Objectives. The National AIDS Behavioral Survey (1990-1992) of heterosexual adults (18-49 years) measured human immunodeficiency virus (HIV) risk factors, condom use, and HIV antibody testing, with a focus on major "high-risk" cities.

Methods. A longitudinal survey was conducted.

Results. There was little reduction in the overall prevalence of HIV risk factors in the national or high-risk cities cohorts over time. Despite this picture of stability, approximately 39% of the population at risk for HIV because of multiple sexual partners turns over annually. There was little change in HIV test-seeking or in consistent condom use with primary sexual partners. Although the majority of at-risk respondents used condoms sporadically or not at all (65%), a significant increase in condom use was found among those reporting multiple sexual partners in both waves, particularly among Black heterosexuals. Data from other surveys and condom sales nationally support the findings.

Conclusions. There is a need for a series of surveys in this area to assess the reliability of the present findings and to monitor the general US population's response to prevention programs. (Am J Public Health. 1995;85:1492-1499)
rate for the AIDS in Multiethnic Neighborhoods survey was 80%).

Our rates were closer to those obtained in a longitudinal subsample of the National Survey of Family Growth involving face-to-face interviews (in 1988) and telephone interviews (in 1990) (68% follow-up) and lower than those reported in a national longitudinal telephone survey of mental health issues (80% follow-up). In general, respondents were lost to follow-up because they had moved rather than because they did not participate in the survey.

The present report focuses on the age group at highest risk for HIV and other sexually transmitted diseases (individuals 18 to 49 years of age); separate reports will examine older respondents.

The data were weighted to reflect differences in probability of selection and in the demographic characteristics of each sample as compared with the Current Population Survey (wave 1). Wave 2 respondents were somewhat less likely to report a risk factor for HIV at wave 1 than nonparticipants (high-risk urban sample, 22% vs 25%; national sample, 17% vs 23%; P < .01). Consequently, weights were developed to adjust for attrition between waves 1 and 2 (due to nonvolunteering and noncontacts); segmentation modeling techniques within the CHAID algorithm were used in these calculations (further technical information on the attrition weights is available from the first author). Unless indicated otherwise, all analyses and sample sizes reported here are based on weighted data, and all standard errors were adjusted to reflect the complex survey design. Table 1 provides the weighted and unweighted distributions of the samples by demographic characteristics for heterosexuals.

All measures were parallel across waves; details concerning the assumptions, validity, and pretesting of these measures have been presented in Catania et al. (for further details on risk behavior and condom use measures, see table notes). Respondents were asked whether they had been tested for HIV in the past year (yes or no). National condom sales data, obtained from Towne-Oller and Associates of New York City, were based on electronic scanner data in a national sample of retail outlets (for further details, contact the first author) and were weighted to adjust for differences in store parameters across each annual panel. The data presented here were standardized to reflect the actual number of condoms sold as opposed to the number of units (i.e., packages, which contain varying numbers of condoms across companies).

**Results**

Table 2 presents prevalence data concerning risk factors for HIV and other sexually transmitted diseases for the national and high-risk cities samples (figures were adjusted for condom use and "serial monogamy"; see below). Nationally, none of the risk estimates changed significantly from wave 1 to wave 2. The proportion of respondents reporting multiple sexual partners increased significantly in high-risk cities (4% increase; McNemar $\chi^2 = 23.88, P = .001$). Respondents who appear to have been monogamous with the same partner at both waves may have been serially monogamous with two partners across waves and, therefore, at some level of risk for HIV and other sexually transmitted diseases. For instance, a person may have reported one partner at wave 1 and one at wave 2, but they may not have been the same partner. Approximately 3.5% (36 of 1033) of the national sample and 3.3% of the high-risk cities sample (117 of 3506) were serially monogamous across waves. Further consistent condom users (100% use with all partners) may have been excluded from the definition of risk. Taking into account both serial monogamy across
TABLE 2—Risk Characteristics of Heterosexuals 18 to 49 Years of Age, by Wave of Study

