SUPPORTING STATEMENT

Part B

Standardizing Antibiotic Use in Long-Term Care Settings (SAUL) Study

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Agency of Healthcare Research and Quality (AHRQ)

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B. Collections of Information Employing Statistical Methods

1. Respondent Universe and Sampling Methods

Twelve sites (six intervention and six control) will participate in this project. The settings will be selected using convenience sampling and recruited from those participating in the Collaborative Studies of Long-Term Care (CS-LTC), a research consortium that was formed in 1996 and now consists of almost 700 settings in 14 states. Eligibility criteria for facilities will be that the administrator agrees to participate in the project, a physician champion (a physician who supports the research project and agrees to participate) is identified, the site will be randomized into a control or intervention group, and (to maximize efficiency and reduce travel costs) the site be within 50 miles of UNC (the home base of the intervention and chart abstracting team). Additionally, facilities that have recently participated in Quality Improvement (QI) or other activities aimed at reducing inappropriate antibiotic use will be considered ineligible. At the present time, the CS-LTC includes 161 settings in North Carolina, of which 77 are within 50 miles of UNC. Thus, there are ample sites suitable for participation. In order to validate the Loeb Criteria and to test the efficacy of the QI intervention, recruited facilities will be matched in pairs with respect to bedsize, profit status and location (urban, suburban, rural) and within each pair, one facility will be randomized to each study arm (treatment and control).

Facility recruitment procedures will follow those established by the CS-LTC. The procedures include a telephone call and mailed letter briefly explaining the project and eligibility criteria (see Attachment B), followed by a scheduled on-site visit by the investigative team with the facility administrator and other key staff (e.g., director of nursing, medical director).

Research subjects will include nurses from all participating nursing homes as well as the physicians who provide care to residents in those facilities. Participation of the nurses will be virtually assured by the facility's agreement to participate in the study so the response rate for these professionals is expected to be 75% percent. Although the literature indicates that the survey response rate for physicians is low (estimated 30%), we expect a higher rate since the participation of physicians will be facilitated by a physician champion identified at each site. Once a facility has been recruited for participation, a letter will be sent to all facility physicians signed by the facility administrator describing the project and requesting their participation if/when they are contacted in regard to prescribing or for purposes of an interview (see SAUL QI Program Guide, Attachment C). If necessary, Dr. Sloane, Co-PI (geriatrician) will contact the physicians directly and speak with them by telephone. We are anticipating a 50 – 60 percent physician response rate.

2. Information Collection Procedures

Sample Size Justification

The following assumptions guided determination of the sample size:

1) the intervention and control groups will be of equal size (this maximizes power for a given total number of sites);

2) by using data collection methods that do not gather resident/patient identifiers (e.g., resident/patient name), we will be able to include the entire population of participating sites in our data collection;

3) the target infections guiding sample size justification are genitourinary infections and upper respiratory infections, because these are among the most common infections and the ones for which good evidence exists supporting antibiotic overuse;

4) using data collected by our team in earlier work, we estimate the incidence rate to be 0.32 infections per 100 resident-days for genitourinary infections, and 0.10 per 100 resident-days for upper respiratory infections (see Table 1); and

5) currently, approximately 86 percent of these infections are treated with antibiotics (see footnote to Table 1). We estimate that approximately 30 percent of these prescriptions are not medically indicated. Therefore, we determined that a rate reduction of 15 percent in the rate of antibiotic prescribing would be significant from a clinical and policy perspective, so we have selected this as the minimum effect size we seek to generate.

Table 1. Rate and Percentage of Identified Nursing Home Infections by Type (N = 2,015)[a]

Type of Infection	Rate per 100 Resident Days	Number of Episodes	Percent of All Infections
Infections (all)[b]	1.20	5,523	100.0
Genitourinary	0.32	1,440	26.1
Skin	0.19	986	17.9
Lower respiratory	0.16	611	11.1
Upper respiratory	0.10	683	12.4

[a] Twenty percent of the infections were identified on the basis of antibiotic use only, 14% by diagnosis only, and 66% by both methods. The table lists infection rates by type of infection; 26.1% of infections were genitourinary (including urinary tract infections/urosepsis), and 17.9% were skin, followed by upper and lower respiratory infections (12.4% and 11.1%, respectively).

[b] Infections (all) includes, in addition to those listed; gastrointestinal, eye, systemic, gynecological, other and not identified.

Source: Zimmerman, Gruber-Baldini, Hebel, et al., 2002.

Primary data collected from the medical record reviews and secondary data collected from provider interviews will be used to evaluate the effectiveness of the intervention including change in:

a) Antibiotic prescribing rates for skin and soft-tissue infections, respiratory infections, urinary tract infections, and fever of unknown origin;

b) the extent to which the Loeb criteria were employed in making these prescribing decisions; and

(c) rates of infection-related hospital transfers, adverse drug events (e.g., symptoms including diarrhea, allergic skin rashes, nausea, vomiting) and facility-associated *C. difficile colitis* (positive culture results).

