

## Reducing Delay in Seeking Treatment by Patients With Acute Coronary Syndrome and Stroke

### A Scientific Statement From the American Heart Association Council on Cardiovascular Nursing and Stroke Council

Debra K. Moser, DNSc, RN, FAHA; Laura P. Kimble, PhD, RN, FAHA;  
Mark J. Alberts, MD, FAHA; Angelo Alonzo, PhD; Janet B. Croft, PhD;  
Kathleen Dracup, DNSc, RN, FAHA; Kelly R. Evenson, PhD; Alan S. Go, MD;  
Mary M. Hand, MSPH, RN, FAHA; Rashmi U. Kothari, MD, FAHA; George A. Mensah, MD, FAHA;  
Dexter L. Morris, PhD, MD; Arthur M. Pancioli, MD, FAHA; Barbara Riegel, DNSc, RN, CS, FAHA;  
Julie Johnson Zerwic, PhD, RN, FAHA

**Abstract**—Patient delay in seeking treatment for acute coronary syndrome and stroke symptoms is the major factor limiting delivery of definitive treatment in these conditions. Despite decades of research and public education campaigns aimed at decreasing patient delay times, most patients still do not seek treatment in a timely manner. In this scientific statement, we summarize the evidence that (1) demonstrates the benefits of early treatment, (2) describes the extent of the problem of patient delay, (3) identifies the factors related to patient delay in seeking timely treatment, and (4) reveals the inadequacies of our current approaches to decreasing patient delay. Finally, we offer suggestions for clinical practice and future research. (*Circulation*. 2006;114:168-182.)

**Key Words:** AHA Scientific Statements ■ acute coronary syndrome ■ stroke ■ delivery of health care

Despite major advances in identifying effective treatments for heart attack and stroke, there are substantial difficulties in applying these treatments to care. The weak link in the chain of events leading to prompt and effective treatment is patient delay in seeking care. More than 50% of the 1.2 million people who suffer an acute myocardial infarction (AMI) or coronary death each year in the United States die in an emergency department (ED) or before reaching a hospital within an hour of symptom onset.<sup>1</sup> About 700 000 individuals will have a stroke each year, 167 000 of those who have strokes will die, and more will suffer a major disability.<sup>1</sup> Of the stroke deaths that occur each year, almost half occur before the patient reaches the hospital.<sup>2</sup> Many of these deaths and significant disability could be prevented if patients received earlier treatment.<sup>1,3</sup>

Although the benefits of early treatment of heart attack and stroke are clear, only a minority of eligible patients receive optimally timed treatment for their symptoms because of delay

in seeking care. The development and use of appropriate interventions to decrease treatment-seeking delay by patients could produce important gains in reducing death and disability from heart attack and stroke. Unfortunately, efforts to date to develop effective interventions have met with disappointing results.<sup>4-6</sup> Accordingly, the purpose of this statement is to summarize the evidence that demonstrates the benefits of early treatment,<sup>1,2</sup> describes the extent of the problem of patient delay,<sup>3</sup> identifies the factors related to patient delay in seeking timely treatment, and reveals the inadequacies of our current approaches to decreasing patient delay.<sup>4</sup> Finally, we offer suggestions for clinical practice and future research.

#### Benefits of Early Treatment

The burden of cardiovascular disease is growing worldwide. Ischemic heart disease is the No. 1 cause of death in the

The findings and conclusions in this scientific statement are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention and the National Heart, Lung, and Blood Institute.

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

This statement was approved by the American Heart Association Science Advisory and Coordinating Committee on April 24, 2006. A single reprint is available by calling 800-242-8721 (US only) or writing the American Heart Association, Public Information, 7272 Greenville Ave, Dallas, TX 75231-4596. Ask for reprint No. 71-0364. To purchase additional reprints: up to 999 copies, call 800-611-6083 (US only) or fax 413-665-2671; 1000 or more copies, call 410-528-4121, fax 410-528-4264, or e-mail kelle.ramsay@wolterskluwer.com. To make photocopies for personal or educational use, call the Copyright Clearance Center, 978-750-8400.

Expert peer review of AHA Scientific Statements is conducted at the AHA National Center. For more on AHA statements and guidelines development, visit <http://www.americanheart.org/presenter.jhtml?identifier=3023366>.

© 2006 American Heart Association, Inc.

*Circulation* is available at <http://www.circulationaha.org>

DOI: 10.1161/CIRCULATIONAHA.106.176040

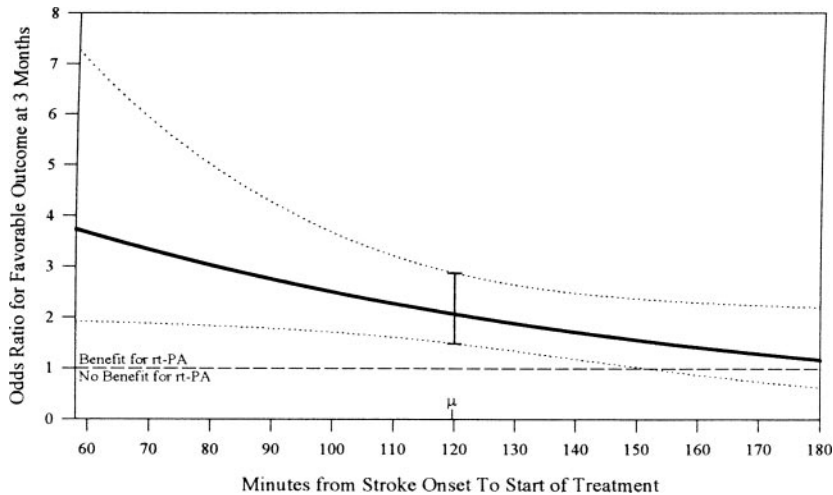


Figure. Relationship of time to treatment and odds of favorable outcome in stroke.

United States and other developed countries and is projected to emerge as the No. 1 cause of death worldwide by the year 2020.<sup>1,7</sup> Stroke is the No. 3 cause of death and a major cause of disability.<sup>1</sup>

Delay to treatment for acute coronary syndromes (ACS) and stroke is a major contributor to the morbidity burden of cardiovascular disease because a significant number of individuals who delay seeking care develop potentially preventable complications.<sup>8–10</sup> The disability associated with stroke and with heart failure after AMI is largely a consequence of infarct size, and lack of timely treatment is a major determinant of increased infarct size in both AMI and stroke.<sup>8,11,12</sup> Unfortunately, most individuals who experience symptoms delay substantially before seeking treatment.<sup>13–27</sup>

### Acute Coronary Syndrome

Institution of definitive treatment for ACS should begin within 1 hour of symptom onset. This goal is based on data that demonstrate that increased morbidity and mortality are associated with increased time from symptom onset to treatment.<sup>9,11,16,28–31</sup> Delay has been an important predictor of patient morbidity and mortality outcomes in numerous clinical trials of reperfusion therapy.<sup>8,9,11,29,32,33</sup> Survival rates are improved by up to 50% if reperfusion is achieved within 1 hour of symptom onset and by 23% if it is achieved within 3 hours of symptom onset.<sup>34</sup> In one trial, delaying treatment by 30 minutes reduced average life expectancy by 1 year.<sup>35</sup> In another recent study of 565 patients undergoing angioplasty for AMI, those who received the first balloon inflation within 60 minutes of arrival at the hospital had a 30-day mortality rate of 1.0%, but for every 15 minutes longer than 1 hour the odds of death increased 1.6 times.<sup>11</sup>

Delay also affects morbidity. A shorter interval between symptom onset and treatment is associated with better cardiac function.<sup>34,36</sup> The level of cardiac function is the best predictor of morbidity, as well as of mortality.<sup>35,37,38</sup> Thus, early treatment with reperfusion, as well as with other agents such as angiotensin-converting enzyme inhibitors,  $\beta$ -blockers, and aspirin, can reduce mortality and morbidity.

