Therapeutic drugs have been classified based on pharmacodynamics and disease indications. However, it has gradually been revealed that profiling of side effects can be used to classify therapeutic drugs and to find novel disease indications of drugs. In this study, we generated multidimensional vectors for each therapeutic drug based on the cosine similarity of side effects in Adverse Event Open Learning through Universal Standardization (AEOLUS), a standardized version of the US FDA Adverse Event Reporting System. Density-based spatial clustering was applied to the multidimensional vectors based on the side effects in AEOLUS. By comparing these clusters, we were able to identify several sets of therapeutic drugs, including a few sets comprising of therapeutic drugs with different pharmacodynamics. These findings suggest that clustering therapeutic drugs based on similarities of indications and side effects reported in public databases can be useful to find new functions of therapeutic drugs.