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# The Importance of Reassessment: How Changes in the LSI-R Risk Score Can Improve the Prediction of Recidivism

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*The Level of Service Inventory-Revised (LSI-R) is a correctional assessment tool that identifies the individual risk and needs of criminal offenders. The predictive validity of the LSI-R has the support of numerous studies, large samples, and multiple meta-analyses. The dynamic nature of many of the items in the LSI-R suggests that offenders are capable of altering their likelihood for future reoffending. However, despite the hundreds of studies conducted on the LSI-R, there have been only two to investigate whether or not changes in LSI-R score were empirically related to recidivism (Raynor, 2007; Vose, Lowenkamp, Smith, & Cullen, 2009). The current study attempts to add to this literature by assessing the predictive and dynamic validity of the LSI-R. Furthermore, this study is the first to investigate the relationship between changes in LSI-R domain scores and recidivism. The results support the LSI-R as a valid instrument in predicting recidivism and suggest future research on risk/needs assessments should include examinations of the percentage change in risk scores.*

*KEYWORDS correctional classification, Level of Service Inventory-Revised, LSI-R, risk/needs assessments, risk prediction*

## INTRODUCTION

During the last three decades, the principles of effective correctional intervention have become the predominant paradigm for offender rehabilitation (Andrews, 1995; Andrews & Bonta, 2010; Andrews, Zinger, Hoge, Bonta,

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Gendreau, & Cullen, 1990; Gendreau, 1996; Smith, Gendreau, & Swartz, 2009; Vose, Lowenkamp, Smith, & Cullen, 2009). This theory maintains three main principles: risk, need, and responsivity (RNR; Andrews & Bonta, 2010; Andrews, Bonta, & Hoge, 1990). The *risk principle* asserts criminal behavior is predictable when valid risk assessment tools are used, and treatment intensity is matched to level of risk, where higher risk offenders receive more services than lower risk offenders. The *need principle* mandates that practitioners target dynamic (i.e., changeable) crime-producing risk factors, or criminogenic needs, to reduce recidivism (e.g., antisocial personality, antisocial cognition, antisocial associates). The *responsivity principle* describes how to provide treatment to an offender in a manner that is most conducive to his or her learning style, motivation, abilities, and strengths (Andrews & Dowden, 2006). To summarize the RNR model, the risk principle indicates *who* should be treated (higher risk offenders), the need principle indicates *what* should be treated (criminogenic needs), and the responsivity principle determines *how* treatment strategies should be employed (match strategies to the learning styles and motivation of offenders).

Several meta-analyses and primary studies have found support for the risk, need, and responsivity principles (see Smith, Cullen, & Latessa, 2009 or McGuire, 2013 for a review). The evidence indicates: (a) Decreases in recidivism occur when treatment focuses on higher risk offenders, whereas increases in recidivism occur when treatment focuses on lower risk offenders (Lowenkamp, Latessa, & Holsinger, 2006); (b) Targeting criminogenic risk factors (e.g., antisocial personality, antisocial cognitions) will reduce recidivism, whereas targeting noncriminogenic areas (e.g., self-esteem, anxiety) will have weak to null effects on recidivism (Andrews & Bonta, 2010); and (c) The use of cognitive-behavioral techniques to influence change—especially when matched to specific offender characteristics—is the most effective in reducing recidivism compared with all other types of treatment (Andrews & Bonta, 2010). A 26 percentage point reduction in recidivism has been found in programs that adhere to all three RNR principles (Andrews & Bonta, 2010, p. 74). However, if none of the principles are followed, slight increases in recidivism have often been recorded.

In order for the RNR model to be effective, it is essential that practitioners are able to assess offenders' risk level and target for change their specific criminogenic needs with the appropriate type of interventions. Therefore, a key component of the model—and arguably the most important step—is the assessment of offender risk for reoffending.

