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Validity of Self-Declared Teaching Status in Mandatory Public Reporting

To the Editor—Mandatory public reporting programs using the National Healthcare Safety Network (NHSN) have noticed discrepancies between hospital characteristics versus NHSN designation of teaching status. The NHSN variable coding teaching status of each hospital is self declared and subjectively defined; it has not been verified against other sources of information. Accreditation of medical teaching programs is well established, so it should be possible to confirm teaching status in a more objective manner.

Sackett[1] was among the first to describe referral filter bias, noting that referrals of patients from primary to tertiary care facilities leads to increasing prevalence of more-severe or unusual cases, which increases the likelihood of adverse or unfavorable outcomes. That is why hospitals with teaching programs for medical students, interns, residents, and fellows need to be distinguished from other hospitals. Because academic medical centers have both advanced care capabilities and the desire to provide a rich teaching environment by attracting complex cases, their patient case-mix is recognized as different. NHSN includes teaching status among the variables it uses to adjust for inherent differences in the challenges faced by the wide range of hospitals using that system for reporting healthcare-associated infection. The need to compensate for such differences is not just theoretical. Trends in healthcare-associated infection have long been noted as different in small hospitals, community hospitals, larger regional hospitals, and teaching hospitals.[2] Various case-mix index approaches have been used by different agencies to identify where a higher proportion of complex cases justifies higher rates of reimbursement in medical care insurance systems, such as the one used by the US Centers for Medicare and Medicaid Services.[3]

Information on self-reported teaching status was obtained from NHSN for the hospitals participating in our state's mandatory public reporting program. Objective information on accredited hospital teaching programs in our state was obtained from the Association of American Medical Colleges (AAMC) website (for undergraduate medical student education) and the Accreditation Council for Graduate Medical Education (ACGME) website (for physicians after completion of undergraduate medical education to prepare for independent practice in a medical specialty or subspecialty).[4,5] We classified accredited level of involvement per NHSN as none, major (undergraduate medical students), or graduate (interns, residents, and fellows). We classified the extent of involvement per ACGME as graduate (at least 4 months on site during 2-year programs or at least 6 months during programs lasting more than 2 years) or limited (shorter durations).

Five hospitals that are enrolled in our state's mandatory reporting program were excluded from this analysis because of insufficient information available in their NHSN survey module. Among the remaining 56 hospitals, a subjective claim in NHSN of any versus no teaching status matched the objective accredited teaching program status for 44 (positive predictive value, 75%, and negative predictive value, 81%). Twelve discordant pairs did not show evidence of significant differential misclassification ($P = .77$, McNemar's χ^2 test).[6] More detailed examination (Table 1) shows modest concordance (unweighted$\kappa = 0.4$).[6] Most of the hospitals participating in teaching programs involve residencies or fellowships rather than medical students. There was misclassification in both presence of any teaching activity as well as in distinction between major undergraduate versus graduate activity.

It has long been recognized that infection control program resources and the complexity of patient conditions differ between small community hospitals and large academic medical centers. Before NHSN opened enrollment to all facilities, its forerunner (the National Nosocomial Infections Surveillance system) was known to overrepresent large academic centers, and few other study groups focused on smaller hospitals.[7,8] NHSN now serves as the major secure data network for statewide mandatory public reporting programs, so accurate classification of teaching status is important to ensure fair representation of all hospitals. Hospitals joining NHSN fill in a survey screen that asks them to indicate whether they are affiliated with a medical school (yes or no) and, if yes, to characterize their involvement as one of the following 3 types: (1) major (facility is an important part of the teaching program of the medical school, and the majority of medical students rotated through multiple clinical services), (2) graduate (facility is used by the medical school for graduate training programs only—that is, residency and/or fellowships), or (3) limited (facility is used in the medical school's teaching program to a limited extent only). There is no definition of what constitutes "important" and no specification of duration in a facility being "used," which leaves considerable room for interpretation.

Our initial efforts reclassified teaching status solely on the

TABLE 1. Cross-Tabulation of Level of Medical Teaching Programs in Acute Care Hospitals

Subjective claim	Objective status				
	No teaching	Limited	Graduate	Major	Total
No teaching	29	5	2	0	36
Limited	4	0	4	0	8
Graduate	0	1	5	0	6
Major	1	0	2	3	6
Total	34	6	13	3	56

basis of whether a hospital was listed as an approved program on the AAMC or ACGME websites. This resulted in some improvement in our risk-stratified list of hospitals but still presented anomalies. A deeper look at the AAMC and ACGME websites showed that the administrative home of each medical teaching program is not necessarily the only hospital where time is spent during training and that the amount of time spent in different places is reported by training site. That enabled us to test a more refined variable, which revealed misclassifications in both directions on the self-reported NHSN teaching status claim.

We recommend that NHSN adopt a more objective approach to defining hospital teaching status. Some hospitals have extensive involvement in a single teaching program, often a family practice residency program; the influence on case-mix of type of specialty as well as extent of time also should be investigated further.

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Evaluation of the Flush Characteristics of 2 Peripheral Vascular Catheters

To the Editor—Peripheral vascular access is almost universal in current institutional health care, but devices intended for this purpose have risks associated with their use. Microorganisms can be introduced into these devices at insertion or during use, and once in the fluid path of these devices, they can grow to high numbers and be potentially life threatening. Although peripheral vascular catheters are not associated with the same risk for catheter-related bloodstream infection as central venous catheters, a recent review of the topic estimated a rate of 0.5 infections per 1,000 peripheral vascular catheter–days.[1]

Recently a peripheral vascular catheter with an internal valve (Z5; Medikit) was developed to limit healthcare worker exposure to blood. In this study, we compared the Z5 catheter to one without a valve (Insyte Autoguard [IAG]; Becton Dickinson). We found that the device with the integral backflow valve had higher numbers of bacteria recovered than the device without the blood control valve.

Staphylococcus epidermidis (ATCC 12228) was inoculated into trypticase soy broth and incubated at 35°C for 24 hours. Broth culture turbidity was adjusted to a 0.5 McFarland standard (approximately 1×10^8 colony forming units [CFU]/mL), and dilutions of this suspension were made in sterile water to give concentrations of approximately 1×10^3, 1×10^4, 1×10^5, and 1×10^6 CFU/mL. The control consisted of sterile water without microorganisms. Organism concentrations were confirmed by quantitative culture. Ten devices were tested in each group for each bacterial concentration.

Sterile, defibrinated sheep blood (Hemostat Laboratories) was added to a sterile syringe barrel attached to latex tubing. The other end of the tubing was attached to a 3-way stopcock to control the filling of the tubing. This simulated blood vessel was maintained at a positive pressure similar to venous pressure in a patient (10–15 mm Hg, or 13.7–20.3 cm of blood) by elevating the blood-filled syringe barrel approximately 17.8 cm above the blood draw site on the tubing.

Each catheter was then inserted into the tubing, the cannula was removed, and the device was allowed to fill with sheep blood until it was stopped by the valve (Z5) or until blood flowed from the back of the device (IAG). Each catheter was then removed from the simulated vein, and a needleless connector (Q-Syte; Becton Dickinson) was attached. For each catheter, a syringe containing 10 mL of the designated bacterial cell suspension was attached to the needleless connector. Over a period of 20 seconds, the bacterial suspension was