



# Crime Is Down and so Is Fear? Analyzing Resident Perceptions of Neighborhood Unsafety in Rotterdam, the Netherlands

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## Abstract

There is little research on how resident perceptions of neighborhood unsafety develop over time and how changes in these perceptions relate to decreasing crime rates. The present study analyzes and explains trends in perceived neighborhood unsafety within the Dutch city of Rotterdam, based on survey and register data collected in the years 2003–2017 ( $N=148,344$ , 62 neighborhoods). In addition to crime, we also assess to what extent (changes in) the economic status, level of ethnic heterogeneity, degree of residential mobility, and amount of disorder in the neighborhood play a role in how safe or unsafe inhabitants have felt in a 15-year period. We find that unsafety levels steadily declined in the years up to 2007. This decrease was best explained by changes regarding the economic status, victimization rates and disorder level of neighborhoods. After a sudden increase in feelings of unsafety between 2007 and 2008, explained by the shift towards using more self-administrated questionnaires, fear levels stabilized during the remaining years (2008–2017) although recorded crime levels continued to decrease in this period.

**Keywords** Fear of crime · Neighborhoods · Crime · Feelings of unsafety

## Introduction

Various cities across Europe and Northern America have seen their crime rates dropping since the 1990s or early 2000s (Tonry, 2014; Van Dijk et al. 2012). There has been extensive research on what has caused crime to decline. Explanations relate to changes in demographics, policies, imprisonment, and drugs markets (Farrell et al., 2014; Sharkey, 2018; Zimring, 2008). So far, the potential societal consequences of this development have been largely overlooked. Little is known about whether and how these declining crime rates have impacted or improved people's sense of safety over time (for an exception, see Skogan, 2011). This is surprising, since crime is considered one of the relevant determinants of fear of crime (Breetzke & Pearson, 2014; Brunton-Smith & Sturgis, 2011).

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Only a few studies have addressed the over-time dynamics of fear, resulting in mixed empirical evidence. According to some criminologists, fear levels are relatively stable over time and do not really respond to fluctuations in crime rates (Ditton et al., 2000; Warr, 1995). In contrast, more recent studies demonstrate that fear levels do follow crime trends: these scholars observed that fear levels, similarly to crime, have also fallen (Skogan, 2011; Smeets & Foekens, 2018). It is, however, unlikely that fear levels are entirely consistent with changes in crime rates. Researchers have repeatedly pointed out that there are mismatches between the level of crime and individual-level fear rates (Covington & Taylor, 1991; Hooghe & De Vroome, 2016). This inconsistency between crime and fear is a recurring theme within the fear-of-crime literature (Rountree, 1998).

Overall, limited research exists on whether and why fear rises or declines over time and to what extent such trends can be attributed to changing levels of crime. The current study aims to address these questions by analyzing repeated survey data on resident perceptions of neighborhood unsafety, in combination with administrative data. The data were collected in Rotterdam, the second most populous municipality of the Netherlands. The surveys were conducted over a period of 15 years, from 2003 to 2017. More specifically, we have analyzed 11 waves of the Rotterdam Safety Index ( $N=148,344$  in 62 neighborhoods). Like other European cities, Rotterdam has experienced a clear decline in crime numbers (Akkermans, 2015; Lub and De Leeuw 2017). This trend is summarized in the graph below, which displays a selection of the number of recorded crimes at the municipality level.<sup>1</sup> After a slight increase, recorded crime in Rotterdam fell by almost 50 percent.

The amount of crime is not the only determinant that has been linked to perceived unsafety. Fear-of-crime researchers have identified a much broader set of factors that help to explain patterns of fear. The current study mainly focuses on the characteristics of the local residential environment. In addition to crime, we take into consideration the following characteristics: economic status, level of ethnic heterogeneity, degree of residential mobility, and amount of disorder. These factors will be assessed at the spatial level of the neighborhood. The expectation is that changes in each neighborhood condition may have had an independent influence on how safe or unsafe the inhabitants of Rotterdam have felt in their neighborhood. The two main aims of the current study can be summarized as follows:

1. Describing how the level of perceived neighborhood unsafety has developed in the city of Rotterdam, between the years 2003 and 2017
2. Explaining the observed trends, by examining to what extent changes in the amount of crime, economic status, level of ethnic heterogeneity, degree of residential mobility, and presence of disorder have played a role in how unsafe inhabitants of Rotterdam have felt in this period

This article proceeds as follows. The theoretical framework consists of three parts. In the first two parts, we further review the existing literature and research on fear of crime and explore how (changing) neighborhood conditions can account for changes in fear levels. In the third part, we briefly discuss the case of Rotterdam and its situation with regard to safety and unsafety. We then describe the data and analytical strategies

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<sup>1</sup> The following crimes are included: burglaries, illegal drug trade, robberies, (aggravated) assault, battery, rape and sexual assaults, child sexual abuse, and manslaughter and murder.

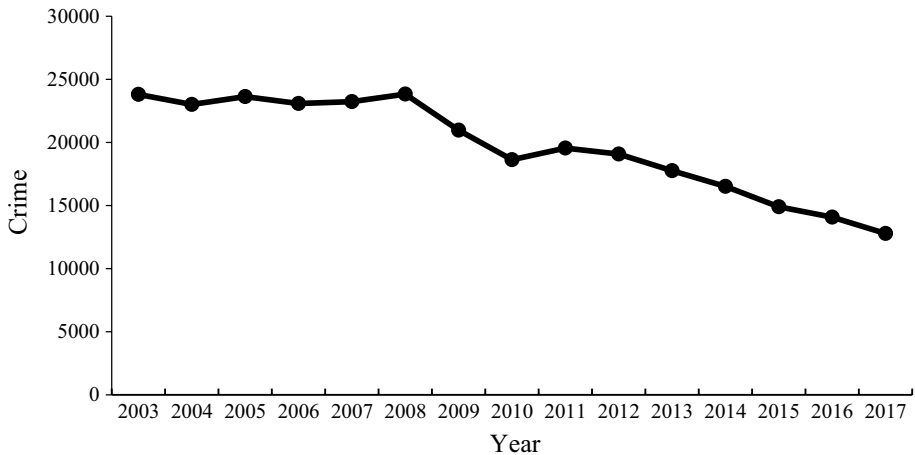
in more detail and also discuss how changes in survey mode may impact the observed level of unsafety. Afterwards, the trends in perceived unsafety are inspected, and we discuss the results of the multilevel analyses. We finish with a discussion and conclusion to position the findings within the broader literature.