## Risk Assessment

Although not a new phenomena, risk assessment instruments have become increasingly more important to effective correctional intervention (Flores, Lowenkamp, Holsinger, & Latessa, 2006). Over the last two decades,

correctional agencies have adopted a wide array of assessment instruments to help classify, manage, and treat offenders (Vose, Cullen, & Smith, 2008). Risk assessment tools classify offenders into groups based upon their risk for re-offending (i.e., low-risk, moderate-risk, high-risk). However, these instruments not only predict recidivists, but also identify the criminogenic factors that are problematic for each individual offender. According to the RNR model, when an offender decreases the number of his or her criminogenic risk factors (e.g., an offender refrains from associating with criminal peers) it results in a reduced risk for re-offending, whereas when an offender increases the number of his or her criminogenic risk factors (e.g., an offender with pro-social values develops pro-criminal sentiments) it results in an increased risk for re-offending. As offender management tools, risk assessments can guide practitioners in the development of offender case plans (i.e., determine level of supervision, treatment targets, type and duration of interventions). Within the RNR model, the goal of case planning is to reduce the number of offender criminogenic needs and thereby decrease the likelihood for further criminal involvement.

One of the most popular of these instruments in use today is the Level of Service Inventory-Revised (LSI-R; Andrews & Bonta, 1995). The utility of the LSI-R has the support of numerous primary studies, large samples, and multiple meta-analyses (Gendreau, Goggin, & Smith, 2002; Gendreau, Little, & Goggin, 1996; Smith et al., 2009; Vose, Cullen, & Smith, 2008). It has been validated with a wide array of correctional populations, and support has been noted for samples comparing ethnicities, gender, and age (Andrews & Bonta, 2010). Previous studies also include examinations of prisoners (Gendreau, Goggin, & Law, 1997; Hollin & Palmer, 2006), probationers and parolees (Lowenkamp & Bechtel, 2007), female offenders (Van Voorhis, Wright, Salisbury, & Bauman, 2010), violent offenders (Hollin & Palmer, 2003), mentally ill and domestic violent offenders (Andrews & Bonta, 2010), and African American and Hispanic offenders (Schlager & Simourd, 2007).

## Assessing Offender Change

In order to study the nature of the relationship between offender change in risk and outcome (i.e., recidivism), offenders must, at a minimum, be assessed for risk at two separate time points—at an initial assessment and a follow-up reassessment. Theoretically, risk assessments, such as the LSI-R, are capable of relating changes in offender score over time (through reassessment) to changes in the probability for recidivism, a concept that is known as dynamic validity (Bonta, 2002).

A review of the available literature reveals that the measurement of offender change in LSI-R score has been operationalized in three ways. The first method is to divide the sample into groups, or typologies, based on the initial assessment score and the direction of the change in score at

reassessment. For example, Raynor (2007) divided his sample of offenders into four categories based on overall assessment scores: (a) low-risk offenders at the initial assessment that stayed the same risk or reduced their risk at reassessment, (b) low-risk offenders at the initial assessment that increased their risk at reassessment, (c) high-risk offenders at the initial assessment that stayed the same risk or reduced their risk at reassessment, and (d) high-risk offenders at the initial assessment that increased their risk at reassessment. According to Raynor (2007), low-risk offenders who increased their risk showed higher rates of recidivism than low-risk offenders who decreased their risk (59% compared to 29%), and high-risk offenders who decreased their risk demonstrated lower recidivism rates than high-risk offenders who increased their risk (54% compared to 76%).

The second method involves the use of the raw difference in score from assessment to reassessment. For example, Vose et al. (2009) examined the raw difference in score (i.e., reassessment score minus initial assessment score) and found that it correlated with recidivism. The third method makes use of the percent change in score between initial assessment and reassessment, or the raw difference in score divided by the initial assessment score multiplied by 100. According to Vose et al. (2009), the percentage change was also correlated with offender outcome.

While all three of these methods should be interpreted as general support for the dynamic validity of the LSI-R, it is questionable which measure of change is best, and there still remains the question of how much change is needed to be meaningful. The reality is that the study of offender change in risk scores has remained elusive as the subject of extensive empirical investigation, with very few studies to date testing the ability of risk instruments to empirically relate change in score to recidivism. Therefore, this study explores the under-researched area of offender change by offering an in-depth look at the predictive and dynamic validity of the LSI-R. This study also assesses the role that changes to the LSI-R domain scores play in the prediction of recidivism, a variable neglected by past research.



