MRgFUS is an emerging treatment modality for the non-invasive treatment of a variety of disorders. It is FDA approved for the treatment of uterine fibroids and is in clinical trials for the treatment of neuropathic pain, essential tremor, brain tumors, painful bone metastases, prostate cancer, and liver cancer. For these applications, MRI provides image guidance for targeting, temperature imaging, and treatment assessment. Focused ultrasound is also being investigated for neuromodulation and for opening the blood brain barrier for drug delivery. This talk will review the clinical applications, ongoing basic science research, as well as discuss current work to address ongoing engineering challenges.