

CARDIOVASCULAR DISEASE EVENT CLASSIFICATION IN THE JACKSON HEART STUDY: METHODS AND PROCEDURES

Objective: The process of identifying, abstracting, and classifying cardiovascular disease (CVD) endpoints in the Jackson Heart Study (JHS) is described.

Method: Trained interviewers conduct telephone annual followup interviews on or near the JHS exam 1 anniversary to ascertain any significant health events since the last JHS contact, including diagnostic tests, hospitalizations, or death. Information on cohort hospitalizations and deaths is transmitted to the medical record abstraction (MRA) unit who review death certificates and hospital records to identify CVD events in the cohort. Interviews with the next of kin and completed questionnaires by physicians and medical examiners or coroners are used to obtain information on deaths in the cohort. A computer-generated diagnosis with follow-up review and adjudication by trained medical personnel completes final, disease-specific event classification of hospitalized and fatal coronary heart disease (CHD), stroke, and congestive heart failure (CHF) events.

Discussion: Surveillance of this well-characterized group of African Americans for CVD events as well as sub- and preclinical manifestations of disease is a central aspect of the JHS. Particular focus is placed on the leading causes of CVD illness and death, including fatal and nonfatal CHD, stroke, and CHF. (*Ethn Dis*. 2005;15[suppl 6]:S6-62-S6-70)

Key Words: African Americans, Cardiovascular Disease, Jackson Heart Study, Lifestyle, Risk Factors

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INTRODUCTION

Mississippi often reports the highest cardiovascular disease (CVD) mortality rate in the nation; CVD accounts for up to 43% of all deaths in the state.¹⁻³ One in five CVD deaths occurred prematurely in Mississippians <65 years old in 1998.² In Mississippi, the state with the highest concentration of African Americans, African Americans have higher CVD death rates than Whites, and men have higher death rates than women. Although the CVD death rate is declining in Whites, it has remained at the same level in African Americans since the early 1980s, thus creating a growing disparity in CVD mortality rates between Whites and African Americans in Mississippi. The disparity in CVD mortality rates is a growing concern. Similarly, mortality from coronary heart disease (CHD) has continued to decline in the United States during the past 30 years.²⁻⁷ The decline in the rate of CHD in Mississippi is slower than other states in the country. In Mississippi, as well as other states, the highest decline has been observed in White males, while the lowest decline was observed in Black females.² The rationales for the Jackson Heart Study (JHS) include the investigation of fatal and nonfatal CHD, stroke, and congestive heart failure (CHF). The JHS cohort provides credible unique information regarding the prevalence, incidence, natural history, and prognosis of CVD manifestations.

The JHS is a single-site, prospective, epidemiologic investigation of CVD among African Americans from the Jackson, Mississippi, metropolitan

statistical area (MSA), and is sponsored by the National Heart, Lung, and Blood Institute (NHLBI) and the National Center for Minority Health and Health Disparities (NCMHD) in partnership with three Jackson, Mississippi, institutions: Jackson State University, the University of Mississippi Medical Center, and Tougaloo College. Participants were recruited from the Jackson tricounty area: Hinds, Madison, and Rankin. The cohort size is 5302, with a recruitment eligibility age of 35-84 years and an embedded family study age of 21-90+ (Table 1). Family members are included in the study to permit studies of familial/genetic contributions to CVD.⁵ Approximately 1600 recruited participants came from the Jackson cohort of the Atherosclerosis Risk in Communities (ARIC) study.^{6,8} Thus, the JHS cohort is composed of "JHS only" and "JHS/ARIC joint" participants. This paper describes the JHS CVD morbidity and mortality ascertainment procedures.

METHODS

The JHS morbidity and mortality methods evolved from those used for the ARIC study. The method has been highly successful in documenting trends in events rates in the ARIC cohort.^{7,9} Methods for stroke classification and event rates have also been published.¹⁰ The JHS cohort surveillance system identifies all cohort illnesses and deaths, hospitalizations, and out-of-hospital deaths and validates the diagnoses of CHD, stroke, and CHF (Figure 1).

Table 1. JHS cohort surveillance eligibility criteria

Criteria	Eligibility
Age	Between 35 and 84 for full cohort Between 21 and 90+ for Family Study
Race	African American
Place of residence	Hinds, Madison, and Rankin Counties
Date of discharge or death	September 2000 or later

JHS=Jackson Heart Study.

