

Hospital-Acquired Pneumonia – The Forgotten Hospital Associated Infection  
Martin Kiernan, University of West London  
A Webber Training Teleclass



# HOSPITAL-ACQUIRED PNEUMONIA

THE FORGOTTEN HEALTHCARE ASSOCIATED INFECTION

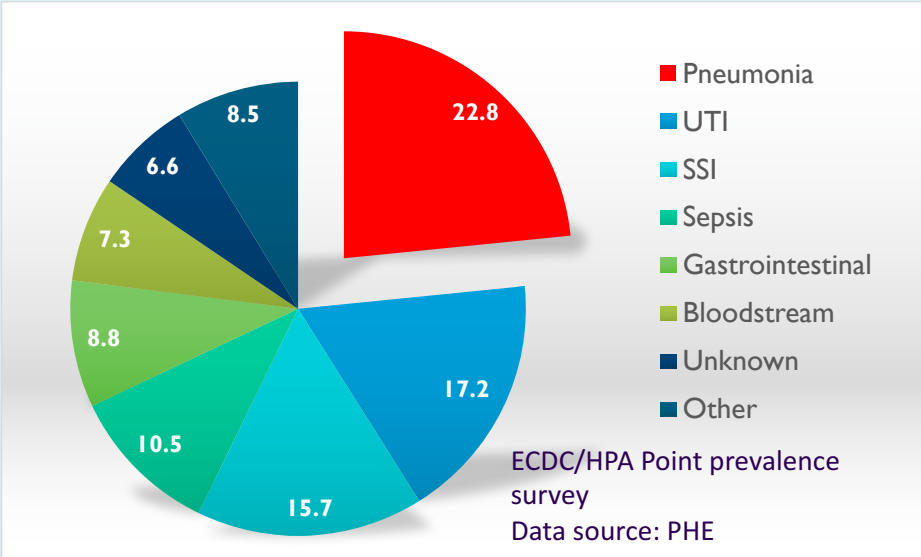
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## ENGLAND POINT PREVALENCE STUDY 2011 PROPORTIONS OF HCAI

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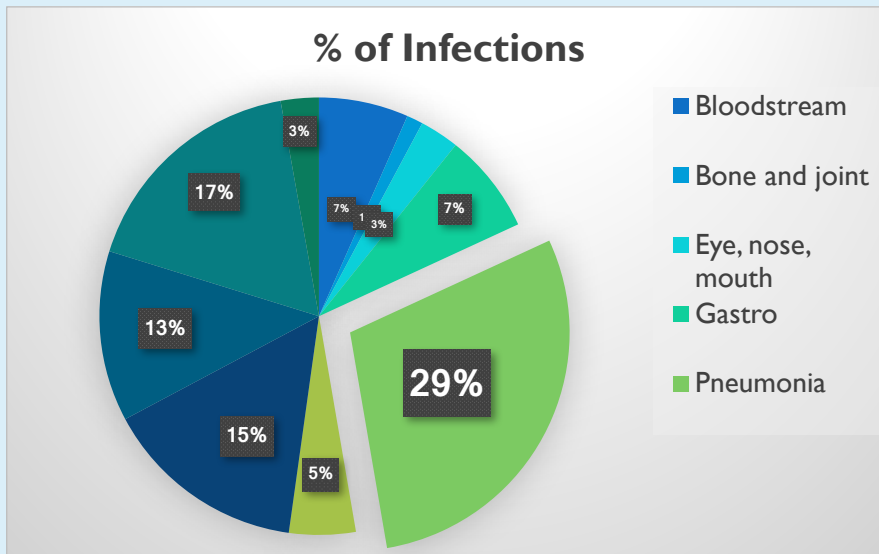


64% not ventilated

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## ENGLAND POINT PREVALENCE STUDY 2016

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74% not ventilated

## INTERNATIONAL ISSUE

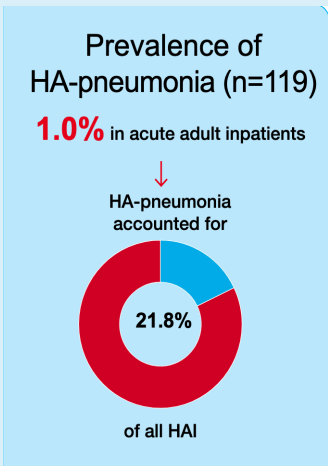
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- These findings are echoed in other large-scale international PPS including the USA, Europe, Argentina, Vietnam and Singapore
- Results from the 2016 PPS in Scotland show a slightly different picture with pneumonia responsible for 22.4% of HCAI, slightly behind UTI (24.5%) although as in England, the greater proportion (72%) of these infections had no history of assisted ventilation

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# EPIDEMIOLOGY IN SCOTLAND



**10.3%** of HA-pneumonia were present on admission to hospital

**Causative Microorganism**

Causative Microorganism	%
<i>H. influenzae</i>	23.8%
<i>S. aureus</i>	23.8%
<i>K. oxytoca</i>	14.3%
<i>E. coli</i>	9.5%
Other	28.6%

