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Mind the Gap: Hospitalizations from Multiple Sources in a Longitudinal Study

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ABSTRACT

Background: Medicare claims and prospective studies with self-reported utilization are important sources of hospitalization data for epidemiologic and outcomes research. **Objectives:** To assess the concordance of Medicare claims merged with interview-based surveillance data to determine factors associated with source completeness. **Methods:** The Atherosclerosis Risk in Communities (ARIC) study recruited 15,792 cohort participants aged 45 to 64 years in the period 1987 to 1989 from four communities. Hospitalization records obtained through cohort report and hospital record abstraction were matched to Medicare inpatient records (MedPAR) from 2006 to 2011. Factors associated with concordance were assessed graphically and using multinomial logit regression. **Results:** Among fee-for-service enrollees, MedPAR and ARIC hospitalizations matched approximately 67% of the time. For Medicare Advantage enrollees, completeness

increased after initiation of hospital financial incentives in 2008 to submit shadow bills for Medicare Advantage enrollees. Concordance varied by geographic site, age, veteran status, proximity to death, study attrition, and whether hospitalizations were within ARIC catchment areas. **Conclusions:** ARIC and MedPAR records had good concordance among fee-for-service enrollees, but many hospitalizations were available from only one source. MedPAR hospital records may be missing for veterans or observation stays. Maintaining study participation increases stay completeness, but new sources such as electronic health records may be more efficient than surveillance for mobile elderly populations.

Keywords: data linkage, data sources, hospitalizations, Medicare.

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Introduction

When conducting comparative effectiveness research, it is important to understand the completeness of sources of health care utilization data and how any gaps in the data may affect findings [1]. One method for assessing data completeness is to compare multiple sources of the same information collected through different methodologies. For example, comparisons can be made between primary data collection of self-reported hospitalizations and hospital claims. Each data source has strengths and weaknesses because one data source may capture hospitalizations that the other misses. Researchers can identify discrepancies between data sources and use the knowledge to improve estimates. Statistical techniques can be used to adjust for factors known to be associated with missing data.

In the case of research using hospitalizations as a primary outcome, some studies have found high concordance between self-reports and either hospital medical records or Medicare claims from the Centers for Medicare & Medicaid Services (CMS)

[2,3]. Other studies have identified important gaps in different data sources for hospitalizations and shown that some sources may systematically under-report or over-report hospitalizations. Examples of such gaps include under-reporting of hospitalizations in particular geographic areas [4] and under-reporting [5] or over-reporting [6] of hospitalizations in self-reports. Therefore, the existing evidence does not indicate a clear pattern in the extent or type of discrepancies between different data sources for hospitalizations. The inconsistent findings suggest that more research may be useful to identify factors associated with the completeness of hospitalization records.

We compared primary data collection of hospitalizations from an ongoing prospective cohort study with administrative Medicare hospital records with the objective to identify the strengths and weaknesses of each data source. Unlike data sources from previous studies that relied solely on self-reports [2,3,5,6], the cohort study identified hospitalizations through a combination of self-reports and surveillance of medical records. We considered factors that could affect the completeness of

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hospitalization data including programmatic factors (Medicare Advantage [MA] or fee-for-service [FFS] enrollment), personal characteristics (e.g., veteran status or proximity to death), and study attributes (e.g., use of hospitals outside the study area or loss to follow-up). Evidence on how these factors relate to missing hospitalization data for each data source may help researchers avoid erroneous conclusions by increasing understanding of the frequency and causes of missing hospitalization data.

Methods

Population/Data Sources

The Atherosclerosis Risk in Communities (ARIC) study is an ongoing longitudinal cohort study funded by the National Heart, Lung, and Blood Institute. Cohort members aged 45 to 64 years were selected during 1987 to 1989 through population-based random sampling from four US geographic regions: Forsyth County, NC; Jackson, MS; the suburbs of Minneapolis, MN; and Washington County, MD [7]. Notably, Forsyth County was the only site that sampled enough blacks and whites to analyze the two races separately. The Jackson field center sample included only blacks, and the Minneapolis and Washington County samples were almost entirely white. The analysis dropped nonwhites from Minneapolis and Washington County and other races beside whites and blacks from Forsyth County because the number of these individuals was too small to control for race at these sites.

