
1. Background
   a. Antibiotic resistance is an increasing problem in health care settings especially nursing homes.
   b. 42% of NH residents receive antibiotics in a 6 month period.
   c. Overuse facilitates resistance especially since many studies indicate 25-75% of antibiotics do not meet specific clinical guidelines - i.e. -highest 30-50% NH residents received antibiotics for asymptomatic bacturia.
   d. Multiple RCTs have shown inappropriate AB prescribing causes harm rather than benefits patients.
   e. Multi-drug resistance increasingly common.

2. Purpose
   To determine whether antibiotic prescribing can be reduced in nursing homes using a quality improvement (QI) program that involves providers, staff, residents, and families.

3. Study design/methods
   a. 9 month quasi-experimental trial of QI program in 12 NHs (6 control; 6 intervention) that were part of Collaborative Studies of LTC Consortium based at University of NC at Chapel Hill conducted from March to November 2011; IRB approval UNC and Abt Assoc; including waiver of informed consent.
   b. The 2 groups were separated by geographical location; matched for cultural; socioeconomic; size; profit status.
   c. Roughly half of residents received care from a single long-term care practice group; different providers at each geographical area.
   d. Research nurses who were blind to study aims collected data regarding antibiotic prescribing.
   e. Intervention: On-site education by independent UNC interdisciplinary team to LTC providers, NH staff included prescribing guidelines (i.e. LOEB "minimum criteria") and 12 common situations that ABs are inappropriately prescribed; pocket cards with 12 situations distributed and used as communication tools.
   f. Monthly feedback (QI program) on adherence to prescribing guidelines.
   g. Family and residents received information in brochures, resident councils.

4. Outcomes Studied:
   a. Participants: all NH residents including 1497 who were prescribed antibiotics.
   b. Measurements: rate of antibiotic prescribing for presumed urinary tract, skin and soft tissue and respiratory infections.
   c. Did not include resident, prescription or provider level characteristics.

5. Statistics
   a. Sample size determined based on power calculation specifying a minimal detectable effect size of 15 percentage points was estimated to be 0.87 for GU infections and 0.86 for URIs (116 residents/NH).
   b. Multivariate difference-in-differences analyses examined whether QI program decreased antibiotic prescribing (prescriptions per resident day) in intervention NHs > control NHs by comparing pre-post change between 3 months baseline data and 6 months post-intervention data focusing on prescribing for urinary tract, respiratory, and skin and soft tissue infections.
   c. Eleven NH characteristics included as covariates to adjust for potential cofounders.
Models were estimated using multilevel Poisson regression, with standard errors adjusted to account for clustering of prescriptions within residents within NHs.

Covariates reported in exponentiated form and interpreted as adjusted incidence rate ratios (IRR).

6. **Results**
   a. Table 1 (pg 909) - Baseline NH Characteristics According to Site. NH groups well balanced except proportion of residents < 65 yrs old (21.6% intervention vs. 8.0% control sites)
   b. 3 month Baseline: average # antibiotic prescriptions for all infections: 12.95 per 1000 resident-days; UTIs (4.8/1000 resident days); Resp (4.6); skin and soft tissue (2.1)
   c. 6 month study period - 3815 prescriptions for 336,522 resident days
      1) Intervention group decreased from baseline 13.16 per 1000 resident-days to 9.51 during follow-up
      2) Control group decreased from 12.70 to 11.80; not statistically significant at P<.05 but prescribing for urinary and skin infections decreased more in intervention sites (P =.09).
   d. Adjusting for NH confounders there was a significant reduction in prescribing rates for all indications combined in intervention NHs but not for urine or skin/soft tissue separately
   e. Multivariate models showed the QI program decreased prescribing rate for respiratory indications
   f. Based on baseline prescribing rate of 12.95 prescriptions/1000 resident-days, the estimated adjusted incident rate ratio (IRR) of 0.86; 95% confidence interval = 0.79-0.95 implies reduction to 11.1 prescriptions per 1000 resident days attributable to QI program or approximately 1.8 prescriptions avoided per 1000 resident-days.

7. **Reviewers Critique/Limitations**
   a. Significant decrease in number of antibiotic prescriptions - committed providers; low number and turnover
   b. Antibiotic stewardship programs must consider challenges of NH understaffing; lack of EMRs; variable type of prescribers; amount of time spent physically in the NH; "closed" provider models
   c. Study design did not discern what components of QI program was most effective
   d. Antibiotic prescribing not significantly different between prescribers who attended or not, but may be attributable to NH staff communication (use of Medical Care Referral form).
   e. Monthly review of antibiotic prescribing may increase attention to prescribing
   f. Reduction was only statistically significant for resp infection even though prescribing for all infections declined probably because the denominator was too low.
   g. Size, design, length of study not adequate to address interventions on hospitalizations or death rates.
   h. Study did not identify infections that were not treated with antibiotics
   i. Nursing staff often did not use templates - workflow/EMR considerations

8. **Practice Implications**
   a. Do you know infection rate/facility?
   b. Interdisciplinary collaboration to decrease inappropriate AB prescribing takes a village (act of prescribing often influenced by nursing staff; families; others)
   c. Written standards to decrease inappropriate antibiotic use decreases variation in care
   d. Drill down data can prioritize highest types of infections where inappropriate AB use occurs
12 Common Situations in which systemic antibiotics are generally not indicated:

1. Positive urine culture in asymptomatic individual
2. Urine culture ordered because of change in urine appearance
3. Nonspecific s/s not referable to urinary tract
4. Upper respiratory infection
5. Bronchitis/asthma without COPD
6. CXR infiltrate in absence of clinically significant symptoms
7. Suspected or proven influenza in absence of secondary infection
8. Respiratory symptoms in patient with advanced dementia receiving palliative care/end of life
9. Skin wound without cellulitis, sepsis or osteomyelitis
10. Small abscess (< 5 cm) localized abscess without surrounding cellulitis
11. Pressure ulcer at end of life
12. Acute vomiting and diarrhea in abscess of positive culture for shigella; salmonella; c diff