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Self-report compared to electronic medical record across eight adult vaccines: Do results vary by demographic factors?

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ABSTRACT

Immunizations are crucial to the prevention of disease, thus, having an accurate measure of vaccination status for a population is an important guide in targeting prevention efforts. In order to comprehensively assess the validity of self-reported adult vaccination status for the eight most common adult vaccines we conducted a survey of vaccination receipt and compared it to the electronic medical record (EMR), which was used as the criterion standard, in a population of community-dwelling patients in a large healthcare system. In addition, we assessed whether validity varied by demographic factors. The vaccines included: pneumococcal (PPSV), influenza (Flu), tetanus diphtheria (Td), tetanus diphtheria pertussis (Tdap), Human Papilloma Virus (HPV), hepatitis A (HepA), hepatitis B (HepB) and herpes zoster (shingles). Telephone surveys were conducted with 11,760 individuals, ≥18, half with documented receipt of vaccination and half without. We measured sensitivity, specificity, positive and negative predictive value, net bias and over- and under-reporting of vaccination. Variation was found across vaccines, however, sensitivity and specificity did not vary substantially by either age or race/ethnicity. Sensitivity ranged between 63% for HepA to over 90% (tetanus, HPV, shingles and Flu). Hispanics were 2.7 times more likely to claim receipt of vaccination compared to whites. For PPSV and Flu those 65+ had low specificity compared to patients of younger ages while those in the youngest age group had lowest specificity for HepA and HepB. In addition to racial/ethnic differences, over-reporting was more frequent in those retired and those with household income less than $75,000. Accurate information for vaccination surveillance is important to estimate progress toward vaccination coverage goals and ensure appropriate policy decisions and allocation of resources for public health. It was clear from our findings that EMR and self-report do not always agree. Finding approaches to improve both EMR data capture and patient awareness would be beneficial.

1. Introduction

Because immunization is crucial to the prevention of disease, having an accurate measure of vaccination status for a population can serve as an important guide in targeting prevention efforts.[1,2] To monitor vaccination status, the United States conducts population-based vaccination coverage surveys, [3,4] however, obtaining accurate assessment is difficult. Most people have attended multiple medical practices, leaving records scattered or incomplete. Time may also result in lapses in memory [5–7]. Several vaccinations, such as tetanus/diphtheria (Td), pneumococcal polysaccharide vaccine (PPSV), hepatitis A (HepA) and hepatitis B (HepB) series, may have been administered years before a survey is conducted [6]. Also, patients may affirm receipt of vaccines they

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believe they should have obtained or deny obtaining a vaccination that might indicate risky behavior [8,9]. Lack of accurate data decreases the ability to interpret estimated coverage levels and may cause providers to miss opportunities to provide needed vaccines. Validity of self-report has been extensively studied for Influenza (Flu) and PPSV [9–15], but there is a paucity of literature on other vaccines (e.g., HepA, HepB) and relatively new vaccines such as Human Papillomavirus (HPV). Further, information on validity that is age and race/ethnicity specific has also had limited study [5,7,16]. In order to comprehensively assess the validity of self-reported adult vaccination status for the eight most common adult vaccines, we conducted a survey of vaccination receipt and compared it to the electronic medical record (EMR) in a population of community-dwelling patients in a large healthcare system. In addition, we assessed whether validity varied by demographic factors. The purpose of this paper is to report the concordance of data obtained through both methods of data collection.

2. Methods

2.1. Study setting and population

This study was conducted in an integrated health care delivery system with 21 primary care clinics, 30 specialty clinics and over 700 practicing physicians. The plan insures over one million people in an open-access system, allowing patients to obtain care within the medical group or the larger network. The vast majority of care is obtained within the network as nearly all services are covered. The majority of the population is white, employed, with education of high school or beyond. Eligible patients were 18 years or older as of January 1, 2007, and seen in one of the medical clinics during 2007.

Health plan Institutional Review Board (IRB) approval was granted for the conduct of this study.

The study was conducted in two phases. The first, was a retrospective review of the EMR data to determine documented receipt of vaccine. In the second phase, a telephone survey was conducted. Concordance of vaccination status between the EMR and self-report from survey results was assessed.

