**Highlights Review**

* We study network robustness in resting state functional connectivity networks
* We apply analytic measures of network communication efficiency in the human brain
* We find that young individuals are more resilient than old ones to random lesioning of brain areas
* We find more idiosyncratic responses to specific brain network lesioning in elder compared to young subjects
* The lesioning of central and limbic structures in young subjects yield a larger efficiency loss than in older individuals