Educational Workshop

EW05: Infection control issues in different types of long-term healthcare facilities (LTCF)

Arranged with the ESCMID Study Group for Infections in the Elderly (ESGIE) and the ESCMID Study Group for Nosocomial Infections (ESGNI)

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U. Frank (Heidelberg, DE) – no handout available
Cookson - National and local performance indicators for infection prevention and control and antimicrobial stewardship in LTCF

National and local performance indicators for infection prevention and control and antimicrobial stewardship in LTCF
(from HALT Project)
Professor Barry Cookson

HALT Performance Indicator (PI)
Methods
• Used HARMONY methodology in Word and Excel Spreadsheets (used in IPSE and WHO projects)
• National PIs stemmed from the IPSE WP2 work (Cookson et al, J Hosp Infect 2011: 79; 260-264)
• Local PI methods developed (consensus) and piloted
• Both included Infection Prevention & Control (IPC) & Antimicrobial Stewardship (AS) PIs
• Local PIs collected as part of the HALT Point Prevalence Survey (other systems developed but took too long and external audits impossible)

HALT LTCF’s National Performance Indicator
Range of Performance
(% of possible total in 32 Countries)
Important Points:

- Examples where NPIs fully implemented: so are feasible
- Most NPIs very significantly related: indicating they were considered important
- “Guidelines” and “IC Structure” were related significantly to European regions ($p \leq 0.05$)

Accreditation/Inspection (A/I)

- Terms not indicate what was in place!
- A/I not evident in 7 (22%) Countries
- 9 (28%) included IPC in the A/I
- 7 (22%) included IPC and ASt in A/I
- Multivariable analysis:
  Only “Expert Advice” was associated with A/I and only if included IPC and ASt.
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### 44 PIs in Seven HALT Local PI Categories

<table>
<thead>
<tr>
<th>LPI No</th>
<th>Local Indicator Category collected during the PPS</th>
<th>No of PIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clinical Governance</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Infection Control parameters</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Hand Hygiene</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Other protocols for Infection Prevention &amp; Control (PR)</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Antimicrobial Stewardship (ASt)</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>Infection diagnosis/Laboratory Support</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Surveillance</td>
<td>4</td>
</tr>
</tbody>
</table>

### LP1 CG: Clinical Governance

- **Mean Total:** 29%

### LP1 CG: Clinical Governance

- Inf Cont Committee: 3%
- Meeting/Year: 4%
- Antibiotic Committee: 11%
- Designated In Charge Physician and Nurse (~37% missing): 5%

Max Score (6): 5
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**LP2 IC: LTCF Scores for Infection Control Parameters**

- Mean Total: 48%

**LP2 IC: Infection Control Parameters**

- ECDC request
- Access to Expert IC advice
- Care Protocol Development
- Decontamination
- Supervisor
- Training: Nurses/Parameds
- Medical

**LP3 HH: LTCF Scores for Hand Hygiene**

- Mean Total: 79%
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**LP3 HH: Hand Hygiene**

- Training
- Protocol
- Alcohol Rub
- Liquid Soap
- Audit
- 1% Only Bar Soap (AUDIT?)

**ECDC: Alcoholic Hand Rub (AHR) Consumption**

- Some of the data collected of dubious provenance
  - Range uses 6 Opps/month to 100 Opps/day
- Relationships with lengths of patient stay and types of LTCF
- Needs external audit data?
  - Likely not using when should
  - Using more than the recommended volumes of AHR at each usage
  - Using it for visitors or perhaps disinfection of surfaces?
  - Not recording accurately

**LP4 PR: LTCF Scores for Inf. Control Protocols**

- Mean Total: 62%
- Other protocols for Infection Control (MAX=6)
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**LP4 PR: Infection Control Protocols**
- Urinary Catheters
- Venous Catheters
- Enteral Feeds
- MRSA Carriers
- Flu Immunisation Offered
- Multi-Res. Org. Patient Isolation

**LP5 AST: LTCF Total Scores for Antimicrobial Stewardship**
- Mean Total: 21%

**LP5 AST: LTCF Scores for each of 12 Antimicrobial Stewardship LPIs**
- Responsibility may lie outside home: Need interactions in HALT 2
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LP6 DS: LTCF Scores for Diagnostic Support

![Bar chart showing infection diagnosis/laboratory support scores for 22% of LTCFs. Mean total: 40%]

LP6 DS: Diagnostic Support

![Bar chart showing antimicrobial resistance profiles and microbiological samples taken. Urine dipstick: 86%, Microbiological samples taken: 51%.]

LP7 Surv: LTCF Scores for Surveillance

![Bar chart showing surveillance scores for 40% of LTCFs. Mean total: 30%]
The HALT LTCF showed very different designs with wide ranges of ratios for single room/beds, single rooms/rooms and rooms/beds. No relationship with the various LPIs. More details needed to interpret this PI.
- Not explore single rooms where flexibly used
- Specific single rooms available for isolation purposes incl. use at terminal stages of life
Case Mix: Type of LTCF and LPIs?

- Type of LTCF related to LPI mean scores for 5/7 LPIs
- Contributions to significance related to three largest LTCF types represented (Residential, General & mixed)
- Other types also some significant differences.
  - All performed well for LP3 HH
  - Mixed LTCFs performed best for LP1 CG and LP2 IPC
  - General NH performed best for LP6 DS and LP7 Surv
  - No significant differences for LP4 PR
- Need a good, simple & validated scoring system.
- Explore in larger numbers of homes; especially “step-down” or “intermediate care” LTCF

Case Mix: LTCF specialism and LPIs?

- Specialism: vast majority of the HALT PC were “All/some of the above” the analysis was un-interpretable.
- This part of the questionnaire needs to be revisited.

Case Mix: Lengths of stay and LPIs?