## Theoretical Framework

### The (In)Stability of Fear

It is a popular belief that although crime has decreased in many countries, citizens still feel unsafe and they continue to worry about crime (Skogan, 2011; Smeets & Foekens, 2018). Researchers have coined a term for this mismatch between beliefs and the objective risk of becoming a victim: the reassurance gap (Innes, 2004). Moreover, according to Ditton and colleagues (2000), a “criminological maxim” exists which means that “rates of fear may climb when crime rates climb, but fail to fall when crime rates fall” (p. 143). Research has provided empirical evidence to support the existence of a widening gap between crime statistics and fear levels. More specifically, British and Scottish crime surveys conducted in the 1990s and early 2000s show that although crime rates were falling during this period, fear levels remained unchanged (Ditton et al., 2000; Innes & Fielding, 2002). Other researchers observed small but consistent increases in feelings of unsafety across the entire European Union in the years 1996–2002 (Barker & Crawford, 2006). These figures demonstrate that people may be concerned about or afraid of crime without experiencing actual victimization. It also suggests that other factors, besides crime, may shape perceptions of risk and fear (Ferraro, 1995). Scholars have, for instance, considered how certain policing strategies can be effective in bringing down crime and disorder while increasing the probability of feeling unsafe. For instance, increased police activity on the street may remind residents of the problems in their neighborhood and make them believe that crime has increased (Hinkle & Weisburd, 2008; Innes, 2004). The news media may also play a negative role: studies have established that media consumption increases perceptions of both crime and fear (Lowry et al., 2003; Pfeiffer et al., 2005, but also see Ditton et al., 2000).

The view that fear levels tend to stabilize or even continue to grow despite lower crime rates has been altered by more recent research. In his study on fear and crime trends in Chicago, Skogan (2011) showed that fear levels decreased “dramatically” in the years between 1994 and 2003. This downward trend was observed across different age, gender, and income groups. Factors that explained the decreasing fear levels include declining crime rates, improved perceptions of neighborhood conditions, and increased confidence in the police. Similar insights on the fear drop came from Smeets and Foekens (2018) who constructed a “fear of crime trend index”, which showed that in the last two decades large parts of the Western world experienced clear drops in fear rates. We expect to find these patterns as well in this study on feelings of unsafety among the inhabitants of Rotterdam. The aim is, however, not only to describe but also to explain trends in fear. With the exception of Skogan’s (2011) study, there is almost no empirical research on how to account for changes in fear over time.



**Fig. 1** Recorded crimes in Rotterdam 2003–2017, including burglaries, illegal drug trade, robberies, (aggravated) assault, battery, rape and sexual assaults, child sexual abuse, and manslaughter and murder

## The Role of Changing Neighborhood Conditions

The existing literature on fear of crime often treats fear as a static phenomenon and mainly relies on data collected at a single point in time to analyze why differences in fear levels exist (e.g., Brunton-Smith & Sturgis, 2011; Collins & Guidry, 2018; Hooghe & De Vroome, 2016). The current study adopts a more dynamic approach. Part of this approach involves identifying conditions that may account for changes in fear (and are themselves subject to change). We focus on processes at the neighborhood level, as individual determinants of fear — such as gender, ethnicity, and class — are often fixed and therefore unable to explain shifts in fear levels. A distinction is made between three different sets of neighborhood characteristics: (1) local crime rates; (2) demographic and economic characteristics of the neighborhood; and (3) disorder. To understand how these neighborhood characteristics may shape perceptions of unsafety, we will also discuss the mechanisms that help explain why and how the neighborhood impacts levels of unsafety.

## Crime

For obvious reasons, the expectation is that the amount of crime in a neighborhood is related to how unsafe people feel. This can be explained by the logic that inhabitants feel less safe when living in a neighborhood where the actual risk of victimization is higher. Because these inhabitants are objectively more likely to become victimized, fear is considered a “rational” response in this case (Brunton-Smith & Sturgis, 2011). A recurring point of discussion in fear-of-crime research is how strong (or weak) the link between crime and fear empirically is, or whether there is any significant relationship at all (Rountree, 1998). Most recent studies have shown that inhabitants living in a residential environment with higher levels of registered crime feel less safe. This relationship has been found in various country contexts, including the USA (Pfeiffer et al. 2005), the UK (Brunton-Smith & Sturgis, 2011), and New Zealand (Breetzke & Pearson, 2014).

In line with recent research, the expectation is that inhabitants of a crime-ridden neighborhood perceive their living environment as being less safe because they are more likely to be victimized. However, the main focus is on how neighborhood crime rates are reflected in feelings of unsafety over time. Because the level of recorded crime is decreasing in Rotterdam — as shown previously in Fig. 1 — the expectation is that inhabitants' perceptions of safety will have improved. An overall decline in crime at the city level, however, does not necessarily mean that every neighborhood has experienced a similar drop in crime. Studies that examined the spatial distribution of the crime drop have shown that the declines are not evenly distributed across city areas (Kirk & Papachristos, 2011; Sharkey, 2018; Weisburd et al., 2004). The same may apply to feelings of unsafety. We will therefore pay close attention to the spatial distribution of fear levels.

It is common knowledge that fear of crime is not only a product of crime, but rather an outcome of various processes. Sacco (2005) expresses this as follows: “changing fear levels over time may be related to shifts in other kinds of conditions that might be related to but are in fact quite separable from changing crime levels” (p. 134). To better understand why inhabitants feel unsafe, scholars should therefore consider how people's fear is influenced by other factors than crime (Jackson, 2004). The present study focuses on how the neighborhood context shapes perceptions of unsafety. The next two sections will therefore examine how neighborhood conditions (other than crime) may be related to (changes in) fear. Despite our focus on the neighborhood, we acknowledge that perceptions of perceived unsafety may also be shaped by processes and conditions that go beyond the neighborhood. This is in line with the idea that fear is more than “fear” alone, and that instead it relates to broader feelings of unease and a more general anxiety about state of the wider society (Farrell et al., 2009).

### **Economic Status, Residential Mobility, and Ethnic Heterogeneity**

Scholars have also addressed how structural characteristics of the neighborhood affect individuals' level of perceived unsafety. The focus has been mainly on the level of economic deprivation, residential mobility and ethnic heterogeneity of a neighborhood. It is expected that all three neighborhood aspects are related to increased fear. Shaw and McKay's (1942) social disorganization theory, originally introduced to explain spatial concentrations of juvenile delinquency, is relevant for understanding this relationship. The theory's main premise is that neighborhoods characterized by deprivation, residential instability, and heterogeneity are often socially disorganized. Inhabitants of these neighborhoods lack the capacity to maintain social order and to combat collective problems, such as deviant and criminal behavior. Social disorganization in a neighborhood may be understood as the product of inhabitants' diminished feelings of self-efficacy combined with their struggle to understand and interpret each other's behavior. Also important in this regard is the concept of “collective efficacy,” defined by Sampson and colleagues (1997) as “social cohesion among neighbors combined with their willingness to intervene on behalf of the common good” (p. 918). People living in socially organized neighborhoods with more collective efficacy are better able to maintain control over their neighborhood and to reduce crime and violence, and, consequently, they experience lower fear levels. A greater sense of control may also directly decrease fear.

