The Cumulative Risk Model to encompass perceived urban safety and well-being

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Abstract
The Cumulative Risk Model (CRM) has usually been applied to developmental and quality of life psychology; however, the CRM could also be applied to the urban safety and personal well-being of people living in urban environments, since cities are complex, multi-risk scenarios. This paper presents two studies meant to provide evidence in support of this hypothesis. The first study (N=287) was aimed to create and validate a set of scales to measure the cumulative risk index and to pilot study two. Study two (N = 540), instead, aimed at showing how a higher number of risk factors is associated to a higher level of perception of insecurity/fear of crime and a smaller level of wellbeing/satisfaction with life and provided consistent correlational evidence, controlling for the neighborhood effect. These studies showed that the CRM can be used to study urban safety issues, since perception of personal safety, fear of crime and well-being are multidimensional constructs, and are affected by a large series of environmental and psychosocial risk factors. The CRM could have significant applications for policymaking and urban renovation.

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1. Safety and well-being in the urban environment: cities as multi-risk contexts

Guaranteeing safety for urban residents has become one of the most critical problems of our time (Amerio, 1999; Ferguson & Mindel, 2007). Personal safety has been studied mostly in terms of psychological reactions to crime and in particular fear of crime (Amerio & Roccato, 2007), that can be defined as an apprehension of attacks and of their psychological and (or) physiological consequences (Brantingham & Brantingham, 1997). According to psychological research on the subject, perceived urban insecurity, and the consequent fear of crime, can have negative psychological consequences (anxiety, distrust, dissatisfaction, etc.). Perceived urban insecurity is also associated with specific coping strategies that may have further negative personal and social consequences (reduction of social activities, moving to other areas of the city considered safer, etc.; Amerio & Roccato, 2007; Skogan & Maxfield, 1981). Safety is often one of the most desired attribute of a neighborhood and it is considered to contribute to quality of life (Conde & Pina, 2014). Safety is also one of the features inhabitants always consider when assessing their own residential neighborhood, a preference that is consistently displayed across different cultures and languages (Bonaiuto *et al.*, 2015; Mao *et al.*, 2015).

The key to reduce perceived insecurity is to understand its antecedents, i.e., the factors affecting it. Previous research has consistently identified two major types of perceived urban insecurity antecedents: *environmental factors* and *community factors* (Gifford, 2007). Several *environmental factors* have been found to affect the perception of safety, with people reporting more crime in old neighborhoods, with denser housing designs, with high traffic and commercial or industrial land uses mixed amongst the residences (Taylor, 2002). Moreover, visibility usually associated to public lightning and open spaces, seems a key feature for perceived safety since it enables individuals to supervise and control the situation, and adapt to it (Hall, 1966; Appleton, 1975). Consistently, the availability of shelter and way outs favoring protection or escape routes from dangerous situations is also associated to perceived safety (Loewen, Steel & Suedfeld, 1993; Nasar & Fisher, 1993).

Some aspects of urban space design can also affect and increase perceived safety, particularly easing or preventing behaviors that affect the safety perception. According to the Defensible Space Theory (Newman, 1972), for instance, certain design features such as real or symbolic barriers separating public from private territory, and designs that allow owners to observe suspicious activities around their property, increase residents' sense of security and decrease crime in the area (see also Sommer, 1987; Casteel & Peek-Asa, 2000).

However, these places and neighborhoods are also settings for the social relations and the interactions of people and communities that share these physical spaces. Unsurprisingly, residents show less fear of crime when they have a strong sense of community (Riger, LeBailly & Gordon, 1981; Skogan & Maxfield, 1981). Thus, higher social capital is found to be associated not only to lower rates of homicide, assault, robbery, and burglary but also to increased participation in formal local organizations, and to decreasing perceptions of personal insecurity and fear of crime (Kawaki, Kennedy & Wilkinson, 1999; Sampson & Groves, 1989). In fact, social capital seems to mediate the association between crime and neighborhood conditions of disadvantage (Kruger, Reischl, & Gee, 2007). Overall, both environmental and community related factors contribute to people's perceived safety/insecurity and thus ultimately to their well-being. Indeed, perceived security and fear of crime ultimately affect residents' well-being, quality of life and satisfaction with life (Garofalo & Laub, 1978; Motl *et al.*, 2006). On the one hand, features usually associated to perceived insecurity and fear of crime are often associated to loss of well-being and negative physical health consequences (Ross & Mirowsky, 2001); on the other hand, positive social and environmental features (e.g., presence of nature) are found to increase people's well-being and life satisfaction (Venhoeven *et al.*, 2018). Some studies also found a relationship between socio-physical neighborhoods features and residential neighborhood attachment (Bonaiuto *et al.*, 1999; Fornara *et al.*, 2018).

2. The Cumulative Risk Model: from developmental psychology to the environmental psychology domain

Forty years ago, studying the risk factors of children development, Rutter was the first researcher to apply a cumulative risk model. Studying the factors affecting childhood psychiatric disorders, he found significant increased effects as risk factors accumulated. While no single risk factor by itself increased risk for mental disorder, the presence of two to six risk factors contributed to fourfold and tenfold increases in mental disorder, respectively (Rutter, 1979).

In the CRM, a dichotomous classification of risk exposure is determined for each personal or environmental construct, typically by a statistical cutoff (greater than one standard deviation above the mean) or based on a conceptual categorization (e.g., gender, age, poverty, etc.). A cumulative risk index is then calculated by simply adding the dichotomized risks categories (Evans, 2003). Since its conceptualization, the CRM has been mainly applied to developmental issues and suggests that the effect of multiple risk factors is often cumulative: as the number of risk factors experienced by an individual (a child, in Rutter's case) rises, the likelihood of negative outcomes increase (Evans, 2003; Evans & Marcynyszyn, 2004; Greenberg *et al.*, 1999). Compared to the traditional risk models that tend to isolate the effects of singular risk factors (Covington & Taylor, 1991; Hale, 1996; Hunter, 1978; Merry, 1981; Lewis & Salem, 1986; Skogan & Maxfield, 1981), the CRM allows accounting for the exponential consequences of experiencing a large number of risk factors; such effects are undetectable when considering risk factors individually. Since cities are multi-place complex environments (Bonnes & Secchiaroli, 1992; Bonnes & Secchiaroli, 1995; Zani, Cicognani & Albanesi, 2001), and

the perception of urban security is influenced by a large series of factors, the CRM appears an appropriate framework, with its associated array of methodological tools, to study perceptions of insecurity and well-being in the urban context

However, most urban safety models tend to isolate the effects of different factors (Covington & Taylor, 1991). Models traditionally employed to analyze urban risk factors (e.g., *indirect victimization model,* Skogan & Maxfield, 1981; *community concern model*, Conklin, 1975, *incivilities model*, Hunter, 1978; Lewis & Salem, 1986; *subcultural diversities model*, Merry, 1981) tend to isolate the effects of specific factors (Covington & Taylor, 1991). Instead, the CRM allows a more "ecological" approach to risk (Bronfenbrenner, 1979), taking into account a larger series of factors (of different nature). This would be consistent with the complexity and dynamic nature of the urban context, where it is unlikely to be confronted to only one specific risk at a time or to a specific and stable pattern of risks. Instead, it is more common to face changing, unstable and dynamic configurations of risks, mixing in line with broader contemporary VUCA (Volatility, Uncertainty, Complexity, Ambiguity) scenarios. Given the multidimensional characteristic of the safety issue (Amerio & Roccato, 2007) and the large number of factors that may influence it (Skogan & Maxfield, 1981), it is plausible to apply a cumulative risk model to the analysis of its negative consequences on city inhabitants.