- Lengths of stay
  - Needs more detail
  - Largely skewed towards “Long (>12m)” and “Defined lengths of stay (to death)”
- Just LP6 DS was significant in these analyses for all its three component PIs
Regional and Country Effects

• Several regions had strong effect in many LPIs
• Particularly evident for the Northern and Eastern regions (for two LPIs), and the Baltic States for four LPI
• Contributions of the countries with the majority of the HALT LTCF explained many but not all regional effects

Accreditation Effects

• LP3 HH performance improved when there was any Accreditation system.
• LP1 CG and LP3 IC both showed an improved performance when Accreditation included IC
• This further increased for CG when ASt was added.
• Needs more data for their correct interpretation;
  – date of commencement
  – penalties for non compliance
  – periodicity, regularity
  – speed and granularity of the feedback of audit data

Summary

• Established by consensus new tools to assess NPI and LPI for LTCF IC and ASt
• The HALT LPIs realistic
  – Some LTCF scored maximum points for 6/7 LPIs
  – Lowest was for LP5 ASt (23%) – Clinical Governance mechanisms often outside the LTCFs’ aegis
• The LPIs have potential as useful indicators for benchmarking and CQI intra-LTCF
  – Mode near max score only for LP3 HH and LP4 PR so room for improvement in many of them
  – Good correlations between total LP scores for 2/3 of the comparisons; may be helpful in examining future performance?
• LP1 CG has to be improved and Nationally!
Cookson - National and local performance indicators for infection prevention and control and antimicrobial stewardship in LTCF

Acknowledgements

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• Jacques Fabry
• Carl Suetens
• All HALT national contact points
Appropriate antibiotic therapy in the elderly: open issues from ICU to LTCF

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Infection Control Program - Geneva University Hospital

PGEW 05
Berlin, 27.04.2013

Infectious diseases in older persons compared with younger individuals are relatively more frequent and severe

- The elderly also suffer greater complications of these infections, which eventually contribute to a higher mortality
- Infections in aging adults that are associated with increased morbidity include pneumonia, often complicated by bacteremia, delayed resolution, and pulmonary function compromise
- TB infection and disease, which is prone to dissemination and consequent development of extrapulmonary and miliary forms
- UTIs, which often is associated with bacteremia and persistence or recurrence of infection
- Intra-abdominal infections (i.e., cholecystitis and diverticulitis), which are more likely to progress to abscess formation, perforation, and gangrene

Elderly and Intensive Care
a new tale to be written

- Given the progress and advancements in intensive care management and in medical and surgical procedures, decision about admitting elderly patients to the ICU cannot be made considering age alone, but taking into account individualized factors such as the reason for hospital admission
- Once elderly patients are admitted to the ICU, similar aggressive treatment could be performed, expecting a similar outcome for people older than 64 years compared to those older than 74 years
- Studies evaluating hospital costs and long-term outcome after ICU discharge are needed, searching specifically for patients who do not benefit from intensive care treatment.
Influence of age and intensity of treatment on intra-ICU mortality of patients older than 65 years admitted to the intensive care unit

• Patients admitted to a medical-surgical ICU were divided in two groups:
  - group A 65 to 74 years old
  - group B, older than 74
• Both groups were compared for APACHE II score, admission group, length of stay, usual ICU procedures (arterial and venous catheters, mechanical ventilation and tracheostomy) and mortality
• In this series of ICU patients, cardiac disorders had higher intra-ICU mortality in those >74 years old. Once admitted, no restriction for ICU procedures was applied to older patients

The higher death rates in older patients are the result of many factors

• Diminished host defenses
• Presence of underlying diseases (e.g., diabetes mellitus, malignancy, cerebrovascular accidents, and alcoholism)
• Nosocomial infections
• Complications from diagnostic and therapeutic procedures, and delays in diagnosis and treatment as well as adverse reactions to antibiotics

Health care-associated infection in elderly people

• Although data to assess the size and nature of the problem are very limited, infections in LTC facilities are very common.
• Infections in LTCF in USA: over 100,000 deaths and cost over $1 billion annually
• Infections cause 26% to 50% of transfers to hospitals in nursing homes in USA
• Increasing use of antibiotics among residents: 4 to 7 antibiotics course per 1000 resident-days
• Risk factors: impaired immunity, chronic underlying diseases, colonization by MDR pathogens, invasive devices, pressure ulcers, poor nutritional status, overcrowding.
• Type of infection: UTI 25-30%, pneumonia 13-48%, soft tissue infections, upper respiratory tract infection, gastrointestinal

Although data to assess the size and nature of the problem are very limited, infections in LTC facilities are very common.
Ethical or professional dilemma?

- Minimum criteria to support antimicrobial initiation for UTIs are frequently absent in NH residents with advanced dementia.
- Antimicrobial therapy is prescribed for the majority of suspected UTIs that do not meet these minimum criteria (82/110 episodes, 74.5%).
- Urine specimens are frequently positive regardless of symptoms.
- These observations underscore the need to reconsider the diagnosis and the initiation of treatment for suspected UTIs in advanced dementia.
- Can we then speak of patient safety?

Rapid diagnosis and prompt institution of appropriate antibiotics are essential for improved survival from infectious diseases in this population.

PCT and infection in elderly patients

PCT may be useful to identify severely ill elderly patients admitted to an acute geriatric ward but not to discriminate patients with infection from those without.


Any other help??
Certain antibiotics are associated with an increased side-effect profile in older patients:

- Aminoglycosides (renal and auditory nerve dysfunction)
- β-lactams (seizures, skin rash)
- Macrolides (nausea, abdominal cramps)
- Vancomycin (renal dysfunction)
- Quinolones (seizures, hallucination)
- Drug interactions in the elderly are increased as a consequence of greater numbers of medications taken concomitantly than as a consequence of age per se.

