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| **Introduction**  Magnetic resonance imaging (MRI) is a noninvasive medical test that helps physicians diagnose and treat medical conditions.  MRI imaging uses a powerful magnetic field, radio frequency pulses and a computer to produce detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. The images can then be examined on a computer monitor, printed or copied to CD. MRI does not use ionizing radiation (x-rays). | | | **Figure 1**  **Source: assets.aarp.org** | | |
| Comparing the intensity of one part of an image to another part (of known density) provides an indication of the density of each the unknown portions of the image. In the Figure 2, the unknown density of the liver is compared to the density of the Para spinal muscle (the known value).  See further Hemochromatosis by James Barton and Corwin Edwards  See: 7.5 MRI of 4 Livers | | **Figure 2**  **Source: oernst.f5lvg.free.fr** | | | |
| A technician administers the test and sends the results to physicians who analyze the results.  According to Payscale.com, the hourly rate of pay for MRI technicians increases with experience.   1. Find the ratio for the pay of MRI technicians with 20+ years of experience compared to those with 10-19 years of experience. Compare that with the ratio of 1-4 years to less than 1-year. | **Figure 3**  **Source: www.payscale.com** | | | | |
| Hemochromatosis is the most common form of iron overload disease. Physicians use the information from an MRI to decide whether to perform the invasive procedure of a liver biopsy. Iron content in the liver normally is around the 400 μmol/g.   1. When the iron content is greater than 400 μmol/g, action may be required. Beyond what signal intensity ratio might physicians prescribe a biopsy? 2. The signal intensity ratio of the liver (siL) and the signal intensity ratio of the paraspinal muscle (siM) on the same CAT-scan provide what is called the siL/siM ratio. The siL/siM ratio can be used to determine the amount of iron in the liver, measured in μmol/g. Iron overload in the liver decreases the signal intensity of the liver while muscle signal intensity remains unchanged. 3. The data (right) came from biopsies and shows the signal intensity ratio and the iron content. Describe the general trend you see in the data.   For more information Hemochromatosis on see: <http://digestive.niddk.nih.gov/ddiseases/pubs/hemochromatosis/index.htm>  Table 1 | | | | |  |  | | --- | --- | | **Signal** |  | | **Intensity** |  | | **Ratio (SIR)** | **Iron** | | **0.42** | **960** | | **0.58** | **800** | | **0.6** | **570** | | **0.77** | **420** | | **0.82** | **360** | | **0.83** | **680** | | **0.92** | **280** | | **1** | **510** | | **1.02** | **315** | | **1.16** | **390** | | **1.3** | **250** | | **1.51** | **230** | |

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| The objective is to find a model that will predict the iron content in the liver. If the amount of iron found is greater than 400 μmol/g, the physician may prescribe additional tests, including a biopsy.   1. Construct a scatter plot of the data in Table 1. |  | |
| 1. Find a linear model for iron as a function of the SIR. | |  |
| 1. According to the model, below what SIR might the physician prescribe additional tests? | |  |
| 1. Discuss why other factors might enter into the decision. | |  |