European Centre for Disease Prevention and Control

Hand hygiene: A key determinant of antimicrobial resistance in European Hospitals

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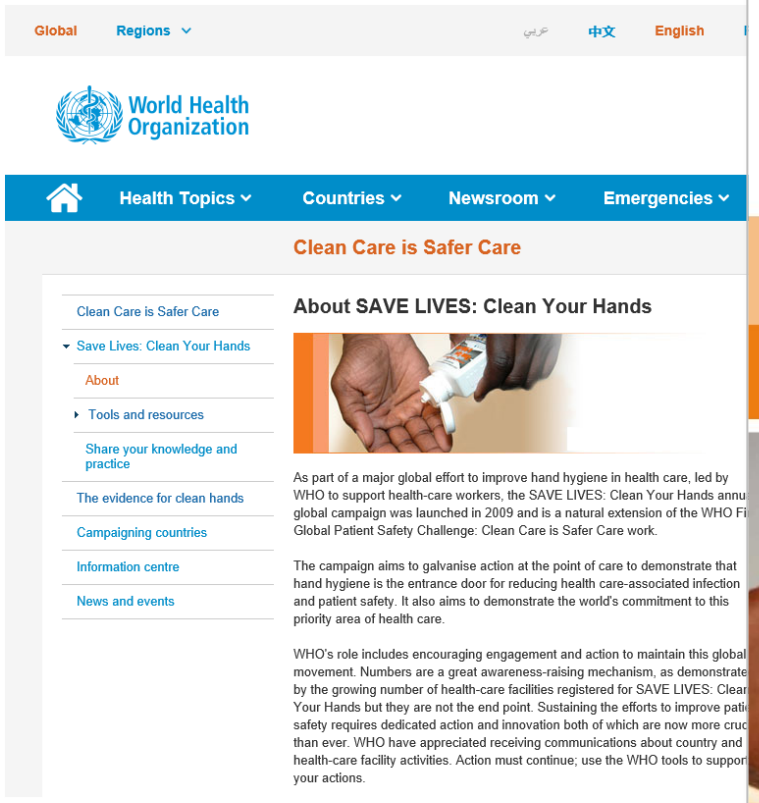
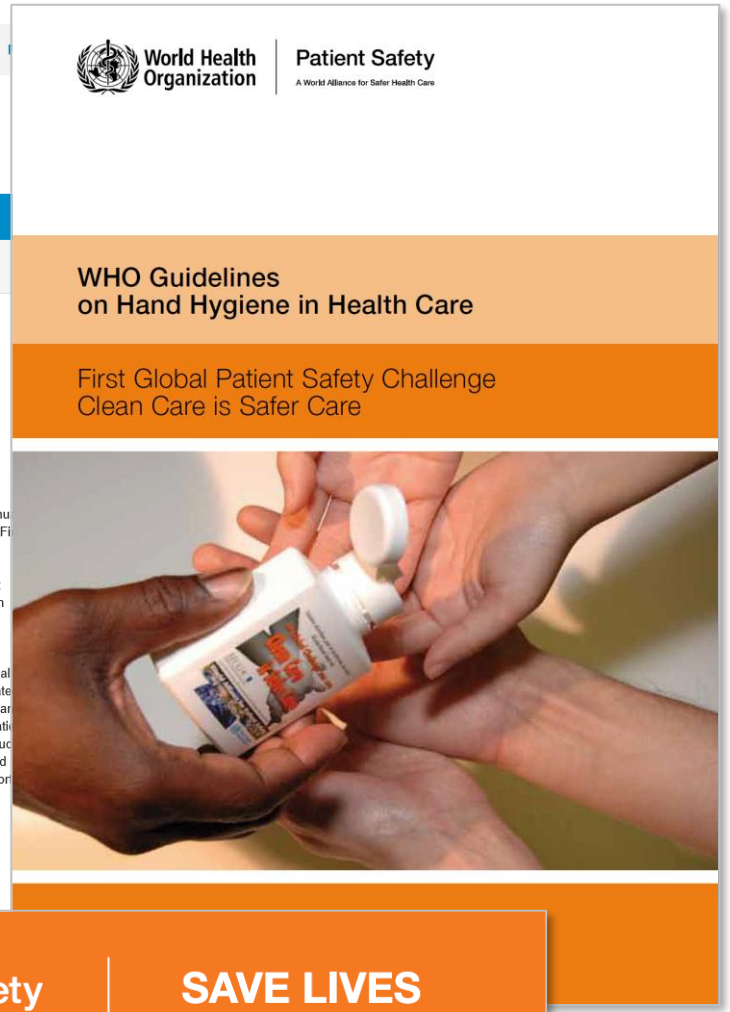
Importance of hand hygiene

- Every year, approximately 4 million patients acquire an infection while receiving care in European acute care hospitals[1]
- An estimated 90 000 patients die every year from these infections[2]
- Hands are the main pathways of germ transmission during healthcare
- Hand hygiene is therefore the most important measure to avoid the transmission of harmful germs and prevent healthcare-associated infections (HAIs)

Source: European Centre for Disease Prevention and Control (ECDC) – ECDC PPS in acute care hospitals
(1) Suetens C, et al. Eurosurveillance 15 November 2018.
(2) Cassini A, Plachouras D, et al. PLoS Med 2016;13(10):e1002150 – 6 major types of HAI included

WHO SAVE LIVES
Clean your hands 5 May





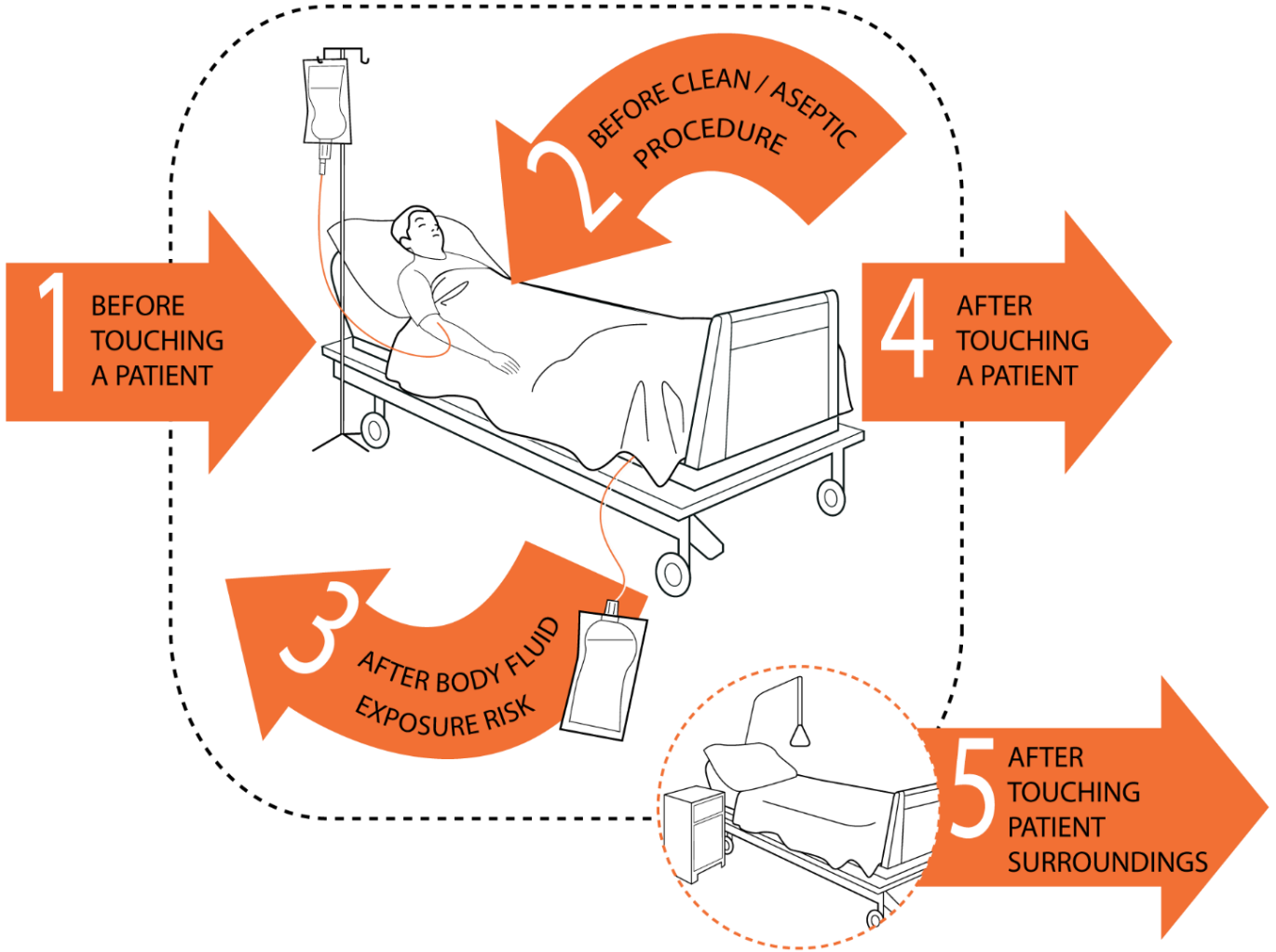
Who, how?

- Any health-care worker, caregiver or person involved in patient care needs to be concerned about hand hygiene

- **Alcohol-based handrub (AHR)** is the preferred solution for **routine hand antisepsis**: more effective, faster, better tolerated
- Hand washing with water and soap:
  - When hands are **visibly dirty or soiled** with body fluids
  - After exposure to spore-forming pathogens, e.g. ***C. difficile***

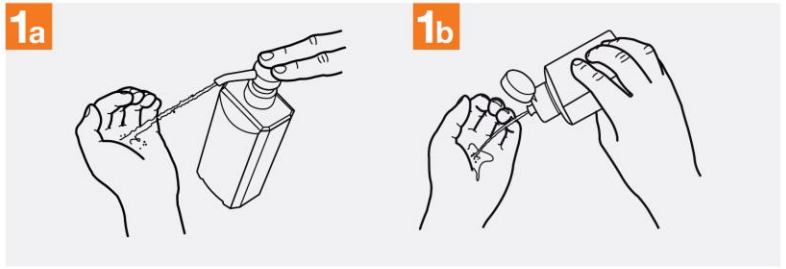
Source: WHO Guidelines on Hand Hygiene in Health Care, 2009.

The "My 5 Moments for Hand Hygiene" approach



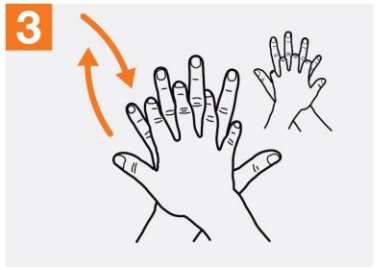
Source: WHO Guidelines on Hand Hygiene in Health Care, 2009.

How to handrub

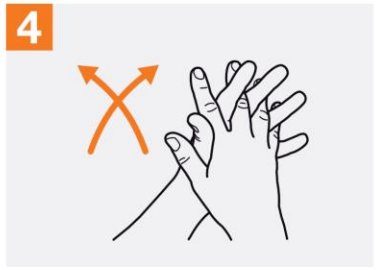


Apply a palmful of the product in a cupped hand, covering all surfaces;

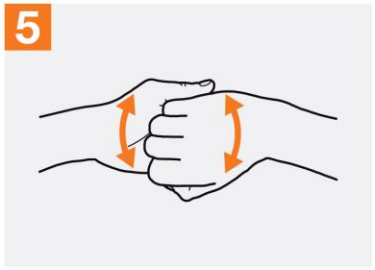
Rub hands palm to palm;



Right palm over left dorsum with interlaced fingers and vice versa;

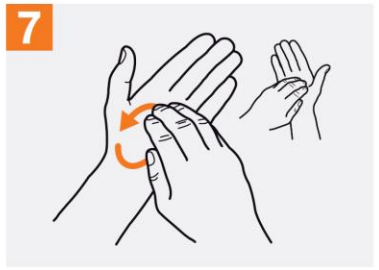


Palm to palm with fingers interlaced;

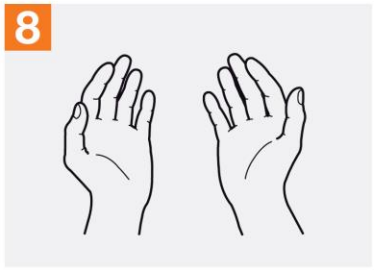


Backs of fingers to opposing palms with fingers interlocked;

Rotational rubbing of left thumb clasped in right palm and vice versa;



Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;



Once dry, your hands are safe.

Source: WHO Guidelines on Hand Hygiene in Health Care, 2009.

To effectively reduce the growth of germs on hands, **handrubbing** must be performed by following all of the illustrated steps.

This takes only 20–30 seconds!

