Scales)	Observed Indicators at HC	Observed Indicators at LC	CPTED Score (HC)	CPTED Score (LC)
Natural Surveillance (0–3)	Proper lighting in surrounding areas	✓	–	3	0
	Illuminated building exteriors	✓	–		
	Physical features providing visibility, e.g., large windows	✓	–		
Access Control (0–3)	Locked 24/7	✓	–	3	1
	Front desk control	✓	–		
	Presence of patrol	✓	✓		
Territoriality (0–3)	Physical elements delineating residential areas	–	–	2	2
	Features defining entry/exit to residential areas	✓	✓		
	Signage indicating residential areas	✓	✓		
Maintenance (0–3)	Trash and recycling collection	✓	✓	3	2
	Lack of broken fixtures	✓	–		
	Planting and vegetation care	✓	✓		
Activity Support (0–3)	Existence of recreational facilities	✓	✓	3	2
	Existence of picnic tables, benches, etc.	✓	✓		
	Existence of student lounges, shops, cafés, and food courts	✓	–		
Total CPTED Score (0–15)				14	7

are open and not protected with gates or fences. Although several desk assistants serve this housing complex, they do not have direct supervision over residents/strangers because their office is situated in a separate building. There is no exterior door or hallway for these buildings, so residents enter their individual rooms directly without passing a main entrance or a front desk. Therefore, the implementation of a guest control policy (e.g., limited visitation and escorting) is not feasible.

The observations also revealed that the HC area was well maintained with trimmed vegetation, clean well-kept areas, and no noticeable hardware or security equipment failure. LC only had satisfactory well-trimmed vegetation; the presence of litter and broken lights in adjacent parking lots contributed to the feeling that the area was cluttered and unsafe. In terms of territoriality, both housing complexes met the standards by providing signage, pavements, fences, and plantation that drew clear boundaries and conveyed the message that the area is residential.

Last, the HC facility had several physical and social features that promoted safety by supporting the intended use of the residential area (activity support). These features include existence of swimming pools, playgrounds, benches, and picnic tables in surrounding areas; and holding frequent cultural and entertainment events. The existence of a café/supermarket at the residential quad entrance is another feature promoting the legitimate use of this area. Although the LC facility had several sport playgrounds and picnic tables, it lacked other activity support features such as entertainment events, stores, and dining places (see Figure 2).

Dependent variable

The dependent variable was the residents' perception of safety, derived from respondents' self-reports. This variable was measured by asking "How safe do you feel …" (1) in your individual room? (2) about the safety of your personal belongings in the room? (3) in the dormitory halls, (4) while walking in surrounding areas at night? and (5) overall in your dorm residence? Each of these were estimated at an ordinal level of measurement, ranging from 1 (very unsafe) to 10 (very safe). The primary dependent variable, the overall perception of safety, was taken from question five. The first additional dependent variable, determining perceptions of safety inside residential facilities, was derived from collapsing questions one, two and three. The second additional variable used question four to assess how CPTED level might "spill over" to influence safety perceptions outside residential facilities in surrounding areas.

Figure 2. Pictures indicating CPTED differences between the two facilities.

Independent variables

The main explanatory variable of this study is the dormitory of residence. This was dichotomous: residing in HC was coded as 1 and residing in LC was coded as 0. Control variables included: age, gender, race, educational level, duration of stay in dormitory, and victimization experience. Gender and race were measured at the nominal level, age, and duration of stay at the ratio level, and educational status at the ordinal level. Victimization experience was arranged dichotomously. Respondents were asked whether they had ever been victimized in/around their dormitory or if they know of someone who had such experience. Their responses were coded as 0 = "No Victimization Experience" and 1 = "Having 1 or more Victimization Experience either of themselves or others."

Data analysis and results

A one-tailed t-test was used to determine whether the average safety perceptions of each site's residents differed. The null hypothesis was that there is no statistically significant difference between the two group means; H_0: *HC*= *LC*, which suggests that differences between the two facilities – in terms of environmental design – do not significantly affect the perception of safety among residents.