The application of a cumulative risk model (Evans, 2003; Evans, 2004; Evans & Marcynyszyn, 2004) would allow analyzing the effects of the multiple risk factors involved in the perception of safety and fear of crime and well-being within the residential neighborhood urban scenarios.

3. Assessing the CRM in urban scenarios

An ecological approach (Becker, 1995; Bronfenbrenner, 1979) could help to clarify how complex dynamics featuring risk factors co-occurrence may impact the perception of personal safety, fear of crime, and well-being. Therefore, the present studies aim to apply the cumulative risk model to assess the effects of multiple risk exposure on urban residential perception of safety, fear of crime and well-being/satisfaction with life. The first study aims to create and validate the research tool and to provide preliminary evidence of the expected relationships between the variables; while the second study is fully devoted to the test of two main substantial hypotheses via the adoption of two independent samples procedure to measure predictors and criteria.

4. Study 1

4.1. Aims

Integrating the literature about cumulative risk model (Evans, 2003; Evans, 2004; Evans & Marcynyszyn, 2004; Greenberg *et al*., 1999; Lengua, 2002) with the one about perception of safety and fear of crime (Amerio & Roccato, 2007; Ferraro & LaGrange, 1992; Sampson & Raudenbush, 1999), this first study aims at validating the necessary research tools, as well as to offer a preliminary test of the cumulative effects of multiple risk factors on resident's perception of insecurity/fear of crime, and as an ultimate variable, on resident's well-being/satisfaction with life.

In order to be able to compare residents living in neighborhoods affected by different levels of urban risks, data were collected in three different Roman neighborhoods, which are representative of different levels of perceived safety. A pilot study allowed choosing three Roman neighborhoods – i.e., Parioli, Tiburtino and Centocelle - as representative, at the time of data gathering, of a "safe" (Parioli), an "intermediate" (Tiburtino) and an "unsafe" (Centocelle) neighborhood of Rome. Collecting data in these three different neighborhoods was expected to provide a wide range of experienced risks across contexts, allowing testing the cumulative risk model.

The independent variables (the so-called risk factors) of the present study are the following:

1. Gender (being a woman is considered as a risk factor)
2. Age (being older is considered as a risk factor)
3. Monthly salary (a lower salary is considered as a risk factor)
4. Perceived physical disorder (higher score is considered as a risk factor)
5. Perceived social disorder (higher score is considered as a risk factor)
6. Perceived neighborhood violence (higher score is considered as a risk factor)
7. Victimization (higher score is considered as a risk factor)
8. Police presence (lower score is considered as a risk factor)
9. Sense of community (lower score is considered as a risk factor)
10. Neighbors ties (lower score is considered as a risk factor)
11. Informal social control (lower score is considered as a risk factor)
12. Psychological health (lower score is considered as a risk factor)
13. Perceived stress (higher score is considered as a risk factor)
14. Negative affect (higher score is considered as a risk factor)

The dependent variables (criteria) are the following:

1. Perceived insecurity/fear of crime
2. Well-being/satisfaction with life.

Specifically, study 1 aimed at:

1) developing a reliable measurement tool for each of the following CRM *predictors*: Perceived physical disorder, perceived social disorder, perceived neighborhood violence, victimization, police presence, sense of community, neighbors' ties, informal social control, psychological health, perceived stress, negative affect;

2) developing a reliable measurement tool for each of the following CRM *criteria*: perceived safety, fear of

crime, well-being, satisfaction with life;

3) exploring if, in the same sample, the number of risk factors is both associated to insecurity/fear of crime (positively) and to wellbeing/satisfaction with life (negatively).

4.2. Method

4.2.1. *Sample*

Data were collected in Rome, Italy; 287 residents of the neighborhoods of Parioli (n = 89), Tiburtino (n = 97) and Centocelle (n= 101) participated in the study (mean age = 41.6, SD = 18.5; years of residence in the neighborhood M = 43.5, SD = 17.5; 95.5% Italians, 52.5% female, 30.7% earning 1000 Euros per month or less, 40.1% earning between 1000 and 2000 Euros per month, 22.6% earning 2000 Euros or more per month).

4.2.2. *Instrument*

The instrument consisted of a self-administered questionnaire composed by two main sections. A map of the specific inhabitants' residential neighborhood was also provided in the second page of the questionnaire, with a list of the streets corresponding to the borders of the neighborhood, in order to make sure that all interviewees from the same neighborhood were referring exactly to the same urban area.

Section 1 contained 13 assessment scales measuring the predictors (see table 1), while section 2 contained 4 assessment scales measuring the criteria (see table 2) and the socio-demographic information.

Scale	Authors	Number of items	Rating scale
Sense of community	Prezza, Costantini, Chiarolanza & di Marco (1999)	13 items; Example of item: "I feel I belong to this neighborhood"	from 1 = *completely disagree,* to 5 = *completely agree*
Whole neighborhood satisfaction scale	Bonaiuto, Fornara & Bonnes (2006)	3 items; Example of item: "Would you recommend this neighborhood to some friend of yours who is looking for an apartment for renting/sale?"	from 1 = *not at all* to 5 = *completely*
Informal social control	Sampson, Raudenbush & Earls, 1997	4 items; Example of item: "Would you say that your neighbors could be counted on to take action if children were spray painting graffiti on a local building?"	from 1 = *very likely* to 5= *very unlikely*
Neighbourhood ties	Sampson & Raudenbush, 2004	4 items; Example of item: "In your neighborhood, how often do you loan things to one another?"	from 1= *never* to 5 = *frequently*
Perceived neighbourhood violence	Sampson, Raudenbush & Earls, 1997	6 Item; Example of item: "During the past 6 months, how often a sexual assault had occurred in your neighborhood?"	from 1 = *never* to 5 = *frequently*
Victimization	Austin, Furr & Spine, 2002	2 items; Example of item: "Have you or anyone you know in this neighborhood ever had their home broken into and/or something stolen?"	from 1 = *never* to 5 = *frequently*
Police presence	Ferguson & Mindel, 2007	2 items; Example of item: "How often have you seen in your neighborhood a police officer searching or frisking anyone or breaking up groups or arresting anyone?"	from 1 = *never* to 5 = *frequently*
Perceived physical disorder	adapted from Sampson & Raudenbush, 1999	8 items from the original version + 6 new items[1]; Example of item: How much each of the following items (e.g., gang graffiti) is present in your neighborhood.	from 1 = *not at all* to 5 = *very much*

[1] 6 items were added to the original scale on the basis of a qualitative piloting results about neighborhood features that affect perceived physical and social disorder in Rome:

a) Home appliance and furniture abandoned by the street;
b) Barracks /caravans (like those owned by the gypsies);
c) Lack of illumination at night;
d) Good maintenance of the buildings;
e) Good maintenance of the streets;
f) Good maintenance of the green areas.

Perceived social disorder	Sampson & Raudenbush (1999)	5 items from the original version + 5 new items[2]; Example of item: How much each of the following items (e.g., adults fighting or hostilely arguing) is present in your neighborhood.	from 1 = *not at all* to 5 = *very much*
Perceived Safety	Austin, Furr & Spine, 2002; Ferraro & LaGrange, 1987)	9 items Example of item: "People who live in this neighborhood have to worry about someone breaking into their home to steal things"	from 1 = *completely disagree* to 5 = *completely agree*

Table 1: assessment measures included in section 1 (CRM predictors).

