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Antimicrobial resistance in long-term care facilities

Nkiruka Eze[1], Michele Cecchini[2], Tiago Cravo Oliveira Hashiguchi[2]

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Authorised for publication by Stefano Scarpetta, Director, Directorate for Employment, Labour and Social Affairs

(1) Manitoba Centre for Health Policy, University of Manitoba
(2) OECD, Directorate for Employment, Labour and Social Affairs, Health Division

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Abstract

Long-term care facilities (LTCFs) provide care for extended periods to older people who frequently require antimicrobials to treat and prevent infection, a leading cause of morbidity and mortality among older LTCF residents. Evidence indicates that, due to a combination of factors related to LTCF residents, prescribers and health care systems, up to 75% of antimicrobial prescriptions in LTCFs are inappropriate, in terms not only of the duration and choice of therapy, but also the need for therapy in the first place. Inappropriate use of antimicrobials is associated with the high rates of multi-drug resistant organisms that are recovered in LTCFs, and may exacerbate the threat of antimicrobial resistance (AMR), both in LTCFs and in the community. Yet, policies to tackle inappropriate antimicrobial use and AMR in LTCFs, such as antimicrobial stewardship and infection prevention and control (IPC), remain underused or suboptimal. Some countries are starting to act but they are a minority. Countries seeking to improve antimicrobial consumption, and minimise the threat of AMR, in LTCFs can: set up routine surveillance systems dedicated to collecting and reporting data on antimicrobial use and resistance in LTCFs; design, implement and enforce multifaceted antimicrobial stewardship programmes that comprehensively address multiple determinants of inappropriate antimicrobial prescribing and use; and adopt IPC programmes tailored to the specific needs and risks of LTCFs.

Résumé

Les établissements de soins de longue durée (ESLD) fournissent des soins pendant de longues périodes à des personnes âgées qui ont souvent besoin d'antimicrobiens pour traiter et prévenir les infections, une cause majeure de morbidité et de mortalité chez les résidents âgés des ESLD. Les données disponibles indiquent qu'en raison d'une combinaison de facteurs liés aux résidents des ESLD, aux prescripteurs et aux systèmes de soins de santé, jusqu'à 75% des prescriptions d'antimicrobiens dans les ESLD sont inappropriées, non seulement en termes de durée et de choix du traitement, mais aussi en termes de nécessité du traitement. L'utilisation inappropriée des antimicrobiens est associée aux taux élevés d'organismes multirésistants détectés dans les établissements de soins de longue durée et peut exacerber la menace de la résistance aux antimicrobiens (RAM), tant dans les ESLD que dans la communauté. Cependant, les politiques visant à lutter contre l'utilisation inappropriée des antimicrobiens et la RAM dans les ESLD, telles que la gestion des antimicrobiens et la prévention et le contrôle des infections, restent sous-utilisées ou sous-optimales. Quelques pays commencent à agir, mais ils sont une minorité.. Les pays qui cherchent à améliorer la consommation d'antimicrobiens et à minimiser la menace de la RAM dans les ESLD peuvent : mettre en place des systèmes de surveillance dédiés à la collecte et à la communication de données sur l'utilisation des antimicrobiens et la résistance dans les ESLD; développer, mettre en œuvre et appliquer des programmes de gestion des antimicrobiens multidimensionnel qui traitent de manière exhaustive les multiples déterminants de la prescription et de l'utilisation inappropriées des antimicrobiens; et adopter des programmes de prévention et de contrôle des infections adaptés aux besoins et aux risques spécifiques des ESLD.

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Key Findings

Residents of long-term care facilities (LTCFs) are at increased risk of health care associated infections (HAIs) as they are often frail, elderly, and have multiple comorbidities. **In the OECD, the average prevalence of HAIs was 3.8% in 2016-17** (2018 in Australia), ranging from 0.9% in Lithuania to 8.5% in Spain.

Infection prevention and control (IPC) is challenging in LTCFs due to extended stays, socialisation among residents and limited resources. Older LTCF residents are also more likely than community-dwelling older adults to be infected with multi-drug resistant organisms (MDROs). In European OECD countries, **a third of isolates from HAIs in LTCFs are resistant to first-line antimicrobials**.

Up to 75% of antimicrobial prescriptions in LTCFs are inappropriate, a key driver of antimicrobial resistance (AMR). Based on European data, **between 54% and 96% of antimicrobial prescriptions in LTCFs are given without laboratory or diagnostic testing**. Often, broad-spectrum antimicrobials are used, creating the greatest selective pressure for resistant organisms. Inappropriate use in residents of a given LTCF puts all other residents and care workers in that LTCF at risk, as MDROs can affect everyone. There is also **concern that COVID-19 is leading to more broad-spectrum antibiotic use** in patients with COVID-19. In addition, antibiotics given in an effort to keep secondary bacterial infections in COVID-19 patients at bay may be accelerating the threat of AMR.

Three policy areas are key to tackle AMR in LTCFs. First, **better surveillance systems** monitoring antimicrobial consumption and AMR are fundamental. Available country-level surveillance does not often stratify data from LTCFs. LTCF-specific data can help determine susceptibility rates and guide the development of lists of antimicrobials that should be preserved. LTC-specific surveillance is also key for benchmarking, auditing and goal setting. Without it, it is impossible to assess the impact of other policy actions to tackle AMR in LTCFs.

Second, **comprehensive antimicrobial stewardship programmes** can help optimise antibiotic therapies in terms of selection, dosage and duration, thus preventing the selection of resistant strains. Evidence suggests that antimicrobial stewardship programmes should be multi-faceted (i.e. targeting multiple determinants of inappropriate prescribing, such as high staff turnover, limited access to microbiological labs and rapid diagnostic testing, or limited access to physicians and pharmacists), and implemented in collaboration with other health care provision in the community. Consistent reductions in antimicrobial use in LTCFs have been achieved with staff education and feedback on antibiotic prescribing rates.

Third, LTCFs should **implement IPC programmes** that are tailored not only to the LTC context but also to the needs and risks of specific LTCFs. Simple practices, such as appropriate hand hygiene and environmental cleaning, are an effective and low-cost way to prevent infections in LTCFs, however these practices are not yet widely adopted in LTCFs. Although the evidence on cost-effectiveness is scarce, there are indications that infection prevention practices and immunisation against common infections may be cost-effective.

Acronyms and Concepts

ACH	Acute care hospital
AMR	Antimicrobial resistance
Antibiograms	Profiles of antimicrobial susceptibility testing results of commonly reported infections in a geographical area in a defined period
Antimicrobials	Includes antibiotics, antifungals, antivirals and other therapeutic or prophylactic agents used to treat or prevent infections, by killing or inhibiting the growth of microorganisms.
Antimicrobial resistance	The ability of a microorganism to change in ways that render antimicrobial medication ineffective
Antimicrobial susceptibility	When an organism is unable to grow in the presence of one or more antimicrobials
ASP	Antimicrobial stewardship programmes
CDC	Centres for Disease Control and Prevention
DDD	Defined Daily Dose
ECDC	European Centre for Disease Prevention and Control
Empirical prescriptions	Prescriptions based on the prescribers' experience and observation of the patient's signs, symptoms and medical history in the absence of complete information (e.g. microbiological testing)
EU/EEA	European Union/European Economic Area
HAI	Health care Associated Infection
Isolates	Microorganisms separated from a strain for further study
IPC	Infection Prevention and Control
LTC	Long-Term Care
LTCF	Long Term Care Facility
MDRO	Multi-drug resistant organism
MDRI	Multi-drug resistant infection
PPS	Point Prevalence Survey

1 Introduction

1. Antimicrobial resistance (AMR) is a global health emergency, with a significant health and economic burden (OECD, 2018[1]). In long-term care facilities (LTCFs), infections are a leading cause of morbidity and mortality among frail, older residents (Wójkowska-Mach et al., 2013[2]; Herzig et al., 2017[3]; Muder, 1998[4]). Antimicrobials are frequently prescribed in LTCFs to treat and prevent infections, and many residents receive multiple courses each year (Stuart, Lim and Kong, 2014[5]; Nicolle et al., 2000[6]). Research suggests that many antimicrobial prescriptions in LTCFs are unnecessary or inappropriate in terms of not only the duration and choice of therapy, but also the need for therapy in the first place, representing key driving factors for AMR among residents of LTCFs (Beović et al., 2018[7]). The unnecessary and inappropriate use of antimicrobials is associated with the high rates of multi-drug resistant organisms (MDROs) recovered in LTCFs, which are similar or higher than rates in acute care hospitals (ACH) (Bonomo, 2000[8]; Nicolle, 2014[9]; Cassone and Mody, 2015[10]; Suetens et al., 2018[11]).

2. There are interactions between infections, antimicrobial use and AMR in LTCFs. The use of antimicrobials in LTCFs may lead to further use of antimicrobials because of the resulting emergence of infections with *Clostridioides difficile* (CDI) and multi-drug resistant infections (MDRIs). Use of antimicrobials in LTCFs – whether appropriate or not – is a risk factor for the emergence of new resistant strains, which in turn are associated with extended hospital stays and increased costs. As residents move in and out of LTCFs, so do organisms. As a result, AMR in long-term care (LTC) settings is a serious threat to not only LTCF residents but also local communities. The problem is exacerbated by little or no progress in the development of new antimicrobials. If nothing is done, there is a possibility of a post-antibiotic era in which common infections and minor injuries can be fatal (Crnich et al., 2015[12]).

3. Despite the growing threat of AMR to global public health, and the documented risks for LTCFs, data on antimicrobial use and resistance in LTC settings (both in institutional settings and in community care) are fragmented and not systematically collected in most countries. Country-level guidelines and recommendations on antimicrobial prescribing in LTCFs, and guidance concerning residents who suffer from conditions like advanced dementia, are scarce. Gaps persist in the literature on effective and cost-effective interventions to tackle AMR in LTCFs, including evidence on cost-effective infection prevention strategies. These gaps are highlighted further by the fact that many interventions are designed for ACHs, and may well be ineffective in LTCFs as these institutions are very different from ACHs. For example, LTCFs provide care mainly for older populations and typically have limited resources compared to ACHs.

1.1. Scope and overview

4. LTC consists of a range of medical, personal care and assistance services that are provided to alleviate pain, and reduce or manage the deterioration in health status for individuals who are no longer able to perform activities of daily living on their own (OECD, Eurostat and World Health Organisation, 2017[13]). The definition of LTC may vary at country level, due to differences in health care systems, culture and demographics (European Centre for Disease Prevention and Control, 2014[14]). However, the primary goal of LTC services is to help ensure that individuals who have a degree of long-term functional or cognitive disability are able to live as independently and safely as possible (OECD, Eurostat and World Health Organisation, 2017[13]). LTC can be provided in various settings such as within the home (e.g. home

care), in the community (e.g. day care) and in LTCFs. This paper includes data from residential homes, general nursing homes and mixed LTCFs. Data from ACHs, primary care settings, and all other community-based health care settings, are not included, as discussed in Box 1.1 below. While LTCF residents can include people younger than 65 years old, the majority of residents are at least 65 years old.

5. There may be cross-country differences in the types of services provided by LTCFs, and the individual needs that they cater to, ranging from social assistance and nursing care for residents with limitations in physical functioning and/or cognitive impairments, to more intensive medical care for residents who require ventilators. While these cross-country differences can help explain differences in the prevalence of AMR in LTCFs, it is challenging to capture these cross-country differences in the characteristics of LTCFs. More work is needed to characterise the provision of care in LTCFs and how this provision relates to antimicrobial use and resistance.

Box 1.1. Gaps in data availability restrict focus to long-term care facility residents

6. In many countries, most people who require LTC live in their own homes or with family members within the community. Home care may be delivered by nurses, personal carers and personal assistants who visit homes to assist care recipients with activities of daily living and instrumental activities of daily living, from personal hygiene, to preparing meals and administering medication. In an effort to support ageing-in-place, home care may be complemented by institutions providing adult day care and respite care (OECD, Eurostat and World Health Organisation, 2017[13]). It is estimated that a significant share of LTC is provided informally by unpaid family members and friends, but data on recipients of informal home care are limited (Saltman, Dubois and Chawla, 2006[15]).

7. LTC recipients who live within the community access health care through their primary care providers or ACHs. While data on antimicrobial use in primary care and ACHs are available, it is challenging – if not impossible – to distinguish LTC recipients from the general population. While it is possible to stratify primary care or ACH data by age, this is not sufficiently informative in the context of LTC, as many community-dwelling older adults do not have LTC needs. Consequently, this report focusses on those recipients of LTC who reside within LTCFs, as these are the only ones that can be unequivocally identified as being LTC recipients.

Types of long-term care facilities included in this paper

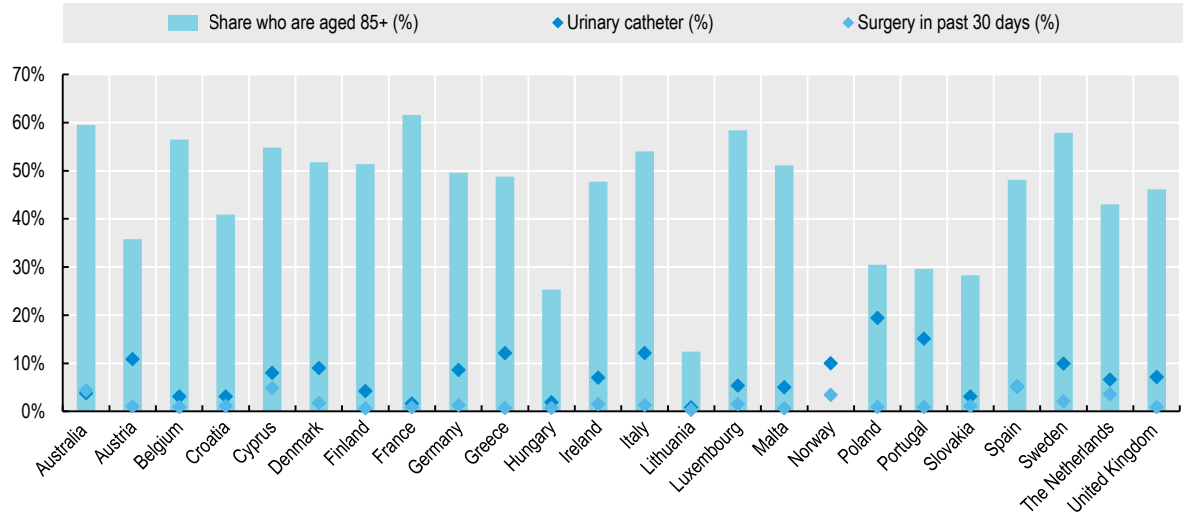
8. The paper uses data from residential homes, general nursing homes and mixed LTCFs that mainly provide care for older adults. *Residential homes* are also known as personal care homes, assisted living facilities, aged care facilities or care homes. Residents of these facilities are unable to live independently and typically require help with (instrumental) activities of daily living such as personal care, housekeeping and meal preparation. *General nursing homes* are facilities that care for older people with severe illness or injuries, requiring skilled nursing care 24 hours a day. They many also include nursing homes specialised in a specific type of care such as physical impairment, dementia, psychiatric illness, rehabilitation, intensive or palliative care. *Mixed LTCFs* are a combination of residential homes and general nursing homes. Certain LTC facilities, like LTCFs for the mentally and physically disabled, rehabilitation centres and palliative care centres are excluded. Also excluded are community-based care, such as adult day care centres, as well as all care delivered in ACHs, primary, community or outpatient health care settings. These inclusion criteria account for the large majority of LTCFs included in surveys of infections and drug resistance in OECD countries.

