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## Prison Crowding Research Reexamined

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## Abstract

Continued increase in the United States' inmate population has raised new concerns about prison crowding. Although growth in prison capacity has lagged behind that of the inmate population, there is no consistent evidence that crowding is associated with mortality, morbidity, recidivism, violence, or other pathological behaviors. This paper reviews the major areas in which prison crowding has been examined. Conceptual, methodological, and empirical criticisms are raised concerning prison crowding and the areas of health, violence, and recidivism. The paper is divided into five primary areas related to prison crowding research: 1) the Eighth Amendment test of cruel and unusual punishment; 2) ecological versus individual level differences in crowding; 3) theoretical and empirical problems associated with violence and its relation to crowding; 4) an analysis of inmate illness reporting and its relation to crowding; and 5) the degree to which the literature points to consistency both within the prison and across other crowded settings. In the area of prison litigation, the criteria suggested by Thornberry and Call (1983) for deciding prison crowding suits are evaluated. It is concluded that the first criterion, that the courts first consider general evidence on the relationship between crowding and debilitation, cannot be met, based on the extant crowding literature. In the area of violence, it is argued that most prison crowding studies do not clearly examine the

relationship of intervening mechanisms proposed by theorists to account for the relationship between crowding and violence, if and when a relationship is found. Furthermore, it is suggested that one reason underlying the inconsistency in the results of these studies is that researchers have failed to examine the proximal causes of violence and the formal mechanisms prison administrators use to control or limit violence. With regard to health, it is argued that the most demonstrative finding, that dormitories are associated with higher illness reporting rates than are other types of housing, is probably an artifact of selection bias. Furthermore, illness reporting is the result of a complex set of circumstances that is affected as much by psychological and sociological causes as by the health status of the inmate. Thus, despite the prevailing sentiments about the harmful effects of crowding, there is little consistent evidence supporting the contention that short- or long term- impairment of inmates is attributable to prison density. One reason for this may be that researchers have failed to consider management interventions under periods of high confinement, and have failed to account for conditions other than crowding that affect inmate debilitation.

The real-life impact of the social science literature that treats the effect of prison crowding is undeniable. This literature has been used by the legislatures, courts, prison administrators, and others to shape policy that has profound implications for both the incarcerated and for society as a whole. Unfortunately, the oversimplification of problems and conclusions in the literature itself reduces its usefulness and may lead to less than optimal or even erroneous policy applications.

In addressing any problem area, one first must define the terms or operational definitions one is using so that others can determine whether they are studying the same phenomenon. Unfortunately, the terms used in the crowding literature are often unclear or confusing. The term "crowding" fails to differentiate between the two operational definitions of density: social density, which refers to the number of persons in a given area, and spatial density, which refers to the amount of space apportioned to each individual. Analysis is made more difficult by the realities of prison administration. At the aggregate (also called the "ecological") level, crowding is usually defined as the ratio of the number of inmates in a prison to its rated capacity. Rated capacity usually combines spatial and social density so that a change in one density is confounded with a change in the other kind of density. Usually, increases in the number of prisoners confined leads to decreases in the amount of space per person. Furthermore, the effect of housing space on prisoners is typically obscured by the highly variable amount of time spent in the housing unit and by the availability and

spaciousness of other prison areas such as the prison library or recreation yard. I have discussed in greater detail the many conceptualizations of crowding in a prison setting in a previous review (Gaes, 1985).

In the 1985 review, I concluded that there were two basic findings to the emerging prison crowding literature: (1) open bay dormitories were associated with higher clinic utilization and elevated blood pressure; (2) prisons which greatly exceeded their rated capacity, or contained dormitories, had higher assault rates. Based on more recent evidence and a reconsideration of the previous data, I now believe neither of these relationships has much support.

There are five areas I consider in this paper: (1) the implications of empirical findings for Eighth Amendment tests of cruel and unusual punishment and the different perspectives of judges, prison administrators, and academicians on the crowding evidence; (2) theoretical differences between ecological and individual levels of density; (3) conceptual and empirical problems with the relationship between prison violence and density; (4) the relationship between density and inmate health; and (5) the degree to which there is consistency in the crowding literature.

Most attention is spent on the relation of crowding to inmate health, both because there has been some consistency to the research finding that dormitory housing produces increased illness-reporting over single- or double-bunked housing, and because if it can be shown that crowding is related to health debilitation, this would merit serious attention by the criminal justice community. However,

the purported links between crowding and health have not been critically evaluated in the light of a rich literature that has been developed to account for clinic and physician utilization. This literature is important because it shows the many factors involved in the decision to seek medical care and how these factors may or may not be influenced by crowding.

I also think the other four sections of this paper are equally important in understanding the crowding literature. The section on ecological versus individual differences in crowding studies is most important for theorists who are primarily familiar with individual data. The ecological fallacy (Robinson, 1950) of inferring individual relations from aggregated data may be causing further confusion in the crowding literature. The section on crowding and inmate violence suggests that formal control mechanisms have been ignored by most crowding researchers, and this may be the reason that there has been such inconsistency in the crowding-violence studies. The section on the presumed consistency across crowded settings is intended to challenge the belief held by some researchers and public policy practitioners that crowded environments produce similar results in different settings. Although the scientific merit of the crowding literature should stand or fall on its own weight, there are non-research participants to this imbroglio, who often have different public policy perspectives, which may or may not be research-based. This is inevitable; however, the first section tries to give some

perspective to the status of the crowding literature in relation to these different views.

Crowding As Seen by the Courts: The Eighth Amendment Test of  
Cruel and Unusual Punishment

Increases in the confined population in the United States and its territories have been viewed by some criminologists as synonymous with a crisis in corrections resulting from overcrowded prisons (see Gottfredson and McConville, 1987). From 1980 to 1987, the combined State and Federal prison population climbed from 329,821 to 581,609 (Bureau of Justice Statistics (BJS), 1988), an increase of 76 percent. Using each State's definition of capacity, BJS found that in 1987, using a high estimate of capacity, State prison systems were, on average, 5 percent overcrowded, and using a low estimate of capacity, 19 percent overcrowded. The State with the lowest reported density was Utah, which was 18 percent below its capacity.

Connecticut reported a high overcrowding level of 99 percent. For Federal prisons, which represent about 8 percent of the entire prison population, the low estimate was 37 percent and the high estimate was 73 percent.

The capacity of a prison system can be an elusive number unless some care is used in systematically defining the living arrangements and living space in an institution. One careful analysis (Mullen and Smith, 1980) showed that by rigorously applying the cell standards

recommended by the American Correctional Association (ACA), in March 1978 nearly two-thirds of all prisoners were confined to below-standard units -- i.e., units with less than 60 square feet per person. Every 5 years the Bureau of Justice Statistics completes a prison census in which a thorough analysis of capacity is assessed. The last census in 1984 showed that between 1979 and 1984 the inmate population rose 45 percent while the additional square feet of housing space rose 29 percent. In this same time period, however, the number of correctional officers rose at a faster rate than the inmate population so that the inmate-to-staff ratio actually dropped from 4.6 to 4.1 in this time frame.

Another approach to describing the status of crowding and corrections has been to cite the amount of litigation addressing crowding and unconstitutional conditions in various jurisdictions. According to an American Civil Liberties Union (ACLU) annual report released in December 1988, there were 10 entire prison systems, including Puerto Rico's, under court order or consent decree in which overcrowding was a primary issue. In addition, 30 jurisdictions had a major prison under court order or consent decree in which crowding was cited as a primary or major problem (Corrections Digest, 1989). The primary issue in court interventions has been the quality of conditions with regard to (but not limited to) inmate safety, medical care, nutrition, and sanitation. Ingraham and Wellford (1987) have pointed out that the lower courts have treated crowding as the source of all problems instead of being a contributing factor. The "totality of conditions" test emphasized



in Rhodes v. Chapman made it clear that crowding and double bunking were not by themselves unconstitutional. Crowding may exaggerate harsh and unpleasant conditions to the extent that they become unconstitutional, but the test is not the precise level of crowding, but whether a prison system can deliver adequate care and protection.

Call (1988) has reviewed the case law from 1979 to 1986 to see whether lower courts required plaintiff-inmates to demonstrate the harmful effects of prison crowding. Inmate-plaintiffs won 73 percent of the reported cases <sup>1</sup>. In the 65 cases decided in Federal courts that Call reviewed, 35 did not consider evidence regarding harmful effects. According to Call's analysis, the lower courts had not heeded the Supreme Court's "sermon about giving greater deference to the decisions of corrections officials" (p. 35). Thornberry and Call (1983) advocated an approach to deciding prison crowding cases based on two criteria: (1) the court first considers evidence on the general relationship between crowding and debilitation; (2) the court then considers evidence that crowding had caused specific problems at the institution or institutions under consideration. Of the 65 Federal district or appellate cases studied by Call, only 4 had used such rigorous criteria.

There remains a great deal of confusion concerning how to deal with prison crowding in relation to other conditions of confinement. Clearly, the courts as well as social scientists must acknowledge there is tremendous variability in the quality of prison conditions independent of crowding levels. From my perspective, the social

science prison crowding literature is fraught with theoretical and methodological problems. Furthermore, since there is such inconsistency in the findings, the literature cannot be the basis for establishing Thornberry and Call's first criterion, that prison crowding is either a necessary or sufficient condition for debilitation. Obviously, there can still be Eighth Amendment tests based on the totality of conditions criterion; however, alleviation of the problems may require a combination of administrative responses including some reduction in crowding, better classification of inmates, better training of staff, and changes in the adjudication of misconduct. In one of the most encompassing prison conditions suits, Martin and Ekland-Olson (1987) have shown that all of these remedies were imposed on the Texas Prison System.

Crowding and the Different Perspectives of Judges,  
Administrators, and Social Scientists

There is an interesting dilemma that arises from the different perspectives of social scientists, policy makers, and judges on the crowding issue. Each of these people bring different criteria to bear upon the importance or significance of the effects of crowding. From a judicial/legal perspective, it would seem that whether or not a general relationship exists between crowding and the quality of inmate life is irrelevant to a specific finding that a prison is in violation of the Eighth Amendment. Because there will be exceptions at many diverse levels of crowding, a finding of fact

must be made for the specific prison under consideration. If a finding of unconstitutional conditions prevails, then a reduction in crowding may be the logical choice to alleviate conditions. However, there may be other practical interventions as well.