**Patients with HA-pneumonia**

**35.6%** female **64.4%** male

Median age: **74** years

**64.4%** had life limiting or end of life prognosis

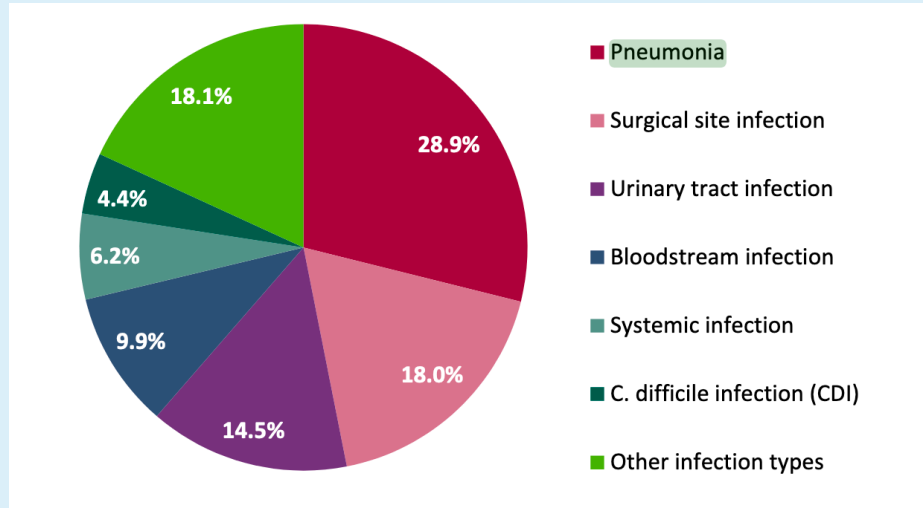
Specialty	%
Medicine	38.7%
Surgery	36.1%
Geriatric Medicine	16.8%
Intensive Care	5.9%
Psychiatry	1.7%
Other specialty	0.8%

**1 in 4** patients with HA-pneumonia were intubated prior to onset

Source: [https://hpspubsrepo.blob.core.windows.net/hps-website/nss/2204/documents/6\\_Infographic%20-%20Epidemiology%20of%20HA\\_Pneumonia.pdf](https://hpspubsrepo.blob.core.windows.net/hps-website/nss/2204/documents/6_Infographic%20-%20Epidemiology%20of%20HA_Pneumonia.pdf)

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# 2017 PPS IN IRELAND



Health Protection Surveillance Centre, Point Prevalence Survey of Hospital Acquired Infections & Antimicrobial Use in European Acute Care Hospitals, May 2017: National Report Ireland

## HEALTHCARE-ASSOCIATED PNEUMONIA IN IRELAND

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- 2017 PPS results show that the greatest proportion (29%) were pneumonia, 1.2% of inpatients
- Huge increase as a proportion in 2017 vs. 2012 (28.9 versus 17%)
  - Doubling of prevalence (1.9 vs. 1.0%) for hospitals that participated in both PPS
  - 195% increase in the HAI categories pneumonia & lower respiratory tract
    - Possible contribution of changed definitions
- Data collection was during May, outside of the traditional influenza season

## STRATEGIES

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**Table 4.6.** Hospital-wide multi-modal strategies to prevent HAI and promote antimicrobial stewardship

	Hospital-wide strategy (excluding ICU)*				
	Pneumonia	Bloodstream infection	Surgical site infection	Urinary tract infection	Antimicrobial use
Guidelines	13 (23%)	30 (53%)	27 (47%)	38 (67%)	57 (100%)
Care Bundles	3 (5%)	25 (44%)	17 (30%)	39 (68%)	15 (26%)
Surveillance	3 (5%)	44 (77%)	31 (54%)	22 (39%)	42 (74%)
Education	3 (5%)	27 (47%)	17 (30%)	28 (49%)	42 (74%)
Checklist	2 (4%)	17 (30%)	13 (23%)	19 (33%)	9 (16%)
Audit	3 (5%)	28 (49%)	18 (32%)	23 (40%)	48 (84%)
Feedback	5 (9%)	40 (70%)	31 (54%)	25 (44%)	49 (86%)

\*57 of 60 hospitals completed the hospital questionnaire

Health Protection Surveillance Centre, Point Prevalence Survey of Hospital Acquired Infections & Antimicrobial Use in European Acute Care Hospitals, May 2017: National Report Ireland

## OTHER FINDINGS

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- Only 16% of pneumonia infections were associated with intubation
- 85% were not critical care (where the guidelines and bundles are)
  - Responsible for 30% of all prescriptions
  - Major issue for antimicrobial stewardship
  - 84% had no microbiological diagnosis
  - How do you focus treatment and de-escalate?
  - What do you know about the epidemiology of the organisms responsible for these infections?