Surveillance activities for JHS consist of two essential components, which work together to ultimately complete the process of events ascertainment: the annual followup and the medical record abstraction (MRA) units. The annual followup unit is charged with calls to the cohort members yearly. Trained interviewers contact each participant by telephone within a window of six months before the anniversary of the cohort initial clinic examination and not more than six months past the anniversary date. The interview is designed to ascertain any significant health events

since the last JHS contact, including diagnostic tests, hospitalizations, or death, as well as changes in health behaviors and sociocultural parameters. These data are entered directly into the JHS data management system by the interviewers as the participants respond to interview questions. The JHS started recruitment for exam 1 in September 2000; hence by the end of recruitment (February 29, 2004) and clinical examinations (March 31, 2004), the AFU was in contact year three (CY3) of annual followup for those recruited into the cohort at the very beginning of

enrollment. The information that is obtained by the AFU unit on cohort hospitalizations and deaths is transmitted to the MRA unit.

The MRA unit has two subunits that function together to obtain information regarding hospitalizations and deaths occurring either in or out of the hospital. The AFU interviews provide self-reported information that is corroborated by comparison with hospital discharge indexes and death certificates for the designated year. Identification and abstraction of CVD illness and death data are performed by a certified medical record abstractor who enters event data directly into a laptop computer that is equipped with automated entry forms and communicates with the University of North Carolina Collaborative Studies Coordinating Center (UNC-CSCC) at Chapel Hill, where surveillance data are managed in conjunction with the JHS Coordinating Center in Jackson. For quality assurance, the medical record abstractor compares annual followup hospitalization reports with the annual hospital discharge lists that are obtained from area hospitals to ascertain reported hospitalization.

All hospitals in the Jackson MSA participate in the JHS surveillance system. The MRA unit of JHS communicates with each hospital on a routine basis through the JHS trained medical record abstractors to obtain discharge lists and subsequently abstract medical records. For each year of abstraction, a request is made to the hospitals requesting a hospital discharge list that meets specific discharge diagnosis criteria. The discharge list is used to identify potential cases for abstraction. All other communications are done on an as-needed basis in conjunction with the record abstraction process. Requests for copies of death certificates for deceased cohort members are submitted to the Mississippi State Department of Health (MSDH) (or other state health departments if the death occurred out-of-state) on an as-