Scale	**Authors**	**Number of items**	**Rating scale**
Well-being/satisfaction with life	adapted from Pavot & Diener, 1993	5 items; Example of item: "In most ways my life is close to my ideal"	from 1 = *completely disagree* to 5 = *completely agree*
Perceived stress	Cohen, Kamarck, & Mermelstein 1983	4 items; Example of item: "How often, in the last month, have you felt that you were unable to control the important things in your life?"	from 1 = *never* to 5 = *very often*
Psychological health	Berwick, Murphy, Goldman, Ware, Barsky & Weinstein, 1991	5 items; Example of item: "How often, in the last month, you felt so down in the dumps that nothing could cheer you up?"	from 1= *never* to 5 = *very often*
Negative affect scale	Watson, Clark & Tellegen, 1988	10 items; Example of item: "Indicate to what extent you generally feel this way (e.g., upset), that is, how you feel on average"	from 1 = *not at all* to 5 = *very much*

Table 2: assessment measures included in section 2 (CRM criteria).

4.2.3. *Procedure*

Data were collected between the months of November 2008 and March 2009 in the Roman neighborhoods of Parioli, Tiburtino and Centocelle. Data collection was suspended during December 2008, in order to avoid the peculiarity of the city during Christmas time (e.g., brighter lights in the streets and enhanced illumination in the shops' windows), which could have affected people's responses to the survey.

Participants were recruited on the streets or in main informal areas of the neighborhoods and asked to participate in a research project about their neighborhood.

4.3. Results

4.3.1. *Aim 1*

In order to fulfill Aim 1, a Principal Component Analysis (PCA) was conducted for each CRM predictors' scales, and Chronbach's *alpha* were computed, with the exception of the victimization (Austin *et al.*, 2002), and police presence[3] scales (Ferguson & Mindel, 2007) that counted less than 4 items (it is commonly accepted that a small number of items can deflate the alpha value). The sense of community scale (Prezza *et al*., 1999) was merged to the whole neighborhood satisfaction scale (Bonaiuto *et al*., 2006) because of the high correlation

[2] 5 items were added to the original scale on the basis of a qualitative piloting results about neighborhood features that affect perceived physical and social disorder in Rome:

a) Beggars by the streets;
b) Car-windows cleaners and/or sellers at the traffic lights;
c) Homeless people;
d) Illegal peddler by the streets/squares;
e) Immigrants.

[3] Police presence scale (Ferguson & Mindel, 2007) was reduced to one item; the item "*How often have you seen in your neighborhood a police officer searching or frisking anyone in your neighborhood or breaking up groups or arresting anyone?*" was taken out from the subsequent analyses because it was negatively correlated with the second item of the scale.

between the two scales (r = .83, p < .001). Analyses showed a mono-factorial structure for all the scales. Table 3 presents the final range of saturations, eigenvalues, and Chronbach's alpha of the CRM predictors' scales.

Scales	*Range of saturations*	*Eigenvalues 1; 2; 3*	*Cronbach's Alpha (N of items)*
Sense of community[4]	.82 - .24	5.50; 1.95; 1.18	.86 (15)
Informal social control	.86 - .64	2.45; .76; .42	.79 (4)
Neighbor ties	.84 - .75	2.57; .60; .53	.81 (4)
Perceived neighborhood violence	.77 - .74	3.48; .87; .55	.85 (6)
Victimization			.61 (2)*
Perceived physical disorder	.79 - .40	4.76; 2.36; 1.38	.85 (13)
Perceived social disorder	.82 - .46	3.97; 1.43; 1.21	.82 (10)

*since Victimization was composed of two items, reliability was calculated as Pearson's *r*.

Table 3. Range of *saturations*, *eigenvalues*, and Chronbach's *alpha* of the CRM predictors' scale

4.3.2. Aim 2

Principal Component Analyses (PCA) were performed on CRM criteria's scales, and Chronbach's alpha were subsequently computed. Perceived safety scale (reversed into "perceived insecurity"; Austin, et al. 2002), perceived risk scale (Ferguson & Mindel, 2007), concern about crime scale (Amerio & Roccato, 2005), and fear of crime scale (Ferraro & LaGrange, 1992) were merged into one scale, named perception of insecurity/fear of crime, because of their high inter-correlation (see table 4). Table 5 summarizes the results of the final factor analyses, and each scale's reliability scores.

	Perceived insecurity	*Perceived risk*	*Concern about crime*	*Fear of crime*
Perceived insecurity	1	.70**	.70**	.58**
Perceived risk		1	.48**	.47**
Concern about crime			1	.36**
Fear of crime				1

**p < .001 (one tailed test)

Table 4. Pearson's correlations for perceived insecurity, perceived risk, concern about crime, and fear of crime (N= 287)

Scales	*Range of saturations*	*Eigenvalues 1; 2; 3*	*Cronbach's Alpha (N of items)*
Perception of safety/fear of crime	.81 - .35	7.68; 1.98; 1.73	.90 (22)
Well-being/satisfaction with life	.86 - .72	3.20; .64; .45	.85 (5)
Perceived stress	.78 - .68	2.17; .80; .54	.72 (4)
Psychological health	.78 - .66	2.57; .80; .69	.75 (5)
Negative affect	.78 - .49	4.70; 1.04; .97	.87 (10)

Table 5. Range of *saturations*, *eigenvalues*, and Chronbach's *alpha* of the CRM criteria scales

[4] The item "*In this neighborhood there are some feasts or recurrences that involve the majority of the residents*" from Prezza *et al.* (1999) was taken out from the subsequent analyses because of its lower saturation (.27).

4.3.3. *Aim 3*

For each of the environmental, psychosocial and individual risk factors, risk was defined as scores larger than one standard deviation above the mean for the entire sample (Evans, 2003). Only for psychosocial characteristics "positively oriented" (the higher the score, the lesser the perceived discomfort) such as police presence, sense of community, neighbors' ties and informal social control, risk was defined for scores lower than minus one standard deviation below the mean for the entire sample. Each risk factor was defined dichotomously (0 = absence of risk; 1 = presence of risk): cumulative risk was defined as the simple, un-weighted sum of fourteen risk factors (Evans 2003), named the Cumulative Risk Index (CRI).

Table 6 provides descriptive information on each of the fourteen risk factors composing the CRI and on the two outcome variables. For the analyses of perception of personal safety, fear of crime and well-being/satisfaction with life, cumulative risks of seven or more risks were combined into one category given the small sample sizes from eight to fourteen risk factors. As a result, 9.3% of the sample had no risk factor, 22.4% had one risk factor, 22.8% had two risk factors, 20.5% had three risk factors, 9% had four risk factors, 6.3% had five risk factors, 4.1% had six risk factors, and 5.6% had seven or more risk factors.