## METHOD

### Participants

A Midwestern U.S. state provided the data for the current study. Data elements included basic demographic information, offense information, initial LSI-R assessment, follow-up LSI-R reassessment, and recidivism data. Initially, this data set included 1,599 cases. However, the current study excluded all cases that did not include two LSI-R assessments within the 3-year time period examined. The sample was limited in this way because it was necessary in order to examine change in risk scores.

## Measures

### LSI-R

The Level of Service Inventory-Revised (LSI-R; Andrews & Bonta, 1995) is a 54-item risk/need assessment instrument in which trained raters score each item as *present* (1) or *absent* (0) on the basis of a file review and interview with the offender. An offender's score on this scale determines his or her overall level of risk, where higher scores indicate a greater risk of recidivism than lower scores. The LSI-R variable is operationalized here in five ways: (a) the initial LSI-R total score (ranging from 0 to 54), (b) the LSI-R reassessment total score (ranging from 0 to 54), (c) the raw difference in total score between initial assessment and reassessment, (d) the percentage change in total score between initial assessment and reassessment, and (e) the percentage change in domain scores between initial assessment and reassessment. The percentage change is the difference in score from initial assessment to reassessment divided by the score at the initial assessment multiplied by 100. Negative values of percentage change indicate a reduction in offender risk (a lower score at reassessment than at initial assessment). Conversely, positive values indicate an increase in offender risk (a higher score at reassessment than at initial assessment).

### Sample demographics

Gender, race, age, and offense type are used here as moderator variables. The demographic variables of gender and race were coded dichotomously while age remained a metric level of measurement. Specifically, gender was labeled as 0=*female* and 1=*male* and race was labeled 0=*non-White* and 1=*White*. Offense type was also coded dichotomously where 0=*misdemeanor* and 1=*felony*.

### Outcome measure

Recidivism is the outcome of interest in this study and is measured as any new arrest within one-year of the reassessment date.

## Analysis

This study assesses the predictive and dynamic validity of the LSI-R through the following three steps. First, it examines the bivariate relationships of total LSI-R initial and reassessment scores on recidivism. Second, it reviews the multivariate models with the total LSI-R initial score and reassessment score, as well as compares the benefit of adding separately the raw difference in score and percent change in score. Finally, it concludes by exploring several multivariate models for the percentage change of LSI-R domain scores from initial assessment to reassessment.

## RESULTS

The present sample includes 828 adult probationers. A description of the sample is presented in Table 1. Generally speaking, the probationers in this study were predominately male (79.8%), White (67.6%), and on supervision for a felony-level offense (61.4%). The mean LSI-R score at the initial assessment is 19.7 and the mean score at the follow-up reassessment is 18.7, which indicates as a group, these offenders reduced their probability for recidivism between the two assessments.

Table 1 also provides a description of the excluded offenders and compares the two groups. It should be noted that there are a few significant differences between the included and excluded probationers. Specifically, the current sample includes a significantly higher proportion of white, felony-level offenders with slightly higher risk scores at the initial assessment than the excluded probationers.

### Predictive Validity of the LSI-R

Table 2 presents the bivariate correlations between the total LSI-R scores and recidivism. Both the initial score and reassessment score were significantly correlated with rearrest ($r$=.20 and .23, respectively). Comparatively, the correlation between total LSI-R score and rearrest is higher at reassessment than initial assessment. However, it should also be noted that the confidence intervals of the two correlations overlap with each other, which indicates the two values are statistically similar.

Table 3 presents the multivariate models of the total LSI-R scores while controlling for the moderator variables of race, age, gender, and offense

**TABLE 1** Descriptive Statistics of the Sample and Comparison Between Included and Excluded Cases

| | Sample ($n$=828) | Excluded cases ($n$=771) |
|---|---|---|
| Descriptive statistics | $n$ (%) | $n$ (%) |
| Felony* | 508 (61.4) | 402 (52.5) |
| Male | 661 (79.8) | 593 (77.4) |
| White* | 547 (67.6) | 398 (53.6) |
| Age | | |
| Under 25 | 296 (36.0) | 312 (40.8) |
| 26–35 | 236 (28.7) | 186 (24.3) |
| 36 and over | 291 (35.4) | 266 (34.8) |
| Mean age at initial LSI-R (SD) | 31.7 (11.6) | 31.4 (11.3) |
| Mean age at LSI-R reassessment (SD) | 32.5 (11.5) | n/a |
| Mean initial LSI-R score (SD)* | 19.7 (7.4) | 17.6 (9.0) |
| LSI-R reassessment score (SD) | 18.7 (7.8) | n/a |
| Mean months between assessments (SD) | 9.5 (4.4) | n/a |

*$p$<.01.