**National Surveillance of Emergency Department Visits for Outpatient Adverse Drug Events**

Budnitz DS et al. JAMA 2006; 296: 1858-1866

**Drug Class and Adverse Drug Events**

- Estimated annual incidence of adverse drug events treated in US emergency departments vs age.
Cost Efficiency
The cost of antimicrobial therapy for the elderly is an important consideration in the overall management of infections.

- Although the acquisition costs of antibiotics contributes significantly to the overall expense of antimicrobial therapy, other costs must be taken into account when making valid cost comparisons among different drugs:
  - Preparation and administration costs (drug reconstitution, intravenous administration material, pharmacy labor) and costs of monitoring of drug levels and adverse reactions.
- An often overlooked cost, which should be considered in the overall expense of antimicrobial therapy, is the cost of additional medical care required because of adverse reactions to antibiotics.

Adverse Drug Reactions in a Population of Hospitalized Very Elderly Patients

Drugs Aging 2012;29:669-679

Risk of serotonin syndrome with concomitant administration of linezolid and serotonin agonists.

Huang V et al. Pharmacotherapy 2006 Dec; 26(12): 1784-93
Pagani - Appropriate antibiotic therapy in the elderly: open issue from ICU to LTCF
Pagani - Appropriate antibiotic therapy in the elderly: open issue from ICU to LTCF

Age-related changes in pharmacokinetics and pharmacodynamics: basic principles and practical applications


The elderly—a challenge for appropriate drug treatment


POLYPHARMACY AND PRESCRIBING QUALITY IN OLDER PEOPLE
Therapy should maximally reduce or eradicate the bacterial load

- **Increasing resistance**
- **Spread**
- **Selection of resistant bacteria**

**Appropriate treatment**

- **Bacterial eradication**
- **Maximize clinical cure**
- **Minimize potential for resistance**

Infection

**Inappropriate treatment**

- **Failed bacterial eradication**

Prompt institution of **appropriate** antibiotics.

- The selection and dosing of antibiotics in the elderly necessitates a clear comprehension of the physiologic changes:
  - e.g., the decline in renal function and consequently the clearance of these agents
  - and the higher frequency of adverse drug reactions commonly encountered in this vulnerable population

- Although it is unclear whether drug absorption, hepatic metabolism, and drug response vary significantly with old age, it is evident that drug clearance from the body, particularly through renal mechanisms, is altered in aging persons.

**Defining pharmacokinetics and pharmacodynamics**

- **Pharmacokinetics (PK):**
  - reflects how a drug is absorbed, distributed and eliminated in the body
  - these factors, along with the dosing regimen of the drug, determine the time course of drug concentration in the serum, tissues and body fluid

- **Pharmacodynamics (PD):**
  - the relationship between a drug’s serum concentrations and its pharmacological and toxicological effects
  - in other words, PD integrates PK with drug potency (measured by the drug minimum inhibitory concentration [MIC] against a bacterium)

Craig WA. *Clin Infect Dis* 1998; 26:1-12
Pharmacokinetic parameters

- Clearance
- Volume of distribution
- Half-life ($t_{1/2}$)
- Protein binding
- Bioavailability

The fate of an antimicrobial within the human body.
The basis of PK & PD *in vivo* (relationship between dose and effect)

Loss of protein binding affects free active concentration of highly bound antimicrobials

Hypoalbuminemia in elderly may greatly affect drug disposition and active concentration (drug loss)
PECULIAR ASPECTS OF DRUG THERAPY IN THE ELDERLY

**DISTRIBUTION**

- ↑ conc. of hydrophilic drugs
- ↓ total body water

**PK EFFECT**

As a result of reduced muscle mass with age, the creatinine clearance is a more accurate estimate of renal function than the serum creatinine.

**THE RELATIONSHIP BETWEEN AGE AND GLOMERULOSCLEROSIS**

(Neugarten et al., 1995)

**RENAL ELIMINATION**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>RBF and GFR</th>
<th>t1/2 of renally eliminated drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30</td>
<td>↓</td>
<td>∼1</td>
</tr>
<tr>
<td>40-50</td>
<td>↓</td>
<td>∼1.2</td>
</tr>
<tr>
<td>60-70</td>
<td>↓</td>
<td>∼2</td>
</tr>
<tr>
<td>80+</td>
<td>↓</td>
<td>∼2.5</td>
</tr>
</tbody>
</table>

PECULIAR ASPECTS OF DRUG THERAPY IN THE ELDERLY

**PHYSIOLOGIC CHANGES**

**PK EFFECT**

**DISTRIBUTION**

- ↑ ratio of adipose tissue to lean tissue
- ↑ t1/2 of lipophilic drugs

**METABOLISM**

- ↓ phase 1 enzyme (CYP-450) activity
- ↑ t1/2 of drugs metabolized by CYP 450 enzymes
Improving efficacy with less toxicity
(the aminoglycoside example)

- Allow optimal H/R/P parameters (Cmax/MIC > 1) & only dosing allows reaching the PK/Pa objectives on several 
bacterial strains, especially Pseudomonas aeruginosa.
- Facilitates tissue distribution because of high plasma tissue concentration gradients.
- Has a clinical effectiveness at least identical to administration with several daily injections.
- Is responsible for comparable or inferior renal toxicity and ototoxicity.
- Decreases the risk of resistant mutant emergence.

