## Analyzing energy consumption patterns for solitary death in single-person elderly households

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**Purpose** Solitary death (kodokushi) has emerged as a significant social issue in South Korea, mirroring its prominence in Japan[1]. In South Korea, "solitary death" is legally defined as the passing of individuals who lived in a state of social isolation, disconnected from family members, relatives, and others, and who succumbed to factors such as suicide or illness. In particular, in Seoul, the risk of solitary death is increasing due to the rise in single-person households and the growing number of socially isolated elderly individuals. Preventing solitary death requires extensive efforts from social welfare workers, yet there is a shortage of both budget and personnel. To address this issue, Seoul is utilizing IoT technology to monitor the well-being of socially isolated households, aiming to provide timely assistance and support. However, the monitoring technology utilizing IoT is currently limited to early detection within three days after the occurrence of death. Therefore, there is a need for technology that utilizes artificial intelligence to detect crisis signals before death occurs. In this study, we aim to analyze changes in daily life patterns before death by using time-series data of power consumption and luminosity obtained from smart plugs installed in actual single-person households where solitary deaths occurred. **Method** The Seoul Metropolitan Government, through the Seoul Welfare Foundation, monitors 3,945 households identified as at risk of solitary death using smart plugs. The study analyzed changes in daily life patterns using the power consumption and luminosity data stored at 10-minute intervals for approximately a month prior to the deaths of 16 solitary individuals and 244 monitored subjects until February 2024. Figure 2 is a flowchart of the study. We analyzed the daily life patterns through the average daily power usage and correlation coefficient over a month. Additionally, we aimed to distinguish between normal and abnormal situations using DBSCAN, an unsupervised learning method. **Results and Discussion** A total of 260 households at risk of solitary death were analyzed, with the majority of the 16 solitary death victims being men in their 60s. After these individuals passed away alone at home, with no activity recorded by the IoT sensors for 2 to 3 days, welfare checks were conducted and their deaths confirmed. There were more male users than female. IoT sensors were installed on the power supply of TVs in 40.7% of cases. Most users are in their 60s, and the majority of early death detection cases are also in this age group. Figure 3 visualizes the daily power consumption measured by IoT sensors in the month preceding the solitary deaths, with average values displayed, and clustering results using DBSCAN. From the usage patterns observed, it appears that connected devices were predominantly used between 6 PM and 9 PM. In this study, the activity patterns preceding the deaths of individuals who died alone at home were examined. The analysis of daily life patterns before death provides valuable insights into early warning signs and crisis signals, enabling timely intervention and support from healthcare professionals and social welfare workers.

### References

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*Figure 1.*

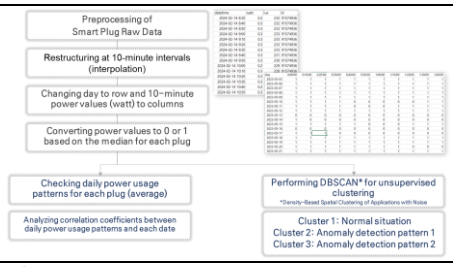


*Figure 2.*

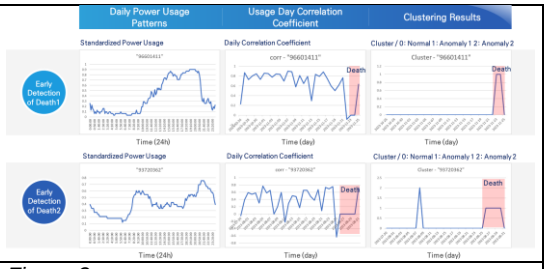


*Figure 3.*