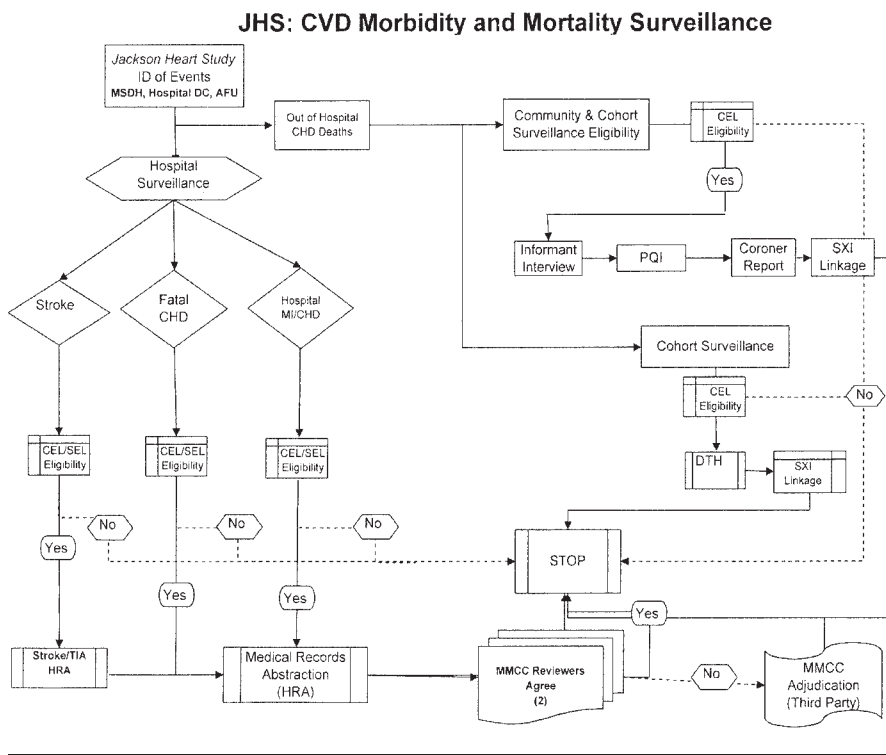


Figure 1. JHS morbidity and mortality surveillance

Table 2. ICD-9 and -10 codes for identification of JHS CVD events

Event Type	ICD9 Codes	ICD10 Codes
CHD death	250, 401, 402, 410-414, 427-429, 440, 518.4, 798, 799	E10-14, I10-11, I21-25, I46-51, I70, I97, J81, J96, R96, R98-99
Hospitalized MI	402, 410-414, 427, 428, 518.4	
Stroke	430 Subarachnoid hemorrhage 431 Intracerebral hemorrhage 432 Other intracerebral hemorrhage 433 Occlusion of precerebral arteries	I60 Subarachnoid hemorrhage I61 Intracerebral hemorrhage I62 Other nontraumatic intracranial hemorrhage I63 Cerebral infarction I65 Occlusion of precerebral arteries not resulting in infarction I66 Occlusion and stenosis of cerebral arteries not resulting in infarction
	435 Transient ischemic attack	G45 Transient cerebral ischemic attacks and related syndromes. (Not relevant death classification; do not include in algorithm)
	436 Acute, ill-defined CVD	n/a
	437 Other ill-defined CVD	I64 Stroke, not specified as hemorrhage or infarction
	438 Late effects of CVD	I69 Sequel of CVD

JHS=Jackson Heart Study; CVD=cardiovascular disease; CHD=coronary heart disease; MI=myocardial infarction.

needed basis. The JHS also receives routine death lists that reflect age-specific African-American deaths within the tricounty area. The death lists are used to identify or verify deaths of JHS participants. Once cases are identified, requests are made to the State Department of Health for a death certificate, which completes the death review process and contributes data to the calculations of mortality statistics.

Identification and Classification of CVD Events

Cardiovascular illnesses and deaths among the JHS cohort are identified by monitoring and surveillance of a combination of hospitalizations and deaths. Final event classification is completed by a carefully developed process of computer-generated diagnosis with follow-up review and adjudication by trained medical personnel, if necessary. A disease-specific process is followed for identification and classification CHD, stroke, and CHF events that require hospitalization or cause deaths in the JHS cohort as described below.

Cohort Morbidity and Mortality for CHD

Hospitalizations (Morbidity)

To identify CHD events that required hospitalization, myocardial in-

farction (MI), stroke, or CHF, the annual hospital discharge lists are reviewed for selected International Classification of Diseases, 9th and 10th Revision (ICD9, ICD10) diagnosis codes. The specific codes for each disease category are listed in Table 2.

Cohort events are eligible if the participant has: 1) valid cohort identification; 2) events occurred after the baseline examination (visit 1); and 3) an eligible discharge code listed in Table 2 and/or a CHD key word (Table 3) in the discharge summary. Cases that meet these eligibility criteria are investigated by trained and certified abstractors who

review all hospital medical records. The abstractors perform medical record abstraction with direct data entry into a laptop computer equipped with Foxpro and all JHS abstraction forms. Abstracted clinical information include presenting symptoms, presence and location of chest pain, history of MI, angina, other CVD, timing of onset of symptoms, use of medication, diagnostic procedures, and therapeutic procedures. The abstractors also recorded cardiac biomarker levels on the first four days of hospitalization or after an in-hospital event. The cardiac biomarkers include troponin I, troponin T,

Table 3. CHD key words or screening codes

Hospital chart discharge summaries are reviewed for the following screening codes:	
250	Diabetes
390-459	Diseases of the circulatory system
786.02; 786.09	Other dyspnea and respiratory abnormalities
Cardiovascular symptoms: signs and ill-defined conditions:	
794.3	Abnormal function study
798	Sudden death, cause unknown
799	Other
35.0-35.39; 35.9-35.99	Operations on valves and septa of heart
36-36.3	Operations on vessels of heart
37.21-37.23	Diagnostic procedures on heart and pericardium
37.6-37.66	Implantation of heart assist system
88.50-88.58	Angiocardiography using contrast materials
88.72	Diagnostic ultrasound of heart
92.05	Cardiovascular and hematopoietic scan and radioisotope function study

