Antimicrobial resistance (AMR) is a global threat (1), and Japan has tackled AMR based on the “National Action Plan on AMR 2016-2020” (2). Antimicrobial stewardship (ASP) intervention is one of the key action items in this action plan, and antimicrobial use (AMU) is one of the key indicators of ASP (2).

AMR is an emerging problem among both acute care hospitals and nursing homes (3). The risk of developing an infection that requires treatment with antimicrobials is relatively high among nursing home residents, and the infections often have serious consequences (4).

Past point prevalence surveys (PPS) from Norway and Northern Ireland have examined the epidemiology of AMU among nursing homes (5,6). These studies have revealed a high overall AMU in nursing homes, with variability evident within and between nursing homes (5,6).

Although some epidemiological studies examining AMU among acute care hospitals and the general population have been conducted in Japan (7,8), limited epidemiological studies have examined AMU among nursing homes. Therefore, we have limited data on the burden of AMR among nursing homes compared to the general population. This pilot study aimed to examine the AMU among nursing homes in Japan to tackle AMR in nursing homes.

This study was approved by the ethics committee of the National Center for Global Health and Medicine (NCGM) (approval no: NCGM-G-002385-00) and was implemented in accordance with the Declaration of Helsinki. We conducted a descriptive epidemiological study from January to December 2016 to examine AMU among 6 nursing homes in Tokyo, Japan. AMU was measured using the defined daily dose (DDD) and estimated as DDDs/1,000 resident-days. The overall AMU was 15.3/1,000 resident-days, including oral antimicrobials (15.2/1,000 resident-days [99.3%]). The most frequently prescribed oral-antimicrobials was macrolides (5.8/1,000 resident-days [38.2%]) and quinolones (4.2/1,000 resident-days [27.6%]). Oral macrolides and quinolones were thought to be a convenience in prescription among nursing homes with resource limiting due to smaller defined the number of daily doses compared to penicillins and cephalosporins. In addition, multicenter studies that include resident-specific data (demographics and diagnosis) and focus on the purpose of antimicrobials (treatment or prevention) are needed to evaluate the appropriateness of antimicrobials.
World Health Organization Collaborating Centre for Drug Statistics Methodology (9). The data on the total number of beds was collected from each nursing home. AMU was measured using the defined daily dose (DDD) and estimated as DDDs/1,000 resident-days using the number of beds (10). There were no data on resident-specific and policy of infection prevention and control (IPC) and ASP of nursing homes. We evaluated the overall AMU and oral AMU for each nursing home.

During the study period, the overall AMU among the nursing homes was 15.3/1,000 resident-days and oral AMU was 15.2/1,000 resident-days; the proportion of oral AMU among overall was 99.3%. The most frequently prescribed oral antimicrobials were penicillins, cephalosporins, and macrolides. The variability in oral-antimicrobial use among 6 nursing homes in Japan is shown in Fig. 1. Table 1 shows the total antimicrobial use among six nursing homes in Japan, 2016.
were macrolides (5.8/1,000 resident-days [38.2%]) and quinolones (4.2/1,000 resident-days [27.6%]) (Table 1 and Fig. 1). Among the nursing homes, variability was observed among both overall AMU and each oral AMU. The oral AMU ranged from 3.0 to 69.2/1,000 resident-days. The proportion of individual oral AMU for macrolides, quinolones, cephalosporins, trimethoprim-sulfamethoxazole, tetracyclines, and penicillins ranged from 13.2% to 55.3%, 5.5% to 37.2%, 0% to 32.3%, 0% to 76.3%, 0% to 25.9%, and 0% to 26.7%, respectively (Fig. 1).

Our results revealed that there was variability in AMU among the nursing homes as well as among past PPS (5). Past PPS showed that the potential reasons for variability might reflect resident-associated risk factors such as the use of catheters and may be linked to nursing homes’ policy such as IPC and ASP (5). Although this study had similar potential reasons for variability (5), we had no data on resident-associated risk factors and policy of IPC and ASP in nursing homes. Another potential reason for the variability in our results was that there is a potential difference in the AMU practice among doctors because there is a lack of national guidelines regarding AMU among nursing homes in Japan. A variability of types of antimicrobials was used among the nursing homes in past studies, but they were mainly in line with the national guidelines (5). Moreover, similar to past studies in Japan, the variability in AMU could be attributed to the differences in the available types and numbers of antimicrobials used at each nursing home (11). To encourage implementation of the ASP, Japan should establish national guidelines for AMU among nursing homes in Japan.