9. The underlying data in this paper are sourced from the European Centre for Disease Prevention and Control (ECDC), the United States Centers for Disease Control and Prevention (CDC), the Australian Commission on Safety and Quality in Health Care, as well as other government reports and published

studies, as described in Annex A. There is wide variation in the average age of LTCF residents surveyed in point prevalence surveys in the EU/EEA and in Australia. In participating LTCFs in the EU/EEA, residents aged 85 years and older ranged from 12% in Lithuania to over 60% in France (see Figure 1.1). In Australia, 59.5% of residents were aged 85 years and older. Overall, 44.8% of residents in participating EU/EEA LTCFs were aged 85 years and older, 7.3% were on a urinary catheter while 1.5% had a recent surgery (within 30 days of the survey date) (Suetens et al., 2018[11]). Differences in samples (e.g. age) can lead to differences in the prevalence of infections and drug resistance proportions.

Figure 1.1. Wide variation in the average age of long-term care facility residents surveyed in point prevalence surveys in EU/EEA and Australia

Point prevalence surveys (PPS) from EU/EEA (2016-17) and Australia (2018)



Note: The Australian survey is from 2018 and data included all residents admitted to hospital 30 days before the survey date.
Source: (Suetens et al., 2018[11]; Australian Commission on Safety and Quality in Health Care, 2019[16])

10. The first part of this paper discusses the importance of AMR in LTCFs. It highlights high rates of infection among LTCF residents, especially when compared to community-dwelling older adults. The second section examines the use of antimicrobials in LTCFs, mainly driven by high rates of unnecessary and inappropriate prescriptions, and identifies factors that contribute to inappropriate use of antimicrobials in LTCFs. The third and final section discusses antimicrobial stewardship programmes and IPC interventions to tackle AMR in LTCFs.

11. It is important to note that the results included in this report are limited by data comparability within and across countries. There may also be variation in measuring antimicrobial use in different countries, differences in health care systems, and other organisational differences (Van Buul et al., 2020[17]). Furthermore, this paper does not consider the impact of COVID-19 on the emergence and spread of AMR in LTCFs (see Box 1.2 for more details). Future work on this topic is ongoing and findings will be published at a later date.

Box 1.2. The impact of COVID-19 on antimicrobial resistance in long-term care facilities

The impact of the pandemic remains speculative due to limited data

12. The COVID-19 pandemic has led to massive changes in societies and economies. In the context of AMR, and especially in LTCFs, it is still early to tell what impact the pandemic will have in the medium- to long-term. Most publicly available and internationally comparable datasets on AMR available today do not yet include numbers for 2020, and data availability is even more limited in the context of LTC settings (indeed this challenge predates the pandemic, as discussed in subsequent sections). While it is likely that COVID-19 will have both positive and negative impacts on the emergence and spread of AMR (Monnet and Harbarth, 2020[18]), the net effect remains difficult to establish with any certainty. Besides a lack of comprehensive data, it will take time for the different effects to play out, and for understanding and measurement to develop.

13. In the context of LTC, the pandemic has led to a number of changes that may eventually affect the emergence and spread of infections and AMR. On the one hand, there have been reductions in health care seeking behaviours, with fewer primary care visits and postponement of routine medical procedures (Wellcome, 2020[19]). These reductions, in turn, may have led to not only fewer opportunities for organisms to spread, but also fewer antibiotics being dispensed. In the United States, an analysis of retail prescriptions of antibiotics, found that from January to May 2020, the number of patients dispensed antibiotics decreased from 20.3 to 9.9 million (King et al., 2020[20]). Over 6 million fewer outpatients were dispensed antibiotics from retail pharmacies than would be expected based on the same timeframe in previous years (ibid). It is also unclear what impact the lower incidence of influenza has had on incidence of infections due to antimicrobial resistant organisms.

14. On the other hand, as the first wave of COVID-19 hit, significant uncertainty, coupled with the severity of the disease, the possibility of bacterial coinfection, and extraordinary increases in physician workloads may all have contributed to a surge in the use antibiotics to treat COVID-19 patients (Beović et al., 2020[21]; Pelfrene, Botgros and Cavaleri, 2021[22]). Around three in every four COVID-19 patients were given antibiotics (Rawson et al., 2020[23]; Langford et al., 2021[24]), yet only around 4% of COVID-19 patients actually had a bacterial coinfection (Strathdee, Davies and Marcelin, 2020[25]). At the same time, a higher proportion of around 14% of COVID-19 patients did acquire nosocomial infections, especially those patients requiring intensive care (ibid). These types of infections tended to be multi-drug resistant (Khurana et al., 2020[26]). There is also concern that the massive shift to virtual care that followed restrictions to mobility and social distancing, could have resulted in higher rates of antibiotic due to challenges in examining patients remotely, and a greater use of empirical prescriptions (Armitage and Nellums, 2020[27]; Wellcome, 2020[19]).

15. As stated, it is not yet possible to fully assess the impact of COVID-19 on both antimicrobial consumption and resistance, at an international level, in the context of LTC. The OECD is working to collect data and information on how countries addressed AMR in LTC settings during the pandemic, and will publish findings as these become available.

2 Antimicrobial resistance in long-term care facilities is a unique threat

16. Residents of LTCFs are at a high risk of acquiring infections compared to their peers who live in the community. Despite many of these infections being preventable, IPC practices are more challenging to implement effectively in LTCFs than in ACHs. To make matters worse, LTCF residents may be over twice as likely as community-dwelling older adults to be infected with MDROs. For all this, AMR is an especially significant challenge in the context of LTCFs, and responses to this challenge must take into account the specificities of LTCFs.

2.1. Long-term care residents are at higher risk of health care associated infections compared to older people living in the community

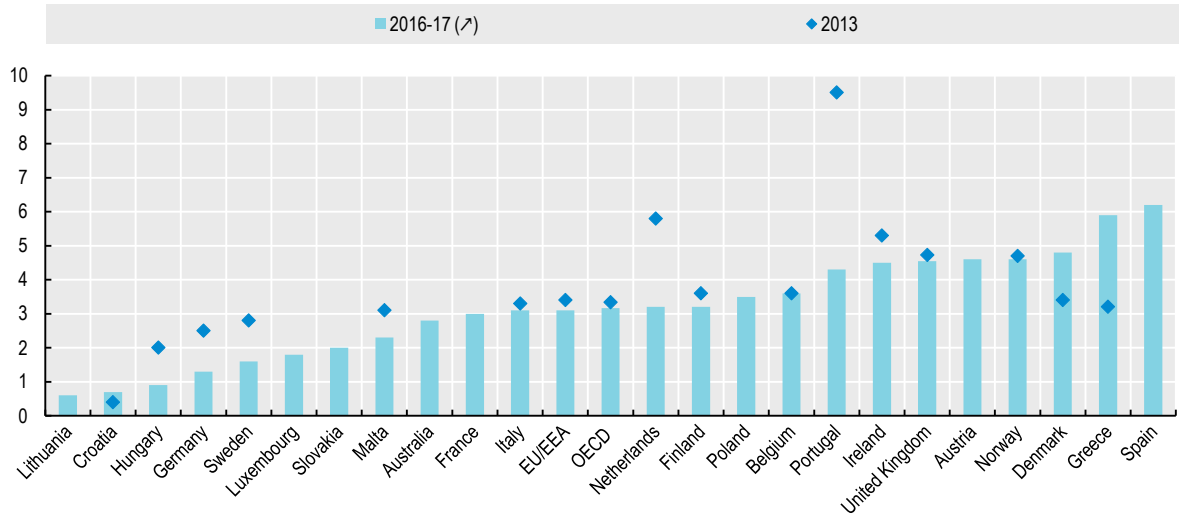
17. Most LTCF residents are older (i.e. aged 65 years and over), frail and often have multiple comorbidities. They may suffer from incontinence, disorientation, prior antimicrobial use, malnourishment, limited mobility and pressure ulcers, all of which place them at a risk of health care associated infection (HAIs), including from resistant organisms (Bonomo, 2000[8]; Moyo et al., 2020[28]). For many residents with multiple comorbidities, managing their chronic conditions may necessitate the use of invasive devices such as gastronomy feeding tubes, and indwelling urinary catheters. Use of invasive devices like urinary catheters is a significant risk factor for both HAIs and antimicrobial use among LTCF residents (Nicolle, 2001[29]; Tandan et al., 2018[30]). In France, the risk of antibiotic-resistant *Enterobacteriaceae* cultured from urine samples was 40% higher in older people in nursing homes than in community-dwelling peers (Pulcini et al., 2018[31]). High rates of infections and use of antimicrobials go hand in hand, promoting the emergence and spread of resistant organisms, as evidenced by the high rates of MDRIs among LTCF residents (Cosgrove, 2006[32]; Montoya and Mody, 2011[33]; Herzig et al., 2017[3]).

18. Among OECD countries for which point prevalence survey (PPS) data are available (European OECD countries and Australia), the average prevalence of HAIs was 3.8% in 2016-17 (2018 in Australia) and 3.3% in 2013 (excludes Australia), as shown in Figure 2.1. Country-level rates of HAIs ranged from 0.9% in Lithuania to 8.5% in Spain. It is important to note that Lithuania also had one of the lowest shares of participants over the age of 85, which may explain the low rate of HAIs in the country. The rate of HAIs in EU/EEA countries in the ECDC PPS was 1.02 infections per infected resident and while in Australia, the rate was 1.2 infections per infected resident. The majority of reported infections were associated with the LTCF where the survey was conducted (84.7% in Europe and 80.1% in Australia). Annual estimates suggest that the rates of HAIs in ACHs and LTCFs are similar (Suetens et al., 2018[11]).

19. These results should be interpreted with caution, as PPSs may not provide a true representation of infection prevalence (e.g. participation was lower in some countries, which may have affected representativeness). Moreover, PPSs may be affected by seasonal variations, for example more infections are reported in colder months compared to warmer months (Lee et al., 2019[34]). Nevertheless, that available evidence points to LTCF residents being at a comparable risk of HAIs as people in ACHs is concerning.

Figure 2.1. Results of point prevalence surveys of health care associated infections among long-term care facility residents in participating OECD countries, in 2013 and 2016 (or nearest year)

Percentage of residents with at least one HAI on survey dates (see note)



Note: Australian PPS was held in 2017, while ECDC PPSs were held in 2013 and 2016-17. In the United Kingdom, England did not participate in the 2016-17 survey and Scotland did not participate in the 2013 survey. In 2016-17, within-country data representativeness was poor in Croatia, Luxembourg, Malta, Poland, Cyprus, Austria and Greece. In 2013, within-country data representativeness was poor or very poor in Croatia, Malta, Finland, Netherlands, Norway, Greece and England. Differences in infections across countries should be interpreted with caution due to differences in sampling (e.g. age of participants). Only HAIs associated with residents' own facilities are shown.
Source: (European Centre for Disease Prevention and Control, 2014[14]; Suetens et al., 2018[11]; Australian Commission on Safety and Quality in Health Care, 2019[16])

2.2. Infection prevention and control is more challenging in long-term care facilities than in acute care hospitals

20. Many HAIs can be prevented by implementing strict IPC protocols (Schreiber et al., 2018[35]). However, IPC practices are more challenging in LTCFs than in ACHs, due to a combination of factors:

- In many LTCFs, visits and socialisation among residents are encouraged to promote mental health and wellbeing, and communal areas have multiple shared objects (Mody et al., 2015[36]).
- Length of stay at LTCFs is much longer than in ACHs and disoriented residents, such as those with dementia, may wander and may less willing to use personal protective equipment. Implementing IPC protocols, such as isolation, is difficult and may be ineffective in practice, especially when residents require specialised health care (Auditor General of Ontario, 2009[37]; Montoya and Mody, 2011[33]).
- LTCFs have lower staff-to-resident ratios than ACHs' staff-to-patient ratios and often have limited resources (funding) and skills (including training and education) to implement IPC protocols compared to ACHs (Hübner et al., 2017[38]; Nucleo et al., 2018[39]; Barney, Felsen and Dumyati, 2019[40]).

21. Because of these factors, there are more opportunities for colonised (the presence of bacteria without signs and symptoms of infection) or infected LTCF residents to spread pathogens within LTCFs, ACHs and the wider community. A study conducted in the United States found that in a 15-month period, 4.4 million admissions to LTCFs came from ACHs and 2.1 million discharges from LTCFs were to ACHs. Approximately 1.8% (79 187) of residents admitted from LTCFs to ACHs had an active MDRI, and 2% (42

043) of ACH patients discharged to LTCFs had an active diagnosis of infection with MDRO (Kahvecioglu et al., 2014[41]).

22. This bi-directional flow between ACHs and LTCFs demonstrates the potential for transmission of drug resistant and MDROs across care settings (Bonomo, 2000[8]). Besides residents, there is also a potential for health care workers to spread MDROs across the health care network and the local community, because health care practitioners (e.g. nurses) in LTCFs often work at multiple sites (van den Dool et al., 2016[42]). Due to the prevalence of MDROs among LTCF residents and the potential to spread these infections beyond LTC settings, LTCFs are recognized as important reservoirs of drug resistant and MDROs (Augustine and Bonomo, 2011[43]; Nucleo et al., 2018[39]).

2.3. Multi-drug resistant organisms are more prevalent and severe in long-term care facilities than in the community

23. Adults aged 65 years and older are generally at a higher risk of infection compared to younger cohorts because of their declining immune systems, higher rates of chronic disease, as well as higher use of health and social care facilities. LTCF residence is an important risk factor for colonisation and infection with a MDRO (Cassone and Mody, 2015[10]). In England, a large retrospective cohort study analysed infection rates in community-dwelling adults aged 70 years and older, and compared them to rates of similarly aged adults residing in LTCFs (Rosello et al., 2017[44]). The authors found that LTCF residents were over twice as likely as community-dwelling older adults to present with a laboratory-confirmed *Escherichia coli* or *Klebsiella* urinary tract infection. Furthermore, LTCFs residents were over four times more likely than community-dwelling older adults to develop laboratory-confirmed resistant *E. coli* or *Klebsiella* urinary tract infection.

24. Another study compared bacterial isolates among Australian community-dwelling older adults and LTCF residents, aged 65 years and older, who visited emergency departments and outpatient clinics (Xie et al., 2012[45]). Methicillin resistance among *Staphylococcus aureus* isolates in the LTCF group was much higher (89%) compared to the community-dwelling group (38%). Among LTCF residents, there was also resistance to several empiric antibiotics among *Enterobacteriaceae* isolates in urine cultures. In addition, the increased incidence of the urinary tract pathogen *Proteus mirabilis* in specimens from the LTCF group suggested that there may be more cases of bacteraemia originating from a urinary tract source in residents of LTCFs (Xie et al., 2012[45]; Mylotte, Goodnough and Tayara, 2001[46]).

