"Broken Windows" and the Risk of Gonorrhea

ABSTRACT

Objectives. We examined the relationships between neighborhood conditions and gonorrhea.

Methods. We assessed 55 block groups by rating housing and street conditions. We mapped all cases of gonorrhea between 1994 and 1996 and calculated aggregated case rates by block group. We obtained public school inspection reports and assigned findings to the block groups served by the neighborhood schools. A "broken windows" index measured housing quality, abandoned cars, graffiti, trash, and public school deterioration. Using data from the 1990 census and 1995 updates, we determined the association between "broken windows," demographic characteristics, and gonorrhea rates.

Results. The broken windows index explained more of the variance in gonorrhea rates than did a poverty index measuring income, unemployment, and low education. In high-poverty neighborhoods, block groups with high broken windows scores had significantly higher gonorrhea rates than block groups with low broken windows scores (46.6 per 1000 vs 25.8 per 1000; $P<.001$).

Conclusions. The robust association of deteriorated physical conditions of local neighborhoods with gonorrhea rates, independent of poverty, merits an intervention trial to test whether the environment has a causal role in influencing high-risk sexual behaviors. (*Am J Public Health*. 2000;90:230–236)

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Sexually transmitted diseases (STDs), including AIDS, have been associated with race/ethnicity, poverty, and substance use.[1–6] Efforts to control the spread of STD/AIDS have targeted individuals through counseling, education, and admonishing them to be abstinent or, failing that, to limit the number of sex partners and use condoms.[7,8] Worldwide, these efforts have had modest success, and the United States remains the only developed country to have STD rates comparable to those of developing countries.[9] Many have pointed to the lack of universal health care as the reason for the disparity.[1,9] However, lack of health care cannot be a sufficient explanation, given the low STD rates documented in China, where access to health care is poor and poverty is high.[10,11]

The Broken Windows theory described by James Q. Wilson draws an association between disorder and crime[12]: "If a broken window is unrepaired, all the windows will soon be broken. Broken windows are a signal that no one cares." The theory suggests that the appearance of the physical environment provides direct messages that regulate individual behavior. A disordered physical environment is not only a consequence of neglect but also a signal to others that behaviors that are usually prohibited are tolerated. Several studies support the importance of physical conditions in influencing behavior, including studies on littering, which indicate that people are more likely to litter in environments that are already filled with litter.[13,14] A classic experiment by Zimbardo on car vandalism showed that vandalism occurs readily in both high- and low-poverty neighborhoods when a car appears to be abandoned.[12] The appearance of the environment can suggest what is acceptable, with a disordered environment implying that behaviors that are usually unacceptable can be perpetrated without fear of consequences.

A multilevel study of neighborhoods, violence, and collective efficacy by Sampson et al.[15] suggests that the occurrence of crime is mediated by "collective efficacy," a measure of the ability of neighborhoods to maintain effective informal social controls. Informal social controls are associated with environments that have relatively lower rates of crime.[16,17] These social controls may include such efforts as willingness to intervene to prevent truancy or to discourage teenagers from hanging out at street corners, and may include efforts to reduce litter and graffiti.

Given that STDs occur primarily among persons between the ages of 15 and 25 years, the high prevalence of STDs represents a failure to control and protect our youth. High-risk behaviors tend to cluster together and have been shown to form a continuum.[18] For example, the gateway drug theory postulates that criminal behavior is at the end of a continuum that may begin with tobacco or alcohol use and progress to illicit drug use.[19] Sexual behaviors with casual or anonymous partners are likely to be part of the continuum because they are highly associated with substance use.[20–22] It is plausible that conditions conducive to antisocial behaviors such as vandalism, truancy, and drug use are also permissive of high-risk sexual behaviors.

To examine the possible association of neighborhood conditions with high-risk sexual behavior, we analyzed the relation between a measure of community disorder (i.e., "broken windows") and gonorrhea rates in New Orleans neighborhoods.