Although comparison might not be appropriate due to the difference in the denominator among nursing homes (DDDs/1,000 resident-days) and general population (DDDs/1,000 inhabitants-days [DID]) (7), mean AMU of oral macrolides (9.5 vs 4.9) and quinolones (6.6 vs 2.8) were higher among the nursing homes than among the general population (7). One of the possible reasons for frequent use of oral macrolides and quinolones is because they are thought to be more convenient to prescribe in resource-limited settings. The number of daily doses of oral macrolides and oral quinolones are smaller than those of penicillins and cephalosporins. Broad-spectrum oral antimicrobials such as macrolides and quinolones are used more frequently in Japan than in European Union countries (12). The National Action Plan on AMR in Japan aims to achieve a 50% reduction in the use of these broad-spectrum oral antimicrobials between 2013 and 2020 (2). Although comparison might not be appropriate due to the difference in the denominator among nursing homes (DDDs/1,000 resident-days) and general population (DDDs/1,000 inhabitants-days [DID]) (7) as well as comparison of oral macrolides and quinolones, the mean AMU of oral penicillins was lesser in the nursing homes than in the general population (0.3 vs 1.1), which was also lesser than the general population in other developed countries (2,7). The appropriate use of oral macrolides, quinolones, and penicillins should be encouraged among both nursing homes and the general population in Japan.

This study has some limitations. First, our study was a pilot study among only 6 nursing homes and did not include data on resident (demographics and diagnosis) and the purpose of antimicrobials (treatment or prevention), which are needed to evaluate the appropriate use of antimicrobials. Second, we estimated AMU using bed-days, similar to a past study (10), because our study had no data of the number of residents in the nursing homes. In Japan, past PPSs have shown that the utilization of beds was high (84.3% [612/72] among nursing homes) (11). This result indicates the possibility of using bed-days instead of the number of residents to estimate AMU in the nursing homes.

In conclusion, our study revealed that the important target of ASP in nursing homes in Japan might be oral antimicrobials with variability. Convenience in prescription (smaller defined the number of daily doses) such as oral macrolides and quinolones might be the key for ASP in nursing homes with resource-limited settings. Further multicenter studies that include resident data (demographics and diagnosis) and the purpose of antimicrobials (treatment or prevention) are needed to evaluate ASP in the nursing homes.

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Conflict of interest None to declare.

REFERENCES

1. Howard SJ, Catchpole M, Watson J, et al. Antibiotic resistance: global response needed. Lancet Infect Dis. 2013;13:1001-3.
2. The Government of Japan. National Action Plan on Antimicrobial Resistance (AMR) 2016–2020. Available at <https://www.mhlw.go.jp/file/06-Seisakujouhou-10900000-Kenkoukyoku/0000138942.pdf>. Accessed July 1, 2019.
3. Lim CJ, Kong DC, Stuart RL. Reducing inappropriate antibiotic prescribing in the residential care setting: current perspectives. Clin Interv Aging. 2014;9:165-77.
4. Koch AM, Eriksen HM, Elsborn P, et al. Severe consequences of healthcare-associated infections among residents of nursing homes: a cohort study. J Hosp Infect. 2009;71:269-74.
5. Eriksen HM, Saether AR, Viktil KK, et al. Use of antibiotics in nursing homes—surveillance with different methods. Tidsskr Nor Legeforen. 2013;133:2052-6.
6. McClean P, Tunney M, Gilpin D, et al. Antimicrobial prescribing in nursing homes in Northern Ireland: results of two point-prevalence surveys. Drugs Aging. 2011;28:819-29.
7. Muraki Y, Yagi T, Tsuji Y, et al. Japanese antimicrobial consumption surveillance: first report on oral and parenteral antimicrobial consumption in Japan (2009–2013). J Glob Antimicrob Resist. 2016;7:19-23.
8. Muraki Y, Kitamura M, Maeda Y, et al. Nationwide surveillance of antimicrobial use and drug interaction in nursing homes in Japan: a multicentre prevalence study. J Antimicrob Chemother. 2019;74:3132-6.