In Phase 1, EMR data were examined for patients seen in 2007. For HepA this timeframe was expanded back to 2001 to ensure adequate numbers of potential subjects. All vaccination information was obtained for each patient as far back as it was available. The denominator of those eligible for each vaccine was determined and a vaccine specific database was created. The eight vaccines studied included: PPSV, Flu, tetanus/diphtheria Td), tetanus/diphtheria/acellular pertussis: (Tdap), HPV, HepA, HepB and herpes zoster vaccine (shingles). Data were stratified by age group for most vaccines and by race/ethnicity for PPV and Flu.

Vaccination history was retrieved from information obtained from patients when they entered the health system, which was entered into the EMR as were vaccinations obtained within the system. A vaccination procedure code as well as the facility where it was obtained, lot number and vaccine manufacturer were considered evidence of vaccination. For each vaccine, the date of the most recent vaccination was recorded ensure we were using the most relevant information.

EMR data were sorted by vaccine and within each vaccine for the ages and racial/ethnic specific groups of interest to the Centers for Disease Control and Prevention (CDC). For surveys of PPSV, tetanus, HepA, and Flu vaccination, the age groups sampled were for 18–49 years, 50–64 and 65+; for shingles (50–64 and 65+); HepB (18–49 and 50–64) and HPV (females 18–26). Specific racial/ethnic groups (White, Black, Hispanic) were targeted for those 65+ for the PPSV vaccine and all three age categories for Flu. For each group we determined the underlying EMR vaccination rate. We then sorted based on documented evidence of receipt of vaccination: those with and without. After creating all age and race/ethnicity groups by receipt or no receipt of vaccine, there were a total of 56 sampling strata (Appendix A).

2.2. Patient survey

For Phase 2, the patient survey, we randomly selected 300 individuals from each strata, to ensure 200 completed surveys. Two weeks prior to initiating the telephone calls for a given strata, the EMR data was refreshed to be certain all vaccination information was current. Anyone with modified information was reclassified. Letters of invitation for participation were then sent to the 300 randomly selected individuals. There were up to 15 attempts to reach each patient by telephone. Surveys were conducted between January 2009 and March 2011. The intention was to ask any individual about just one vaccine. However, in order to fill some strata (i.e. Hispanic 65+, Black 65+) 339 subjects were surveyed for more than one vaccine.

2.3. Survey content

Surveys were created for each vaccine. Subjects were asked if they "ever" received the vaccine in question. Responses were "yes", "no", "don't know", and "refused to answer." Follow-up questions varied by vaccine regarding how long ago the immunization was obtained. Subjects surveyed about tetanus vaccination were also asked if they were told if the vaccine contained pertussis (whooping cough). Specifics on all vaccines can be found in Table 2. The core content of all surveys was similar. Demographics included: age, sex, race/ethnicity, marital status, education, employment and annual household income. We asked whether reported information was based on recall or if participants had records of vaccination status. Patients with no EMR documentation, claiming to have been vaccinated, were asked if they had any evidence. Some immigrants (<5%) had vaccination history cards.

2.4. Statistical analysis

Demographic characteristics were reported overall and by self-reported vaccination status. In order to assess the validity of self-reported vaccination status, we measured sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV). In addition, we assessed net bias and lack of concordance indicated by over-and under-reporting of vaccination.

We calculated agreement statistics sensitivity, specificity, positive predictive value, and negative predictive value.[17] Additionally, we calculated a Kappa statistic,[18] to measure agreement between self-report and EMR (agreement was categorized as follows: almost perfect 0.81–1.00, substantial agreement 0.61–.80, moderate agreement 0.41–0.60, fair 0.21–0.40, and poor <0.21). These validity parameters were calculated for all vaccines and for each vaccine separately. Clinically, if a patient can't affirm that they have had the vaccine, a provider may offer the vaccine, thus we considered the lowest coverage scenario where all "don't knows" for self-reported vaccination status were considered "no".

Biased estimates can occur as a result of unequal sampling rates across strata. To correct for the unequal sampling rates of vaccinated and unvaccinated persons across sampling strata, all study data were weighted to reflect the actual distribution of EMR vaccination status among study-eligibles within each of the age and race/ethnicity-specific strata. Sampling weights were computed as the reciprocal of the achieved sampling fraction for each stratum. The weighted analysis results in numbers that sum to that of the original population. Statistical analyses of validity measures