Table 7 and figure 1 illustrate the effects of CRI exposure on perception of insecurity/fear of crime and well-being/satisfaction with life. Consistently with Aim 3, data showed that as the numbers of risk factors rises, perception of insecurity and fear of crime increase (β = .37, t = 6.60, $p < .001$; R^2 = .14; F (1, 266) = 43.44), while well-being/satisfaction with life decreases (β = -.41, t = -7.35, $p < .001$; R^2 = .17; F (1, 266) = 54.08). Particularly, having three or four risk factors seems to lead significantly higher Insecurity/fear of crime than having indiscriminately zero, one, or two. Having five or six risk factors is associated to even higher Insecurity/fear of crime, and having seven or more risks further increases

Measure	*Mean*	*Standard Deviation*	*Proportion of the sample with risk factor*
Risk factors			
Gender (M/F)			.52
Age	43.5	17.5	.17
Monthly salary (0/4)	2.03	.96	.33
Perceived physical disorder	3.00	.63	.14
Perceived social disorder	3.12	.69	.15
Perceived neighborhood violence	2.02	.74	.16
Victimization	2.18	.96	.12
Police presence	3.00	1.16	.11
Sense of community	3.37	.55	.17
Neighbors ties	2.49	.89	.19
Informal social control	2.64	.84	.19
Psychological health	2.60	.67	.15
Perceived stress	2.58	.67	.21
Negative affect	2.10	.65	.15
Cumulative risk (0/14)	2.66	2.02	
Outcome variables			
Perceived insecurity/Fear of crime	2.92	.64	
Well-being/satisfaction with life	3.38	.70	

Table 6. Descriptive statistics on cumulative risk factors and outcome variables (N = 287)

	Number of cumulative risks							
Variable	0	1	2	3	4	5	6	7 and more
Insecurity/ fear of crime	2.57[a]	2.70[a]	2.83[a]	2.96[b]	3.09[b]	3.22[c]	3.35[c]	3.48[d]
Well-being/satisfaction with life	3.78[a]	3.63[b]	3.48[b]	3.33[c]	3.18[c]	3.03[c]	2.88[d]	2.73[d]

Note: numbers correspond to means; different letters indicate significant differences among the means ($p < .001$).

Table 7. Relation of cumulative risk to perception of safety/fear of crime and well-being/satisfaction with life (N = 287)

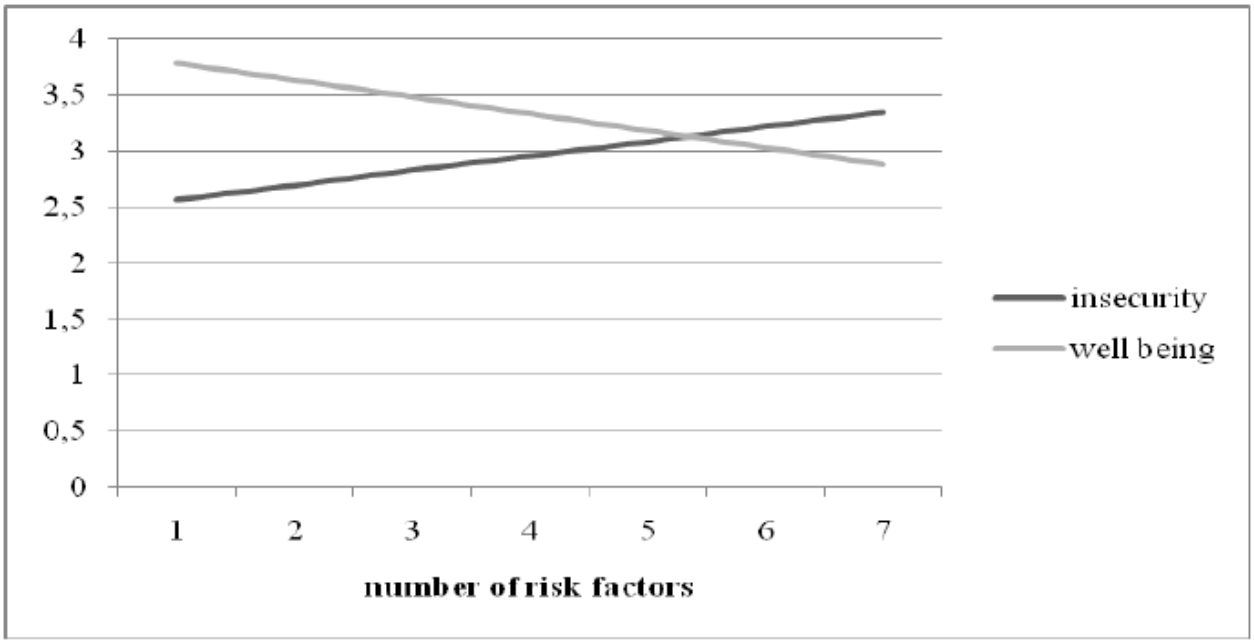

Figure 1. Regression of Perceived Insecurity and Well-being on the number of risk factors (N = 287)

it. On the other hand, having one or two risk factors already decreases well-being/satisfaction with life compared to having zero risk factors. Having three, four or five risk factors is associated to even lower scores of well-being/satisfaction with life; having six or more risk factors further decreases this score.

4.4. Discussion

Principal component analyses and internal consistency indicators have shown that predictors and criteria were adequately measured with the scales at hand.

Regression analyses show a positive association between the number of risks and insecurity/fear of crime, and a negative association between number of risks and well-being/satisfaction with life. As the number of factors rises, insecurity and fear of crime increase, while well-being and satisfaction with life decrease, in line with the tradition of studies of cumulative risk effects on developmental outcomes (Evans, 2003; Evans, 2004; Evans & Marcynyszyn, 2004).

This preliminary study thus provided some reliable scales for measuring both CRM predictors and CRM criteria for the urban safety issue, and it gave preliminary evidence of the association between number of risks, wellbeing and fear of crime.

Study 2 employed these scales in order to test the CRM in the urban safety issue context.

5. Study 2

5.1. Aims and hypotheses

Aiming to test the CRM in the urban safety context, this study chose to employ two different samples in order to separately measure CRM predictors and CRM criteria. As suggested by the literature about neighborhood effects (Leventhal & Brooks-Gunn, 2000) and environmental psychology methods (Winkel, Saegert, & Evans, 2009), the sample used for the community survey and the observation of the neighborhood (i.e., the risk predictors level) should be independent from the sample of residents providing broader evaluations about general perception of insecurity/fear of crime and well-being/satisfaction with life (i.e., the criteria level).

For instance, asking the same subject about perceived neighborhood violence or police presence and then about the levels of fear of crime s/he experiences, could probably hint to the participant that a link is expected between these variables, thus inflating estimates of main effects of environmental factors (e.g., physical disorder) on safety/fear of crime and well-being/satisfaction with life (Winkel *et al*., 2009).Thus, in the present study, one smaller sample (named "the observers") provides an observational report of the neighborhood characteristics answering to items about: sense of community, whole neighborhood satisfaction, informal social control, neighbors ties, perceived neighborhood violence, victimization, police presence, perceived social and physical disorder; in addition to that, negative affect and socio-demographic questions were included. A separate, bigger sample (named "the criteria") was recruited for more general measures of perception of insecurity/fear of crime, well-being/satisfaction with life, psychological measures of health, stress and affect; socio-demographic variables were included too. The same variables described for Study 1 were assessed in Study 2 (see section 4.1).

The hypotheses to verify in study 2 are thus as follows:

H1: A higher number of risk factors in the "observers" sample is expected to be associated to a higher level of perception of insecurity/fear of crime in the "criteria" sample.

H2: A higher number of risk factors in the "observers" sample is expected to be associated to a lower level of perception of well-being/satisfaction with life in the "criteria" sample.

5.2. Method

5.2.1. *Sample*

Five hundred-fifty residents of three neighborhoods of Rome (i.e., Parioli, Tiburtino, Centocelle) participated in the study. One hundred eighty-two participants (61 in Parioli, 60 in Tiburtino, 61 in Centocelle) filled in the "observers" questionnaire (age M=46.5, SD=16.9; years of residence in the neighborhood M=25.8, SD=16.7; 97.3% Italians, 52.2% women; 33% had a salary of 1000 Euros per month at most, 49.5% had a salary between 1000 and 2000 Euros per month, 13.7% had a salary of more than 2000 Euros per month).

