**Melanoma Incidence Rates: Australia vs. United States**

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**Introduction**

Cancer and more particularly skin cancer is a disease that affects individuals all over the world. There are three different classifications of skin cancers which include, basal cell carcinoma, squamous cell carcinoma and malignant melanoma. Malignant melanomas are skin cancers that metastasize throughout the body and are typically deadly. Melanomas only make up 5% of all skin cancers and can be deadly.( McCandless 2020) In this data set Melanoma rates were collected in four different areas of the world including the United States, Australia, Germany and the United Kingdom. A comparison of the United States versus Australia was analyzed in this case because of the abnormally high number of Melanoma incidences in Australia. One factor that may contribute to this finding was the difference in the ozone layer in these two different places in the world. The main explanation behind this data stems from the depletion of the ozone layer in Australia. Because of the depletion of Australia’s ozone layer due to chlorofluorocarbons (CFC), a much greater amount of UV rays reaches earth’s surface. (O’Reilly 2022). Ultimately Australia experiences a more depleted ozone layer compared to the United States because of excessive use of CFC’s and its proximity to the largest ozone hole on the planet near Antarctica. This data set was important to analyze and consider because the health of individuals living in Australia especially seemed to be compromised. Ultimately, I expect Melanoma rates in Australia will be significantly different than Melanoma rates in the United States throughout the course of approximately two and a half decades.

**Data Set**

 From 1982 to the year 2006 incidences of melanoma per 100,000 people were recorded in Australia and The United States of America by both the Australian Institute of health and the National Cancer Institute. According to the Australian Institute of Health and Welfare, it is required by law to document all cases of melanoma (Australian Institute of Health and Welfare 2023.) Therefore, it can be assumed that roughly 100% of melanoma cases are recorded in Australia. On the other hand, the United States does not have a law that requires all melanoma cases to be properly documented which results in only about 26% of the population being recorded according to the National Cancer Institute (Seer Cancer Statistics Review 1975-2007). Through both national data banks, the melanoma incidences were able to be compared side by side and analyzed.

**Results**

 Both the trend in melanoma incidences in the United States as well as in Australia follow a positive linear trend. Although, the trend in the United States was more consistent while the trend in Australia has slightly more variability while still maintaining a positive linear trend. For this data set a paired samples t-test was run because of the presence of a dyad between the years of melanoma incidences and the rate of melanoma occurrences between individuals in both the United States and Australia. This happens to be a dyad because if the melanoma incident rates were swapped around for different years it would affect the positive trend that is present. For example, in Australia if the melanoma incident rate of 43.5 in the year 1995 was placed at the year 1985 instead the graph and data set would be affected. When taking the observed data into consideration a nondirectional test was selected in order to give a more conservative result. In this case the null hypotheses would be rejected that the melanoma rates in the United States and Australia were the same, t (24) = -26.88, p < 0.001, Cohen’s d= 4.66 which indicates a large effect size. Melanoma rates in Australia (M= 41.24 Incidences per 100,000 People, SD=7.51 Incidences per 100,000 people.) The melanoma rates in Australia were significantly higher than the melanoma rates in the United States (M= 16.06 Incidences per 100,000, SD= 3.27 Incidences per 100,000) which can be found in Table 1.

Graph 1: Melanoma rates in Australia versus United States

Table 1: Melanoma rates in Australia versus United States

|  |  |  |
| --- | --- | --- |
| SUMMARY OUTPUT |  | t-Test: Paired Two Sample for Means |
|  |  |  |  |  |  |
| *Regression Statistics* |  |  | *US* | *AUS*  |
| Multiple R | 0.919994 |  | Mean | 16.066 | 41.244 |
| R Square | 0.84638896 |  | Variance | 10.6889917 | 56.4342333 |
| Adjusted R Square | 0.83971022 |  | Observations | 25 | 25 |
| Standard Error | 1.30894467 |  | Pearson Correlation | 0.919994 |  |
| Observations | 25 |  | Hypothesized Mean Difference | 0 |  |
|  |  |  | df | 24 |  |
|  |  |  | t Stat | -26.88145 |  |
|  |  |  | P(T<=t) one-tail | 9.959E-20 |  |
|  |  |  | t Critical one-tail | 1.71088208 |  |
|  |  |  | P(T<=t) two-tail | 1.9918E-19 |  |
|  |  |  | t Critical two-tail | 2.06389856 |   |

**Discussion**

The p value that was obtained from running a paired samples t-test was less than 0.05 which indicates that the null should be rejected. Since the null hypothesis was rejected, the hypothesis that melanoma incidences in Australia are significantly higher than the United States could be confirmed to be true. The large effect size in this case also confirms that there is a significant relationship between the melanoma incidences in the United States and Australia.

Potential limitations for the analysis would have been not having data for the number of melanoma incidences for the same years. This led to some more recent years to not be included because there was not data available for Either the United States or Australia for certain years. An additional limitation that is present would be the assumption that 100% of the melanoma cases in Australia were recorded. There could be instances where for some reason several cases were not recorded because an individual living in Australia may have been diagnosed somewhere else.

The benefits of this analysis included being able to definitively confirm the hypothesis that there was a significant difference in the incidences of melanoma between the United States and Australia. It also gave insight into conducting further research as to why the data may have shown this specific trend. The reason for higher melanoma incidences in Australia is because of depletion of the ozone layer. This information could be utilized by the Australian Institute of Health and Welfare as well as the National Cancer Institute in order to come up with a better solution on how to approach this issue.

Overall, because the null hypothesis was rejected, a conclusion that there was a significant difference between melanoma incidences in Australia compared to the United States. The extremely small P value as well as the large effect size helped to confirm this finding. Many different factors such as CFC’s and weather changes lead to the depletion of the ozone layer which is most likely the main contributor to elevated melanoma rates in Australia.

**References**

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