<table>
<thead>
<tr>
<th>Sample and Risk Factor</th>
<th>Wave 1 (June 1990 to February 1991)</th>
<th>Wave 2 (January to August 1992)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% 95% CI</td>
<td>% 95% CI</td>
</tr>
<tr>
<td>National sample (n = 1033)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No risk</td>
<td>84.1 81.5, 86.7</td>
<td>83.7 80.9, 86.4</td>
</tr>
<tr>
<td>Multiple partners</td>
<td>10.5 8.2, 12.7</td>
<td>10.6 8.4, 12.9</td>
</tr>
<tr>
<td>Risky partner</td>
<td>2.9 1.8, 4.0</td>
<td>3.4 2.1, 4.6</td>
</tr>
<tr>
<td>Transfusion</td>
<td>2.1 1.1, 3.1</td>
<td>1.6 0.8, 2.5</td>
</tr>
<tr>
<td>Other risk</td>
<td>0.4 0.2, 1.0</td>
<td>0.7 0.1, 1.5</td>
</tr>
</tbody>
</table>

High-risk cities (n = 3506)

<table>
<thead>
<tr>
<th>Sample and Risk Factor</th>
<th>Wave 1 (June 1990 to February 1991)</th>
<th>Wave 2 (January to August 1992)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% 95% CI</td>
<td>% 95% CI</td>
</tr>
<tr>
<td>No risk</td>
<td>79.5 77.8, 81.1</td>
<td>76.7 74.9, 78.4</td>
</tr>
<tr>
<td>Multiple partners</td>
<td>15.3* 13.8, 16.8</td>
<td>19.3 17.6, 21.0</td>
</tr>
<tr>
<td>Risky partner</td>
<td>3.3 2.5, 4.0</td>
<td>2.7 2.1, 3.4</td>
</tr>
<tr>
<td>Transfusion</td>
<td>1.7 1.1, 2.3</td>
<td>1.1 0.6, 1.5</td>
</tr>
<tr>
<td>Other risk</td>
<td>0.3 0.1, 0.5</td>
<td>0.2 0.1, 0.4</td>
</tr>
</tbody>
</table>

Note. Risk factors were assigned hierarchically, with categories being filled in the following order: multiple partners, risky partner, transfusion recipient, and other risk factors (including hemophiliac and intravenous drug user). For example, respondents who had multiple partners, regardless of what other risk factors they might have had, were grouped in the multiple partner category. This procedure produced mutually exclusive categories. People with two or more partners in the past year were defined as having multiple sexual partners. Homophobic and those receiving transfusions between 1977 and 1984 (inclusive) were categorized as at risk unless they had had no other risk factors and reported a negative HIV antibody test. “Risky partner” refers to a main sexual partner who was HIV positive, an intravenous drug user, had multiple sexual partners in the past year, was a hemophiliac, or a transfusion recipient between 1973 and 1985 (unless HIV negative with no other risk factors). HIV-positive persons were removed from all analyses.

*Overall, 37% of those with risky partners at wave 1 reported this risk factor at wave 2, and 63% eliminated the risk factor. Among those with no risk at wave 1 (n = 2328), 2% reported a risky sexual partner at wave 2. Women were significantly more likely than men to report being in a risky partnership at both waves 1 and 2 (50% vs 11%; P = .05).

Table 4 presents the percentage of respondents reporting multiple partners (or no risk) at both waves for different social strata. We examined, by means of logistic regression, demographic differences (age, education, income, marital status, and race/ethnicity) between those who reported multiple partners at both waves and those who reported multiple partners for the year prior to wave 1 but no risk factors for the interval between waves. Those reporting multiple partners at both waves were predominantly male (odds ratio [OR] = 3.88, 95% confidence interval [CI] = 2.3, 6.5) and had a high school vs college education (OR = 2.05, 95% CI = 1.07, 3.92) (those with less than a high school education did not differ from either group). In general, across all ethnic groups, individuals who were separated, divorced, or widowed, and those who had never been married were significantly more likely than married individuals and cohabitants to report multiple partners at both waves (data are available from the first author). There was a significant interaction between ethnicity and marital status. Among cohabitants and separated/divorced/widowed individuals, proportionately more Blacks than Whites reported ongoing risk (a similar pattern was observed for Hispanics vs Whites, but that pattern did not reach statistical significance); there were no differences between married individuals of any race/ethnicity. Among those who had never been married, proportionately more Whites than Hispanics reported ongoing risk (ongoing vs risk reduction): Black cohabitants vs White cohabitants, OR = 10.60, 95% CI = 2.75, 40.9; Black vs White single, divorced, or widowed individuals, OR = 3.93, 95% CI = 1.42, 10.88; and White never-married individuals vs Hispanic never-married individuals, OR = 3.86, 95% CI = 1.29, 11.58.

