# t-tests

On the attached excel file are data on cancer rates by region for the whole of Scotland. The data were collected in 2000 and are expressed as rates per 100,000. If you were to compare the statistical likelihood of a man or a woman contracting lung cancer using a t-test Excel would produce the following output.

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| t-Test: Two-Sample Assuming Unequal Variances |
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|  | *Variable 1* | *Variable 2* |  |
| Mean | 86.99158 | 50.35315 |  |
| Variance | 461.3188 | 146.3005 |  |
| Observations | 29 | 29 |  |
| Hypothesized Mean Difference | 0 |  |  |
| df | 44 |  |  |
| t Stat | 8.004239 |  |  |
| P(T<=t) one-tail | 1.99E-10 |  |  |
| t Critical one-tail | 1.68023 |  |  |
| P(T<=t) two-tail | 3.98E-10 |  |  |
| t Critical two-tail | 2.015367 |   |  |

This analysis would tell you the following:

The average rate of lung cancer per 100,000 men in Scotland = 87

The average rate of lung cancer per 100,000 women in Scotland = 50

Because the t-statistic associated with the above is 8.00 and the critical point at the 0.05% level for statistical significance (with 2 tails) is 2.02 then there is a statistically significant difference in lung cancer rates between men and women in Scotland. Indeed the probability value (P(T<=t) two-tail) associated with the above analysis is 0.0000000000398 or 3.98 \* 10-10 . This is much less than 0.05 and is also less than 0.01 (the two limits commonly used by scientists).

The above output could therefore be summarised in a table as follows:

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| **Statistical Comparison of Lung Cancer Rates between Men and Women in Scotland** |
| Mean rate (per 100,000) for Men = | 87 |
| Mean rate (per 100,000) for Women = | 50 |
| t-value at 5% level = | 2.02 |
| t-statistic generated from t-test =  | 8.00 |
| p-value associated with t-test = | p < 0.01 |
| Conclusion = | There is a significant difference in lung cancer rates between men and women in Scotland. |

Please complete the following tables based on the data for other cancers.

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| **Statistical Comparison of Stomach Cancer Rates between Men and Women in Scotland** |
| Mean rate (per 100,000) for Men = |  |
| Mean rate (per 100,000) for Women = |  |
| t-value at 5% level = |  |
| t-statistic generated from t-test =  |  |
| p-value associated with t-test = |  |
| Conclusion = |  |

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| **Statistical Comparison of Large Bowel Cancer Rates between Men and Women in Scotland** |
| Mean rate (per 100,000) for Men = |  |
| Mean rate (per 100,000) for Women = |  |
| t-value at 5% level = |  |
| t-statistic generated from t-test =  |  |
| p-value associated with t-test = |  |
| Conclusion = |  |

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| **Statistical Comparison of Bladder Cancer Rates between Men and Women in Scotland** |
| Mean rate (per 100,000) for Men = |  |
| Mean rate (per 100,000) for Women = |  |
| t-value at 5% level = |  |
| t-statistic generated from t-test =  |  |
| p-value associated with t-test = |  |
| Conclusion = |  |

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| **Statistical Comparison between the rate of Stomach Cancer and the rate of Cervical Cancer in the Female population in Scotland** |
| Mean rate of Stomach Cancer = |  |
| Mean rate of Cervical Cancer = |  |
| t-value at 5% level = |  |
| t-statistic generated from t-test =  |  |
| p-value associated with t-test = |  |
| Conclusion = |  |

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| **Statistical Comparison between the rate of Large Bowel Cancer and the rate of Prostate Cancer in the Male population in Scotland** |
| Mean rate of Large Bowel Cancer = |  |
| Mean rate of Prostate Cancer = |  |
| t-value at 5% level = |  |
| t-statistic generated from t-test =  |  |
| p-value associated with t-test = |  |
| Conclusion = |  |