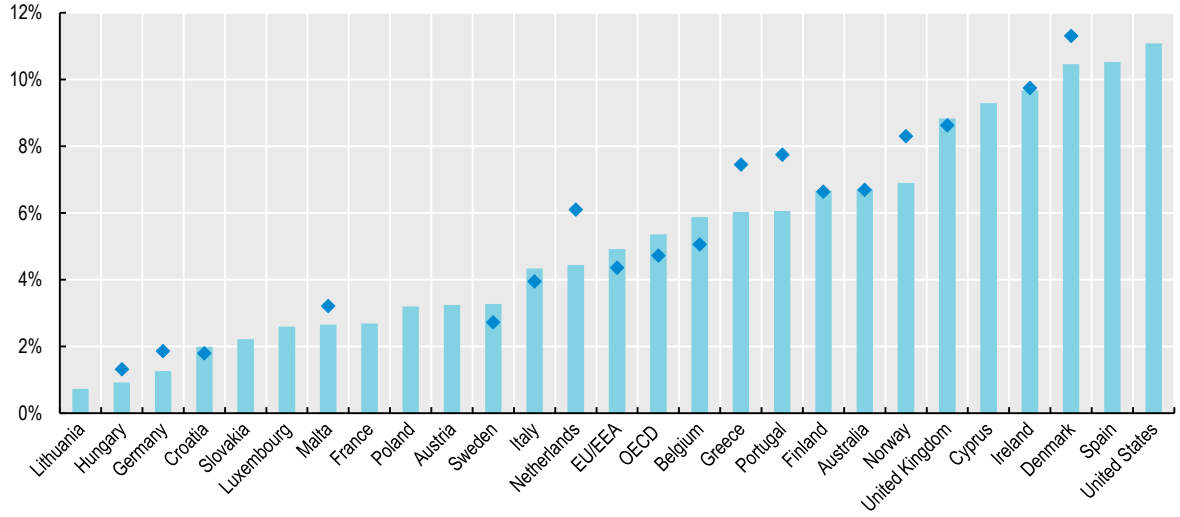
25. While pneumonia is a common infection among all elderly, it is more severe among LTCF residents compared to community-dwelling older adults. It is a leading cause of morbidity and mortality among LTCF residents (Muder, 1998[4]; Marrie, 2002[47]; Henig and Kaye, 2017[48]). Compared to community-associated pneumonia, pneumonia acquired in LTCFs has a different microbiologic profile, is associated with increased morbidity (such as more frequent use of a ventilator, whether in an ACH or in a LTCF) and a higher prevalence of MDRO in isolates (Labelle and Kollef, 2011[49]; Koh and Lee, 2015[50]; Kang et al., 2017[51]). As a result, initial empiric treatment is recommended with broad-spectrum antimicrobials to treat suspected LTCF-associated pneumonia, although some experts suggest this should only apply to frail residents and not all LTCF residents (Guay, 2006[52]; Nakagawa et al., 2013[53]). However, empiric prescriptions of broad-spectrum antimicrobials may promote development of further resistance (Pereira, Oliveira and Almeida, 2016[54]). In non-bacteraemia (e.g. viral) LTCF-associated pneumonia, initial empiric treatment not only contributes to AMR, but can triple the risk of in-hospital mortality, despite subsequent treatment de-escalation (Zilberberg et al., 2008[55]).

3 Trends in antimicrobial use and resistance in long-term care

26. Antimicrobial use in LTCFs varies significantly across countries. In the 2016-17 ECDC survey, the observed prevalence of antimicrobial use among participating EU/EEA countries ranged from 0.7% in Lithuania to 10.5% in Spain and Denmark. The average EU/EEA prevalence was 4.9%, slightly higher than the rates observed in the ECDC survey conducted in 2013 (4.4%). Similar to previous ECDC surveys, approximately one-third of all antimicrobial prescriptions were for prophylactic use (Ricchizzi et al., 2018[56]). In the 2018 Australian survey, 6.7% of residents in participating LTCFs were prescribed an oral antimicrobial on the day of the survey, the same rate as the 2017 survey, and 27% of all antimicrobials were for prophylactic use (Australian Commission on Safety and Quality in Health Care, 2019[16]). In the United States, 11.1% of residents in participating LTCFs received at least one antimicrobial on the survey date (Thompson et al., 2016[57]). Among OECD countries, the average utilisation rate in 2016-17 was 5.4% (see Figure 3.1). In 2013, the average utilisation rate among OECD countries was 4.7%, ranging from 1.3% in Hungary to 11.3% in Denmark.

Figure 3.1. Use of antimicrobials in long-term care facilities in OECD and EU/EEA countries

Percentage of LTCF residents with at least one systemic antimicrobial prescription on survey dates (see note)



Note: Australian surveys were held in 2017 and 2018, and the US survey was from 2013-14. In the United Kingdom, England did not participate in the 2016-17 survey and Scotland did not participate in the 2013 survey. A PPS for England conducted at the end of 2017 has reported that 6.3% of LTCF residents on the survey date were on at least one antimicrobial (Thornley et al., 2019[58]); these data are not included in the figure as it was not possible to determine comparability with the 2016-17 ECDC survey. In 2013, within-country data representativeness was poor or very poor in Croatia, Malta, Finland, Netherlands, Norway, Greece, England and the United States.
Source: (Ricchizzi et al., 2018[56]; European Centre for Disease Prevention and Control, 2014[14]; Thompson et al., 2016[57]; Australian Commission on Safety and Quality in Health Care, 2019[16])

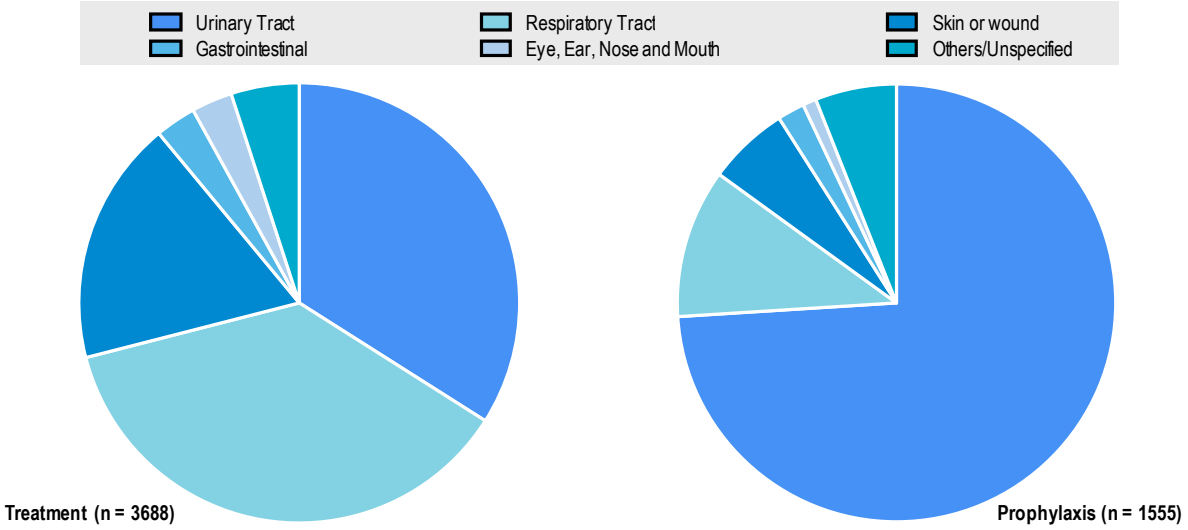
27. The lack of a standard unit of measurement for antimicrobial use in the published literature, and the absence of national surveillance systems in many countries, make it difficult to compare antimicrobial utilisation in LTCFs (Fulchini et al., 2019[59]). A Canadian study concluded that antimicrobial use in 2014 was 35.2 defined daily doses (DDD) per 1,000 resident days (Marra et al., 2017[60]). Another study found that over half (52.1%) of all LTCF residents in the United Kingdom received at least one antimicrobial in a twelve-month period (Thornley et al., 2019[61]), and a US study reported antimicrobial use as 1 351 days of therapy per 100 regimens (Peron et al., 2013[62]). The variables monitored in these studies, as well as the units of measurement differ, making comparisons virtually impossible.

3.1. Empirical prescribing and extended prophylaxis are common in long-term care facilities

28. Estimates suggest that empirical prescriptions account for between 54% and 96% of all antimicrobial prescriptions in LTCFs (Latour et al., 2012[63]; Szabó and Böröcz, 2014[64]). It is common practice to initiate empirical therapy – based on prescriber experience and patient signs and symptoms – while waiting for confirmation of results from laboratory testing. Empirical prescriptions may be appropriate in certain clinical situations, but there are a number of risks with empirical therapies that are not compliant with evidence based guidelines on diagnosis and treatment. First, LTCF residents are often on empirical therapy for longer than necessary (Boivin et al., 2013[65]; Dyar, Pagani and Pulcini, 2015[66]). Second, empirical prescriptions may fail because of pre-existing resistance to the antimicrobials used, or because prescribers do not prescribe based on antibiograms but rather their experience (Hughes et al., 2016[67]). Finally, empirical prescriptions are typically for broad-spectrum antimicrobials, which, when used for prolonged periods, create the greatest selective pressure for drug resistance in gram-negative bacteria (Cassone and Mody, 2015[10]; European Centre for Disease Prevention and Control, 2019[68]).

29. Figure 3.2 shows the proportion of antimicrobials used by indication and body site in LTCFs, as published in ECDC 2016-17 PPS. On the day of the survey, there were 5 334 antimicrobial prescriptions with an indication. Overall, 70% of antimicrobials were for treatment, 29% for prophylaxis, and 1% were prescribed for an unknown indication. Most prophylactic prescriptions were for urinary tract infections (74%), followed by respiratory tract infections (11%). For treatment, 34% of prescriptions were for urinary tract infections, while 37% were for respiratory tract infections.

Figure 3.2. Indication for antimicrobial use among long-term care facility residents in EU/EEA countries, 2016-17



Source: ECDC.

30. Long-term antimicrobial prophylaxis to prevent HAIs, especially urinary tract infections, is common among LTCF residents. In the 2013 ECDC survey, 79.5% of prophylactic prescriptions had no documented end date (European Centre for Disease Prevention and Control, 2014[14]). While such prophylactic use has been shown to reduce the risk of recurrent urinary tract infections in women, the protective benefit diminishes on cessation of antimicrobial use, and is associated with a large increase in the proportion of resistant bacteria isolated in urine and faeces (Ricchizzi et al., 2018[56]).

3.2. A significant share of antimicrobial prescriptions in long-term care facilities are inappropriate

31. A significant share of antimicrobial prescriptions in LTCFs are inappropriate (Loeb, 2003[69]; Morrill et al., 2016[70]; Beović et al., 2018[7]). Although published estimates vary, available evidence suggests that a high proportion (up to 75%) of antimicrobials prescribed in LTCFs may be unnecessary or inappropriate (Patterson et al., 2019[71]; Furuno and Mody, 2020[72]). Antimicrobials can be inappropriate based on their indication, choice, dosage and length of therapy. Inappropriate medication use is generally a problem in LTC settings (de Bienassis, Llena-Nozal and Klazinga, 2020[73]).

32. Inappropriate initiation of antimicrobials occurs when antimicrobial therapy was not indicated for the clinical condition being treated, as when prescribing antimicrobials for a viral infection or for an asymptomatic urinary tract infection (Morrill et al., 2016[70]). The use of antimicrobials for asymptomatic urinary tract infections in LTCFs is common, even though randomized controlled trials suggest that such treatment offers no benefit and may promote AMR (Zabarsky, Sethi and Donskey, 2008[74]). Colonisation (the presence of bacteria without signs and symptoms of infection) may be mistaken for infection, and unnecessarily treated. Compared to no therapy, treatment with antimicrobials for asymptomatic urinary tract infections is associated with an increased incidence of reinfection, adverse antimicrobial drug effects, and isolation of increasingly resistant organisms in recurrent infections (Nicolle, Mayhew and Bryan, 1987[75]).

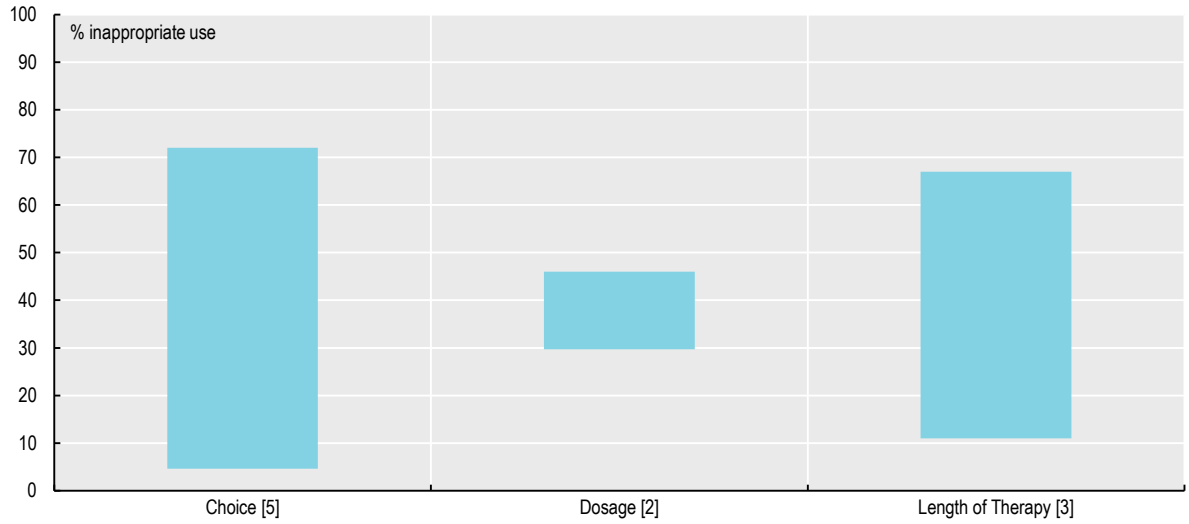
33. Inappropriate choice of antimicrobials occurs when an antimicrobial is inappropriate for the infection indicated. For example, quinolones are highest priority antimicrobials recommended only in the case of resistance, or for serious infections – such as complex upper urinary tract infections. However, they are commonly used to treat uncomplicated urinary tract infections (Bergman, Schjøtt and Blix, 2011[76]). In a retrospective study to evaluate the appropriateness of fluoroquinolone use in LTCFs, only 25% of prescriptions were found to be appropriate (Pickering et al., 1994[77]). Another study that surveyed antimicrobial use in 161 US LTCFs found that quinolones were the most common antimicrobial used to treat urinary tract infections, accounting for 18% of all prescriptions (Thompson et al., 2020[78]). The use of quinolones is associated with higher resistance in older adults and severe adverse effects, such as *Clostridioides difficile* infection and damage to the central nervous system (Thompson et al., 2020[78]; Garcia, Delorme and Nasr, 2017[79]).

34. Incorrect dosage of antimicrobials, and prolonged or inadequate length of therapy, also constitute inappropriate use. In LTCFs, prolonged use of antimicrobials is far more prevalent than inadequate length of therapy, and is often contrary to guideline recommendations (Australian Commission on Safety and Quality in Health Care, 2019[16]). An example is the high rate and prolonged use of prophylactic antimicrobials for urinary tract infections in LTCFs, despite sparse evidence on its effectiveness (Daneman et al., 2011[80]; Lee et al., 2012[81]). The prolonged use of prophylactic antimicrobials for urinary tract infections inevitably selects for resistant organisms (Daneman et al., 2011[80]; Stuart, Lim and Kong, 2014[5]).

35. Figure 3.3 shows the estimated proportion of inappropriate antimicrobial use reported in the published literature. Overall, 15 studies reported on inappropriate initiation (of which ten provide information on the reason why initiation was inappropriate), and their findings indicate that unnecessary use of antimicrobials can be very high in LTCFs. Five studies out of the 15 reported on inappropriate choice, two on dosage, and three on length of therapy.

Figure 3.3. A significant share of antimicrobial prescriptions are considered inappropriate

Estimated proportion of inappropriate antimicrobial prescriptions by choice, duration and length of therapy



Note: Where indicated, criteria for inappropriate use: Loeb, McGeer, CDC FDA Guidelines, Consensus criteria, literature and patient chart reviews. Numbers in square brackets indicate the number of studies used to determine the range of inappropriate use.
Source: OECD analysis of available evidence published in the literature listed in Annex B.

36. Assessing the appropriateness of antimicrobial prescribing in LTCFs is not without its challenges. Guideline-based criteria such as the McGeer criteria are widely recognised, and often used to assess the appropriateness of antimicrobial use, but they were developed for infection surveillance purposes and are highly specific rather than sensitive (McGeer et al., 1991[82]; van Buul et al., 2015[83]). In addition, reliance on resident chart reviews to assess appropriateness of antimicrobial prescribing may be unreliable because residents often receive antimicrobials without any documented signs or symptoms of infection (Australian Commission on Safety and Quality in Health Care, 2019[16]). This lack of documentation further hinders efforts to assess the appropriateness of antimicrobial use in LTCFs.