According to this line of reasoning, feeling unsafe encompasses more than anxiety about crime or victimization alone. Such feelings instead reflect a broader set of concerns about the breakdown of (the local) community. Contexts that are judged as being unpredictable,

unfamiliar, and beyond the control of oneself or the community may generate a sense of disquiet and, ultimately, of unsafety caused by the feeling that “anything could happen” (Jackson, 2004: p.12). As mentioned previously, we will focus on the role of neighborhood and, more specifically, on how deprivation, diversity, and residential mobility in this context may influence feelings of unsafety both directly and indirectly. Brunton-Smith and Sturgis (2011) express this as follows: “neighbourhood social-structural characteristics are thought [...] to affect fear of crime both indirectly through their influence on criminality and disorder in the neighbourhood and directly as signifiers of deficient mechanisms of social control and weak or fragile feelings of efficacy within the local community” (p. 336).

Prior studies have shown that in particular the degree of economic disadvantage and ethnic heterogeneity in a residential environment relate to inhabitants’ perception of unsafety. Research into these factors has primarily been conducted within American cities and, to a lesser extent, within the British context (for exceptions, see Hanslmaier 2013; Hooghe & De Vroome, 2016). More fear of crime is observed in neighborhood contexts with higher levels of economic disadvantage (Brunton-Smith & Sturgis, 2011; Hanslmaier 2013; Scarborough et al., 2010) and greater ethnic diversity (Chiricos et al., 1997; Covington & Taylor, 1991; Moeller, 1989). There is less research on the potential association between residential mobility and perceived unsafety; residential mobility is more often considered a relevant predictor of crime (Bogges & Hipp, 2016; Sampson et al., 1997, but see Brunton-Smith & Sturgis, 2011).

Most existing studies are unable to examine the role of change because of their cross-sectional research design. In the current research, the dimension of time will be considered more closely. The expectation is that fear levels fell in neighborhoods where levels of deprivation, heterogeneity, and mobility were decreasing. However, existing research suggests that neighborhoods are relatively stable and durable systems where demographic patterns tend to persist over time — despite changes in the population composition (Sampson, 2012; Skogan, 1986). This “slothfulness” of neighborhoods has been studied primarily in relation to their socio-economic and ethnic status (Fransham, 2019; Tunstall, 2016; Zwiers, 2018). In the Netherlands, Zwiers (2018) demonstrated that neighborhoods experience little change in their socio-economic status and ethnic composition over time, concluding that significant neighborhood change is rare and takes several decades to take effect. However, because of the study’s relatively long time frame, we expect that these neighborhood characteristics can be relevant to explain decreases or increases in fear.

## Disorder

The third set of neighborhood conditions we assess are signs of physical disorder and their role in shaping perceptions of unsafety. Physical disorder refers to the deterioration of public space, such as garbage on the street, graffiti, and damaged street furniture (Sampson & Raudenbush, 1999). Hunter (1978) was one of the first to address how these manifestations of disorder — or incivilities — generate feelings of unsafety. Incivilities, defined by LaGrange and colleagues (1992) as low-level breaches of community standards, do not necessarily trigger fear by themselves. Rather, it is the fact that they send out a “signal” to residents that conventionally accepted norms and values are eroding and social control is lacking. As a result, residents living in disorderly neighborhoods will feel more vulnerable to crime and hence less safe (Taylor, 2001). Over the years, various scholars have further redefined and redeveloped Hunter’s ideas about the impact of disorder. Kelling and

Wilson's (1982) broken window theory, on how persistent signs of disorder may ultimately lead to higher neighborhood crime rates, is considered especially influential (Robinson et al., 2003).

The link between incivilities in the neighborhood and fear of crime seems to be empirically well established. Numerous studies have shown that more neighborhood disorder is associated with higher levels of fear (Brunton-Smith & Sturgis, 2011; Covington & Taylor, 1991; Markowitz et al. 2001; Rountree & Land, 1996; Scarborough et al. 2010). Most research on this relationship is, however, based on cross-sectional analyses. To our knowledge, there are only three studies that use longitudinal datasets (Markowitz et al., 2001; Robinson et al., 2003; Taylor, 2001). With the exception of Markowitz et al. (2001), these studies do not find consistent evidence that disorder has a longitudinal impact on feelings of unsafety. The effects of incivilities 'were neither as consistent nor as sizable as had been anticipated, given the theorizing to date' (Taylor, 2001: p.228).

Studies also differ with regard to their measurement of disorder. The vast majority relies on the self-reported perceptions of respondents: in these cases, perceptions of disorder and fear are measured within the same survey (for an overview, see O'Brien et al., 2019). This approach is considered problematic because a detected effect of disorder on fear can be endogenous, meaning that fear generates perceptions of disorder rather than (or in addition to) the other way round (Brunton-Smith & Sturgis, 2011; Sampson & Raudenbush, 1999). Research showed that residents who are more fearful of crime are more likely to judge their neighborhood as being disorderly than residents without these worries (Jackson et al., 2018). The alternative is to construct a measure of disorder based on independently collected observations, either through systematic social observation of public spaces (Sampson & Raudenbush, 1999) or by interviewer assessments (Brunton-Smith & Sturgis, 2011). The downside of this approach is that collecting the necessary data is costly and time-consuming.

## Unsafety in Rotterdam

Issues related to unsafety have been high on Rotterdam's agenda for over two decades. These themes began to dominate the agenda in the late 1990s and early 2000s, when Rotterdam had become an increasingly unsafe city. Inhabitants started to voice their discontent about the rising crime levels and — in their eyes — inadequate response from local government (Van Ostaaijen, 2010). This resulted in a "regime change" following the local elections in 2002, during which the Labour Party lost its majority to a new populist party, Liveable Rotterdam (in Dutch: *Leefbaar Rotterdam*). Safety became Rotterdam's top priority, and a tougher approach to unsafety issues was announced and implemented (Tops, 2007).

Rotterdam's safety policy evolved in a zero tolerance approach, characterized by a combination of repression and prevention with a focus on implementation and action (Van Ostaaijen, 2010). New means were introduced, such as "city marines" (highly paid public servants appointed to tackle urgent public safety problems) and "intervention teams" for dealing with concrete but neglected problems in certain neighborhoods of Rotterdam (Noordegraaf, 2008). Scholars observe a shift towards a more repressive urban policy approach, characterized by more surveillance, targeting and tougher interventions. This can be illustrated by the increased use of camera surveillance and new means of policing, such as carrying out preventive (car and body) searches (Snel & Engbersen, 2009 2009).