A series of nested regression models were used to examine the correlations between students' perception of safety and their residential facilities across the three dependent variables. Within each series of regression modeling, Model 1 assessed the influence of residing in one of the two sites on the residents' perception of safety (overall, inside and outside, respectively). Model 2 considered the effect of participants' demographic characteristics. Thus, age, gender, educational standing, and race were added to the model. Finally, Model 3 added previous victimization experience and duration of stay in residential facilities to the equation to examine a full model of location, demographics, and past victimization experience.

Descriptive statistics

Table 2 summarizes the descriptive statistics of the study variables. The table presents several central findings. First, the residents of HC, on average, reported an overall perception of safety of 7.12, while LC residents, on average, showed a lower perception of safety: 5.34. Second, the respondents from both residences were approximately the same age on average (HC, M = 21 vs. LC, M = 19.5), the number of male and female participants was intentionally kept equal, and the average duration of stay of HC and LC residents was also approximately the same (HC, M = 1.7 years vs. LC, M = 1.4 years). Third, the proportions of freshmen and non-Americans in the population differed according to residence: Freshmen HC, N = 11 (22%) vs. LC, N = 19 (38%); Non-Americans HC, N = 6 (12%) vs. LC, N = 12 (24%). The greater number of newcomers and foreign students in LC indicates a possible impact on the average safety perception of its residents. Fourth, HC participants had a higher rate of past victimization compared to LC respondents [HC (14%) vs. LC (10%)], although they showed a higher level of safety perception. This was an interesting finding – suggesting that better environmental design can compensate for the influence of past victimization experience on perception of safety.

T-test results

The descriptive statistics clearly indicate higher average safety perception for HC residents. Additionally, t-tests were used to determine if there were statistically significant differences between the group means of safety perceptions of residents of each facility. The average perception of safety of HC residents was significantly higher than that of LC inhabitants: t (99) = 2.99, $p < .01$. The t-test results indicated a statistically significant difference at the .05 significance level between the group means of LC and HC residences, rejecting the null hypothesis of the study and suggesting that the two groups were significantly different in their perceptions of safety. Figure 3 contains a boxplot to further illustrate the differences revealed in the means tests.

Table 2. Descriptive statistics for the variables used in the analyses.

	Mean	Std. Dev	Range	Number
Low Conformity Buildings (LC)				
Dependent Variables				
Perception of Safety	5.85	1.31	3–10	50
Individual Rooms	5.44	1.83	2–9	50
Personal Belongings	5.24	1.94	2–10	50
Safety in Halls	5.29	1.95	3–10	50
Walking at Night	5.32	1.69	2–8	50
Independent Variables				
Age	19.5	.48	18–23	50
Male	.5	.51	0–1	25
Freshman	.38	.3	0–1	9
Non-American	.24	.5	0–1	12
Duration of Stay	1.4	.8	>1–4<	50
Victimization Experience	.1	.4	0–1	5
High Conformity Buildings (HC)				
Dependent Variables				
Perception of Safety	6.24	.96	3–10	50
Individual Rooms	6.8	1.68	2–10	50
Personal Belongings	5.72	1.71	3–10	50
Safety in Halls	6.08	1.38	1–10	50
Walking at Night	5.92	1.55	2–10	50
Independent Variables				
Age	21	.43	18–25	50
Male	.5	.53	0–1	25
Freshman	.22	.27	0–1	11
Non-American	.12	.39	0–1	6
Duration of Stay	1.7	.91	>1–4<	50
Victimization Experience	.14	.18	0–1	7