37. A common side effect of high rates of antimicrobial use in LTCFs is infection with *Clostridioides difficile* (Jump and Donskey, 2014[84]). *C. difficile* infections are endemic to LTCFs, they disproportionally affect older adults, are associated with extended hospital stays, increased costs and further use of antimicrobials (Guerrero et al., 2011[85]; Chopra and Goldstein, 2015[86]). In the United States, the elderly are estimated to have between five to twenty-six times greater risk of infection with *C. difficile* compared to younger generations (Hunter et al., 2016[87]; Kamboj et al., 2019[88]). Residents of LTCFs who receive inappropriate antimicrobials may be eight times more likely to develop a *C. difficile* infection compared to those who receive appropriate therapy (Rotjanapan, Dosa and Thomas, 2011[89]).

3.3. Inappropriate antimicrobial consumption in long-term care facilities puts all residents at risk, not just those taking antimicrobials

38. Antimicrobial use varies across LTCFs. Residents in high-use LTCFs (LTCFs with comparatively high rates of antibiotic consumption) may experience more adverse outcomes than residents in low-use LTCFs (LTCFs with comparatively low rates of antibiotic consumption), even when residents in low-use LTCFs have not directly received antimicrobials. A longitudinal cohort study of 607 LTCFs in Ontario, Canada, found that antimicrobial-related adverse events such as *C. difficile* infections, gastroenteritis, diarrhoea, MDROs and other allergic reactions were more common in residents of high-use LTCFs (13.3%) than in residents of low-use LTCFs (11.4%) (Daneman et al., 2015[90]). This is because adverse outcomes of antimicrobial use (e.g. MDROs and *C. difficile* infections) can indirectly affect non-recipients of antimicrobials in high-use LTCFs.

39. Among residents in the same LTCF, rates of inappropriate use vary and some residents may experience higher rates than others. For example, LTCF residents with advanced dementia who are at the end-of-life may experience higher rates of inappropriate antimicrobial prescriptions compared to other LTCF residents. A study found that 42% of LTCF residents with advanced dementia received antimicrobials in the last two weeks of life (D'Agata, 2008[91]). Antimicrobials may have little or no benefit for these seriously ill residents for whom comfort should be the primary goal of care (Loizeau et al., 2019[92]). Furthermore, it remains unclear whether the aggressive use of antimicrobials in this population reduces discomfort or improves their quality of life, particularly in the context of impaired cognitive function (Stuart, Lim and Kong, 2014[5]; Leibovici and Paul, 2015[93]). This variation in use of antimicrobials, and unnecessary or inappropriate use, is important and may have ethical implications because antimicrobial use affects both recipients and non-recipients alike. Inappropriate use of antimicrobials in some residents of a given LTCF potentially puts all other residents and health care workers in that LTCF at risk.

3.4. Factors behind inappropriate use of antimicrobials in long-term care facilities relate to residents and their relatives, prescribers, facilities, health care systems and countries

40. Unnecessary and inappropriate use of antimicrobials in LTCFs is due to a combination of factors related to residents and their relatives, prescribers, facilities, health care systems and countries.

3.4.1. Resident factors

41. In the elderly, typical signs and symptoms of infection are often absent or diminished, which can lead to diagnostic uncertainty for prescribing physicians (Cassone and Mody, 2015[10]). For example, symptoms of catheter-associated urinary tract infections are rarely specific, and cognitive impairment among residents reduces the ability to effectively communicate symptoms (Hedin et al., 2002[94]; Furuno and Mody, 2020[72]). These factors impede effective empirical diagnosis, especially in most LTCFs with limited access to rapid diagnostic testing and microbiology laboratories. Residents and their family members may also request antimicrobials, against the advice of their health care practitioner (Kistler et al., 2017[95]; Kistler et al., 2013[96]). This is an important driver of inappropriate prescribing, and is testament to the importance of educating the general public about the adverse effects associated with inappropriate antimicrobial use.

3.4.2. Prescriber factors

42. Physician preferences, rather than resident characteristics, may result in inappropriate prescribing. Some physicians may be more likely to prescribe certain antimicrobials, and for longer periods (7 days or longer) even though most common infections can be treated with antimicrobial courses of 7 or fewer days (Daneman et al., 2013[97]). A study analysing prolonged antimicrobial prescription patterns (7 days or longer) among LTCF physicians in Ontario, Canada, found that of 2 601 physicians that prescribed antimicrobials to LTCF residents with similar characteristics in 2010, 22% of the physicians were responsible for 80% of the antimicrobial treatment courses. These long-duration prescribers were mostly male (83%) family practitioners (98%) with a median 31 years of practice experience (ibid). The fact that long-duration prescribers could be so clearly characterised suggests that the prolonged prescriptions were driven by prescriber habits and preferences, rather than underlying patient characteristics (Daneman et al., 2013[97]). Perceived risks such as fear of treatment failure, and emergence of secondary infection, particularly in older chronic patients, may also contribute to inappropriate prescribing (Vazquez-Lago et al., 2011[98]).

3.4.3. Long-term care facility factors

43. Fragmented access to visiting medical staff, high staff turnover, limited access to microbiological labs and rapid diagnostic testing, lack of onsite pharmacists and reliance on nursing staff to communicate resident symptoms, are all LTFC factors that contribute to inappropriate prescribing (Nicolle et al., 2000[6]; Lim et al., 2014[99]; Daneman et al., 2015[90]; European Centre for Disease Prevention and Control, 2014[100]). In many LTCFs, nursing staff play an important role in antimicrobial prescribing, because physicians who are often based off-site rely on nurses to communicate resident symptoms and changes in clinical status. As a result, nurses in LTCFs who may be untrained to diagnose infection can influence antimicrobial prescribing, and efforts to implement adequate training may be constrained by high staff turnover in LTCFs (OECD, 2019[101]; Dyar, Pagani and Pulcini, 2015[66]; Beović et al., 2018[7]), or lack of availability of training providers.

3.4.4. Health care system factors

44. Health care system and wider organisational characteristics, from poor continuity of care to limited access to resident files, may also contribute to inappropriate use of antimicrobials (Lim et al., 2014[99]). Residents of LTCFs often visit other health care facilities, such as the emergency room in ACHs and outpatient clinics in the community. Physicians at these health care facilities may be unfamiliar with the specific needs and history of residents, and may therefore be more likely to prescribe antimicrobials inappropriately compared to prescriptions written by the residents' usual physicians (Pulia et al., 2018[102]).

3.4.5. Country-level factors

45. Inappropriate antimicrobial use in LTCFs may vary across countries because of existing structures to aid appropriate antimicrobial prescribing. For example, availability of data on local resistance patterns is an important tool to guide empirical prescribing, and guidelines specific to LTCFs may help to reduce inappropriate antimicrobial use (Dyar, Pagani and Pulcini, 2015[66]; Tandan et al., 2018[30]). Without LTCF-based data on antimicrobial use and resistance, improvement programmes will be ineffective and likely wasteful. The practice of defensive medicine in some countries may also contribute to inappropriate use of antimicrobials in both community health care settings and LTCFs. For example, physicians in the United States may be more likely, compared to physicians in other countries, to prescribe antimicrobials due to fear of litigation from residents or their family members if complications arise (Fleming et al., 2015[103]).

3.5. Resistant organisms are becoming more prevalent in long-term care facilities

46. Historically, outbreaks of infections, particularly infections caused by MDROs, were more prevalent in ACHs. In recent years, an increasing proportion of MDROs are being recovered from LTCF residents, particularly from residents of high acuity LTCFs (Prabaker et al., 2012[104]). Carbapenem-resistant *Klebsiella pneumoniae* is one pathogen that has been causing epidemics within and across countries, mainly in ACHs (Hajogrundmannrivmnl et al., 2010[105]), but now rising numbers of carbapenem-resistant *K. pneumoniae* isolates are being found in LTCFs. An 11-year retrospective analysis of over 500 000 pneumonia isolates in the United States found that the frequency of *K. pneumoniae* isolates resistant to carbapenems and third-generation cephalosporins increased from 5.3% to 11.5% during the study period. These antibiotic-bacterium combinations were more common among older adults (aged 65 years and over). The adjusted odds ratio relative to isolates from outpatient settings was 3.9 for cultures obtained at LTCFs, exceeding those obtained at intensive care units (odds ratio of 2.8) and inpatient settings (odds ratio of 2.2) (Braykov et al., 2013[106]).

47. The ECDC has produced a composite index of AMR, using its PPS of 2016-17, calculated as the percentage of isolates resistant to first-level AMR markers in HAIs (see Box 3.1). The composite index of AMR among participating EU/EEA countries ranged from 6.8% in Finland to 42.9% in Poland. Across participating OECD countries, the average index was 28% (see Figure 3.4), indicating that about a third of isolates from HAIs were resistant to first-line antimicrobial treatments. The survey also found that the composite index of AMR in LTCFs was at the same level in ACHs, in countries where both indicators could be calculated. As already mentioned, these results should be interpreted with caution because of very limited country representativeness and the low testing frequency in LTCFs, likely biased towards infections that are non-responsive to empiric treatment (Suetens et al., 2018[11]).

Box 3.1. The ECDC Composite Index of AMR in isolates recovered from health care associated infections

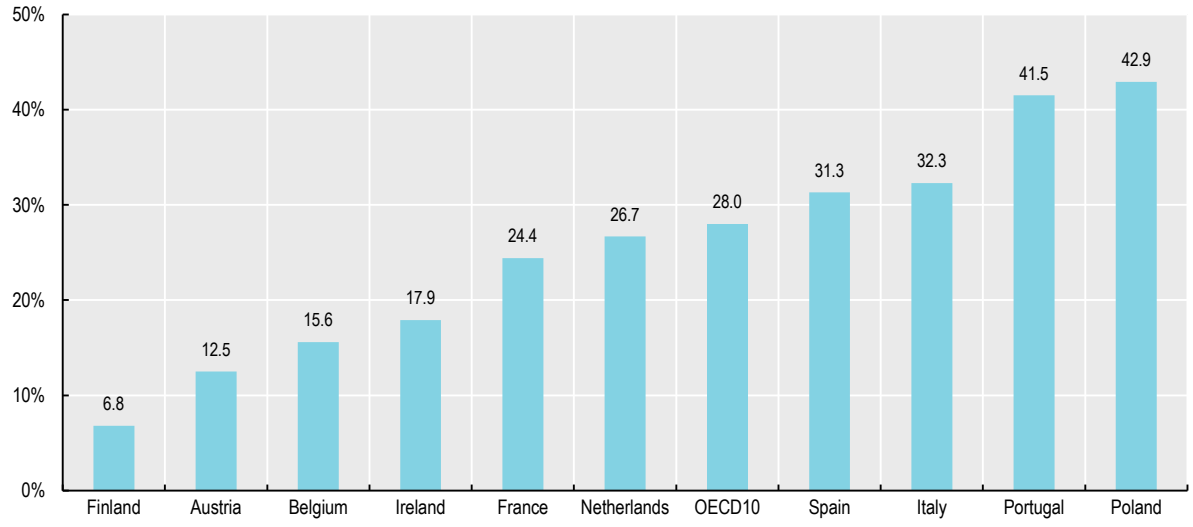
48. A drug resistance index (DRI) is a composite measure that combines the ability of antimicrobials to treat infections with the extent of their use in clinical practice. A DRI can be interpreted as the probability of inadequate treatment given observed drug use (Laxminarayan and Klugman, 2011[107]; Hughes et al., 2016[67]).

49. The ECDC composite index of AMR was calculated as the percentage of isolates resistant to first-level AMR markers in HAIs. In the 2016-17 survey, the index was calculated by country for countries with at least 10 isolates. The first level markers were: *Staphylococcus aureus* resistant to methicillin (MRSA), *Enterococcus faecium* and *Enterococcus faecalis* resistant to vancomycin, *Enterobacteriaceae* resistant to third-generation cephalosporins and *Pseudomonas aeruginosa*, and *Acinetobacter baumannii* resistant to carbapenems. *Enterobacteriaceae* selected for the AMR markers: *Escherichia coli*, *Klebsiella* spp., *Enterobacter* spp., *Proteus* spp., *Citrobacter* spp., *Serratia* spp. and *Morganella* spp.

Source: (Suetens et al., 2018[11])

Figure 3.4. ECDC Composite Index of AMR in bacteria from health care associated infections among long-term care facilities residents in participating OECD countries, 2016-17

The Composite Index is the percentage of isolates resistant to first-level antimicrobial resistance markers in HAIs



Note: The percentage of resistance was not calculated if less than 10 isolates were reported.
Source: (Suetens et al., 2018[11])

3.6. There is resistance in long-term care facilities to critically important antimicrobials

50. The intense use of antimicrobials in LTCFs is exerting selective pressure on common pathogens and is driving the emergence of resistant organisms (Capitano and Nicolau, 2003[108]; Cassone and Mody,

2015[10]). Of particular concern is a growing resistance to carbapenems. Carbapenems are the choice treatment for serious infections caused by extended-spectrum beta-lactamase (ESBL) producing gram negative bacteria such as *E. coli* and *K. pneumoniae*. Patients who are colonised or infected by EBSL-producing gram negative bacteria are at risk of developing infections that are difficult, or nearly impossible, to treat with existing antimicrobials. Moreover, there is the potential to spread AMR from the strain to other bacterial species (Conlan et al., 2016[109]).

51. The prevalence of carbapenem-resistant *Enterobacteriaceae* is a cause for concern across health care sectors, and particularly in LTCFs (Kuehn, 2013[110]; Legeay et al., 2019[111]). For example, in Italy, a study found a 20% prevalence rate in 196 positive urine cultures from LTCF residents (Marinosci et al., 2013[112]). The prevalence of carbapenem-resistant *Enterobacteriaceae* may even be underestimated because of heterogeneous expression of resistance (El-Halfawy and Valvano, 2015[113]), which makes it difficult to detect this pathogen during routine cultures (Hajogrundmannrivmnl et al., 2010[105]; Van Dulm et al., 2019[114]).

52. Risk factors for infection with *Enterobacteriaceae* resistant to third-generation cephalosporins among LTCF residents include the use of gastrostomy tubes and previous exposure to any cephalosporin, especially third or fourth generation cephalosporins (Sandoval et al., 2004[115]; Brennan et al., 2014[116]). Carbapenems are an important option for treating urinary tract infections that are resistant to quinolones and cephalosporins. Resistance to carbapenems severely limits treatment options, and is an independent risk factor for six-month mortality (Marinosci et al., 2013[112]).

4 Interventions to tackle antimicrobial resistance in long-term care

53. There are a number of policies that can be implemented to address AMR in LTCFs. First, data on antimicrobial consumption and AMR are desperately needed. Without good data, it is difficult to design good policies. It is thus essential to improve surveillance of antimicrobial consumption and AMR in LTC settings, specifically in LTCFs. Second, multi-faceted antimicrobial stewardship programmes (ASPs) could bring down unnecessary and inappropriate antimicrobial use, helping prevent selective pressure for resistant organisms. ASPs are needed in LTCFs to ensure the optimal selection, dosage and duration of antimicrobial therapies that result in the best clinical outcome, with minimal impact on resistance. Third, and finally, LTCFs should implement IPC programmes that are tailored to their specific needs to achieve high compliance and effectiveness. Alongside ASPs, IPC programmes cannot only reduce infections – notably MDRIs – but have been shown to also be cost-effective. This section focuses on key policy actions, but there are other examples that might be relevant that are not discussed below (for example, Denmark has had national campaigns on the prudent use of antibiotics as a part of the antibiotic awareness week, and the topic in 2019 was how to prevent urinary infection in the elderly).