CHD=coronary heart disease.

creatinine phosphokinase (CPK) and its isoenzyme CK-MB, serum lactate dehydrogenase (LDH) and its subfractions LDH1 and LDH2 along with their ratio of LDH1/LDH2. Copies of up to three electrocardiograms (ECG) from the first day, third day (or the first ECG thereafter), and the last day of hospitalization or in-hospital event are obtained and sent to the University of Minnesota ECG Reading Center for classification according to the Minnesota code.^{8,11,12} The abstracted information and ECG readings are transmitted to the UNC-CSCC at Chapel Hill, North Carolina approximately every two weeks.

Abstracted event data are entered into the UNC-CSCC surveillance database and checked for eligibility based on cohort membership, event timing with respect to the baseline clinic exam, and the presence of a valid CVD diagnosis. All incomplete or ineligible forms are referred back to JHS surveillance team for clarification and correction. Other data related to cohort events include computed tomography (CT) and magnetic resonance imaging (MRI) data from hospitalizations for stroke or CHF related events.

In- and Out-of-Hospital Deaths (Mortality)

Deaths are investigated to ascertain that the cause of death is CHD or unspecified CVD. Death certificates that meet the criteria for the underlying cause of death (ICD-9 Codes for identification of CHD deaths: 250, 401, 402, 410-414, 427-429, 440, 518.4, 798, 799; ICD-10 codes for ID of CHD deaths: E10-14, I10-11, I21-25, I46-51, I70, I97, J81, J96, R96, R98-99) are reviewed and data are abstracted by a trained abstractor. Hospital records are reviewed for all in-hospital deaths by a trained abstractor. If the deceased had no vital signs on arrival at the hospital or death occurred outside the hospital, the death is classified as an out-of-hospital death. For out-of-hospital death, family mem-

ber interviews, physician short questionnaires, and coroner records are utilized. A trained abstractor interviews family members about the medical history of the deceased person, the circumstances surrounding the death, and the use of emergency medical services. Contact with the next-of-kin informant that is listed on death certificate is attempted within nine months of the death. A letter is also sent and is followed by a telephone interview to confirm symptoms and events around the time of death. On the average, three informants are contacted for every death certificate, though the informant who is listed on the death certificate often provides the most complete information. Physicians who are familiar with the deceased or the person who signed the death certificate are asked to complete a short questionnaire. If the deceased was hospitalized within 28 days of death, then hospital records are abstracted. Annual death indices that are provided by the states are used to locate deaths of JHS cohort members. Information on out-of-hospital deaths, including interviews and death certificates, is transmitted to UNC-CSCC every two weeks.

Classification

For MI classification, a computerized algorithm is applied to the hospital record data on symptoms, cardiac biomarkers, and ECG evaluation to generate each participant's computer diagnosis (Table 4).⁹ Most cases that have multiple hospitalizations and those with disagreement between the discharge diagnosis code and the computer-generated diagnosis are referred for review or adjudication by the Morbidity and Mortality Classification Committee (MMCC). One MMCC reviewer reviews linked (multiple) and nonlinked hospitalizations when needed. Only certain hospitalized cases get two MMCC reviewers; however, all out-of-hospital deaths get reviewed independently by two MMCC reviewers. If the

two reviewers disagree in their diagnosis, then a trained adjudicator makes the final diagnosis.

Using standardized criteria, all out-of-hospital deaths are reviewed and assigned a fatal CHD diagnosis by two MMCC reviewers.⁹ The chairman of MMCC adjudicates any disagreement in assigning a final fatal CHD diagnosis. Deaths are classified into: 1) definite fatal MI (requires hospitalization with definite MI within the previous 28 days); 2) definite fatal CHD; 3) possible fatal CHD; 4) non-CHD death; and 5) unclassifiable. Definite and possible CHD deaths are classified according to time from first symptoms to death. The criteria for classifying CHD deaths are based on combinations of: 1) chest pain; 2) history of CHD, MI, or angina; 3) no evidence of other probable cause of death; and/or 4) ICD-9 codes for identification of CHD deaths: 250, 401, 402, 410-414, 427-429, 440, 518.4, 798, 799; ICD-10 codes for identification of CHD deaths: E10-14, I10-11, I21-25, I46-51, I70, I97, J81, J96, R96, R98-99.