## BLOOD CULTURE VS RESPIRATORY CULTURE

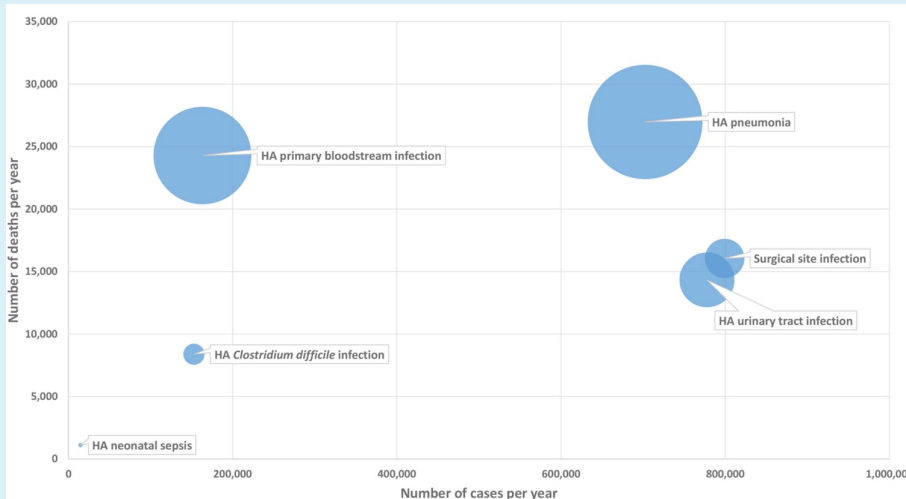
10

- There is a difference in clinical characteristics, treatment patterns, and outcomes in patients hospitalised for pneumonia with pathogens detected by blood versus positive respiratory cultures
  - Haessler, S. et al (2019). "Blood cultures versus respiratory cultures: Two different views of pneumonia." *Clin Infect Dis.* (In press)
- Very low overall prevalence of pathogen detection
  - <10% of 138,561 cases revealed a pathogen; majority by respiratory culture
  - Respiratory isolates more often resistant than blood isolates (54.2 vs. 26.6,  $p=0.001$ )
  - Respiratory cultures: most common pathogens *S. aureus* (34%) and *P. aeruginosa* (17%)
    - more likely to be colonisation rather than infection
  - Blood cultures most commonly grew *S. pneumoniae* (33%), then *S. aureus* (22%)

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WHY BOTHER? – BURDEN AND MORTALITY

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Cassini, A., et al (2016). "Burden of Six Healthcare-Associated Infections on European Population Health: Estimating Incidence-Based Disability-Adjusted Life Years through a Population Prevalence-Based Modelling Study." *PLoS Med* 13(10): e1002150.

Fig 1. Six healthcare-associated infections according to their number of cases per year (x-axis), number of deaths per year (y-axis), and DALYs per year (width of bubble), EU/EEA, 2011–2012 (time discounting was not applied). DALY, disability-adjusted life year, HA, healthcare-associated.

HAP ALSO HITS THE WALLET

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- 3-year study of HAP in Pennsylvania from 2009-2011 found that NV-HAP affects more people than VAP (5,597 vs 2,299), has comparable mortality rate (18.7% vs 18.9%), and has higher total costs (\$156 million vs \$86 million), respectively
  - Davis, J. and E. Finley (2012). "The Breadth of Hospital-Acquired Pneumonia: Nonventilated versus Ventilated Patients in Pennsylvania." *Pennsylvania Patient Safety Advisory* 9(3): 99-106
- Two hundred five NV-HAP cases occurred in 1 year at Montefiore Medical Center (1400 beds)
  - Incidence of 0.47 per 1000 patient-days
  - Estimated excess cost of \$8.2 million
    - Tesoro, M., et al (2018). "A Retrospective Study of Non-Ventilator-Associated Hospital Acquired Pneumonia Incidence and Missed Opportunities for Nursing Care." *The Journal Of Nursing Administration* 48(5): 285-291

## RISK FACTORS FOR HAP OUTSIDE OF ITU

SOPENA, N. ET AL. 2014 *AM J INFECT CONTROL* **42**(1): 38-42

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- Multivariate analysis identified significant risk factors for HAP
  - malnutrition
  - chronic renal failure
  - anaemia
  - depression of consciousness
  - Charlson comorbidity index  $\geq 3$
  - previous hospitalization
  - thoracic surgery
- Complications occurred in 57.1% patients
- Attributable mortality 27.7%



## UPDATE ON INCIDENCE AND RISK FACTORS

STRASSLE, P. D., ET AL. (2019). "INCIDENCE AND RISK FACTORS OF NON-DEVICE-ASSOCIATED PNEUMONIA IN AN ACUTE-CARE HOSPITAL." *INFECT CONTROL HOSP EPIDEMIOL*: (IN PRESS)

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- Cohort study in an academic teaching hospital, review of inpatients between 2013 and 2017, data were captured through comprehensive, hospital-wide active surveillance using CDC definitions and methodology
- 163,386 hospitalisations (97,485 unique patients) and 771 pneumonia cases (520 ND pneumonia and 191 VAP)
- Rate of ND pneumonia remained stable, with 4.15 and 4.54 ND pneumonia cases per 10,000 hospitalisation days in 2013 and 2017 respectively ( $P = .65$ )
  - In 2017, 74% of pneumonia cases were ND pneumonia
- Interestingly, a diagnosis of Dementia was protective (HR, 0.41; 95% CI, 0.18–0.95)

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## UPDATE ON INCIDENCE AND RISK FACTORS

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STRASSLE, P. D., ET AL. (2019). "INCIDENCE AND RISK FACTORS OF NON-DEVICE-ASSOCIATED PNEUMONIA IN AN ACUTE-CARE HOSPITAL." *INFECT CONTROL HOSP EPIDEMIOL*: (IN PRESS)

- Risk factors
  - Male sex and increasing age (<40..) associated with increased risk of ND pneumonia
  - Also chronic bronchitis or emphysema (hazard ratio [HR], 2.07; 95% confidence interval [CI], 1.40-3.06)
  - congestive heart failure (HR, 1.48; 95% CI, 1.07-2.05)
  - paralysis (HR, 1.72; 95% CI, 1.09-2.73)
  - immunosuppression (HR, 1.54; 95% CI, 1.18-2.00)
  - ICU (HR, 1.49; 95% CI, 1.06-2.09)
- No change in ND pneumonia risk with use of chlorhexidine mouthwash, total parenteral nutrition, all medications of interest, and prior ventilation

## SURVEILLANCE IS SPARSE

16

- Multi-centre study (USA, 21 hospitals) reported 71% of non-ventilator HAP occurred outside ICU and 19% required transfer into critical care
  - Baker, D. and B. Quinn (2018). *Am J Infect Control* **46**(1): 2-7.
  - HAP rate ranged from 0.12-2.28 per 1,000 patient days across the hospitals
  - Interesting finding was that 51% of cases were <66 years of age
  - limitation was that it was a retrospective case-note review
- Larger review of 2012 US National Inpatient Sample dataset (subject to limitations of coding data), estimated NV-HAP incidence at 1.6%, representing a rate of 3.63/1,000 patient days
  - Giuliano, K. K et al (2018). "The epidemiology of nonventilator hospital-acquired pneumonia in the United States." *Am J Infect Control* **46**(3): 322-327.