Prevention Behavior: Ongoing Risk Group

Similar proportions of those who reported multiple partners at both waves sought HIV testing in the year prior to interview at waves 1 (35%) and 2 (37%). Of those reporting HIV testing at wave 2, approximately half were being tested for...
the first time, and only a small fraction (19%) of people with multiple partners in both waves repeatedly sought testing. We found no significant demographic correlates of HIV test seeking between waves for respondents who reported multiple partners at both waves.

Condom use (see Table 5) with primary sexual partners did not change significantly across waves (P > .10), but there was a significant increase in condom use with secondary partners, particularly in consistent use (McNemar χ² = 8.20, P = .004; comparison of consistent use vs less than 100% use for wave 1 vs wave 2). Logistic regression analyses indicated that, by wave 2, proportionately more Blacks than Whites were consistent condom users with primary partners (33% vs 19%; OR = 2.29, 95% CI = 1.09, 4.54) and secondary partners (42% vs 28%; OR = 2.18, 95% CI = 1.06, 4.44); Hispanics were similar to Whites and Blacks (Ps > .10). (The small number of Hispanics with secondary partners at both waves [n = 18] reduced the reliability of the findings.) No other demographic variables were significant correlates.

We examined whether people with primary and secondary partners use condoms with their secondary but not primary partners. Only 7% of those with primary and secondary partners at wave 2 (n = 244) were consistent condom users with secondary partners and nonusers with their primary partner. Another 19% used condoms consistently with their primary and secondary partners, 18% were nonusers with both types of partner, and 66% used condoms sporadically with both types of partner.

**Multiple Sexual Partners: Risk Onset vs No Risk**

We examined demographic differences between those who reported multiple partners in wave 2 but not wave 1 (risk onset) and those reporting no risk factors in either wave (see Table 4). For those with multiple partners at wave 1 who reported no risk by wave 2, 70% remained untested, 8% consistently used condoms, and 64% never used condoms as of wave 2. Thus, some people reduced their risk by reducing their numbers of sexual partners but have not determined by testing whether they are at no risk. Since they continue not to use condoms consistently, they may be placing their current partner at risk for HIV and for other sexually transmitted diseases.

Two significant gender interactions were obtained (gender by age, gender by marital status). Proportionately more younger women than older women reported risk onset, but men were similar across age categories. Women 18 to 29 years old were more likely to report risk onset than women in their 40s (OR = 7.2, 95% CI = 3.32, 15.76) and 30s (OR = 4.2, 95% CI = 1.94, 9.31), and women in their 30s were more likely to do so than those in their 40s (OR = 1.7, 95% CI = 1.02,
The interaction between gender and marital status was quantitative. Men showed larger effects than women across marital categories. For instance, the odds ratio for never-married men relative to married men was 16.1 (95% CI = 8.7, 29.8), whereas the odds ratio for never-married women relative to married women was 5.1 (95% CI = 2.76, 9.59). Overall, single individuals were more likely to report risk onset. (Among both men and women, proportionately more cohabitants, separated/divorced/widowed individuals, and never-married individuals than married individuals acquired multiple partners. There were no significant differences among the former three groups.)

Prevention Behavior: Risk Onset Group

In the risk onset group, approximately 74% (n = 273) were untested for HIV between waves. Analysis of the demographic correlates of HIV testing revealed two significant gender interactions. First, there were significant differences between educational groups for women but not for men; proportionately more women with high levels of education (>12 years) than with moderate levels (12 years) (OR = 5.30, 95% CI = 1.26, 22.28) or low levels (<12 years) (OR = 6.24, 95% CI = 1.19, 32.68) got tested. Also, proportionately more moderately educated individuals than less educated individuals were tested (OR = 33.1, 95% CI = 4.39, 250.00; SE = 1.03). The unusually wide confidence intervals reflect the small sample size. Second, married women were significantly less likely to get tested than cohabiting women (OR = 14.98, 95% CI = 1.68, 133.71); separated, divorced, or widowed women (OR = 25.8, 95% CI = 3.02, 232.22); and never-married women (OR = 7.0, 95% CI = 1.30, 38.02). Proportionately more separated/divorced/widowed men than married men obtained testing (OR = 11.68, 95% CI = 1.97, 69.19).