4.1. Better surveillance of antimicrobial resistance and more testing in long-term care settings are needed

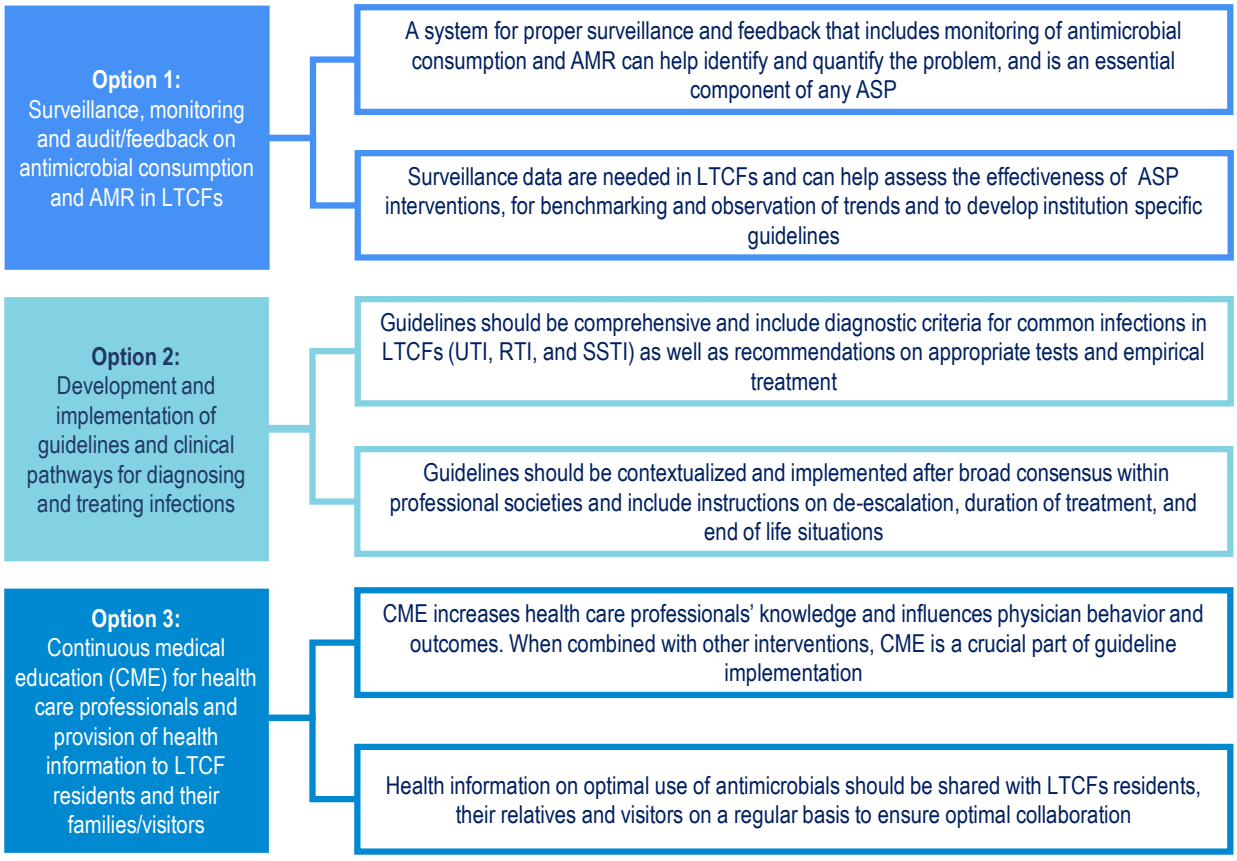
54. Many EU/EEA countries have national monitoring systems that record whether infections or outbreaks occurred in a LTCF, and other countries (e.g. France, Australia) have plans to conduct more PPSs. In several German regions, there are networks of nursing homes, hospitals and local health authorities established for the specific purpose of reducing multi-drug resistant bacteria in those settings, and some regions use specific quality criteria like hygiene concepts and educational programmes to assign specific quality certificates. In France, there is routine surveillance of antibiotic use in LTCFs that are part of a larger hospital group (this is around 20% of LTCFs in France), while surveillance of antibiotic use for the other LTCFs is planned. The French surveillance programme Primo (*Prévention et contrôle de l'infection en établissements médico-sociaux et en soin de ville*) incorporates 1 000 local laboratories to monitor antibiotic use and resistance in urban settings and LTCFs, including during COVID-19. The Primo programme also provides support to regional centres that coordinate ASPs and IPC. Canada has published a protocol for a planned national PPS on AMR in LTCFs (Public Health Agency of Canada, 2019[117]). New Zealand has identified the lack of LTCF-specific data on AMR as a priority, with a policy recommendation to implement a survey similar to the Australian and ECDC surveys (Ministry of Health and Ministry for Primary Industries, 2017[118]).

55. Notwithstanding efforts to improve data collection, data on antimicrobial consumption and AMR in LTC settings are not yet widely available, and routine surveillance of AMR in LTC settings is still limited in most countries (Haenen et al., 2019[119]). As stated, findings from PPSs indicate the majority of infections in LTCFs originate in the residents' own LTCF. However, existing systems of routine surveillance would pick up most of these infections when residents are transferred to ACHs, where samples are collected and

sent to laboratories. Having routine surveillance systems that can capture the detail included in PPSs would be of significant help in the fight against inappropriate prescribing and AMR in LTCFs.

56. The importance of surveillance and testing in LTCFs is evidenced in EVIPNet Europe's three feasible policy options to promote optimal antimicrobial prescriptions for the elderly in LTCFs (see Figure 4.1). These policy options were developed as part of a brief commissioned by the Ministry of Human Capacities of Hungary and published under the aegis of WHO Evidence-informed Policy Network. The working group included representatives from the clinical field, pharmacology, public health and health care management, who identified, selected, appraised, and synthesized relevant research evidence on the problem, suggesting three options for tackling it. The working group also considered implementation, including building on existing processes such as current educational systems to disseminate knowledge about AMR in LTCFs, specific guidelines for LTCFs, and further development of surveillance systems to fulfil LTCF-specific needs (Beović et al., 2018[7]). Education is discussed in a subsequent section below.

Figure 4.1. EVIPNet Europe's three viable options to promote optimal antimicrobial use in long-term care facilities



Note: Reported examples have been reworded from their original version to fit the figure
Source: OECD analysis of (Beović et al., 2018[7])

57. Available country-level surveillance often aggregates data from ACHs and outpatient settings across the health care network, without stratifying data from LTCFs. LTCF-specific AMR data can help to determine susceptibility rates within a given community or country and to guide the development of antimicrobial restrictive lists. Surveillance of both antimicrobial use and resistance may also help with benchmarking, audit and goal setting, and when combined with other interventions is an effective behavioural regulation that can contribute to improved ASPs (Fleming et al., 2014[120]). The use of metrics

to estimate the volume and appropriateness of antibiotics in LTCFs would be welcome, as illustrated by Simon and colleagues (Simon et al., 2020[121]). In addition, public reporting of indicators like HAIs can inform more effective infection control practices and is associated with a reduction in rates of HAIs (Daneman et al., 2012[122]).

58. Antibiograms – data summaries of susceptibility of isolated bacterial pathogens to antimicrobial agents in a particular area – can support appropriate antimicrobial use. Antibiograms have been shown to reduce the rates of inappropriate prescribing in ACHs (Simpao et al., 2018[123]). Antibiograms developed for LTCFs may also be effective in reducing inappropriate prescribing, by guiding prescribers when selecting antimicrobial therapy (Furuno et al., 2014[124]). Setting up LTCF-specific surveillance systems is not without challenge, as LTCFs often use several laboratories which seldom have enough data to enable a full microbiological and epidemiological overview. However, designing LTCF-specific surveillance systems is feasible, and these systems can collect data securely, provide strong privacy and confidentiality, obtain high response rates and can be integrated into existing health care systems (Nicolle et al., 2000[6]; El Emam et al., 2014[125]).

4.2. Antimicrobial stewardship programmes can prevent antimicrobial resistance in long-term care facilities

59. ASPs are a set of commitments and activities that encourage the optimal selection, dosage and duration of antimicrobial therapies that result in the best clinical outcome, with minimal impact on resistance (WHO, 2001[126]), including potentially no therapy at all. In ACHs and LTCFs, it is estimated that between 35% and 55% of HAIs can be prevented by multi-faceted comprehensive ASPs (Schreiber et al., 2018[35]). ASPs reduce the incidence of infections caused by MDROs, and when implemented alongside IPC programmes such as hand hygiene, are more effective than implementing an ASP alone (Baur et al., 2017[127]).

60. The ECDC PPS of 2016-17 (Ricchizzi et al., 2018[56]) surveyed ASP structure and process indicators reported by LTCFs in participating EU/EEA countries. Among responding LTCFs, 39% reported that they had written guidelines for appropriate antimicrobial use, while 20.7% reported conducting annual regular training sessions on appropriate antimicrobial prescribing. Twenty four percent of LTCFs in the EU/EEA reported that they had a restrictive list of antimicrobials to be prescribed (see Table 4.1 in the next page). The most commonly restricted antimicrobials were carbapenems (70.1%), parenteral vancomycin (J01XA01, 63.7%), and all intravenously administered antibiotics (53.9%).

61. Among responding OECD countries, 54% had written guidelines for appropriate use of antimicrobials, and 22% had a restrictive list of antimicrobials to be prescribed. Across OECD countries, 11% of responding LTCFs reported that they had annual regular training on antimicrobial use, however a relatively large number of LTCFs in the United States and Australia did not report any data for this indicator. In the Australian National Antimicrobial Prescribing Survey, 84% of participating LTCFs had an IPC programme alongside an ASP, and an employee responsible for coordinating the ASP (Australian Commission on Safety and Quality in Health Care, 2019[16]). In the United States, 63% of responding LTCFs provided antimicrobial education resources, 66% had antibiotic prescribing guidelines and 68% of the ASPs provided feedback to clinicians on antimicrobial use (Fu et al., 2020[128]).

62. These findings suggest that stewardship programmes are insufficiently adopted and used in many LTCFs, despite many tools being available online that could be used to inform ASPs in LTCFs (Belan, Thilly and Pulcini, 2020[129]). Differences at the country level, such as the presence of a physician in some LTCFs, and the absence in others, private or publicly owned LTCFs, resident care load, variable ASP and policies, and different guidelines developed at a country level, hinder comparability. For example, a study describing LTCF experiences with ASP in Netherlands, Norway, Poland and Sweden illustrates some organisational and policy differences in LTCFs in these countries. Norway is unique among this group in

the administration of intravenous antimicrobials, while the presence of a fixed physician team in the Netherlands implies greater continuity of care for residents and favours opportunities to promote ASPs (Van Buul et al., 2020[130]).

Table 4.1. Structure and process indicators of antimicrobial stewardship programmes reported in participating long-term care facilities, by country

Based on responses to surveys in the EU/EEA (2016-17), Australia (2018) and United States (2018)

Country	Responding LTCFs	Written guidelines for appropriate antimicrobial use	Annual regular training on appropriate antimicrobial prescribing	A 'restrictive list' of antimicrobials to be prescribed†	
				Responding LTCFs	A 'restrictive list' of antimicrobials to be prescribed
	N	%	%	N	%
Australia	407	85.7	-	-	-
Austria	12	75	16.7	12	16.7
Belgium	78	34.6	6.4	79	13.9
Croatia	8	12.5	0	8	12.5
Cyprus	11	18.2	9.1	11	9.1
Czech Republic	9	11.1	11.1	9	11.1
Denmark	95	2.1	0	95	1.1
Finland	147	13.6	4.8	149	2.7
Germany	82	1.2	2.4	82	0
Greece	13	0	0	13	38.5
Hungary	72	8.3	2.8	75	13.3
Ireland	106	38.7	7.5	109	13.8
Italy	193	21.2	9.8	195	56.4
Lithuania	26	0	0	26	3.8
Luxembourg	16	6.3	0	16	0
Malta	11	45.5	9.1	11	0
Netherlands‡	21	100	-	22	95.5
Norway	51	76.5	-	-	-
Poland	24	29.2	8.3	24	33.3
Portugal	130	37.7	21.5	132	77.3
Slovakia	59	32.2	0	59	100
Spain	42	73.8	33.3	46	54.3
Sweden	285	100	82.8	285	0
UK – Northern Ireland	70	28.6	2.9	70	2.9
UK – Scotland	52	28.8	1.9	51	9.8
UK – Wales	26	11.5	0	28	7.1
United States	861	65.7	-	861	19
OECD22	2877	54.0	11.7	2438	22.5
EU/EEA23	1639	39.4	20.7	1607	24.0

Note: Data was not collected in Netherlands and Norway, Australia and United States on specified items. England did not participate in the survey. Australia and US data from 2018. UK stands for United Kingdom. Antimicrobial groups reported as being restricted include: Broad-spectrum antibiotics; D06AX09, R01AXA6: Mupirocin; Intravenously-administered antibiotics; J01DD: Third-generation cephalosporins; J01DH: Carbapenems; J01MA: Fluoroquinolones; J01XA: Glycopeptides; J01XA01: Vancomycin (parenteral). Only a limited number of participating LTCFs in Netherlands collected antimicrobial stewardship data.

Sources: ECDC point prevalence survey 2016-17: (Ricchizzi et al., 2018[56]; Fu et al., 2020[128]; Australian Commission on Safety and Quality in Health Care, 2019[16])

4.2.1. Policy actions that contribute to effective antimicrobial stewardship programmes in long-term care facilities

63. Antimicrobial prescribing in LTCFs is strongly influenced by the health and care system within which the LTCF operates. Therefore, meaningful and sustained improvement may only arise as a result of overarching policy action (Society for Healthcare Epidemiology of America/Infectious Diseases Society of America/Pediatric Infectious Diseases Society, 2012[131]; Stuart, Lim and Kong, 2014[5]). In 2016, the United States Centres for Medicare and Medicaid Services implemented a final rule that LTCFs must meet to participate in the Medicare and Medicaid programmes. Some of the requirements included a condition that LTCFs develop an infection prevention programme that includes an antibiotic stewardship component and employs a trained infection preventionist (Centers for Medicare & Medicaid Services (CMS), 2016[132]). A survey of 861 LTCFs conducted after this policy change found that the majority of LTCFs surveyed had moderately comprehensive or comprehensive ASPs, including increased rates of trained infection preventionists (Fu et al., 2020[128]). This illustrates the importance of regulation in implementing effective ASPs, although the long-term impact of this change on the use of antimicrobials remains unclear.

64. From July 2019, Australian government funded LTCFs must meet the Aged Care Quality Standards, as well as collect and report quality indicators, to ensure quality care and services are provided to residents. LTCFs must demonstrate that clinical care is best practice, tailored to residents, and supported by a governance framework that includes antimicrobial stewardship. In addition, LTCFs must minimise infection-related risks by implementing standard and additional precautions, and promote appropriate antimicrobial prescribing. Furthermore, a medication management quality indicator that includes antipsychotic and polypharmacy measures will be included in the National Aged Care Mandatory Quality Indicator Program from July 2021.

65. The United States CDC core elements for ASPs in LTCFs are shown in Box 4.1. These elements are similar to ASPs in ACHs but implementation may vary across LTCFs based on facility staffing and resources. A regulatory framework would be required to implement these core elements. In Denmark, a number of original approaches have been adopted to reduce the use of antibiotics, from kits to remove nail polish as a way to improve hand hygiene, to collaborations between nurses and dentists to improve oral hygiene among residents (Sundheds- og Ældreministeriet and Det Nationale Antibiotikaråd, 2019[133]).