## MAKING SURVEILLANCE EASIER

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- Prospective surveillance is difficult and time consuming, so not done
- Automated surveillance to detect possible cases
  - Wolfensberger, A. et al (2019). "Development and validation of a semi-automated surveillance system-lowering the fruit for non-ventilator-associated hospital-acquired pneumonia (nvHAP) prevention." *Clin Microbiol Infect* **25**(11): 1428 e1427-1428 e1413
- Automated classification algorithm mirroring ECDC definition to distinguish patients 'not at risk' from patients 'at risk' for nvHAP
  - ECDC: radiologic criteria, systemic symptoms (fever  $>38^{\circ}$ , leukopaenia or leukocytosis) and pulmonary symptoms (e.g. cough, sputum production)
  - 'At risk'-patients manually screened for nvHAP

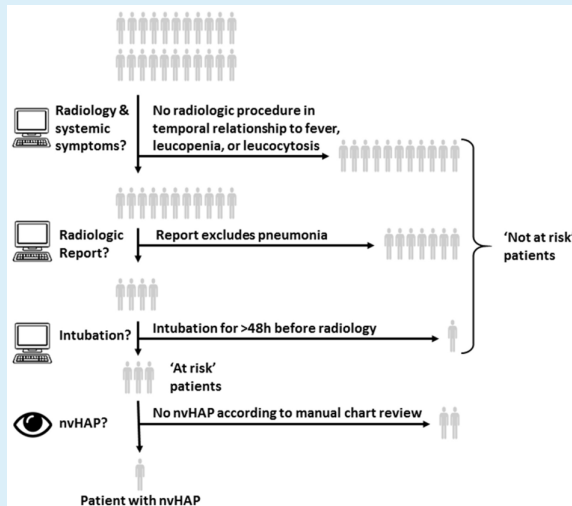
## FINDINGS

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- Mean in-hospital incidence of nvHAP was 0.65% (95%CI: 0.57-0.73%)
- Incidence rate was 0.83/1000 patient days (95%CI: 0.73-0.94)
- Majority of nvHAPs (72.5%) acquired on general wards
  - Some nvHAPs (4.3%) acquired during previous hospitalisation and readmitted
- Most (84%) were sampled; blood culture the most common technique
  - Bacterial and viral pneumonias were found in 36% and 5% respectively.
    - When only including samples of 'good quality' (i.e. sputum or tracheal aspirate with  $<10$  SEC/LPF), % of pneumonias with identification of a bacterial pathogen dropped to 20%.
      - Possible fungal pneumonia was found in 5% of patients
- Method of identifying at risk patients found semi-automated surveillance had a very high sensitivity, negative predictive value and accuracy

## ALGORITHM DEVELOPED BY IPC TEAM

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- Automated classification algorithm to distinguish patients 'not at risk' from those 'at risk' for nvHAP
- After a 3-month period with about 650 'at-risk' patients, the temporal relationship of systemic symptoms to radiological procedure was reduced from -5 and +3 days to -3 and +1 day
- Number of 'at-risk' patients was reduced by 8%; sensitivity analysis showed no difference in the number of patients with nvHAP

## MORE WORK ON SURVEILLANCE

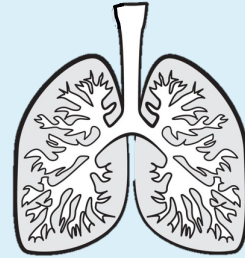
20

- Study to suggest and assess potentially objective, efficient, and reproducible surveillance definitions for non-ventilator hospital-acquired pneumonia (NV-HAP) using routine clinical data stored in electronic health record systems
  - Ji, W. et al (2019). "Development and Assessment of Objective Surveillance Definitions for Nonventilator Hospital-Acquired Pneumonia." *JAMA Netw Open* 2(10): e1913674
- Did not suggest optimal definition, but that a credible definition could identify a case of NV-HAP by worsening oxygenation, new antibiotic use, fever or leukocytosis, and receipt of chest imaging
- Cases meeting this definition were detected with an incidence of 0.6 events per 100 admissions and were associated with a 6-fold higher likelihood of in-hospital death compared with matched controls
- Has potential; more work needed on sensitivity, specificity and preventability

## AETIOLOGY

21

- “HAP occurs because of aspiration of the patients’ own oropharyngeal material, with hospital respiratory pathogens more commonly found in the mouths of those who are unable to clear secretions”
- Ewan, V., T. Hellyer, J. Newton and J. Simpson (2017). "New horizons in hospital acquired pneumonia in older people." *Age Ageing* **46**(3): 352-358.



## PATHOGENESIS

22

- Bacteria enter the lung through several routes:
  - Microaspiration the most common way (from previously colonized oropharynx)
  - Macroaspiration (stroke, seizure, CVA): Loss of neurologic protection of the upper airway
  - Inhalation of Legionella or TB (airborne)
  - Haematogenous: from extra-pulmonary sites of infection
  - Direct extension / spread from nearby (e.g., liver abscess).
  - Critically ill / ICU / Ventilator: Retrograde spread from a colonized stomach to the oropharynx
- Lungs constantly exposed to invading pathogens and oropharyngeal bacteria yet pneumonia not common because of natural defences (as long as they still work)

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**Healthy**

*i)* Minor direct environmental access to lungs.  
*ii)* Mechanical clearance of oral contents to stomach.  
*iii)* Intact swallow, epiglottis protects lungs.  
*iv)* Immune response adequate; environmental local organisms cleared.