The rates of consistent condom use with primary and secondary partners were approximately 30% (n = 281) and 39% (n = 193), respectively (44% and 34%, respectively, were nonusers). Marital status and income were significant correlates of condom use with primary partners. Proportionately more never-married individuals than married (OR = 6.41, 95% CI = 1.40, 23.98), cohabiting (OR = 7.16, 95% CI = 1.99, 25.60), or separated/divorced/widowed (OR = 2.67, 95% CI = 1.06, 6.75) individuals consistently used condoms with their primary partners (the latter three groups did not differ). Furthermore, proportionately more respondents with low (<$10,000); OR = 9.49, 95% CI = 1.76, 51.18) and moderate ($20,000 to $40,000; OR = 10.33, 95% CI = 1.94, 54.79) incomes than respondents with high incomes (> $40,000) consistently used condoms with primary partners. For condom use with secondary partners, only marital status was significant. Consistent condom use with secondary partners was similar for cohabiting and never-married individuals, but the latter were proportionately more likely than married (OR = 6.9, 95% CI = 2.06, 22.92) or separated/divorced/widowed (OR = 5.3, 95% CI = 1.92, 14.55) individuals to consistently use condoms with secondary partners. Sample size limitations prevented a reliable estimate of the joint distribution of condom use between primary and secondary partners.

Condom Sales: Validation of Self-Reported Change

Total condom sales data for the United States for 1990 (earliest available year), 1991, and 1992 are presented in Figure 1. There was an approximate 3% increase in sales from 1990 to 1991 and then a very small decline in purchases from 1991 to 1992 (<1%).

Discussion

The present study mapped changes in (1) risk factors relevant to HIV and other sexually transmitted diseases, (2) condom use, and (3) HIV antibody testing for heterosexual adults. There was no appreciable reduction, over an approximate 1-year span, in the prevalence of HIV-related sexual risk factors nationally or in major urban centers. There was a small but significant increase in the proportion of heterosexuals in major urban centers reporting multiple sexual partners that reflects an increase in those entering, relative to leaving, the at-risk population.

A broad array of individuals, particularly men and "singles," reported multiple partners at both time points. The gender results may reflect overreporting of numbers of sexual partners by men and underreporting by women.27 There were no significant changes in HIV test seeking for any at-risk group. There was, however, a significant increase in consistent condom use with secondary sexual partners among those reporting multiple partners in both waves 1 and 2, although there was little change in consistent use with primary partners. Thus, some individuals in this at-risk segment may be placing their primary partners at risk for HIV and other sexually transmitted diseases. This
conclusion would be tempered somewhat if respondents (assuming that they are seronegative) with primary partners were using condoms consistently with their secondary sexual partners, but we found no evidence that this safer sex strategy is being widely used.

Black heterosexual adults with multiple sexual partners at both waves reported the largest changes in condom use. Preliminary results indicate that Blacks were more likely than other ethnic/racial groups to report being influenced to use condoms by Magic Johnson’s announcement of his HIV-positive status. However, we have not found a correlation between the announcement and a differential increase in condom use among Blacks relative to Whites or Hispanics (unpublished data available from the first author).

The demographic correlates of people who reported multiple sexual partners at wave 2 but not at wave 1 further substantiate the importance of intervening with young adults in the “dating phase” of life.2 Young adults account for nearly 70% of all sexually transmitted diseases in the United States and report the highest levels of sexual risk factors for HIV and other sexually transmitted diseases.2 Although proportionately fewer of those who reported multiple partners at wave 2 (but not at wave 1) than those with a longer history of multiple sexual relationships sought HIV testing, the former group was more likely to consistently use condoms. The condom findings suggest that prevention messages are having an impact on population segments that, at some future date, will move into periods of risk for HIV and other sexually transmitted diseases.

