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CHAPTER THREE: SELECTION CRITERIA

The AMI analysis was designed to focus on fresh AMI admissions to acute care hospitals. The goal was to select patients who had just experienced an acute heart attack due to coronary artery disease. Inclusion and exclusion criteria were developed after careful review of the medical literature and extensive discussions with an expert panel that included cardiologists, health services researchers, a cardiac care nurse, and a health information management professional.

INCLUSION CRITERIA

AMI cases were identified by reviewing the discharge abstracts from all acute care hospitals in California that report data to the Office of Statewide Health Planning and Development (OSHPD). These hospitals do not include facilities operated by the US Department of Veterans Affairs or the Department of Defense. Discharge abstracts that were identified as coming from a non-acute level of care (e.g., skilled nursing, rehabilitation) were not reviewed.¹ Cases selected for the study were required to meet all four of the inclusion criteria listed below.

- 1. A principal diagnosis of acute myocardial infarction, initial or unspecified episode of care (410.x0 or 410.x1), or a principal diagnosis of a presumed AMI complication with a secondary diagnosis of AMI, initial or unspecified episode of care.**

¹Before January 1, 1995, hospitals were not required to submit separate reports (or bundles of discharge abstracts) for each type of care they provide. As a result, it was impossible to identify with certainty the skilled nursing discharges from 61 of the 153 California hospitals that had distinct skilled nursing units in 1990 (Meux E, written communication). Similarly, it was impossible to identify with certainty the rehabilitation discharges from 47 of the 80 California hospitals that had distinct rehabilitation units in 1990. The other listed criteria presumably excluded most of the non-acute care discharges at these hospitals.

The principal diagnosis is "the condition established, after study, to be chiefly responsible for occasioning the admission of the patient to the hospital for care."² Note that cases with a principal diagnosis of 410.x2 (AMI, subsequent episode of care) were **not** included because the focus was on fresh admissions for acute diagnosis and management. Cases with a principal diagnosis of 410.x0 (AMI, unspecified episode of care) were included because they were clustered at certain facilities and their overall mortality rate and other characteristics closely resembled those of 410.x1 cases (AMI, initial episode of care). These facilities appear to be coding many initial AMI hospitalizations as 410.x0.

Table 3.1 lists the principal diagnoses labeled as presumed AMI complications for the purpose of selecting study cases. Cases with other principal diagnoses were not included because their AMIs may have been complications of unrelated conditions. Several conditions that appeared on the list of acceptable principal diagnoses in 1993, such as arterial thrombosis and hypotension, were removed this year after careful review and preliminary findings from OSHPD's validation study suggested that AMIs in these patients often are related to other conditions or procedures, such as sepsis and arterial bypass surgery.

At some hospitals, patients who presented with one of the cardiovascular complications listed in Table 3.1 may have been assigned a principal diagnosis of AMI and a secondary diagnosis of the observed complication. At other hospitals, the complication may have been coded as the principal diagnosis because coders may not have understood the temporal sequence. To capture similar cases from both sets of hospitals, patients with principal diagnoses of suspected AMI complications were included in the sample. It was assumed that when a discharge abstract listed one of the complications in Table 3.1 as the principal diagnosis, the complication followed an AMI rather than vice versa.

Although coding guidelines allow respiratory failure (518.81 -518.82) to be coded as the principal diagnosis when it follows an AMI, it was not included on the list of allowable principal diagnoses because most such cases had an indeterminate infarction site and an underlying diagnosis of pneumonia or chronic obstructive pulmonary disease. These findings

²OSHPD, 1991. *Discharge Data Tape Format Documentation*.

suggest that AMIs more often were complications rather than causes of respiratory failure.

2. Age at admission of 18 years or greater

Children were not included because the pathophysiology of AMI in this population usually relates to a congenital anomaly or an acute ischemic event rather than coronary artery disease.

3. Source of admission equal to routine (11), emergency room (12), other facility (16), home health service (17), or other (19)

Patients transferred in from other acute care hospitals (13) were not included in the primary analysis. Instead, these records were linked whenever possible with the corresponding record from the original admitting hospital, so that the patient's ultimate outcome could be attributed back to the hospital that provided the initial care.