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Methods

The unit of analysis was the block group, consisting of several city blocks designated by the US census and considerably smaller than a census tract. Although block group boundaries are arbitrary and may have little meaning to residents, block groups are more representative of local neighborhoods than the larger census tracts. We did not to try to define neighborhood boundaries, because such boundaries are often fluid and highly subjective. Moreover, urban neighborhoods as discrete, independent units do not exist. While residents tend to make their daily rounds and interact with other residents in and around their neighborhoods, they go to other parts of the city for jobs, entertainment, worship, and other activities.[23]

Gonorrhea reporting is mandated by law and is a well-established practice in most localities. Using Map Marker, a geographic information systems (GIS) software, we geocoded gonorrhea cases for New Orleans from 1994 to 1996, aggregated these cases to the block group level, and calculated gonorrhea rates for all block groups. The dependent variable was the sum of annual reported case rates of gonorrhea per 1000 persons for each block group between 1994 and 1996.

The sample of block groups was chosen from the 546 block groups with more than 300 residents in New Orleans on the basis of an existing data set of physical conditions of neighborhood structures assessed by city planners at the College of Urban and Public Affairs (CUPA), University of New Orleans. As part of an ongoing technical assistance project, the CUPA planners survey neighborhood areas. All block groups (n = 55; population = 26 600) for which complete data were available were included. The CUPA planners assessed the block groups at various periods from 1994 to 1997 in 5 different sections of the city.

To collect data on physical structures, the CUPA planners videotaped each street in each of the block groups while driving through the study area. Afterward, the images were entered in a visual database and the conditions of the structures were rated on a simple 4-point scale: 1, no visible damage; 2, minor cosmetic damage; 3, minor structural damage; 4, major structural damage. A structure with "no visible damage" was in mint condition, while "minor cosmetic damage" indicated cosmetic problems such as peeling paint, a broken window, or an overgrown lawn. Examples of "minor structural damage" could be visible termite damage or minor foundation or roof problems. "Major structural damage" included structures that were in a deteriorated condition and often abandoned. Each structure was also classified in terms of its land use: residential, commercial, institutional (schools, church, library), industrial, recreational, and vacant land.

In addition, we assessed other physical features of the block groups: garbage accumulation, graffiti, abandoned cars, billboards and signs, and general upkeep of nonstructures such as parks, playgrounds, vacant lots, and institutional properties. To collect these data, we walked the block group areas and evaluated each block or street segment (e.g., the 1600 block of Canal St). For each street segment, we looked for the presence of garbage, graffiti, and abandoned vehicles. We developed dichotomous variables to evaluate these conditions (e.g., presence or absence of accumulated garbage). The score for each block group was an aggregate of the percentage of street segments that had accumulated garbage, graffiti, or abandoned (apparently inoperable) cars.

Investigating the physical conditions of neighborhood public high schools was another aspect of our survey of neighborhood conditions. We obtained physical plant inspection reports of public schools conducted by the Office of Sanitation Services in New Orleans. These provided assessments of the schools' sites and play areas, buildings, toilet facilities, handling of solid wastes, and water supply from drinking fountains. To code the reports, we totaled the number of reported problems for each category. We gave each individual problem of whatever type highlighted on the report a score of 1, thus, for example, giving equal weight to a broken toilet and missing floor tiles. When the sanitation inspector noted a problem or code violation in specific rooms or locations in the school, we gave a point to each room or area listed on the report. When the report did not give exact numbers for the observed problems but cited problems in a "few," "many," or "most" areas of the school or "throughout" the school, we gave such descriptions the following values: a few or some = 3 problems; many or several = 5 problems; most or throughout = 7 problems.

To link the schools to the block groups, we obtained school "catchment area" maps from the New Orleans School Board. Using MapInfo and a block group boundary map, we identified those schools whose catchment areas encompassed our study block groups. We then gave the schools' scores (total number of physical plant problems) to each block group within each school catchment area.

We also calculated the density of retail outlets that sold alcohol for consumption off the premises ("off-sale") by geocoding all off-sale licenses obtained from the State Alcohol Beverage Control Agency. Off-sale alcohol outlet density has been shown to be geographically related to gonorrhea rates.[24]

We created an index that reflects neighborhood deterioration, the "broken windows" index, which is the sum of the percentage of homes with major structural damage, minor structural damage, or cosmetic damage; the percentage of streets with trash, abandoned cars, or graffiti; and the number of physical problems and building code violations in public high schools, as documented by the Office of Sanitation Services. Each of these variables was normalized, with a mean of 0 and a standard deviation of 1, so that each contributed equally to the broken windows index. Using 1990 US Census data with 1995 updates, we created an index of poverty for each block group that consisted of the sum of the percentage of households with incomes of less than $15 000, of individuals with less than a high school education, and of persons older than 18 years who were unemployed.