Méd Mal Infect 2012;42:303-308

Cefepime Dosing

- 1 gram q8h gives same T>MIC exposure as 2 gram q12h
  - TA (70% T>MIC) = 78% vs 77%, respectively
- Saves approximately $10 per patient per day due to use of ½ less drug
- Use empirically targeted at higher MIC organisms


HA-Acute kidney injury in the elderly

- Elderly hospitalized patients are at high risk of developing AKI
  - Age-related changes in the kidney
  - Systemic vasculature
  - Immunological system
  - Frequent comorbidities
  - High exposure to iatrogenic insults
    - Medications
    - Radiocontrast agents
    - Surgery
Factors potentially contributing to perioperative, HA-AKI

Chronopoulos A et al. Nat Rev Nephrol 2010;6:141-149

Systematic review and meta-analysis of vancomycin-induced nephrotoxicity associated with dosing schedules that maintain troughs between 15 and 20 mg/L

Site-specific toxicity targets & antibiotic missiles
(such famous collateral damages..)

Ricci Z, Ronco C. Swiss Med Wkly 2012;142:w13662
Antibiotic dosing in critically ill patients with acute kidney injury

- Altered drug PK in critically ill patients with AKI and heterogeneous renal replacement therapy (RRT) techniques in ICU preclude standardized antibiotic dosing
- Most critically ill patients with AKI exhibit altered antibiotic PK that necessitate increased doses in spite of decreased renal clearance, particularly when serious infections are implicated

Risk factors for HA-AKI in the elderly

- Age-related changes in the kidney, systemic vasculature or immunological system
- Co-existing illnesses (chronic kidney disease, cardiovascular, hypertension, diabetes, obstructive uropathy or infection)
- Hypovolemia
- Sepsis
- Medication-related toxicity (NSAIDs, diuretics, ACE inhibitors or nephrotoxic antibiotics)
- Contrast-induced nephropathy
- Perioperative factors

Towards individual drug-dosing strategies?

- Such specific characteristics should drive initial dosing decision:
  - Individual patient-specific
    - Body weight and fluid status
  - RRT-specific (if any)
    - Effluent rate, dialyzer flux, mode of fluid replacement
  - Drug-specific
    - Pharmacokinetics and pharmacodynamics
- Doses should be adjusted continually as a patient’s clinical status changes
- Drug dosing in patients with AKI can be quite complex!!
Take home messages...I.

- Pharmacokinetics of antimicrobials in aged people still misunderstood
- Many PK factors may affect drug disposition (renal function, adsorption, fluid replacement, ...)
- Age as a misleading factor in severe infections
  - Cave of underdosing hydrophilic drugs!
  - TDM of β-lactams
  - Consider dosage increase in critically ill aged people

Principles for prescribing in elderly
(not so easy to get there...)

- Identification of bacterial infection by optimized diagnosis
- Severity assessment
- Recognition and incorporation of local resistance data
- Targeting bacterial eradication (or maximal reduction in bacterial load)
- Use of pharmacodynamic (PD) indices to optimize choice and dosage
- Objective assessment of true (overall) costs of resistance and related treatment failure
- Patient safety-centered Antimicrobial Stewardship

Decreasing daily dosing according to physiopathological status

- High single dose (e.g., from 2 x 500 mg to 1 x 500 mg)
- Low dose of single dosing (e.g., from 4 x 500 mg to 4 x 250 mg)
Pagani - Appropriate antibiotic therapy in the elderly: open issue from ICU to LTCF

Decreasing daily dosing according to physiopathological status

<table>
<thead>
<tr>
<th>β-lactams</th>
<th>Aminoglycosides</th>
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<tbody>
<tr>
<td>Glycopeptides</td>
<td>Fluoroquinolones</td>
</tr>
<tr>
<td>Carbapenems</td>
<td>Lipopeptides</td>
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</table>

- **Cmax / MIC**
  - AMK: from 1 x 15 mg/kg to 15 mg/kg/48 hrs
  - CIP: from 2 x 500 mg to 1 x 750 mg
  - DAP: from 1 x 6 mg/kg to 6 mg/kg/48 hrs

- **Cmin > MIC**
  - TZP: from 3 x 4.5 g to 4 x 2.25 g
  - CAZ: from 3 x 2 g to 3 g CI/24 hrs
  - MEM: from 3 x 1 g to 4 x 500 mg

Take home messages...II.

- For short half-life, hydrophilic antimicrobials (β-lactams and carbapenems) prefer split doses and extended infusions (no PAE)
  - Minor daily exposure (about 1/4 to 1/3 less each day) with greater results on outcome and resistance

- Concentration-dependent usually with prolonged PAE: amikacin, gentamicin, ciprofloxacin and levofloxacin require higher single shot delaying next administration (Cmax/MIC > 10)
  - CIP 1 x 750 mg rather than 2 x 500 mg (1/4 less/day)
  - Amikacin 20-25 mg/kg/48 hrs rather than 2 x 7.5 mg/kg
  - TDM of peak levels for improved results

Some key points (certainly not all..)

- Early diagnosis of AKI is particularly important, but:
  - Occult decreased renal function is common in elderly
  - Serum creatinine is an unreliable marker of kidney function

- Preventative measures are the most important part of AKI management

- RRT is generally well tolerated and effective, but elderly patients are prone to hypotension, bleeding, and subtle disequilibrium syndrome
Fluid, electrolyte and acid-base disorders associated with antibiotic therapy

- Renal tubular function can be affected by antibiotic treatment without a concurrent reduction in glomerular filtration rate.
- Hypokalemia is a frequent complication of antibiotics.
- Aminoglycosides can affect renal tubular function in several ways and can lead to hypokalemia, acidosis and alkalosis.
- Carefully check prescribed medications whenever unexpected disturbances in electrolyte or acid-base balance occur.
Drug dosing decision must take into account pharmacodynamic as well as pharmacokinetic considerations.

Clinicians should compare their RRT protocols to those in published guidelines and ensure that their recommendations are applicable to the individual patient's clinical situation.

Hybrid RRTs require the same antibiotic dosing modifications as do continuous RRTs, but for hybrid therapies the dose timing must also be considered.

