**Introduction:** For cognitive neuroscience research Transcranial Magnetic Stimulation (TMS) is a useful method for probing brain connectivity, combined with fMRI. Standard fMRI experiments interleaved with TMS are possible as proven from several studies [1-2], but to date, there are no specific studies that thoroughly characterize and discuss all risks related to concurrent TMS/fMRI. An important contribution relative to methodological considerations for concurrent TMS/fMRI was recently printed [3]. Our goal was to identify main risks of such multimodal experiments. By means of thermal map, flip angle map, tSNR and signal stability evaluation of EPI (percent fluctuation and drift), we try to identify the influence of the TMS-coil in terms of safety and quality.

**Methods:** In our study we used a “MagPro Magnetic” stimulator from the Medtronic company combining with the certified TMS-coil MRI-B88 from the MagVenture company, a MR-compatible figure-of-eight TMS-coil with a diameter of 90 mm certified for MRI scanner up to 4 Tesla. We used a MedSpec® 4T; Bruker Biospin MRI scanner (Siemens MAGNETOM electronics, Sonata Gradients). A 170 mm diameter spherical Silicon Oil phantom was used with a Tx/Rx Bird Cage (BC) coil. Only superior position of the TMS-coil was studied (on motor area). The stimulator was positioned outside the scanner room and the TMS line was appropriately filtered through the Faraday cage to not induce RF pickup artifacts during MRI. Thermal mapping of the TMS-coil was obtained from a thermal camera (Fluke TI20) before and after the application of Ruff’s protocol [4], in both cases inside and outside the scanner. The B1 map was performed using the spin-echo double angle method [5] on phantom with and without the TMS-coil to evaluate the changing in the RF filed. B1 map was obtained in coronal orientation on one slice at the center. tSNR, second-order detrended voxel-wise time-series SNR (mean voxel value over series/standard deviation over series), was calculated using MATLAB, neglecting the first 4 images in the series to allow equilibrium in longitudinal magnetization to be established. The difference between the two time series (with and without the TMS-coil) was calculated as a percentage of the mean of the two. Percent fluctuation and drift [6] were evaluate using single-shot EPI sequences, with 64x64x64 matrix, a voxel size of 3x3x3mm³, TR=2s, TE=35ms, 37 slices and 280 volumes.

**Results:**

**Thermal Mapping:** Figure 1 shows the temperature in the TMS-coil after one session of the Ruff’s protocol. Maximum temperature value reached was 30.7 °C (baseline was 24°C). Same results in the thermal map were obtained repeating the test with the TMS-coil outside the magnet field. **B1-inhomogeneity:** Figure 2 shows the percentage distribution of the flip angle respect the nominal value (60°). The colors show a maximum variation of 23.8% (yellow) at 1.5cm close to the TMS-coil. **tSNR:** Figure 3 shows the tSNR differences between the two conditions, with and without the TMS-coil during EPI acquisition. The presence of the TMS-coil provides a loss in the tSNR of 120% as showed in green color. **Signal stability:** 0.12, 0.36 and 0.15, 0.38 are respectively the percent fluctuation and drift evaluated without and with the TMS-coil in the BC. The variations of parameters are in the confidence interval evaluated in one year of weekly QA tests: 0.06 and 0.31 are respectively standard deviations of percent fluctuation and drift.

**Conclusions:** Even though stability tests suggest none influence of the TMS-coil in concurrent TMS/fMRI and good performance of the TMS-filter, thermal map advise a presumable risk of temperature increasing on head patient, that can compromise the normal patient’s thermoregulation during the TMS/fMRI studies. The B1 map shows that the TMS coil might affect the loading of the MR RF coil. The SARs from the MR system are relatively worthless when another device is present and used (in both cases of B1 maps, SARs value are the same and equal to 0.0010819 W/Kg). More tests are necessary to quantify the effect on human, and also appropriate practical measures for minimizing the risks.

**Acknowledgements:** Support for this research was provided in part by the government of the Provincia Autonoma di Trento, Italy, the private foundation Fondazione Cassa di Risparmio di Trento e Rovereto, and the University of Trento, Italy.