Bivariate relationships among several variables were examined, including the sum of rates of gonorrhea (1994–1996), the broken windows index, the poverty index, and the percentages of residents who were married, Black, home owners, between the ages of 15 and 24 years, or female. Since many of the independent factors measured similar variables (e.g., broken windows and percentage of home ownership are related to poverty), correlations were performed to determine the extent of possible confounding.

Backward elimination linear regression was used to examine the relationship of broken windows to gonorrhea and other correlated variables. The following variables were included: the percentage of the population between the ages of 15 and 25 years, the poverty index, marital status, home ownership, broken windows index, off-sale alcohol outlet density, and race. In addition, it was necessary to determine whether gonorrhea rates were related to poverty in different ways, depending on the level of neighborhood deterioration. To test this, an interaction term was added to the regression model. Results showed no significance, so the term was omitted. Using ANOVA, we calculated the difference in mean gonorrhea rates among high- and low-poverty block groups and block groups with high and low broken windows indexes.

Results

The average size of a block group from our sample was 0.04 square miles, with an average population of 507. The population of the block groups was predominately Black.

TABLE 1—Descriptive Statistics and Correlations for 55 Block Groups

	Mean	SD	Minimum	Maximum	Correlation With Gonorrhea *r* (*P*)	Correlation With Broken Windows, *r* (*P*)	Correlation With Poverty Index, *r* (*P*)
Size, sq miles	0.04	0.02	0.01	0.12	–0.305 (.023)	–0.397 (.003)	–0.347 (.009)
1995 total population	507.18	226.83	75	1252	–0.354 (.008)	–0.362 (.007)	–0.206 (.131)
1995 total households	189.78	75.12	36	414	–0.370 (.005)	–0.415 (.002)	–0.207 (.130)
Homes occupied by owner, %	37.05	17.02	1.82	73.45	–0.439 (.001)	–0.557 (.000)	–0.503 (.000)
Households with income <$15 000, %	55.20	14.12	32.30	94.48	0.379 (.004)	0.499 (.000)	0.777 (.000)
Population unemployed, %	21.49	9.37	0.50	44.81	0.402 (.002)	0.525 (.000)	0.741 (.000)
Population aged between 15 and 25 y, %	13.90	2.11	8.73	21.33	0.030 (.827)	0.104 (.450)	–0.010 (.943)
Females, %	54.68	3.09	46.88	66.67	–0.093 (.499)	–0.186 (.175)	–0.140 (.307)
Married, %	27.50	9.80	0.50	41.71	–0.588 (.000)	–0.624 (.000)	–0.495 (.000)
Population 18+ y without high school diploma, %	53.38	16.37	28.81	95.22	0.341 (.011)	0.520 (.000)	0.767 (.000)
Off-sale alcohol outlet density	33.23	37.74	0.50	162.31	0.543 (.000)	0.548 (.000)	0.326 (.015)
Black, %	91.10	16.56	29.02	100	0.286 (.034)	0.317 (.018)	0.419 (.001)
Poverty index	0	2.29	–5.28	4.70	0.491 (.000)	0.675 (.000)	. . .
Broken windows index	0	4.75	–9.57	11.47	0.651 (.000)	. . .	. . .
Sum of gonorrhea rates per block group, 1994–1996	34.47	16.98	1.77	80.91	. . .	. . .	. . .

The block groups tended to have high rates of household poverty and low educational levels. Table 1 describes each of the variables and lists their correlations with gonorrhea rates, the broken windows index, and the poverty index. Table 2 lists descriptive information for variables used to create the poverty and broken windows indexes; the Cronbach α's for these are 0.64 and 0.81, respectively. With the exception of percentage of females and percentage of population younger than 25 years, all of the variables were associated with both the poverty index and the broken windows index.

Least squares regression indicated that broken windows index shows a much stronger relationship with gonorrhea rates than does poverty ($R^2 = 0.241$ for poverty and gonorrhea vs $R^2 = 0.424$ for broken windows and gonorrhea; $P = .000$ for both correlations).