From the perspective of prison administrators and lawmakers, correctional standards and practical limits on the number of inmates a facility can hold are major concerns. With regard to standards, administrators must be concerned about minimum levels of inmate living conditions. Unfortunately, if they turn to social scientists, it is rare that they will receive absolute criteria with regard to crowding levels. Social scientists may provide suggested standards; however, these must be weighed against the needs of the public and the cost of designing and constructing prisons. A very different set of questions arises from the perspective of prison administrators than from that of social scientists. Prison administrators, aside from their concern about legal actions against them, want to know such factors as the caseload limits of prison staff, the capacities of prison dining facilities, or the capabilities of their medical facilities. These issues constitute the "nuts and bolts" of prison administration; however, such problems may be considered too mundane by some social scientists, who are primarily interested in the effects of crowding on inmates.

Finally, social scientists have traditionally concentrated on what they have presumed to be the damaging effects of prison crowding. This is because this area of study evolved from the examination of subhuman species in which overpopulation led to

dramatic changes in mortality and other behaviors both in natural environments (e.g., Christian and Davis, 1964) and laboratories (Calhoun, 1962). Because of this orientation, the research community has generally ignored other environmental and psychological stressors; however, this seems to be changing. Zamble and Porporino (1988) and, to some extent, Toch and Adams (1989) have examined not only some of the other causes of pathology and adaptation in prison, but have formulated the research to suggest potential intervention strategies as well.

The reason there is a dilemma involving these different perspectives is that there is no clear and consistent evidence that levels of density are unequivocally (or even in all probability) related to human health or pathology. If we could say with some precision that a prison which confines more than some fixed percent of its capacity will necessarily lead to violence and illness, then this could be the basis for establishing Eighth Amendment tests of inmate living conditions that would satisfy judges as well as standards for correctional institutions that would meet the needs of correctional administrators. That kind of evidence may or may not be achievable and, until it is, the criteria for judges and administrators will shift with the context of situation.

#### Ecological Versus Individual Crowding Effects

Because crowding has been studied at both the individual and aggregate (ecological) levels of analysis, some confusion persists over theoretical expectations at these different levels. Most researchers have treated the different studies as if they were reflections of the same process, when it may be the case that crowding at an ecological level influences individuals in very different ways than crowding at an individual level. An example from a different, but related set of variables may help to clarify this problem. A similar confusion has arisen over the relationship between age and assault rates in prison. At an ecological level, it is more useful to view age in terms of age composition or age blending. Age blending refers to the policy that purposely houses older inmates with younger inmates.

Proponents of age blending in a prison setting have argued that older inmates tend to suppress the negative behavior of younger, more volatile inmates. We might assume that the unfettered relationship between age and assault rates at the individual level is as it appears in figure 1 (i.e., the higher the percentage of younger inmates, the higher the assault rate). However, figure 2 shows the individual relationships at different levels of the ecological variable, age composition. Figure 2 demonstrates how the contextual effect of age composition modifies the individual effect of age with respect to assault rates. It shows that the individual level relationship between age and assault can change with different age compositions. To complicate this example further, it is probably the case that the age composition of an

institution is also related to other ecological characteristics such as staff-inmate ratios and available programs. These variables might also affect the individual-level effects of age with respect to assault rates.

In the same way, crowding may have very different effects at both the ecological and individual levels of measurement. At an ecological level, density may be related to economic costs and benefits (i.e., economies of scale), the efficient or inefficient delivery of services (also an economies-of-scale issue), and custodial requirements concerned with monitoring and controlling the inmate population. That is, density may affect an institution's ability to control behavior and maintain health. At the individual level, density could have very different effects on stress, and consequently on behavior and health. In short, density has different effects on institutions and individuals, and the effects of density on institutions can modify effects on individuals.

#### Crowding and Inmate Violence: Theoretical Problems

The relationship of crowding to violence has been studied either in the absence of theory or with little or no effort to conduct a strong test of the theoretical assumptions underlying the assumed crowding-pathology relationship. Most of the crowding-violence literature has examined the relationship between some operational definition of crowding and some measure of violence. There are few instances in this literature in which the

relationship of crowding to other prison variables (e.g. inmate-staff ratios, institution size) has been studied - variables that may clarify how crowding actually relates to violence. When other variables have been used, it has typically been in the context of controlling sources of error in the interpretation of the crowding relationship. This shortsightedness may make many of the policy implications of the prison crowding research irrelevant or very limited in their application. The exceptions to this approach (Ekland-Olsen, 1986; Ellis, 1984) have introduced rather broad theoretical explanations of the possible link between crowding and violence.

If prison administrators were to compile a "laundry list" of all of the variables that may provoke violence among inmates, the list would probably contain the following: prison drug trafficking, homosexual relationships, predatory behavior, gang confrontations, arguments over thefts and valued possessions, and racially prejudicial behavior. These are the typical proximal causes of violence. Social scientists have proposed that crowding affects these proximal causes in two ways. The first is through psychological mechanisms: crowding causes stress that elevates the "arousal level" of the inmate and makes any behavior more likely to occur or, secondly, unwanted interactions due to increased density stress the individual over time. These are stress-mediated mechanisms. The second set of mechanisms are sociological. Social control theorists (Ekland-Olsen, 1986; Ellis, 1984) argue that crowding creates uncertainty in the control environment through transiency, a

weakening in staff-inmate attachments, and reduction in the certainty of punishment. Ellis (1984) has noted the overlap in these approaches, and Ekland-Olsen has argued that it is more likely social control mechanisms explain serious violence (homicides) and some combination of the psychological and sociological approaches explain less serious misconduct. There have been very few attempts to specify operational measures of stress or social control constructs and then show how such measures 1) relate to crowding and 2) mediate assaults or homicides. Ekland-Olsen, however, has attempted to demonstrate how social control mechanisms may have led to changes in the violence patterns during resolution of the Ruiz suit involving the Texas correctional system.

In summary, the crowding research offers little insight into how crowding may interact with the proximal causes of violence. Instead, researchers in this arena study the relationship between a crowding measure and some measure of inmate violence, and this is taken as evidence that crowding causes violence. Such research does not address the relative contribution of crowding to these other proximal causes of violence, nor does it provide meaningful results for policy intervention. The reduction of crowding from a level of 150-percent overcrowding to 120-percent overcrowding may have little or no impact on the proximal causes of violence. It may be a waste of resources when other interventions are more meaningful to the prison climate. With regard to violence, these other interventions may include a better inmate security classification system to reduce predatory behavior by separating predators and more aggressive



inmates from the other inmate population, a more comprehensive random urinalysis program to reduce drug usage and drug trafficking, more staff to increase surveillance and cope with inmate problems, more concrete policies regarding property ownership to reduce theft and an inmate "underground economy," and more programs to promote meaningful work and learning opportunities for the prison population.

These interventions are formal control strategies that are practiced in varying degrees by administrators in most prison systems. To simply focus on crowding to the exclusion of these interventions adds little to the policy repertoire of prison administrators. The prescription I am proposing for crowding research as it relates to violence not only requires the intervening constructs to be more clearly stated and measured, but also requires the relative assessment of formal control strategies. As Ruback and Innes (1988) have pointed out, most crowding research has been conducted by social scientists who are most focused on the processes underlying crowding, stress, and the consequences of stress. Although their focus is on these mediating constructs, they have failed to do strong tests of these theoretical assumptions. Until crowding research also begins to address the formal control strategies, it may be of limited value to prison administrators, legislators, and jurists who must balance issues of cost, humane treatment, and inmate and staff security.

## Crowding and Violence: Empirical Problems

There are also empirical reasons to question the crowding-violence relationship. One of the few studies to find an aggregate prison crowding and assault relationship (Gaes and McGuire, 1985) also found that this relationship was inelastic<sup>2</sup>. A 1-percent increase in social density resulted in a .3-percent increase in the rate of inmates assaulting other inmates. In the Federal prison system, where this data was collected, this meant that the prison population could double with an increase of between only 2 and 3 assaults per 10,000 inmates in a 1-month period. Furthermore, Innes (1986) found that when looking at all major prisons in the United States, there was no relationship between crowding (defined as spatial density) and the assault rates at the various State prisons. More recent studies by Porporino and Dudley (1984) and Fry (1988) have not shown a relationship between density and assault rates. Gaes and McGuire (1985) reviewed the prison density-violence relationship. Although the existing research results revealed various inconsistencies, Gaes and McGuire argued that the inconsistency was due to different specifications in the quantity and quality of variables in the relationships and different levels of analysis. Upon further consideration, it seems there might be fundamental differences in the way individual Federal and State prison system managers and staff respond to crowding. At an ecological level, it may be possible to evaluate prison system differences in the crowding-violence relationship; however, until

there is a theory relating the ecological influences to system responses, crowding studies will continue to be aimless inquiries based on arbitrary theoretical specifications.

### Crowding and Violence: Prison Disturbances

In a Wall Street Journal article on August 18, 1981 ("Life in Prison: More Riots Are Feared as Overcrowding Fuels Tension Behind Bars"), a staff reporter addressed the Nation's swelling prison population. In that article, the reporter introduced the topic by describing the prison riot in the New Mexico State Penitentiary in which 33 inmates died, some by decapitation or mutilation. Although the reporter cited the State's attorney general's report indicating the major problem was mismanagement, the report also implicated chronic prison overcrowding. This article is typical of many other newspaper pieces which have implicitly or explicitly linked crowding with prison riots. Unlike the Wall Street Journal article, which merely identified crowding as a problem area, most newspaper accounts wrongly treat prison crowding as synonymous with major disturbances.