Patients transferred in from skilled nursing (14) or intermediate care facilities (15) were not included to minimize the number of patients in the sample with "do not resuscitate" (DNR) orders. Patients with DNR orders have a high risk of death, both because of their underlying medical problems (which may not be captured in the risk-adjustment model) and because they are not candidates for life-prolonging interventions, such as mechanical ventilation. Many of these patients are admitted only for comfort care.

Cases admitted from other facilities (16) were included because OSHPD's 1988 reabstraction study showed that most (69%) of these cases should have been reported as emergency room admissions. Therefore these cases were grouped with emergency room admissions.

4. Date of admission between August 26, 1990 and May 31, 1992 (inclusive).

As described in Chapter Four, the encrypted social security number and date of birth were used to link prior and subsequent records for each

case. Reporting of social security numbers in California began on July 1, 1990. Cases admitted between July 1 and August 25, 1990 were available, but were excluded to provide a full 8 week (56 day) period before admission to ascertain risk factors and previous AMI hospitalizations. This represents an increase from the 30 day period used in 1993. An 8 -week period is preferable to a 30 -day period because ICD - 9-CM coding rules allow medical records professionals to use the AMI diagnosis code (410.xx) up to 8 weeks after the event. If no other AMI admissions occurred within 8 weeks before the index AMI admission, it is reasonable to assume that the index admission is actually the first admission for that AMI.

Cases admitted in June 1992 were excluded because they may not have been discharged until July. Discharge records after June 30, 1992 were not available when this study was conducted. Note that the admission date was always used for case selection because it most closely approximates the actual date of the AMI.

RECORD LINKAGE

Records for patients transferred from one hospital to another within California were linked (as described in Chapter Four). Linkage was used to combine multiple records on the same patient into a single episode of care. This means that information from a series of discharge abstracts for a patient transferred from one facility to another was combined, and the disposition of the final hospitalization (e.g., death or survival) was ascribed to the "index" hospital. The "index" hospital was the first facility in a series of linked transfers that reported a **qualifying** AMI admission (based on the above inclusion criteria). That admission was labeled the "index" AMI, and need not have been the first admission in the transfer series.

The purpose of this procedure was to eliminate differing transfer rates as a cause of outcome differences across hospitals. Otherwise, hospitals that transferred most of their AMI patients to other facilities would have demonstrated exceptionally low mortality. A strategy was developed to maximize the number of correct matches and to minimize the number of erroneous matches. This strategy is described in Chapter Four.

EXCLUSION CRITERIA

Finally, several exclusion criteria were defined to eliminate cases that may not truly represent fresh AMIs, such as unstable angina that was potentially misdiagnosed by physicians or misinterpreted by coders. Because the index record alone was not always sufficient to establish the presence or absence of these exclusion criteria, they were applied after linkage. Note that congenital or rheumatic aortic stenosis (AS) constituted an exclusion criterion in 1993, but not in 1995. Although some patients with severe AS may suffer myocardial ischemia despite clean coronary arteries, the applicable ICD -9-CM codes do not describe the severity of AS. Indeed, less than 4% of patients with AS underwent valve replacement, and cardiac catheterization was performed less often in AS patients than in patients without that diagnosis. In most cases, AS is a minor finding associated with echocardiography rather than a lesion requiring evaluation or treatment. In 1995, cases with any of the following characteristics were excluded:

- 1. One or more prior AMI admissions within the 8 weeks preceding the targeted hospitalization.**

An AMI that met the four inclusion criteria listed above was excluded from the study if it was preceded by a prior AMI admission during the previous 8 weeks (from admission date to admission date). Prior AMI admissions were defined as any with a principal or secondary diagnosis of 410.x0 or 410.x1, without regard to the patient's age, source of admission, or type of care, or to the AMI exclusion criteria listed here. For example, an AMI that occurred in a skilled nursing or intermediate care facility would not have been eligible for this study, but would have counted as a prior AMI for the purpose of disqualifying any AMI admission in the next 8 weeks. An AMI in a patient admitted with a principal diagnosis of gallbladder disease would not have been eligible for study (because it might have been a postoperative complication), but still would have counted as a prior AMI.