World Health Organization | Patient Safety — A World Alliance for Safer Health Care | SAVE LIVES Clean Your Hands

Factors influencing adherence to hand hygiene practices

- WHO hand hygiene guidelines:
  - Doctors less than nurses
  - Intensity of patient care (ICU), high workload and understaffing
  - Lack of knowledge, lack of awareness of transmission risk
  - Inaccessible hand hygiene supplies
  - Insufficient time for hand hygiene
  - Skin irritation, wearing of gloves
- PROHIBIT study:
  - High income country
  - National programme training of Infection Prevention and Control nurses

Source: WHO Guidelines on Hand Hygiene in Health Care, 2009; Hansen et al. PROHIBIT study (2011-2012), CMI 2017

WHO Multimodal Hand Hygiene Improvement Strategy

Based on the evidence and recommendations from the WHO Guidelines on Hand Hygiene in Health Care (2009), a number of components make up an effective multimodal strategy for hand hygiene

ONE System change
Readily accessible alcohol-based handrub at the point of care

+

TWO Training / Education
Providing regular training to all healthcare workers

+

THREE Evaluation and feedback
Monitoring hand hygiene practices, infrastructure, perceptions and knowledge, while providing results feedback to health-care workers

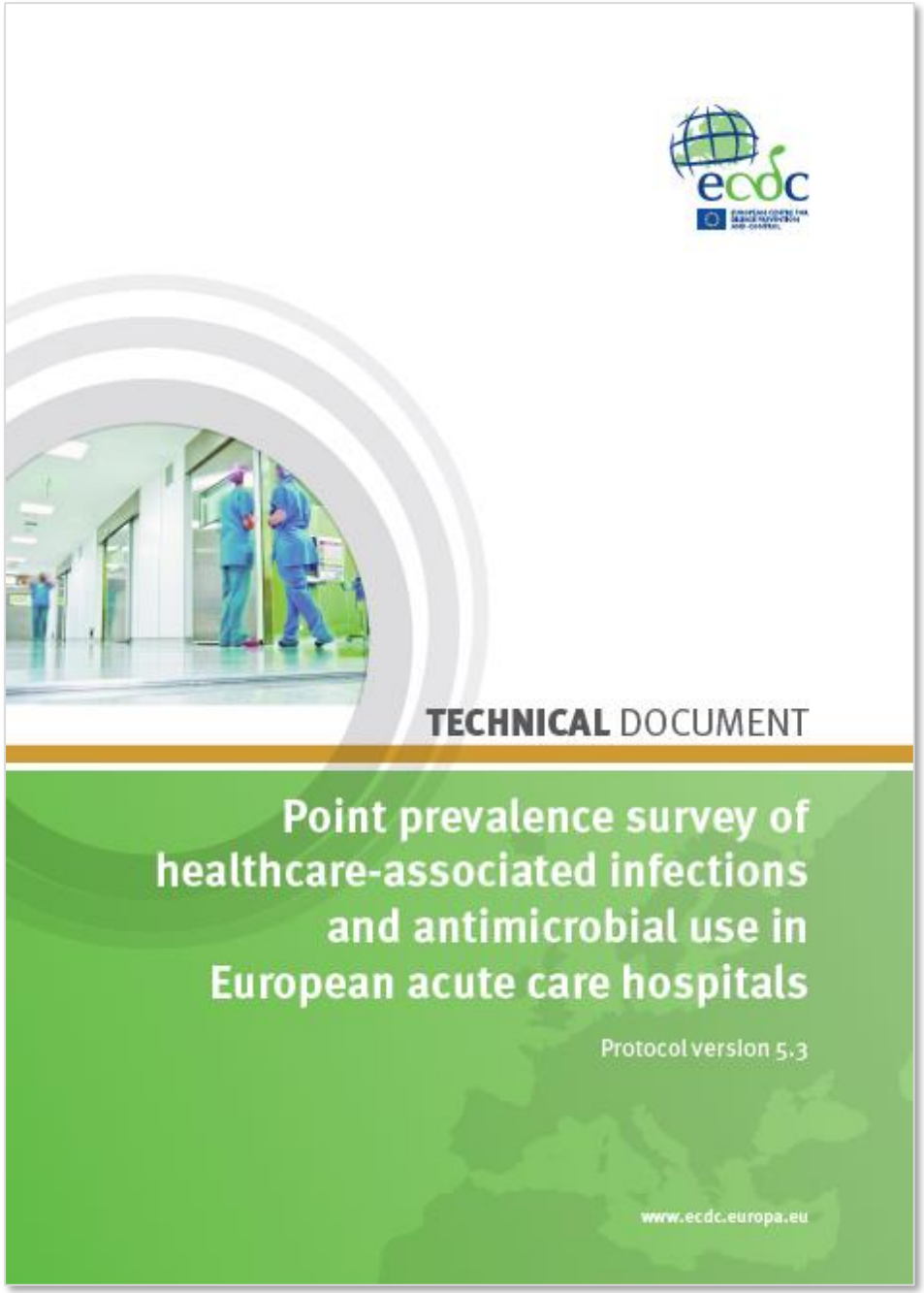
+

FOUR Reminders in the workplace
Prompting and reminding health-care workers

+

FIVE Institutional safety climate
Creating an environment and the perceptions that facilitate awareness-raising about patient safety issues

Source: WHO Guidelines on Hand Hygiene in Health Care, 2009.

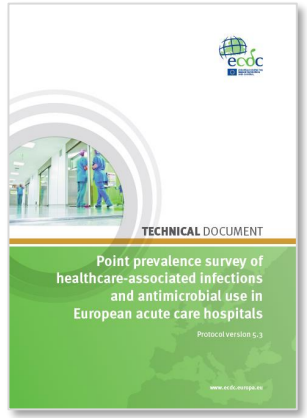


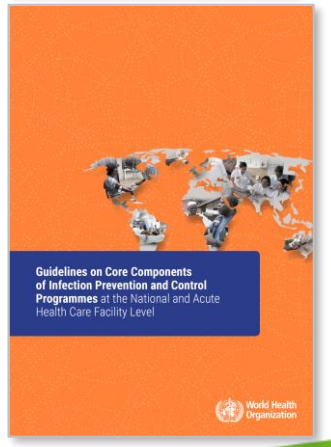
ECDC PPS 2016-2017

- 29 countries
- 2257 hospitals
- Sample:
  - 1274 hospitals
  - 325 737 patients

ECDC PPS 2016-2017 indicators of WHO core components of infection prevention and control (IPC) programmes

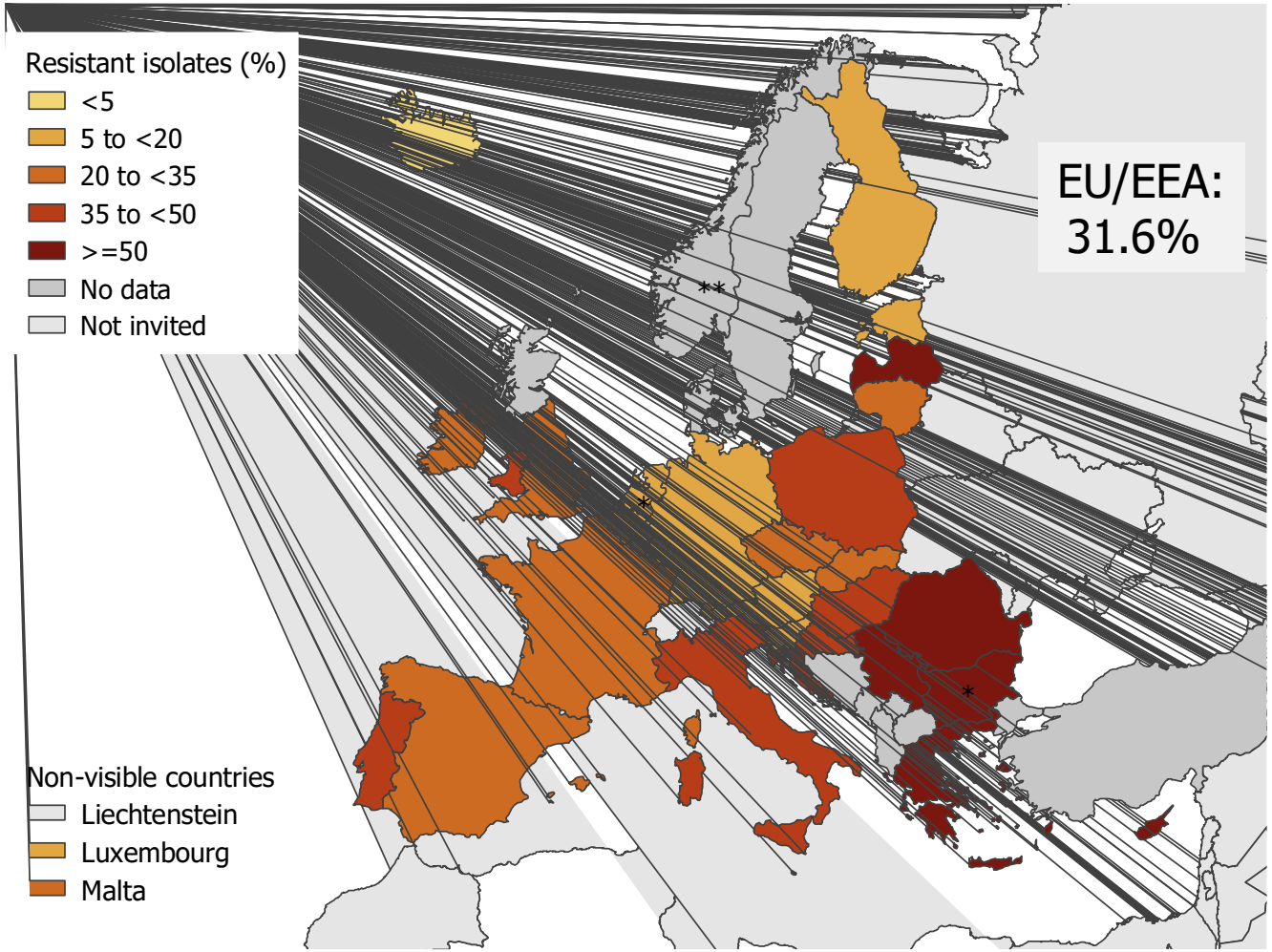
	WHO Core Component	Description	ECDC PPS hospital indicators
1	**Infection prevention and control (IPC) programme**	An effective IPC programme in an acute care hospital must include at least: one full-time specifically trained IPC-nurse ≤ 250 beds; a dedicated physician trained infection control; microbiological support; data management support	▪ FTE IPC nurses and doctors ▪ IPC plan and report approved by hospital CEO ▪ Number of blood cultures, stool tests for CDI ▪ Microbiology services during weekends
2	**IPC guidelines**	Evidence-based guidelines + education, training of relevant health care workers and monitoring of adherence with guidelines	Presence of guidelines, audit and checklist for prevention of PN, BSI, UTI, SSI and for antimicrobial stewardship (as part of multimodal strategy, in ICU and hospital-wide)
3	**IPC education and training**	IPC education and training involves frontline staff, and is team- and task-oriented	Presence of training in prevention of PN, BSI, UTI, SSI and antimicrobial stewardship (as part of multimodal strategy, ICU and hospital-wide)
4	**Surveillance**	Participating in prospective surveillance and offering active feedback, preferably as part of a network	▪ Participation in ICU, SSI, CDI, AMR and AMC surveillance networks ▪ Surveillance as part of multimodal strategy
5	**Multimodal strategies**	Implementing infection control programmes follow a multimodal strategy including tools such as bundles and checklists developed by multidisciplinary teams and taking into account local conditions	Presence of guideline, bundle, training, checklist, audit, surveillance, feedback for prevention of PN, BSI, UTI, SSI and for antimicrobial stewardship
6	**Monitoring/audit of IPC practices and feedback**	Organising audits as a standardized (scored) and systematic review of practice with timely feedback	▪ Number of hand hygiene observations ▪ Alcohol hand rub consumption ▪ Audit and feedback as part of multimodal strategy
7	**Workload, staffing and bed occupancy**	To make sure that the ward occupancy does not exceed the capacity for which it is designed and staffed; staffing and workload of frontline health-care workers must be adapted to acuity of care; and the number of pool/agency nurses and physicians minimized	▪ Bed occupancy at midnight ▪ FTE registered nurses, hospital-wide and ICU ▪ FTE nursing assistants, hospital-wide and ICU
8	**Built environment, materials and equipment for IPC at the facility level**	Sufficient availability of and easy access to material and equipment and optimized ergonomics; adequate number of single rooms (preferably with private toilet facilities) and/or rooms suitable for patient cohorting for the isolation of suspected /infected patients, including those with TB and multidrug-resistant organisms, to prevent transmission to other patients, staff and visitors	▪ Alcohol hand rub dispensers at point of care + carriage of AHR bottles by health-care workers ▪ Number of single rooms ▪ Number of single rooms with toilet and shower ▪ Number of airborne infection isolation rooms

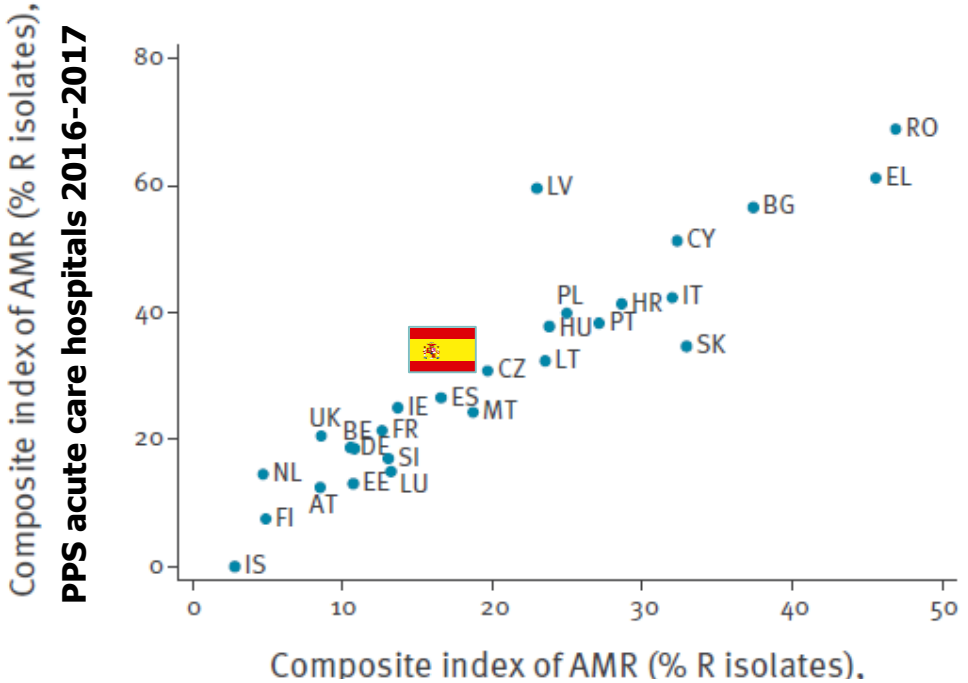




Adapted from ECDC point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals. Protocol version 5.3.