This image of the crowded prison as a boiling cauldron of inmate hostility, ready to erupt instantaneously into a riot has also been used by prison administrators when they are asking for funds to build more housing. To what extent is this image true? It is very difficult to track prison disturbances in relation to

crowding, first, because they occur rather infrequently and, second, because they are difficult to define. Due to these factors, journalists, administrators, and other participants in the prison crowding debate have used the suggested relationship between crowding and riots for their own convenience.

Useem and Kimball (1989) define a prison riot as "...when the authorities lose control of a significant number of prisoners, in a significant area of the prison, for a significant amount of time" p. 4). Useem and Kimball, who have studied some of the major prison riots in the last two decades including Attica, Santa Fe, and Joliet, contend that many of the sources of tension that existed in these prisons prior to the riots also were present in most prisons throughout the country. The major cause of riots in these prisons was a breakdown in the administrative control and operation of the prison, including an erosion of the security system. The authors do not exclude objective deprivations (e.g., poor sanitation, violence, crowding) as a cause of prison riots; however, they argue that many other prisons have suffered from the same deprivations. The difference between besieged prisons and the others was that inmates at the former perceived their grievances to be legitimate. Additionally, they viewed the State authorities responsible for the prison as likely to capitulate to at least some of their demands.

While the previous discussion could be considered a broad critique of the prison crowding literature and violence, the following critique provides a more detailed analysis of the most

cited relationship between crowding and debilitation: the effect of crowding on illness reporting.

### Crowding and Illness Reports

Two levels of analysis, aggregate and individual, have been used to study the presumed deleterious effects of prison crowding with regard to health. Aggregate studies have focused on indicia of pathology such as rates of morbidity, mortality, and psychiatric commitments (see Cox, Paulus and McCain, 1984). Individual studies of prison crowding have examined a variety of criteria including self-reports of stress, symptomatology, hostility, and psychopathology measures of physical health such as blood pressure, urine, catecholamine production, and illness reporting in a prison clinic. Illness reporting has been the most frequently used criterion of health. Because of the focus on illness reporting in the prison crowding literature and the importance this measure has had in interpreting crowding's effect on health, I will examine the theory and data underlying illness reporting in some detail. Most of the crowding literature relying on illness reporting does not recognize there is not a one-to-one relationship between illness reporting and health.

Theories concerning crowding have dominated the explanations for variations in prison illness reporting. This has occurred to the exclusion of: (1) an understanding of the meaning and role of

illness reporting and (2) the consideration of other causes that may prove to be more meaningful, more influential, and more tractable to policy changes. One basic underlying model of crowding which attempts to explain the variation in illness reporting is that crowding antecedents such as high social density results in a stress reaction which in turn leads to pathology and/or psychopathology. This model has several variations (see Cox, Paulus, and McCain, 1984; Gaes, 1985); however, illness reports have been used as a primary criterion in drawing conclusions about the relationship between crowding and inmate health. In the following sections, I will examine in greater empirical and theoretical detail the concept of illness reporting; examine other research that has focused on antecedents of clinic and physician utilization that have been overlooked in the crowding-illness literature; and assess the relative contribution of crowding to some of the other causes of illness reporting variations.

#### Illness Reporting: Conceptual and Empirical Relationships

The process of illness reporting begins with a decision by the inmate to go to the prison clinic during "sick call," or those times when he is feeling acutely ill. The inmate is seen by a physicians assistant, nurse, or physician and the results of the medical intervention are recorded in the inmate's chronological medical record. To measure illness reporting, an inmate's medical record

is culled for evidence related to the inmate's visit. The data may consist of symptoms, diagnoses, lab tests, or suggestions for further medical testing. The data are typically reported as an incidence rate in a given time frame. In the prison crowding literature, illness reports have been presumed to be a veridical reflection of inmate health. For the remainder of this section, I will analyze the nature of illness reports in the context of prison crowding. The conclusions of this analysis are germane to other research applications in which illness reporting is used to assess health care issues such as those reported in the sociology of medicine literature.

Illness reporting has also been labeled symptom reporting, illness complaining, clinic utilization, and illness behavior. Although these terms are sometimes used interchangeably, for clarity, we are operationally defining the target behavior as the recording of a visit to the prison health clinic. The medical record may contain a combination of the symptoms described by the patient (e.g., pain, headache, anxiety), the medical indicia of symptomatology (e.g., fever, rash, blood pressure level) and the medical diagnosis (e.g., influenza, allergy, hypertension). As a further refinement, I am restricting illness reporting to voluntary visits, rather than a series of treatments (e.g., blood pressure clinics) or required examinations (e.g., medical histories and physical examinations).

Although there is a certain face validity to the assumption that illness reports represent the underlying health of the inmate

population, there are parameters other than the health of the population which determine the extent of health service utilization in a clinic setting. These other parameters are related both to dispositional characteristics of the inmate population and the administration of medical care in an institution.

Table 1 indicates a large variation in individual illness reporting (0-31 visits) over a six month period, as well as a large variation in the incidence of reporting by institution (.016 - .044 visits per person per day). These data were collected by Paulus, Cox, and McCain in six Federal prisons containing only male prisoners (see Paulus, 1988). In examining the individual level data, one can see that nearly one-third of the inmate population never used the prison clinic in a 6-month period. Furthermore, more than half of the inmates used the clinic once or not at all in the 6-month period. A few inmates skewed the distribution by using the clinic 11 to 31 times in the 6-month time frame. Future research should identify these heavy users to examine the etiology of such high usage. Turning to the institution data, one can see that Site 3B's rate was 2.75 times that of site 5. There does seem to be some stability to illness reporting rates for the two sites (sites 2 and 3) that were measured at different times. Clinic utilization can be extremely high. As much as 67 percent of the inmate population may have used the health clinic in a 1-month period (see McCain et al., 1980). Table 1 also lists distributional information on illness reports for a sample of 1,199 inmates in a 6-month period. It also lists the different institutional incidence rates computed



as the number of reports per days at risk. This individual and institutional variation has been attributed to levels of crowding; however, there are many other factors that cause these variations and crowding is not a significant contributor.

### Illness Behavior, Health Behavior, and the Sick Role

Analytical distinctions among the purposes of health-related behavior have been the focus of work in the sociology of medicine literature. Kasl and Cobb (1966) distinguished between health behavior, illness behavior, and sick role behavior. Health behavior is preventive, involving actions taken to insure health. Illness behavior involves the actions of people who feel ill and seek the definition, causes, and remedies for their illness. As a consequence of the definition of illness, sick role behavior includes activities while the individual is ill and attempting to get better (Parsons, 1951).

A parallel theoretical development in the health education literature has identified a conceptual model for understanding why individuals engage in health-related actions. The health belief model (see Becker, 1974) consists of attitudinal and behavioral dimensions which focus on the individual's desire to avoid illness and the belief that a specific health action will prevent or ameliorate an illness (Janz and Becker, 1984). In their review of the health education literature, Janz and Becker identified

perceived barriers as the most consistent dimension of the health belief model in predicting health actions. Barriers refer to the implicit cost analysis the individual undergoes when weighing the disadvantages to a health action. The costs include medication, side effects, other health action side effects, inconvenience, and time away from work.

The second most common dimension in predicting health actions was the individual's perceived susceptibility to contracting a condition. The third most important dimension was the perceived benefit of a health action. Thus, although an individual might perceive a condition, no health action would ensue if he/she did not anticipate that the health action would be beneficial. Finally, the least consistent predictor of health actions was the dimension of perceived seriousness of an illness. Janz and Becker demonstrated that perceived seriousness is a more important dimension for individuals who are already defined as sick rather than individuals practicing preventive health actions.

Although illness reporting in a prison clinic is primarily illness behavior, it also involves health behavior and sick role behavior. This is because, unlike in the free community, prison clinic and health care systems are an inmate's only opportunity to acquire medical prophylaxis and receive medical attention. There is little opportunity for "home remedies" and little opportunity to seek alternative private or public sources of medical care.

An indication of the different functions of prison and free community health clinics is the difference in the individual

utilization rates of inmates and citizens seeking health care. Most estimates of the community clinic utilization rates place individual usage rates at between 1 to 2 times per year (U.S. Department of Health and Human Services, 1980). Estimates of clinic utilization rates in a prison system average 6 to 7 times per year and for those inmates who use the clinic, as much as 11 to 12 times per year for voluntary visits. There is the possibility that some of the utilization differences are due to differences in the health of free and imprisoned populations.

Table 2 represents information on the most frequently occurring categories of complaints for the same sample of inmates represented in table 1. The most commonly occurring contagious illnesses were cold or flu symptoms (18.2 percent of all reported symptoms). The most commonly occurring noncontagious symptoms were neuroses/psychoses (7.0 percent) and back pain (6.9 percent). As can be seen from table 2 most of the illness reports concerned relatively minor, non-virulent symptoms.

Thus, although the analytical distinctions among health, illness, and sick role behavior may be more important in a less constrained environment, there are other analytical distinctions that are more important in a prison. These are explained in the following sections.

#### Factors Affecting Illness Reporting

## Prison Housing, Crowding, and Illness Reports

Most of the evidence involving individual housing units within a variety of Federal prisons has demonstrated that open dormitory housing of 20 or more inmates produces twice as many illness complaints as single- or double-cell housing (Paulus, 1988). While double-bunked cells or rooms are rated negatively by inmates on other scales, such as degree of crowding relative to singles, they do not consistently produce elevated illness reporting rates. These findings concerning housing variations, social density, and illness reporting have been interpreted as reflecting the health consequences of the stress produced by prolonged exposure to prison crowding (Cox, Paulus, McCain, and Karlovac, 1980). I believe this presumption is in error and needs to be examined more closely. The first step in dissecting this presumption is to place the clinic visit in the broader context of illness behavior.

One problem associated with the use of illness behavior is that it involves a decision about one's health in addition to judgments about the adequacy of diagnosis, the adequacy of treatment, and the costs incurred in reporting health problems (e.g., loss of wages, accusations of malingering). This is particularly telling for crowding research if the decision to use the clinic is associated with differences in the housing densities of the inmates. As an example, in most prisons, inmates occupying single cells have the most preferred housing in a prison. Assignment to single cell housing is somewhat of a privilege, based on a combination of tenure

and good behavior. Inmates housed in these preferred conditions may be less likely to complain about a problem, including their health, in order to gain the acceptance of prison administrators. Alternatively, inmates assigned to single cells may be more likely to take better care of themselves. In either case, assignment to single cells would be confounded with health actions.