Three hundred fifty-eight participants (119 in Parioli, 118 in Tiburtino, 121 in Centocelle) filled in the "criteria" questionnaire (age M=47.8, SD=17.9; years of residence in the neighborhood M=26.4, SD=21.3; 93.6% Italians, 51.7% women; 29.1% had a salary of 1000 euro per month at most, 44.7% had a salary between 1000 and 2000 Euros per month, 15.7% had a salary of more than 2000 Euros per month)[5].

5.2.2. *Instruments*

The "observers" questionnaire contained the CRM predictors described for Study 1 (see Table 1). The questionnaire included also the Negative affect scale (Waston, Clark & Tellegen, 1987), and measures for Socio-demographic indicators.

The "criteria" questionnaire contained the CRM criteria measures, already employed in study 1 (see Table 2), and the socio-demographic information.

5.2.3. *Procedure*

The same data collection procedure employed for study 1 was applied for study 2. Participants were told about the anonymity of the questionnaire and about the length of filling in the questionnaire (about 15 minutes for the "observers" questionnaire, and about 10 minutes for the "criteria" one).

5.3. Results

Since data were collected on two different samples, before calculating the cumulative risk index on the "criteria" sample, a direct discriminant function analysis was computed on the "observers" sample using the neighbourhood of residence as the grouping variable. The perceived *environmental risk* factors (i.e., perceived physical disorder, perceived social disorder) and the *psychosocial risk* factors (i.e., sense of community, neighbor ties, informal social control, and perceived neighborhood violence) were considered as predictor variables.

In order to determine which variables discriminate between the neighborhoods, two discriminant functions were calculated with a combined χ^2 (12) = 103.84, $p < .001$; after removal of the first function: χ^2 (5) = 26.58, $p < .001$. The two functions could therefore be retained. The two discriminant functions accounted for 76.8% and 23.2%, respectively, of the between group variability[6]. The loading matrix of correlations between predictors and discriminant functions, as seen in Table 8, shows that the first function is composed by perceived social disorder, perceived physical disorder and perceived neighborhood violence. The first function was named "disorder and violence". Centocelle's residents have higher perceptions of social disorder (mean = 3.59) than Tiburtino's (mean = 3.63) and Parioli's (mean = 2.67); they also have higher perceptions of physical disorder (mean = 3.38) than Tiburtino's (mean = 3.10) and Parioli's (mean = 2.61) residents, and higher perceptions of perceived neighborhood violence (mean = 2.51) than Tiburtino's (mean = 1.92) and Parioli's residents (mean = 1.76).

The second function is composed by neighborhood ties, informal social control and sense of community; the second function was called "social capital". Tiburtino's residents have lower neighbors ties (mean = 2.11) than Parioli's (mean = 2.74) and Centocelle's (mean = 2.79); they have lower informal social control (mean = 2.17) than Parioli's (mean = 2.81) and Centocelle's (mean = 2.28), and also lower sense of community (mean = 3.08) than Parioli's (mean = 3.49) and Centocelle's residents (mean = 3.13). The plots of the three group centroids on function 1 and function 2 are shown in Figure 2. The Bonferroni contrasts performed showed there are significant differences among the three neighborhoods on the function "disorder and violence". The three neighborhoods differ one from another; F (2, 179) = 38.95, $p < .05$. For "social capital", Tiburtino neighborhood differed from Parioli and Centocelle (F = (2,179) = 9.59, $p < .05$).

Concerning the first function "disorder and violence", the value 0 (no risk) is assigned to Parioli; the value 1 (presence of risk) is assigned to Tiburtino and the value 2 (presence of higher risk) is assigned to Centocelle. This is the only case here where the risk factor was not dichotomized, since data demonstrated there is a significant difference among the three neighborhoods. Concerning the second function "social capital", the value 0 (absence of risk) was assigned to Parioli and Centocelle, and the value 1 (presence of risk) to Tiburtino. Through this strategy, it is possible to add these two new risk factors to the cumulative risk index of the "criteria"

[5] No significant difference was detected across the two samples on the distributions of gender, education, occupation, monthly salary, marital status and nationality (χ^2s' *p*s all > .23). Similarly, mean levels of age and years of residence in the neighborhood did not differ across samples (*p*s > .49).

[6] The variable "victimization" was kept out of the analyses because of its similar correlation with the two functions (.26 on function 1, .34 on function 2), and in order to achieve a simple structure of the two functions.

sample.

	Correlations of predictor variable with discriminant functions			Pooled within group correlations Among predictors					
Predictor variable	1	2	Univariate F (2,179)	Perceived social disorder	Perceived physical disorder	Perceived neighborhood violence	Neighborhood ties	Informal social control	Sense of community
Perceived social disorder	.77	-.46	32.58	1	.67	.34	-.25	-.19	-.38
Perceived physical disorder	.75	-.24	28.20		1	.34	-.26	-.24	-.40
Perceived neighborhood violence	.60	-.33	19.29			1	-.05	-.02	-.45
Neighborhood ties	.04	.83	10.01				1	.52	.62
Informal social control	-.32	.51	8.85					1	.52
Sense of community	-.28	.39	6.14						1

Table 8. Discriminant function analysis of perceived environmental and psychosocial risk factors

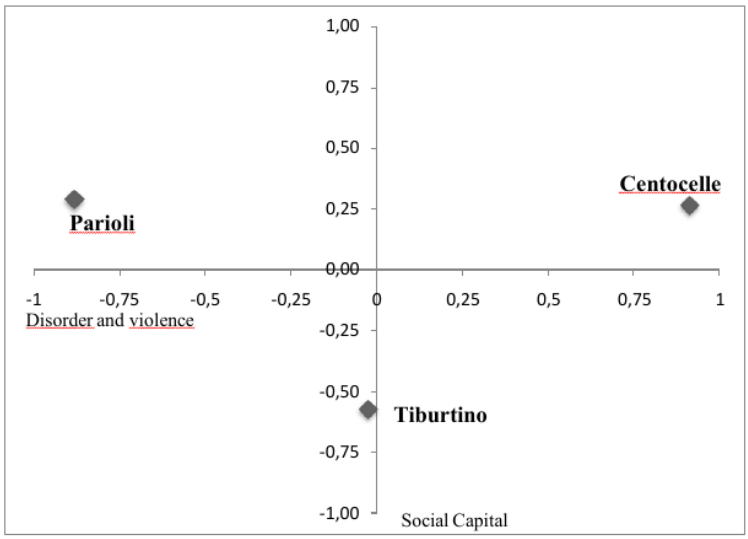

Figure 2. Plots of the three group centroids on "Disorder and Violence" (function 1) and "Social Capital" (function 2)

Table 9 provides descriptive information on each of the risk factors composing the CRI; 13.8% of the sample had one risk factor, 30.3% had two risk factors, 25.3% had three risk factors, 16.9% had four risk factors, 9.4% had five risk factors, and 4.4% had six or more risk factors.

For the analyses of perception of insecurity/fear of crime and well-being/satisfaction with life, cumulative risks of six or more risks were combined into one category given the small sample sizes from seven to eight risk factors.