Most scholars and policymakers agree that this approach has made Rotterdam a safer city (Noordegraaf, 2008). How inhabitants of Rotterdam experience and perceive their safety has been studied more recently by Lub and De Leeuw (2017). One of the central questions of their qualitative research examined the extent to which residents believe that crime and disorder has declined in their neighborhood. The researchers observe that the respondents are all predominantly positive about the crime levels they experience and agree and acknowledge that the municipality of Rotterdam has made good progress in tackling crime and other safety issues (Lub & De Leeuw, 2017: p.432). Rotterdam's "governmental crime fighting success" has already been well documented in previous research (Tops, 2007; Van Ostaaijen, 2010).

## Research Design

### Data

This study relies on a combination of survey data and register data. We used 11 waves of the Rotterdam Safety Index, a cross-sectional survey on crime-related feelings of unsafety and victimization. The Rotterdam Safety Index is a unique dataset with high-quality representative data at the neighborhood level, collected over a period of 15 years. All surveys are conducted among a large representative sample of people living in Rotterdam, aged 15 years or older. The samples were drawn from the municipality population register. Response rates varied between 28.5 and 23.1%.<sup>2</sup> In total, 153,384 respondents participated in the surveys. Because the focus is on how neighborhoods develop over time, we only selected respondents living in neighborhoods that are included in every survey. There are 148,344 respondents who meet this criterion, living in 62 administratively defined neighborhoods. We use these administratively defined neighborhoods as a measure of people's spatial context mainly for reasons of data availability. In the Dutch context, the administrative neighborhood is considered a valid measure of the residential context. One of reasons is that the borders of Dutch neighborhoods seem to be aligned with how residents perceive their neighborhood (Miltenburg, 2017, but see Petrović et al. 2020). The surveys of the Safety Index were originally conducted every year, but in 2009, this changed to a biannual survey. In addition to survey data, we used administrative data to construct the neighborhood variables.<sup>3</sup> Administrative data are collected and held by public authorities (in our case, the municipality of Rotterdam) and can be described as data which are derived from the operation of administrative systems (Connelly et al., 2016).

### Operationalizations

We use one item to measure perceived neighborhood unsafety. Respondents were asked whether they ever feel unsafe in their neighborhood and, if so, how often (rarely,

<sup>2</sup> Response rates in 2009 (28.5%), 2011 (27.6%), 2013 (24.8%), 2015 (23.5%), and 2017 (23.1%). The municipality was unable to provide the response rates of the surveys conducted before 2009.

<sup>3</sup> The Rotterdam Police granted us access to the crime statistics and the research department of the Rotterdam Municipality (Research and Business Intelligence, OBI) provided access to the other statistics. Some of these statistics are also available through [www.onderzoek010.nl](http://www.onderzoek010.nl).



occasionally, frequently). This resulted in a four-point scale ranging from one (never feeling unsafe) to four (frequently feeling unsafe). Relying on a single-item measure can be considered problematic; most importantly because single-items are more prone to measurement error which could have been reduced by using multiple items (Hoepfner et al., 2011; Laurence & Bentley, 2016). Unfortunately, however, no other items were available to measure perceptions of neighborhood unsafety.

At the neighborhood level, we considered the role of (1) crime, (2) ethnic diversity, (3) economic status, (4) residential mobility, and (5) disorder. For the measurement of crime, we relied on both police-recorded crime data and self-reported victimization measures. Two data sources were used in order to provide a fuller picture of the levels of crime present. The police-recorded crimes include incidents related to burglaries, illegal drug trade; robberies, (aggravated) assault, battery, rape and sexual assaults, child sexual abuse, and manslaughter and murder. This crime variable captures the relative incidence of these crimes per 100 inhabitants. For the victimization rates, we distinguished between burglaries and violent crimes. The rates were based on respondents' answers to the question whether they have been a victim of either burglaries or violent crimes — these being robberies or (violent) threats — during the last 12 months.

The level of ethnic diversity in a neighborhood was assessed by the Herfindahl–Hirschman Index (HHI). The HHI represents the probability that two randomly selected individuals living in the same neighborhood are from a different ethnic background. We differentiated between nine different ethnic groups.<sup>4</sup> The HHI value varies between zero (total homogeneity) and one (total heterogeneity). Next, economic status was measured using an index that combines a neighborhood's average income, percentage of low-income households, and average housing value. Before constructing the index, the distribution of the percentage of low-income households was reversed, and all measures were standardized. Lastly, the mean was calculated. A higher value indicates a higher economic status. For residential mobility, dummy variables were created based on the length of residence. We distinguished between the percentage of inhabitants living at their address for less than 3 years (reference category), between 4 and 10 years, between 11 and 15 years, and more than 16 years.

To capture the role of disorder, we used data collected by the municipality of Rotterdam. Approximately every 3 months, inspectors from the municipality evaluate together with the inhabitants how orderly or disorderly the public space is.<sup>5</sup> More than 2300 spots located across the entire municipality are rated on their level of cleanness and absence of physical disorder. The ratings are based on a scale from one (high levels of disorder) to five (low levels of disorder).<sup>6</sup> For every year and neighborhood, we calculated the average order/disorder score. A higher score indicates that the public space is considered clean and well-maintained.

A range of control variables were included at the individual level. These variables are age (in years), age squared, gender (reference category is male), education level

<sup>4</sup> Distinguish between people from the Netherlands, Surinam, former Netherlands Antilles, Turkey, Morocco, Cape Verde, European Union countries, and other Western and other non-Western countries.

<sup>5</sup> Officially referred to as *Productnormering Rotterdam*. See for more information (in Dutch): [www.rotterdam.nl/wonen-leven/schouwkaart/Folder-productnormering-2011.pdf](http://www.rotterdam.nl/wonen-leven/schouwkaart/Folder-productnormering-2011.pdf) (accessed March 3, 2020).

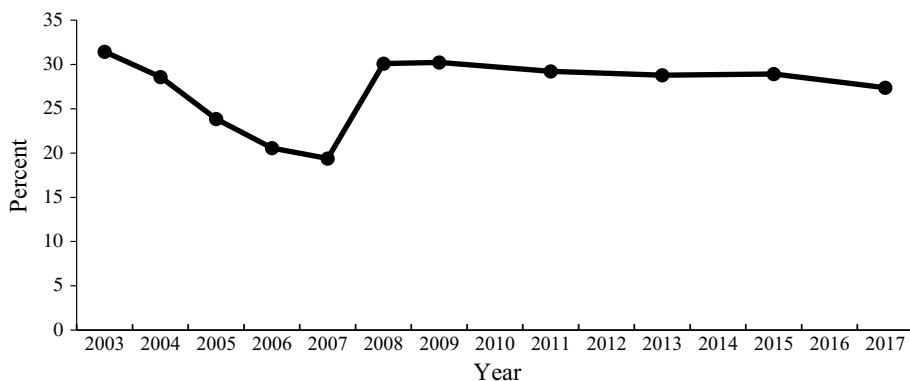
<sup>6</sup> Cleanness is measured by the absence of litter on the street, graffiti, dog mess, weed, and having well-maintained bins. Absence of other forms of disorder means having no bike wrecks; no wrongly parked cars; having a well-maintained green space; that all household waste is collected in the designated containers; and that all retail displays are well-organized.