### Acute Ischemic Stroke

Delivering the earliest possible definitive treatment for acute ischemic stroke is a major goal of clinicians caring for stroke

patients. In the United States, the use of fibrinolytics for ischemic stroke received Food and Drug Administration approval on June 18, 1996. Subsequent trials demonstrated that shorter time to fibrinolysis substantially improved clinical outcome in acute ischemic stroke patients. National Institute for Neurological Disorders and Stroke trials demonstrated that treatment within 3 hours of symptom onset is beneficial for patients with acute ischemic stroke.<sup>39</sup> Even within the 3-hour window, benefit from fibrinolysis decreases as time from symptom onset increases (Figure).<sup>40</sup> An analysis of 6 large, randomized, controlled trials of intravenous fibrinolysis corroborated these findings and indicated that the optimal administration time is within 90 minutes of symptom onset.<sup>41</sup>

### Delay Phases

Different treatment-seeking delay phases have been defined and evaluated for ACS, and the study of stroke care could benefit from a similar approach. These phases include the time intervals from (1) symptom onset to the decision to seek medical attention, (2) from the decision to seek medical attention to first medical contact, and (3) from first medical contact to hospital arrival. Transportation to the hospital consumes only a very small proportion of prehospital delay.<sup>42–45</sup> Once patients arrive for care, the in-hospital phase of delay to treatment is small compared with the other phases.<sup>46</sup> The longest phase of delay continues to be the time from symptom recognition to the decision to seek care, and it is in this phase that the most improvement could be achieved.

### Acute Coronary Syndrome

The delay in seeking treatment for ACS has changed little in recent decades, despite increased public awareness of the benefits of reperfusion therapy.<sup>15,47</sup> In the United States, median delay time from symptom onset to hospital arrival ranges from 1.5 to 6.0 hours.<sup>9,14,42,48</sup> Data from the Atherosclerosis Risk in Communities Study indicate no improvement in delay from 1987 through 2000: 49.5% of patients delayed >4 hours.<sup>49</sup> Even delay times at the short end of the time-to-treatment spectrum show that at least 50% of patients delay  $\geq 1.5$  hours in seeking treatment, putting them outside the time frame to receive optimum benefit from reperfusion.

Prehospital delay time is also a significant problem worldwide.<sup>13–15</sup> For example, in one study conducted in Australia, median delay time was 6.4 hours.<sup>13</sup> In many European countries such as Britain and Sweden, prehospital delay times are notably longer than those reported in the United States.<sup>50</sup>

### Acute Ischemic Stroke

A comprehensive review of studies published from January 1981 to March 2000, focusing on delay in seeking treatment among acute ischemic stroke patients, revealed findings of prehospital delay that were similar to those for ACS patients. In the majority of studies reviewed, median delay time ranged from 3 to 6 hours.<sup>1,51</sup> Despite this, the primary focus of healthcare professionals and researchers to date has been on reducing in-hospital treatment delays (such as by developing stroke protocols, stroke teams, and optimizing referral patterns).<sup>52</sup>

### Who Delays and Why?

More than 100 studies have been conducted over the past 3 decades to identify characteristics predictive of increased patient delay in response to symptoms of ACS and acute ischemic stroke.<sup>42,51,53</sup> Most investigators have concentrated on examining the relationship of sociodemographic and clinical factors to delay.<sup>54</sup> This is important work because these variables are essential to any understanding of how different social groups react to symptoms and for identifying high-risk groups needing educational and clinical intervention.<sup>55</sup> Although the literature on factors related to delay in seeking treatment for ACS symptoms is more extensive and in depth than that for acute ischemic stroke, few investigators in either area have examined the impact of social, cognitive, and emotional factors on delay.<sup>56,57</sup> Table 1 summarizes the significant trends in past research.

**TABLE 1. Factors That Affect Prehospital Delay in Patients With ACS and Ischemic Stroke Symptoms**

Factor	Effect on Delay in ACS	Effect on Delay in Acute Ischemic Stroke
Sociodemographic characteristics		
Older age	Increase	No difference
Female sex	Increase	No difference
Lower educational level	Increase	No difference
Black or Latino race	Increase	Increase
Low socioeconomic status	Increase	Increase or no difference
Clinical characteristics		
History of angina	Increase	Not studied
Prior myocardial infarction	No difference or increase	No difference
Diabetes	Increase	No difference
Hypertension	Increase	No difference
Heart failure	Increase	No difference
History of atrial fibrillation	Not studied	No difference
Smoking	Increase	No difference
Hyperlipidemia	Increase	No difference
Prior stroke or transient ischemic attack	Not studied	Decrease
Social		
Living alone or being alone at symptom onset	Increase	Increase
Consultation with physician	Increase	Increase
Consultation with a family member versus a nonrelative	Increase	Increase
Consultation with a nonrelative	Decrease	Increase
Cognitive and emotional		
Knowledge of symptoms or risk factors	No difference	No difference
Appraisal of symptoms as not being serious or urgent	Increase	Increase
Waiting for symptoms to go away	Increase	Not studied
Concern about troubling others	Increase	Not studied
Fearing the consequences of seeking help	Increase	Not studied
Being embarrassed about seeking help	Increase	Not studied
Correct attribution of symptom origin	Decrease	Not studied
Self-treatment	Increase	Increase

## Acute Coronary Syndrome

### *Sociodemographic Factors*

Old age, female sex, low education level, low socioeconomic status, and black race are associated with increased delays in seeking treatment.<sup>16,42,53,58–60</sup> Special mention of the impact of race/ethnicity on treatment-seeking delay is warranted because of the complexity of this issue. Data from single-center studies,<sup>61</sup> large multicenter trials,<sup>55</sup> and from the National Registry of Myocardial Infarction 2 (NRM1 2)<sup>58</sup> have demonstrated longer prehospital delay among black patients than among white patients. Latino/Hispanic persons make up the fastest-growing minority group in the United States, but relatively few investigators have examined whether or not differences exist in prehospital delay among this diverse group. Although Latino/Hispanic persons had significantly greater median prehospital delay than did whites (4 versus 2 hours) in one study,<sup>62</sup> other large studies failed to show this difference.<sup>55,63</sup>

Although few studies have examined prehospital delay among black and Latino/Hispanic patients, even fewer of adequate sample size have examined this delay among Asian/Pacific Islanders and Native Americans, whether overall or across their various major subgroups. The largest assessment to date comes from the NRM1 2 registry, where no differences in prehospital delay were found between patients who were Asian/Pacific Islander Americans and those who were white.<sup>63</sup> On the other hand, median prehospital delay times were higher among Native Americans in this registry than among whites.<sup>64</sup>

Why might racial or ethnic differences in treatment-seeking behavior exist? Data conflict with regard to whether the clinical presentation of ACS differs among white versus black,<sup>63,65</sup> Latino/Hispanic,<sup>63</sup> Asian/Pacific Islander,<sup>63</sup> and Native American<sup>66</sup> patients. Adequate familiarity with possible symptoms of ACS is generally low among adults and may vary by race or ethnicity.<sup>67,68</sup> Perceptions of chest pain or ischemic symptoms and their severity may differ in blacks from those in whites and other groups.<sup>69</sup> Cultural differences in symptom response may accentuate other factors that contribute to differential use of emergency services.<sup>70,71</sup> Trust in physicians and medical institutions,<sup>72</sup> satisfaction with previous medical care,<sup>73</sup> perceived access to necessary services,<sup>74</sup> perceived discrimination,<sup>31,38,42,43,75,76</sup> and effectiveness of patient–provider communication likely add to the challenges of optimizing patient decision-making while they complicate attempts to address disparities in health care.

### *Clinical Factors*

The preponderance of evidence indicates that having a prior AMI does not facilitate care seeking.<sup>77</sup> In general, chronic health conditions such as diabetes, hypertension, and high cholesterol, as well as high-risk behaviors such as smoking, are associated with additional delay in seeking treatment.<sup>43</sup> A history of heart failure or angina also appears to delay care seeking.