This exclusion is important for two reasons. First, many patients are admitted for acute management of an AMI, then go home and return to the hospital several weeks later for diagnostic evaluation or coronary revascularization. The *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD -9-CM) directs coders to classify any

AMI less than eight weeks old as acute (410.xx), although it offers a fifth digit to distinguish the initial episode of care from subsequent episodes. If prior AMI admissions had not been sought, the same AMI might have been inadvertently double-counted. It also is important to identify prior AMIs because some people suffer a second AMI very shortly after their first, and these reinfarcts confer an increased risk of death. Such reinfarcts had to be excluded to obtain a homogeneous sample of AMIs.

Note that a prior AMI did **not** disqualify an index AMI if the patient was transferred from the prior facility to the index facility (e.g., the two records were part of a transfer series). By definition, the index AMI in a transfer series was the first record that met the four inclusion criteria listed above. In addition, a prior AMI did **not** disqualify an index AMI if the prior AMI record was part of a separate transfer series that included a **not**her index AMI admission outside the 8-week prior interval.

2. Total length of stay less than 2 days (e.g., 0 -1 day) with an ultimate disposition other than the following: acute hospital (2), discharge against medical advice (6), or death (8)

Note that the ultimate disposition is the one reported on the last in a series of linked records, if a patient was transferred from one facility to another. The total length of stay in this situation was calculated by adding the lengths of stay across hospitals.

After excluding deaths, inter-hospital transfers, and discharges against medical advice (all of which had artificially truncated hospital stays), short hospitalizations were thought to represent remote infarctions, trivial infarctions (e.g., cardiac enzyme elevation without electrocardiographic changes), or patients who actually "ruled out" for AMI. The clinical advisors unanimously agreed that a hospital stay of two or more days remains the standard of care for new AMIs in California. This represents a decrease from the three-day cutoff used in 1993, based on the striking temporal trend toward shorter stays. ICD-9-CM guidelines require coders to assign the AMI code (410.xx) to the diagnosis of "rule out" myocardial infarction, unless an alternative diagnosis has been established.³ Previous research has confirmed that patients discharged with a

³Coding Clinic for ICD-9-CM 1985;2(2):3.

diagnosis code of 410.xx after a short stay often ruled out for AMI or were admitted for post-AMI diagnostic evaluation.⁴ Other investigators have excluded short-stay patients for the same reason.⁵

- 3. An external cause -of-injury (E) code indicating a transport accident of any type (E800.x -E848) from the index record or any subsequent linked record .**

These cases were excluded because of concern that traumatic myocardial contusions, which usually result from steering column impact, may be misclassified as AMIs. Traumatic injury can lead to elevated cardiac enzymes and electrocardiographic changes that mimic those seen in acute infarction.

⁴Iezzoni, LI, Burnside S, Sickles L, Moskowitz MA, Sawitz E, Levine PA. Coding of acute myocardial infarction: Clinical and policy implications, *Annals of Internal Medicine* 1988; 109:745-751.

⁵Udvarhelyi IS, Gatsonis C, Epstein AM, Pashos CL, Newhouse JP, McNeil BJ. Acute myocardial infarction in the Medicare population. Process of care and clinical outcomes. *JAMA* 1992;268:2530-2536.

Table 3.1: ICD -9-CM codes for principal diagnoses presumed to represent AMI complications if the case had a secondary diagnosis of 410.x0 or 410.x1

<i>ICD-9-CM Code</i>	<i>ICD-9-CM Description</i>
426.0	Atrioventricular block, complete
427.1	Paroxysmal ventricular tachycardia
427.41	Ventricular fibrillation
427.42	Ventricular flutter
427.5	Cardiac arrest
429.5	Rupture of chorda tendinae
429.6	Rupture of papillary muscle
429.71	Acquired cardiac septal defect
429.79	Other sequelae of myocardial infarction
429.81	Other disorders of papillary muscle
518.4	Acute edema of lung, unspecified
780.2	Syncope and collapse
785.51	Cardiogenic shock, without mention of trauma