Composite index[1] of antimicrobial resistance (AMR) in healthcare-associated infections from acute care hospitals, EU/EEA countries and Serbia, 2016-2017





EARS-Net 2016

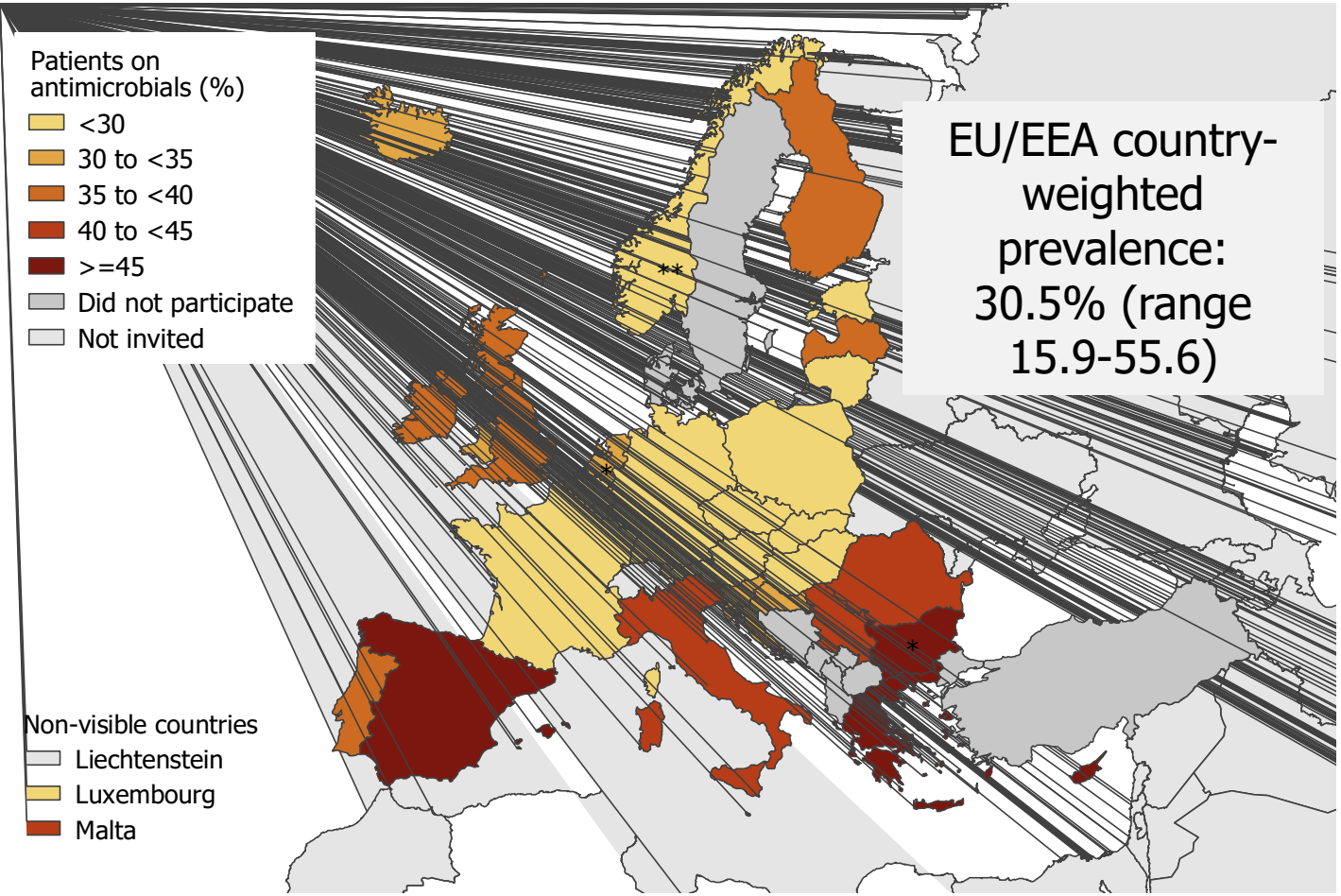
[1]Percentage of isolates resistant to first-level antimicrobial resistance markers in healthcare-associated infections, i.e.:

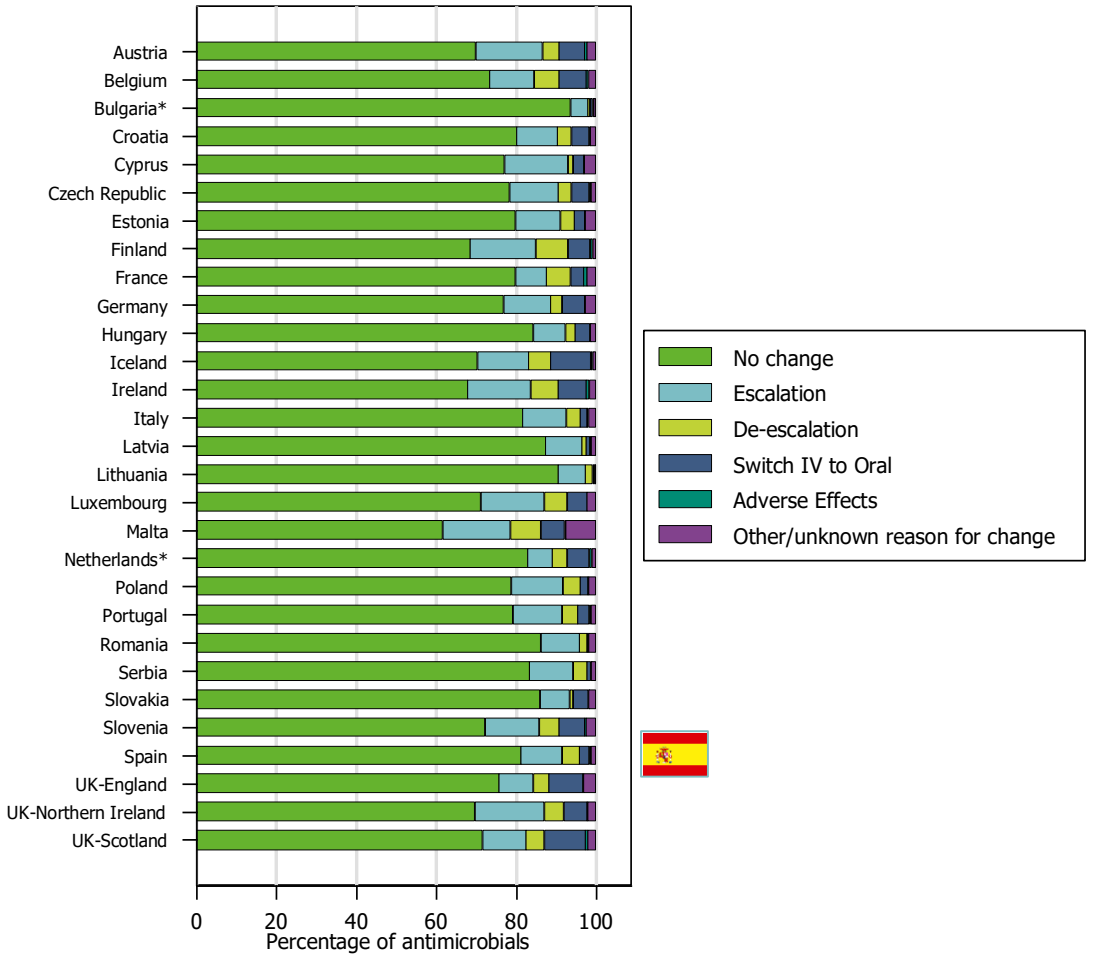
- *Staphylococcus aureus* resistant to meticillin (MRSA),
- *Enterococcus faecium* and *Enterococcus faecalis* resistant to vancomycin,
- Enterobacteriaceae resistant to third-generation cephalosporins,
- *Pseudomonas aeruginosa* and *Acinetobacter baumannii* resistant to carbapenems.

* Bulgaria and the Netherlands: poor national representativeness of acute care hospital sample; ** Norway: national protocol; Norway and UK-Scotland did not collect microbiological data; Denmark and Sweden did not participate.

Adapted from: Suetens C, et al. Eurosurveillance 15 November 2018.

Prevalence of antimicrobial use and change of antimicrobials, ECDC PPS 2016-2017

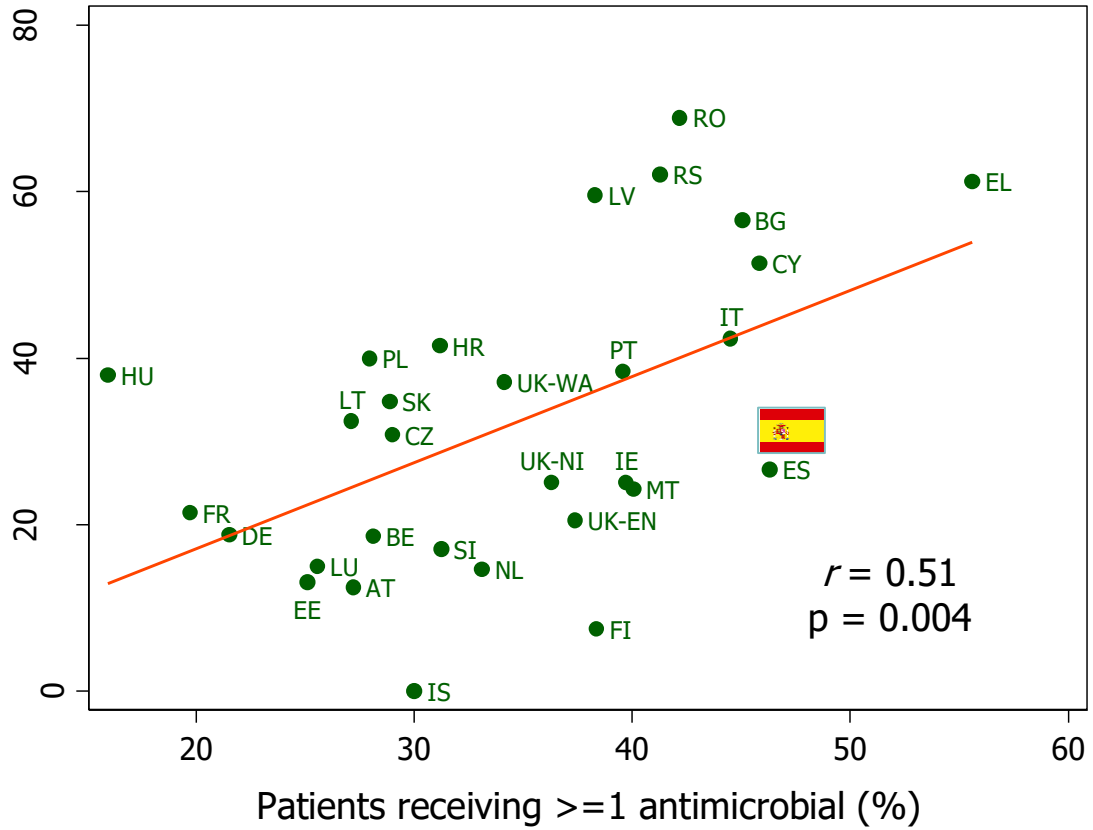


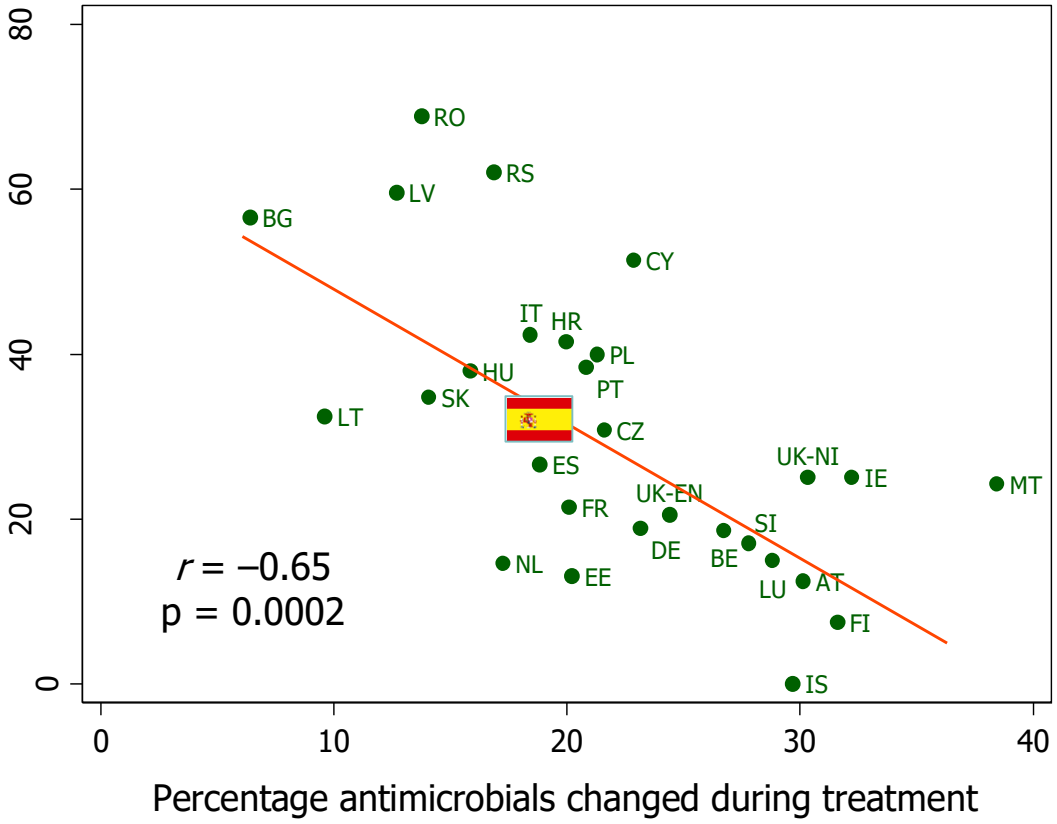


* Bulgaria, the Netherlands: poor national representativeness of acute care hospital sample;
** Norway: national protocol.