Measure	*Mean*	*Standard deviation*	*Proportion of the sample with risk factor*
Risk factors			
Gender (M/F)			.52
Age	47.8	17.8	.24
Monthly salary (0/4)	1.91	.83	.32
Disorder and violence (0/2)	1.00	.47	.34
Social capital (0/1)	.33	.82	.33
Psychological health	2.80	.74	.17
Perceived stress	2.71	.69	.18
Negative affect	2.48	.71	.18
Cumulative risk (0/8)	2.92	1.37	
Outcome variables			
Insecurity/Fear of crime	3.19	.83	
Well-being/satisfaction with life	3.15	.80	

Table 9. Descriptive statistics on cumulative risk factors and outcome variables (N = 358)

In order to test H1 and H2, each risk factor was defined dichotomously (0 = absence of risk; 1 = presence of risk) on the basis of statistical or theoretical criteria. Cumulative risk was defined as the simple, un-weighted sum of the risk factors, including the new ones emerged by the discriminant analysis (Evans 2003). A Cumulative Risk Index (CRI) was obtained by adding each single risk factor one to the other to test all the hypotheses of the present study.

Table 10 and Figure 3 illustrate the effects of CRI exposure on insecurity/fear of crime and well-being/satisfaction with life. Coherently with the initial hypotheses, data showed that as the numbers of risk factors rises, insecurity/fear of crime increases (β = .41, t = 7.93, p < .001; R^2 = .16; F (1, 318) = 62. 4) (H1), while well-being/satisfaction with life decreases (β = -.29, t = -7.35, p < .001; R^2 = .09; F (1, 318) = . 29.91, p < .001) (H2). Particularly, having two, three or four risk factors seems to lead to significantly higher Insecurity/fear of crime than having indiscriminately zero or one; having five or more risk factors is associated to even higher Insecurity/fear of crime. On the other hand, having two or more risk factors indiscriminately decreases well-being/satisfaction with life compared to having zero or one risk factors.

Number of cumulative risks

Variable	0	1	2	3	4	5	6 and more
Insecurity/ Fear of crime	2.55[a]	2.76[a]	2.97[b]	3.18[b]	3.39[b]	3.60[c]	3.81[c]
Well-being/satisfaction with life	3.60[a]	3.44[a]	3.28[b]	3.12[b]	2.96[b]	2.80[b]	2.64[b]

Note: numbers correspond to means; different letters indicate significant differences among the means (p < .001).

Table 10. Relation of cumulative risk to insecurity/fear of crime and well-being/satisfaction with life (N = 358)

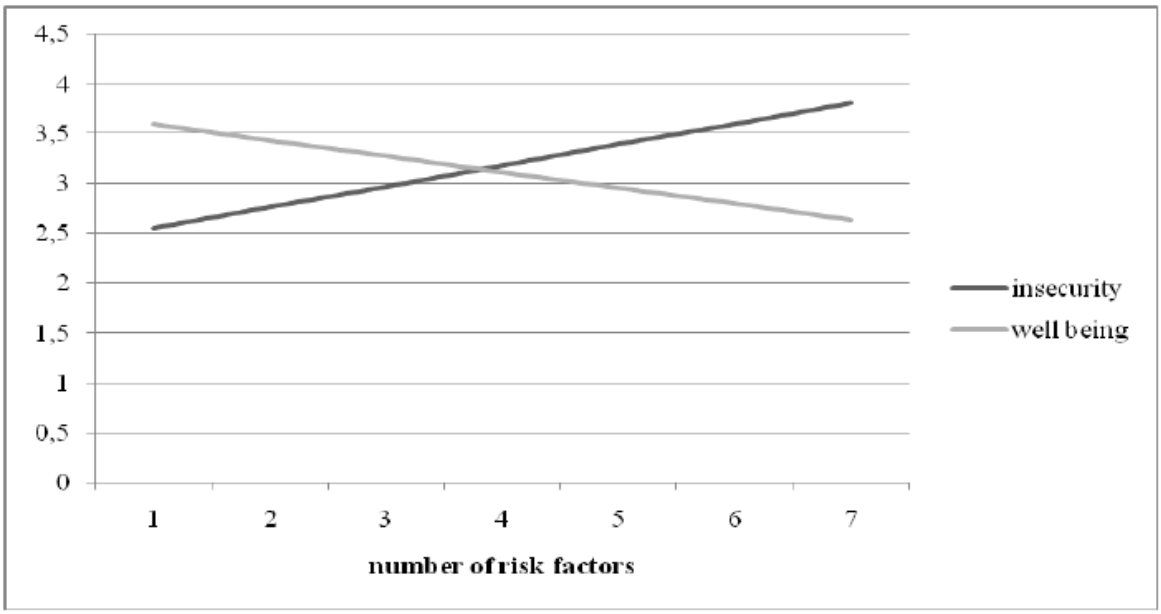

Figure 3. Regression of Perceived Insecurity and Well-being on the number of risk factors

5.4. Discussion

A cumulative risk model was applied in order to assess its effects on perception of insecurity/fear of crime and well-being/satisfaction with life via two independent samples of residents in three Rome neighborhoods: Parioli, Tiburtino, and Centocelle. One sample reported the physical and psychosocial characteristics of their neighborhood (predictor variables), while a different sample reported perception of insecurity/fear of crime and of well-being/satisfaction with life (criterion variables).

The direct discriminant function analysis computed on the "observers" sample showed the presence of two functions for distinguishing among Centocelle, Parioli and Tiburtino neighborhoods. The first function, named "disorder and violence", was composed by perceived social disorder, perceived physical disorder and perceived neighborhood violence. The second function was named "social capital", and it was composed by neighbors' ties, informal social control and sense of community. The two functions "disorder and violence" and "social capital" were added to the risk factors of the criteria sample in order to calculate the cumulative risk index. This was possible because the two separate "observers" and "criteria" samples had the variable "neighborhood of residence" in common.

Concerning the test of the hypotheses, results showed a significant effect of cumulative risk both on perception of insecurity/fear of crime (H1) and well-being/satisfaction with life (H2). As anticipated, as the number of risk factors rises, insecurity and fear of crime increase, while well-being and satisfaction with life decrease. These results suggest the presence of a linear model of cumulative risk (Sameroff *et al.*, 1998; Appleyard *et al.*, 2005) in line with the tradition of studies of cumulative risk effects on developmental outcomes (Evans, 2003; Evans, 2004; Evans & Marcynyszyn, 2004).

From an applied and policy-oriented perspective, the CRM could inform local municipal administrators and decision-makers involved in the issue of urban safety and wellbeing. CRM would help to know the amount of risk perception people experience and the most common risk factors in a given area. The CRM could be employed to compare different urban areas or to test the efficacy of urban interventions, easily showing if the number of risk factors has decreased after the intervention.

6. General discussion

A Cumulative Risk Model (Evans, 2003; Evans, 2004; Evans & Marcynyszyn, 2004), traditionally applied to developmental issues, was proposed here for assessing perception of safety and fear of crime (and well-being/satisfaction with life as an ultimate variable) within a large metropolitan urban environment, namely the city of Rome. Both results of Study 1 (conducted on a single sample of residents) and Study 2 (conducted on two separate samples of residents in order to independently measure predictors and criteria variables) confirmed the cumulative effects of multiple risk factors on perception of insecurity/fear of crime (positively) and well-being/satisfaction with life (negatively). Data showed that as the number of risk factors rise, perception of insecurity/fear of crime increases, while well-being/satisfaction with life decreases. The direction of such effects is conceptually in line with the theoretical model and with previous empirical results.