### Illness Versus Psychological Problems

Many of the factors that produce variations in illness reporting in settings other than prison are probably also operating in prison. As Mechanic and his colleagues have pointed out, illness behavior has an important psychological component (Mechanic, 1980; Tessler and Mechanic, 1978; Tessler, Mechanic, and Dimond, 1976). Patients respond to their overall sense of well-being, not just to specific symptoms. Psychological distress is just as potent a predictor of health care utilization as is the patient's perceived health status. A clinic visit may represent the inmate's attempt to alleviate distress that may have an associated medical complaint, may be the cause of a medical complaint, or may even be the result of a medical complaint. In this sense, a clinic visit may represent the seeking of both medical and psychological intervention.

There are other examples in the health literature in which researchers have found psychological variables to be related to clinic visits. Gortmaker, Eckenrode, and Gore (1982), in a

prospective study of women registered at a neighborhood health center, found that stressful life events were related to the probability of using the clinic. The Gortmaker et al. study also replicated a study by Roghmann and Haggerty (1972) in which a diary was used to measure daily stress in relation to clinic use. Both studies found that daily stressors were predictive of clinic use, while the Gortmaker et al. study also showed that the contribution of daily stressors was independent of that of negative life events.

#### Free-Community Determinants of Physician Utilization

In addition to psychological variables, there are many other factors which determine illness reporting rates. Mechanic (1979, 1989) has reviewed both large-scale multivariate studies of physician utilization and smaller scale studies. He found that in the large-scale studies, those variables which measure the extent of medical need, either actual or perceived, account for most of the variation in physician utilization. Need is operationalized as the extent to which people worry about their health, the symptoms they are experiencing, or the number of bed days they report. Smaller scale studies often find other factors such as demographics, beliefs about medical care, and enabling characteristics such as income and availability of the clinic to be influential variables.

## Determinants of Prison Clinic Utilization

Suls, Gaes, and Philo (1989) measured negative life events among a sample of 151 inmates in a Federal prison. Negative life events were measured by a series of questions that asked inmates about significant occurrences in their lives. Typical events include the death of a loved one, financial loss, sickness in the family, and separation from one's family. In addition to this traditional set of questions, Sulz, Gaes, and Philo developed a set of questions specific to the prison environment. These items included problems with parole, altercation with an officer, problems with case appeals, and grievances against the prison administration. Illness reports were measured at two different time frames in this study: concurrent and prospective. The concurrent time frame occurred in the same 3-month period as the recall of significant life events. A prospective time frame was the 3-month period immediately following the survey administration.

Results of this study showed that negative life events predicted both concurrent and prospective prison clinic utilization rates as well as they predicted self-reported symptoms. Thus, psychological distress is an important antecedent of both clinic utilization and self-reports of symptoms. Sulz, Gaes, and Philo (1989) have also found that inmates have different attitudes about their dependence on medical expertise. Adapting the behavioral component of a self-treatment instrument developed by Krantz et al.,

(1980), Suls, Gaes, and Philo developed generalized and prison self-care subscales. The generalized subscale elicits attitudes about a person's disposition to treat medical problems without health care intervention. The prison self-care subscale elicits the inmate's reliance on and satisfaction with the health care he can receive at the prison clinic. Only the prison self-care subscale predicted concurrent and prospective clinic illness reports. These results demonstrate that part of the decision to use the prison clinic depends more on the specific trust in treatment of that particular clinic rather than some generalized expectation about medical care and expertise.

The failure to find a relationship between generalized attitudes about health care intervention and clinic utilization has also occurred in community studies of physician utilization (Mechanic, 1979; Sharp, Ross, and Cockerham, 1983). Sharp et al. (1983) demonstrated that neither a generalized attitude toward physician visits nor symptoms by themselves predicted utilization; however, symptoms that were rated as serious enough to warrant a physician visit were related to the physician utilization variable.

Schaeffer, Paulus, Baum, and Gaes (1988) measured catecholamine levels (epinephrine and norepinephrine) in a sample of inmates who volunteered to have their urine tested. Elevated catecholamine levels have been associated with stressful environments (Baum, Gatchel, and Schaeffer, 1982). Although this study concluded that dormitories produced elevated levels of catecholamines, the sample of inmates housed in single cells was so small (n=9), it is



difficult to be confident in the contrasts between inmates housed in dormitories and double cells (n=84) versus the inmates housed in single cells.

Self-reported symptoms and clinic illness reports were also assessed for these same inmates. Disregarding type of housing, the correlations among some of the variables measured in this study appear in table 3. Time in unit was the number of weeks an inmate reported he had spent in the particular housing unit he was in at the time of the study. Time served was the amount of time in weeks the inmate reported he had spent in his current incarceration. Perceived crowding refers to the self-report of how crowded the inmate felt in his particular housing unit (rated on a 5-point scale), and perceived control was a series of items assessing the inmate's self-perceptions of control over the prison environment.

Table 3 shows that neither the frequency nor the rate of illness reports by inmates were related to self-reports of symptoms in a concurrent time period. This lack of a relationship between self-reports and clinic visits was also found by Suls, Gaes, and Philo (1989). In this latter study, self-reported symptoms were unrelated to the rate of clinic visits in both a concurrent and prospective time period.

In Schaeffer et al., illness reporting was also unrelated to biochemical markers of stress (epinephrine and norepinephrine levels); however, illness reporting was related to time served in the inmate's current incarceration--the longer the current incarceration, the less likely it was that an inmate would make a

voluntary visit to the health clinic. This latter finding has also been observed by Paulus with regard to time in housing with a much larger sample. Illness reporting was related to perceived control in the direction expected and marginally related to perceived crowding in an unexpected direction. Inmates expressing less control were more likely to use the prison clinic; however, contrary to expectation, inmates reporting greater crowding used the health clinic less often. Typically, perceived crowding is unrelated to illness reports.

Together, the correlations in table 3 suggest that illness reporting at the prison health clinic was more influenced by psychosocial factors than it was by biological factors. Furthermore, the biological stress markers were unrelated to both self-report of symptoms and clinic visits, whereas these markers were related to time in prison and perceptions of control and crowding. If the stress markers were indicative of long-term exposure to crowding, one would expect these variables would be related to both the crowding and illness variables. This is one of the few strong tests of the assumptions that crowding is related to stress and that a biological component of stress is related to health impairment. The data do not support this assumed relationship. Instead, the data lend credence to an adaptation effect. The longer an inmate has been incarcerated, the lower the level of both biological stress markers and behavioral measures of clinic use.

There are several methodological problems with these comparisons that may be causing an error in this interpretation. The first is that the lack of a relationship between self-reports of symptoms and clinic visits may be due to an artifact of the way these two variables are measured. Both symptom self-reporting and illness reports are measured as the rate of occurrence, for example, the illness report rate per week in a 6-month period. This may lead to spurious conclusions. An inmate who has the flu may report to the clinic for treatment, but he may also go for other minor ailments or concerns. When he fills out the self-report questionnaire he may focus only on the flu symptoms. Conversely, another inmate may consider all minor and major ailments as reportable, yet use the clinic only for major ailments. The studies previously cited by Sharp et al. (1983) and Mechanic (1979) support this contention. Only symptoms rated by the individual as serious result in a physician visit.

The true measure of relationship between symptom self-reports and clinic visits is the correspondence of complaints with specific illness categories; to make correspondence more meaningful one must get a sense of the seriousness of symptoms because the literature shows that people must consider their symptoms to be serious before they will seek clinic assistance. Improvements in this measurement process may lead to more valid conclusions in future studies comparing illness self-reports and clinic visits.

Another problem in comparing the self-report of symptoms and actual clinic visits, given the present method, is that the former

depends on recall (typically 3-6 months), while the latter does not. Verbrugge (1980) has reviewed the literature on health diaries and found that the diary produces higher reporting rates for both acute and chronic illnesses. This is taken as evidence that retrospective self-reports are subject to recall errors typically under-representing symptoms and disabilities. Thus, compounding the problem of matching the self-reporting of symptoms and the recording of health actions (clinic visits) is the fact that the former is subject to greater error, unless the health diary methodology is used.

#### Reanalysis and Reclassification of Illness Reports

In an attempt to gain further insight into the nature of illness reports, two further analyses were conducted and reported in Paulus (1988). In the first analysis, illness reports were coded according to 70 symptom or diagnostic categories and then factor--analyzed. In the second analysis, the symptom categories were rated by physicians and other health personnel on several important theoretical dimensions including the following: verifiable stress-related, contagious, and psychosomatic. Based on these a priori categories, inmates' illness report rates were recomputed and analyzed while controlling for demographic and other background variables.

Paulus (1988) reports that inmates housed in dormitories were more likely to report pain-related symptoms than were inmates housed in double-bunked cells or single-bunked cells. Pain-related symptoms included reports of chest pain, back pain, and other nonspecific pain as well as gastrointestinal pain. Based on physicians' ratings of all of the symptoms, those that were rated as verifiable (e.g., fever, abrasions) were more likely to be reported by inmates housed in dormitories than by inmates housed in double- or single-bunked cells.

Together, these results imply that inmates housed in dormitories were reporting more verifiable symptoms and pain-related symptoms. This is not intended to imply that dormitory-housed inmates are malingering when they report pain-related symptoms. Excluding chest pains, these other forms of pain may be symptomatic of a more general malaise.

Overall, the results of the factor analysis and of these symptoms yielded few additional insights into the illness reporting process. Other classification schemes may be more appropriate; however, a more fruitful approach seems to be the one where different exogenous variables, such as health attitudes, and different endogenous variables, such as prior clinic use are examined. Thus, negative life events and the self-care survey provide more of an insight into the illness reporting process than the reclassification of symptoms.