**TABLE 2** Bivariate Correlations of LSI-R Initial and Reassessment Scores on Recidivism

| | | 95% CI | |
|---|---|---|---|
| | *R* | *LL* | *UL* |
| Initial LSI-R total score* | .20 | .14 | .27 |
| LSI-R reassessment total score* | .23 | .16 | .29 |

*$p < .01$.

type. Both the initial score and the reassessment score were significantly related to recidivism (OR=1.06 and 1.07, respectively). This means for every 1-point increase in total LSI-R score during the initial assessment, there was a 6% increase in the probability for rearrest, and at reassessment a 1-point increase was associated with a 7% increase in the odds of rearrest. Race, age, and gender were also significant predictors for both models. Specifically, the odds of rearrest increase for younger, non-white, males. It should be noted that the effect size for the reassessment model was larger than the initial assessment model (Nagelkerke $R^2$=.10 versus .09, respectively). Again, while the difference is not a statistically significant improvement, it does suggest there is an importance to reassessing risk to reoffend.

## Dynamic Validity of the LSI-R

To assess the dynamic validity of the LSI-R, this study explores the effects of the changes in scores on rearrest. Approximately 52% of offenders in the sample had decreases in score from the initial assessment to reassessment, 18% had the same reassessment score as initial assessment score, and 30% had increases in score from initial assessment to reassessment.

**TABLE 3** Logistic Multivariate Analyses of LSI-R Initial and Reassessment Total Score

| | Initial assessment | Reassessment |
|---|---|---|
| Race | .70* | .71* |
| Age | .98* | .99* |
| Gender | 1.61* | 1.65** |
| Offense type | .81 | .78 |
| Initial LSI-R total score | 1.06** | |
| Reassessment LSI-R total score | | 1.07** |
| Constant | .30** | .27** |
| Model chi-square (*df*) | 54.2 (5) | 63.7 (5) |
| −2 log likelihood | 1049.7 | 1040.2 |
| Nagelkerke $R^2$ | .09 | .10 |

*$p < .05$. **$p < .01$.

**TABLE 4** Logistic Multivariate Analyses of Raw Difference and Percentage Change in Risk Score

| | Raw difference | Percent change |
|---|---|---|
| Race | .70* | .70* |
| Age | .99* | .99* |
| Gender | 1.65** | 1.64* |
| Offense type | .78 | .80 |
| Initial LSI-R total score | 1.07** | 1.07** |
| Raw difference | 1.05** | |
| Percent change | | 1.01** |
| Constant | .25** | .26** |
| Model chi-square (*df*) | 64.6 (6) | 67.0 (6) |
| −2 log likelihood | 1039.3 | 1036.9 |
| Nagelkerke $R^2$ | .10 | .11 |

*$p<.05$. **$p<.01$.



Table 4 compares a multivariate model with the raw difference in total score to a multivariate model with the percentage change in total score. In both models the initial LSI-R total score is predictive of rearrest (OR=1.07), as well as race, age, and gender ($p<.05$). Interestingly, both the raw difference and percentage change in score are predictive of rearrest ($p<.01$). According to the raw difference model, for every one-point increase in the total score from initial assessment to reassessment, there is a 5% increase in the probability for rearrest. To illustrate, if a probationer received a total score of 16 at the initial LSI-R assessment and a 15 at reassessment, the one-point difference would be associated with a 5% decrease in his probability for rearrest during the one-year follow-up period.

According to the percentage change model, for every 1% increase in the total score from initial assessment to reassessment, there is a 1% increase in the probability for rearrest. Using the same probationer who scored a 16 at the initial assessment and a 15 at reassessment described above, this 6.25% reduction in score would be associated with a 6.25% decrease in likelihood for rearrest during the follow-up period. This difference in effect size between the two change variables examined suggests that the use of the percentage change in scores affords a greater amount of incremental validity compared to that of the raw difference in scores. This conclusion is also supported by the larger effect size of the percentage change model (Nagelkerke $R^2=.11$) compared to the raw difference model (Nagelkerke $R^2=.10$).