Adapted from: Plachouras D, et al. Eurosurveillance 15 November 2018.

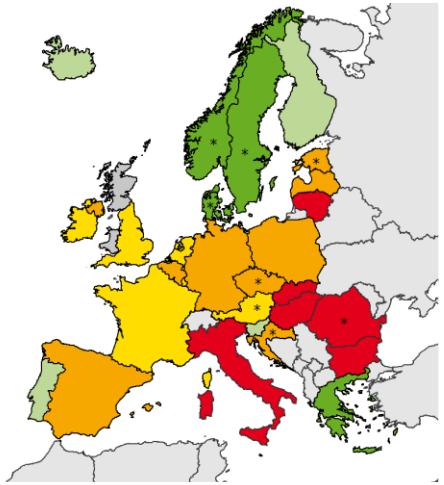
Countries with a higher prevalence of antibiotic use have a higher composite index of AMR, but countries with more frequent review and change of antibiotic prescriptions have a lower composite index of AMR





Source: ECDC point prevalence survey in European acute care hospitals, 2016-2017 (preliminary, unpublished results).

Hand hygiene:
Alcohol hand rub consumption (L/1000 patient-days)

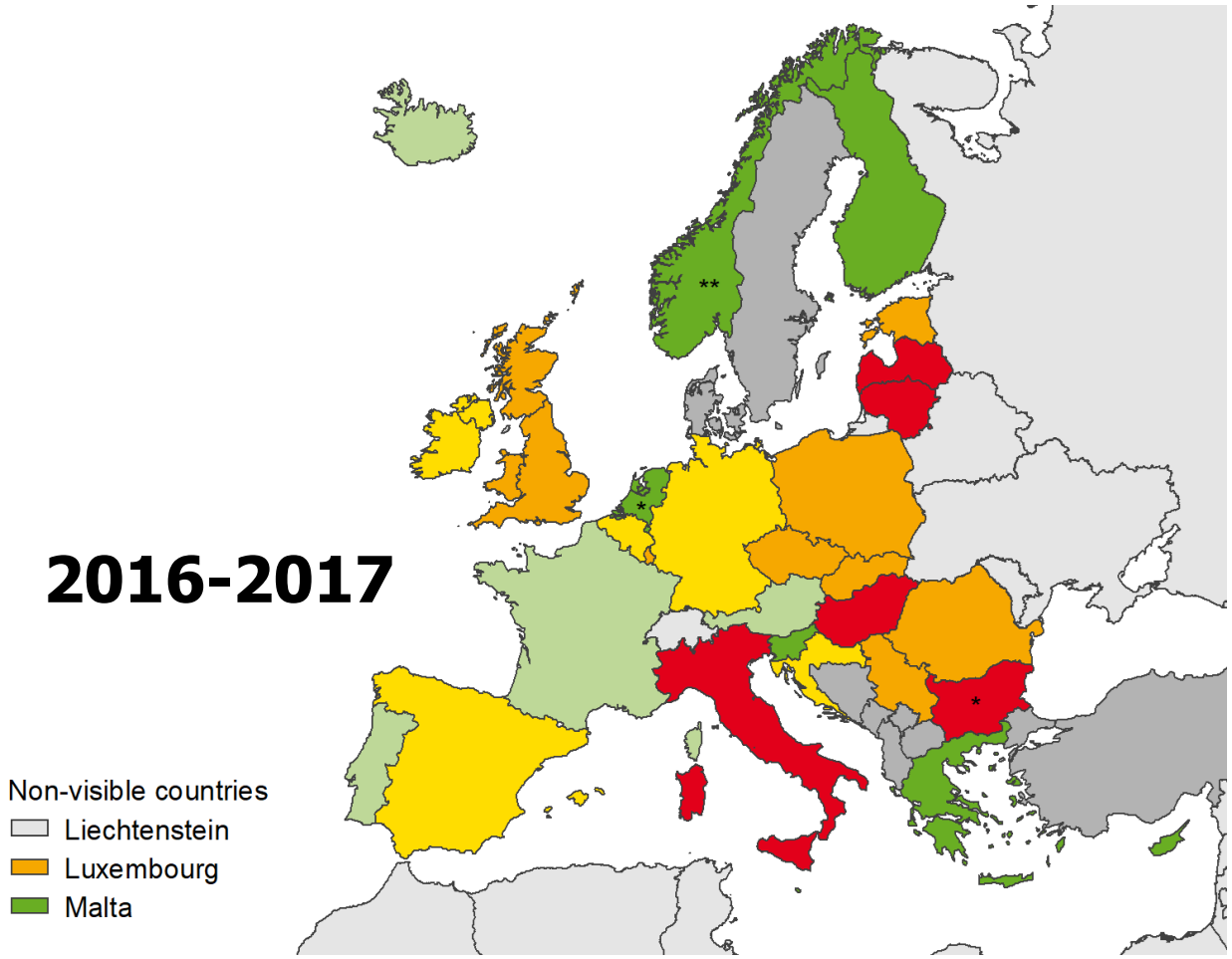


2011-2012

Alcohol hand rub consumption (L/1000 patient days)

- <10
- 10-19.9
- 20-29.9
- 30-39.9
- >=40
- No data
- Not included

2016-2017



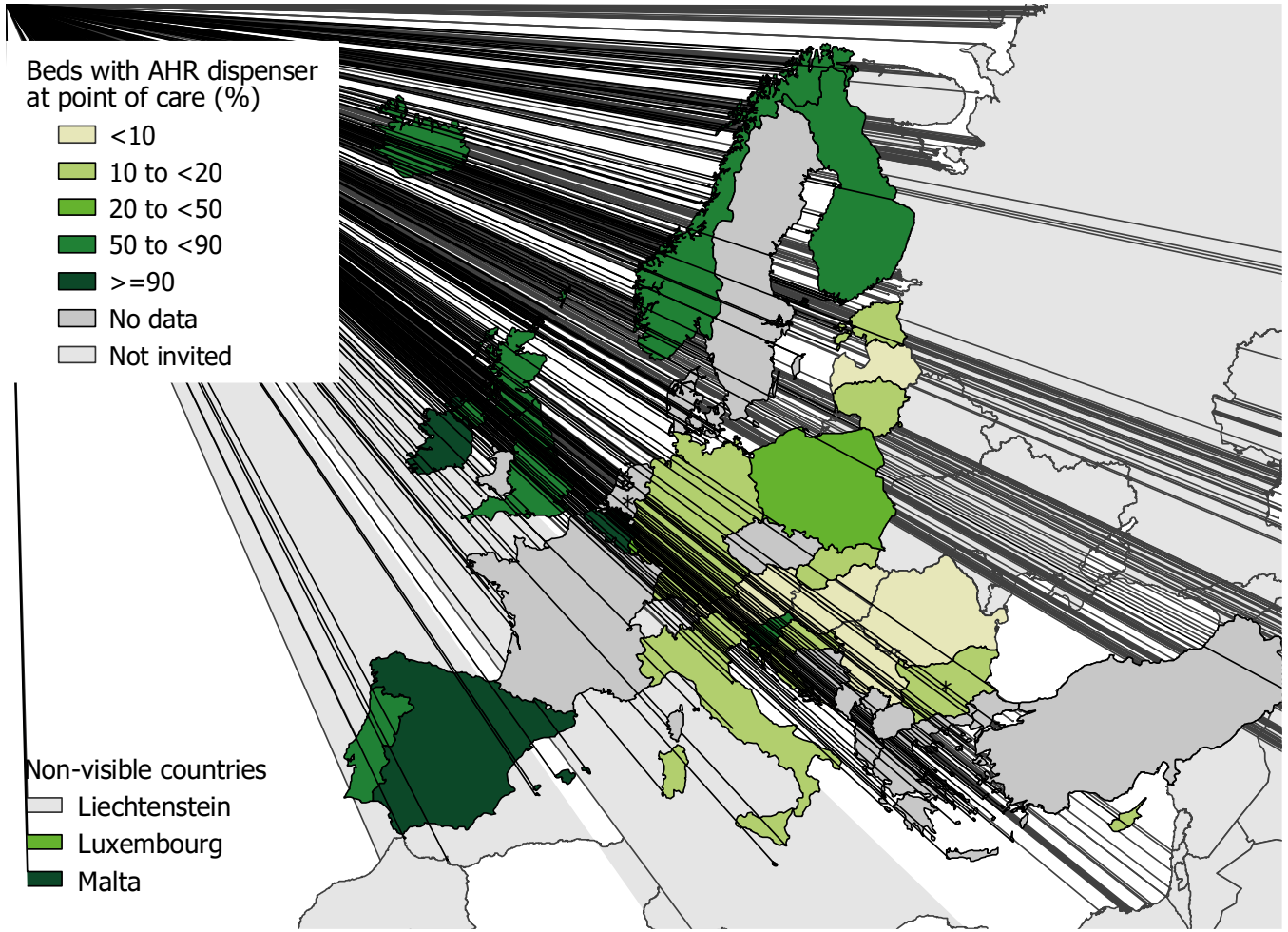
Non-visible countries

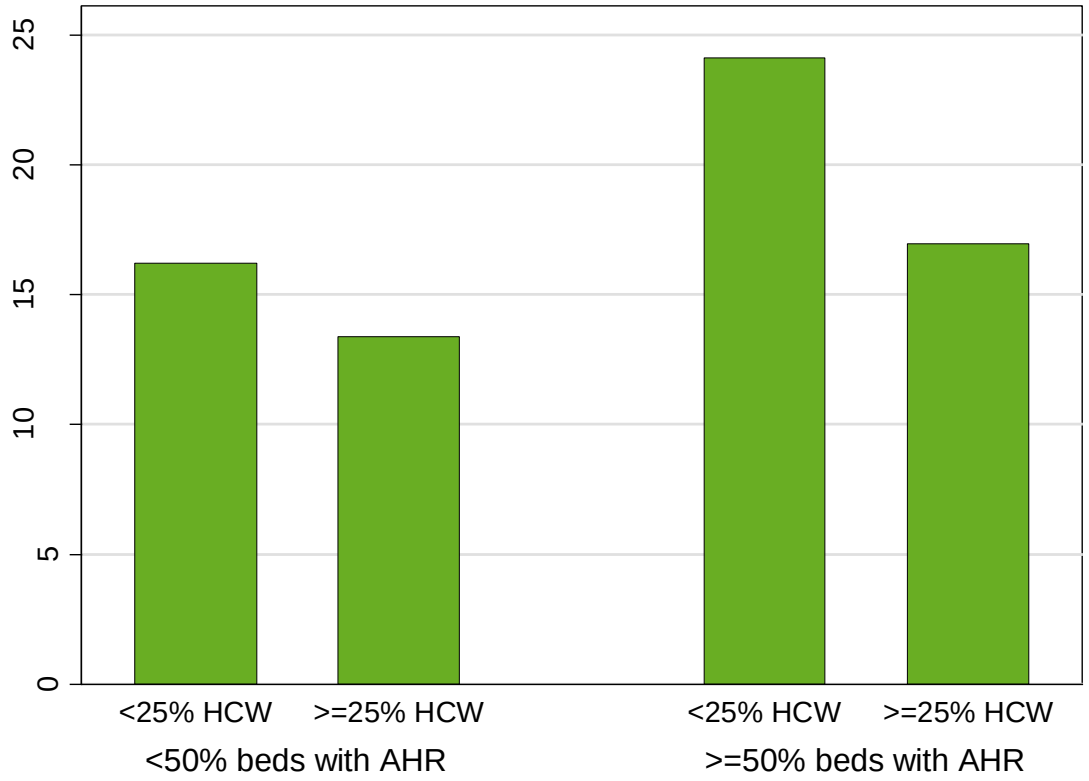
- Liechtenstein
- Luxembourg
- Malta

*poor country representativeness

Source: ECDC PPSs in European acute care hospitals, 2011-2012 & 2016-2017 (preliminary, unpublished results).