Three sources provide indirect verification of the significant increase in condom use with secondary sexual partners among those reporting multiple sexual partners (at both waves). First, the pattern of increasing condom use over the early years of the 1990s among respondents with risk factors for HIV and other sexually transmitted diseases has also been observed in the San Francisco AIDS in Multiethnic Neighborhoods survey (consistent use rates of 11% in 1988 and 22% in 1992; unpublished data). Second, National Survey of Family Growth studies indicate that condom use prior to 1988 was fairly constant among all sexually active women (9% in 1973, 10% in 1982, and 11% in 1988),28 although total use among never-married women rose modestly from 1982 (4%) to 1988 (8%). A telephone follow-up of the 1988 National Survey of Family Growth sample revealed that condom use among unmarried women (and among women reporting multiple sexual partners [prior 3 months]) had risen to 16% by 1990.12 Finally, the self-report data parallel the national picture for condom sales, which showed a net increase from 1990 to 1992. Overall, despite methodological and sample differences, prior studies and the present data support the view that condom use increased starting in the late 1980s and continuing into the early 1990s. Whether these changes are due to increased efforts at disease prevention is unclear. However, we are struck by the consistent rate of condom use from the mid-1970s to 1988 among women in the National Survey of Family Growth studies. This suggests that use of condoms to prevent pregnancy was relatively constant throughout most of the 1980s. However, people may be using condoms for both disease and pregnancy prevention (the present study did not distinguish motivations). Data from the National Survey of Family Growth indicate that approximately 55% of condom use in 1988 was directed toward disease prevention (approximately 20% involved multiple reasons).29

The present findings on risk behavior, condom use, and HIV testing are supported by recent analyses comparing two independent cross-sectional national surveys (unpublished data available from the first author; K. Choi and J. A. Catania, unpublished data, June 1995): the 1990/91 National AIDS Behavioral Survey and the 1992 National AIDS Behavioral Methodology survey. The results of this comparison show no change in the percentage of people reporting multiple partners (11% in both surveys), no change in the percentage of people reporting risk in the past year who were tested in the past year (34% vs 35%), and a significant increase in consistent condom use from 11% to 20% (P < .05). These findings provide a check on the possible effects of repeated measurement in the present study and confirm our findings to a large extent. The difference in absolute levels of consistent condom use over time between the present findings and the above results may reflect (1) sample differences (e.g., urban vs national); (2) the fact that the National AIDS Behavioral Surveys, but not the National AIDS Behavioral Methodology survey, can separate condom use with primary vs secondary partners (thus, the latter data represent an average across relationship contexts; however, the average condom use rate across relationships for wave 2 of the National AIDS Behavioral Surveys was 21%, approximately the same value as the for the 1992 National AIDS Behavioral Methodology survey); or (3) differences in nonresponse between studies. Nevertheless, the results just described suggest that the observed increase in condom use in the present longitudinal study is not entirely due to repeated measurement effects.

The present data have relevance to modelers interested in the population dynamics of various at-risk segments. The data suggest that the annual turnover rate (percentage of the at-risk population that is replaced annually) is approximately 39% (i.e., 39% drop out of the at-risk group and are replaced by those who formerly were not at risk) for the population at risk for HIV and other sexually transmitted diseases because of multiple sexual partners. Variation in these at-risk population segments should be examined over longer periods of time (e.g., 10 years). The present risk behavior estimates are, to some degree, underestimates given an assumption that people underreport or are unaware of risky activities (e.g., their partner’s behavior).30

Movement into and out of the “at-risk pool” may be facilitated by a host of factors including, for example, changes in marital/relationship status, partner availability, illness, and concerns about HIV and other sexually transmitted diseases. Although the process of partnering through legal marriage or cohabitation imparts some degree of risk reduction, this reduction may at times be illusory. We have found that heterosexuals with a history of risk factors for HIV seldom obtain testing prior to cohabitation or marriage and do not regularly use condoms after establishment of the relationship.31 Furthermore, the present study suggests that married people reporting extramarital sexual partners are typically the least likely to use condoms or obtain HIV testing.32