**Table 1** Descriptive statistics

	Min	Max	Mean	SD
<i>Individual level</i>				
Perceived neighborhood unsafety	1	4	1.56	0.97
Age	14	100	49.29	18.24
Gender (ref. = male)	0	1	0.55	
Ethnicity (ref. = native Dutch)	0	1	0.38	
Education (ref. = low)	0	1	0.36	
Middle	0	1	0.28	
High	0	1	0.33	
Employment status (ref. = unemployed)	0	1	0.54	
Victim of burglary (ref. = not)	0	1	0.05	
Victim of violence (ref. = not)	0	1	0.05	
<i>Contextual level</i>				
Survey mode in % (ref. = internet)	0	60.16	31.47	26.54
Face to face	0	22.52	6.67	6.67
Mail	0	14.56	7.67	6.50
Phone	21.47	91.81	54.2	29
Recorded crime	0.28	42.39	3.95	4.59
Victimization rate burglary in %	0	14.42	5.07	2.59
Victimization rate violence in %	0	12.94	5.19	2.19
Ethnic diversity	0.19	0.88	0.62	0.16
Economic status	-1.37	4.14	0	0.92
Residential length (ref. = % less than 3 years)	13.19	61	26.47	6.11
% less than 11 years	11.48	61.39	34.06	4.96
% less than 16 years	5.52	45.26	15.90	4.43
% more than 16 years	3.29	45.51	23.57	7.62
Absence of disorder	2.44	4.77	4.05	0.27

(reference category is low), employment status (reference category is unemployed), ethnicity (reference category is native Dutch), and previous victimization experiences regarding burglaries and threats (reference category is no experience). Aside from the gender and ethnicity variables, all control variables were based on self-reported answers.

To assess a person's education level, respondents were asked about their highest completed education degree. Their answers were recorded in order to construct a three-level education variable (low, middle, and high). To measure employment status, respondents had to indicate whether they have a paid job and if so, whether they work more than 12 h a week (on average). Those who work 12 h or more were categorized as "employed" and respondents without a job or working less than 12 h were categorized as "unemployed." To categorize people as native or non-native Dutch, we adopted the definition of Statistics Netherlands. According this definition, a person who is born in the Netherlands and whose both parents are also born in the Netherlands is considered native Dutch (and otherwise non-native Dutch). Lastly, previous victimization experiences were measured by asking the respondents whether they had become a victim of a burglary or threat during the last 12 months.



**Fig. 2** Percentage of respondents who sometimes feel unsafe in the neighborhood

Missing values were deleted listwise or included as a dummy. We also controlled for the different modes of data collection. More specifically, we calculated the share of surveys conducted by phone, mail, the Internet, or face to face for each wave. The descriptive statistics of all variables are reported in Table 1. Table 4 in the Appendix provides an overview of all neighborhood and mode variables and their year-specific means.

### Analytical strategy

The analytical approach consisted of two steps. In the first step, the trend of perceived unsafety is examined more closely, and it is considered whether the observed changes are “real” and not an artifact of survey methodology (Hout & Fischer, 2002). In this regard, special attention was paid to the survey mode and changes to it. We also considered how increases or decreases in fear are spatially distributed by mapping the relative change in perceived neighborhood unsafety scores across the neighborhoods of Rotterdam. To capture change, an individual regression slope was estimated for each neighborhood, based on the aggregated level of neighborhood unsafety reported in years in which the survey was conducted (Pfister et al., 2013).

The second step involved analyzing the role of the different neighborhood factors in multilevel regression models. The aim of these multilevel analyses was to obtain a more precise understanding of which factors help to explain the trends in fear observed previously. For this purpose, we estimated multilevel regression models. A multilevel model is necessary because of the nested data structure. To account for the dependency in the data, we followed the strategy of Schmidt-Catran and Fairbrother (2016) and estimated three-level models that include years, neighborhoods, and neighborhood-years as contextual levels.<sup>7</sup> This model recognizes that (1) respondents within the same year are more likely to be similar than respondents from different years; (2) respondents within the same neighborhood are more likely to be more similar than respondents from different neighborhoods; and (3) respondents within the same year *and* neighborhood are more likely to be similar than respondents from different years and neighborhoods.

<sup>7</sup> Same structure as Model F as reported by Schmidt-Catran and Fairbrother (2016: p.25). For a recent application of this model, see Custers et al., (2019).

We added splines to the multilevel analyses to model the time dimension. In this way, we took into account that the trend line of perceived neighborhood unsafety is not linear. Figure 2 shows the trend in the percentage of inhabitants that sometimes feel unsafe in their neighborhood. In the years up to 2008, the level of fear consistently declined. Between 2007 and 2008, there was a sudden increase, and after 2008 the trend once more saw a slight decrease. The abrupt increase is perhaps the most remarkable; we expect that changes in survey mode played a role here (for a more elaborate discussion, see “Actual change or methodological artifact” section). Using splines enabled us to estimate a model with different slopes in order to analyze changes in the observed trend.<sup>8</sup> In the models, three separate slopes are estimated: one for the period up to 2007 (period 1), another for the period between 2007 and 2008 (period 2), and a final one for the remaining years up until 2017 (period 3).<sup>9</sup>

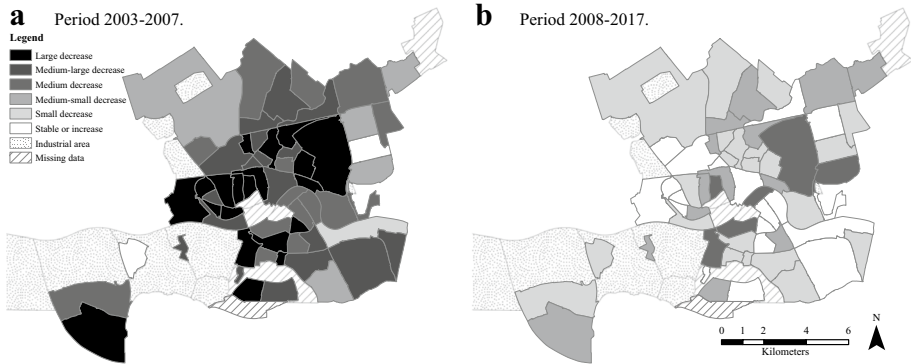
### Actual Change or Methodological Artifact

In order to describe and analyze whether perceptions of unsafety have actually improved over time, it is necessary to establish that the changes in the survey data are real and not an artifact of the survey. We therefore pay close attention to the representativeness and the comparability of the samples. Sample comparability is difficult to maintain over time, especially if changes are made to the survey’s design (Brady & Johnston, 2015). As for the Rotterdam Safety Index, it is important to note that adjustments have been made to the survey mode over the years (Snel et al., 2015). In the first years of the Safety Index, until 2007, respondents were interviewed by phone or face to face. In more recent waves, survey data were collected using the following modes: phone, mail, and the Internet. These changes may have implications because survey answers may be influenced by the survey mode (Jäckle et al., 2010). Such mode effects are related to, but distinct from, the general problem of self-selection bias. Self-selection results when respondents decide for themselves whether or not they participate in a survey. This may lead to biased data, as the respondents who chose to participate are not representative of the entire population (Lavrakas, 2008). In our case, it could be that people who feel unsafe are more likely to respond to the survey, which may result in an overestimation of unsafety levels. However, in the current study, we mainly focus on potential mode effects.