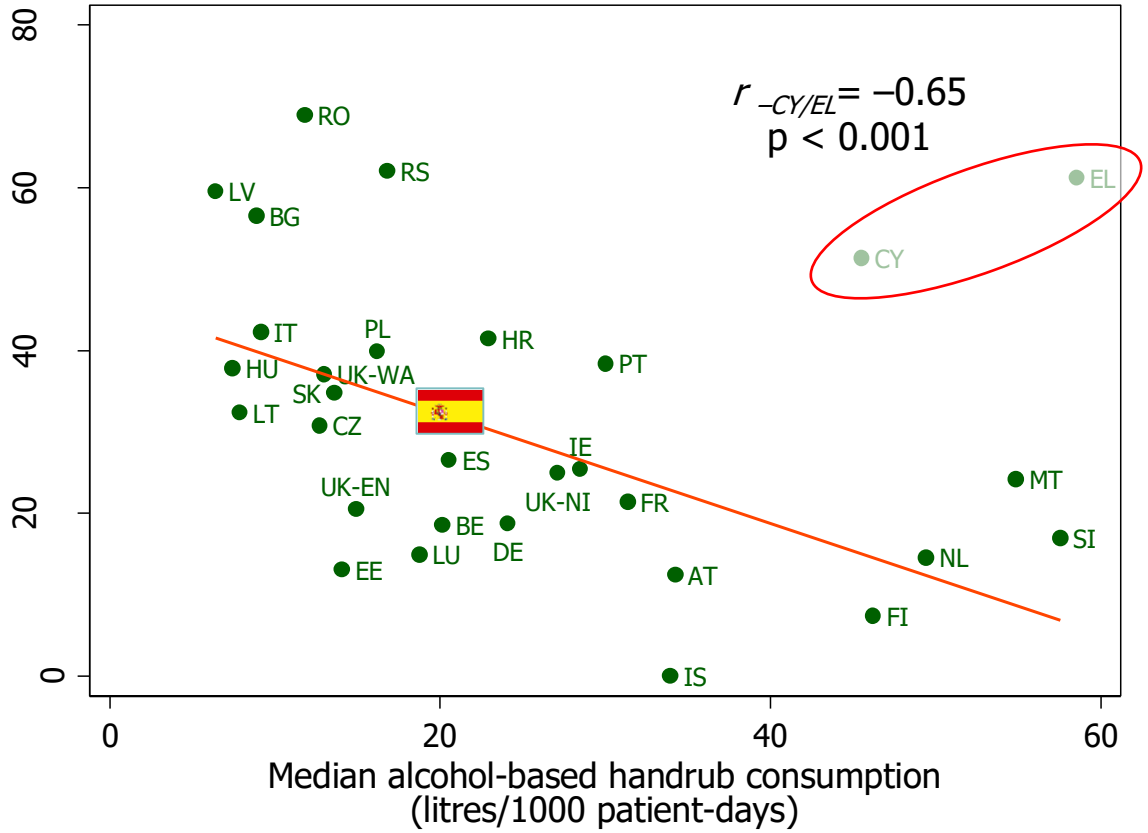
Beds with alcohol hand rub dispensers at point of care (%)

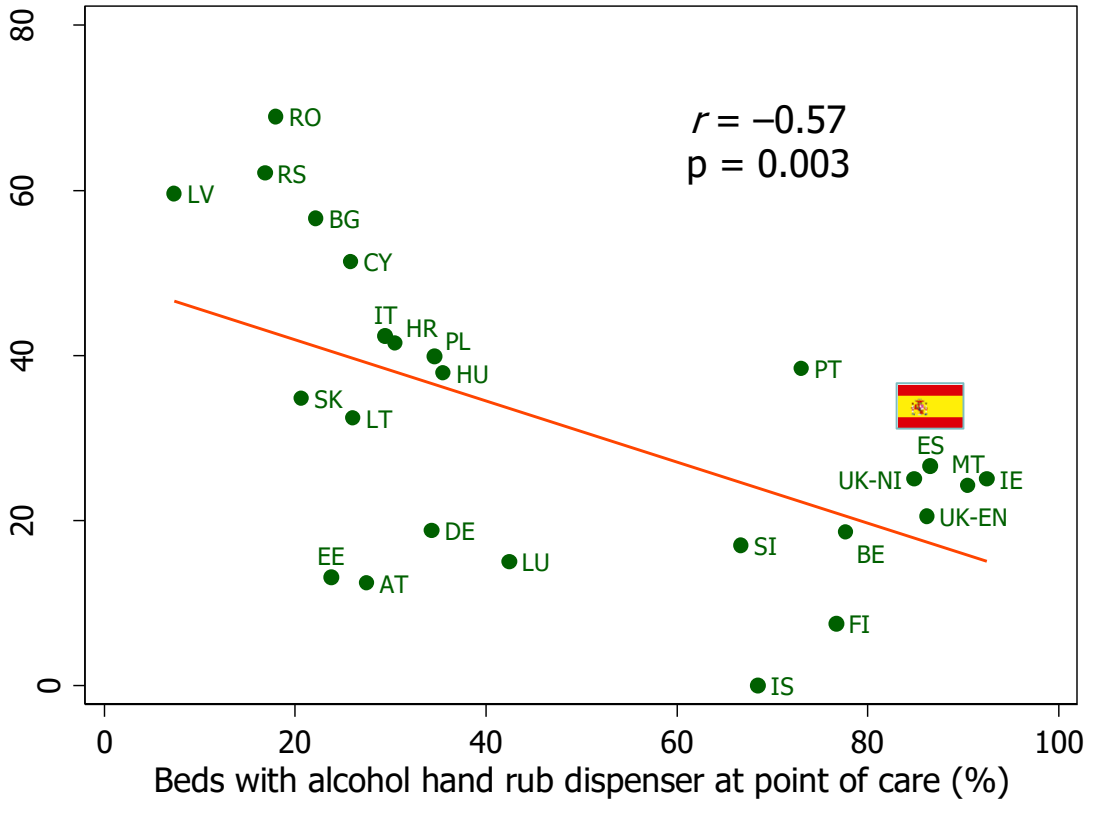




Source: ECDC PPS 2016-2017, unpublished results

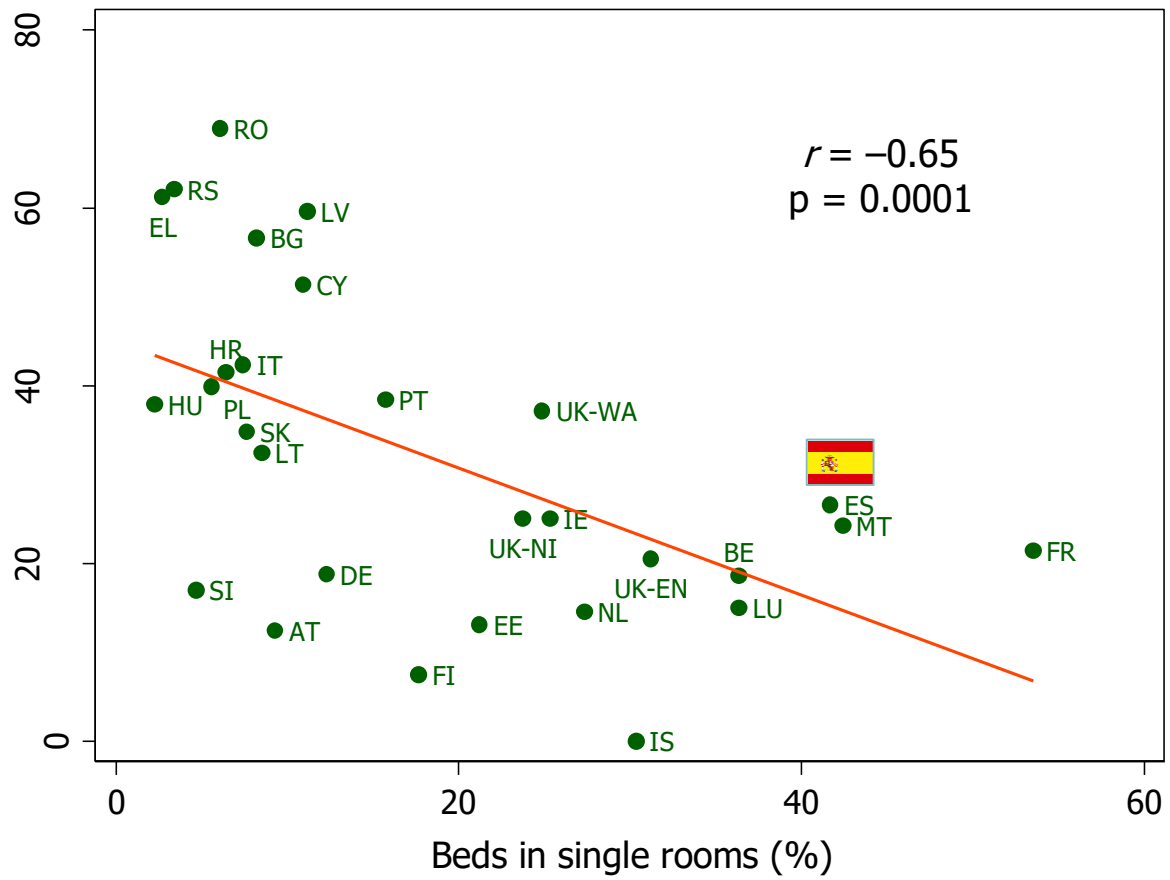
Countries with higher consumption of alcohol-based handrub have a lower composite index of AMR

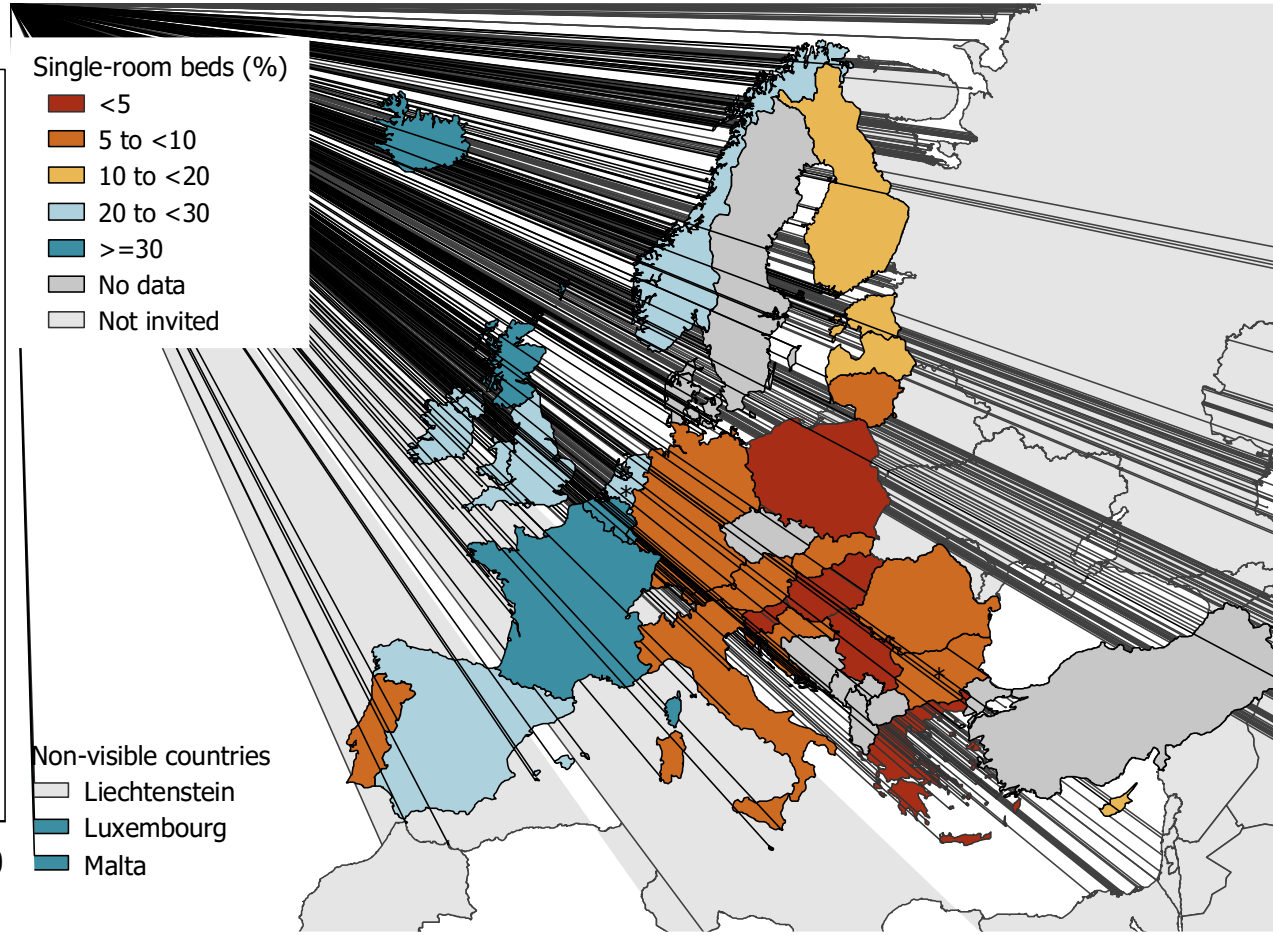




Source: ECDC point prevalence survey in European acute care hospitals, 2016-2017 (preliminary, unpublished results).

Countries with higher isolation capacity (single rooms) have a lower composite index of AMR