**Host-associated Pneumonia (HAP)**

*v)* Minor direct environmental access to lungs.  
*vi)* Impaired swallow leads to impaired clearance of oral contents to stomach, stagnation and growth of respiratory pathogens.  
*vii)* Stagnant oral material aspirated.  
*viii)* Low level of reflux and aspiration of gastric contents.  
*ix)* Immune response adequate or inadequate leading to HAP.

Ewan, V., T. Hellyer, J. Newton and J. Simpson (2017). "New horizons in hospital acquired pneumonia in older people." *Age Ageing* **46**(3): 352-358

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## HOST DEFENCES DECLINE WITH AGE

<b>Nasopharynx</b>	Nasal Hairs Turbinates Upper airway anatomy Mucociliary apparatus IgA secretions
<b>Oropharynx</b>	Saliva Sloughing of epithelial cells Bacterial Interference Complement Production
<b>Trachea, Bronchii</b>	Coughing, epiglottic reflexes Airway branching Mucocillary apparatus Immunoglobulin production Airway Surface Liquid
<b>Terminal airways Alveoli</b>	Alveolar lining fluid Cytokines Alveolar Macrophages Polymorphonuclear Leukocytes Cell-mediated Immunity

## HOST DEFENCES DECLINE WITH AGE

25

Nasopharynx	Nasal Hairs Turbinates Upper airway anatomy Mucociliary apparatus IgA secretions
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Terminal airways Alveoli	Alveolar lining fluid Cytokines Alveolar Macrophages Polymorphonuclear Leukocytes Cell-mediated Immunity



## MICROBIOLOGICAL RISK FACTORS

EWAN, V. C., ET AL (2015) PLOS ONE 10(4): E0123622

26

- Time series of tongue/throat swabs from 90 patients with lower limb fracture
  - incidence of HAP 10%, mortality 80% at 90 days post discharge
  - not associated with being dentate, tooth number, or heavy dental/denture plaque
  - was associated with prior oral carriage E. coli/S. aureus/ P. aeruginosa/ MRSA (p = 0.002, OR 9.48 95% CI 2.28- 38.78)
    - E. coli only individual significant organism (p=0.036)
  - incidence of HAP in those with carriage 35% (4% without), with relative risk 6.44 (95% CI 2.04-20.34, p = 0.002)

## THE EFFECT OF INFLUENZA A

27

- Staph. aureus is a less common cause of pneumonia, however risk increases after influenza
- Host physiologic changes (including raised temperature) promote dissemination from nasal tissue to lungs in an animal model
  - Reddinger RM, et al 2016. Host physiologic changes induced by influenza A virus lead to Staphylococcus aureus biofilm dispersion and transition from asymptomatic colonization to invasive disease. mBio 7(4):e01235-16. doi:10.1128/mBio.01235-16

## NV-HAP

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- NV-HAP is an issue
  - ABX = Clostridioides difficile Infection
  - Increased length of stay
  - Increased mortality
- Why?
  - Medico-legal fears
    - the elderly patient with a crackling chest in the middle of the night..
  - Changes in nursing custom and practice
    - Patients do not get dressed as much and beds are automated
- Prevention has been rather poorly studied..

## UK PREVENTION GUIDANCE

29

- VAP
  - EPIC3 does not cover VAP
  - There was a High Impact Intervention (2011), updated in 2017
  - No NICE Guideline (apart from diagnosis and management)
  - BSAC Guidelines were for 'management' but did include prevention guidance (for VAP) and most points were 'Good practice points'
    - Masterton R. et al JAC (2008) 62, 5-34
- HAP?
  - Nitto

## HOW DO WE KNOW IF CARE IS AS PLANNED?

30

- Incomplete nursing care documentation for most patients
  - oral care undocumented 60.5% of the time
  - Only 32% had documented out-of-bed activity
  - Tesoro, M., et al (2018). "A Retrospective Study of Non-Ventilator-Associated Hospital Acquired Pneumonia Incidence and Missed Opportunities for Nursing Care." The Journal of Nursing Administration 48(5): 285-291

## EVIDENCE FOR HAP INTERVENTIONS

31

- Systematic review of HAP
  - McAuley S. et al (2015). *European Geriatric Medicine* 6(4): 336-340
- 17 searches yielded 5101 papers, two of which could be included
  - one from a search of physical therapy interventions, one from search of enteral feeding
  - No studies on non-stroke patients that could be included
- Not enough evidence to make **any** recommendations
- Reduced to ISLAGIATT methodology

## TURN-MOB TRIAL CUESY ET AL, J STROKE CV DIS 2010 19(1)

32

- Multi-centre RCT
  - Standard care comprised oxygen, adequate nutrition and hydration, anti-platelet agents, glycaemic control, routine measurements and 'general nursing care' which included the nurses changing the position of the patients three times per day
  - Intervention group received changes in position every 2 hr. and passive mobilisation of all 4 limbs (10 reps, every 6 hr.) from a trained relative
  - 26.8% in control arm developed pneumonia, 12.6% in intervention arm
    - RR 0.39 (95% CI 0.19-0.79; P = 0.008)
- Passive limb movements results in significant increases in metabolic and hemodynamic variables for critically ill patients, with approximately 15% increase in oxygen consumption
  - M. Norrenberg, D. et al *Intensive Care Med*, 21 (1995), p. S177