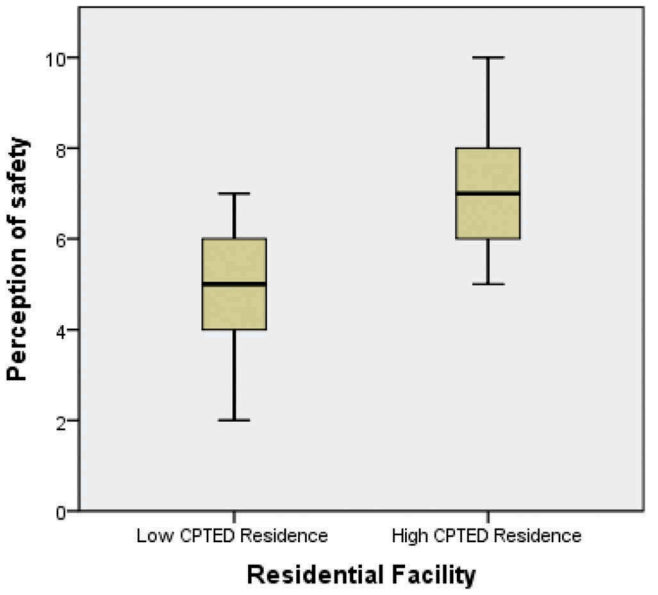

Figure 3. Differences in perception of overall safety.

Regression results

Table 3 presents the results of the three regression models predicting residents' overall perception of safety. Model 1 indicated that living in the HC was positively correlated with higher safety perception. In Model 2, with the addition of demographic variables, location (residing dorm) remained

Table 3. Regression models explaining overall perception of safety.

	Model 1		Model 2		Model 3	
Independent Variables	β Coefficient	SE	β Coefficient	SE	β Coefficient	SE
HC	.29***	.398	.19**	.415	.11**	.284
Age			1.28	.631	.73	.647
Male			.48	.315	.39	.774
Freshman			−.05*	.491	−.04*	.895
Non-American			−.76*	.716	−.43*	.617
Duration of Stay					1.06	.603
Victimization Experience					−.43	.711
R-Squared		.29		.56		.63

*$p < .1$; **$p < .05$; ***$p < .01$.

significant, keeping the same directional relationship. Two of the other four variables – freshman and non-American – were found to be significant determinants of residents' perception of safety, which inversely affected the outcome variable. Finally, Model 3 demonstrated the same results for location and demographic variables in terms of significance and direction, with some slight changes in numbers. However, previous victimization and duration of stay were not significantly related to safety perceptions. Of particular importance is that the HC variable remained significant across all models in the same direction after controlling for all independent variables. Lastly, the R^2 across the models ranged from .35 to .57 indicating that the added variables improved the overall explanatory power of the collected variables.

To further explore the impact of residential location on participants' perception of safety, two additional sets of regression models were run. One which assesses the influence of CPTED on perceptions of safety *inside* residential facilities and the other which assesses the influence of safety perceptions *outside* residential facilities in the surrounding areas. The purpose of estimating these models was to determine whether the influence of CPTED was limited to the specific facilities themselves or whether the benefits extended to improved perceptions of safety in other nearby campus areas. Hence, the dependent variables of the new models were perception of safety inside the facilities and in the surrounding areas, respectively. The independent variables were the same as previous models (i.e., location, demographics, duration of stay and victimization experience).

Table 4 reports the results of the three regression models explaining residents' perception of safety inside the facilities. Model 1 indicated that residential location significantly affects perception of safety inside the facilities at .01 level. Following the inclusion of four demographic variables (i.e., age, male, freshman, and non-American) in Model 2, being a freshman was found to be negatively related to perception of safety inside the facilities and residing location is still a significant factor though its significance level dropped to .05. In Model 3, duration of stay and victimization experience were controlled for, showing that location of residence and freshman remained significant while none of

Table 4. Regression models explaining perception of safety inside residential facilities.

	Model 1		Model 2		Model 3	
Independent Variables	β Coefficient	SE	β Coefficient	SE	β Coefficient	SE
HC	.41**	.448	.38*	.356	.33*	.342
Age			1.09	.843	.98	.653
Male			.5	.768	.66	.732
Freshman			−.08*	.678	−.06*	.923
Non-American			−.61	.817	−.57	.745
Duration of Stay					1.06	.637
Victimization Experience					−.56	.784
R-Squared		.35		.52		.57

*$p < .1$; **$p < .05$; ***$p < .01$.

Table 5. Regression models explaining perception of safety outside residential facilities.