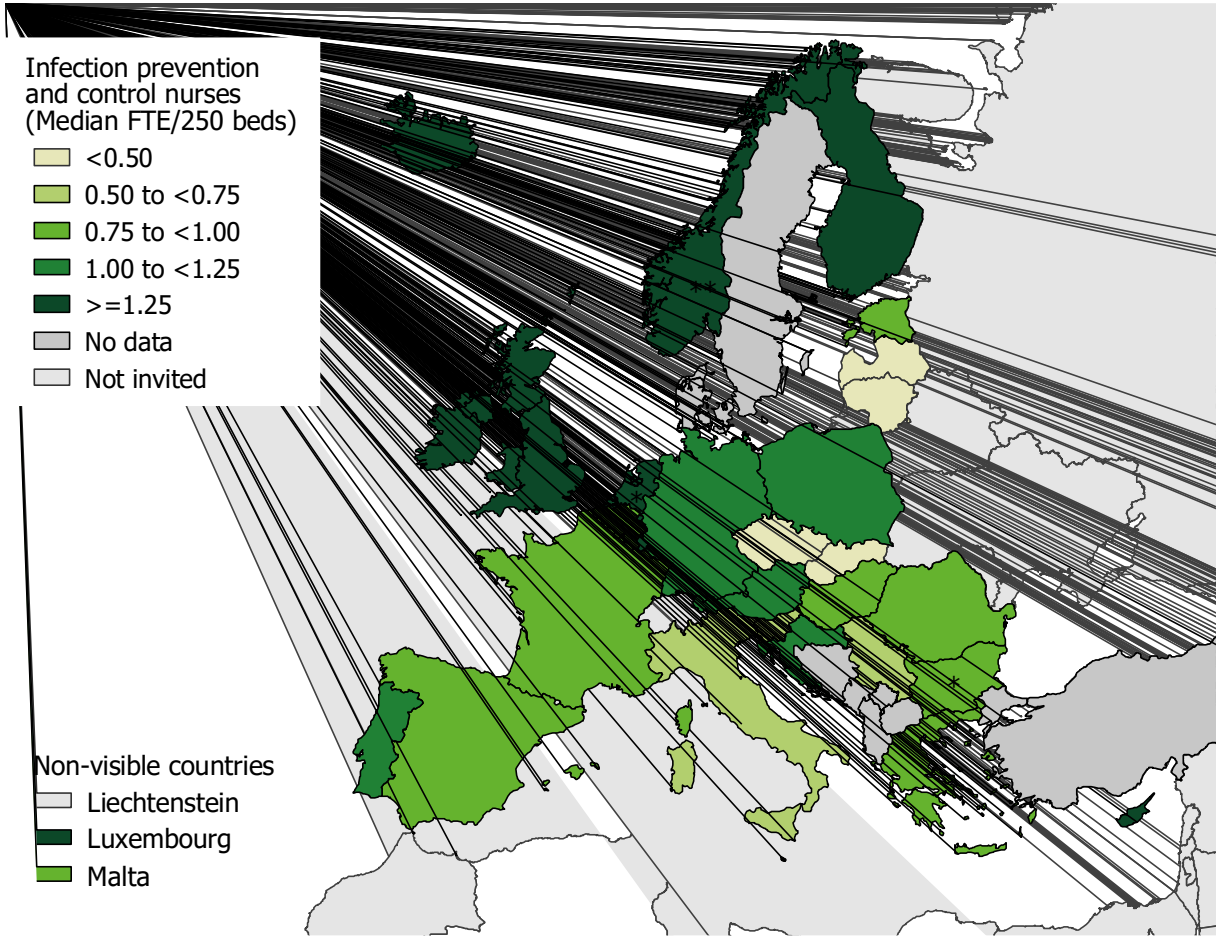


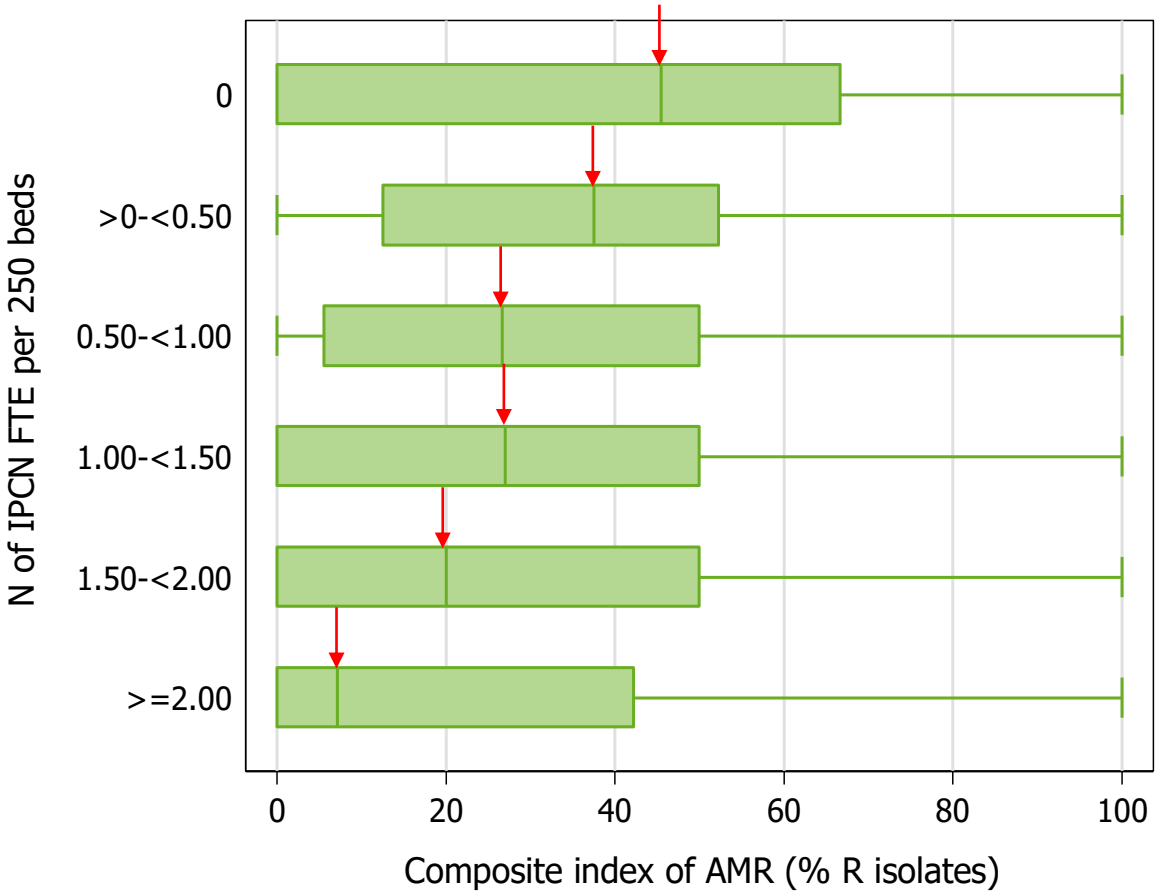


*poor country representativeness

Source: ECDC PPSs in European acute care hospitals, 2016-2017 (preliminary, unpublished results).

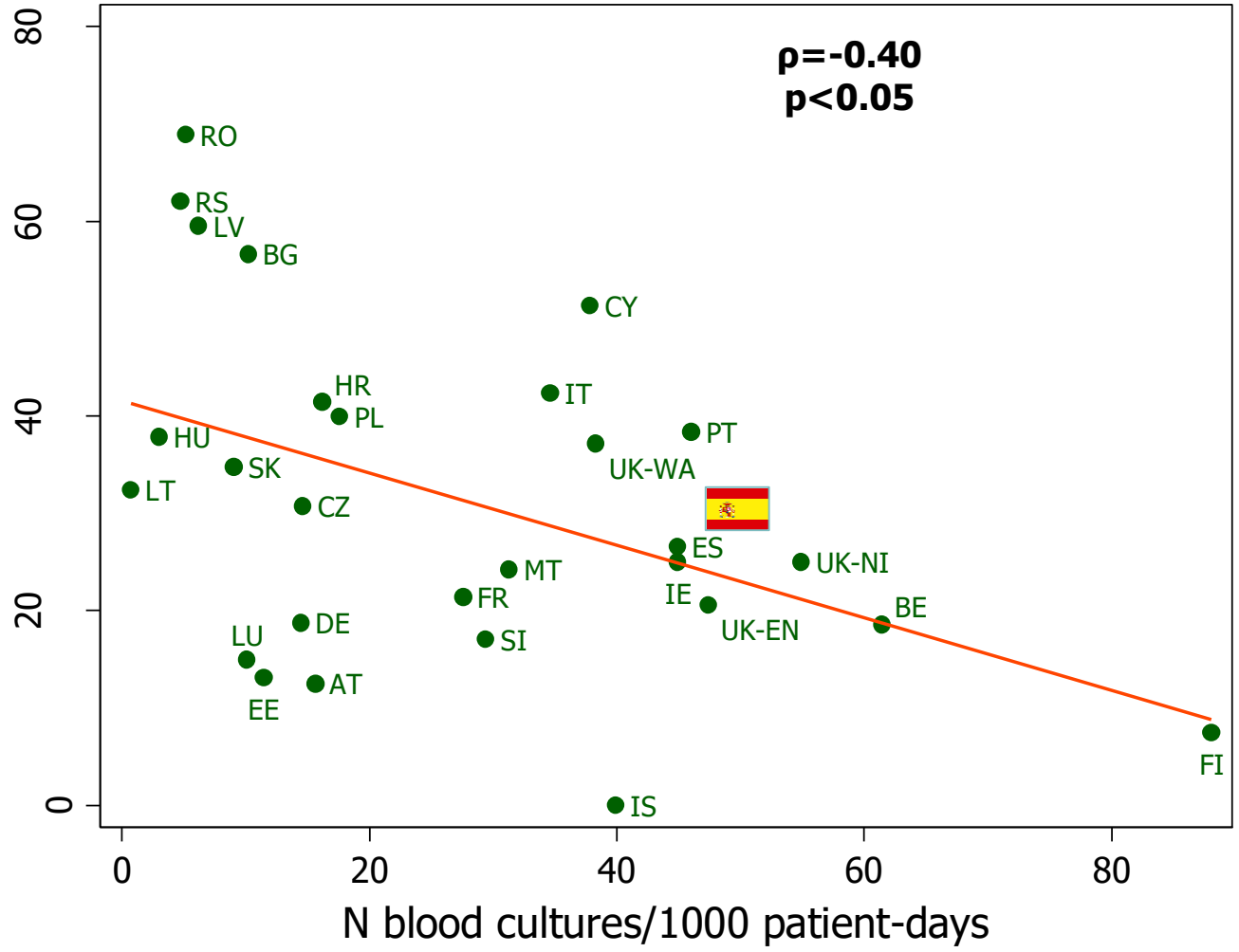
Hospitals with more infection prevention and control nurses (FTE IPCN per 250 beds) have a lower composite index of AMR





Source: ECDC PPSs in European acute care hospitals, 2016-2017 (preliminary, unpublished results).

Correlation blood culture use rate with composite index of antimicrobial resistance[1], ECDC PPS 2016-2017



Good compliance with indication for blood culture
vs
Blood culture when empiric treatment fails

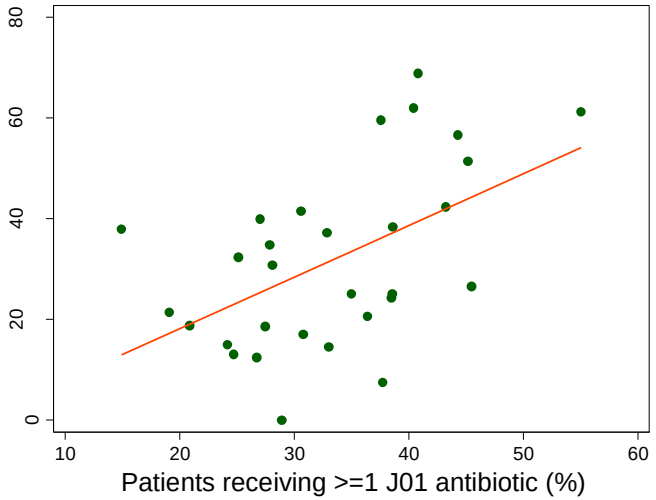
[1]Percentage of isolates resistant to first-level antimicrobial resistance markers in healthcare-associated infections, i.e.:

- *Staphylococcus aureus* resistant to meticillin (MRSA),
- *Enterococcus faecium* and *Enterococcus faecalis* resistant to vancomycin,
- Enterobacteriaceae resistant to third-generation cephalosporins,
- *Pseudomonas aeruginosa* and *Acinetobacter baumannii* resistant to carbapenems.

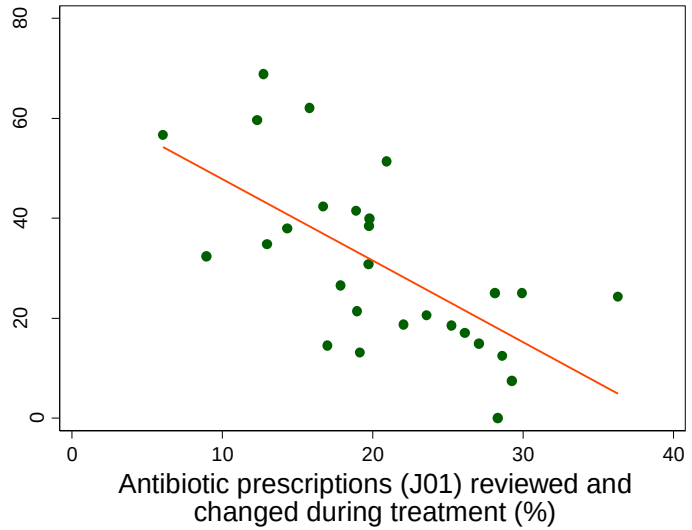
Source ECDC PPS 2016-2017 - composite index AMR: Eurosurveillance 15 November 2018.

Correlations composite index of AMR in acute care hospitals

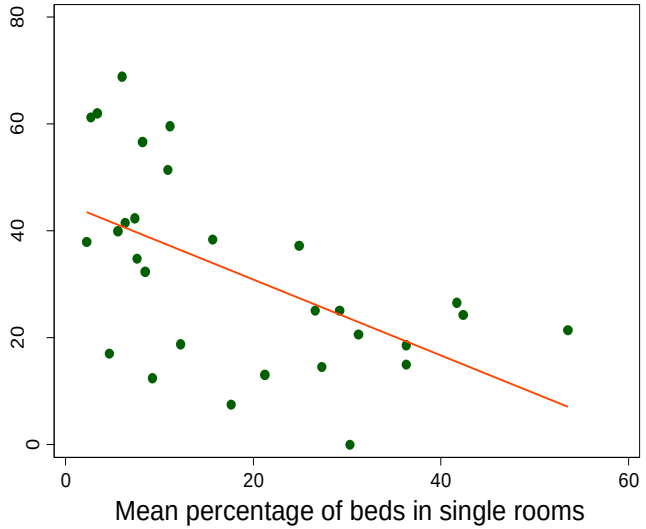
Prevalence antimicrobial use



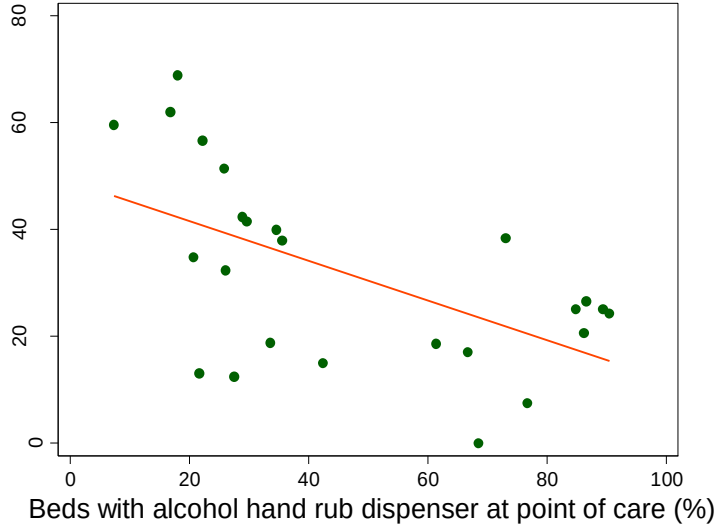
Antimicrobials reviewed and changed (%)



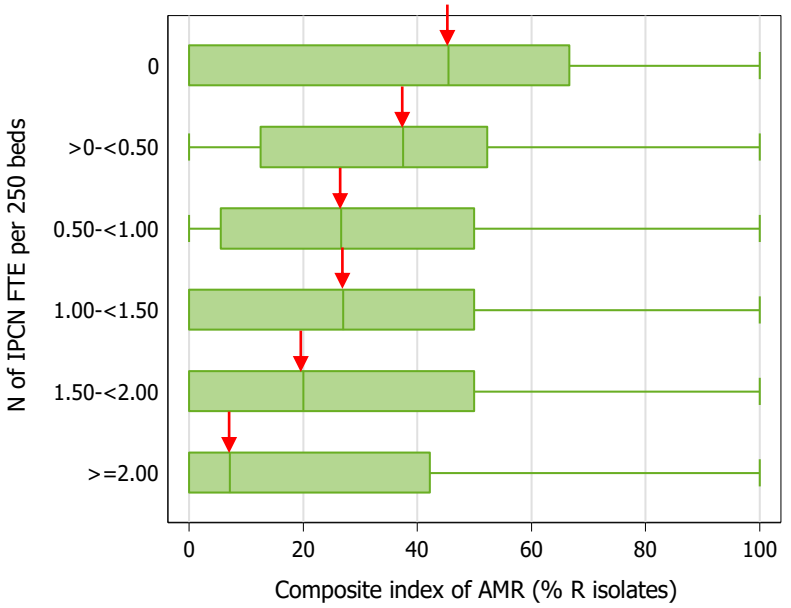
Beds in single rooms (%)



Beds with AHR dispensers (%)



FTE IPC nurses



Source: ECDC point prevalence survey in European acute care hospitals, 2016-2017 (preliminary, unpublished results).