As might be expected, patients reporting more acute symptoms<sup>58</sup> and those in cardiogenic shock exhibit shorter delays before seeking care than those with less severe

symptomatology.<sup>13,42,50,56,77–79</sup> Patients who assess their symptoms as relatively benign are more likely to delay the care-seeking process.<sup>80</sup>

### *Social, Cognitive, and Emotional Factors*

The decision to seek treatment is heavily influenced by patients' social context, cognitive processes, and emotional reactions, but these aspects of delay remain underexplored. One of the earliest studies on patient delay in seeking treatment during AMI incorporated both cognitive and emotional variables,<sup>81,82</sup> but research in the 3 decades since this study was published has included these factors only sporadically.

People routinely participate in situations where they experience organized social life and the intersection of social, psychological, and biophysical features of ongoing life. Social commitments can outweigh the impulse to seek immediate care, even for acute cardiac symptoms. Situations and circumstances constrain individual behavior because we are committed to them; they represent our sense of social reality, and our identities are invested in them. Although healthcare providers can find it incomprehensible that patients would fail to immediately seek care at the onset of ACS symptoms, individuals often value social situations—in all their complexity and challenge—too highly to immediately terminate them.

A major social and situational factor is an individual's location when symptoms begin. Onset of symptoms at home is associated with delayed hospital arrival.<sup>83</sup> This association is especially significant, because almost three quarters of patients are at home when symptoms begin.<sup>38</sup> The patient's activity level at symptom onset is another situational factor: those resting or sleeping at symptom onset delay longer than those engaging in physical activity.<sup>38</sup> As might be expected, long travel distances to the hospital,<sup>59</sup> rural residence,<sup>82</sup> and traveling home in response to symptoms are all associated with longer delays.<sup>16,38,84</sup>

Living alone<sup>84</sup> and being alone at symptom onset<sup>82</sup> are associated with longer delays in seeking care for ACS symptoms. Although being alone and at home at acute symptom onset increases delay,<sup>83</sup> the vast majority of individuals are with someone when symptoms begin.<sup>83</sup> Being with a companion promotes faster care seeking.<sup>82</sup> The fastest response times are found in those who are with a coworker or a companion who is not a family member when symptoms begin.<sup>56,85</sup> Family members (particularly spouses) often recommend strategies that increase delay.<sup>56,85</sup>

Anxiety or acknowledgment of the seriousness of symptoms is associated with reduced delay.<sup>86</sup> In one study, no effect on delay was observed for patients' perceived level of control over their personal health,<sup>87</sup> whereas other investigators found that patients who believed their health was determined by chance (that is, they had low levels of health locus of control) were less likely to recognize their symptoms.<sup>88</sup>

Feelings of embarrassment have been shown to be significant factors in delay.<sup>56,79,83</sup> The concern for social propriety delays care seeking because people do not want to trouble others about their symptoms.<sup>56,81</sup> The potential for feeling

embarrassed increases when symptoms occur after business hours or on the weekend and when patients consider the possibility that their symptoms are not really serious.<sup>89</sup> The experience of prior false alarms is associated with intentions to delay when future symptoms occur<sup>90</sup> and with increased reticence to call emergency medical services (EMS).<sup>83,91</sup>

Cognitive factors, or interpretations and assessments of situations and circumstances, can contribute to delay, especially when a discrepancy exists between what an individual believes about symptoms of ACS and what he or she actually experiences.<sup>91</sup> The mismatch between symptom expectations and actual experiences produced greater delay than sociodemographic or clinical factors in one study.<sup>54</sup> Many patients reported being underwhelmed by their symptom experience because it did not resemble a typical "Hollywood heart attack," as seen on television.<sup>91</sup> Consistent with this finding, absence of chest pain and slow onset of acute symptoms delay care seeking.<sup>62,81,91,92</sup> An evolving, cumulative event produces even more delay.<sup>56,62,93</sup>

Patients who believe their symptoms are related to their heart seek care faster than those who attribute their symptoms to other causes.<sup>66,94</sup> Patients' failure to recognize that symptoms are heart related can be explained by lack of familiarity with the symptoms of ACS, but even patients who know the symptoms of AMI often delay seeking treatment.<sup>91,95,96</sup> In fact, several investigators have documented that the US public is quite familiar with the association between chest pain and AMI.<sup>16,97-99</sup> However, the public is less aware that ACS often presents with a constellation of symptoms, not just chest pain, and many people do not realize that the chest sensations of ACS are often not severe and may have qualities not typical of pain. Clearly, some individuals have trouble reconciling their actual symptoms with their preconceptions.<sup>100</sup>

Symptom patterns appear to differ by gender, with women having less typical symptom patterns than men, which may contribute to women's delay in seeking care.<sup>101</sup> The mistaken belief that women are less likely to have an ACS event is held by both patients and physicians,<sup>91</sup> also potentially contributing to delay.<sup>95</sup> Conversely, perceiving oneself to be at risk can decrease delay in seeking care for ACS.<sup>102</sup>

Another factor thought to affect delay is an individual's knowledge of potential treatment options. Many patients have little understanding of the benefits of using EMS or of reperfusion therapies.<sup>13</sup> Only 16% of AMI patients in one study knew about fibrinolytic therapy, but those patients sought treatment significantly sooner than patients who were not aware of this therapy.<sup>86,103</sup> In a study that compared delay for physicians experiencing AMI to delay for nonphysicians experiencing AMI, median delay was substantially shorter for physicians (1.8 hours versus 4.9 hours).<sup>86</sup> Physicians may have delayed less because they were aware of the time-dependent requirements for reperfusion therapies.

The concept of denial is commonly used to explain delay. However, the few investigators who have attempted to measure this phenomenon have found no relationship between denial and delay.<sup>87,104</sup> Patients, however, who attempted to distract themselves from their symptoms delayed longer,<sup>16</sup> and those who scored low on their ability to

recognize emotions and bodily sensations also had longer delays.<sup>91</sup> These findings suggest that it may be more appropriate to speak of indecision rather than denial.<sup>77,78,81</sup> Indecision, circumstantial and more variable than denial, is defined as not knowing what to do and constructing and weighing options before taking action.

One natural coping response to indecision is waiting. When patients wait for symptoms to go away<sup>82</sup> or wait for them to evolve into a highly recognizable pattern, substantial delay in seeking treatment occurs. Taking medications<sup>42,54</sup> and other self-care strategies, very common with ACS symptoms, result in delays in seeking care.<sup>78</sup> Self-treatment with prescription medication, including nitrates and nonprescription medications (for example, antacids), is a frequent cause of delay among AMI patients, including those with a history of AMI or angina.<sup>78</sup> In 2 studies within the past decade, both the rate of medication use and the number of doses taken were positively correlated with delay in hospital arrival.<sup>84,105</sup>

### *Healthcare Provider Contributions to Delay*

A number of investigators have demonstrated that calling a physician's office increases delay in seeking treatment.<sup>78</sup> In fact, some have demonstrated that provider delay accounts for more time lost than patient delay in the prehospital period.<sup>106</sup> This problem is even more profound when we consider that most individuals believe calling their doctor, not EMS, is the correct course of action.<sup>84,106</sup> Deference toward physicians causes delays when symptoms occur during off hours.<sup>90,107</sup> Persons who call a physician are less likely to use EMS.<sup>108</sup> Patients who use EMS receive reperfusion therapy faster than those who do not.<sup>108,109</sup>

Providers may believe that it is unnecessary to tell patients to call 911 because they assume patients already know to do so.<sup>110-113</sup> Many physicians are unaware of, or fail to appreciate, the empirical evidence with regard to the consequences of patient delay.<sup>17,19-22,24,110-112,114</sup>

## **Acute Ischemic Stroke**

### *Sociodemographic Factors*

In most studies of delay in seeking care for stroke symptoms, gender and age differences were not associated with prehospital delay.<sup>17,19-21,24,26,110-117</sup> Socioeconomic factors, such as educational level,<sup>21,25,111-113,115,117</sup> employment,<sup>20,24,111,113</sup> and insurance status<sup>110,112,113,117</sup> were also unrelated to prehospital delay in most studies, whereas results were mixed for income level.<sup>113</sup> Although race or ethnicity was unrelated to delay in many studies,<sup>20,22,110,111,113,117</sup> some investigators found longer delays for blacks<sup>24</sup> and for Asians and Pacific Islanders.<sup>113</sup>