Results of the present research evidenced the presence of a linear model of cumulative risk exposure (Appleyard *et al.*, 2005), i.e., the growth of the negative consequences of risk exposure (insecurity perception, loss of wellbeing) is proportional to the number of present risk factors, and follows a monotonic linear

progression as cumulative risk increases. Traditional approaches, focusing on of the role of singular risk factors may thus lead to underestimate the level of risk exposure that people face, especially in complex urban contexts, where many different risks may co-occur (Appleyard *et al.*, 2005). Beside the possibility of considering the complex variety of coexisting risks, another strength of the CRM in this context is that, for risks measured by metric scales an individual's cumulative risk index includes only risks which intensity goes beyond one standard deviation from the general mean. Therefore, the cumulative risk index does not include every single risk the individual perceives or feels, but it reflects exposure to the most severe levels of risk, highlighting the risks that are significantly more relevant for the individual.

It should also be acknowledged that dichotomization and summation of risk exposure can be considered arbitrary and minimalist, consisting in a loss of information about variables and their associations (Greenberg *et al*., 1999; Szatmari, Shannon & Offord, 1994), and therefore a potential limitation of the approach described herein. Focusing on the *number* of risks rather than the *types* of risks implies that all the risk factors are considered as having the same impact on the outcome, while research reports how some variables might be more relevant than others for perception of safety/fear of crime and well-being/satisfaction with life (e.g., Pantazis, 2000). Some methodological solutions, such as testing the separate role of some risk factors - especially social and socio-demographic risk factors- as moderators of the relationship between the cumulative risk index and fear of crime and/or wellbeing, could try to couple the ecological approach of the CRM with indicators of the specific importance of a given risk factor.

As a further limitation of this study, one could point to concerns related to reliance on self-report data of risk factors. In contrast with some previous research, (e.g., Sampson & Raudenbush, 1999) no census data, systematic observation, or police data were used herein. More objective data would be suitable for further studies on the issue. A possible development regards therefore the use of behavioural measures as criteria variables, both overt behaviors and neurophysiological indexes. Along the same line of reasoning, a welcome development would consist in setting up laboratory experiments where risk factors can be manipulated and behavioural modifications measured in order to investigate in a more controlled setting the possible cause-effect relationships implied by the CRM. This could be achieved by designing standard urban layouts on which single risk factors can be presented according to a cumulative logic, i.e., in terms of increasing or decreasing elements added to or subtracted from a standard urban layout, and then by presenting the different scenarios to measure a number of behavioural and neurophysiological indexes in the target subject. However, unlike to our studies, such an approach would risk reducing external and ecological validity of results.

From an applied perspective, the present studies suggest that politics and local (neighborhood) communities should consider insecurity perception and residents' well-being as the result of the combination of multiple factors, encompassing social (both at an individual and community level) and physical neighborhood features. Their intervention should try to deal with all these different factors, since focusing on isolated risk factors may fall short in significantly improve people's neighborhood and life experience. It is clear that intervention to tackle one risk factor or the other may be very different, ranging from social policies to urban design. Thus, for example, solely enhancing police presence in an unsafe neighborhood most probably will not affect the perception of insecurity among the residents, because the many other risk factors that characterize their neighborhood, e.g. like physical and social decay, lack of social support, etc. would be still intact. Rather a more systemic approach should target several of the major risk factors, after a diagnosis has been carried out in order to identify priorities. Under this respect, of course, the CRM can be useful to assign priorities in terms of vulnerability by comparing exposure to multiple risk factors across targets, e.g., across inhabitants groups or neighborhoods, etc.. The possibility of applying CRM in both ecological settings and laboratory procedures opens the possibility to monitor inhabitants reactions to contemporary urban scenarios with varying degree of risk factors: this kind of knowledge could greatly help the design of new urban environments as well as the management of the existing ones, in order to increase the social sustainability of contemporary urban life.

7. References

Amerio, P. & Roccato, M. (2005). A predictive model for psychological reactions to crime in Italy: An analysis of fear of crime and concern about crime as a social problem. *Journal of Community and Applied Social Psychology*, 15, 17-28.

Amerio, P. & Roccato, M. (2007). Psychological reactions to crime in Italy: 2002-2004. *Journal of Community Psychology*, 35, 91-102.

Amerio, P. (1999). Dimensioni della sicurezza. In P. Amerio (Ed.). *Il senso della sicurezza*. Milano: Unicopli, pp. 15-22.

Appleyard, K., Egeland, B., van Dulmen, M.H.M. & Sroufe, L.A. (2005). When more is not better: The role of cumulative risk in child behavior outcomes. *Journal of Child Psychology and Psychiatry*, 46, 235-245.

Austin, D.M., Furr, L.A. & Spine, M. (2002). The effects of neighborhoods conditions on perceptions of safety. *Journal of Criminal Justice*, 30, 417-427

Becker, F. (1995*). Workplace by design: Mapping the high-performance workscape*. Jossey-Bass Publishers, San Francisco.

Berwick, D.M., Murphy, J.M., Goldman, P.A., Ware, J.E., Barsky, A.J. & Weinstein, M.C. (1991). Performance of a five-item mental health screening test, *Medical Care*, 29, 169-176.

Bonaiuto, M., Fornara, F. & Bonnes, M. (2006). Perceived residential environment quality in middle- and low-extension italian cities. *Revue Européenne de Psychologie Appliquée – European Review of Applied Psychology*, 56, 23-34.

Bonaiuto, M., Fornara, F., Ariccio, S., Ganucci Cancellieri, U., & Rahimi, L. (2015). Perceived Residential Environment Quality Indicators (PREQIs) relevance for UN-HABITAT City Prosperity Index (CPI). Habitat International, 45, 53–63.

Bonaiuto, M., Aiello, A., Perugini, M., Bonnes, M., Ercolani, A.P. (1999). Multidimensional perception of residential environment quality and neighbourhood attachment in the urban environment. *Journal of Environmental Psychology*, 19, 331–352.

Bonnes, M., & Secchiaroli, G. (1995). *Environmental psychology: A psycho-social introduction* (C. Montagna, Trans.). Thousand Oaks, CA, US: Sage Publications, Inc.

Bonnes, M., Secchiaroli, G. (1992). *Psicologia ambientale. Introduzione alla psicologia sociale dell'ambiente*. Roma: Carocci.

Brantingham, P.J. & Brantingham, P.L. (1997). Understanding and controlling crime and fear of crime: Conflicts and trade-offs in crime prevention planning. In S.P. Lab (Ed.), *Crime Prevention at a Crossroads.* Anderson, Cincinnati, OH.Bronfenbrenner U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.

Casteel, C. & Peek-Asa, C. (2000). Effectiveness of crime prevention through environmental design (CPTED) in reducing robberies. *American Journal of Preventive Medicine*, 18, 99-115.

Cohen, S., Kamarck, T. & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Psychology*, 24, pp 385-396.

Conde, K., & Pina, S. (2014). Urban dimensions for neighborhoods with higher environmental value. The Sustainable City IX.

Conklin, J.E. (1975). *The impact of crime*. New York: Macmillan.

Covington, J. & Taylor, R.B. (1991). Fear of crime in urban residential neighbourhoods: Implications of between- and within-neighbourhood sources for current models. *The Sociological Quarterly,* 32, 231-249.

Diener, E., Suh, E.M., Lucas, R.E. & Smith, H.L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, 125, 276-302.

Evans, G.W. & Marcynyszyn, L.A. (2004). Environmental justice, cumulative environmental risk, and health among low- and middle-income children in upstate New York. *American Journal of Public Health*, 94, 1942-1944.

Evans, G.W. (2003). A multimethodological analysis of cumulative risk and allostatic load among rural children. *Developmental Psychology*, 39, 924-933.

Evans, G.W. (2004). The environment of childhood poverty. *American Psychologist*, 59, 77-92.