To better explain so-called mode effects, a distinction can be made between selection processes and transformation processes (Voogt & Saris, 2005). Mode effects as a result of selection exist if different modes attract different types of respondents or, in other words, when certain groups of respondents are more or less likely to participate in a survey based on the survey mode. This could also play a role in our study. For instance, it is a possibility that people who feel safe are less likely to participate in the Safety Index, and especially when it is a mail or web questionnaire. Only when

<sup>8</sup> For other applications of using splines in regressions, see Hout and Fischer (2002); Lim and Laurence (2015); and Schnabel (2016).

<sup>9</sup> The first period in the spline function, 2003–2007, is coded as zero for 2003 and increases by one for each year until 2007, which is four. Four is then the value for 2007 and all following years. The second interval, 2007–2008, is zero until 2007 and then increases by one for 2008. One is then the value for 2008 and the following years. The third interval, 2008–2017, is coded zero for all years until 2008 and then increases by one for each year until the final year in the sample 2017, which has the value of nine.



**Fig. 3** Relative change in neighborhood unsafety scores. **a** Period 2003–2007. **b** Period 2008–2017

they are approached by phone or face to face, it becomes more likely that this group actually participates. Transformation takes place when respondents answer the survey questions. This process is biased when a respondent's answers differ depending on the survey mode. Here, social desirability plays a role: people misrepresent themselves in the survey because they feel the need to comply with certain social norms. Previous studies have shown that self-administrated questionnaires (mail and the Internet) yield fewer socially desirable answers than interviewer-administrated questionnaires (phone and face to face) (Kreuter et al., 2008; Heerwegh, 2009). Research by the Pew Research Center (2015) demonstrates that compared to web respondents, telephone survey respondents are more likely to give answers “that paint themselves or their communities in a positive light” (p.20) and are, for instance, more biased in their evaluation of how safe (or unsafe) their neighborhood is.

Based on this discussion of mode effects, we expect that the sudden increase in unsafety feelings observed in Fig. 2 can be (partly) explained by the decision to use more often self-administered surveys (mail and the Internet) and to rely less on phone and face to face, in part because different types of respondents will be attracted and also because social desirability is less likely to affect the answers of the respondents.

## Results

### Spatial Patterns of Changing Neighborhood Perceptions

Before presenting the results of the multilevel analyses, we first examine in more detail the trends in perceived neighborhood unsafety at the spatial level of the neighborhood. The maps in Fig. 3 are aimed at improving our understanding of how changes in neighborhood unsafety scores are spatially distributed across Rotterdam's neighborhoods, and, more specifically, the extent to which the fear drops observed previously (in Fig. 2) can be found within the different neighborhoods. We examine the relative change in the years 2003–2007 and 2008–2017. The left-hand map in Fig. 3a shows that all neighborhoods — except for two — witnessed a drop in average fear levels in the period 2003–2007: there is almost a citywide decline in fear. The size of the

**Table 2** Multilevel regressions of perceived neighborhood unsafety

	Model 1	Model 2	Model 3
	B SE	B SE	B SE
Intercept	1.646 (0.028)	1.832 (0.417)	1.194
Period 1 spline (2003–2007)	−0.066 (0.006) ***	−0.066 (0.010) **	−0.047 (0.013) *
Period 2 spline (2007–2008)	0.214 (0.020) ***	0.338 (0.396)	0.117 (0.495)
Period 3 spline (2008–2017)	−0.004 (0.002)	−0.008 (0.004)	−0.009 (0.004)
<i>Individual level</i>			
Age		0.112 (0.008) ***	0.112 (0.007) ***
Age squared		−0.127 (0.007) ***	−0.126 (0.007) ***
Gender (ref. = male)		0.254 (0.005) ***	0.254 (0.005) ***
Ethnicity (ref. = native Dutch)		−0.074 (0.006) ***	−0.075 (0.006) ***
Education level (ref. = low)			
Middle		0.026 (0.006) ***	0.027 (0.006) ***
High		−0.002 (0.007)	−0.002 (0.007)
Employment status (ref. = unemployed)		−0.055 (0.006) **	−0.055 (0.006) ***
Victim of burglary (ref. = not)		0.455 (0.011) ***	0.451 (0.011) ***
Victim of violence (ref. = not)		0.661 (0.010) ***	0.659 (0.011) ***
<i>Contextual level</i>			
Survey mode in % (ref. = Internet)			
Face to face		−0.004 (0.004)	−0.002 (0.005)
Mail		0.017 (0.013)	−0.002 (0.016)
Phone		−0.006 (0.004)	−0.002 (0.005)
Recorded crime			0.005 (0.001) ***
Victimization rate burglary			0.006 (0.002) ***
Victimization rate violence			0.006 (0.002) **
Ethnic diversity			0.656 (0.081) ***
Economic status			−0.058 (0.014) ***
Residential length (ref. = less than 3 years)			
Less than 11 years			0.0001 (0.001)
Less than 16 years			0.001 (0.001)
More than 16 years			0.001 (0.001)
Absence of disorder			−0.046 (0.022) *
<i>N</i>	144,779	144,779	144,779

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Notes: the variables age and age squared were recoded for purposes of interpretation. Age was divided by 10 and age squared by 1000.

decline differs slightly from neighborhood to neighborhood. The relative change in neighborhood unsafety levels between 2008 and 2017 is visualized in the right-hand map (Fig. 3b). The decline in fear levels is smaller in this period and observed only in approximately 70% of the neighborhoods. In the remaining 17 neighborhoods, fear levels have increased slightly.