The fact that the symptoms judged to be most contagious did not distinguish between dorms and other housing arrangements has also

been found by Gaes (1982). Contagious illness may not be related to housing type because of the high level of inmate contact throughout the prison environment such as the work environment, recreation yard, and dining hall. In prisons and jails where inmates are confined to their quarters most of the day and therefore are more segregated from each other, contagious complaints may be elevated when these facilities are more crowded.

Clearly, the types of illness reports underlying clinic visits represent legitimate efforts by the inmate to seek the source of and alleviate health problems. It is also apparent that there are psychological and dispositional factors that determine what health action the inmate will choose. To the extent that these factors are related to housing assignment and are not controlled for in a statistical analysis, observed relationships between housing and illness reports may be spurious.

#### The Strength of the Crowding-Illness Reporting Relationship

Theoreticians and methodologists alike have cautioned against using statistical variance explained as a criterion for assessing the importance of empirical relationships (Lieberson, 1985; Singer, and Marini, 1987). The purpose of this section is not to dismiss variables based on their relative contribution to the explanation of illness reporting, rather it is to point out what may or may not be accomplished from a policy perspective. This assumes that the

structural relationships that have been studied are well specified and do not omit important variables that are correlated with illness reporting (Arminger and Bohrnstedt, 1987). With well-specified relationships, we might then assess the degree to which we can anticipate how manipulation of certain variables might allow us to intervene in the health/illness reporting process. It is the contribution of crowding relative to other variables that concerns us, rather than the total amount of variance explained.

In order to "benchmark" the strength of the crowding-illness reporting relationship, two household density studies should be mentioned. The first was conducted in Toronto (Booth, 1975), the other in Chicago (Galle and Gove, 1972). Unfortunately, these studies were discrepant in their results. The Chicago study showed evidence of household density effects while the Toronto study did not. The relationship in Chicago was weak, however. Galle and Gove (1972) reported the effects of household density in a hierarchical presentation by first demonstrating the variance explained in their regression results when various background factors were related to measures of illness and psychopathology. The reduction in error gained by adding various household density scales was on the order of 1- to 2-percent additional variance explained.

In Mechanic's review of large-scale physician utilization studies (1979) cited earlier, he reported that between 12 and 25 percent of the variation in physician utilization was explained by the different variable sets in the various studies. Of this 12 to 25 percent, illness variables accounted for almost 85 percent of the

explained variance, with demographic and other variables accounting for the rest. Thus, the major determinant of a visit to a physician was the degree to which an individual perceived his illness to be serious enough to warrant a visit. Neither demographic or enabling factors such as income or insurance availability were as influential as the individual's perception of seriousness. Although perceived seriousness seems to be the critical factor for free community clinic use, this construct has never been tested for its influence on prison clinic use.

Paulus (1988) has conducted an analysis of the data collected on the 1,199 Federal inmates described throughout this paper in which he looked at a number of variables in relationship to clinic use. The relationship between different illness reporting measures and back-ground variables was computed. Then the additional variance contributed by inmate housing density was computed. The background variables were parental occupation, parents' high school graduation, home size, highest grade completed, SAT score, Beta IQ score, size of hometown as a child, size of hometown as an adult, prior prison commitments, duration of prior commitments, current level of custody, months left to serve, weeks in housing, weeks in prison, weeks in present sentence, height, and weight. The multiple R-squared between these variables and illness reporting was .03. When both age and housing type were added, the multiple R-squared was .06.

Illustrating the comparatively small impact that housing type had on illness reporting, Paulus reported results for other health



and subjective well-being criteria based on a series of regressions that combined background and housing variables in addition to the variables outlined below. In those regression equations in which the housing variable was significant, Paulus found the following R-squared values: perceived crowding, .33, room rating, .29, diastolic blood pressure, .13, systolic blood pressure, .07, self reporting of headaches, .23, and reported crowding tolerance, .26.

These data indicate that when crowding is measured as a contrast between dormitory and other kinds of prison housing, the influence on illness reporting is rather weak. By contrast, the negative life events scale used by Suls, Gaes, and Philo increased the R-squared by .13 above the effects of race, age, time served, disposition to use the prison health clinic, and self-reported symptoms. Gortmaker et al. also found that negative life events increased the R-squared by .14 after controlling for other variables. Although it is inappropriate to compare these three studies since the specifications for the regressions in each study were different, there is consistency in the findings. The contribution of crowding is much less important than the measurement of negative life events and other psychosocial factors examined in these two studies. The Mechanic review also points out that the perceived seriousness of symptoms is more important than other demographic or enabling factors. Future research should identify whether the free and prison community factors determining clinic use are the same. It is plausible that they are not the same. The costs associated with free community clinic use are probably greater than

those associated with use of the prison clinic. Public clinic use usually involves a long commute and long waiting period once you are there. Neither of these factors enters into the decision to use a prison clinic.

#### Adaptation Effects With Respect to Illness Reporting

Paulus (1988) has shown that differences in illness reporting that are related to housing assignment begin to converge by the 6th week of confinement, and by the 4th month the illness reporting rates among inmates housed in dormitories, double-bunked cells, or single-bunked cells are practically identical (see Paulus, 1988, table 4-10, p. 38). This data showed that for inmates who remained in a dormitory for at least 3 months, the rate at which they used the prison clinic is no different than inmates in the other, more preferred types of housing, and was actually lower than inmates in preferred housing who had recently been assigned to that unit. Subjectively, inmates in dormitories and double-bunked cells still rated their housing as more crowded and rated the overall housing environment less favorably than inmates in single-bunked cells. This evidence of an adaptation effect with respect to illness reporting was cited before with respect to biological stress markers. This adaptation effect occurs for all of the housing types. Illness reporting for inmates housed in single cells had a rate of .31 visits per week in the first 5 weeks and dropped to .14 visits per week by the 16th week. For double-bunked cells, the respective

rates were .38 and .16, and for dorms the rates were .81 and .18 . Clearly, inmates use the prison health clinic more often when they are first assigned to a housing unit.

Because of the problem of assignment bias (considered in detail below), one must be cautious in interpreting the absolute levels of illness reporting in relation to housing assignment. Furthermore, this kind of longitudinal data involves a great deal of retention bias due to the fact that the inmate sample size decreases as time in housing increases. Inmates who are retained in the dorm setting may be very different from inmates retained in the more preferred housing. Reassignment from a dorm to more preferred housing is typically associated with good conduct and tenure, while reassignment to less preferred housing is associated with misconduct or special treatment needs. Consistent with the adaptation effects in Paulus' data are data reported by Ostfeld, Kasl, D'Atri and Fitzgerald (1987). Ostfeld et al. were primarily concerned with blood pressure measure over time; however, their study not only shows an adaptation as measured by blood pressure within hours and days of confinement (pages 97,98), it also shows adaptation with respect to clinic use (page 155) over four weeks.

Ignoring the effect of housing for the moment, what are the causes of this apparent adaptation effect for illness reporting? There are at least two plausible reasons why inmates use the prison clinic more often during the initial stages of their confinement. First, many incoming inmates have health problems, particularly drug-related illness. As reported by BJS (1988), 42.7 percent of

all State prisoners admitted to using some kind of drug on a daily basis in the month prior to their conviction offense. Second, moving to a new housing unit or a recent imprisonment may create psychological distress. Both of these factors may be unrelated to the kind of housing to which an inmate is assigned; however, to the extent dormitory inmates are more likely to be recent arrivals than are double- or single- bunked inmates, the observed relationship between housing and illness reporting may be nothing more than an artifact of preferential housing assignment.

#### Cross-Sectional Versus Longitudinal Studies and the Nature of Selection Bias

Most of the data that have demonstrated increased illness reporting in dormitories have involved cross-sectional comparisons. In some instances, other variables have been introduced to control for the differences in populations between the dormitory- and single-cell housed inmates. Paulus (1988) has claimed that the prison sites he and his colleagues chose were selected for their variety in housing to insure contrasts between single- and double-bunked cells and dormitory housing. By optimizing the difference among types of housing, Paulus and his colleagues may have inadvertently enhanced the possibility of selection bias. In those sites where a variety of housing existed, preferential assignment of housing was most likely to occur. Paulus has acknowledged this possibility; however, he has claimed that

either assignment bias did not occur, or that such bias could be evaluated independently. However, there is strong evidence in Paulus' data that assignment bias did occur, and was not adequately handled in either the methods of sampling or statistical control.

Table 4-8 in Paulus (1988, 36) displays the results of analysis of variance, contrasting characteristics for inmates housed in singles, doubles, and dorms for the 1,199 prisoners on whom the data were collected. Inmates housed in single-bunked cells had spent 100- percent more time in any prison, 150-percent more time in the current prison, and 50-percent more time in their current housing than inmates housed in dormitories. Single-cell inmates also had more time left to serve, a longer previous confinement, and more previous commitments and were housed at a lower level of custody than inmates housed in dormitories. The picture that emerges from this data is that of inmates in single cells who had "earned" preferred housing, had more extensive criminal histories, and had by their behavior met requirements that made them less prone to escape or assault than their dormitory counterparts. These are relatively unmistakable signs of self-selection or assignment bias.

Paulus and his colleagues (McCain, Cox and Paulus, 1980; Paulus, 1988) have made an effort to statistically control assignment through covariance or regression analysis. However, covariance or regression analysis will not remove bias in two different populations if there is a self-selected or assigned difference in the populations and the variables used to adjust for the bias are themselves affected by the assignment process.

Wainer's (1986) example of the distribution of SAT scores for different States showed that when an adjustment is made with a variable that is also affected by a treatment variable, (the treatment variable in this case was the State in which the SAT tests were taken), covariance adjustment does not remove the assignment or selection bias. Analogously, adjusting for time in housing or other variables, which may be a result of the housing assignment process, will not produce an unbiased estimate of the variable of interest.

Because of the strong relationship between time in housing and illness complaint rates, the elevated illness complaining in dormitories found by Paulus and his colleagues could be merely an artifact based on the assignment of dormitory inmates, who have spent much less time in the institution or housing unit. If we are to have any confidence in future cross-sectional comparisons, some quasi-experimental design or statistical control for selection bias should be used. Either Heckman and Robb's (1986) approach or the prospective method suggested by Rubin and Rosenbaum (1984) using a propensity score will help control for selection bias.