Collective responsibility:
- Sustain diversity of antibacterial therapy for all:
  - appropriate licensing
  - formularies and guidelines
  - education of prescribers, patients and the public
  - reduced over-the-counter availability
  - reduced non-therapeutic use
  - industry/academia research and development - new agents/formulations

Individual responsibility:
- Ensure each prescription is necessary and appropriate:
  - prescribe for bacterial infections only
  - maximize pathogen reduction/elimination
  - maximize clinical care
  - minimize development and spread of resistance.

LEADING CAUSES OF ADVERSE DRUG EVENTS

<table>
<thead>
<tr>
<th>Class of Drug</th>
<th>Causal, No.</th>
<th>Annual Estimates, No. (%)</th>
<th>Annual Estimates, No. (%)</th>
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<tr>
<td>Antihypertensives</td>
<td>1000</td>
<td>100 (100)</td>
<td>100 (100)</td>
<td>100</td>
</tr>
</tbody>
</table>
“Practical” approaches to drug dosing

- LD that will achieve the target serum concentrations based on the expected Vd should be given in nearly all situations.
- No adjustments need to be made for residual renal function or RRT for this initial dose.
- TDM should subsequently be used whenever possible.
- For hybrid RRT, additional attention should be paid:
  - To the timing of drug administration relative to that of the dialysis treatment.
  - Some drugs exhibit REBOUND: an increase of drug concentrations in the blood that can occur when RRT ends and drug sequestered in the tissues redistributes back into the blood.

Conclusions: ABC (the goal of antibacterial therapy)

- Appropriate antibacterial therapy guided by pharmacodynamics
- Bacteriological eradication
  - Clinical failure
  - Recurrence or relapse
  - Selection of resistance
- Clinical cure
  - Mortality
  - Morbidity
  - Resource utilization/cost

Clinical failure → recurrence or relapse → selection of resistance → morbidity → mortality → resource utilization/cost

Alterations in Absorption: Chelation

- Chelation
  - Irreversible binding of drugs in the GI tract
  - Tetracyclines, quinolone antibiotics - ferrous sulfate (Fe^{2+}), antacids (Al^{3+}, Ca^{2+}, Mg^{2+}), dairy products (Ca^{2+})
  - Usually separating administration of chelating drugs by 2+ hours decreases interaction effect

Trovafloxacin +/- Maalox®

Fasted
With Maalox


HA-Acute kidney injury in the elderly

- Elderly hospitalized patients are at high risk of developing AKI
  - Age-related changes in the kidney
  - Systemic vasculature
  - Immunological system
  - Frequent comorbidities
  - High exposure to iatrogenic insults
    - Medications
    - Radiocontrast agents
    - Surgery
Hand hygiene and other standard precautions
B. Allegranzi
Clean Care is Safer Care
WHO Patient Safety

Educational Workshop, “Infection control issues in different types of long-term healthcare facilities”, 23rd ECCMID, Berlin, Germany

HAI burden in LTCFs
- HAI prevalence in LTCF: 6-10 per 100 residents
- In USA LTCFs, 1.6 million to 3.8 million infections occur each year
- On average, any LTCF resident develops 1 to 3 infections per year, mainly UTI and pneumonia
- The onset of infection is the most common cause of hospital admission (26-50% of transfers to hospitals from LTCF) and death among residents in LTCF, mainly from pneumonia
- 19% of infections occurs in clusters/outbreak

• Strausbaugh LJ. Emerging Infectious Diseases, 2001, 7:268-271.

Estimates for Europe*
- LTCF residents with signs and symptoms of an infection on any given day in the EU: 117,800-140,600
- Average duration of an infection episode: 10 days
- Total number of infections in LTCFs in EU/EEA countries: 4.3 million each year based on signs and symptoms
- 2.6 million would be confirmed as HAIs


* Assuming an occupancy rate of 95%
Healthcare Associated infections in Long-Term care facilities (HALT) project – Dec 2008 - May 2011

Aims:
- to support prevention of HAIs and AMR in European LTCFs
- to provide a tool for assessment of the prevalence of HAIs (repeated point prevalence surveys) antimicrobial use, performance indicators for IPC practices and antimicrobial stewardship in LTCFs.

Estimated population:
- at least 62,000 LTCFs in the EU in 2010, with a capacity of about 3.1 million beds
  - 58% general nursing homes (residents needing 24-h medical or highly skilled nursing supervision)
  - 32% in residential homes (residents needing 24-h supervision of daily activities)
  - 10% in mixed facilities

European prevalence survey of antibiotic & infection in nursing homes, 2010
- First EU-wide point prevalence survey from May to September 2010
- Total of 64,007 residents surveyed in 722 LTCFs in 25 countries
- Participating LTCFs: nursing homes (75%), mixed facilities (15%) and residential homes (7%)
- Confirmed HAI in 1,488 (2.4%) residents
- Most frequently reported HAI types: respiratory tract infections (33.6%), urinary tract infections (22.3%), skin and soft tissue infections (21.4%), conjunctivitis (8%) and gastro-intestinal infections (4.6%)
- 4.3% received at least one antimicrobial agent
- 48.9% of all antimicrobial agents prescribed for a UTI
- Uro-prophylaxis: 27.7% of all prescribed antimicrobial agents

Protective and risk factors associated with healthcare-associated infections in European studies