ARIC conducts ongoing surveillance of hospitalizations for cohort participants through self-report during annual follow-up (AFU) interviews by telephone and review of hospitalization records for all cohort participants. ARIC identifies records through established agreements with hospitals in the study areas and general outreach with hospitals outside the study areas. The combination of the cohort self-report and active surveillance components may make ARIC hospitalization records more complete than those of other cohort studies that use only one of the two components. In the ARIC hospitalization records from 2006 to 2011, 65% of data for stays were obtained through self-report, whereas 35% of data were obtained only through active hospital record surveillance. Although ARIC was able to locate the hospital records for 92% of the self-reported stays (indicating that many would have been obtained through hospital surveillance also), relying on self-report alone would result in many missing stays. During the AFU, investigators ask cohort members about any hospitalizations that have occurred since the last communication. If the cohort member has given consent, investigators also request for records from hospitals, whether or not reported by the individual during the AFU. Self-reported hospitalizations are confirmed with the hospital and medical records obtained to abstract, at a minimum, discharge date and discharge codes. Although investigators are unable to access records if the cohort member retracts consent [8], fewer than 20 cohort members retracted informed consent for accessing hospital records as of September 2010. Unreported stays at hospitals outside the ARIC field center regions will be missed because ARIC does not have ongoing agreements outside the study catchment areas. Hospital stays that are shorter than 24 hours or are for inpatient rehabilitation services or hospice care are not captured by ARIC cohort surveillance of hospitalized events. If a cohort member dies, the investigators ask a proxy to report hospitalizations since the last contact with the study participant. The ARIC study achieved excellent participation over time; till 2011, 90% of the surviving cohort still participated in the AFU [9].

Medicare Provider and Analysis Review (MedPAR) data are constructed as a single record per inpatient stay by CMS for

Medicare beneficiary admissions to hospitals (short or long stay) or skilled nursing facilities (SNFs). The MedPAR file does not contain records for patients who present at the emergency room and are kept for observation only (i.e., never admitted to the hospital as an inpatient) even though these observation stays (which are paid under Part B) may last for more than 24 hours [10]. Although MedPAR covers 100% of Medicare beneficiaries with inpatient admissions, including FFS- and MA-managed care enrollees [11], MA stay records historically have been incomplete in MedPAR because submission of MA inpatient stay information as shadow bills was requested by CMS but not tied to payment. Beginning in 2008, CMS tied a hospital's "disproportionate share hospital" (DSH) payment to submission of shadow bills for MA enrollees staying at the hospital [12]. As a result, the completeness of MedPAR hospital records for MA enrollees may have increased since 2008.

The analysis uses short-stay hospitalizations of Medicare-enrolled ARIC cohort members reported by the ARIC study and MedPAR between 2006 and 2011. The ARIC study obtained Medicare administrative and claims files for cohort members by providing key variables (social security number [SSN], sex, birth date) and linking records if the SSN plus one other key variable matched. This procedure linked 99% of ARIC participants expected to match (e.g., alive after 65 years and nonmissing SSN). Figure 1 shows the cohort enrollment in Medicare (FFS vs. MA, and with or without Part D) over the study period. We merged the ARIC and the MedPAR short-stay hospitalization records by matching on ARIC IDs and discharge dates. Discharge dates within 7 days of each other were considered matches. ARIC hospitalizations were excluded if the participant was not yet enrolled in Medicare at the time of discharge. In addition, we used the Medicare outpatient file to identify 2188 observation stays from 2006 to 2011 for the cohort members; merging these records with ARIC records led to the exclusion of 542 observation stays that ARIC identified as hospitalizations but did not have matching MedPAR records. Because ARIC did not code hospitalizations shorter than 24 hours, we believe this process eliminated most, if not all, of the observation stays. MedPAR records were excluded if the stay was in an SNF or a long-stay hospital (except for 86 SNF or long-stay records that matched an ARIC hospital record discharge date and were for stays of fewer than 30 days, because such stays might represent internal facility transfers or swing-bed utilization). Discharge dates within 1 day of each other were considered an exact match; discharges were considered a close match if the date in mm/dd/yyyy format differed by one digit and diagnosis codes from both sources were identical.

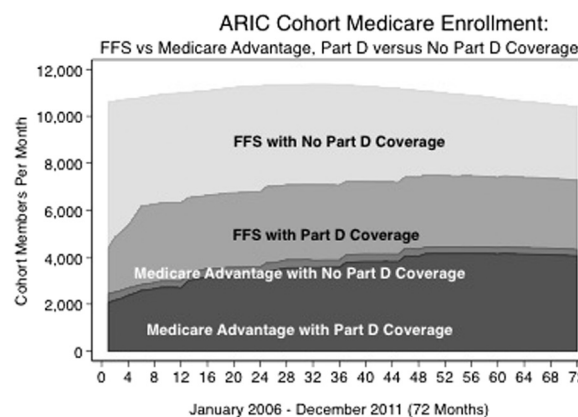


Fig. 1 – ARIC cohort Medicare enrollment. FFS vs. MA, Part D vs. no Part D coverage. ARIC, Atherosclerosis Risk in Communities; FFS, fee for service; MA, Medicare Advantage.

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