Cohort Morbidity and Mortality for Stroke

Stroke events are identified and validated for cohort participants. The procedure for identification, investigation, and classification of these events is outlined below.¹⁰

Hospitalizations

Trained and certified stroke abstractors review the cohort eligibility (CEL) forms and identify participants with a stroke code (Table 2 for complete listing) listed on their hospital discharge form. Hospitalizations with ICD-9 discharge codes 430-438 are investigated further. Also, discharge summaries of all reported hospitalizations are reviewed for key words, including stroke, transient ischemic attack (TIA), cerebrovascular disease, cerebral hemorrhage, cerebral infarction, subarachnoid hemorrhage, cerebral embolus, paraly-

Table 4. Summary of JHS diagnostic criteria for hospitalized MI

Cardiac Pain	ECG Finding	Enzymes	Diagnosis
Present	Evolving diagnostic ECG pattern	Abnormal	Definite MI
		Equivocal	Definite MI
		Incomplete	Definite MI
		Normal	Definite MI
	Diagnostic ECG pattern	Abnormal	Definite MI
		Equivocal	Probable MI
		Incomplete	Suspect MI
		Normal	No MI
	Evolving ST-T pattern	Abnormal	Definite MI
		Equivocal	Probable MI
		Incomplete	Suspect MI
		Normal	No MI
	Equivocal	Abnormal	Definite MI
		Equivocal	Suspect MI
		Incomplete	No MI
		Normal	No MI
	Absent, uncodable, or other	Abnormal	Probable MI
		Equivocal	Suspect MI
		Incomplete	No MI
		Normal	No MI
Not present, unknown or missing	Evolving diagnostic ECG pattern	Abnormal	Definite MI
		Equivocal	Definite MI
		Incomplete	Definite MI
		Normal	Definite MI
	Diagnostic ECG pattern	Abnormal	Definite MI
		Equivocal	Suspect MI
		Incomplete	No MI
		Normal	No MI
	Evolving ST-T pattern	Abnormal	Probable MI
		Equivocal	Suspect MI
		Incomplete	No MI
		Normal	No MI
	Equivocal ECG pattern	Abnormal	Suspect MI
		Equivocal	Suspect MI
		Incomplete	No MI
		Normal	No MI
	Absent, uncodable, or other	Abnormal	Suspect MI
		Equivocal	No MI
		Incomplete	No MI
		Normal	No MI

MI=myocardial infarction; ECG=electrocardiogram.

sis, aphasia, diplopia, lacunar (syndrome infarction), dysarthria, cerebral angiography, carotid endarterectomy, CT/MRI scan showing cerebrovascular findings, or neurological intensive care unit.

In- or Out-of-Hospital Deaths

Death certificates are reviewed for an underlying cause of death that is suggestive of stroke (ICD-10 code: I60-69). Stroke deaths without additional hospitalization data are not investigated. Classification of non-linked stroke deaths (not linked to a hospitalization within

28 days) is determined on the basis of the underlying cause of death code.

Review and Classification

Any stroke event that meets the above criteria is reviewed by a trained stroke abstractor who completes a stroke abstraction (STR) form. The abstracted data are transmitted to UNC-CSCC and run through a series of data check programs. All stroke hospitalizations are automatically assigned a stroke diagnosis by the computerized stroke algorithm, which depends on abstracted

data on the STR and the death form (DTH) if the event is a death. The computerized stroke classifications are as follows: 1) definite or probable subarachnoid hemorrhage; 2) definite or probable brain hemorrhage; 3) definite or probable brain infarction, thrombotic; 4) definite or probable brain infarction, non-carotid embolic; 5) possible stroke of undetermined type; 6) undocumented fatal stroke; 7) out-of-hospital death stroke; or 8) no stroke. Undocumented fatal strokes and out-of-hospital death strokes do not require a STR form. In the rare case where a stroke event meets the criteria for two different diagnoses, the following hierarchy is used: definite brain hemorrhage; definite subarachnoid hemorrhage; definite brain infarction, non-carotid embolic; definite brain infarction, thrombotic; probable brain hemorrhage; probable subarachnoid hemorrhage; probable brain infarction, non-carotid embolic; probable brain infarction, thrombotic; possible stroke of undetermined type. A stroke event summary form (S-ESF) is produced for each stroke event that includes information on number of major/minor symptoms, procedures, discharge diagnosis codes, and the computer classification of the event.