<table>
<thead>
<tr>
<th>Country</th>
<th>Protective Factors</th>
<th>Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy [4]</td>
<td>None</td>
<td>Degree of dependency, the presence of co-morbidities and immune disorders</td>
</tr>
<tr>
<td>Ireland [16]</td>
<td>None</td>
<td>Urinary catheters, deconditioning, pressure sores, other wounds, surgery is the patient’s job</td>
</tr>
<tr>
<td>France, Switzerland [10]</td>
<td>Presence of a psycho-behavioral disorder</td>
<td></td>
</tr>
<tr>
<td>Germany [23]</td>
<td>None</td>
<td>Urinary catheters, gastric tubes, age ≥ 65 years</td>
</tr>
<tr>
<td>Norway [14]</td>
<td>None</td>
<td>Blood transfusions or a stay of ≥ 26 hours in the hospital, presence of chronic heart disease, urinary incontinence, an existing catheter, a skin ulcer</td>
</tr>
</tbody>
</table>

* The degree of dependency was derived from the number of disabilities (N= activities of daily living (ADL), m-a, d-a, m > 4, m > 5 risk factors (x5))


Risk factors for specific HAIs – Frankfurt am Main, Germany

Risk factors for specific HAIs – Frankfurt am Main, Germany

<table>
<thead>
<tr>
<th>Type of infection</th>
<th>Risk factors with</th>
<th>Risk factors without</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infections severe</td>
<td>Urinary tract infections, hospital-acquired infections, skin infections, healthcare-associated infections</td>
<td></td>
</tr>
<tr>
<td>Infections mild</td>
<td>Urinary tract infections, hospital-acquired infections, skin infections, healthcare-associated infections</td>
<td></td>
</tr>
<tr>
<td>Infections minor</td>
<td>Urinary tract infections, hospital-acquired infections, skin infections, healthcare-associated infections</td>
<td></td>
</tr>
<tr>
<td>Infections minor</td>
<td>Urinary tract infections, hospital-acquired infections, skin infections, healthcare-associated infections</td>
<td></td>
</tr>
<tr>
<td>Infections minor</td>
<td>Urinary tract infections, hospital-acquired infections, skin infections, healthcare-associated infections</td>
<td></td>
</tr>
</tbody>
</table>


Healthcare-associated infections in long-term care facilities (HALT) in Frankfurt am Main, Germany, January to March 2011

<table>
<thead>
<tr>
<th>Type of site</th>
<th>Number of residents</th>
<th>Percentage of residents with HAIs</th>
<th>Range of percentage of HAIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term</td>
<td>64</td>
<td>1.2</td>
<td>0.0-11.5</td>
</tr>
<tr>
<td>Long-term</td>
<td>47</td>
<td>0.2</td>
<td>0.0-5.0</td>
</tr>
<tr>
<td>Skilled nursing</td>
<td>21</td>
<td>0.7</td>
<td>0.0-5.0</td>
</tr>
<tr>
<td>Geriatric</td>
<td>26</td>
<td>0.6</td>
<td>0.0-5.0</td>
</tr>
<tr>
<td>Other skilled</td>
<td>2</td>
<td>0.0</td>
<td>0.0-2.0</td>
</tr>
<tr>
<td>Health center</td>
<td>4</td>
<td>3.8</td>
<td>0.0-5.0</td>
</tr>
<tr>
<td>Nursing home</td>
<td>6</td>
<td>0.0</td>
<td>0.0-2.0</td>
</tr>
</tbody>
</table>

HAI in LTCF in the Netherlands (HALT 2010)

- 10 nursing homes, 1,429 elderly people
- Overall prevalence of 2.8% (range between the homes: 0.10–5.6%).
- UTI was the most prevalent diagnosed infection
- On average, antibiotics were used by 50 residents (0–7%)
- Of the 40 residents who showed signs of an HAI, 24 did not use antibiotics


Klebsiella pneumoniae carbapenemase (KPC)-producing Enterobacteriaceae

- Outbreak investigation (2008)
- 14 acute care hospitals, 2 LTACHs, and 10 nursing homes
- 42 cases
- 27.5% mortality
- 60% of cases were in one LTCF
- Only 10% of cases were acquired in acute care hospital

Won et al, CID 2011
MRSA colonization among LTCF residents

Studies in Europe: 0.9-22%

C. difficile in LTCF/nursing homes

• Large outbreak of CDIs, ribotype 027 in Northern France.
• 38 healthcare facilities (mainly LTCF and nursing homes), 529 CDIs over a 22-month period (281 laboratory-confirmed 027)
• Most cases were over 80 years-old (mean age: 79.8 years)
• Incidence: 1.19 cases/10,000 hospitalisation days in acute care facilities (range: 0.1 to 4.5) and 2.39 in LTCF (range: 0.15 to 19.8)


Source: Utsumi M, Age and Aging 2010
Courtesy: ML Moro

37 pathogens associated with 206 outbreaks in Nursing Homes, 1996-2008

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Median attack rate %</th>
<th>Median case fatality rate %</th>
<th>Median duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSV</td>
<td>40</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Norovirus</td>
<td>45</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>GAS</td>
<td>8</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>S. aureus</td>
<td>70</td>
<td>120</td>
<td></td>
</tr>
</tbody>
</table>

Source: Utsumi M, Age and Aging 2010
Courtesy: ML Moro
Factors associated with AMR in the elderly

• Transfer to the LTCF of colonized or infected patients from other institutions
• Excessive and inappropriate use of antibiotics, especially broad-spectrum antimicrobial agents:
  – Prescribing antibiotics for unproven bacterial infections (e.g., upper respiratory viral infections) or “prophylactic” antibiotics for residents/patients with chronic urinary catheters.
  – Prolonged use beyond the standard recommended duration
• Factors increasing the probability of microbial colonization (and subsequent infection): malnutrition, immunosuppression, urinary catheters, feeding tubes, pressure ulcers, and chronic immobility
• Inadequate adherence to infection-control measures

HALT Pilot Survey - ICP Resources in nursing homes (NH)

43 participating NHs (38.1%) had an IC practitioner
  ➢ 21/43 had both an IC nurse and an IC doctor
  ➢ 16/43 (37.2%) had an IC nurse, 6 (14.0%) had an IC doctor
  ➢ 20.7% of ICPs were external persons
Allegranzi - Hand hygiene and other standard precautions