### *Clinical Factors*

Prehospital delay is influenced by stroke symptoms because some stroke symptoms render the patient unable to call for help. In some studies, shorter delays were associated with an array of factors, including sudden onset of symptoms<sup>26,115</sup> and impaired consciousness.<sup>17,118,119</sup> Greater stroke severity, measured in a variety of ways, was associated with shorter prehospital delays in most<sup>19,26,116,117,119,120</sup> but not all studies.<sup>24,110,111,113</sup> Findings on the differences in delay time by type of stroke are mixed. Although not shown with absolute

consistency, short prehospital delays were found with hemorrhagic stroke in most studies.<sup>20,24,26,114,118–120</sup> A history of transient ischemic attack<sup>19</sup> or prior stroke<sup>115</sup> was related to shorter prehospital delay in 2 studies yet was unrelated to prehospital delay in many more studies.<sup>19–21,25,110,113,114,116–118</sup> Other preexisting comorbidities were generally unrelated to prehospital delay for stroke, including AMI,<sup>19,20</sup> congestive heart failure,<sup>20</sup> atrial fibrillation,<sup>22</sup> and diabetes.<sup>19</sup> Risk factors for stroke, such as hypertension,<sup>19,24</sup> hypercholesterolemia,<sup>24</sup> alcohol consumption,<sup>19</sup> and smoking,<sup>19,22,24</sup> were also generally unrelated to prehospital delay.

### **Social, Cognitive, and Emotional Factors**

Findings are inconsistent with regard to how the presence of witnesses to the onset of stroke symptoms affects prehospital delay. In some studies, prehospital delay was reduced when the witness, rather than the patient, identified the problem.<sup>112,120</sup> In other studies, no impact on delay was evident on the basis of who recognized the problem as stroke.<sup>26,117</sup> If the first action after symptom onset was to contact another person, including a family member or a physician, then prehospital delay was significantly longer than in cases where a different action was taken.<sup>25,26,120</sup> Living alone or being alone when symptoms first occurred was associated with longer delays in some<sup>19,111</sup> but not most studies.<sup>6,20,22,51,114,121</sup> Use of EMS was associated with significantly shorter prehospital delay times.<sup>20,22,26,110–114,117,118,120</sup>

Patients' familiarity with stroke warning signs, belief that symptoms are related to stroke, awareness that they have risk factors for stroke, and previous exposure to a stroke program appear to be unrelated to prehospital delays in seeking care.<sup>21,112,117</sup> Knowing someone who had suffered a stroke was associated with shorter prehospital delay in one study<sup>117</sup> but not in another study.<sup>112</sup> However, as might be expected, prehospital delay was significantly longer when patients did not believe their stroke symptoms were serious and urgent.<sup>26,112,117</sup>

Greater delay occurred with nocturnal onset of symptoms.<sup>17,24,26,116,118–120</sup> Weekend onset was unrelated to prehospital delay in 2 studies<sup>24,114</sup> but associated with longer delays in 1 study.<sup>118</sup> Greater distance between home and hospital was associated with longer delays in several studies<sup>25,114,120,122</sup> but unrelated to delay in others.<sup>26,113,117–119</sup>

### **Healthcare Provider Contributions to Delay**

As in the case of ACS, if a patient's response to symptoms includes calling a physician, prehospital delay is longer.<sup>25,26,120</sup> Few other aspects of healthcare provider behavior have been studied.

### **Differences Between Delay in Seeking Treatment for ACS and for Stroke**

ACS and acute ischemic stroke have considerable pathophysiological overlap, and their procedures for treatment share the need to minimize the time from onset of symptoms to definitive management. Despite the many similarities, however, these disease processes are significantly different in terms of the median duration from symptom onset to presentation at a hospital. Delay from symptom onset to presentation is 2 to 3 times longer for acute ischemic stroke than for

ACS.<sup>123</sup> Understanding the factors leading to the different patterns of delay associated with ACS and acute stroke may have an impact on the design of potential interventions.

The primary clinical differences between ACS and acute ischemic stroke are the symptom complexes of the 2 diseases. One very important difference is that pain is frequently associated with ACS but is uncommon with stroke. Although the precise incidence of pain in ACS is unknown, the majority of patients with AMI likely have pain or discomfort.<sup>124</sup> In contrast, pain is associated with only 8.7% of anterior circulation ischemic stroke cases and 15% of posterior circulation ischemic stroke cases.<sup>125</sup> Pain is a motivating symptom. In ACS and acute stroke, the presence of severe pain is associated with decreased delay.<sup>22</sup>

Possibly the greatest area of difference between ACS and acute ischemic stroke is the greater likelihood of cognitive impairment in the stroke patient. Although most victims of ACS do not have acute changes in mental status, a large proportion of victims of acute stroke will have significant communicative, motor, or cognitive deficits. Each of these deficits can dramatically increase delay to medical care by necessitating the assistance of another individual. In the setting of acute stroke, 23% of patients have dysphasia, 77.4% have an acute upper limb motor deficit, and 18.7% have an altered level of consciousness.<sup>126</sup> Thus, a large proportion of acute stroke victims have a disease-specific potential cause of delay in seeking treatment. This conclusion is further supported by the finding that stroke victims who were alone at the time of onset had a longer median prehospital delay compared with those who were not alone at onset.<sup>127</sup>

Finally, healthcare providers may contribute to the disparity in delay. Use of EMS reduces prehospital delay and is the optimum means of reaching care for patients with ACS. In many areas, however, stroke does not receive the same dispatch priority as ACS. Therefore, there may be an inherent bias toward greater delay for acute stroke victims over ACS victims. Moreover, the public perception of warning signs for acute stroke is considerably less advanced than for ACS.<sup>4,5</sup> Although familiarity with acute stroke warning signs is improving, it lags considerably behind familiarity with the warning signs of ACS.<sup>6</sup> In 2 surveys of the public's knowledge of stroke warning signs, only 18% of respondents cited "doctors" as their primary source of stroke knowledge. More attention by physicians to educating their patients about stroke may help reduce delays. Thus, although many differences between stroke and ACS exist, the acute treatment of AMI has been defined in public consciousness 20 years longer than the acute treatment of stroke. Although the diseases are different, we can examine the efforts that have and have not been successful for ACS and apply the lessons that have been learned to the treatment of stroke.

### **Interventions to Reduce Prehospital Delays in Seeking Treatment**

#### **Acute Coronary Syndrome**

Previous attempts to reduce patient delay in seeking treatment for ACS symptoms using broad-based community education

programs have yielded disappointing results,<sup>128</sup> likely because of emphasis on simply providing information without attending to the complex cognitive, emotional, and social contexts in which treatment-seeking behavior occurs. In the vast majority of studies conducted over the past 3 decades, investigators have documented little or no decrease in patient delay from community education programs carried out in the media or by mass mailings on the topics of symptom recognition and early EMS access.<sup>4</sup>

The Rapid Early Action for Coronary Treatment (REACT) trial<sup>6,128</sup> has been the most ambitious study to date designed to reduce delay in seeking treatment for ACS symptoms. REACT was a 4-year, multisite community intervention study funded by the National Heart, Lung, and Blood Institute (NHLBI) to test whether a community-based, multicomponent intervention of 18 months' duration would reduce patient delay. The intervention included the following: (1) education of medical and nonmedical community leaders and agencies; (2) community education to promote awareness of heart attack symptoms and the need to call 911; (3) provider education to increase knowledge and promote delivery of patient education; and (4) patient education for high-risk patients and their families. No reduction in delay was observed as a result of the intervention, although an increase in EMS use occurred in the intervention communities. It should be noted that delay prior to the intervention was already lower than that seen in most communities.

