

## ABSTRACT

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Magnetic resonance imaging has traditionally provided qualitative information about patient anatomy. However, magnetic resonance methods are sensitive to the presence of different chemicals, such as fat and iron. We will exploit this sensitivity to provide quantitative measures of fat and iron in the context of the liver. Liver fat content is related to non-alcoholic fatty liver disease, while liver iron content is related to genetic hemochromatosis and repeated blood transfusions. Fat quantification requires correction for the tissue's transverse decay; at least two methods have been proposed to model the decay rate, and we will examine these signal models with both simulated and in vivo data, in the context of in vivo liver imaging by comparison to spectroscopy methods. Iron quantification can be performed using multiple methods, among them measuring the transverse decay rate, and estimating the tissue's susceptibility through phase information. We will look at the performance of measuring the transverse decay rate with differing coil combination and parameter fitting and averaging methods, in simulation and in phantoms. Finally, we will present a novel method for part of the quantitative susceptibility estimation pipeline: the theoretical basis is proffered, followed by simulation and experimental results.