Table 5 presents the multivariate models for the LSI-R domain scores controlling for the variables race, age, gender, and offense type. When the initial LSI-R total score is examined along with the percentage change in each of the ten domains, both the LSI-R total score (OR=1.07) and the percentage change in criminal history domain score (OR=1.006) are significant predictors of rearrest. When the domains, and percent change in domains,

**TABLE 5** Logistic Multivariate Analysis of LSI-R Domain Scores

| | LSI-R | CH | ED | FIN | FAM | ACC | REC | PEER | DRUG | EMOT | ATT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Race | .687* | .695* | .811 | .767 | .728* | .776 | .747 | .738* | .692* | .719* | .740* |
| Age | .987 | .980** | .988 | .980** | .980** | .982** | .983** | .984* | .981** | .981** | .983** |
| Gender | 1.634* | 1.420 | 1.510* | 1.601* | 1.587* | 1.515* | 1.557* | 1.580* | 1.447 | 1.516* | 1.467* |
| Offense type | .762 | .814 | .828 | .907 | .928 | .930 | .905 | .816 | .948 | .960 | .907 |
| Total LSI-R score | 1.070** | | | | | | | | | | |
| CH domain score | | 1.240** | | | | | | | | | |
| CH % change | 1.006* | 1.008** | | | | | | | | | |
| ED domain score | | | 1.136** | | | | | | | | |
| ED % change | 1.000 | | 1.001 | | | | | | | | |
| FIN domain score | | | | 1.220 | | | | | | | |
| FIN % change | 1.000 | | | 1.001 | | | | | | | |
| FAM domain score | | | | | 1.188** | | | | | | |
| FAM % change | .998 | | | | 1.000 | | | | | | |
| ACC domain score | | | | | | 1.129 | | | | | |
| ACC % change | 1.001 | | | | | 1.001 | | | | | |
| REC domain score | | | | | | | 1.264* | | | | |
| REC % change | 1.003 | | | | | | 1.004* | | | | |
| PEER domain score | | | | | | | | 1.270** | | | |
| PEER % change | 1.002 | | | | | | | 1.005** | | | |
| DRUG domain score | | | | | | | | | 1.101** | | |
| DRUG % change | 1.003 | | | | | | | | 1.004* | | |
| EMOT domain score | | | | | | | | | | 1.069 | |
| EMOT % change | 1.000 | | | | | | | | | 1.001 | |
| ATT domain score | | | | | | | | | | | 1.220** |
| ATT % change | 1.002 | | | | | | | | | | 1.004** |
| Constant | .247* | .568 | .516 | .830 | .810 | .924 | .722 | .619 | .789 | .957 | .818 |
| Model chi-square (*df*) | 74.9 (15) | 56.6 (6) | 38.9 (6) | 22.3 (6) | 26.9 (6) | 20.8 (6) | 27.1 (6) | 36.2 (6) | 30.0 (6) | 20.7 (6) | 35.3 (6) |
| −2 log likelihood | 1028.9 | 1047.2 | 1065.0 | 1081.6 | 1076.9 | 1083.1 | 1076.8 | 1067.6 | 1073.9 | 1083.1 | 1068.6 |
| Nagelkerke $R^2$ | .12 | .09 | .06 | .04 | .04 | .03 | .04 | .06 | .05 | .03 | .06 |

*$p<.05$. **$p<.01$.

are examined individually, the initial scores of all but three domains (finances, accommodation, and emotional/personal) were significant predictors of rearrest ($p < .05$). Interestingly, the two domains of finances and accommodation were removed from the Level of Service/Case Management Inventory (LS/CMI; Andrews, Bonta, & Wormith, 2004), a revised version of the LSI-R.

Within these ten models examined, the percentage change in score is significant for the domains of criminal history, leisure/recreation, antisocial associates, and antisocial attitude. This is intriguing because—with the exception or the leisure/recreation—Andrews and Bonta (2010) describe these domains to be the best predictors of criminal conduct. Although the remaining domains were not significant, the odds ratios do maintain a positive direction, where increases in percent change are associated with increases in the risk for rearrest and decreases in percent change are associated with decreases in the risk for rearrest. Similar analyses were run with each domain total score along with the raw difference in domain score from the initial assessment to reassessment. The general direction of the odds ratios were in the same direction as the analyses with the percentage change. However, the percentage change scores yielded larger effects than the raw difference totals.