Power Estimates. In order to have equal numbers of NHs in both intervention and control conditions, the number of sites must be a multiple of 2. We therefore conducted power calculations for 4, 8, 12 and 16 sites. Based on our preliminary data cited above, the estimated numbers of episodes of genitourinary and upper respiratory infections (assuming a 6-month intervention period) would be 236, 472, 708, and 944 respectively for 4, 8, 12, and 16 facilities. For genitourinary tract infection alone, the corresponding numbers would be 180, 360, 540, and 720 incidents of infection.

Power calculations were produced using nQuery Advisor 6.01. In generating these estimates, we adjusted for the clustering of residents within settings, using a variance inflation factor (VIF) calculated as $1 + (m - 1)*\rho$, where ρ is the intraclass correlation (ICC), or the degree of similarity among subjects within the same facility. Estimates of the ICC are based on values found in our previous CS-LTC studies. In those studies the ICC has been primarily in the range of 0.02 to 0.03, but has at times been higher. Even with small values of the ICC, the variance inflation factor is substantial because of the large cluster sizes. Because the values of the ICC are not known precisely, power estimates for a range of possible values were calculated and are presented in Table 2.

Table 2. Power Values (β) to Detect 15% Difference in Rates of Antibiotic Prescribing*

Number of settings	4		8		12			16		
ICC	0.02	0.03	0.02	0.03	0.02	0.03	0.04	0.02	0.03	0.04
Genitourinary	.43	.36	.71	.62	.87	.80	.72	.94	.89	.84
Genitourinary and upper respiratory	.48	.39	.77	.67	.91	.83	.76	.97	.92	.87

* Two-tailed alpha (type I error rate) set at 0.05

As is evident from Table 2: (a) four settings do not provide minimally acceptable power; (b) eight settings provide power > .70 for the lower estimate of ICC; (c) twelve settings provide at least 80 percent power for ICC = .02 and ICC = .03, the range we have most commonly encountered in previous research; and (d) sixteen settings provide >80 percent power even for an ICC of .04. When only genitourinary tract infections are considered,

power estimates change minimally, whereas all power estimates for upper respiratory infections alone are < .60 and are therefore not presented. Similarly power is < .70 when the ICC = .04, except when considering 12 or 16 settings; these columns are omitted for space.

Power calculations revealed that twelve settings provide at least 80 percent power for ICC = .02 and ICC = .03, the range we have most commonly encountered in previous research. As a result, six sites will serve as intervention sites and six will serve as control sites. A statistically significant reduction in antibiotic prescriptions will be used to determine success.

3. Methods to Maximize Response Rates

Developing QI plans of action is a federal regulation for long-term care facilities (483.75(o) Quality Assurance and Assessment). The antibiotic prescribing QI program will be incorporated into the regular, routine operating procedures of the six treatment group long-term facilities. Participation in the intervention will hinge on a facility's willingness to focus their current QI efforts on an antibiotic QI program. The administrators' willingness to participate in the study will virtually guarantee the participation of the facility's QI team (facility physicians, directors of nursing, other staff who generally participate in QI activities).

Participation of physicians will be facilitated by a physician champion identified at each site. Once a facility has agreed to participate, in the month prior to program implementation, a second letter will be sent physicians that is co-signed by the facility administrator, project director, and co-principal investigator (Dr. Sloane, Geriatrician), describing the project and requesting their participation in a survey that assesses the decision-making process involved in prescribing practices. The letter will be followed by a telephone recruitment call during which time the research staff will determine the method by which the physician prefers to complete the survey (i.e., web-based or telephone). If the physician prefers a telephone interview, an interview date and time will be scheduled. Physicians who prefer to complete the web-based survey will receive an email invitation to participate in an on-line survey. Non-responders will receive an email (or telephone) reminder one week after the original invitation. A second reminder will be sent out one week after the first reminder to those who have still not responded. We are anticipating a 50 – 60 percent physician response rate. See Attachment B for survey recruitment letter, telephone recruitment script, email invitation and reminders (email and telephone).

Research staff will attend regularly scheduled monthly QI program meetings with QI team members including physicians and key facility leadership (i.e., administers, the director of nursing and nurse educators) to observe their process and to learn about the intervention implementation at that site, to review the intervention monitoring forms, and help facilities problem solve as necessary.

4. Tests of Procedures

We will pilot test the provider surveys to the first 10 respondents. We will administer the survey via a web-based tool, however, if respondents request that the survey be administered via a telephone interview, or if they state that they would prefer to receive it as hard copy and return it via fax, we will accommodate these requests. We will use the responses from the first 10 respondents to fine-tune the survey questions.

5. Statistical Consultants

- We do not anticipate needing statistical consultants for this project.