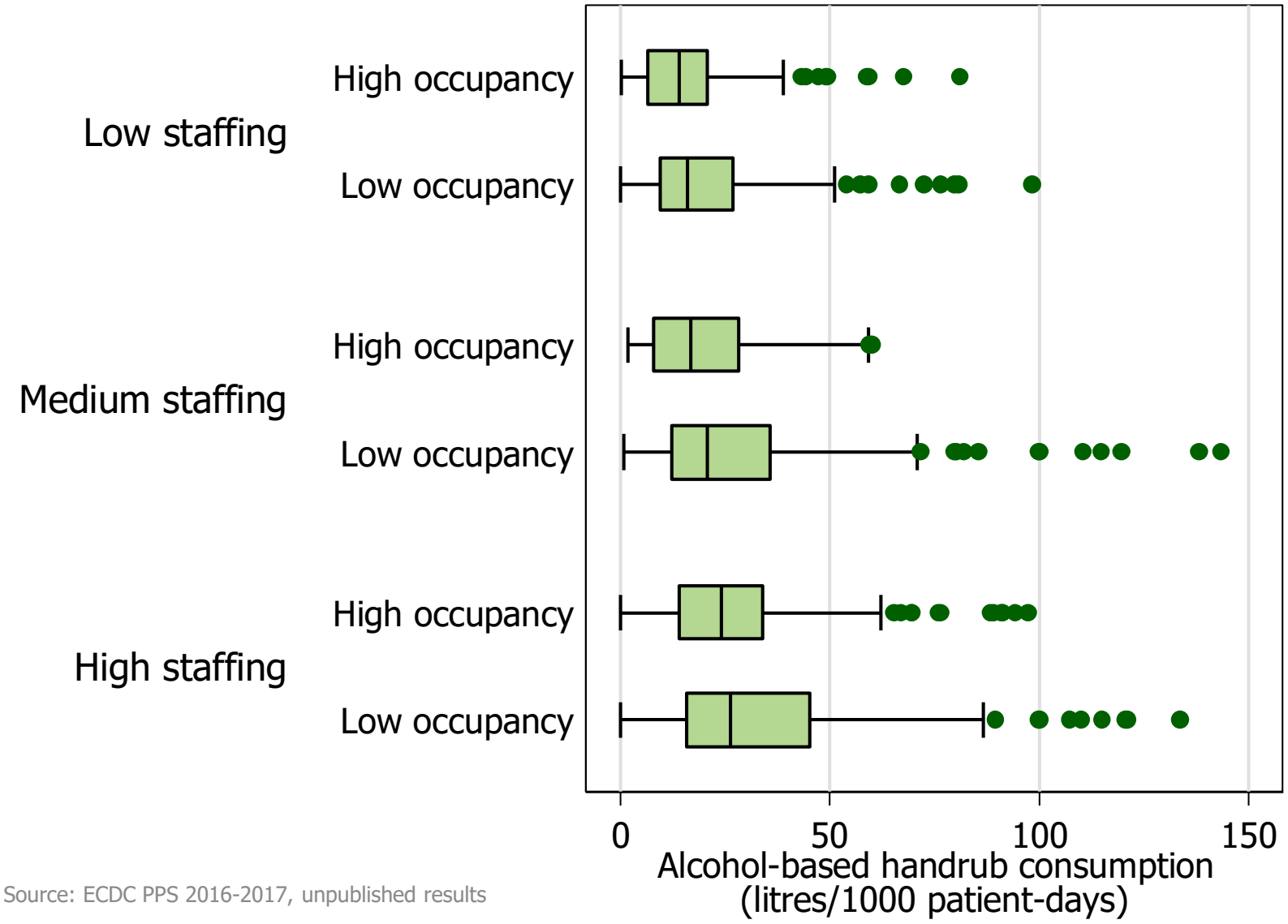
Multivariable analysis

Multiple ordinal logistic regression for determinants of composite index of AMR at hospital level (n=658 hospitals)

	Regression coefficient	P-value
IPC nurse staffing levels (FTE / 250 beds)	-0.196	<0.001
AHR consumption (L/1000 patient-days)	-0.010	<0.01
Beds in single rooms (% beds)	-0.016	<0.001
Prevalence of antimicrobial use (% patients)	0.028	<0.001
Change of antimicrobials (% antimicrobials)	-0.006	0.028
Case-mix severity (predicted HAI prevalence)	0.106	0.008
Blood culture use rate (N per 1000 pt-days)	0.000	0.944

Source: ECDC point prevalence survey in European acute care hospitals, 2016-2017 (preliminary, unpublished results).

ECDC PPS 2016-2017: Hand hygiene and workload (nursing staffing levels and bed occupancy)



Staffing levels of registered nurses and nursing assistants:

- Low: < 80 FTE / 100 beds
- Medium: 80-129 FTE / 100 beds
- High: ≥ 130 FTE / 100 beds

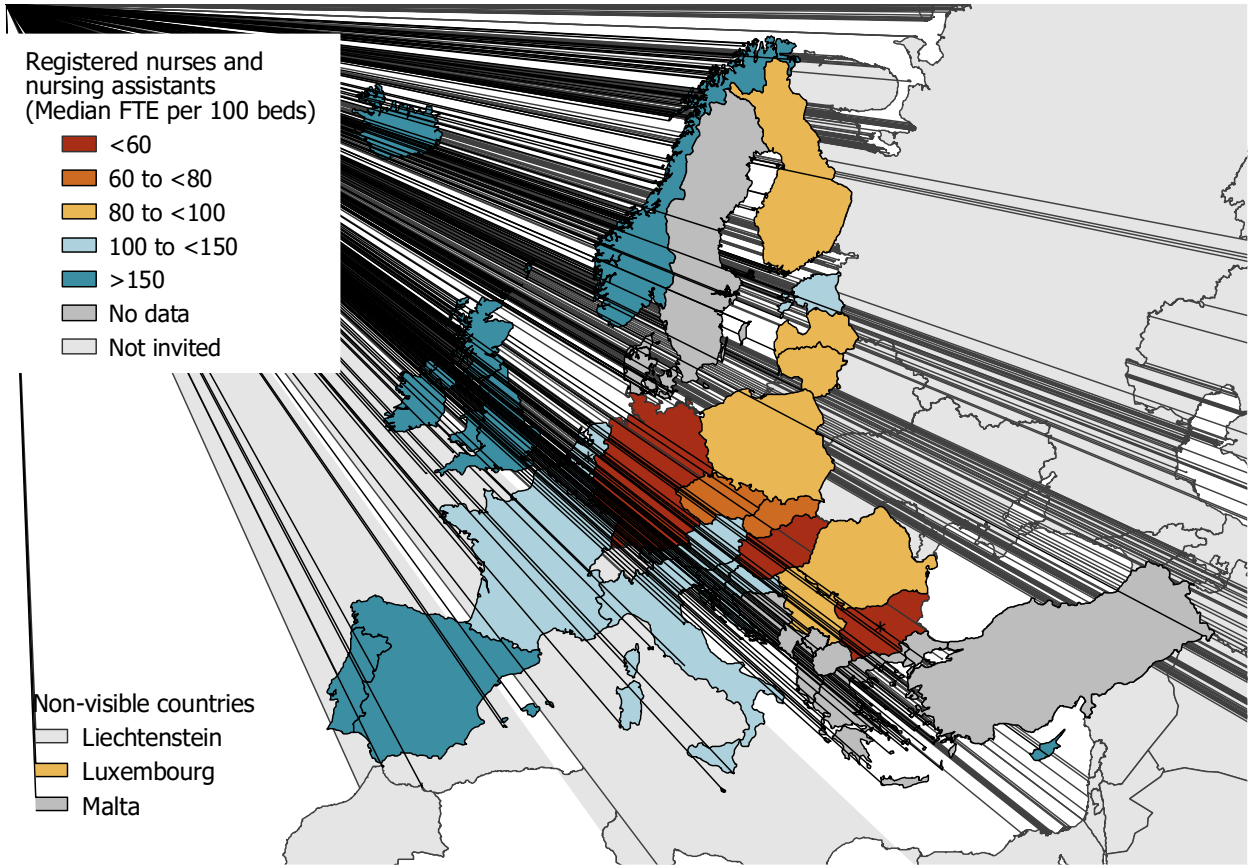
Bed occupancy

- High: ≥ 75%
- Low: <75%

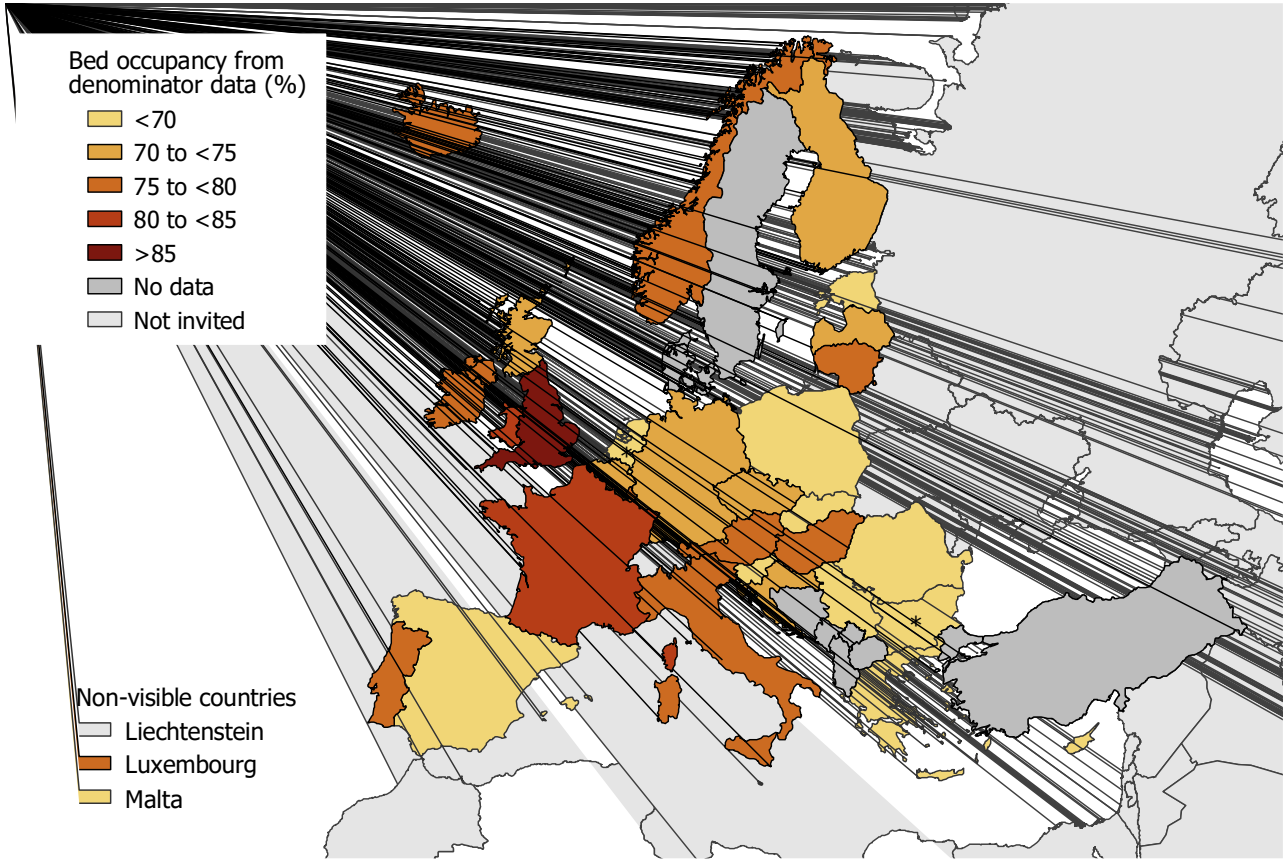
Source: ECDC PPS 2016-2017, unpublished results