The results of the multiple regression are shown in Table 3. After all the variables were entered, only broken windows remained significantly related to gonorrhea rates. Marital status and off-sale alcohol outlet density had a marginal but independent effect on gonorrhea rates. Figure 1 illustrates how the variables are associated in a hypothetical model.

ANOVA indicated that gonorrhea rates were significantly higher in neighborhoods with both high broken window indexes and high poverty indexes (46.6 per 1000 vs 25.8 per 1000 in neighborhoods with low broken window and high poverty indexes [$P < .001$]). When block groups with low broken windows indexes and high poverty indexes were compared with those with low broken windows indexes and low poverty indexes, there were no significant differences in rates of gonorrhea. Unadjusted means are given in Table 4.

TABLE 2—Descriptive Statistics for Variables Used to Create Poverty Index and Broken Windows Index

	Mean	SD	Minimum	Maximum
Poverty index				
Households earning <$15 000	55.20	14.12	32.30	94.48
Population with no high school diploma, %	53.38	16.37	28.80	95.22
Population unemployed, %	21.49	9.37	0.50	44.81
Broken windows index				
Properties with major structural damage, %	5.34	3.71	0.50	15.70
Properties with minor structural damage, %	8.31	3.86	0.80	17.10
Properties with minor cosmetic damage, %	20.03	6.42	9.30	35.60
Segments with graffiti, %	27.41	20.68	0.50	76.69
Segments with accumulated garbage, %	46.34	23.97	0.50	97.27
Segments with abandoned vehicles, %	17.68	14.17	0.50	52.67
Neighborhood public high school problems, n	20.23	15.47	4.00	48.00

TABLE 3—Linear Regression Results Using a "Backward Elimination Method"–Gonorrhea as the Dependent Variable

Model	B	SE	β	*t*	*P*
(Constant)	42.699	7.157	. . .	5.966	.000
Broken windows index	1.394	0.478	0.390	2.917	.005
Off-sale alcohol outlet density	0.0928	0.055	0.206	1.686	.098
Married, %	–0.411	0.227	–0.237	–1.812	.076

Note. $R^2 = 0.476$. ANOVA results for regression model are as follows: F statistic = 17.38, $P = .000$. B = Beta; β = standardized Beta.

Discussion

The results suggest that physical deterioration of a neighborhood is either a marker for a risk factor for gonorrhea or itself a risk factor for gonorrhea. Our data suggest that traditional variables associated with STDs (i.e., poverty, race, and unemployment) do not provide as robust an explanation for gonorrhea as is the broken windows factor, a measure of neighborhood deterioration. We have insufficient

TABLE 4—Descriptive Statistics and ANOVA Results by Broken Windows and Poverty Indexes

Broken Windows Group	Poverty Groups	Sample Size	Gonorrhea Rate (Mean ± SD)
Low[a]	Low[a]	25	27.4 ± 12.5
Low	High[b]	10	25.0 ± 9.0
High[b]	Low	4	32.3 ± 9.9
High	High	16	52.0 ± 15.8

Note. Mean gonorrhea rate for the "high–high" group is significantly higher than those for all other groups (multiple comparisons test results as follows: $P = .000$ for the difference with groups "low–low" and "low–high" and $P = .072$ for group "high–low" because of small samples in this group).
[a]Low for both broken windows index and poverty index is defined as below the mean (or 0).
[b]High for both broken windows index and poverty index is defined as above the mean (or 0).

information to determine whether the broken windows measurement is directly associated with high-risk sexual behavior or reduced health care–seeking behavior or whether the association is mediated by another construct.

