**BIO2003/BIO2005/BMS2007**

**Summative Assignment 2 (SA2)**

**Introduction**

The Health and Safety Executive (HSE) commissions you to analyse information obtained from an accredited laboratory of workers from four different chemical industries. The HSE wants to know if there is any cause for concern that the workers may potentially be affected by exposure to organic solvents resulting in liver damage. Data for four industries, all of which use a range of potentially hazardous chemicals, has been collected which the HSE hope may shed light on any potential problems.

**The problem**

Many industrial processes rely on the use of organic chemicals – including volatile solvents. Such compounds are sometimes described as xenobiotics, meaning that they do not exist in nature in any meaningful concentration - their existence is solely the result of human activity. Many of these chemicals, typically chlorinated hydrocarbons, are known to be hazardous, particularly by inhalation. Once in the blood stream they are capable of interfering with enzyme activity as well as interrupting genetic replication processes. Although the use of such chemicals is carefully monitored and regulated the HSE remain concerned about worker exposure. As such the HSE takes the issue seriously and has undertaken a preliminary study via the agency of the accredited laboratory to look into any potential problems and it is the results of this study that you are commissioned to analyse.

**The use of LDH as a warning sign**

Lactate dehydrogenase (LDH) is an intracellular enzyme. It oxidizes lactate in the presence of NAD+ (oxidised form of nicotinamide adenine dinucleotide) or reduces pyruvate in the presence of NADH (reduced form of NAD). It is used clinically to determine cell damage in a number of organs including heart, liver, muscle and blood. There are 5 iso-enzymes of LDH. Changes in the level of iso-enzyme LDH-5 can be associated with liver function and as such elevated LDH-5 is deemed to be a useful indicator of the initial stages of liver damage that may be caused by exposure to many organic solvents. One method of gauging liver damage is to calculate the ratio of LDH-5 to LDH-1. The higher this value, the greater is the risk that liver damage is taking place. You have been provided with the value of this ratio (LDH-5:LDH-1) for each participant in the study. It is on the basis of the value of this variable that you are being asked to compare the workers’ health.

**The study group and the data collected**

The HSE in undertaking the study stipulated criteria for workers to take part in the study, namely:

* The workers worked exclusively in the specified industries
* They worked in areas of actual production (i.e. not in an office or other areas away from the industrial activity)
* They had not smoked historically or currently (as self-reported by questionnaire)
* They did not historically or currently drink alcohol above the then guideline value of 21/14 (men/women) units/week (as self-reported by questionnaire)
* They did not have any known underlying medical condition that could affect the results

From the population satisfying these criteria, a total sub-sample of 127 workers were randomly selected for blood testing, 37 from paint manufacturing, 27 from de-greasing, 31 from dry cleaning and 32 from the plasticizer manufacturing.

In the Minitab worksheet the results of the study are shown in 6 columns of data.

C1 - A worker ID, identifying the industry and the individual (3 digit number)

C2 - The industry in which the employee worked

C3 - Length of service of each employee in the sector (in years)

C4 - Age of each employee (in years)

C5 - The LDH assay result - LDH-5:LDH-1 ratio

C6 - The gender of each worker

**Your task**

You a required to produce a coherent, concise, well presented and well-structured report which informs the HSE **whether or not there is genuine evidence of difference in the potential health hazard between workers at the different industries – as indicated by the LDH-5:LDH-1 ratio.**

Further, you are required to report on **whether there is any association between worker length of service in the industry and the potential damage to their health.** In concluding the report you cannot assume that the HSE understands statistical methods in detail and you will therefore have to summarise your findings in plain non-technical language. The length of the report should be no longer than 7 pages or 2500 words.

You are expected to:

* introduce the type of question you are facing including hypothesis testing
* produce appropriate descriptive/graphical summaries of the data
* justify your choice and undertake the correct statistical tests
* interpret any p-values and confidence intervals and correlation co-efficients correctly
* arrive at brief and clear conclusions that directly answer the problem
* you are free to explore and will be credited for any further analyses of the data you deem worthy of investigation
* finally, are the HSE asking exactly the right questions and most importantly, is this a well-designed study?

**General advice**

As previously indicated, only include computer output which you fully label and refer to in the text, and which you feel helps answer the problem.

Do not produce vast amounts of output from computer software. Only include computer output which you fully format, label, and discuss in the text. Be selective on use of Tables and graphics. Do not write the report like an instruction manual on how to operate Minitab – focus on the interpretation and discussion of the output generated, not on how it was produced. Regarding referencing, you are not expected to cite a large amount of references in this kind of work. If however, you have read material that is relevant to your report, please cite it and reference it according to University Guidelines. Take into account any relevant feedback from SA1. Proof read your work before submitting it.

*Finally and most importantly, it is the clarity and insight that you display in your interpretation and evaluation of the results obtained that is the key to obtaining a good grade.*

**Submission and deadline – Via Turnitin Date to be confirmed.**

# Assessment Criteria for Assignment 2

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| **Criteria** | 70%+ | 60%-69% | 50%-59% | 40%-49% | <40% |
| Introduction to type of question being faced including hypothesis testing |  |  |  |  |  |
| Production of appropriate descriptive/graphical summaries of the data |  |  |  |  |  |
| Justification of choice of statistical test |  |  |  |  |  |
| Undertaking of the correct and relevant statistical tests |  |  |  |  |  |
| Interpretation of p values confidence intervals, HO/H1 and correlation correctly |  |  |  |  |  |
| Arrival at brief and clear conclusions that directly answer the problem |  |  |  |  |  |
| Report coherent, concise (no more than 7 pages), well structured and well presented |  |  |  |  |  |

Comments:

Tutor signature Date Overall grade