## FOOD TRIAL

DENNIS M ET AL HEALTH TECHNOL ASSESS 2006;10(2). III-X, 1

33

- Investigated early feeding in dysphagic patients compared with no feeding for at least seven days after randomisation
- Patients in the intervention group could receive nutrition by nasogastric (NG) tube or by percutaneous endoscopic gastrostomy (PEG) feeding
- Early intervention group had similar rates of pneumonia to the control group

## EVIDENCE FROM NON-RCTS

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- Some non-RCTs give an indication as to where to target with good studies
- Introduction of early mobility bundle associated with a lower risk of HAP (OR 0.39; 95% CI 0.22 to 0.68, P = 0.001), although falls rates were non-significantly higher in the early mobility group
  - Stolbrink, M. et al (2014). *J Hosp Infect* **88**(1): 34-39
- Introduction of a 'basic nursing oral care' package led to a 40% reduction in the occurrence of HAP compared to historical controls
  - Quinn B, et al Basic nursing care to prevent non ventilator hospital-acquired pneumonia. *J Nurs Scholarship* 2014;46(1):11-9

## 'BASIC NURSING CARE'

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- Descriptive, quasi-experimental study to determine the incidence of NV-HAP and the effectiveness of enhanced basic oral nursing care versus usual care to prevent HAP
  - Rate of HAP/1000 patient days decreased from 4.9 to 3.0 (38.8%)
  - Number of cases of HAP reduced by 37% during 12-month intervention period
  - Avoidance of HAP cases resulted in an estimated 8 lives saved, \$1.72 million cost avoided, and 500 extra hospital days averted
  - Extra cost for therapeutic oral care equipment was \$117,600 during the 12-month intervention period

## THEY MADE IT EASY

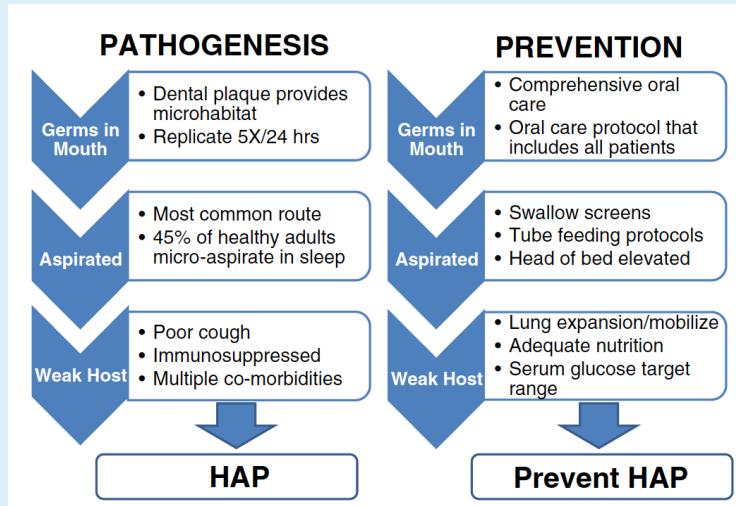
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- Gap analysis revealed a need for new and improved oral care equipment
  - Nursing assistants not using hospital toothbrushes because bristles fell out into patient's mouths
  - Hesitant to attempt oral care on patients with decreased consciousness level because of possible aspiration and choking
- New equipment purchased
  - including higher quality soft-bristled, curved toothbrushes
  - toothpaste that contained sodium bicarbonate to remove plaque
  - alcohol-free antiseptic mouth rinse
  - Non-petroleum lip moisturizer
  - suction toothbrush sets for patients at risk for aspiration

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ADDRESSING RISK FACTORS FOR HAP



Quinn, B., et al (2014). "Basic nursing care to prevent nonventilator hospital-acquired pneumonia." J Nurs Scholarsh 46(1): 11-19

38

MULTI-CENTRE RCT  
HOLLAAR, V., C. ET AL [BMJ OPEN 2015 5\(12\): E007889](#)

- Dysphagia and poor oral health are significant risk factors for developing aspiration pneumonia
  - It is not clear which oral hygiene care intervention is most efficacious in reducing the risk of aspiration pneumonia
- Protocol of study aimed to assess whether application of 0.05% Chlorhexidine containing solution in addition to the usual daily oral hygiene care reduces incidence in physically disabled care home residents with dysphagia
- Reported in 2017: Chlorhexidine oral rinse was not found to reduce incidence of aspiration pneumonia
  - number of participants to achieve sufficient power was not established, high drop-out rate and compliance issues

## ORAL HYGIENE IN THE ELDERLY

39

- Seems to be big in Japan, narrative review, many papers coming from that region
  - Tada, A. and H. Miura (2012). "Prevention of aspiration pneumonia (AP) with oral care." *Arch Gerontol Geriatr* **55**(1): 16-21.
- Still the majority centre on VAP
- Mechanical cleaning by a dentist or dental hygienist was effective
  - Relative risk of intervention:
    - Febrile day: 2.45 (1.77–3.40)
    - Pneumonia: 1.67 (1.01–2.75)
    - Death: 3.20 (1.34–7.14)
  - Yoneyama, T., et al. (2002) *J. Am. Geriatr. Soc.* 50, 430–433

## SMALL QUASI-EXPERIMENTAL STUDY

40

- Before/after study in an acute neurosurgical unit at a tertiary trauma hospital in W. Canada
  - Robertson, T. and D. Carter (2013). "Oral intensity: Reducing non-ventilator-associated hospital-acquired pneumonia in care-dependent, neurologically impaired patients." *Canadian Journal of Neuroscience Nursing* **35**(2): 10-17.
- Intervention
  - Change mouth suction equipment every 24 hours
  - Mouth assessment every 2-4 hours
  - Cleanse mouth with toothbrush every 12 hours
  - Cleanse oral mucosa with oral rinse solution every 2-4 hours
  - Moisturize mouth/lips with swab and standard mouth moisturizer every 4 hours
  - Suction mouth and throat as needed
- Statistically significant decrease in pneumonia rate occurred in prospective group ( $p < 0.05$ )
- Subjects who developed HAP were slightly, but not significantly younger (mean age 51.07) than those who did not (mean age 60.6 years)

