Disparate Impact Analysis
(an On-Line Internet based application)

Instructions: Please fill out the information into the form below. Once you have entered your data below, you may select the types of analysis to be conducted by checking the appropriate boxes. Then press the compute button at the bottom of the form to view the results.

Select the type of employment decision: Selection

Enter a title for your report: Arborist (2014)

Number of Male	Number of Non-Minority	Number of Younger	Number of Non-Disabled
17 Applicants	17 Applicants	Applicants	Applicants
5 Selected	5 Selected	Selected	Selected
Number of Female	Number of Minority	Number of Oder	Number of Disabled
1 Applicants	1 Applicants	Applicants	Applicants
0 Selected	0 Selected	Selected	Selected

☑ -Adverse Impact
☑ -Chi-Square
☑ -Standard Deviation
☑ -Confidence Intervals
☑ Probability Distribution

Select the Statistical Tests you wish to execute by checking or unchecking the boxes on the left. Then press the 'Compute' button below.

Compute

Display: ☑ Description of Statistic   ☑ Interpretation of Results

Arborist (2014)

Adverse-Impact Report

Adverse Impact **and the "four-fifths rule." - A selection rate for any race, sex, or ethnic group which is less than four-fifths (4/5ths) (or eighty percent) of the rate for the group with the highest rate will generally be regarded by the Federal enforcement agencies as evidence of adverse impact.** *Uniform Guidelines on Employee Selection Procedures*

Rate of Females Applicants Selected	Rate of Males Applicants Selected	Adverse Impact Ratio for Females	Adverse Impact Ratio for Males
(0/ 1) = 0	(5/ 17) = 0.2941		
Adverse impact as defined by the 4/5ths rule was not found in the above data.			

Rate of Minorities Applicants Selected	Rate of Non-Minorities Applicants Selected	Adverse Impact Ratio for Minorities	Adverse Impact Ratio for Non-Minorities

(0/ 1) = 0	(5/ 17) = 0.2941		
Adverse impact as defined by the 4/5ths rule was not found in the above data.			

Chi-Square Report

Observed Expected	Selected	Not Selected	Row Totals
Males	5 4.7222	12 12.2778	17
Females	0 0.2778	1 0.7222	1
Column Total	5	13	18

Chi-Square = 0.4072
The value of the statistic is less than 3.841. This indicates that there is a 95 percent chance that these results have been obtained absent any form of bias. Therefore, you may conclude that these results fall within normal random variations and are not the result of bias.

Observed Expected	Selected	Not Selected	Row Totals
Non-Minorities	5 4.7222	12 12.2778	17
Minorities	0 0.2778	1 0.7222	1
Column Total	5	13	18

Chi-Square = 0.4072
The value of the statistic is less than 3.841. This indicates that there is a 95 percent chance that these results have been obtained absent any form of bias. Therefore, you may conclude that these results fall within normal random variations and are not the result of bias.

Standard-Deviation Report

The difference between the proportion of the protected class Selected and the proportion of all Applicants Selected has a normal distribution with a mean and standard deviation. The statistic is shown below:

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        (r / n) - p

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 sqrt(p * (1-p) / n) * sqrt(1-q)
```

Analysis of proportion of Females Selected
where:

- **r = number of Females Selected.**
- **n = number of Selected (Females and Males).**
- **p = proportion of Applicants that are Females.**
- **q = proportion of Applicants Selected.**

	Selected	Not Selected	Row Totals
Males	5	12	17
Females	0	1	1
Column Total	5	13	18

r = 0
n = 5
p = 1 / 18 = 0.056
q = (0 + 5) / (1 + 17) = 0.278

Standard Deviation Statistic = -0.638

These results show that the proportion of Females Selected is -0.638 standard deviations below the proportion of Applicants Selected. A result of less than 2 standard deviations is generally considered non-significant.

Analysis of proportion of Minorities Selected
where:

- **r = number of Minorities Selected.**
- **n = number of Selected (Minorities and Non-Minorities).**
- **p = proportion of Applicants that are Minorities.**
- **q = proportion of Applicants Selected.**

	Selected	Not Selected	Row Totals
Non-Minorities	5	12	17
Minorities	0	1	1
Column Total	5	13	18

r = 0
n = 5
p = 1 / 18 = 0.056
q = (0 + 5) / (1 + 17) = 0.278

Standard Deviation Statistic = -0.638

These results show that the proportion of Minorities Selected is -0.638 standard deviations below the proportion of Applicants Selected. A result of less than 2 standard deviations is generally considered non-significant.

Confidence Interval Report

The proportion of the protected class Selected has an expected value that would fall within a specified confidence interval. The statistic is shown below:

Observed value = (r / n)

Expected value = p

Standard Deviation = sqrt(p * (1-p) / n) * sqrt(1-q)

Confidence Interval:

Lower Bound = p - 1.96 * Std Dev

Upper Bound = p + 1.96 * Std Dev

Analysis of proportion of Females Applicants Selected **where:**

- **r = number of Females Selected.**
- **n = number of Applicants Selected.**
- **p = proportion of Females among those Selected.**
- **q = proportion of Applicants Selected.**

r = 0

n = 5

p = (1/(1+17))=0.056

q = ((0 + 5)/(1 + 17))=0.278

(r/n)=0/5=0

The lower bound of the confidence interval is: 0.056 -(1.96* 0.087)= -0.1151

The upper bound of the confidence interval is: 0.056 +(1.96* 0.087)= 0.2262

Confidence Interval = -0.1151 to 0.2262

These results show that the proportion of Females Females (r/n=0) is contained in the confidence interval. Therefore a finding of disparate impact is not supported by this data.

Analysis of proportion of Minorities Applicants Selected **where:**

- **r = number of Minorities Selected.**
- **n = number of Applicants Selected.**
- **p = proportion of Minorities among those Selected.**
- **q = proportion of Applicants Selected.**

r = 0

n = 5

p = (1/(1+17))=0.056

q = ((0 + 5)/(1 + 17))=0.278

(r/n)=0/5=0

The lower bound of the confidence interval is: 0.056 -(1.96* 0.087)= -0.1151

The upper bound of the confidence interval is: 0.056 +(1.96* 0.087)= 0.2262

Confidence Interval = -0.1151 to 0.2262

These results show that the proportion of Minorities Minorities (r/n=0) is contained in the confidence interval. Therefore a finding of disparate impact is not supported by this data.

Probability Distribution Report

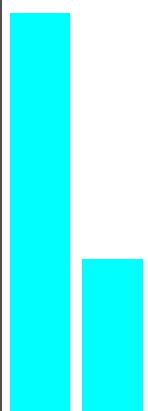| Number Females Selected	Number Males Selected	Rate of Females Applicants Selected	Rate of Males Applicants Selected	Adverse Impact Ratio of Females	Adverse Impact against Females ?	Probability	Cumulative Probability
Selected-> 0	5	(0/1)	(5/17)	0	YES	0.722222	0.722222
1	4	(1/1)	(4/17)	4.25	NO	0.277778	1

Given that 5 were Selected from a pool of 17 Males and 1 Females it was possible to have Selected from 0 to 1 Females.

Adverse Impact would be found if you Selected 0 or fewer Females.

The probability of Adverse Impact occurring even if the employment decisions were random (i.e. unbiased) is 0.7222 (the sum of the probabilities of having Selected 0 or fewer Females).

Since the probability of Adverse Impact occurring even if the employment decisions were random (i.e. unbiased) is greater than 10%, an observed Adverse Impact may be not significant since the probability is greater than 1 in 10 that Adverse Impact would have occurred due to chance.

Probability Distribution of the variable: Number of Females Selected.


0   1

Number of female Applicants Selected

The probability distribution of having Selected from 0 to 1 Females is displayed above. As can be seen, the most likely event (highest probability) to have occurred by chance (or decisions not affected by any form of bias) is to have Selected 0 female Applicants. This represents the mean of the probability distribution. Approximately half of the probability distribution is above this point and approximately half is below this point. The total area contained in the probability distribution is equal to 1. Thus, probabilities for each number of female Applicants Selected are a fraction of the total probability distribution. The larger areas of the distribution represent higher probabilities of occurance. Adding the individual probabilities up to a certain point enable you to compute the probability of having Selected that many or fewer female Applicants. Adding the individual probabilities from a certain point and higher enable you to compute the probability of having Selected that many or more female Applicants.