The S-ESF and all hospital materials for the stroke event are sent to one member of the Stroke-Mortality and Morbidity Classification Committee (S-MMCC) for classification. The trained S-MMCC reviewer with medical expertise in stroke assigns a final diagnosis of stroke. The S-MMCC reviewer can either cite exclusionary conditions such as major head trauma, neoplasm, central nervous system infection, etc, or classify the stroke event based on computerized stroke classifications as discussed earlier. An S-ESF is not produced for the following three event types: 1) events in which the STR form indicates that neurologic symptoms did not last >24 hours or no new neurologic symptoms were seen before or during

the hospital admission; 2) out-of-hospital stroke deaths not linked to a hospitalization; or 3) hospitalized events with no medical chart available. These events are automatically classified without physician review as “no stroke.”

The one S-MMCC reviewer and the computer algorithm determine final classification of stroke events. If discrepancies exist between these two sources, the final event classification is determined by a second reviewer (stroke adjudicator). A stroke event is considered classified if one of the following situations occurs:

1. The reviewer has not cited any exclusionary conditions and the computer algorithm diagnosis agrees with the reviewer’s diagnosis, the event is classified as such.
2. The reviewer does cite exclusionary conditions and the computer algorithm diagnosis is no stroke, the event is classified as no stroke.

If the S-MMCC reviewer and the computer algorithm disagree, the adjudicator’s classification is taken as the final classification.

Cohort Morbidity and Mortality for CHF

The CHF working group at the JHS has developed a definition for CHF and both inpatient and outpatient CHF criteria based on the modification of those used by Multiethnic Study of Atherosclerosis,¹³ Framingham^{14,15} and Cardiovascular Health Study (patient symptoms, physician physical findings, and diagnostic procedures).¹⁶ Inpatient CHF criteria will be included in the hospital record abstraction (HRA) form as an addendum, and outpatient CHF criteria will be developed for the outpatient record abstraction form. The current HRA form captures CHF discharge codes, but no further information is abstracted. The addendum HRA form will allow detailed HRA abstraction that will parallel that for CHD cases. The cohort eligibility form will be adjusted to

accommodate abstraction of records that meet the CHF criteria and definition for both inpatient and outpatient cohort participants.

The CHF working group also developed CHF questions that are being administered to cohort members during the annual follow-up interview. The CHF questions are already part of the expanded informant interview form that is now completed for out-of-hospital deaths.

The protocol for identifying and classifying heart failure events among cohort participants has been developed and will be re-evaluated after the first six months, and modifications will be made as appropriate. The definition for CHF adopted by the JHS is “a constellation of various symptoms and physical signs that occur in a participant whose cardiac output cannot match metabolic need despite adequate filling pressure as a result of various disease processes.”

Congestive heart failure (CHF) identification will follow the usual routines of reviewing the hospital discharge list and death certificate keywords and ICD-9 and -10 codes suggestive of CHF. A summary of the preliminary approach to heart failure classification is provided below.

Inpatients

Hospitalizations

Trained and certified CHF abstractors review the cohort eligibility forms and identify participants with: 1) a discharge diagnosis of ICD-9 code 428 and/or underlying cause of death I50; and 2) radiographic findings consistent with CHF or increased venous pressure >16, or dilated ventricle/left ventricular function <40% by echo/multiple gated acquisition (MUGA) scan; or 3) autopsy finding of pulmonary edema/CHF.

In- or Out-of-Hospital Deaths

Death certificates are reviewed for underlying secondary or tertiary or

higher cause of death that is suggestive of CHF (ICD-9 code 428 or ICD-10 code I50).