## TRIAL OF AGGRESSIVE ORAL CARE

41

- A structured toothbrushing program was provided to an experimental cohort of patients. Control group received 'usual care'
  - McNally, E. et al (2019). "Oral Care Clinical Trial to Reduce Non-Intensive Care Unit, Hospital-Acquired Pneumonia: Lessons for Future Research." *J Healthc Qual* **41**(1): 1-9.
  - No significant difference in HAP rate between control and experimental groups
- Toothbrushing rates increased significantly in the experimental group ( $p = .002$ ) but fell short of protocol frequency (1.2 – 1.6/day vs protocol aim of 3)
- Implementation requires nursing-led interdisciplinary involvement, more intensive training, a streamlined documentation system, and efficient compliance tracking
  - secondary data analysis did suggest that increasing toothbrushing rates may have the potential to reduce pneumonia in the non-ICU acute care setting

## DENTURES OUT AT NIGHT PLEASE

42

- 524 elderly persons selected, followed up for 3 years
  - Oral hygiene factors examined
  - 48 events associated with pneumonia (20 deaths and 28 acute hospitalizations) identified
  - Those wearing dentures during sleep at higher risk for pneumonia than those who removed them at night ( $p=0.021$ )
  - more likely to have tongue and denture plaque, gum inflammation, positive culture for *Candida albicans*, and higher levels of circulating interleukin-6
    - Iinuma, T., et al (2015) *J Dent Res* **94**(3 Suppl): 28S-36S



## DENTURES OUT AT NIGHT PLEASE

43

Risk Factor	Hazard Ratio (+ 95% CI)
Perceived swallowing difficulties	2.31. (1.11- 4.82)
Denture wearing during sleep	2.38 (1.25 - 4.56)
Cognitive impairment	2.15 (1.06 - 4.34)
History of stroke	2.46 (1.13 - 5.35)
Respiratory disease	2.25 (1.20 - 4.23)

## NARRATIVE REVIEW OF HAP

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- Narrative because authors felt systematic was impossible, no data for meta-analysis, suggested a bundle
  - Passaro, L. et al (2016). ARIC 5: 43
- Hand hygiene
- Oral care with antiseptics but no use of antibiotic prophylaxis
- Prevention of aspiration and dysphagia
  - Systematic programme of diagnosis and treatment
- Bed position
- Mobilisation
- Also, prevent viral infection spread

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HAP BUNDLE POSSIBILITY?

VAP	HAP
Bed elevation	Bed elevation
Daily sedative interruption and daily assessment of readiness to extubate	Mobilisation
Endotracheal tubes with subglottic secretion drainage	Prevention of aspiration & dysphagia
Stress ulcer disease prophylaxis	?
Oral care	Tooth brushing and oral care

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2019 SYSTEMATIC REVIEW



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)  
 ScienceDirect  
 journal homepage: <http://www.journals.elsevier.com/infection-disease-and-health/>

Review

**Strategies to reduce non-ventilator-associated hospital-acquired pneumonia: A systematic review**

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## NEW SYSTEMATIC REVIEW

47

- To identify research exploring and evaluating NV-HAP preventive measures in hospitals and aged-care facilities
- Papers January 1998 to August 2018
- Inclusion criteria: all randomised controlled trials and observational studies that examined measures to reduce HAP in hospitals and aged-care facilities (excluding vaccination and systematic antimicrobial therapy)
  - Accepted definitions and application of defining pneumonia as stated in the paper
- Excluded studies that did not analyse the effect of any prevention measure, VAP, all grey literature, non-peer-reviewed literature, reviews, editorials and commentaries

## ORAL CARE INTERVENTIONS

48

- No two were the same
  - Oral care kits that contained an antiseptic cetylpyridiniumchloride and 1.5% hydrogen peroxide)
  - Oral care by swabbing with an antiseptic (chlorhexidine gluconate vs. metronidazole)
  - Increased volume of oral care and the use of an antiseptic (0.05% cetylpyridiniumchloride)
  - Oral care kits and the use of a toothbrush containing sodium bicarbonate and an antiseptic (unspecified)
  - Moisturiser, toothbrushes and oral swabs impregnated with sodium bicarbonate and an antiseptic rinse



## DYSPHAGIA

49

- Two non-randomised studies used dysphagia screening as the primary method for NV-HAP prevention
  - Dysphagia screening test was applied to all acute stroke patients in the emergency department
  - A nurse-led bedside dysphagia screen and a rapid clinical swallow undertaken by a speech pathologist

## MOVEMENT

50

- Three studies that involved a form of physical activity as a way of reducing the incidence of NV-HAP (2 RCTs)
  - effect of turning and passive mobilisation on patients with acute ischemic stroke (TurnMob study)
  - pre-operative patient education, early ambulation and self-directed breathing exercises, and additional pre-operative physiotherapy
  - physiotherapy-based intervention that involved early mobilisation in patients following a hip fracture

## DIAGNOSIS OF HAP

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- Used different definitions for determining cases of NV-HAP, including
  - Chest radiography with clinical symptoms of pneumonia
  - Administrative coding data
  - Clinical Pulmonary Infection Score
  - Centers for Disease Control and Prevention (CDC) definition
  - National professional guidelines
  - Less clear or did not specify the diagnostic approach