## Multilevel Model Results

Next, we estimated three multilevel models to explain the previously observed shifts in perceived neighborhood unsafety. The results of these models are shown in Table 2. The first model only includes the splines. The spline coefficients can be interpreted as the linear change in the level of perceived neighborhood unsafety during a given period (1, 2, or 3). The coefficient of period 1 ( $b = -0.066$ ) shows a statistically significant decrease in feelings of unsafety in the years between 2003 and 2007. The positive coefficient of period 2 ( $b = 0.214$ ) is also significant, confirming that the level of perceived unsafety suddenly increased between 2007 and 2008. In period 3, a small, non-significant decrease was detected. This means that despite falling crime rates, fear levels stabilized in the period 2008–2017.

To determine whether the significant period effects of period 1 and period 2 are not driven by demographic changes in the sample or by changes in survey mode, a second model was estimated. Model 2 includes the individual-level controls and a set of dummies to control for variations in survey mode across the years. In this model, the spline coefficient of period 2 is no longer significant. Additional analyses showed that this is primarily the result of controlling for changes in survey mode, demonstrating that the observed increase during period 2 is most likely a mode effect.<sup>10</sup> From 2008 on, surveys were no longer only conducted by phone or face to face but were also collected through the Internet and mail. This shift towards self-administered questionnaires explains why unsafety levels increased rapidly after 2007. From 2008 onwards, approximately fifty percent of respondents participate in the Internet survey; before 2008, this was zero. The share of phone respondents decreased by 56 percentage points compared to 2007 (see for more details, Table 4 in the Appendix). The results regarding the splines coefficients of period 1 and period 3 remain unchanged in model 2.

In addition, Model 2 shows that fear is significantly higher among women, the unemployed and the non-native Dutch. These findings are largely in line with existing research (e.g., Brunton-Smith & Sturgis, 2011; Covington & Taylor, 1991). Fear levels are also higher among middle-educated respondents (when compared to the lower-educated reference group). The effect of age seems to be non-linear: fear levels rise when age increases but decrease at a certain age. Victimization experiences also relate to increased levels of unsafety. The separate coefficients indicate that becoming a victim of violent crime has a slightly larger impact on feelings of unsafety than experiencing a burglary. In Model 3, the role of neighborhood factors is further explored. First, we examine more closely how the neighborhood characteristics relate to the spline coefficient of period 1: the only spline that is still significant. We have already established that changes observed in the other two periods are better explained by the survey mode (period 2) or were non-significant from the beginning (period 3). The third model is intended to explain the declining trend during the years 2003–2008 (period 1). We do so by adding the neighborhood-level characteristics. If changes in these characteristics account for the observed decline, the spline coefficient of period 1 reduces in size. Model 3 shows that adding these neighborhood variables reduces the size of the coefficient by almost 30% (from  $b = -0.066$  to  $b = -0.047$ ). Additional analyses indicated that this reduction is mainly the result of increases in economic status

<sup>10</sup> Two additional models were estimated: a model with only splines and individual controls (model 1) and a model with only splines and survey mode dummies (model 2). Only in the second model, the spline coefficient of period 2 was no longer significant. These results are available upon request.

and decreases in victimization rates and disorder.<sup>11</sup> Approximately 70% of the change remains unexplained; the neighborhood characteristics considered here only account for a limited part of the fear drop observed in period 1. There are apparently other factors at play. We will return to this point in the discussion.

Model 3 also provides an overview of neighborhood-level characteristics that significantly predict lower or higher levels of unsafety. Except for residential mobility, all neighborhood factors are significantly related to levels of unsafety. The findings are in line with the expectations and most previous studies. Fear is more widespread in neighborhoods with more recorded crime and higher victimization rates. In addition, higher levels of fear are observed within neighborhoods that are more ethnically diverse. The last finding is that inhabitants living in neighborhoods with a higher economic status and less disorder feel safer.

## Discussion and Conclusion

Criminologists consider the crime drop as one of the most important criminological developments of modern times (Farrell et al., 2014). The potential societal consequences of this drop have not been extensively studied yet. The current study examined the trend in perceived neighborhood unsafety over a period of 15 years and analyzed to what extent changes in unsafety could be attributed to various neighborhood characteristics, including crime. We first considered the changes in unsafety levels over time and found that the trend in perceived unsafety can be divided into three periods. In the first period (2003–2007), unsafety levels steadily declined. A “fear drop” (Smeets & Foekens, 2018) emerged during these years. This decrease was followed by a sudden increase in feelings of unsafety in the second period (2007–2008), which was explained by the shift towards using more self-administrated questionnaires. The last period (2008–2017) experienced a small and non-significant decrease; in these years, unsafety levels more or less stabilized. These findings are in line with Skogan’s (2011) observation that “fear of crime does not inevitably ratchet up; it also can go down, and dramatically so” (p. 120). However, the figures also show that fear levels may stabilize, despite falling crime rates. The results therefore demonstrate that fear levels can be both instable and stable, depending on the period under study.

We will now look more closely at the main results for each period separately. It was found that the fear drop observed in period 1 was present in almost all Rotterdam neighborhoods. This decrease in unsafety levels is best explained by changes in the economic status, victimization rates and disorder level of neighborhoods. The role of recorded crime levels turned out to be rather small. The findings also showed that the multilevel model and neighborhood factors that had been included were only partially successful in explaining the decline in perceived unsafety: approximately 70% of the drop in fear is still unaccounted for. An explanation may be that changing priorities in local politics and policies also helped to reduce fear. From the early 2000s, considerable effort was put into enhancing safety and security in Rotterdam. A coordinated and structured

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<sup>11</sup> We estimated models for each neighborhood variable separately to determine which neighborhood factors had most explanatory power. Afterwards, we compared which variables reduced the spline coefficient of period 1 the most. Results are available upon request.



**Table 3** Average perceived neighborhood unsafety scores. Years and modes

	2003	2004	2005	2006	2007	2008	2009	2011	2013	2015	2017
Phone	1.69	1.62	1.51	1.45	1.42	1.46	1.43	1.43	1.43	1.50	1.45
Face to face	1.53	1.44	1.44	1.38	1.41	1.41	1.45				
Web						1.68	1.66	1.67	1.64	1.58	1.56
Mail						1.80	1.76	1.75	1.80	1.72	1.65

policy approach was implemented, and considerable resources were directed towards local safety policy. Most scholars agree that these efforts contributed to a safer and more liveable Rotterdam (Noordegraaf, 2008; Van Ostaaïjen, 2010; Van Ostaaïjen & Hendriks, 2006). The figures suggest that, at least in the years 2003–2007, a growing number of inhabitants share this conclusion. Unfortunately, we were unable to empirically assess the role of local policy in the analyses. This also holds for other changes or developments that may have positively affected the level of perceived unsafety but are not studied within the current study. Scholars have, for instance, considered how changes in the media landscape and in our technological and communication infrastructure may have contributed to more safety (Smeets & Foekens, 2018). This suggests that future research should more explicitly study the role of non-neighborhood factors and their potential to reduce fear.