The importance of the present findings for HIV prevention program and policy development rests on the assumption that substantial portions of the general heterosexual population are, or at some time over the next several decades will be, at risk for HIV. Although less true of some sexually transmitted diseases, there remains a certain amount of controversy around the belief that HIV will spread beyond current high-risk groups in the United States. A recent National Academy of Sciences committee recom-
mended focusing more on racial minority populations in a small number of large urban areas of low-socioeconomic status (SES). Echoing this view, Laumann et al., based on the National Health and Social Life Survey, have argued that HIV will not spread because of low average infectivity rates for penis-vagina intercourse and because the degree of sexual mixing between major social strata (e.g., Whites and Blacks) may be too low. We would agree, based on the slow but steady increase in numbers of heterosexually transmitted AIDS cases in the United States and other Western, industrialized nations, that HIV probably will not race through the general heterosexual population. However, for a variety of reasons, it is premature to conclude that HIV cannot spread beyond existing high-risk groups or low-SES minority populations in New York and a few other major urban centers.

For example, although some reports have obtained low infectivity rates for vaginal intercourse, there is considerable variability in rates both within and across studies. Furthermore, recent work indicates that infectivity may vary substantially with stage of HIV disease progression. Thus, average infectivity rates may not be meaningful. These transmission complexities, in addition to the unknown contributions of HIV cofactors with a high prevalence among heterosexuals (e.g., herpes simplex virus-2, chlamydia), strike a cautionary note to the view that heterosexual spread will not occur because of low average infectivity rates. Others have also voiced a cautious tone about HIV spread in the heterosexual population. Anderson, for example, has argued that HIV is probably a slow-progression disease that may take decades to peak in the general heterosexual population.

Furthermore, the prevalence data for genital herpes and chlamydia undercut the idea that there is insufficient sexual mixing for HIV to spread beyond current high-risk groups. Siegel et al. reported biological data for a probability sample of White, Black, and Hispanic unmarried heterosexuals 20 to 44 years of age indicating that, among women, 35% of Whites, 39% of Hispanics, and 55% of Blacks were positive for genital herpes (male estimates were 26%, 20%, and 32%, respectively). Chlamydia rates (per 100 000) doubled from 1987 to 1991 (from 91.4 to 197.5). Chlamydia has been found across a wide spectrum of populations, including Whites and Blacks, urban and rural populations, and low and high education groups. Despite differences in infectivity rates, it is difficult to understand how these sexually transmitted diseases have achieved their current prevalence levels in the general population without there being some sexual mixing between different social strata.

Also with respect to sexual mixing, recent work has identified a group of heterosexuals termed heavy mixers (those having sex with two or more partners outside their own social strata) who are significantly more likely than light/nonmixers to evidence genital herpes, even after number of sexual partners, race, age, gender, education, and neighborhood of residence have been controlled. Based on this prior work, the number of heavy mixers among unmarried adults 20 to 44 years of age with multiple sexual partners residing in large urban areas (> 250 000 population) of the country is estimated to exceed 4 million (D. Binson, written communication, January 1995; data available from first author). Although there remain numerous unknown factors (see below), this is a large enough population to warrant further study of the potential it may have for spreading HIV and other sexually transmitted diseases.

Although surveys have estimated the size and stability of the heterosexual population at risk for HIV and other sexually transmitted diseases, we need to know more about the degree of mixing among and between heterosexual population segments with multiple sexual partners and how this population is geographically distributed. The spread of HIV and other sexually transmitted diseases nationally depends not only on the degree of mixing across and within social strata (and other behavioral and biological conditions) but also on the "sexual avenues" connecting cities, suburbs, and rural areas. These unknown factors in terms of the population dynamics of HIV and the continued increase in heterosexually transmitted cases associated with none of the traditional risk factors (sex with a bisexual, hemophiliac, or injection drug user) suggest that the prudent action at this juncture is to assume that at-risk heterosexuals should be the target of prevention programs promoting condom use, HIV testing, and other prevention practices. If nothing else, these individuals may well avoid contracting one of the 15 or more other sexually transmitted diseases currently infecting the US heterosexual population.

Adult heterosexuals at risk for HIV and other sexually transmitted diseases represent a fluid, dynamic population. Estimating changes in the size, turnover, and prevention practices of this population segment remains an important challenge. There is a need for a series of surveys in this area to assess the reliability of the present findings and to regularly monitor how the general US population is responding to prevention programs focusing on HIV and other sexually transmitted diseases. The present findings, and those of others, also argue for widely disseminated prevention programs that address the health implications of accumulating multiple partners over relatively short periods.

Acknowledgments
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