	Model 1		Model 2		Model 3	
Independent Variables	β Coefficient	SE	β Coefficient	SE	β Coefficient	SE
HC	.38**	.346	.32**	.319	.13*	.456
Age			1.89	.816	.98	.814
Male			.45*	.739	.36*	.794
Freshman			−.06	.675	−.08	.818
Non-American			−.69*	.884	−.53	.784
Duration of Stay					1.13*	.611
Victimization Experience					−.34*	.809
R-Squared		.38		.61		.75

*$p < .1$; **$p < .05$; ***$p < .01$.

the newly added control variables were found to be a significant determinant of perception of safety inside the buildings.

Table 5 presents the results of the regression models predicting participants' perception of safety outside their residential facilities. Model 1 suggests that living in the high CPTED facility was positively related to higher safety perception in the surrounding areas. Model 2 showed the same result for location and also revealed the impact of gender and being a non-American on the dependent variable – both in the expected directions. Finally, Model 3 estimated the full model demonstrating that residing in HC and being a male remained significant. It further revealed that respondents' perception of safety in the surrounding areas is not only influenced by their gender and location but also by duration of stay and victimization experience.

Discussion and conclusion

Although CPTED strategies have been empirically evaluated since the 1970s, the effect of CPTED on campus residents' fear of crime remains understudied. This study sought to narrow this gap by comparing the safety perceptions of the residents of two different dormitories located at a large public research university. The focus was to determine whether residents of the facility with design features that conform with CPTED principles were more likely to have higher perception of safety compared to residents of the low CPTED residence.

The t-test results revealed significant differences in perceptions of safety of residents of the two locations overall, as well as in different situations. Residents of the high CPTED structure on average reported higher perceptions of safety in their individual rooms, surrounding areas, and shared halls and buildings, and for their personal belongings – compared to inhabitants of the low conformity building. To further evaluate these results, a series of nested models were estimated. All models supported the main hypothesis of the study, suggesting that residential facility is a significant predictor of on-campus residents' perception of safety. This finding held constant after controlling for all independent variables. Equally important is that the higher CPTED levels also seemed to produce a "diffusion effect" which resulted in improved perceptions of safety in the areas surrounding the residential facility. The diffusion of benefit has been reported extensively in the situational crime prevention literature (Bowers, Johnson, Guerette, Summers, & Poynton, 2011; Clarke & Weisburd, 1994; Guerette & Bowers, 2009). In addition, through systematic observations, the level of CPTED use was evaluated in the two facilities. Considerable differences in architectural design, physical landscape, and neighborhood cohesion were distinguished. These findings provide further evidence of the effectiveness of the CPTED approach in promoting safety through reducing fear of crime. Understanding these differences can improve preventive efforts for on-campus residential facilities.

Although this study offers a step forward in assessing CPTED and fear of crime in a campus setting, several limitations should be considered. The first limitation is the possibility of external factors' influences when the situations do not allow to determine if differences are due to the CPTED

application or other factors. To address this, several, but not all, key factors that can contribute to safety perceptions were held constant in the two different settings. For example, some respondents may have perceived HC facility as safer simply because it was newer and fresher aesthetically, not because of the more secured design. This particular possibility was not accounted for in the current study and remains for future research. To minimize the possibility of common source bias that could arise from the self-reported data of perception of safety and level of CPTED obtained from the same survey, a list of CPTED indicators was developed and each residential hall was scored through in-site observations.

Another potential constraint is the study's reliance on a convenience sample of student residents which presents a possibility of bias in the survey responses. This is less of a concern because the sample was representative of the respective apartment population. The sample was drawn over multiple days and multiple time periods, and the sample size drawn from each facility was a relatively high proportion of overall resident numbers. Finally, it remains unclear whether the findings of this study are generalizable to other universities in the United States. The study setting may differ from other universities in terms of social, cultural, community, and economic context. Therefore, this study might be replicated at other universities in different areas to determine the extent of design influences on student perceptions of safety.

Despite these limitations, the study provides support for CPTED theory and its application in the university context, highlights the impact of campus environmental design on students' perception of safety, and offers CPTED as a viable preventive approach. Methodologically, the operational definitions developed for the CPTED concepts herein could be used by university administrators as a benchmark for campus environmental design. Continued inquiry will improve existing understanding of the association between university communities' perception of safety and campus environmental design. Replication of this research, with additional data sources, offers to provide a more detailed understanding of the determinants of campus residents' perception of crime and safety.

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