HALT Pilot Survey - ICP Resources in NH

Long-term care facilities in Utah: A description of human and information technology resources applied to infection control practice

Infection control programs in long-term care

- IC Structure: Infection Control Practitioner (full-time every 200-300 beds) and IC Committee
- Surveillance
- Outbreak control
- Isolation and precautions
- Hand hygiene
- Resident health
- Employee health
- Antibiotic stewardship
- Education
- Other aspects of policies and procedures, facility management, disease reporting, performance improvement/resident safety

Courtesy: ML Moro
Infection control for MDROs in LTCFs

**Routine control**
- Monitoring MRSA and VRE culture results
- Communicating MDRO data to HCWs
- Assessing compliance with isolation precautions and HH
- Monitoring antimicrobial usage
- Notifying receiving or transmitting facilities of the presence of a MDRO
- Environmental cleaning for residents previously known to be infected or colonized with MDROs

**Additional control measures**
- Consultation from experts
- Intensification of education
- Increased efforts to control antimicrobial use
- Active surveillance cultures
- Point-prevalence culturing of targeted units
- Intensification of isolation with compliance assessment
- Monitoring environmental cleaning

SHEA/APIC Guidelines 2008

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UTI prevention in LTCF – same as in acute care

- Limiting use of catheters
- Insertion of catheters aseptically by trained personnel
- Use of as small diameter a catheter as possible
- HH before and after catheter manipulation
- Maintenance of a closed catheter system
- Avoiding irrigation unless the catheter is obstructed
- Keeping the collecting bag below the bladder
- Maintaining good hydration in residents
- Urinary catheters coated with antimicrobial materials: have the potential to decrease UTIs but have not been studied in the LTCF setting

SHEA/APIC Guidelines 2008

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LRTI prevention in LTCF

- HH after contact with respiratory secretions
- Wearing gloves for suctioning
- Elevating the head of the bed 30 to 45 degrees during tube feeding and for at least 1 h after to decrease aspiration
- Vaccination with pneumococcal vaccine in individuals over the age of 65 years

SHEA/APIC Guidelines 2008
Allegranzi - Hand hygiene and other standard precautions

**C. difficile outbreak control**

- **Control measures:** isolation precautions according to standards, reinforcement of hand hygiene (ABHR + HW) wearing gloves, dedicating equipment, environmental cleaning with hypochlorite solutions (0.5%), and a specific process for waste management
- **Reinforcement:** implementation of cohorting units with isolation in private rooms and dedicated staff personnel

Hand hygiene compliance in LTCFs

![Hand hygiene compliance in LTCFs chart]

Hand hygiene improvement and HAI reduction in LTCFs (1)

<table>
<thead>
<tr>
<th>Author</th>
<th>Type of study</th>
<th>Setting</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loeb M, 2003</td>
<td>Observational, prospective</td>
<td>50 Nursing Homes, Canada and US</td>
<td>Increased staffing, antibacterial soap use, number of sinks</td>
<td>Reduced risk of MRSA; Reduced risk of TMP-SMX R Enterobacteriaceae</td>
</tr>
<tr>
<td>Huang TT, 2008</td>
<td>Before-after</td>
<td>Taiwan, LTCFs</td>
<td>HH training program</td>
<td>HH compliance from 9.3% to 30.4%; Infection incidence from 1.7% to 1.5%</td>
</tr>
<tr>
<td>Makris AT, 2000</td>
<td>Controlled trial, before-after</td>
<td>LTCFs in US</td>
<td>IC educational program including HH</td>
<td>Infection incidence from 6.3% to 4.1%</td>
</tr>
</tbody>
</table>

Hand hygiene improvement and HAI reduction in LTCFs (2)

<table>
<thead>
<tr>
<th>Author</th>
<th>Type of study</th>
<th>Setting</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yeung WK, 2011</td>
<td>Clustered randomized controlled trial, before-after</td>
<td>7 LTCFs in Hong Kong</td>
<td>Pocket-sized containers of ABHR reminder materials, education</td>
<td>HH compliance from 26.8% to 33.3%; Incidence of serious infections from 1.42/1000 to 0.85/1000</td>
</tr>
<tr>
<td>Ho M, 2012</td>
<td>Clustered randomized controlled trial, before-after</td>
<td>18 LTCFs in Hong Kong</td>
<td>ABHR (WHO formulation), ABHR racks, pull reels, HH posters and reminders, a health talk, video clips, training materials, and performance feedback</td>
<td>Significant increase of HH compliance in intervention arms (27% to 61% and 22% to 49%); Decrease of respiratory outbreaks (IRR, 0.52; 95% CI, 0.05–0.93; P = 0.04) and MRSA infections requiring hospital admission (IRR, 0.61; 95% CI, 0.38–0.97; P = 0.04)</td>
</tr>
</tbody>
</table>
Effectiveness of WHO Multimodal Hand Hygiene Improvement Strategy in LTCFs in Hong Kong

Cluster randomized controlled trial
Nov 2009-July 2010
18 LTCFs with only 1 IC nurse
2 intervention (HH promotion with slightly powdered gloves or powderless gloves) + 1 control arms

Results
11,669 HH opportunities
HH compliance increased from 27.0% to 60.6% and from 22.2% to 48.6% in intervention arms I and II respectively.
Increase in HH compliance of 21.6% after intervention in both intervention arms compared to controls (both p<0.001)
Mean knowledge score increased from 5.5 to 6.6 in the intervention arms
Factors associated with less improvement: “Before touching patient” opportunity, activity index >40 opportunities/h, physiotherapist/occupational therapist

WHO Guide on Hand Hygiene in Outpatient and Home-based Care and Long-term Care Facilities