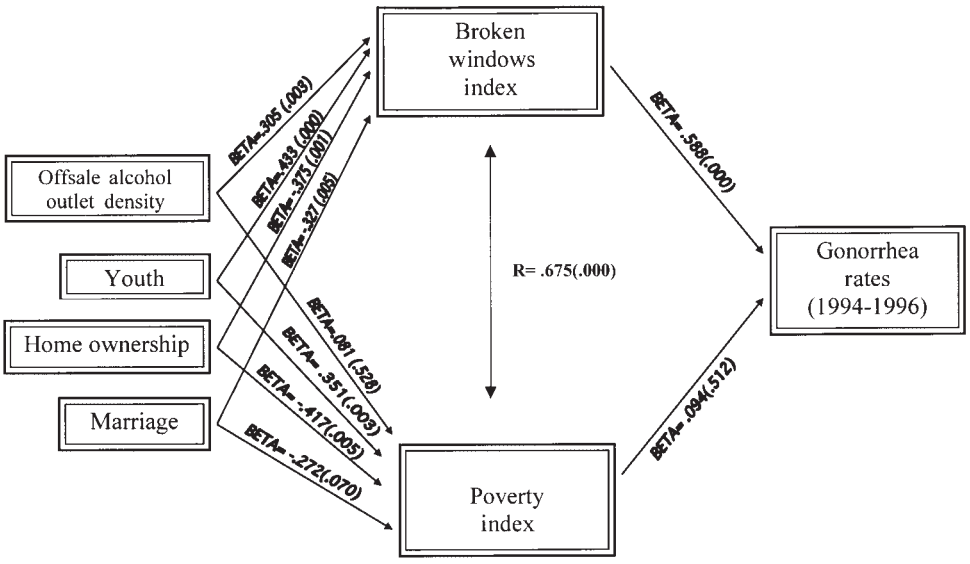
A major limitation of this study is its cross-sectional nature, which would preclude any causal inference. Although we cannot determine the direction of the association between broken windows and gonorrhea, if indeed there is a causal relationship, we can speculate on several possibilities: (1) people with high-risk behaviors/low health care–seeking behaviors cause the problems in the environment (individual-level explanation); (2) the environment causes people to have high-risk behaviors/low health care–seeking behaviors (structural-level explanation); (3) there is a dynamic relationship between people and their environment and each influences the other (combined explanation).

Individual-Level Explanation

Because high-risk behaviors cluster together, it is possible that deteriorated neighborhoods represent a concentration of individuals who have few constraints on their behavior, intentionally create a disorderly environment, and engage in high-risk sexual behavior. "Street culture" predominates,[25,26] and graffiti, vandalism, and trash are tolerated. Deteriorated neighborhoods are simply markers for high-risk personalities or persons who do not take care of themselves. In contrast, neighborhoods that are orderly may have a higher concentration of persons with more traditional values who do not engage in high-risk sex and/or who take care of themselves (seek early screening and treatment of STDs and reduce subsequent transmission). Marital status is an individual-level variable that was marginally associated with gonorrhea, but the protective effect has face validity.

Structural-Level Explanation

An environment that is filled with graffiti, deterioration, trash, and abandoned cars and that is unsafe and subject to vandalism may be a signal that there are no rules and that no one cares. Alcohol outlets may contribute to this environment, serving as places for loitering and public drinking. Given the context of an environment that tolerates behaviors that would otherwise be considered antisocial, there may be few reasons not to engage in high-risk sexual and drug-use behaviors, since



Note. Betas represent the standardized regression coefficients for the models, including the independent factors offsale alcohol outlet density, youth, home ownership, and marriage and the dependent variables broken windows and poverty (2 separate models).Betas on the right side of the figure are for broken windows and poverty against gonorrhea rates. The *R* statistic is the simple correlation between poverty and broken windows.

FIGURE 1—Theoretical model of the relationship between neighborhood deterioration (broken window index), poverty, and gonorrhea.

there are no traditional standards that might result in reputations being tarnished. An uncared-for environment may indicate that self-care is not a priority; persons with symptoms may ignore them rather than seek help. A developmental, contextual perspective would support the idea that as neighborhood conditions deteriorate, the range of behaviors that are considered acceptable expands.[27,28] Norms prevail that may make it acceptable to have sex with multiple partners or with people one does not know or to exchange sex for money or drugs. For persons who live in the environment day after day and believe that no one cares about their behavior, the attention and physical pleasure associated with sex and/or drug use may be a strong motivation to have casual sex partners. For some, high-risk sex and drug use may be a coping mechanism.[29] Furthermore, deteriorated conditions also provide situational opportunities for high-risk behaviors. An abandoned home may be an invitation to open a crack house, which would disproportionately influence individuals who live in that immediate environment.