## RISK OF BIAS IN A THIRD OF STUDIES (<6)

52

**Table 2** Risk of bias assessment.

First Author	Year	Elements of Newcastle–Ottawa Scale			Total stars
		Selection (0–4)	Comparability (0–2)	Exposure (0–3)	
Adachi	2002	4	0	0	4
Bellisimo-Rodrigues	2014	2	2	3	7
Boden	2018	2	2	3	7
Bourigaulta	2010	4	1	0	5
Chen	2016	3	0	2	5
Cuesy	2010	3	1	3	7
Johansen	2016	3	2	3	8
McNally	2018	3	2	3	8
Quinn	2014	2	0	3	5
Robertson	2013	4	0	3	7
Schrock	2018	3	0	2	5
Stolbrink	2014	3	2	2	7
Titsworth	2013	4	2	2	8
Wagner	2016	3	2	2	7
Yoneyama	2002	4	1	3	8

## KEY MESSAGES

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- Lack of consistency in the studies, including the type of intervention, study design, methods and definitions used to diagnose the NV-HAP
- To date, interventions to reduce NV-HAP appear to be based broadly on the themes of improving oral care, increased mobility or movement and dysphagia management

## SMALL STUDIES ARE EMERGING

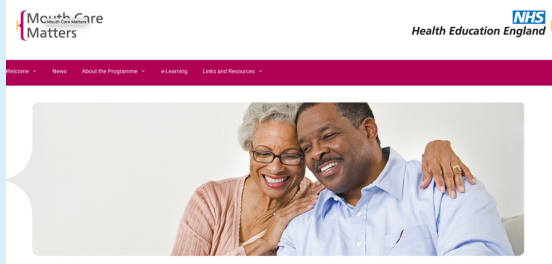
54

- Suggested a HAP Risk Assessment Tool for interventions
  - Age; Mortality; Co-morbidities; Immune system; Surgery; Nutrition
    - Evans, S. (2018). "Could a risk-assessment tool prevent hospital-acquired pneumonia?" *British Journal of Nursing* **27**(7): 402-404.
- Has been shown useful for other infections
  - Tanner, J., D. Khan, D. Anthony and J. Paton (2009). "Waterlow score to predict patients at risk of developing Clostridium difficile-associated disease." *J Hosp Infect* **71**(3): 239-244.
  - Use of routine data so that burden not increased

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MOUTH CARE MATTERS  
[HTTPS://MOUTHCAREMATTERS.HEE.NHS.UK/](https://mouthcarematters.hee.nhs.uk/)

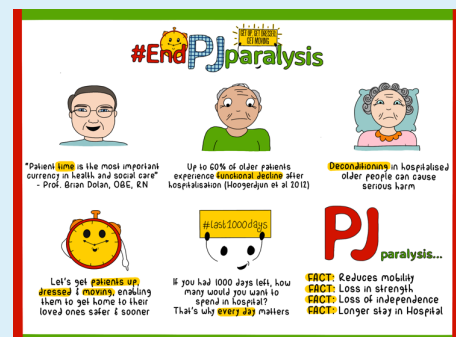
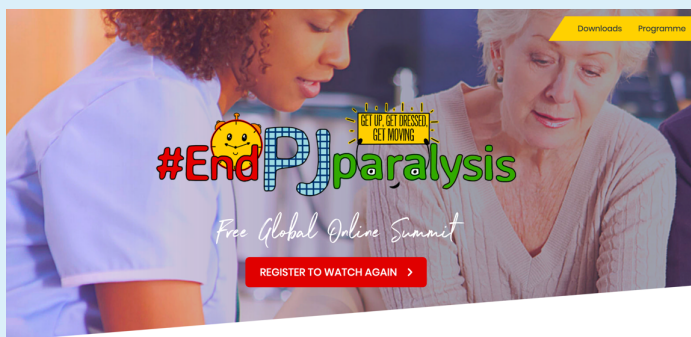
55



- National campaign to improve oral health
- E-learning module available
- HAP Prevention not mentioned

END PJ PARALYSIS

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**LOCAL ACTIONS ARE YIELDING RESULTS**

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ABSTRACT IPS CONFERENCE LIVERPOOL 2018  
HOLDEN K. ET AL UNIVERSITY HOSPITALS BIRMINGHAM

- Formed HAP prevention group, implemented two streams of interventions targeted at ‘usual suspects’ using existing programmes (neither of which were aimed at HAP Prevention)
  - Mouth Care Matters
  - Get up, get dressed and keep moving
- Baseline audits exploring existing practice
- Driver diagrams
  - Primary (and secondary) drivers
    - Education, Communication and awareness, Identifying appropriate patients, Environment and equipment, Patient and staff feedback

**RESULTS OF LOCAL ACTION**

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ABSTRACT 114, HOLDEN K. ET AL IP 2018

- Point prevalence surveys across two pilot wards, repeated after 6 months
  - Number of patients out of bed and engaging in physical activity up by 67%
  - 30% increase in twice daily oral care
- And HAP?
  - Site one (elderly medicine) – 72.31% reduction in HAP
    - 13% to 3.6%
  - Site two (respiratory) - 51.75% reduction in HAP
    - 11.4% to 5.5%
  - Confounder alert – Baseline in January
- Great results from a NURSING intervention

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## CONCLUDING

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- HAP is the highest proportion of HCAI in prevalence studies globally
  - high mortality, action needed
- More can be done undoubtedly
  - **You** could significantly increase the world literature on non-ventilator associated pneumonia
- Possible interventions look suspiciously like good care but not all HAP will be preventable

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