Because cross-sectional studies of prison housing suffer from this methodological problem, longitudinal studies in which the same inmates experience different housing or different density conditions over time may prove to be more insightful. There have been relatively few studies of this kind and the few that have been done are very limited in their scope. Wener and Keys (1986) examined two housing units which were nearly identical except for their

respective population levels. Housing unit A went from an average daily population of 64 inmates to 56 inmates. Unit B went from 48 inmates to 56 inmates. Although unit A did not show a decline in sick call requests as would be expected if density was causing elevated sick call, unit B did show an increase in sick call requests. Pellisier (1988) examined sick call rates before and after an institution increase of from 330 to 653 inmates. The sick call rate declined after the population buildup. There were some changes in the makeup of the population; however, the changes in offense distribution and average security level should have had no effect on sick call. The population actually aged somewhat and this would have been expected to increase sick call rates.

Ostfeld, Kasl, D'Atri and Fitzgerald (1987) have written an expansive description of their longitudinal and cross sectional research. In addition to studying the relationship between housing and blood pressure, these researchers have detailed an analysis of occupational stress and blood pressure among correctional officers. They also have written an extremely insightful chapter on the health status of inmates. The health status chapter assesses prevalence rates for intake disorders as well as clinic use over time. Unfortunately, there is no reference to the relationship between housing, blood pressure, and these latter measures of health status in this chapter. It is unclear whether this was a purposeful omission, or whether the authors simply found no relationship between blood pressure, housing, and/or clinic use over time.

Most of the book presents a detailed analysis of the longitudinal assessment of blood pressure in relationship to many covariates including obesity, age, race, education, marital status, nativity, religion, religiosity, number of children, prior conviction, residential history, parental relationship, housing mode, work release, furloughs, other situational factors, and psychological factors. I will spend some time on this study for two reasons: (1) to my knowledge, there is no critical review of the study, and (2) the study is already being cited in secondary sources as evidence of at least short-term effects of crowding. Bonta and Gendreau (in press) in a forthcoming review of the effects of imprisonment, examined the effect sizes of the data reported by Ostfeld and his colleagues and concluded, based on a meta analysis, that the data indicated a short-term effect of crowding. I think this conclusion is mistaken and based on an uncritical acceptance of the effects reported by Ostfeld and his colleagues.

Ostfeld et al. (1987) cite the following strengths of their longitudinal study : (1) the participation rate was over 90 percent and thus reduced the possibility of bias introduced by volunteerism; (2) a longitudinal design allows one to closely examine changes for the same inmate over time increasing the likelihood of detection of an effect; (3) blood pressure is a non self-report measure unlikely to be biased by other subjective impressions. To this list of advantages, the authors cite one major disadvantage, the longitudinal study was based on one, not very crowded, medium



security, white dominated prison consisting of for the most part young, uneducated inmates.

To this one limitation, I would like to add some other important limitations that from my point of view, severely restrict the usefulness of the study. The major lesson to be learned from the Ostfeld et al. data collection effort is that although a researcher may begin with a clean, crisp, quasi-experimental approach to a longitudinal design, the vagaries of prisoner movement (death, escape, transfer, release) confound the researcher's design. Although the researchers started with over a 90 percent participation rate, the rate shrank precipitously the longer the time frame of the study. Ostfeld et al. presented a figure (figure 6.1, page 77) showing the initial longitudinal sample and the attrition rate of subjects over time. Of the initial 568 inmates out of 612 eligible (92.8 percent), by the second month there were 436 inmates remaining (71.2 percent of the original eligible pool of 612) and by the sixth month there were only 181 inmates (29.6 percent). In the longitudinal analyses, that examined the same inmates from week one through two months, there were only 165 inmates (27 percent) with complete data and for a three-month interval there were only 116 inmates (19 percent). There is no attempt in the analysis either to control for the differences in these censored observations relative to the other inmates, or even depict the possible similarities or differences between the participants and non-participants at each stage.

A second problem with the study is the incompleteness of their quasi-experimental design. Although the authors do not call their design quasi-experimental, many of their analyses are analyses of variance, especially those pertaining to housing and blood pressure as if the study were quasi-experimental. The major conclusions regarding crowding are based on changes in blood pressure that result from a transition from one type of housing to another. There were basically four types of housing studied by Ostfeld et al.: cells, dormitories, work release dormitories and work release cells. Table 4 depicts the possible combinations resulting from a cross-classification of these four types that would be necessary to assess the different housing transitions. Only those cells containing an asterisk were actually examined in this study. This was because it was prison policy to put all newly admitted inmates into cells and transfer them to the "more preferred dormitories" later. According to the authors, transfer was based on good conduct, longevity, and whether there were population pressures in the cell blocks. Thus, the transfer decisions imply selection bias.

Although the authors measured a lot of background variables in this study, it is not clear that in the analyses of housing effects on blood pressure, the author's simultaneously tried to control for these characteristics. There is a section in the book (page 117) that describes an attempt to examine confounding problems. The authors note that there were differences in the average age and obesity of men assigned to the different housing units (variables which have a dramatic influence on blood pressure); however, Ostfeld

et al. claim a covariance analysis showed these influences did not account for the housing effects. Other differences in the covariates among the inmates assigned to different housing units were also addressed by the authors individually; however, it is not clear they were addressed simultaneously. Furthermore, as I have already argued, selection bias cannot be controlled in this way.

Even the authors admit that the blood pressure results they do find are rather small. I would add that given the incompleteness of their design, the results are almost impossible to interpret meaningfully. As can be seen from table 4, there is no "group" which began in a dormitory and transferred to a cell or remained in a dormitory. Although inmates showed a slightly elevated systolic blood pressure when they transferred from a cell to a dormitory, while inmates remaining in a cell or transferring to a work release cell showed no change or a slight decline, there is no evidence available to examine whether inmates initially assigned to a dormitory and later transferring to a cell versus inmates remaining in a dorm would not have exhibited precisely the same pattern of effects.

Finally, as I have already mentioned, Ostfeld and his colleagues measured blood pressure in both a cross-sectional design (D'Atri and Ostfeld, 1975) and a longitudinal design (D'Atri, Fitzgerald, Stanislov, Kasl, and Ostfeld, 1981; Ostfeld, Kasl, D'Atri and Fitzgerald, 1987). The same investigators get dramatically different results when using cross-sectional and longitudinal measures. The authors' explanation is that blood

pressure was measured in a more benign environment in the longitudinal study. suppressing effects. One would further have to accept an assumption that the suppression of blood pressure would be more pronounced for inmates housed in cells than inmates housed in dormitories, muting the differences.

I think a more realistic explanation is that the cross-sectional results were at least partially attributable to selection bias and the longitudinal design, although not eliminating selection bias at least observed the same inmates when they switched housing modes. There are many problems with the use of blood pressure as a measure of health (see Pickering, Phil, James, Boddie, Harshfield, Blank, and Largh, (1987); however, the magnitude of differences between the cross-sectional and longitudinal effects are instructive. In the cross-sectional design, dormitory inmates had a higher systolic blood pressure of between 15 and 21 mmHg, and a higher diastolic blood pressure between 7 to 11 mmHg. In the longitudinal design, there were no differences in diastolic blood pressure when inmates changed housing, and when inmates changed from a cell to a dorm, the increase in systolic blood pressure was closer to 3.6 mmHg. In the longitudinal design, Ostfeld et al. also reported on 42 inmates who transferred from a cell to a dorm and, although there was an initial increase in blood pressure, after 1 month the systolic blood pressure decreased by almost 50 percent.

The blood pressure results present a very confusing picture of density relationships; however, one reason why the cross-sectional and longitudinal results are so dramatically different could be the

results of selection bias. Unfortunately, it will take a systematic study of a combination of biological markers, illness complaints, and objective health assessments before any meaningful assessment of the density-health relationship can be made. The Ostfeld et al. study is extremely useful in its systematic analysis of health and background factors. Unfortunately, it also should serve as a warning to reserachers that maintaing a quasi-experimental, longitudinal design will be extremely difficult to do in a prison setting. Clearly, one should start with a more stable population than the one Ostfeld et al. had an opportunity to examine.

#### Summary of Crowding and Illness-Reporting

The use of illness reporting as a veridical indicator of health may be misleading. The data previously reviewed indicate there may not be a very good relationship between the occurrence of illness and the choice to use the prison health clinic. If we assume the self-reporting of illness to reflect actual health, there is little or no relationship between self reported illness and illness reporting in a prison clinic. Rather than assume that the self-report of illness is the veridical indicator of health, one approach may involve medical examinations of inmates by health personnel "blind" to the inmates housing type. Booth's (1975) household study included such an evaluation of Toronto residents. The medical checkup also included a blood assay for biochemical

stress markers. There were no consistent findings resulting from this examination; however, the level of crowding experienced by Toronto residents may not be as deleterious as the level of crowding experienced by prisoners.

This objective health assessment approach should establish the level of health prior to residence in a particular housing environment and remeasure health states after the inmate has lived in the new environment. Furthermore, because time in prison and time in housing are highly related to health measures and housing assignment, an experimental design or quasi-experimental design in which new commitments are assigned to different housing types may be necessary to separate the influences of housing from these time-related variables. Two quasi-experimental approaches to control for the effects of selection bias have been proposed. Rubin and Rosenbaum (1984) have shown how selection bias can be controlled by prospectively selecting a comparison group using a propensity score. The propensity score summarizes statistical similarities (and dissimilarities) between a study group member and the comparison group member. Heckman and Robb (1986) have shown how selection bias can be controlled through statistical modeling. Any longitudinal design should also include a follow-up period long enough to determine if effects diminish over time.