In contrast, an orderly environment may imply that there are rules and standards that people are expected to meet. The pleasant environment and sense that people care may protect youths. In an orderly neighborhood, people may be more likely to watch and maintain their environs and to notice what others are doing in the street. This might give youths a greater rationale for avoiding sex with casual partners and drug use, if only to protect their reputations. Youths in orderly, caring environments may have a lower need for drugs, casual sex, and associated affection, as they may already feel that people care about them. Perhaps they are participating in maintaining their homes and environments and do not have time or opportunity to engage in high-risk behaviors. The absence of abandoned homes in orderly neighborhoods precludes any opportunity to open a crack house or shooting gallery, further reducing the risk of situational or spontaneous high-risk sex. People who live in well-maintained neighborhoods may be more likely to seek routine health care and treatment for symptoms promptly.

Throughout the early half of the 20th century, social scientists believed that extremely poor housing conditions influenced behavior and attitudes.[30] Schorr[31] postulated that neighborhood conditions directly influence habits of privacy, child rearing, housekeeping, and study. If housing results in isolation, fewer interactions among neighbors can protect youths. If housing is substandard and results in youths' spending more time outside the home, their relationships will be spread superficially in the neighborhood

FIGURE 2—High-gonorrhea, high-poverty neighborhood, New Orleans, La.

FIGURE 3—Low-gonorrhea, high-poverty neighborhood, New Orleans, La.

rather than concentrated in the family. Schorr also pointed to housing as a symbolic extension of one's self. Housing is a symbol of status and achievement and affects how people perceive themselves and are perceived by others. Expectations and aspirations are colored by what a family has and what seems practical. Poor housing and neighborhood environment may lead to pessimism and passivity, chronic stress, and a state of dissatisfaction. Gunnar Myrdal in 1944 said that "any common sense evaluation will tell us that the causation in part goes from poor housing to bad moral, mental and physical health."[32]

Dynamic Relationship Between Individuals and Their Environments

A dynamic relationship between the environment and behavior[33–35] would explain why both of the above explanations may be operating to produce higher rates of gonorrhea in physically deteriorated neighborhoods. With progressive neighborhood deterioration, families with means and traditional standards of behavior often leave the area or the city. When persons with traditional values leave, possible role modeling or controlling factors, called "social buffers" by Wilson,[26] that might have otherwise served to reduce the high-risk behaviors disappear. Norms of the street begin to prevail in the absence of counterbalancing forces.[25,26]

While poverty (low income, low education, and low unemployment) may be associated with neighborhood deterioration, it is not a sufficient explanation for high rates of gonorrhea, given the existence of high-poverty neighborhoods in relatively good physical condition with low gonorrhea rates. While we did not measure collective efficacy,[15] it is possible that in high-poverty neighborhoods with low broken windows indexes, persons are more willing to act for the common good and so maintain their homes and environs and have greater control over the behaviors of local youth. Moreover, the willingness to act for the common good may be reinforced by having a neighborhood whose appearance signifies that rules and standards exist.

Currently, in the area of crime and violence, the role of the environment is regarded as a critical factor influencing human behavior.[12,16] The effect of neighborhood environment on health behavior was recognized in the past and should be further considered, because the implications for influencing disease rates at the population level are enormous. Epidemiologic studies of a variety of health problems, including infectious diseases like measles and AIDS, chronic diseases like cardiovascular diseases, diabetes, and asthma, and conditions like obesity and lower health care–seeking behaviors, indicate that these problems disproportionately affect persons in inner-city neighborhoods.[36–51] Although it is unclear how the inner-city physical environment may influence behaviors that are believed to be causally associated with disease outcomes, further investigation of the role of the inner-city physical environment seems justified. It is plausible that disorderly environments reflective of apathy may diminish behaviors that protect health.

In the past, STDs have been considered to be caused solely by the behavior of individuals; however, this study demonstrates that, independent of individual characteristics such as race, poverty, and unemployment, gonorrhea is clustered in neighborhoods that are physically deteriorated. Prior STD prevention programs have focused on individual-level variables but not on neighborhood conditions. Prevention programs that target the conditions in which people live may in the long run have a dramatic impact on STD rates at the population level. □

Contributors

D. Cohen, S. Spear, and R. Scribner planned the study. K. Mason, S. Spear, D. Cohen, and P. Kissinger analyzed the data. J. Wildgen and all of the other authors contributed to the data interpretation and writing of the manuscript.

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