Review and Classification

Any CHF event that meets the above criteria is reviewed by a trained CHF abstractor who completes a CHF abstraction form. The abstracted data are transmitted to UNC-CSCC and run through a series of data check programs. All CHF hospitalizations are automatically assigned a CHF diagnosis by the computerized CHF algorithm, which depends on abstracted data on the CHF and the death form if the event is a death. The computerized CHF classifications include: 1) definite CHF; 2) probable CHF; or 3) no CHF in accordance with inpatient or outpatient location by using the following criteria:

- Inpatient definite CHF. Criteria for definite CHF in an inpatient setting include: 1) a discharge diagnosis of ICD-9 code 428 and/or underlying cause of death I50; and 2) radiographic findings consistent with CHF or increased venous pressure >16, or dilated ventricle/left ventricular ejection fraction <40% by echo/MUGA/magnetic resonance imaging (MRI) scan; or 3) autopsy finding of pulmonary edema/CHF.
- Inpatient probable CHF. Criteria for probable CHF in the inpatient setting include: 1) a discharge diagnosis ICD-9 code of 428 and/or underlying cause of death I50; and 2) any three findings from the CHF criteria list (Table 5).

Outpatients

Any JHS participant that routinely visits a healthcare provider on an outpatient basis with problems related to CHF will be identified during the usual annual followup. The information, which includes the location of outpatient clinics and treating provider’s name, will be transmitted to the trained and certified CHF medical record

Table 5. Congestive heart failure criteria signs and symptoms list

Signs:
Distended neck veins/jugular venous distention
S3
Rales
Hepatjugular reflux
Hepatomegaly
Decrease in vital capacity by 1/3
Tachycardia
Symptoms:
Paroxysmal nocturnal dyspnea
Orthopnea
Dyspnea on exertion
Shortness of breath (dyspnea at rest)
Night cough
Bilateral lower extremity edema

abstractors. The abstractor reviews the cohort eligibility forms and identifies participants with: 1) a discharge diagnosis of ICD-9 code 428 and/or underlying cause of death I50; and 2) radiographic findings consistent with CHF or increased venous pressure >16, or dilated ventricle/left ventricular ejection fraction <40% by echo/MUGA/MRI scan; or 3) autopsy finding of pulmonary edema/CHF.

Review and Classification

Any CHF event that meets the above criteria is reviewed by a trained CHF abstractor who completes a congestive heart failure abstraction form. The abstracted data are transmitted to UNC-CSCC and run through a series of data check programs. All CHF hospitalizations are automatically assigned a CHF diagnosis by the computerized CHF algorithm, which depends on abstracted data on the CHF and the death form if the event is a death. The computerized CHF classifications include: 1) definite CHF; 2) probable CHF; or 3) no CHF using the following criteria:

- Outpatient definite CHF. Criteria for definite CHF in an outpatient setting include: 1) outpatient diagnosis of ICD 428 and/or underlying

cause of death I50 (out of hospital); and 2) outpatient diagnosis of ICD 428 and chest radiograph findings consistent with pleural effusion/pulmonary edema/cephalization of vessels/cardiomegaly (1 and 2); or 3) outpatient diagnosis of ICD 428 and echo consistent with dilated ventricle/left ventricular ejection fraction <40% (1 and 3); or 4) outpatient diagnosis of ICD 428 and any 3 findings from CHF criteria (Table 5) within two weeks of outpatient visit (1 and 4).

- Outpatient probable CHF. Criteria for probable CHF in the outpatient setting include: 1) outpatient diagnosis of ICD-9 code 428 and/or underlying cause of death I50; or 2) ICD-9 code 425.4 or 518.4 with one or two of the CHF symptoms; and 3) one or two findings from the CHF criteria (Table 5).

For both inpatient and outpatient, the CHF event summary forms (CHF-ESF) and all hospital materials for the CHF event are sent to one member of the CHF-Mortality and Morbidity Classification Committee (CHF-MMCC) for classification. The trained CHF-MMCC reviewer with medical expertise in CHF assigns a final diagnosis of CHF. The one CHF-MMCC reviewer and the computer algorithm determine final classification of CHF events. If discrepancies occur between these two sources, the final event classification is determined by a second reviewer (CHF adjudicator).

TRAINING AND QUALITY CONTROL

An important aspect of accurate events ascertainment and classification is ongoing training and recertification and quality assurance for the trained medical record abstractors, next-of-kin informant interviewers, and the members of the MMCC (reviewers and adjudicators).