Ferguson, K.M. & Mindel, C.H. (2007). Modeling fear of crime in Dallas neighborhoods: A test of social capital theory. *Crime & Delinquency*, 53, 322- 349.

Ferraro, K.F. & LaGrange, R.L. (1987). The measurement of fear of crime. *Sociological Inquiry*, 57, 70-101.

Ferraro, K.F. & LaGrange, R.L. (1992). Are older people most afraid of crime? Reconsidering age differences in fear of victimization. *Journal of Gerontology*, 47, S233–S244.

Fornara, F., Ariccio, S., Rioux, L., Moffat, E., Mariette, J.-Y., Bonnes, M., & Bonaiuto, M. (2018). Vérification de la structure factorielle et de la fiabilité des preqis en France et test d'un modèle de prédiction de l'attachement au quartier : une étude sur un échantillon parisien. *Pratiques Psychologiques*, 24(2), 131–156.

Garofalo, J. & Laub, J. (1978). The fear of crime: Broadening our perspective. *Victimology*, 3, 242-253.

Gifford, R. (2007). *Environmental psychology: principles and practice*. Canada: Optimal Books.

Greenberg, M.T., Lengua, L.J., Coie, J.D. & Pinderhughes, E.E. (1999). Predicting developmental outcomes at school entry using a multiple-risk model: Four American communities. *Developmental Psychology*, 35, 403-417.

Hale, C. (1996). Fear of crime: A review of the literature. *International Review of Victimology*, 4, 79-150.

Hall, E.T. (1966). *The hidden dimension.* New York: Doubleday.

Hunter, A. (1978). *Symbols of incivility: Social disorder and fear of crime in urban neighborhoods*. Annual Meeting of the American Society of Criminology, Dallas, Texas.

Kawaki, I., Kennedy, B.P. & Wilkinson, R.G. (1999). Crime: Social disorganization and relative deprivation. *Social Science & Medicine*, 48, 719-731.

Kruger, D.J., Reischl, T.M. & Gee, G.C. (2007). Neighborhood social conditions mediate the association between physical deterioration and mental health. *American Journal of Community Psychology*, 40, 261-271.

Leventhal, T. & Brooks-Gunn, J. (2000). The neighborhood they live in: the effects of neighborhood residence on child and adolescent outcomes, *Psychological Bulletin*, 126, 309-337.

Lewis, D.A. & Salem, G. (1986). *Fear of crime: Incivility and the production of a social problem.* New Brunswick, NJ: Transaction Books.

Loewen, L.J., Steel, G.D. & Suedfeld, P. (1993). Perceived safety from crime in the urban environment. *Journal of environmental psychology,* 13, 323-331.

Mao, Y., Fornara, F., Manca, S., Bonnes, M., & Bonaiuto, M. (2015). Perceived Residential Environment Quality Indicators and neighborhood attachment: A confirmation study on a Chinese sample in Chongqing. *PsyCh Journal*, 4(3), 123–137.

Merry S.E. (1981). *Urban danger*. Philadelphia: Temple University Press.

Miceli, R., Roccato, M. & Rosato, R. (2004). Fear of Crime in Italy: Spread and determinants. *Environment and Behavior*, 36, 776-789.

Motl, R. W., Dishman, R. K., Saunders, R. P., Dowda, M., & Pate, R. R. (2006). Perceptions of Physical and Social Environment Variables and Self-Efficacy as Correlates of Self-Reported Physical Activity Among Adolescent Girls. *Journal of Pediatric Psychology*, 32(1), 6–12.

Nasar, J. L., & Fisher, B. (1993). 'Hot spots' of fear and crime: A multi-method investigation. *Journal of Environmental Psychology,* 13, 187-206.

Newman, O. (1972). *Defensible space*. New York: Macmillan.

Pantazis, C. (2000). Fear of crime, vulnerability and poverty. *British Journal of Criminology*, 40, 414-436.

Pavot, W. & Diener, E. (1993). Review of the Satisfaction With Life Scale. *Psychological Assessment*, 5, 164-172.

Prezza, M., Costantini, S., Chiarolanza, V. & di Marco, S. (1999). La scala italiana del senso di comunità (The Italian sense of community scale). *Psicologia della Salute*, 3, 135-159.

Riger S., LeBailly R.K. & Gordon M.T. (1981). Community ties and urbanites' fear of crime: An ecological investigation. *American Journal of Community Psychology*, 9, 653-665.

Ross, C., & Mirowsky, J. (2001). Neighborhood disadvantage, disorder, and health. *Journal of health and social behavior*, 258-276.

Rountree, P.W. (1998). A re-examination of the crime-fear linkage. *Journal of Research in Crime and Delinquency*, 35, 341-372.

Rutter, M. (1979). Protective factors in children's responses to stress and disadvantage. In M.W. Kent & J.E. Rolf (Eds.), *Primary prevention of psychopathology, Vol. 3: Social competence in children* (p. 49-74). Hanover, NH: University of New England Press.

Sameroff, A.J., Bartko, W.T., Baldwin, A., Baldwin, C. & Seifer, R. (1998). Family and social influences on the development of child competence. In M. Lewis & C. Feiring (Eds.), *Families, risk, and competence* (161-183). Mahwah, NJ: Erlbaum.

Sampson, R.J. & Groves, W.B. (1989). Community structure and crime: Testing social disorganization theory. *American Journal of Sociology*, 94, 774-802.

Sampson, R.J. & Raudenbush, S.W. (1999). Systematic social observation of public spaces: A new look at disorder in urban neighborhoods. *American Journal of Sociology*, 105, 603-651.

Sampson, R.J., Raudenbush, S.W., Earls F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science*, 227, 918-923.

Sampson, R.J., Raudenbush, S.W., (2004). Seeing disorder: Neighborhood stigma and the social construction of "Broken Windows". *Social Psychology Quarterly*, 67, 319-342.

Skogan, W.G. & Maxfield, G.M. (1981). *Coping with crime: Individual and Neighborhood reactions.* Sage, London.

Sommer, R. (1987). Crime and vandalism in university residence halls: A confirmation of defensible space theory. *Journal of Environmental Psychology*, 7, 1-12.

Szatmari, P., Shannon, H.S. & Offord, D.R. (1994). Models of multiple risk: Psychiatric disorder and poor school performance. *International Journal of Methods in Psychiatric Research*, 4, 231-240.

Taylor, R.B. (2002). Crime Prevention through Environmental Design (CPTED): Yes, no, maybe, unknowable, and all of the above. In R.B. Bechtel, A. Churchman (Eds.). *Handbook of Environmental Psychology*, New York: Wiley, pp. 413-427

Venhoeven, L., Taufik, D., Steg, L., Bonaiuto, M., Bonnes, M., Ariccio, S., De Dominicis, S., Scopelliti, M., van den Bosch, M., Piff, P., Zhang, J.W., Keltner, D. (2018) The role of nature and environment in behavioural medicine. In W. Bird & M. van den Bosch (Eds). *Nature and Public Health: The Role of Nature in Improving the Health of a Population.* Oxford: Oxford University Press (p. 89-94). ISBN: 9780198725916.

Watson, D., Clark, L.A. & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063-1070.

Winkel, G., Saegert, S. & Evans, G.W. (2009). An ecological perspective on theory, methods, and analysis in environmental psychology: Advances and challenges. *Journal of Environmental Psychology*, 29, 318-328.

Zani, B., Cicognani, E. & Albanesi, C. (2001). Adolescents' sense of community and feeling of unsafety in the urban environment. *Journal of Community & Applied Social Psychology*, 11, 457-489.