Main objective:
To provide conceptual and practical guidance for the application of the WHO Multimodal Hand Hygiene Improvement Strategy and the My Five Moments approach in healthcare settings where patients are not admitted as inpatients to a hospital

Ultimate aim:
To facilitate the implementation of hand hygiene improvement programmes and obtain maximum compliance with hand hygiene recommendations in these settings

Literature searches and reviews (2)

Hand transmission and HH practices in LTCF (Geneva)

Keywords: "Long-Term Care"[MeSH Terms], "Nursing Homes"[MeSH Terms], "Rehabilitation Centers"[MeSH Terms], "residential centers", "Residential Facilities"[MeSH Terms], "disease transmission, infectious"[MeSH Terms], hand hygiene, disease outbreak[MeSH Terms]

Source: PubMed  No language or time restriction
Summaries reviewed: 52
Full-texts reviewed: 23
Final selection: 11 articles

Critical elements for evaluation of hand hygiene opportunities

- Transmission risk according to procedure
- Infection risk for the patient
- Patients’ susceptibility status
- Patients’ colonization status
- Infection risk for the healthcare worker
- Frequency of the procedure

The geographical conceptualization of the transmission risk in the hospital setting

The patient zone concept

- The geographical distinction between patient zone and health-care area as far as hand hygiene performance is concerned, helps prevent microbial transmission between patients and health-care environment contamination.

- **Patient zone**: the patient and some surfaces and items in his/her surroundings that are temporarily and exclusively dedicated to him or her and his or her personal belongings.

- **Health-care area**: all physical surfaces outside the patient zone of patient X, including the other patients and their patient zones and the wider health-care environment.
The concept of the Five Moments does not change

Your 5 Moments for Hand Hygiene

1. Before patient contact
2. Before aseptic procedure
3. After body fluid exposure risk
4. After patient contact
5. After touching patient surroundings

The concept of the patient zone and health-care area requires adaptation

Hand hygiene in LTCFs – expert consensus

- In specialized nursing homes (mentally or physically disabled residents and mainly cared for in a dedicated space with dedicated equipment), the patient zone concept and hand hygiene recommendations should be applied in the same way as for hospitals.
- In residential facilities (semi-autonomous residents living in a community, having their own room or shared accommodation and moving within the home facility) hand hygiene recommendations apply only to situations where health care is delivered to residents (e.g. rehabilitation sessions, vital signs check), i.e. at the point of care (where the care procedure takes place) and do not cover any social contacts with or among LTCF residents unrelated to health-care delivery.
Practical examples

- Public vaccination campaign
- Blood drawing in a laboratory
- Visit to a general practitioner’s office
- Mother-and-child consultation in a health post
- Consultation in an emergency policlinic
- Home care
- Chest radiograph in a diagnostic centre
- Haemodialysis in a specialized ambulatory clinic
- Labour and delivery assistance
- Dental care in a clinic
- Long-term care facilities

Monitoring hand hygiene compliance...
German National Hand Hygiene Campaign „AKTION Saubere Hände” 2008 -2013
Participating Institutions by March 2012
- Inpatient Module: 707 hospitals, 51 rehabilitation clinics
- Long Term Care Module: 115 facilities
- Outpatient Care Module: 171 facilities

Courtesy, Christiane Reichard

My 5 moments of hand hygiene: the immobile* and the mobile resident

Hand hygiene and aseptic tasks and method of hand rub

www.aktion-sauberehaende.de | ASH 2011 - 2013
Before a clinical examination

Before helping the patient to mobilize

Before aseptic task
Allegranzi - Hand hygiene and other standard precautions

**After body fluid exposure**

Fuente: OMS
Coordinación de Cooperación Asistencial y Sociosanitaria
Dirección General de Asistencia Sanitaria
Subdirección de Coordinación

**After patient contact**

Fuente: OMS
Coordinación de Cooperación Asistencial y Sociosanitaria
Dirección General de Asistencia Sanitaria
Subdirección de Coordinación

**After contact with patient surroundings**

Fuente: OMS
Coordinación de Cooperación Asistencial y Sociosanitaria
Dirección General de Asistencia Sanitaria
Subdirección de Coordinación
Hand hygiene and glove use

GLOVES PLUS
HAND HYGIENE
= CLEAN HANDS

GLOVES WITHOUT
HAND HYGIENE
= GERM
TRANSMISSION

The use of gloves does not replace the need for cleaning your hands!

You should remove gloves to perform hand hygiene, when an indication occurs while wearing gloves.

You should wear gloves only when indicated (see the Pyramid in the Hand Hygiene Why, How and When Brochure and in the Glove Use Information Leaflet) – otherwise they become a major risk for germ transmission.
Allegranzi - Hand hygiene and other standard precautions

Wearing gloves: the worst enemy of hand hygiene?

“While numerous studies have been undertaken to improve our understanding of the determinants of hand hygiene behavior, it seems urgent to improve our understanding of the determinants of glove usage behavior as well.”

Future Microbiology 2011; 6(8), 635-637

Matthew Everard

American Journal of Infection Control

Brief report

Correlation between glove use practices and compliance with hand hygiene in a multicenter study with elderly patients

Matthew Everard, Ph.D., B.Sc., Mork-Leen, Jody-Gilliss, M.B., M.D., P. Record, M.D.

Correlation between glove use practices and compliance with hand hygiene in a multicenter study with elderly patients

Matthew Everard, Ph.D., B.Sc., Mork-Leen, Jody-Gilliss, M.B., M.D., P. Record, M.D.

• 11 HCF for the elderly
• 1,252 HH opportunities
• Gloves used for 344 (39.2%) contacts

Thank you

WHO Clean Care is Safer Care

Find all information at www.who.int/gpsc/5may
Send enquiries to savelives@who.int