In Period 2, we observed a relatively large increase in feelings of unsafety. The analyses suggest that this is most likely an effect of switching survey modes and using more self-administered surveys. Previous studies have shown that self-administered questionnaires (i.e., web and mail) result in less social desirability and more honest answers compared to interview-administered questionnaires (i.e., phone and face to face, DeLeeuw 2018; Heerwegh, 2009; Kreuter et al., 2008). In the current study, this increased honesty seems to translate into higher average unsafety scores (see Table 3). Note that selection processes may also have played a role here. Overall, the findings illustrate how changes in survey mode may impact research results.

Another relevant finding of this study is the stabilization of unsafety levels observed in period 3. Based on previous research, different explanations can be proposed which may help us to understand why fear levels did not continue to decrease in the years 2008–2017. We will briefly explore two sets of explanations. The first relates to the economic conditions in the neighborhoods. In the years following the 2008–2009 recession, the unemployment rate in Rotterdam more than doubled, from 5.8% in 2008 to 12.6% in 2014 (Custers et al., 2019: p.1951). This worsening of the economic situation may have had various negative side effects. Research has shown that residents across all Rotterdam neighborhoods began to perceive more problems in their neighborhood during this period (Custers et al., 2019). Such developments may have prevented a further decrease in the unsafety scores.

The second set of explanations centers on the idea that over time, Rotterdam's safety policy has become less successful in bringing down residents' unsafety levels. There might be various reasons for this. In the first place, a reduced sense of urgency may have slowed down the decrease in unsafety rates. From 2006 onwards, the issue of unsafety became less of a priority within the municipality as policymakers increasingly felt that the largest safety problems were now under control (Van Ostaaïjen, 2010). It is also possible that parts

of Rotterdam's tough approach towards unsafety had negative side effects, which became increasingly visible over time. Binken and Blokland (2012), for instance, argue that more repressive safety policies do not necessarily make streets safer, but rather result in more feelings of unsafety, especially among inhabitants living in disadvantaged neighborhoods. The last explanation is derived from the literature on unintended consequences of policy (Engbersen, 2009). Here, the idea is that Rotterdam's successful safety policy has made inhabitants more critical about unsafety in their neighborhood. Now that the worst problems have been solved; residents have set the bar higher and are less easily satisfied than they were previously. Policy has not only reduced the problem, but also gave rise to new ones by creating new and unmanageable demands. It is "doing better, feeling worse" (Engbersen, 2009: p. 39).

The current study also provides more general insights into the factors that explain fear differences between neighborhoods. The results confirm most previous research by showing that the level of recorded crime is just one of the neighborhood characteristics that can explain these differences. Other relevant factors are a neighborhood's victimizations rates, economic status, level of ethnic diversity, and level of order (or disorder). We used both police-recorded crimes and self-reported victimization data to better capture the role of crime, as it is well-known that both measures have their shortcomings (Brunton-Smith & Allen, 2010). The found effects regarding economic status and ethnic diversity are in line with existing research (Brunton-Smith & Sturgis, 2011; Covington & Taylor, 1991; Hooghe & De Vroome, 2016). Another important finding is that we found evidence that inhabitants feel less unsafe in less disorderly neighborhoods (Brunton-Smith & Sturgis, 2011). We are certain that this effect is not "an artifact of research design" (O'Brien et al., 2019) as the measure of disorder (or the absence thereof) relied on independently collected data, not the perceptions of respondents. Lastly, the expectation that feelings of unsafety are higher in neighborhoods with more residential mobility was not supported (see also Brunton-Smith & Sturgis, 2011).

Based on our findings, we are able to inform policy in the following way. We observed that crime is just one of the neighborhood characteristics associated with perceived unsafety. It follows that, when the aim is to reduce levels of unsafety, it is insufficient to only fight crime. A fear-reducing policy should also aim at improving the economic status and reducing the level of disorder. The municipality of Rotterdam has already put considerable effort into creating neighborhoods that are clean, well-maintained, and, as a result, safe. It is recommended that these efforts are continued. In addition, it was shown that in neighborhoods where the level of ethnic diversity is higher, it becomes more difficult to create a space where inhabitants feel safe. In such areas, it is important to invest in social relations and to create a well-maintained public space where inhabitants can meet to familiarize and socialize with each other.

Despite the contributions of the current study, its limitations should also be addressed. First, the measure of perceived neighborhood unsafety relies on only one item. Unfortunately, there were no other survey items available to measure perceived unsafety in a more robust way. It follows that our measure is at best a weak proxy for fear of crime. And although perceived unsafety is empirically related to this concept (see Glas et al., 2019), we should be careful when extrapolating from this measure to the broader concept of fear of crime. A second shortcoming is that this study only examined feelings of unsafety within one municipality. It therefore remains the question to what extent the findings and conclusions apply to other cities beyond Rotterdam. Future research could expand the scope by focusing on more cities or on cities other than Rotterdam.

**Appendix**

**Table 4** Average scores mode and neighborhood variables

Year	2003	2004	2005	2006	2007	2008	2009	2011	2013	2015	2017
Survey mode in % (ref. = Internet)	0	0	0	0	0	51.87	60.19	50.31	50.23	53.53	54.84
Face to face	8.32	8.19	10.55	12.02	22.52	14.51	4.11	0	0	0	0
Mail	0	0	0	0	0	12.14	11.46	14.56	13.43	14.13	12.89
Phone	91.68	91.81	89.45	87.98	77.48	21.47	24.24	35.13	36.35	32.35	32.28
Recorded crime	5.32	4.87	5.12	4.82	4.59	4.54	3.67	3.51	3.06	2.61	2.01
Victimization rate burglary in %	7.02	6.66	6.41	4.93	4.82	2.51	3.42	4.10	5.78	5.99	4.65
Victimization rate violence in %	7.04	6.92	5.68	4.55	4.31	4.69	3.72	4.50	5.00	5.27	5.57
Ethnic diversity	0.59	0.60	0.61	0.61	0.61	0.62	0.62	0.67	0.58	0.65	0.65
Economic status	-0.47	-0.47	-0.18	-0.12	0.03	0.08	0.18	0.17	0.11	0.15	0.39
Residential length											
(ref. = % less than 3 years)	27.53	26.73	26.44	25.97	27.02	28.03	28.42	25.77	24.56	24.84	25.80
% less than 11 years	36.73	36.89	36.11	35.64	34.38	33.24	32.10	33.34	33.88	33.36	30.29
% less than 16 years	15.91	16.02	16.15	16.11	15.92	16.05	16.30	16.07	15.77	15.04	15.57
% more than 16 years	19.82	20.36	21.30	22.29	22.69	22.69	23.18	24.81	25.79	26.77	28.33
Absence of disorder	3.72	3.79	3.84	3.92	3.95	4.01	4.16	4.30	4.20	4.24	4.23

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