Before conducting the REACT trial, the NHLBI implemented a phased-in approach to reducing prehospital delay. The primary focus was to educate healthcare professionals until future research provided answers for the Institute about approaches to educating the public.<sup>128,129</sup> The authors of an early National Heart Attack Alert Program publication suggested that, although it may be desirable for all individuals to receive education about the signs and symptoms of AMI, resources available for this purpose should be directed toward reducing delay among those most likely to benefit—patients at high risk for an AMI.<sup>42</sup>

Patients with known coronary heart disease, clinical atherosclerotic disease of the aorta or peripheral arteries, or clinical cerebrovascular disease are at high risk for AMI or death.<sup>11–13</sup> In fact, individuals who survive the acute stage of a heart attack have a chance of illness and death that is 1.5 to 15 times higher than that of the general population. The risk of another heart attack, sudden death, angina pectoris, heart failure, or stroke for both men and women in this group is substantial. Within 6 years of having a recognized heart attack, 18% of men and 35% of women will have another heart attack. Seven percent of men and 6% of women will experience sudden death.<sup>1</sup> Such high-risk individuals are a significant proportion of the US population: some 12.9 million Americans have coronary heart disease. Thus, a defined and identifiable population of patients exists for

**TABLE 2. Interventions to Reduce Prehospital Treatment-Seeking Delay in Stroke**

Reference	Study Dates	Location	Intervention	Major Finding
<b>Community based</b>				
Alberts et al, 1992	1985-1989	Durham, NC	Public education through mass media; professional education of local ambulance personnel, local paramedics, and 3000 referring physicians.	86% of cerebral infarction patients presented to facility <24 hours after onset vs 37% before intervention.
Barsan et al, 1994	1987-1989	12 hospitals in Ohio, Va, and NY	Public education through mass media; professional education of paramedics stressing rapid assessment and transport of stroke patients with early hospital notification.	Mean delay time from symptom onset to hospital arrival declined from 3.2 hours before intervention to 1.5 hours after intervention.
<b>Patient focused</b>				
No studies to date	...	...	...	...
<b>Systems change</b>				
Culley et al, 1994	1986-1992	Kings County, Wash (excluding Seattle)	Emergency medical dispatching criteria.	System efficiency increased during stroke calls by reducing advanced life support responses.
Barsan et al, 1994	1987-1989	12 hospitals in Ohio, Va, and NY	Public education through mass media; professional education of paramedics stressing rapid assessment and transport of stroke patients with early hospital notification.	Mean delay time from symptom onset to hospital arrival declined from 3.2 hours before intervention to 1.5 hours after intervention.
Zweifler et al, 1997	1995-1996	Mobile, Ala	Professional education of EMS personnel; stroke code system.	No preintervention data; 36% of ischemic stroke cases presented to hospital within 6 hours.
Harbison et al, 1999	1997-1998	Newcastle, UK	Rapid ambulance protocol (direct transport and admission to acute stroke care unit).	Mean delay from symptom onset to emergency room: 1 hour, 12 minutes for ambulance protocol admission vs 6 hours for general practitioner's admission.

whom the mortality and morbidity associated with AMI could be reduced if they received effective education and counseling about the appropriate response to symptoms of an evolving AMI. Within this high-risk patient group, it is particularly important to focus on women and some minorities because these populations have longer reported delays before seeking care in response to AMI symptoms, yet they have been substantially underrepresented in this area of research.<sup>9–11,13</sup>

### Acute Ischemic Stroke

A recent systematic review on the delivery of interventions to reduce prehospital and in-hospital delays in acute stroke care between 1981 and 2000 demonstrated a paucity of literature on effective interventions to reduce prehospital delay. Interventions included community-based interventions involving mass media and public education programs,<sup>130,131</sup> interventions involving system changes to promote professional education programs,<sup>130–132</sup> stroke teams and protocols,<sup>132</sup> and ambulance protocols.<sup>133</sup> On the basis of reviews of those studies and more recent reports (Table 2), it is apparent that further studies of effective interventions to reduce prehospital delay are needed in a variety of settings that would specifically target (1) the community at large; (2) high-risk patient populations, patient family members, and caregivers; and (3) the EMS and healthcare providers who are in a position to counsel and educate high-risk patients.

Public education through mass media can increase public awareness of stroke symptoms<sup>134</sup> and reduce delay in presenting to the ED.<sup>130,131</sup> Although their work was not designed as an intervention study, investigators in Cincinnati, Ohio, documented 91 episodes of stroke-related media coverage between 1995 and 2000 that may have contributed to significant improvements in community-level awareness of stroke symptoms.<sup>127</sup> In the 2000 survey, the most frequently cited sources of knowledge about stroke were television (32%), magazines (24%), newspapers (22%), physicians (20%), and a family member with stroke (19%).<sup>127</sup>

To date, no published interventions have targeted high-risk patients with the goal of reducing prehospital delay for stroke (Table 2). Because individuals with hypertension are at risk for stroke and patients with a history of stroke are at risk for a recurrent stroke, these patients and their family members represent a sizable audience that could benefit from education during office visits. Those with hypertension, previous stroke, or transient ischemic attack are more likely to report knowledge of at least 1 stroke symptom.<sup>126,127</sup> However, as in the case of patients with prior AMI, acute stroke victims with a history of previous stroke have longer prehospital delays.<sup>113</sup>

One study showed that, of the calls to activate EMS for stroke, >60% were made by family members and 18% by paid caregivers.<sup>135</sup> To reduce the length of stroke delays, patient education interventions should address family and caregivers of high-risk patients, as well as the patients themselves.

Between 50% and 60% of all stroke patients arrive at the hospital by ambulance, and the mode of arrival significantly impacts length of delay and stroke outcome.<sup>20,110,111,113,136</sup> Effective interventions to reduce prehospital stroke delay

should address emergency dispatch personnel and EMS transport services.<sup>133,137</sup> Emergency dispatch services must have a protocol that assigns a high priority for a possible stroke to ensure rapid transport.<sup>138</sup> Early recognition and identification of stroke symptoms by EMS personnel and advance hospital notification of a possible stroke patient are also important in reducing delay.<sup>131,136</sup> A nationwide survey of paramedics demonstrated that most EMS personnel are knowledgeable about stroke symptoms but are unaware of the therapeutic window for fibrinolysis.<sup>139</sup> Continuing education and protocol updates on stroke identification can improve care.<sup>140</sup> Researchers have advocated establishing stroke centers that could help shape EMS policies for triage of patients and consistently provide the best level of care.<sup>132,138</sup> Development of a regional acute stroke protocol (that is, a coordinated regional system response that improves access to stroke care) could reduce prehospital delay if it incorporated EMS stroke protocols, as well.<sup>133</sup> System policies would need to include documentation of a written plan for transporting and receiving stroke patients via EMS and evidence of cooperative educational activities.<sup>138,141</sup>

### Future Directions

Emphasizing the importance of timely treatment, Dr John Rawles wrote, “The magnitude of the benefit from earlier fibrinolysis is such that giving fibrinolytic treatment to patients with acute myocardial infarction should be accorded the same degree of urgency as the treatment of cardiac arrest.”<sup>3</sup> The same can be said of the timely treatment of acute stroke. Nonetheless, despite more than 2 decades of study, little progress has been made in reducing the delay in seeking treatment for ACS and stroke.

The following 4 major challenges need to be addressed by researchers and clinicians to move knowledge forward in this area and improve patient outcomes: (1) moving from examining sociodemographic and health history factors related to delay to more fully understanding the social, cognitive, and emotional factors that contribute to delay, both singly and through their interaction; (2) testing new interventions that target high-risk populations and that move beyond simply providing individuals with information about symptoms and recommendations for action by addressing social, cognitive, and emotional reasons for delay; (3) systematically applying what is known from research to date to the education of patients who are at risk for ACS and stroke; and (4) focusing on previously understudied and underserved populations.