The characteristics of the probability distribution--its mean and standard deviation--are a function of the number of female and male Applicants and the number of Applicants to be Selected. Though it is possible to have Selected from 0 to 1 female Applicants, the individual probabilities of having Selected each number of female Applicants can be computed and accumulated. As noted before, these individual probabilities are a function of the number of female and male Applicants and the number of Applicants to be Selected.

Using the distribution above, a 90 percent confidence interval on the variable 'Number of Females Selected' would have a lower bound of 0 and an upper bound of 1.

The significance of having Selected 0 or fewer Females is graphically displayed below.
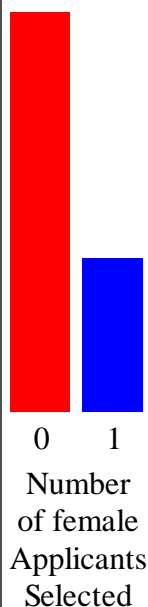
0   1

Number
of female
Applicants
Selected

As noted earlier, Adverse Impact, according to the 4/5ths rule, would be found if you Selected 0 *or fewer* female Applicants.

You have Selected 0 female Applicants. The probability of having Selected 0 *or fewer* Females is equal to the cumulative probability for having Selected 0 Females Applicants. The cumulative probability of having Selected 0 female Applicants is 0.7222 and is graphically displayed, in red, above.

Since the probability is greater than 10%, we are unable to reject the hypothesis that the decisions occurred due to chance. Therefore, we must conclude that it is entirely possible that having Selected 0 or fewer female Applicants is an event that occurred due to chance and not from discriminatory actions by

the employer.

| Number Minorities Selected	Number Non-Minorities Selected	Rate of Minorities Applicants Selected	Rate of Non-Minorities Applicants Selected	Adverse Impact Ratio of Minorities	Adverse Impact against Minorities ?	Probability	Cumulative Probability
Selected-> 0	5	(0/1)	(5/17)	0	YES	0.722222	0.722222
1	4	(1/1)	(4/17)	4.25	NO	0.277778	1

Given that 5 were Selected from a pool of 17 Non-Minorities and 1 Minorities it was possible to have Selected from 0 to 1 Minorities.

Adverse Impact would be found if you Selected 0 or fewer Minorities.

The probability of Adverse Impact occurring even if the employment decisions were random (i.e. unbiased) is 0.7222 (the sum of the probabilities of having Selected 0 or fewer Minorities).

Since the probability of Adverse Impact occurring even if the employment decisions were random (i.e. unbiased) is greater than 10%, an observed Adverse Impact may be not significant since the probability is greater than 1 in 10 that Adverse Impact would have occurred due to chance.

Probability Distribution of the variable: Number of Minorities Selected.


0   1
Number of minority Applicants Selected
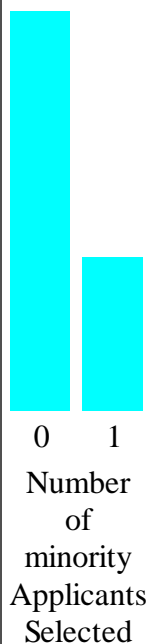
The probability distribution of having Selected from 0 to 1 Minorities is displayed above. As can be seen, the most likely event (highest probability) to have occurred by chance (or decisions not affected by any form of bias) is to have Selected 0 minority Applicants. This represents the mean of the probability distribution. Approximately half of the probability distribution is above this point and approximately half is below this point. The total area contained in the probability distribution is equal to 1. Thus, probabilities for each number of minority Applicants Selected are a fraction of the total probability distribution. The

larger areas of the distribution represent higher probabilities of occurance. Adding the individual probabilities up to a certain point enable you to compute the probability of having Selected that many or fewer minority Applicants. Adding the individual probabilities from a certain point and higher enable you to compute the probability of having Selected that many or more minority Applicants.

The characteristics of the probability distribution--its mean and standard deviation--are a function of the number of minority and non-minority Applicants and the number of Applicants to be Selected. Though it is possible to have Selected from 0 to 1 minority Applicants, the individual probabilities of having Selected each number of minority Applicants can be computed and accumulated. As noted before, these individual probabilities are a function of the number of minority and non-minority Applicants and the number of Applicants to be Selected.

Using the distribution above, a 90 percent confidence interval on the variable 'Number of Minorities Selected' would have a lower bound of 0 and an upper bound of 1.

The significance of having Selected 0 or fewer Minorities is graphically displayed below.
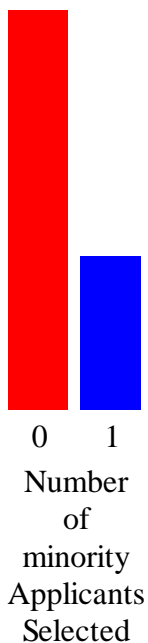
0   1

Number of minority Applicants Selected

As noted earlier, Adverse Impact, according to the 4/5ths rule, would be found if you Selected 0 *or fewer* minority Applicants.

You have Selected 0 minority Applicants. The probability of having Selected 0 *or fewer* Minorities is equal to the cumulative probability for having Selected 0 Minorities Applicants. The cumulative probability of having Selected 0 minority Applicants is 0.7222 and is graphically displayed, in red, above.

Since the probability is greater than 10%, we are unable to reject the hypothesis that the decisions occurred due to chance. Therefore, we must conclude that it is entirely possible that having Selected 0 or fewer minority Applicants is an event that occurred due to chance and not from discriminatory actions by the employer.

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Send questions or comments to webmaster@hr-guide.com. Thank you.