The research by David Mechanic and his colleagues also shows that illness reporting may be indicative of psychological distress and that people mislabel a variety of psychological states as illness. This may be especially true for inmates who are newly

imprisoned, or are new to a housing assignment, resulting in increased somatic complaints. However, as Costa and McCrae (1987) have shown, somatic complaints are not isomorphic with objective indicators of health. Costa and McCrae's review of the relationship between neuroticism and disease has implications for the crowding-illness reporting literature. Costa and McCrae have shown that neuroticism is associated with elevated somatic complaints, but is not associated with increases in objective measures of illness or disease. This implies that rather than reflecting some personality dimension, elevated symptom reporting in dormitories, if it is not an artifact of assignment bias, may indicate only a heightened awareness of somatic complaints. Once again, the methodological solution is to measure objective indicators of disease or morbidity over time while controlling for assignment bias.

Although Paulus (1988) has discussed other variables in the context of crowding, these factors have been exogenous variables used to control for potential differences among prisoners housed in different housing units (race, parents' occupations, highest grade completed, gender, ethnicity, criminal history); intervening background variables that might explain reactions to crowding (crowding tolerance, housing preference, home size); or intervening prison variables that might explain reactions to crowding (length of confinement, custody). The emphasis has been on variables that modify the crowding-illness or crowding- psychological relationships.

Paulus' approach is important if we are to exhaustively test the effect of crowding. From this author's perspective, it is time to move on to other prison stressors that probably have more of an influence on the health of the inmate. Some of these variables have already been mentioned: stressful life events, the prisoner's disposition toward medical care, and the health care delivery system. There are many other variables in a prison setting that are crucial to corrections, yet have been ignored for their relative contribution to inmate health and well-being. These include prisoner classification, correctional officer training and inmate-officer interactions, equity and justice in inmate discipline, prison amenities such as a the library, recreation yard, and other leisure time activities, and the basic necessities of sanitation and nutrition.

Evans and Cohen (1987) have outlined a typology for environmental stress which provides a theoretical vantage point from which we can analyze the different levels of prison stressors. Evans and Cohen discuss four types of stressors: cataclysmic events such as war, floods, or imprisonment; stressful life events such as the death of a loved one; daily hassles such as irritating events at the office; and ambient stressors such as chronic air pollution. Although from Evans and Cohen's perspective, prison is a cataclysmic stressor, there are also more mundane stressors encountered in prison, characteristic of the other levels of stress. Some of these were discussed in relation to the prison stressful life events subscale used by Suls, Gaes, and Philo (1989).



One of the reasons why prison might be considered cataclysmic is because it combines so many sources of stress. How are we, then, to draw conclusions about the relative contribution of crowding when so many other sources of stress converge in one environment? To this point, most of the social science research has concentrated on crowding to the exclusion of many other important stressors. As a practical matter, a reduction in crowding may have little or no effect on any of the other stressors. In this paper, I have shown that when measures of crowding are significantly related to measures of debilitation, the relative percentage of variance explained by crowding is rather low and that the relationship between crowding and debilitation is inelastic. A note of extreme caution is in order. None of these studies have been designed to contrast the relative influence of different classes of stressors. Secondly, elasticity and variance accounted for can themselves be rather slippery statistics. These statistics depend on sound measurement, homoskedastic relationships, unbiased estimates, and, in the case of elasticity, on the level of the explanatory variable (usually the mean) at which the relationship is evaluated.

#### Is There Consistency in Crowding Studies?

Paulus (1988) has argued that despite limitations in some of the prison crowding studies there is consistency across a variety of settings and disciplines. These settings would include human

laboratory studies, household density studies, and crowding studies in other applied settings (ships, college dormitories). Let us first examine the degree of consistency in the published prison crowding studies, and then return to the question of generalizability of data from other settings and disciplines.

### Prison Crowding and Violence

The studies supporting a crowding-violence relationship were Megargee (1974), Nacci et al. (1977), Jan (1980), Cox et al. (1984), Ruback and Carr (1984), and Gaes and McGuire (1985). Studies failing to find a relationship were Carr (1980), Farrington and Nuttal (1980), Ekland-Olson et al. (1983), Ekland-Olson et al. (1986), Dilulio (1987), Pellisier (1989), Porporino and Dudley (1984), Innes (1987), and Fry (1988). These studies vary a great deal in the units of analysis (aggregate versus individual), the definitions of density, and attempt to control for other influences on violence. A meta-analysis of these studies would be inappropriate, because it would unfairly weight those that are well done from those that are cursory attempts at finding a relationship.

### Prison Crowding and Health

Paulus (1988) reviews data he and his colleagues collected examining the relationship between total population over time and death and psychiatric commitment rates. These crude aggregations showed a bivariate relationship over successive years between population and the morbidity/mortality rates described. These crude relationships have been criticized before (Gaes, 1985). There are other similar analyses which contradict these findings (Ekland-Olsen, Barrick, and Cohen, 1983; Carr, 1980; Lebowitz and Pospichal, 1979; Greenfeld, 1982; and Fry, 1988). Furthermore, there are too many other factors that are correlated with the changing population over time that could be the cause of the observed bivariate relationship. Although the burden of proof for establishing what these concomitant changes might be falls on the critics of these crude relationships, there are examples in the prison crowding literature which show that what appears to be a crude relationship at the aggregate level is an artifact of the aggregation process. Ekland-Olsen et al. (1983) have shown that the relationship between population changes and misconduct for an entire prison system does not hold when the data are disaggregated to the individual prisons. Fry (1988) has shown that what appears to be a relationship between density and sick call rates over time for an individual prison does not hold when the data are disaggregated to the level of the housing unit. Furthermore, policy changes that occurred in the prison over time completely account for the prison and unit level changes in sick call rates.

In addition to these aggregate data, Paulus (1988) has argued that the individual data he and his colleagues collected, primarily in six Federal prisons, fills in this picture of consistency. These are the same data I have criticized at length in this paper. Before we can have confidence in the housing contrasts, it must be demonstrated that: (1) illness reports are veridical indicators of the general health of inmates living in different housing units and (2) the housing contrasts are not merely a result of selection bias.

#### Prison Crowding and Recidivism

Farrington and Nuttall (1980) found an aggregate relationship between prison density and recidivism. These data have been cited as yet another density effect. Clayton and Carr (1987) have shown that they could replicate a density-recidivism effect among prisons in Georgia; however, further analysis showed that during times of high density, Georgia practiced a policy of early release to reduce crowding. This policy resulted in the release of a higher proportion of younger offenders, who were more likely to recidivate. Thus, the density-crowding relationship was spurious and was attributable to an early release policy.

#### Generalizability of Density Effects

Now, let us return to the issue of the generalizability of data from other settings. It is clear that the major conclusion to be drawn from the prison crowding literature is one of inconsistency. How are we then to relate the prison crowding literature to studies of crowded laboratories, dormitories, households, and ships? Paulus (1988) has argued that these studies have demonstrated adverse effects of crowding in relatively benign environments, and that crowding in prisons -- a relatively harsh environment -- should elicit demonstrative effects. There are three problems with this argument. The first is that the research on crowding in these other settings is not as consistent as Paulus claims. This is especially true of household density studies (Gaes, 1985). Secondly, there are many differences between prisons and these other settings. The most prominent difference is the nature of the people sharing the prison environment. Finally, if, as Paulus claims, the combination of the conditions of confinement and the antisocial nature of the population should exacerbate the effects of crowding, why isn't the evidence of the impact of crowding more compelling? Is it that the effect of crowding is minimized by other, more important environmental conditions? Perhaps, further developments in the theory of stressful environments offered by Evans and Cohen will lead to testable hypotheses concerning the effects of crowding in different settings. Until that time, we are left with a perplexing set of results under circumstances that make it very difficult to draw conclusions for policymakers.

## Summary

Although the number of prisoners continues to rise rapidly in the United States, with increases in prison capacity seemingly lagging behind, there is no consistent evidence that crowding produces short- or long-term impairment of inmates. There remain logical, empirical, and theoretical problems with the assertions of some social scientists who claim crowding effects have been demonstrated beyond reproach. Crowding has proven to be neither a necessary nor a sufficient condition for the short- or long-term impairment of inmates. Crowding is not a necessary condition because there are other stressors in the absence of crowding that can elicit impairment. It is not a sufficient condition because there is no proven absolute level of crowding that determines debilitation.

In my review of the research in 1985, I suggested that there were two basic conclusions that could be reached, based on the prison crowding literature. The first was that large, open bay dormitories elicit higher illness reporting rates than single- or double-bunked housing arrangements. The second was that prisons with more inmates than their rated capacity are more likely to have higher assault rates. Based on a reevaluation of the data and new evidence concerning prison violence, I now think that neither of those conclusions is valid. The dormitory effects on illness

reporting are probably the result of selection bias, and the data on aggregate measures of density and violence have shown that it is more likely that some factor other than crowding (but possibly correlated with density) is associated with changes in violence.

Although the prison crowding research effort has not been that fruitful, we have learned a great deal about how inmates react to their environment. There are clear adaptation effects. When inmates are first imprisoned and when they change housing units, a number of indicators increase and then gradually subside over time. The adaptation phenomenon can be measured by illness reports, blood pressure, or other biological stress markers (catecholamines). Inmates use the health clinic much more frequently at these early levels of exposure. This result is also consistent with misconduct data reported by Toch and Adams (1989) for a large sample of New York State prisoners. Inmates in general, and especially young inmates, were more likely to exhibit misconduct early in their incarceration. During imprisonment, the annual misconduct rate dropped dramatically for young inmates (age 21 or younger), dropped not quite as much for inmates of intermediate age (22 to 30), and was rather constant for inmates older than 30. Neither Paulus (1988) or Gaes (1982) have found age to be related to illness reporting rates. Nevertheless, there is a consistent picture beginning to emerge from different sources on prison adaptation that deserves further attention.

An adaptation phenomenon has policy implications for both the courts and prison administrators<sup>3</sup>. The claim that crowding is an

unconstitutional condition of confinement gathers most of its weight from the implicit assumptions that both crowding and its consequences are: (1) spread evenly throughout the population and (2) constant or continuous in nature. Courts may tolerate a condition that would otherwise be intolerable, if it can be shown to affect only some prisoners very strongly, and/or with decreasing effect beyond the first part of their sentences. If crowding results are an artifact of assignment bias and merely reflect the adaptation of inmates over time to their conditions, then adding new inmates to a system will not only raise the level of density but also the level of violence and clinic utilization. This phenomenon will be transitory. As the population, on average, increases its time in prison, the levels of violence and clinic use will decline.