Race, age, and gender are significant predictors across most of the models examined. This suggests that these variables may have more or less influence on recidivism depending on which domain is examined. For example, changes in the antisocial attitude domain have a differential effect based on the race, age, and gender of the offender, whereas changes in the education/employment domain do not differ by race and age, but do for gender.

## DISCUSSION

Offender risk assessments have been described as "the cornerstone of a more effective, efficient, and just system" (Latessa & Lovins, 2010, p. 215). Advocates of the new risk assessment systems contend that the measurement of an offender's risk and need factors serves both a predictive *and* practical function (Andrews & Bonta, 2010). That is, risk assessments not only inform practitioners which offenders are at the greatest risk to reoffend, but also point toward treatment strategies that can reduce an offender's risk. However, some critics of the new risk assessment systems argue risk and need items should not be combined into one composite measure, but rather separated into two distinct indices (Baird, 2009). This disagreement will inevitably remain unsettled until there is more available evidence on how changes in risk score relate to recidivism. Therefore, the study of the dynamic validity of the risk assessment systems is a much needed and expanding area of academic investigation.

The results from this study suggest that the LSI-R has both predictive and dynamic validity. Although the initial and reassessment LSI-R total scores are both significantly related to rearrest, the models examined here suggest that the reassessment score is a better measure than the initial assessment score. Further, changes to the total and domain scores are also significantly related to rearrest. Although the examinations of both the raw difference in score and the percentage change in score are both predictively valid, the results of this study suggest that of the two, the percentage change in score is the more predictive measure. This may be because when calculating the percentage change, the offenders initial score influences the magnitude of the value, whereas when calculating the raw difference it does not. Therefore, the impact of an equal reduction of points from assessment to reassessment will impact a low-risk offender more than a high-risk offender. Theoretically, this makes sense because a two-point reduction for an offender that has an LSI-R score of 10 likely made more changes, than an offender with a score of 40 that reduced his risk by the same value.

This study is also the first to investigate the significance of changes in scores on the ten domains of the LSI-R. It found empirical support for the percentage change in score in the four domains of criminal history, leisure/recreation, antisocial associates, and antisocial attitude. This is a very important finding. Knowing empirically which domains, when risk and need levels change, are more correlated with recidivism reductions will assist corrections officials in making more informed case management decisions.

These findings support the notion that it is important to reassess offenders for risk to reoffend and the use of the percentage change in score can add incremental validity to the utility of the LSI-R. In sum, this study adds to many others in supporting the LSI-R as a valid predictor of recidivism and supports the importance of reassessment. The central point advanced in this article, however, is that correctional agencies and researchers should not only pay attention to offender risk scores, but also to changes in offender risk scores as well.

Despite the contributions made by this project, there is still much to learn from studying the impact of changes in offender risk scores. There are several limitations of the current study that should be understood before proceeding with any potential policy changes. First, all of the cases in the study are probationers from a Midwestern state. It is unknown if similar findings would be found with another type of offender in another state.

Second, the cases in the current sample were comprised primarily of lower risk offenders. Studying the effects of change in risk with higher risk offenders is bound to be fruitful. Since higher risk offenders have higher LSI-R scores there is the potential for more change to take place. A study of this type may reveal a stronger relationship between change in LSI-R score and the prediction of recidivism.

Finally, the current study exercised a selection process, including only cases with two LSI-R assessments during a four-year time frame. However, the time from assessment to reassessment was not uniform across all cases. Unfortunately, this may have limited our understanding of the true change in offender risk for the cases in our sample.

Despite these limitations, this study hopes to inspire other researchers to investigate change as a potential means of increasing the precision of offender recidivism prediction. Future research should not only assess the impact of the percentage change in the total score of the LSI-R on recidivism, but also include the change in each LSI-R domain. Armed with this knowledge, correctional agencies would better be able to assign offenders to programs aimed at addressing the criminogenic need areas that are shown to have larger decreases on recidivism.



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