### Understanding Social, Cognitive, and Emotional Factors That Contribute to Delay

The importance of social, cognitive, and emotional factors, particularly in the context of a situational or circumstantial analysis, cannot be overemphasized. Because age, sex, marital status, race, and sometimes education, income, health history, insurance status, and presenting complaints are usually available to researchers, the vast majority of delay studies are based on patient chart reviews and EMS records. Incorporating interviews and questionnaires into study designs provides an opportunity to go beyond demographic correla-



tions. Studies attempting to go beyond demographically based analyses are frequently smaller and at present do not have the statistical power to convince researchers to look further than demographic associations for explanations of delay in seeking care. Understandably, it is much more expensive to interview patients and family members, but to move knowledge forward in this area, such investigations need to be undertaken.

The processes of seeking care for ACS and acute ischemic stroke are complex. Without knowing how and why individuals come to their interpretations of symptoms, construct coping strategies, and finally decide on action, we will continue to plan interventions based on gross categories that do not address patients' actual circumstances. Admittedly the interaction of predisposing, enabling, and circumstantial factors is extremely complex, and this complexity nearly relegates the resulting model to a status of being unchallengeable. Nevertheless, we need to acquire a refined, detailed algorithm of how individuals actually work through symptoms of ACS and stroke: how does their constructed coping strategy emerge and change over time? And which circumstances did they find constraining and which facilitating on their way to medical care?

One component of the social aspect of care seeking that needs more attention is the role of healthcare providers. Systematic study of the behavior of providers needs to be undertaken when studying delay in seeking care. Although a physician is called less often in the United States than in the United Kingdom, patients who call and are eventually hospitalized are too often penalized for their call with greater delay, both in access to EMS and, ultimately, in receiving time-dependent therapies. One unanswered question is the number of patients who call a provider with suspected symptoms of ACS or stroke but do not ever require medical care and are managed out of hospital. The answer to this question may provide some insight into why providers delay. Perhaps they have become accustomed to a proportion of suspected ACS or stroke calls turning out, at least initially, to be benign episodes. We also need to understand how providers establish their office routines to handle patients with ACS symptoms. We need to study this point because we have little insight into healthcare provider behavior when confronting ACS. For example, women delay seeking care longer than men do.<sup>60</sup> It has been noted that physicians require more time to evaluate women patients, and it has been suggested that the differences between men and women in total time from onset of symptoms to ED arrival can be attributed to this physician delay in evaluating women,<sup>84</sup> especially because women appear more likely to call a physician with symptoms.<sup>78</sup>

### Testing New Interventions

Although familiarity with the symptoms of ACS and stroke and the appropriate actions to take when they occur are essential, such familiarity is not sufficient to motivate individuals to take action when symptoms do occur. Nevertheless, describing typical symptoms and recommending appropriate actions have been the focus of all mass public education campaigns to date. Moreover, mass public education campaigns are not the most efficient or effective method

of reaching those individuals most likely to need such education. Thus, new interventions should be tested, targeting individuals at risk for ACS and stroke as well as their families. The scope of the message should be expanded to address the social, cognitive, and emotional factors that contribute to delay.

### Systematic Application of What Is Known

The knowledge of stroke or ACS symptoms alone, even among former stroke or AMI patients, is insufficient to reduce delay substantially. The failure of mass public education campaigns that have focused solely on teaching about symptoms further demonstrates the importance of changing current messages that aim to reduce delay in seeking treatment. Education should emphasize the urgency of immediate emergency transport and treatment within the context of the potential therapeutic *benefits* of reducing prehospital delay. Messages that emphasize the benefits of not delaying have been shown to be more effective than the fear-based messages that providers most commonly use. The role of family members, friends, and coworkers in helping ACS and stroke patients, and the benefit of helping the patient call 911 rather than providing private transportation, must be emphasized.

Future public education strategies should focus on minority populations to make significant gains in decreasing prehospital delay for ACS and stroke. Blacks may recognize ACS and stroke symptoms less readily than whites,<sup>67-69,127</sup> delay longer in seeking treatment, be less likely to reach an emergency room via ambulance in some communities,<sup>20,67-69</sup> and yet have a greater risk of death from both ACS and stroke at an earlier age than the rest of the population. Public campaigns and patient education efforts must focus on improving awareness of ACS and stroke signs and symptoms in this high-risk population and on teaching patients and their families how to manage the social, cognitive, and emotional manifestations that accompany these symptoms and contribute to delay. Particularly for those at risk of stroke, it is imperative that family members and friends be targeted for education and "deputized" to act when stroke symptoms occur because of the cognitive and physical impairments that may render the patient incapable of responding.

Because a greater proportion of stroke deaths occur among older women than among older men, public and patient education efforts among this group represent opportunities to diminish overall delay. More than 52% of all stroke deaths among women occur before EMS arrives, compared with 40% of stroke deaths among men.<sup>142</sup> Evidence suggests that longer delays to hospital treatment for ACS are experienced by women as opposed to men. Public campaigns and patient education must target women who may not be convinced that they are at risk. An equally important target is the healthcare provider, who often does not appreciate the risk of heart disease and stroke in women and who likely contributes to patients' delays in seeking treatment.

Educational efforts should also focus on workers and work sites. In one study, in which EMS was activated for only 38% of stroke cases, patients not employed at the time of their stroke were substantially more likely to use EMS than

employed stroke patients,<sup>135</sup> who more often received transport from coworkers in a private car. This contrast suggests that large employers or work sites should be targeted for public education on symptom awareness and the urgency to activate emergency transport in cases of stroke.

## Focusing on Previously Understudied Populations

### *Different Racial or Ethnic Groups*

Contemporary, prospective studies of ACS and stroke patients are needed that oversample people of color to more accurately determine whether prehospital delay varies across different racial or ethnic groups and subgroups, and if so, the magnitude of the variation and whether race or ethnicity is an independent predictor of prehospital delay. Furthermore, systematic evaluation of many of the patient-centered factors described above, as well as of more practical barriers (such as lack of access to transportation or language differences) will provide us with clearer insights into those group-specific features. Once identified, these features could serve as novel targets for developing appropriate, tailored interventions to decrease prehospital delay across different racial or ethnic groups.

### *Patients With Stroke*

Extensive research to date has focused on delays in seeking treatment among individuals with ACS. Recognition that stroke is a major health problem and the realization that negative outcomes can be mitigated by prompt recognition and treatment have increased the focus on delays in seeking treatment among patients with acute stroke. Still, much more research is needed. Valuable information has been obtained from studying factors associated with prehospital delay; however, more information is needed to effectively reduce this delay. Future approaches could

include dividing prehospital delay into 3 phases and examining factors related to delay in each. These phases would include (1) the period from symptom onset to the decision to seek medical attention, (2) the period from the decision to seek medical attention to first medical contact, and (3) the period from first medical contact to hospital arrival. The most recent report from a large registry confirms that <10% of acute stroke patients arrive at the ED within 1 hour of stroke onset, that <25% arrived within 3 hours, and that 3% to 8.5% (depending on the state) receive fibrinolysis.<sup>143</sup> Investigators using this registry data estimate that the biggest inroads into improving these rates will be made by patients arriving sooner at the hospital.<sup>144</sup> Other factors that might be related to prehospital delay for stroke, including denial, embarrassment, cost, and cultural factors such as feeling like one has little or no control over one's health, have not been fully explored.

## Summary

Despite decades of study, patient delay in seeking treatment for ACS and acute ischemic stroke symptoms remains the major impediment to receiving early, definitive treatment. As a direct consequence, morbidity and mortality in ACS and stroke are substantially higher than they need to be given the treatment options currently available. A number of patient, provider, and healthcare system factors contribute to prehospital delay in patients who seek treatment. Because community-based public education campaigns have to date been ineffective in reducing patient delay, future research should concentrate on interventions that target high-risk populations; social, cognitive, and emotional factors contributing to delay; and the contribution to delay by healthcare providers and healthcare systems.