Training and Recertification

The initial certification of JHS abstractors occurs as a result of an intensive four-day training conducted by a senior abstractor at the University of Minnesota and a member of the physician staff there. Included is an overview of CHD, followed by supervised exercises in medical record abstraction of various scenarios of CHD hospitalizations. Multiple case types are abstracted and discussed.

Medical records abstractors complete an annual recertification during a two-day training session conducted by the surveillance team at the UNC-CSCC. The training entails a detailed discussion of the changes and updates to the data entry system as well as updates within the question-by-question (QXQ) booklet. Also, a review of the yearly quality control reports is generated by UNC-CSCC. Each abstractor is given an opportunity to reabstract four medical records for detailed comparison and discussion by all centers. Successful completion of these exercises is required in order to be recertified.

Re-certification for next-of-kin informant interview staff is also conducted during the yearly sessions. Protocol and QXQ instructions for completing the informant interview form are thoroughly reviewed and discussed. To be recertified, the next-of-kin informant interviewers have to satisfactorily conduct an interview with a UNC-CSCC staff acting as an informant. The coded QXQ responses of the next-of-kin informant interviewer are compared with standard responses.

Recertification training is provided annually for all JHS and ARIC abstractors and MMCC reviewers to assure adherence to protocol and data quality. Topics for discussion include update on changes in ICD coding rules, innovations in diagnostic testing (eg, incorporation of cardiac troponins), review of quality control data, update on form changes, group discussion of informant interviews, and detailed discussion of

changes to case law. A standard set of cases (a variety of types including linked and nonlinked nonfatal hospitalizations, in-hospital, and out-of-hospital deaths) from cohort morbidity and mortality are distributed to all members prior to the meeting. Committee members are asked to complete the appropriate cohort final diagnosis form (CDX) as they normally would do and send them to UNC-CSCC. A tabular summary of data from the CDX forms is distributed for discussion during the recertification. Each case is reviewed in detail with special discussion among the group on any disagreement in diagnosis. The session is led by the chair of the MMCC who also selects special cases for detailed presentation and discussion. Successful completion of these exercises is required for recertification.

Quality Control

The UNC-CSCC generates yearly cohort morbidity and mortality quality control (QC) reports in an effort to maintain data quality. Additionally, reabstraction of medical records for cohort participants is done for discharge ICD-9 codes 410 or 411. Each abstractor is responsible for providing 12 originally abstracted cases for reabstraction annually. Each of the three abstractors (one JHS, two ARIC) reviews a blinded chart of another abstractor each month. Each abstractor is required to review 12 blinded charts of another abstractor each year. In terms of out-of-hospital death cases, up to three informant interviews and two physician questionnaires are collected.

Quality assurance of diagnosis is assured for classified events by assigning two MMCC-trained reviewers to independently review and classify each event that needs review. The diagnoses of the two reviewers are compared and any disagreement is referred to the chairman of MMCC for adjudication and final diagnosis.

CONCLUSION

The JHS is a prospective study and provides the opportunity to observe the relationship of CVD risk factors and the development of CVD in African Americans in the tricounty (Hinds, Madison, and Rankin) Jackson, Mississippi, MSA. The morbidity and mortality classification or surveillance methods of the JHS are similar to those used by the classic ARIC study, therefore they draw on proven approaches for surveillance of a large population-based cohort. The JHS expands this method by including in- and out-patient CHF as a major surveillance diagnosis. This addition will augment the information provided by ARIC and further our understanding of CVD gleaned from such major studies as Framingham,^{17,18} MESA,¹³ CHS,¹⁶ Dupont Study,¹⁹ Pawtucket Heart Health Program,²⁰ Coronary Artery Risk Development in Young Adults (CARDIA)²¹⁻²³ and others that have provided a wealth of information on CVD risk factors and the development of CVD in predominately White or multiethnic samples. The JHS will allow elucidation of these factors in an all-African-American sample.

ACKNOWLEDGMENTS

The authors thank the staff, interns, and participants in the Jackson Heart Study for their long-term commitment to the study. This research was supported by NIH contracts N01-HC-95170, N01-HC-95171, and N01-HC-95172 that were provided by the National Heart, Lung, and Blood Institute and the National Center for Minority Health and Health Disparities.

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CVD ENDPOINTS CLASSIFICATION IN THE JHS - Keku et al

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