Box 4.1. United States CDC core elements of antibiotic stewardship in long-term care facilities

66. The US CDC core elements of antibiotic stewardship in LTCFs are:

- **Leadership commitment**: Demonstrate commitment to safe and appropriate antibiotic use within the LTCF
- **Accountability**: Identify physician, nursing and pharmacy leads responsible for promoting and overseeing antibiotic stewardship activities in the LTCF, and work collaboratively with the infection prevention programme coordinator, consultant laboratory and local health departments
- **Drug expertise**: Establish access to consultant pharmacists or other individuals with experience or training in antibiotic stewardship
- **Action**: Implement at least one policy or practice to improve antibiotic use
- **Tracking**: Monitor at least one process measure of antibiotic use and at least one outcome from antibiotic use in your facility
- **Reporting**: Provide regular feedback on antibiotic use and resistance to prescribing clinicians, nursing staff and other relevant staff
- **Education**: Provide resources to clinicians, nursing staff, residents and families about antibiotic resistance and opportunities for improving antibiotic use

Source: (Centers for Disease Control and Prevention, 2017[134]; Centers for Disease Control and Prevention, 2020[135])

4.2.2. Guidelines to diagnose and treat infections in long-term care facilities are needed

67. There is an urgent need to develop antimicrobial guidelines specific to LTCFs. Most of the available guidelines focus on ACHs, and specific recommendations may not be applicable to LTCFs (Stuart, Lim and Kong, 2014[5]). For example, guidelines relating to LTCF residents with advanced dementia are required to address the high rates of inappropriate use of antimicrobials in this population (Fagan et al., 2011[136]). Guidelines and interventions are also required which focus on review and de-escalation of initial empirical therapies in LTCFs, following microbiological laboratory results (Dyar, Pagani and Pulcini, 2015[66]). France is one country that is developing national therapeutic guidelines focusing on LTCFs.

68. Guidelines in LTCFs should be targeted to areas where inappropriate use is high to decrease resistance to antimicrobials of last resort (i.e. antimicrobials used when all other antimicrobials have failed). For example, the unnecessary use of antimicrobials in older adults with asymptomatic urinary tract infections can be harmful, lead to complications, and contributes to the high rates of antimicrobial use and resistance in LTCFs (Kidd et al., 2016[137]). *Choosing Wisely* has developed practice change recommendations for health care professionals working in LTCFs (see Table 4.2 below).

Table 4.2. *Choosing Wisely*® practice change recommendations to reduce unnecessary antimicrobial use for asymptomatic bacteriuria in long-term care facility residents

Process of care	Practice change recommendations
New admission/periodic health examinations/new referrals in LTCFs	Don't perform screening urinalysis/urine dipstick and/or urine culture and sensitivity for residents on admission, during periodic health examinations, or prior to new specialist referrals.
Use of urine dipstick or urinalysis	Don't perform urine dipstick/urinalysis to diagnose a UTI.
Assessment of resident with change in health status (e.g. change in urine odour or colour, change in behaviour, fever, etc.)	Don't assume a UTI is the cause of any change in health status, until alternate explanations are excluded. Don't send a urine culture unless the change noted is accompanied by minimum criteria for a UTI. Do perform a clinical assessment to identify alternate causes for change in health status. Do complete a comprehensive delirium workup, if clinically indicated Do encourage increased fluid intake if urine is concentrated or malodorous. Do document and reassess.
Substitute decision maker/family request to submit a urine culture or treat a UTI	Don't collect a urine culture upon request without first seeking to understand and address resident/substitute decision maker/family concerns. Provide a differential diagnosis and a rationale that will help identify the etiology of the symptoms.
Management of resident with clinical criteria for a UTI	Don't order a urine culture unless minimum criteria for a UTI are present.
Management of resident with positive urine culture	Don't prescribe antibiotics unless minimum criteria for a UTI are met.
Selecting antibiotic and duration for a resident with clinical criteria for a UTI	Don't treat a UTI for excessive durations.
Follow-up assessment of resident with clinical criteria for UTI	Don't forget to reassess the need for antimicrobial therapy within 3 days of starting antibiotics to check antibiotic sensitivity results and that the resident is improving. Antibiotic therapy should be stopped if result of the urine culture collected before antibiotics is negative.
Resident transferred to the emergency department	Don't routinely screen residents from LTC homes with a urinalysis/urine dipstick unless minimum criteria for UTI are present. Look for alternate explanations for change in clinical status.

Note: Recommendations may have been reworded from their original version to fit in the figure. Minimum criteria for diagnosing UTI in LTCFs is included in Annex C.
Source: (Choosing Wisely Canada, n.d.[138])

69. These recommendations discourage excessive use of urine dipsticks to diagnose urinary tract infections, encourage appropriate diagnosis using evidence-based minimum criteria (Loeb et al., 2001[139]; Nace, Drinka and Crnich, 2014[140]), and frequent review to ensure that duration of treatment is not excessive. Where possible, LTCFs should focus on elements that are most likely to lead to early and visible progress (quick wins) in their context, especially as resources are usually tight. The concept of *diagnostic stewardship* might also provide a good starting point in the development of guidelines that are specific to LTCFs (WHO, 2016[141]).

4.2.3. Initial and continuous education of staff may not be enough if health and long-term care settings are not more integrated

70. Continuous medical education is a fundamental component of many ASPs because knowledge gaps may influence physician prescribing behaviour and decision making (Kassett et al., 2016[142]). However, the effect of physician educational interventions in reducing inappropriate antimicrobial prescribing when implemented in isolation is unclear. For example, a Cochrane review found no clear

evidence of effectiveness of an intervention that provided educational material to physicians and nurses (Fleming, Browne and Byrne, 2013[143]). Another review found that educational interventions targeted at medical and non-medical staff to improve antimicrobial stewardship in LTCFs had limited impact on improving antimicrobial prescribing (Nguyen, Tunney and Hughes, 2019[144]). Finally, a small educational group intervention to reduce the use of quinolone antimicrobials for lower urinary tract infections produced modest effects, which could not be attributed to the intervention (Pettersson et al., 2008[145]).

71. These findings suggest that educational interventions implemented in isolation on a LTCF level may only generate minimal benefits, if any, which could attenuate over time. Including behavioural regulations such as monitoring, surveillance, goal-setting, feedback, and audit may contribute to improved prescriber educational ASPs in LTCFs (Fleming et al., 2014[120]; Wu et al., 2018[146]). For example, in the UK, the Treat Antibiotics Responsibly, Guidance, Education and Tools or TARGET toolkit provides an audit template for urinary tract infections in older adults (these audit templates are used to assess management of infection against current prescribing guidelines). When designing educational components of ASPs, it is also important to include residents and their families in interventions because both may expect residents be treated with an antibiotic, whether it is necessary or not (Holmes et al., 2003[147]). Not just continuous education matters, but also initial training: personal care workers make up the majority of the LTC workforce but have low levels of education (OECD, 2020[148]). Recognising this, several countries in Europe and North America are developing new frameworks and curricula (ibid).

72. Collaboration and clear communication among physicians, nurses, and non-clinical staff within LTCFs is important to the success of ASPs because health care workers play an important role in antimicrobial use. Within LTCFs, communication gaps may exist between physicians who are often off-site and nurses or nurse assistants who are required to communicate patient signs and symptoms over the phone (Crnich et al., 2015[149]). There is a need to extend educational ASPs to all health care workers in LTCFs. Collaboration within LTCFs can be improved by nominating champions, who are staff members with knowledge about the ASP, and advocate for support for ASPs (Cooper et al., 2017[150]). Clinical staff such as physicians, nurses or pharmacists with antimicrobial training are also important to the success of ASPs and suited to act as peer champions (Morrill et al., 2019[151]).

73. Successful ASPs often involve a collaborative multidisciplinary team (e.g. physicians, nurses, pharmacists and health care workers) across multiple care sites within a given community (Salem-Schatz et al., 2020[152]). However, establishing relationships between prescribers and other key stakeholders (e.g. pharmacists, laboratory technicians, nurses, specialist public health officials) can be challenging because in many LTCFs a number of key stakeholders are based off-site (British Society for Antimicrobial Chemotherapy, 2018[153]). This lack of interaction impedes provider-to-provider relationships and can be a barrier to implementing ASP recommendations (Doernberg, Dudas and Trivedi, 2015[154]).

74. Continuity of care is an important challenge for ASPs in LTCFs. In many countries medical care for residents of LTCFs is fragmented and often provided by visiting GPs or other employed medical staff (European Centre for Disease Prevention and Control, 2014[14]). Approximately 5% to 15% of all antimicrobial prescriptions for LTCF residents originate outside the residents' LTCFs, within ACHs and outpatient settings (European Centre for Disease Prevention and Control, 2014[14]; Sloane et al., 2016[155]; Pulia et al., 2018[156]). This emphasizes the importance of implementing ASPs targeted at prescribers across health care sites in the community, to reduce the rates of inappropriate prescriptions which are more likely to occur when initiated outside the residents' LTCFs (Pulia et al., 2018[156]).

75. It is also important to establish clear communication channels between LTCFs and other health care settings in the community due to the potential for LTCF residents to spread MDROs across the health care network (Kahvecioglu et al., 2014[41]). Collaboration also provides better continuity of care for LTCF residents and creates an opportunity for ACHs to share expertise with neighbouring LTCFs. These LTCFs can in turn tailor interventions to suit their specific needs (Kullar et al., 2018[157]). Box 4.2 describes ASPs implemented in two Canadian provinces, illustrating the importance of community involvement.

Box 4.2. A community wide programme for the wise use of antimicrobials in Canadian long-term care facilities

76. Two Canadian provinces, Alberta and British Columbia implemented community-wide regional ASP 'Do bugs need drugs' in 2005, to promote improved hygiene and more prudent use of antimicrobials. In LTCFs, ASPs involved the development of evidence-based resources to:

- Provide a consistent approach to clinical assessment and management of urinary tract infections and nursing home acquired pneumonia for LTCF residents.
- Facilitate the communication of signs and symptoms between LTCFs and physicians.

77. In addition to health care practitioner education, resources also included education for families, guardians and health care aides. Educational programmes were developed specifically for older adults who were residents of LTCFs, as well as older adults attending day programmes to raise awareness of the importance of handwashing, particularly in group settings where many objects are shared.

78. An evaluation of the programme in 2016-17 found that:

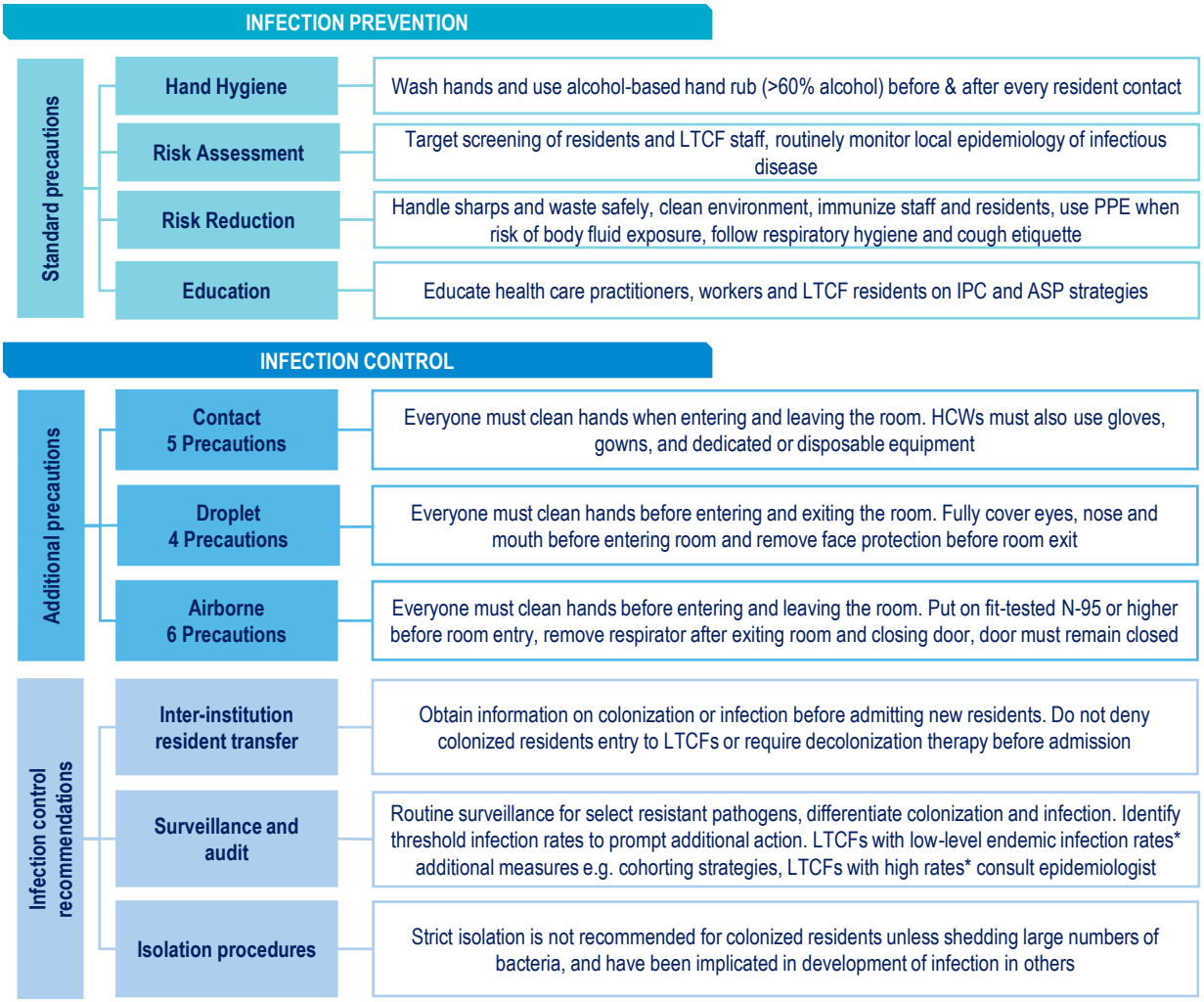
- A collaboration with the provincial academic detailing pharmacists in British Columbia visited 131 publicly subsidized LTCFs, and conducted 745 sessions to provide information and guidance on management of asymptomatic bacteriuria in residents.
- The 'Do bugs need drugs' programme conducted 23 older adult sessions and reached 411 staff, residents and visitors in British Columbia LTCFs.
- Utilisation trends in British Columbia LTCFs was nearly double that of the overall population at around 30 defined daily doses per 1000 residents/day. This finding provided a baseline for antimicrobial use in BCs LTCFs as well as reinforced the importance of activities that aim to reduce inappropriate prescribing among LTCFs.
- In Alberta, consistent reductions in antimicrobial use in LTCFs were achieved with education for staff and feedback on antibiotic prescribing rates.

Source: (Carson and Patrick, 2015[158]; Do Bugs Need Drugs?, 2016[159])

4.3. Infection prevention and control should be implemented alongside antimicrobial stewardship programmes

79. The importance of robust IPC practices in LTCFs cannot be over-stated. Transmission of microorganisms, which could be potentially resistant, is an ongoing risk in LTCFs, and can lead to outbreaks of infectious diseases. Outbreaks in LTCFs are a threat to resident safety, contribute significantly to higher costs of care, lead to increased use of antimicrobials which, in turn, will contribute to resistance (Bonomo, 2000[8]; Nicolle, 2001[29]; Oberjé, Tanke and Jeurissen, 2016[160]). IPC measures should be based on a knowledge and understanding of the chain of transmission, to break the cycle of infection (Infection Prevention and Control Nova Scotia, 2012[161]). IPC programmes in LTCFs should include infection surveillance, an epidemic/outbreak control programme, education, policy and procedure review, preparedness planning, employee and resident programme, as well as monitoring of resident care practices. A summary of best practice recommendations for IPC in LTCFs is included in Figure 4.2.