Workload: staffing (registered nurses and nursing assistants) and bed occupancy

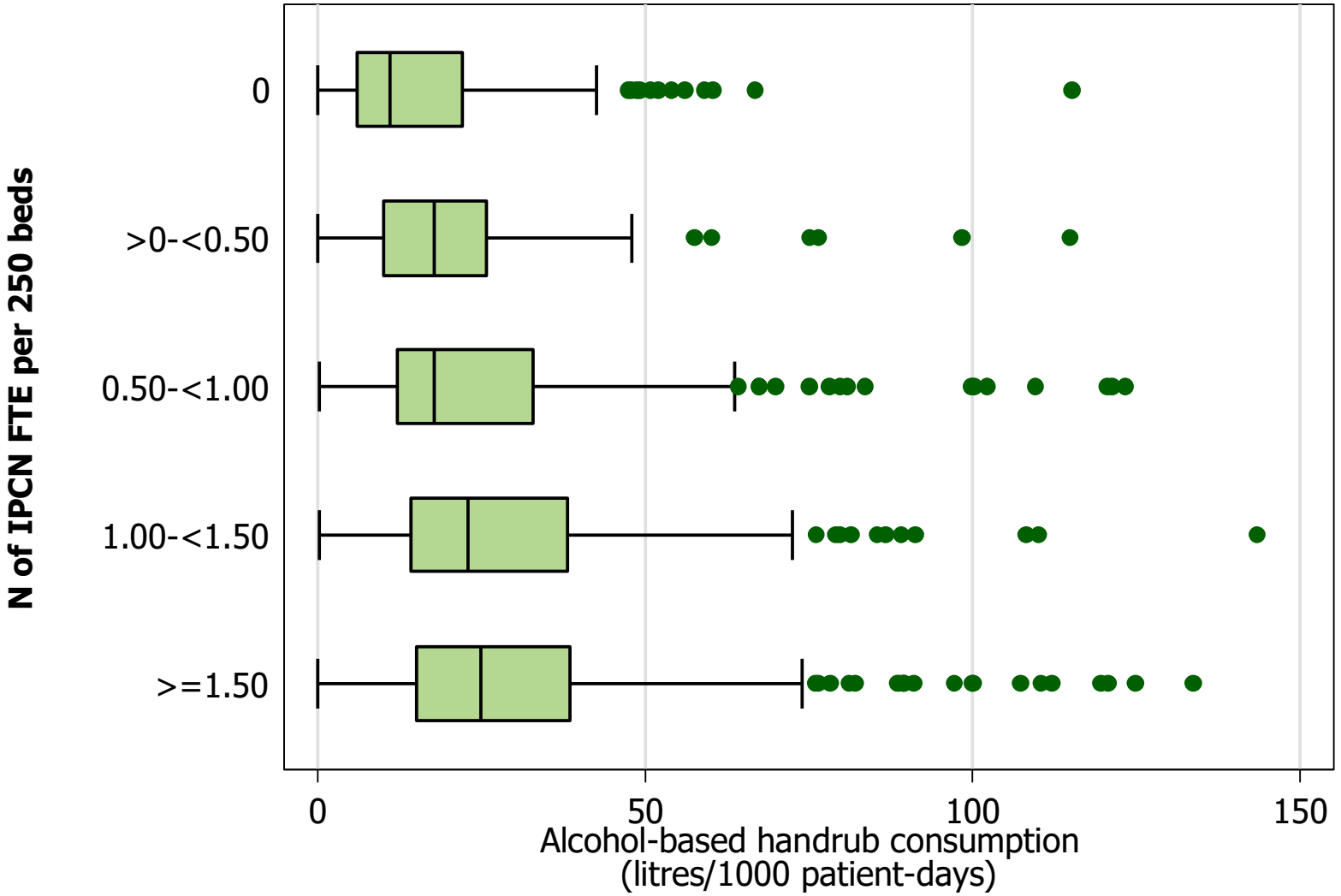
Nursing staffing levels



Bed occupancy



ECDC PPS 2016-2017: Hand hygiene and IPC nurses



Source: ECDC PPS 2016-2017, unpublished results; IPCN: Infection Prevention and Control Nurses

Conclusions

- Hand hygiene is an independent determinant of antimicrobial resistance in healthcare-associated infections in European hospitals, in addition to:
  - Antimicrobial use
  - Antimicrobial stewardship
  - IPC nurses staffing levels
  - Isolation capacity
- Alcohol-based handrub (AHR) consumption in PPS associated with:
  - Workload: staffing levels of registered nurses and nursing assistants and bed occupancy
  - AHR dispensers at the point of care
  - IPC nurses staffing levels

Source: ECDC PPS 2016-2017; IPCN: Infection Prevention and Control Nurses

WHO Multimodal Hand Hygiene Improvement Strategy

Based on the evidence and recommendations from the WHO Guidelines on Hand Hygiene in Health Care (2009), a number of components make up an effective multimodal strategy for hand hygiene

ONE System change
Readily accessible alcohol-based handrub at the point of care

+

TWO Training / Education
Providing regular training to all healthcare workers

+

THREE Evaluation and feedback
Monitoring hand hygiene practices, infrastructure, perceptions and knowledge, while providing results feedback to health-care workers

+

FOUR Reminders in the workplace
Prompting and reminding health-care workers

+

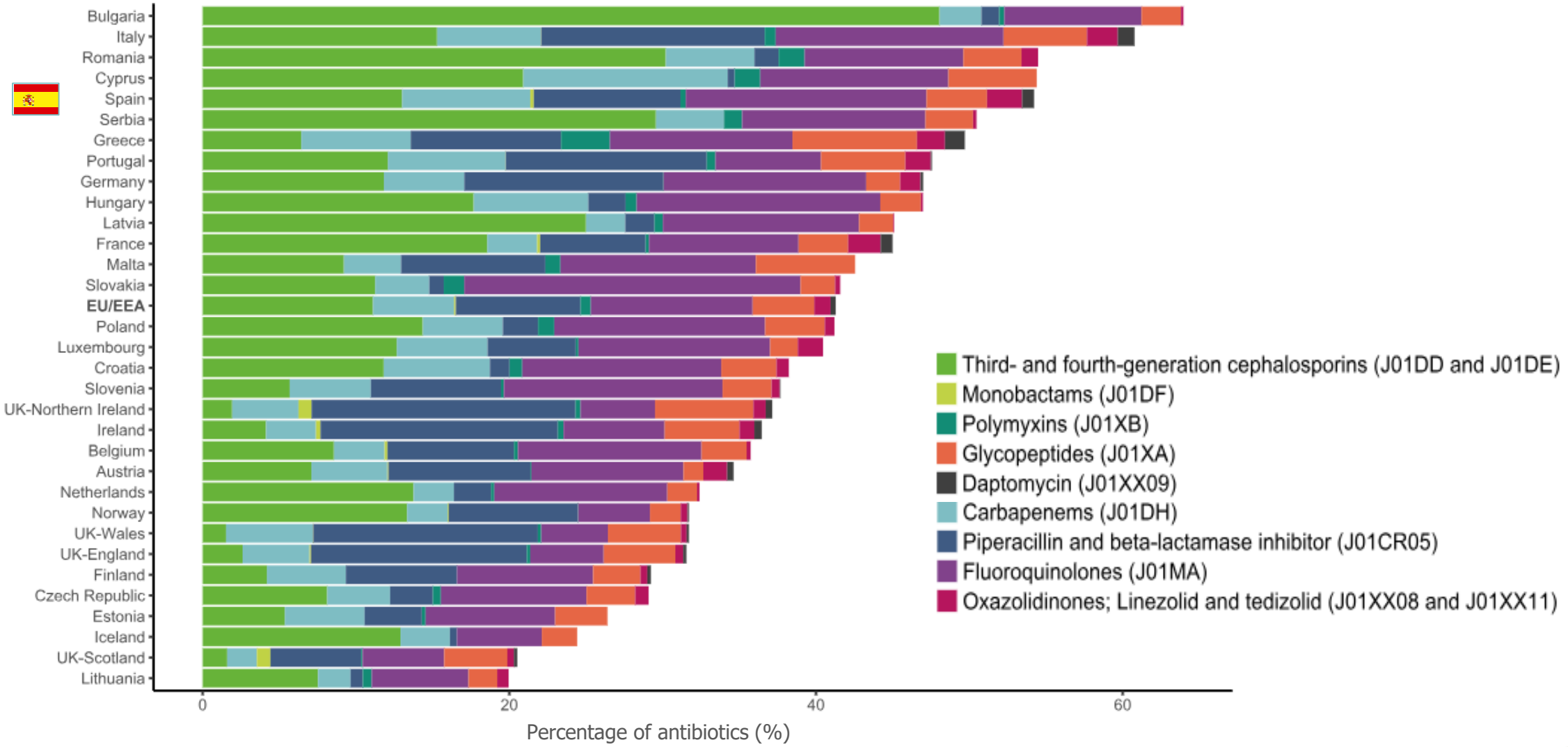
FIVE Institutional safety climate
Creating an environment and the perceptions that facilitate awareness-raising about patient safety issues

Source: WHO Guidelines on Hand Hygiene in Health Care, 2009.

Specific recommendations from ECDC PPS 2016-2017

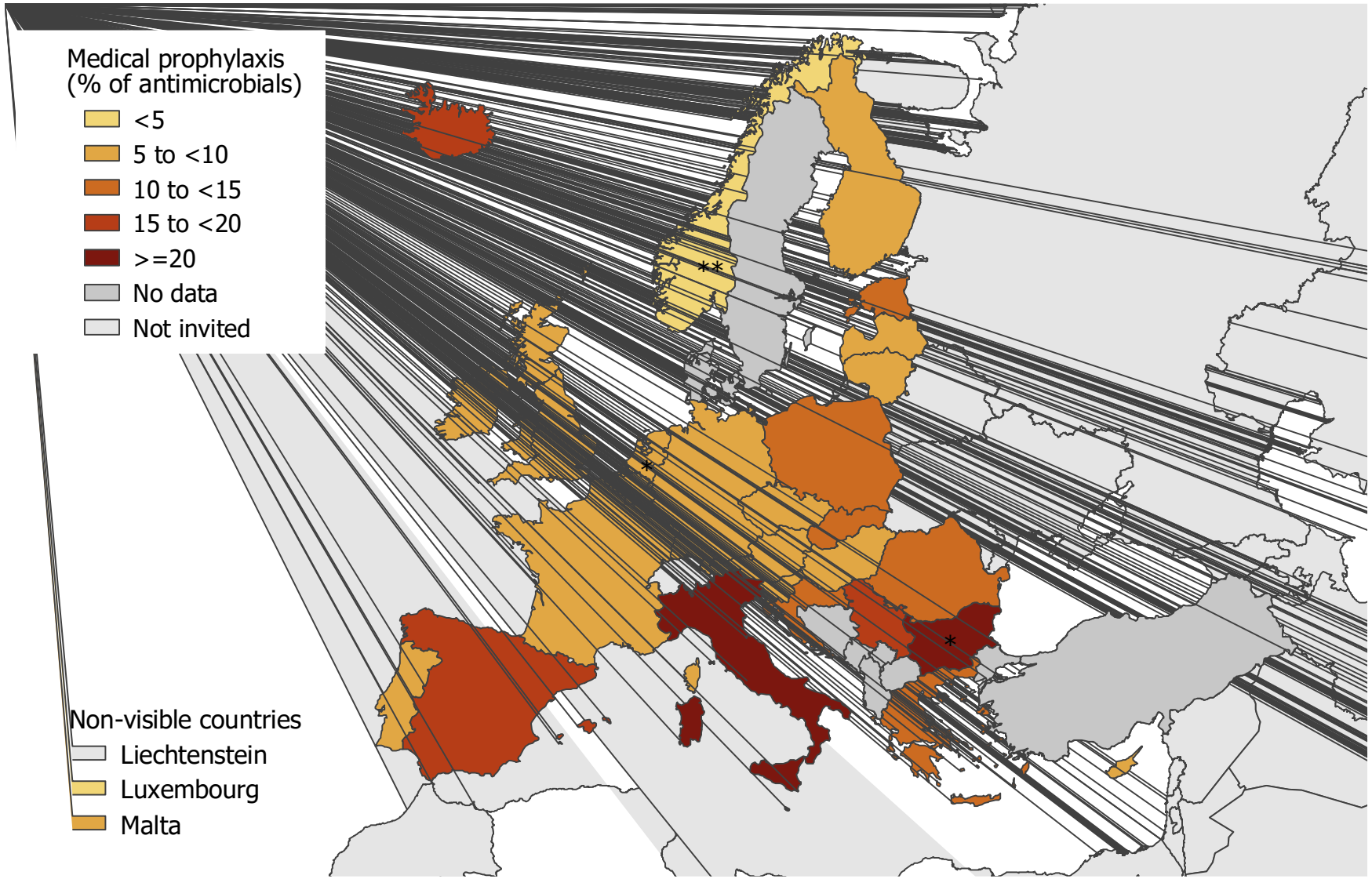
1) increasing IPC nurse staffing levels to (ideally) one IPC nurse per 100 occupied beds,
2) installing alcohol hand rub dispensers at point of care,
3) ensuring adequate nursing staffing levels in accordance with workload to improve hand hygiene compliance,
4) increasing the percentage of single rooms to improve isolation capacity,
5) increasing post-prescription review of antimicrobial treatment, deescalating when possible
6) ensuring dedicated time for antimicrobial stewardship consultancy
7) urgent need to harmonise and support microbiological diagnostic testing of HAIs in EU/EEA hospitals,
8) PPS methods: validation, training, numeric rather than `yes/no/unknown' indicators, promote automated HAI surveillance

Proportion of broad-spectrum antibiotics in acute care hospitals, EU/EEA countries & Serbia, 2016–2017



Source: Plachouras D, et al. Eurosurveillance 15 November 2018.

Proportion of antimicrobials used for medical prophylaxis



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+ ≥ 2257 participating hospitals !