From a management perspective, an adaptation phenomenon suggests that prison administrators adopt procedures at the beginning of a sentence that help address the inmate's integration into prison. This would include more than just the traditional rule orientation. Orientation to prison might include greater attention to the psychological and medical needs of the inmate when he first arrives. There may be a practical limit to the intervention that can be made when an inmate is first imprisoned. If a prisoner has medical or nutritional requirements, they will require attention. Psychologically, the shock of imprisonment may be difficult to ameliorate.

In closing, it is difficult to review the prison crowding literature without confronting pervasive, naive beliefs about



crowding. Although I have not systematically gathered evidence, I believe that the prevailing intuition among people unfamiliar with the research (and even some who are familiar) is that crowding, by itself, is prima facie evidence that prison conditions will be harsh and severe. This view ignores the potential responsiveness of prison administrators and their supporting agencies to increases in population. Camp and Camp (1989) have polled administrators in the United States to ask them the extent of their crowding and how they manage their prisons under crowded conditions. Among their conclusions, Camp and Camp argue that "managing a crowded institution is not substantially different from managing a prison that is not crowded" (p 63). Sound management is required in both instances. There are many institutions that are crowded; however, for the most part, those prisons that are orderly and meet basic inmate needs have avoided litigation or have won conditions suits brought against them. Researchers need to bear in mind that prison crowding research is conducted in an organizational setting -- all the data are collected in the context of an institutional "culture" and an administrative "climate." How prison administrators react to overpopulation may be as important as any variable yet to be proposed in this domain.

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Table 1. Summary data on illness reports collected in 6 Federal prisons in a six month period.

Basic Information		Percentage
Complaint Range	0 to 31	
Total Complaints	3,426	
Total Inmates	1,199	
Total Inmates Using the Clinic	788	65.7%
Total Inmates Not Using the Clinic	411	34.2%
Number Reports Per Inmate	2.86	
Number Reports Per Inmate Using the Clinic	4.35	
Number of Clinic Visits per Days at Risk	.032	

#### Distribution of Illness Reports

Number Complaints	0	1	2	3	4	5	6	7	8	9	10	11-31
Number Inmates	411	186	144	127	82	50	48	23	20	21	25	62

#### Illness Reporting Rate by Institution

Site:	Site 1	Site 2A <sup>1</sup>	Site 2B	Site 3A	Site 3B	Site 4	Site 5	Site 6
Rate:	.037	.023	.027	.038	.044	.035	.016	.029

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<sup>1</sup> A and B refer to two data collection efforts involving different inmates at different time periods in the same institution.

Table 2. Examples of the most frequent contagious and noncontagious illness symptom classifications and their percentage of occurrence among inmates.<sup>2</sup>

<u>CONTAGIOUS</u>	<u>%</u>	<u>NONCONTAGIOUS</u>	<u>%</u>
Venereal Disease	1.8	Neuroses, Psychoses	7.0
Eye, Ear, Nose, Throat Infections/Problems	11.9	Headache	5.2
Cough, Cold, Flu	18.2	Circulatory Heart Problems	2.1
Gastrointestinal, Stomach	8.3	Joints, Bursitis, Arthritis	4.6
Skin, Subcutaneous	11.3	Neck, Shoulder, Hip Pain	5.9
Virus, Chills, Fever	5.2	Chest Pain	2.8
		Back Pain	6.9

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<sup>2</sup> The values indicate the percentages of these inmates who reported a particular complaint. Of the entire sample 35% of the inmates had no clinical visits.

Table 3. Correlations Among Self Reports, Illness Reports, Catecholamine Levels and Time in Prison Variables

	PCr	PCn	SS	CV	UE	UN	TH	TP
Perceived Crowding (PCr)								
Perceived Control (PCn)	-.25*							
Self Reported Symptoms (SS)	.24*	-.37*						
Clinic Visit Rate (CV)	-.16	-.24*	.12					
Urinary Epinephrine (UE)	.30*	-.15	.12	.03				
Urinary Norepinephrine (UN)	.31*	-.25*	.09	.09	.62*			
Time in Housing Unit (TH)	.01	.18*	-.05	-.10	-.10	-.10		
Time in Prison (TP)	-.18*	.15	.01	-.20*	-.20*	-.29*	.64*	

\* significant at  $p < .05$ ,  $n=87$

Table 4. The Potential Cross Classification of Housing Types in the Longitudinal Study Reported by Ostfeld, Kasl, D'Atri and Fitzgerald (1987).

Time 1 Housing	Time 2 Housing			
	Cell	Dorm	Work Release Cell	Work Release Dorm
Cell	*	*	*	*
Dorm				
Work Release Cell				
Work Release Dorm				

Note: Only those cells with an asterisk were included in the design used by Ostfeld et al. The remaining cross classifications were not possible because of the prison policy on assignment of inmates to housing units.

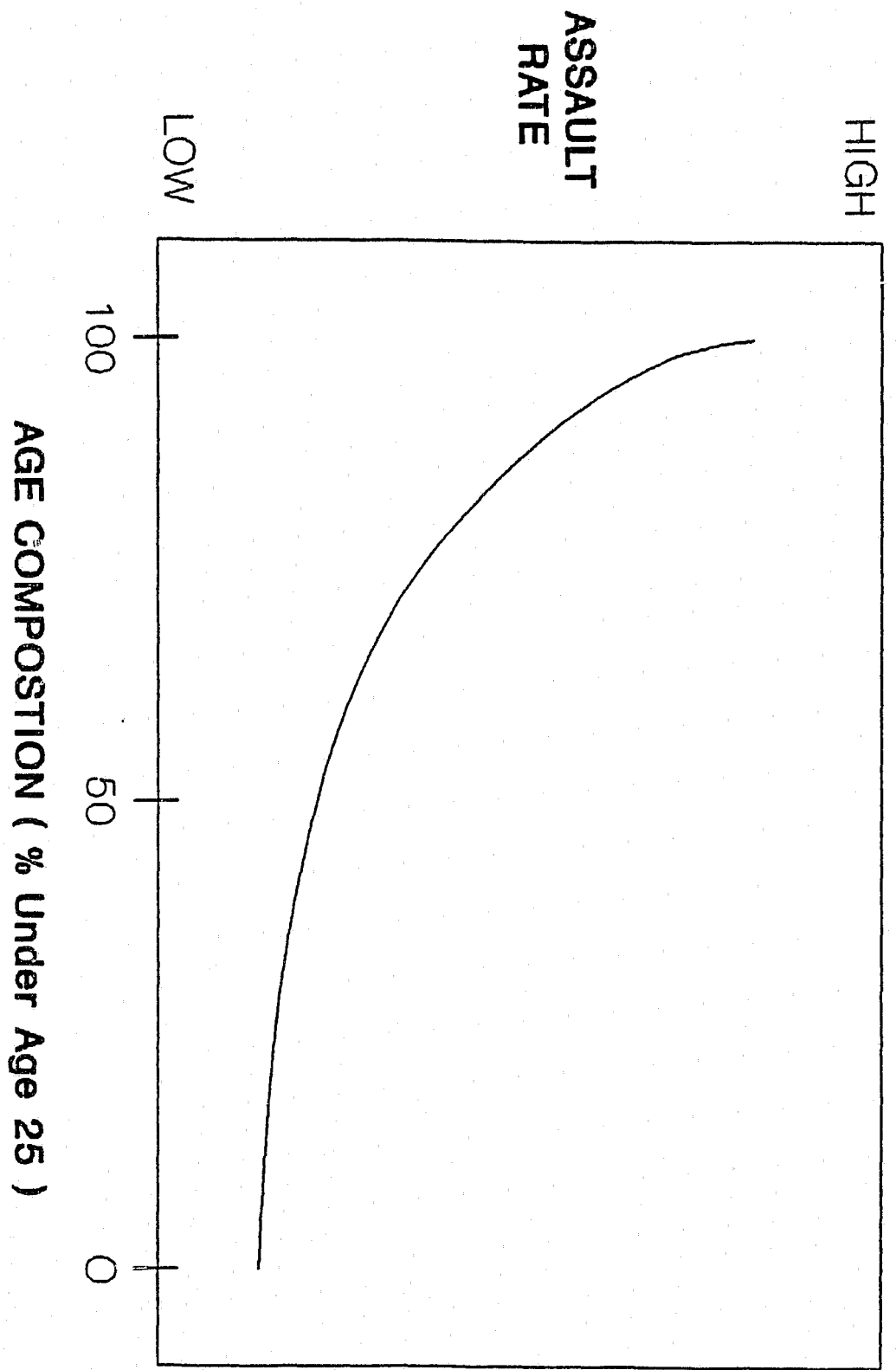
## Footnotes

1. Claire A. Cripe, General Counsel for the Bureau of Prisons has informed me that reported cases represent only a fraction of all District Court cases. The bias has typically been to report reformist/interventionist decisions won by inmate-plaintiffs at the expense of decisions in favor of the government.

2. The concept of elasticity deals with the percent change in a dependent variable that is associated with a 1-percent change in an independent variable. A relationship is inelastic when a good deal of change in the independent variable is needed to evoke a change in the dependent variable. An elastic relationship is one in which little change in the independent variable is needed to affect the dependent variable. More specifically, if the percent of change in a dependent variable is less than 1 percent, the relationship is considered inelastic. When the percent change is greater than 1-percent, the relationship is considered elastic.

3. My thanks to Charles Logan, who suggested these implications of an adaptation effect after reading a draft of this paper.

**FIGURE 1**  
**RELATIONSHIP BETWEEN AGE & ASSAULT RATES**  
**AT AN ECOLOGICAL LEVEL**



**FIGURE 2: RELATIONSHIP BETWEEN AGE AND ASSAULT RATES AT AN INDIVIDUAL LEVEL, MODIFIED BY AGE COMPOSITION**