Figure 4.2. Best practice recommendations for infection prevention and control in long-term care facilities



Note: Best practices have been reworded from their original version to fit in the figure. High rates >1 case per 1,000 resident care days, low rates <1 case per 1,000 resident care days

Source: OECD compilation based on (Strausbaugh et al., 1996[162]; Siegel et al., 2019[163]; Ontario Agency for Health Protection and Promotion, 2013[164]; CNO, 2012[165])

80. In Figure 4.2, precautions are safety measures that should be undertaken to prevent infections in care settings. The two main types are standard precautions and additional precautions. The former include practices that should be used consistently in all LTCFs at all times, and are critical to prevent transmission of microorganisms from residents to other residents or LTCF staff. Additional precautions are the second tier of basic infection control, and are to be used in addition to standard precautions for residents who may be infected or colonised with infectious microorganisms, to prevent spread or transmission through contact with an infectious person.

81. In larger LTCFs, an infection preventionist employed by the LTCF, who is qualified through education, experience and certification, could oversee the IPC programme, besides being a member of the infection prevention committee (Society for Healthcare Epidemiology of America/Infectious Diseases Society of America/Pediatric Infectious Diseases Society, 2012[131]). The infection prevention committee may include administrative staff, nursing representatives, the medical director and the infection preventionist. Other members may include representatives from food services, maintenance,

housekeeping, laundry and clinical services. As many LTCFs have limited resources, cost may be a barrier to implementing effective infection control protocols, including employing an infection preventionist. However, a survey of 861 US LTCFs found that LTCFs that employed a trained infection preventionist were more likely to have comprehensive ASPs (Fu et al., 2020[128]), and that infection prevention can be cost-effective (see section 4.3.3). For smaller LTCFs, one of the LTCF staff could be adequately trained in IPC and could be responsible for the coordination of acivities in the facility, having access to expert advice at a more central level if needed.

4.3.1. Tailoring infection prevention and control programmes to long-term care facilities

82. Most IPC policies are designed for closed systems (i.e. hospital wards in ACHs), but without modification and careful planning, these policies cannot be applied to LTCFs (Marra et al., 2018[166]; Oberjé, Tanke and Jeurissen, 2016[160]). IPC programmes in LTCFs need to be tailored promoting an optimal, healthy lifestyle for residents over time. This is because infection or colonisation may persist indefinitely, and may periodically re-emerge despite treatment attempts at decolonisation (Infection Prevention and Control Nova Scotia, 2012[161]). Furthermore, isolation precautions designed for ACHs may also not be as effective in LTCF residents who are disoriented, as they tend to wander (Auditor General of Ontario, 2009[37]).

83. Isolation protocols can also have a significant impact on already stretched LTCF budgets, who often have lower staff-to-resident ratios and fewer staff qualified in infection prevention compared to ACHs (Stone et al., 2018[167]). Moreover, isolation can be associated with depressive symptoms and reduced quality of life for LTCF residents (Loeb et al., 2001[168]; Schora et al., 2014[169]). Some of these challenges can be addressed by targeting interventions to patients who are at high risk of acquiring infections, such as those with indwelling devices (e.g. feeding tubes, and urinary catheters), and those with pressure ulcers (Blanco et al., 2018[170]). A trial targeted at LTCF residents with catheter-associated urinary tract infection found that interventions such as pre-emptive use of barrier precautions (gown and gloves) during daily care of residents with indwelling devices, reduced the prevalence of MDROs by 23% among all residents with MDROs, and decreased the risk of infection with MRSA (Mody et al., 2015[171]).

84. Infection prevention can lead to lower use of antimicrobials. In the United Kingdom, a Quality Improvement Programme (a programme called “To Dip or Not to Dip”) was used to improve diagnosis and management of urinary tract infections in care homes (DHSC, 2019[172]), and has also been adopted in Australia. The programme’s six month pilot led to: a 50% reduction in older people in care homes with an antibiotic for a urinary tract infection in the last six months; an 82% reduction of older people in care homes prescribed an antibiotic for prophylaxis; and a 67% reduction in antibiotic use over six months (ibid).

85. Dehydration is common among older people because they experience lower thirst perception, difficulty with swallowing, and reduced kidney function compared to the younger population. Dehydration can increase the risk of urinary tract infections in older people. In England, a multi-disciplinary project aimed to reduce the incidence of urinary tract infections and improve diagnosis by improving hydration in four LTCFs. The intervention included staff and resident training on hydration, posters, and introducing a “7 structured drinks round” each day. The number of hospital admissions with a primary diagnosis of urinary tract infection reduced from 18 per year, at the start of the intervention to 4 per year after two years. Additionally, the incidence of urinary tract infections requiring antimicrobials reduced from one every 13 days at baseline to one every 47 days since the program started. The project won the National Institute for Health and Care Excellence 2018 Shared Learning award, and similar programmes aimed at improving hydration have reported success in reducing urinary tract infections among LTCF residents (Lean et al., 2019[173]; Booth and Agnew, 2019[174]).

86. In the United States, a multifaceted evidence-based programme was designed at a LTCF to reduce the inappropriate use of antimicrobials for asymptomatic urinary tract infections; the objective was to prevent catheter-associated urinary tract infections from happening in the first place (Cooper et al.,

2017[150]). The intervention included education, surveillance, change champions and an evidence-based tool, to assist with correct diagnosis of urinary tract infections (see Box 4.3). A three-month retrospective review found significant reductions in inappropriate prescribing from 77.8% (n = 21) in the pre-intervention period to 14.3% (n = 1) in the post-intervention period. This programme was modified and replicated in another LCTF, with similar success (Cooper et al., 2019[175]). Rates of inappropriate prescribing in the pre-intervention period reduced from 72.0% (n = 18) to 5.9% (n = 1) compared to the post intervention period (ibid). In addition, health care worker knowledge was sustained post intervention with significant reductions in the rates of urinary tract infections at the LTCF.

Box 4.3. A national implementation project to prevent catheter-associated urinary tract infections in long-term care facility residents

87. Catheter-associated urinary tract infections are a common cause of life-threatening infections, hospitalisation and antimicrobial use, leading to colonisation with MDROs. This project was implemented in 404 community-based nursing homes in 48 US states, Washington DC, and Puerto Rico between March 2014 and August 2016. The project was a multicomponent initiative that focused on technical and socio-adaptive interventions. The technical intervention was evidence-based and highlighted key interventions targeted to LTCF residents with indwelling urinary catheters. It included guidance for catheter removal, aseptic insertion, regular assessments, training, and incontinence care planning. The socio-adaptive bundle emphasized leadership, resident and family engagement, and effective communication. These elements were modified from successful large-scale studies in ACHs and were essential to facilitate the adoption of the technical bundle.

88. After adjusting for facility characteristics (ownership, chain affiliation, bed size, provision of subacute care, 5-star rating, having an infection preventionist with 3 or more years of experience, and presence of an infection prevention committee), the incidence of catheter-associated urinary tract infections was reduced from 6.42 at the beginning of the project to 3.33 per 1000 catheter-days at the end of the project. Furthermore, 75% (276 in 368) of the nursing homes reported at least a 40% reduction in the rates of catheter-associated urinary tract infections, and a reduction in the frequency of orders for urine cultures. These results highlight that ASPs can be combined with the use of diagnostics for urinary tract infections to prevent inappropriate use of antimicrobials and the emergence of resistant strains. Finally, cost-effectiveness analysis showed that this intervention is likely to save USD39 000 per year with most savings due to reduced hospitalisation related to catheter-associated urinary tract infections (Hutton et al., 2016[176]).

Source: (Mody et al., 2017[177])

89. The COVID-19 pandemic has brought into sharp focus the importance of having good IPC in LTCFs. During the pandemic, LTCFs have struggled with personal protective equipment, testing, staffing, and high staff turnover (Gurwitz and Bonner, 2020[178]). In addition, limited financial resources and staff working at multiple facilities further complicated planning and implementation of IPC programmes (ibid).

4.3.2. Poor compliance with infection prevention and control practices in long-term care facilities

90. As mentioned, 35%-55% of HAIs in LTCFs and ACHs can be prevented by multifaceted infection control interventions irrespective of a country's income level (Schreiber et al., 2018[35]). However, infection prevention practices are poorly adopted and used in some LTCFs. Hand hygiene is an intervention that is simple and low-cost that reduces the transmission of microorganisms and thus prevents HAIs in LTCFs. However, compliance with recommended hand hygiene practices is not always optimal in some LTCFs.

For example in an Italian LTCF, prior to the COVID-19 pandemic, a study observed a 17.5% adherence to hand hygiene and a 47.5% adherence rate to glove use (Pan et al., 2008[179]). Another Swedish study found shortcomings in LTCF staff adherence to infection control guidelines. For example, it was observed that staff occasionally failed to remove used gloves and aprons, and to clean their hands before leaving residents' rooms (Andersson et al., 2012[180]). Finally, a cross-sectional nationwide survey of 354 LTCFs, representing 24% of LTCFs in Hungary, used antiseptic soap and antimicrobial hand rub consumption as surrogate markers for hand hygiene compliance by health care workers. The survey found significant non-compliance with hand hygiene protocols by workers (Szabó et al., 2015[181]).

91. Frequently touched surfaces may also become contaminated with microorganisms, and require adequate and frequent cleaning and disinfection to prevent cross contamination between residents. One study found substandard cleaning of wheelchairs in Canadian LTCFs. Respondents were concerned with the continued use of dirty and visibly soiled wheelchairs, lack of guidelines, lack of resources, and the lack of a system to track and identify dirty and clean wheelchairs (Gardner et al., 2014[182]). A tool to measure the quality of infection control and antimicrobial use, was implemented effectively in 19 nursing homes in The Netherlands. The study found large differences in MDRO prevalence among LTCFs but all included LTCFs had suboptimal environmental cleaning and availability of hand disinfectants (Willemsen et al., 2014[183]). However, implementing these interventions in LTCFs may be challenging. A Cochrane review found that education with additional infection control support may only slightly improve health care workers adherence to standard precautions (e.g. appropriate cleaning and disinfection, cough etiquette and management of clinical waste) in LTCFs (Moralejo et al., 2018[184]). Peer evaluation and checklists with coloured cues is likely to improve adherence to standard precautions, but this has only been shown to be the case in ACHs (ibid).

4.3.3. Infection prevention and control practices in long-term care facilities are likely to be cost-effective though more evidence is needed

92. Empirical research on cost-effectiveness of ASPs in LTCFs is scarce, even though the economic burden of MDROs is substantial (Cohen, Choi and Stone, 2016[185]; Huebner, Roggelin and Flessa, 2016[186]; Morrill et al., 2016[187]). An economic analysis estimated the cost of MDRIs in six German LTCFs. The average annual cost related to MDRO infections was estimated at EUR12 682 per MDRI case, mainly driven by additional staff costs and isolation material. This estimate was from a microeconomic perspective, and did not take into account the potentially significant economic impact on public health and future resistance. The public health economic impact may arise because resistant infections are more difficult and expensive to treat, resulting in longer hospital stays, more intensive treatment, and more expensive second line treatments (Cecchini, Langer and Slawomirski, 2015[188]). AMR also results in lost productivity due to deaths from infection, time away from work due to illness, and increased morbidity (OECD, 2018[1]).

93. Effective interventions in LTCFs may also be cost-effective from the perspective of health care payers. For example, Hutton and colleagues (2018[189]) assessed the cost-effectiveness of a catheter-associated urinary tract infection prevention programme in 12 LTCFs (six intervention and six control). The main components of the intervention included barrier precautions (e.g. gown and glove use), education and active surveillance. The intervention was compared to usual care. Base case analysis showed that for a 120-bed nursing home, implementation of the intervention would lead to 8.7 fewer catheter-associated urinary tract infections and 2.9 fewer resident hospitalizations per LTCF year. The intervention saved USD15 136 in care at the LTCF and USD39 180 in hospital care, for a total net saving of USD34 037 for the health care system, as well as 0.2 additional QALYs in the intervention group compared to the control group. After accounting for uncertainty in all parameters, with the greatest uncertainty around hospitalisations, there was an 85% chance that the intervention was cost-saving. Therefore, it may be beneficial for payers to provide incentives to LTCFs to implement these programmes.

94. Immunisation against viral infections such as influenza can also be effective in reducing rates of influenza in LTCF residents and health care workers during annual influenza epidemics (van den Dool et al., 2009[190]). These vaccines can be cost-effective in the elderly, especially when they are well matched to circulating strains (Smetana et al., 2018[191]). While the influenza vaccine does not prevent bacterial infections, influenza is often serious in the elderly and their weakened immune system puts them at risk of secondary bacterial infections. These secondary infections are often serious, and will likely require antimicrobials to treat, further contributing to drug resistance. As a result, influenza immunisation may be a cost-effective way to reduce AMR in LTCFs. Viral infections beyond influenza can also lead to higher consumption of antimicrobials, and potentially resistance. There is concern that COVID-19 is doing just this, as shown in a recent study including 166 participants from 23 countries that found widespread broad-spectrum antibiotic use in patients with COVID-19 (Beović et al., 2020[192]). Antibiotics given in an effort to keep secondary bacterial infections in COVID-19 patients at bay may be accelerating the problem of AMR (Hsu, 2020[193]).

95. Adherence to IPC practices is likely cost-effective to prevent and control the spread of infection, and as such reduce the use of antimicrobials in health care settings (OECD, 2018[1]). While the cost of IPC can be a barrier for many LTCFs, the costs of controlling an outbreak and the risk of morbidity and mortality for residents and health care workers can be significantly higher, as illustrated in Box 4.4.

Box 4.4. The business case for infection prevention and control in a long-term care facility

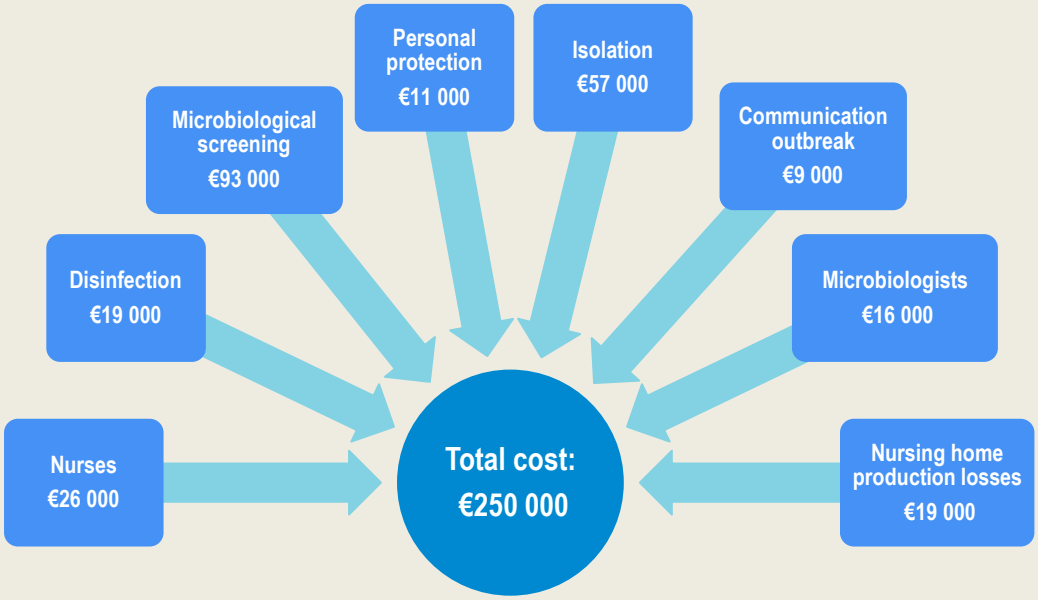
Control of an outbreak of multi-resistant *K Pneumoniae* in a Dutch long-term care facility

96. In nursing home De Riethorst in The Netherlands, there was an outbreak of *K. pneumoniae* in 2013, believed to have started with a resident who was transferred from a hospital intensive care unit to the nursing home. Five residents were infected, and the multidrug-resistant *K. pneumoniae* led to severe health risks for the infected residents and contributed to the death of one resident.