## Writing Group Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/Honoraria	Ownership Interest	Consultant/Advisory Board	Other
Debra K. Moser	University of Kentucky	NIH, NINR, R01, Co-investigator on this NHLBI-funded study of an intervention aimed at decreasing delay in response to AMI. The intervention is an educational approach, not one that we will be marketing or selling.	None	None	None	None	None
Laura P. Kimble	Georgia State University	None	None	None	None	None	None
Mark J. Alberts	Northwestern University	Bristol-Myers Squibb, Boehringer Ingelheim, Sanofi	None	Bristol-Myers Squibb, Biovail, Sanofi, AstraZeneca	None	Bristol-Myers Squibb, Biovail, Sanofi, Boehringer Ingelheim, AstraZeneca	None
Angelo Alonzo	The Ohio State University	None	None	None	None	None	None
Janet B. Croft	Centers for Disease Control and Prevention	None	None	None	None	None	None
Kathleen Dracup	University of Southern California	None	None	None	None	None	None
Kelly R. Evenson	University of North Carolina	None	None	None	None	None	None
Alan S. Go	Kaiser Permanente	None	None	None	None	None	None
Mary M. Hand	National Heart, Lung, and Blood Institute	None	None	None	None	None	None
Rashmi U. Kothari	Borgess Research Center	None	None	None	None	None	None
George A. Mensah	Centers for Disease Control and Prevention	None	None	None	None	None	None
Dexter L. Morris	Currently employed full-time by GlaxoSmithKline.	Co-investigator, no financial or other remuneration on project for EMS education/stroke funded by the Duke Endowment.	None	None	None	None	None
Arthur M. Pancioli	University of Cincinnati	NIH/NINDS	None	None	None	None	None
Barbara Riegel	University of Pennsylvania	Co-investigator on an NHLBI-funded study of an intervention aimed at decreasing delay in response to AMI. The intervention is an educational approach, not one that we will be marketing or selling.	None	None	None	None	None
Julie Johnson Zerwic	University of Illinois at Chicago	Principal investigator on research grant, "Tailored intervention to increase MI symptom recognition." R03NR008750. Funding through National Institute of Nursing Research.	None	None	None	None	None

This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit.

## Reviewer Disclosures

Reviewer	Employment	Research Grant	Other Research Support	Speakers' Bureau/Honoraria	Ownership Interest	Consultant/Advisory Board	Other
Susan Bennett	Indiana University	None	None	None	None	None	None
Maureen Friedman	Nazareth College	None	None	None	None	None	None
David C. Goff, Jr	Wake Forest University School of Medicine	None	None	None	None	None	None
Eric D. Peterson	Duke Clinical Research Institute	Millennium Pharma; Schering Plough; Bristol-Myers Squibb/Sanofi	None	Millennium Pharma; Schering Plough	None	Millennium Pharma	None

This table represents the relationships of reviewers that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all reviewers are required to complete and submit.

## References

- American Heart Association. *Heart Disease and Stroke Statistics—2005 Update*. Dallas, Tex: American Heart Association; 2005.
- Ayala C, Croft JB, Keenan NL, Neff LJ, Greenlund KJ, Donehoo RS, Zheng ZJ, Mensah GA. Increasing trends in pre-transport stroke deaths—United States, 1990–1998. *Ethn Dis*. 2003;13:S131–S137.
- Rawles J. Magnitude of benefit from earlier thrombolytic treatment in acute myocardial infarction: new evidence from Grampian region early anistreplase trial (GREAT). *BMJ*. 1996;312:212–215.
- Caldwell MA, Miaskowski C. Mass media interventions to reduce help-seeking delay in people with symptoms of acute myocardial infarction: time for a new approach? *Patient Educ Couns*. 2002;46:1–9.
- Kainth A, Hewitt A, Sowden A, Duffy S, Pattenden J, Lewin R, Watt I, Thompson D. Systematic review of interventions to reduce delay in patients with suspected heart attack. *Emerg Med J*. 2004;21:506–508.
- Luepker RV, Raczynski JM, Osganian S, Goldberg RJ, Finnegan JR Jr, Hedges JR, Goff DC Jr, Eisenberg MS, Zapka JG, Feldman HA, Labarthe DR, McGovern PG, Cornell CE, Proschan MA, Simons-Morton DG. Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: the Rapid Early Action for Coronary Treatment (REACT) Trial. *JAMA*. 2000;284:60–67.
- Ad Hoc Committee on Health Research Relating to Future Intervention Options. *Investing in Health Research and Development*. Geneva, Switzerland: World Health Organization; 1996.
- Goldberg RJ, Mooradd M, Gurwitz JH, Rogers WJ, French WJ, Barron HV, Gore JM. Impact of time to treatment with tissue plasminogen activator on morbidity and mortality following acute myocardial infarction (the second National Registry of Myocardial Infarction). *Am J Cardiol*. 1998;82:259–264.
- Newby LK, Rutsch WR, Califf RM, Simoons ML, Aylward PE, Armstrong PW, Woodlief LH, Lee KL, Topol EJ, Van de Werf F. Time from symptom onset to treatment and outcomes after thrombolytic therapy. GUSTO-1 Investigators. *J Am Coll Cardiol*. 1996;27:1646–1655.
- Wielgosz AT, Nolan RP. Understanding delay in response to symptoms of acute myocardial infarction: a compelling agenda. *Circulation*. 1991;84:2193–2195.
- Berger PB, Ellis SG, Holmes DR Jr, Granger CB, Criger DA, Betriu A, Topol EJ, Califf RM. Relationship between delay in performing direct coronary angioplasty and early clinical outcome in patients with acute myocardial infarction: results from the global use of strategies to open occluded arteries in Acute Coronary Syndromes (GUSTO-IIb) trial. *Circulation*. 1999;100:14–20.
- Avorn J, Knight E, Ganz DA, Schneeweiss S. Therapeutic delay and reduced functional status six months after thrombolysis for acute myocardial infarction. *Am J Cardiol*. 2004;94:415–420.
- Dracup K, McKinley SM, Moser DK. Australian patients' delay in response to heart attack symptoms. *Med J Aust*. 1997;166:233–236.
- Dracup K, Moser DK, McKinley S, Ball C, Yamasaki K, Kim CJ, Doering LV, Caldwell MA. An international perspective on the time to treatment for acute myocardial infarction. *J Nurs Scholarsh*. 2003;35:317–323.
- Goldberg RJ, Steg PG, Sadiq I, Granger CB, Jackson EA, Budaj A, Brieger D, Avezum A, Goodman S. Extent of, and factors associated with, delay to hospital presentation in patients with acute coronary disease (the GRACE registry). *Am J Cardiol*. 2002;89:791–796.
- Gurwitz JH, McLaughlin TJ, Willison DJ, Guadagnoli E, Hauptman PJ, Gao X, Soumerai SB. Delayed hospital presentation in patients who have had acute myocardial infarction. *Ann Intern Med*. 1997;126:593–599.
- Azzimondi G, Bassein L, Fiorani L, Nonino F, Montaguti U, Celin D, Re G, D'Alessandro R. Variables associated with hospital arrival time after stroke: effect of delay on the clinical efficiency of early treatment. [Erratum in: *Stroke*. 1997;28:1092.] *Stroke*. 1997;28:537–542.
- Goldstein LB, Edwards MG, Wood DP. Delay between stroke onset and emergency department evaluation. *Neuroepidemiology*. 2001;20:196–200.
- Jorgensen HS, Nakayama H, Reith J, Raaschou HO, Olsen TS. Factors delaying hospital admission in acute stroke: the Copenhagen Stroke Study. *Neurology*. 1996;47:383–387.
- Lacy CR, Suh DC, Bueno M, Kostis JB. Delay in presentation and evaluation for acute stroke: Stroke Time Registry for Outcomes Knowledge and Epidemiology (S.T.R.O.K.E.). *Stroke*. 2001;32:63–69.
- Lin CS, Tsai J, Woo P, Chang H. Prehospital delay and emergency department management of ischemic stroke patients in Taiwan, R.O.C. *Prehosp Emerg Care*. 1999;3:194–200.
- Morris DL, Rosamond W, Madden K, Schultz C, Hamilton S. Pre-hospital and emergency department delays after acute stroke: the Genentech Stroke Presentation Survey. *Stroke*. 2000;31:2585–2590.
- Schroeder EB, Rosamond WD, Morris DL, Evenson KR, Hinn AR. Determinants of use of emergency medical services in a population with stroke symptoms: the Second Delay in Accessing Stroke Healthcare (DASH II) Study. *Stroke*. 2000;31:2591–2596.
- Smith MA, Doliszny KM, Shahar E, McGovern PG, Arnett DK, Luepker RV. Delayed hospital arrival for acute stroke: the Minnesota Stroke Survey. *Ann Intern Med*. 1998;129:190–196.
- Srivastava AK, Prasad K. A study of factors delaying hospital arrival of patients with acute stroke. *Neurol India*. 2001;49:272–276.
- Wester P, Radberg J, Lundgren B, Peltonen M. Factors associated with delayed admission to hospital and in-hospital delays in acute stroke and TIA: a prospective, multicenter study. Seek-Medical-Attention-in-Time Study Group. *Stroke*. 1999;30:40–48.
- Yu RF, San Jose MC, Manzanilla BM, Oris MY, Gan R. Sources and reasons for delays in the care of acute stroke patients. *J Neurol Sci*. 2002;199:49–54.
- Berger AK, Schulman KA, Gersh BJ, Pirezada S, Breall JA, Johnson AE, Every NR. Primary coronary angioplasty vs thrombolysis for the management of acute myocardial infarction in elderly patients. *JAMA*. 1999;282:341–348.
- Indications for fibrinolytic therapy in suspected acute myocardial infarction: collaborative overview of early mortality and major morbidity results from all randomised trials of more than 1000 patients. Fibrinolytic therapy Trialists' (FTT) Collaborative Group [published correction appears in *Lancet*. 1994;343:742]. *Lancet*. 1994;343:311–322.
- Stone GW, Brodie BR, Griffin JJ, Morice MC, Costantini C, St. Goar FG, Overlie PA, Popma JJ, McDonnell J, Jones D, O'Neill WW, Grines CL. Prospective, multicenter study of the safety and feasibility of primary stenting in acute myocardial infarction: in-hospital and 30-day results of the PAMI stent pilot trial. Primary Angioplasty in Myocardial Infarction Stent Pilot Trial Investigators. *J Am Coll Cardiol*. 1998;31:23–30.
- Goldberg RJ, Gurwitz J, Yarzebski J, Landon J, Gore JM, Alpert JS, Dalen PM, Dalen JE. Patient delay and receipt of thrombolytic therapy among patients with acute myocardial infarction from a community-wide perspective. *Am J Cardiol*. 1992;70:421–425.
- Yusuf S, Collins R, Peto R, Furberg C, Stampfer MJ, Goldhaber SZ, Hennekens CH. Intravenous and intracoronary fibrinolytic therapy in acute myocardial infarction: overview of results on mortality, reinfarction and side-effects from 33 randomized controlled trials. *Eur Heart J*. 1985;6:556–585.
- Newby K. Clinical outcomes according to time to treatment. *Clin Cardiol*. 1997;20:III11–III15.
- Simoons ML, Serruys PW, van den Brand M, Res J, Verheugt FW, Krauss XH, Remme WJ, Bar F, de Zwaan C, van der Laarse A, et al. Early thrombolysis in acute myocardial infarction: limitation of infarct size and improved survival. *J Am Coll Cardiol*. 1986;7:717–728.
- Rawles JM, Metcalfe MJ, Shirreffs C, Jennings K, Kenmure AC. Association of patient delay with symptoms, cardiac enzymes, and outcome in acute myocardial infarction. *Eur Heart J*. 1990;11:643–648.
- Koren G, Weiss AT, Hasin Y, Appelbaum D, Welber S, Rozenman Y, Lotan C, Mosseri M, Sapoznikov D, Luria MH, et al. Prevention of myocardial damage in acute myocardial ischemia by early treatment with intravenous streptokinase. *N Engl J Med*. 1985;313:1384–1389.
- Herlitz J, Hartford M, Aune S, Karlsson T, Hjalmarson A. Delay time between onset of myocardial infarction and start of thrombolysis in relation to prognosis. *Cardiology*. 1993;82:347–353.
- Six-month survival in 20,891 patients with acute myocardial infarction randomized between alteplase and streptokinase with or without heparin. GISSI-2 and International Study Group. Gruppo Italiano per lo Studio della Sopravvivenza nell'Infarto. *Eur Heart J*. 1992;13:1692–1697.
- Tissue plasminogen activator for acute ischemic stroke. The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. *N Engl J Med*. 1995;333:1581–1587.
- Marler JR, Tilley BC, Lu M, Brott TG, Lyden PC, Grotta JC, Broderick JP, Levine SR, Frankel MP, Horowitz SH, Haley EC Jr, Lewandowski CA, Kwiatkowski TP. Early stroke treatment associated with better