97. Controlling the outbreak took considerable effort. The nursing home formed a collaborative outbreak management team consisting of both internal (location manager, geriatrician, facility manager, a member of the board and communications specialist) and external members (a microbiologist and an infection prevention specialist) to stop the spread of *K. pneumoniae*. Interventions to control the spread included extensive disinfection and screening, isolation and transfer protocols for infected residents, intensive screening, and communication of the outbreak with residents, families and the media.

98. It took three months to control the outbreak, and costs associated with controlling the outbreak totalled EUR250 000 (see Figure 4.3). Following the outbreak, the nursing home implemented more stringent guidelines for hygiene and IPC. An infection preventionist was involved to achieve this. Current expenses for IPC programme are EUR75 000 annually, mainly on infection prevention specialist, disinfection materials and diagnostic procedures. This amounts to 0.15% of the total nursing home budget, but still significantly under the cost of a single outbreak.

Figure 4.3. Costs of controlling a drug-resistant *K. pneumoniae* outbreak in The Netherlands



Source: (Oberjé, Tanke and Jeurissen, 2016[160])

5 Conclusion

99. Antimicrobial consumption and AMR are especially relevant in the context of LTC. Residents of LTCFs are at a higher risk of acquiring infections compared to other elderly who live in the community. Despite many of these infections being preventable, IPC practices are more challenging to implement effectively in LTCFs than inACH, and are thus underutilised. To complicate matters further, LTCF residents are also more likely than community-dwelling older adults to be infected with MDROs.

100. Against this backdrop, up to two-thirds of antimicrobials prescribed for LTCF residents are given without any documented signs or symptoms of infection, driven in part by the lack of access to rapid diagnostic testing and microbiological laboratories. The lack of documented signs or symptoms hinders efforts to assess the effect of stewardship interventions, benchmarking, and auditing of antimicrobial use in LTCFs. Between 54% to 96% of antimicrobial prescriptions in LTCFs are empirical (i.e. based on the prescribers' experience and observation of the patient's signs, symptoms and medical history in the absence of complete information), and mainly for broad-spectrum antimicrobials which create the greatest selective pressure for resistant organisms. Empirical prescriptions do not always align with evidence based guidelines on diagnosis and treatment of infections.

101. Despite the growing threat of AMR to global public health, and the substantial risks to LTCFs, data on antimicrobial use and resistance in LTC settings are fragmented and not systematically collected in many countries. Country-level guidelines and recommendations on antimicrobial prescribing in LTCFs for some infections, and when residents suffer from certain conditions, like advanced dementia, are scarce. Gaps persist in the literature on effective and cost-effective interventions to tackle AMR in LTCFs and cost-effective infection prevention strategies. These gaps are highlighted further by the fact that many interventions are designed for ACHs, and may well be ineffective in LTCFs as these institutions are quite different: they provide care mainly for the elderly and typically have limited resources when compared to ACHs. Despite the success of ASPs in acute and primary care settings, and the significant potential for improvement in LTCFs, uptake in LTCFs is slow and important gaps remain.

102. There are a number of policies that can be implemented to address AMR and inappropriate antimicrobial use in LTCFs, starting with better data collection and reporting, which in turn can shape and inform policies like ASPs and IPC programmes. While more work is needed to understand what policies are most effective in what contexts, generally countries seeking to improve antimicrobial consumption and minimise the threat of AMR in LTCFs can:

- **Set up routine surveillance systems dedicated to collecting and reporting data on antimicrobial use and resistance in LTC settings.** Accurate, timely and detailed data are desperately needed to improve surveillance of antimicrobial consumption and AMR in LTC settings, specifically in LTCFs. There are promising developments in the OECD and more countries are planning to conduct PPSs, but more routine surveillance is needed not only to design policies that are fit for the LTC context, but also to monitor and evaluate their impact.
- **Design, implement and enforce multifaceted ASPs that comprehensively address multiple determinants of inappropriate antimicrobial prescribing and use.** Such ASPs could prevent a significant number of inappropriate prescriptions, in turn minimising the potential for selective pressure for resistant organisms, especially MDROs. ASPs are key to ensure the optimal use of antimicrobial therapies with best clinical outcomes and minimal impact on resistance.

- **Adopt IPC programmes tailored to the LTC setting and to the needs and risks of specific LTCFs.** Alongside ASPs, simple infection prevention practices, such as appropriate hand hygiene and environmental cleaning, are an effective and low-cost way to prevent infections in LTCFs. When there is high compliance, IPC practices, and immunisation against common infections, can be cost-effective.

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Annex A. Data Sources

Table A.1. Data sources used in this report

Country/Region	Source
Australia	National Centre for Antimicrobial Stewardship and Australian Commission on Safety and Quality in Health Care. Antimicrobial Prescribing and Infections in Australian Aged Care Homes: Results of the 2018 Aged Care National Antimicrobial Prescribing Survey. Sydney: ACSQHC; 2019
EU/EEA	European Centre for Disease Prevention and Control. Point prevalence survey of health care associated infections and antimicrobial use in European long-term care facilities. April–May 2013. Stockholm: ECDC;2014. Ricchizzi Enrico, Latour Katrien, Karki Tommi, Buttazzi Rossella, Jans Beatrice, Moro Maria Luisa, Nakitanda Olivia Aya, Plachouras Diamantis, Monnet Dominique L., Suetens Carl, Kinross Pete, the HALT Study Group. Antimicrobial use in European long-term care facilities: results from the third point prevalence survey of health care-associated infections and antimicrobial use, 2016 to 2017. Euro Surveill. 2018;23(46):pii=1800394. https://doi.org/10.2807/1560-7917. ES.2018.23.46.1800394 Suetens Carl, Latour Katrien, K.rki Tommi, Ricchizzi Enrico, Kinross Pete, Moro Maria Luisa, Jans B.atrice, Hopkins Susan, Hansen Sonja, Lyytik.inen Outi, Reilly Jacqui, Deptula Aleksander, Zingg Walter, Plachouras Diamantis, Monnet Dominique L, the Health care-Associated Infections Prevalence Study Group,Members of the Health care-Associated Infections Prevalence Study Group. Prevalence of health care-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys, 2016 to 2017. Euro Surveill.2018;23(46): pii=1800516. https://doi.org/10.2807/1560-7917.ES.2018.23.46.1800516
Unites States of America	Thompson ND, LaPlace L, Epstein L, et al. Prevalence of Antimicrobial Use and Opportunities to Improve Prescribing Practices in U.S. Nursing Homes. J Am Med Dir Assoc. 2016;17(12):1151-1153. doi:10.1016/j.jamda.2016.08.013 Fu CJ, Mantell E, Stone PW, Agarwal M. Characteristics of nursing homes with comprehensive antibiotic stewardship programmes: Results of a national survey. Am J Infect Control. 2020;48(1):13-18. doi:10.1016/j.ajic.2019.07.015

Annex B. Literature sources reporting on inappropriate use of antimicrobials in long-term care facilities

Table B.1. Literature on inappropriate use of antimicrobials in long-term care facilities, by criteria

Inappropriate Initiation	Criteria
Rotjanapan P, Dosa D, Thomas KS. Potentially inappropriate treatment of urinary tract infections in two Rhode Island nursing homes. Arch Intern Med. 2011;171(5):438-443. doi:10.1001/archinternmed.2011.13	McGeer
Zimmer JG, Bentley DW, Valenti WM, Watson NM. Systemic antibiotic use in nursing homes. A quality assessment. J Am Geriatr Soc. 1986;34(10):703-710. doi:10.1111/j.1532-5415.1986.tb04301.x	CDC and FDA guidelines
Warren JW, Palumbo FB, Fitterman L, Speedie SM. Incidence and characteristics of antibiotic use in aged nursing home patients. J Am Geriatr Soc. 1991;39(10):963-972. doi:10.1111/j.1532-5415.1991.tb04042.x	Consensus criteria by their panel of geriatricians and Infectious disease specialist
Pickering TD, Gurwitz JH, Zaleznik D, Noonan JP, Avorn J. The appropriateness of oral fluoroquinolone-prescribing in the long-term care setting. J Am Geriatr Soc. 1994;42(1):28-32. doi:10.1111/j.1532-5415.1994.tb06069.x	Criteria from literature reviews
Mitchell SL, Shaffer ML, Loeb MB, et al. Infection management and multidrug-resistant organisms in nursing home residents with advanced dementia. JAMA Intern Med. 2014;174(10):1660-1667. doi:10.1001/jamainternmed.2014.3918	LOEB 2001
Peron EP, Hirsch AA, Jury LA, Jump RL, Donskey CJ. Another setting for stewardship: high rate of unnecessary antimicrobial use in a veterans affairs long-term care facility. J Am Geriatr Soc. 2013;61(2):289-290. doi:10.1111/jgs.12099	Not Stated
Nicolle LE, Bentley D, Garibaldi R, Neuhaus E, Smith P. Antimicrobial use in long-term-care facilities. Infect Control Hosp Epidemiol. 1996;17(2):119-128. doi:10.1086/647256	LOEB 2001
van Buul LW, Veenhuizen RB, Achterberg WP, et al. Antibiotic prescribing in Dutch nursing homes: how appropriate is it?. J Am Med Dir Assoc. 2015;16(3):229-237. doi:10.1016/j.jamda.2014.10.003	Patient chart review
Moro ML, Mongardi M, Marchi M, Taroni F. Prevalence of long-term care acquired infections in nursing and residential homes in the Emilia-Romagna Region. Infection. 2007;35(4):250-255. doi:10.1007/s15010-007-6200-2	McGeer
Vergidis P, Hamer DH, Meydani SN, Dallal GE, Barlam TF. Patterns of antimicrobial use for respiratory tract infections in older residents of long-term care facilities. J Am Geriatr Soc. 2011;59(6):1093-1098. doi:10.1111/j.1532-5415.2011.03406.x	Criteria from literature reviews
Doernberg SB, Dudas V, Trivedi KK. Implementation of an antimicrobial stewardship programme targeting residents with urinary tract infections in three community long-term care facilities: a quasi-experimental study using time-series analysis. Antimicrob Resist Infect Control. 2015;4:54. Published 2015 Dec 1. doi:10.1186/s13756-015-0095-y	LOEB 2001
Stuart RL, Wilson J, Bellaard-Smith E, et al. Antibiotic use and misuse in residential aged care facilities. Intern Med J. 2012;42(10):1145-1149. doi:10.1111/j.1445-5994.2012.02796.x	McGeer
Pettersson E, Vernby A, Mölstad S, Lundborg CS. Infections and antibiotic prescribing in Swedish nursing homes: a cross-sectional study. Scand J Infect Dis. 2008;40(5):393-398. doi:10.1080/00365540701745279	Not Stated
Lim CJ, McLellan SC, Cheng AC, et al. Surveillance of infection burden in residential aged care facilities. Med J Aust. 2012;196(5):327-331. doi:10.5694/mja12.10085	McGeer

Phillips CD, Adepoju O, Stone N, et al. Asymptomatic bacteriuria, antibiotic use, and suspected urinary tract infections in four nursing homes. BMC Geriatr. 2012;12:73. Published 2012 Nov 23. doi:10.1186/1471-2318-12-73	LOEB 2001
Inappropriate Choice	**Criteria**
Rotjanapan P, Dosa D, Thomas KS. Potentially inappropriate treatment of urinary tract infections in two Rhode Island nursing homes. Arch Intern Med. 2011;171(5):438-443. doi:10.1001/archinternmed.2011.13	McGeer
Zimmer JG, Bentley DW, Valenti WM, Watson NM. Systemic antibiotic use in nursing homes. A quality assessment. J Am Geriatr Soc. 1986;34(10):703-710. doi:10.1111/j.1532-5415.1986.tb04301.x	CDC and FDA guidelines
Pickering TD, Gurwitz JH, Zaleznik D, Noonan JP, Avorn J. The appropriateness of oral fluoroquinolone-prescribing in the long-term care setting. J Am Geriatr Soc. 1994;42(1):28-32. doi:10.1111/j.1532-5415.1994.tb06069.x	Criteria from literature reviews
Doernberg SB, Dudas V, Trivedi KK. Implementation of an antimicrobial stewardship programme targeting residents with urinary tract infections in three community long-term care facilities: a quasi-experimental study using time-series analysis. Antimicrob Resist Infect Control. 2015;4:54. Published 2015 Dec 1. doi:10.1186/s13756-015-0095-y	LOEB 2001
Pettersson E, Vernby A, Mölstad S, Lundborg CS. Infections and antibiotic prescribing in Swedish nursing homes: a cross-sectional study. Scand J Infect Dis. 2008;40(5):393-398. doi:10.1080/00365540701745279	Not Stated
Inappropriate Dosage	**Criteria**
Rotjanapan P, Dosa D, Thomas KS. Potentially inappropriate treatment of urinary tract infections in two Rhode Island nursing homes. Arch Intern Med. 2011;171(5):438-443. doi:10.1001/archinternmed.2011.13	McGeer
Pickering TD, Gurwitz JH, Zaleznik D, Noonan JP, Avorn J. The appropriateness of oral fluoroquinolone-prescribing in the long-term care setting. J Am Geriatr Soc. 1994;42(1):28-32. doi:10.1111/j.1532-5415.1994.tb06069.x	Criteria from literature reviews
Inappropriate length of therapy	**Criteria**
Rotjanapan P, Dosa D, Thomas KS. Potentially inappropriate treatment of urinary tract infections in two Rhode Island nursing homes. Arch Intern Med. 2011;171(5):438-443. doi:10.1001/archinternmed.2011.13	McGeer
Doernberg SB, Dudas V, Trivedi KK. Implementation of an antimicrobial stewardship programme targeting residents with urinary tract infections in three community long-term care facilities: a quasi-experimental study using time-series analysis. Antimicrob Resist Infect Control. 2015;4:54. Published 2015 Dec 1. doi:10.1186/s13756-015-0095-y	LOEB 2001
Lim CJ, McLellan SC, Cheng AC, et al. Surveillance of infection burden in residential aged care facilities. Med J Aust. 2012;196(5):327-331. doi:10.5694/mja12.10085	McGeer

Annex C. *Choosing Wisely* minimum criteria for urinary tract infections

Table A C.1. *Choosing Wisely* minimum criteria for urinary tract infections

Minimum Criteria for urinary tract infections (Modified LOEB Criteria)	
In a non-catheterized resident:	In a catheterized resident:
• Acute dysuria or 2 or more of the following: • fever [> 37.9°C (100°F) or a 1.5° C (2.4°F) increase above baseline on at least two occasions over the last 12 hours] • new or worsening urgency • frequency • suprapubic pain • gross hematuria • flank pain • urinary incontinence	• Any one of the following after alternate explanations have been excluded: • fever [> 37.9°C (100°F) or a 1.5° C (2.4°F) increase above baseline on at least two occasions over the last 12 hours] • flank pain • shaking chills • new onset delirium
1 Note that these are clinical criteria validated for diagnosis for UTI and differ from criteria that are used for surveillance. 2 Note that confusion alone is not symptom of UTI in non-catheterized resident.	

Source: http://www.choosingwiselycanada.org/antibiotics-LTC

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