- outcome: the NINDS rt-PA stroke study. *Neurology*. 2000;55:1649–1655.
41. Hacke W, Donnan G, Fieschi C, Kaste M, von Kummer R, Broderick JP, Brott T, Frankel M, Grotta JC, Haley EC Jr, Kwiatkowski T, Levine SR, Lewandowski C, Lu M, Lyden P, Marler JR, Patel S, Tilley BC, Albers G, Bluhmki E, Wilhelm M, Hamilton S. Association of outcome with early stroke treatment: pooled analysis of ATLANTIS, ECASS, and NINDS rt-PA stroke trials. *Lancet*. 2004;363:768–774.
  42. Dracup K, Alonzo AA, Atkins JM, Bennett NM, Braslow A, Clark LT, Eisenberg M, Ferdinand KC, Frye R, Green L, Hill MN, Kennedy JW, Kline-Rogers E, Moser DK, Ornato JP, Pitt B, Scott JD, Selker HP, Silva SJ, Thies W, Weaver WD, Wenger NK, White SK. The physician's role in minimizing prehospital delay in patients at high risk for acute myocardial infarction: recommendations from the National Heart Attack Alert Program. Working Group on Educational Strategies to Prevent Prehospital Delay in Patients at High Risk for Acute Myocardial Infarction. *Ann Intern Med*. 1997;126:645–651.
  43. Dracup K, Moser DK, Eisenberg M, Meischke H, Alonzo AA, Braslow A. Causes of delay in seeking treatment for heart attack symptoms. *Soc Sci Med*. 1995;40:379–392.
  44. Meischke H, Eisenberg MS, Schaeffer SM, Damon SK, Larsen MP, Henwood DK. Utilization of emergency medical services for symptoms of acute myocardial infarction. *Heart Lung*. 1995;24:11–18.
  45. 9–1–1: rapid identification and treatment of acute myocardial infarction. National Heart Attack Alert Program Coordinating Committee Access to Care Subcommittee. *Am J Emerg Med*. 1995;13:188–195.
  46. Krall SP, Reese CL IV, Donahue L. Effect of continuous quality improvement methods on reducing triage to thrombolytic interval for acute myocardial infarction. *Acad Emerg Med*. 1995;2:603–609.
  47. Goldberg RJ, Yarzebski J, Lessard D, Gore JM. Decade-long trends and factors associated with time to hospital presentation in patients with acute myocardial infarction: the Worcester Heart Attack study. *Arch Intern Med*. 2000;160:3217–3223.
  48. Rosenfeld AG. Treatment-seeking delay among women with acute myocardial infarction: decision trajectories and their predictors. *Nurs Res*. 2004;53:225–236.
  49. McGinn AP, Rosamond WD, Goff DC Jr, Taylor HA, Miles JS, Chambless L. Trends in prehospital delay time and use of emergency medical services for acute myocardial infarction: experience in 4 US communities from 1987–2000. *Am Heart J*. 2005;150:392–400.
  50. United Kingdom Heart Attack Study (UKHAS) Collaborative Group. Effect of time from onset to coming under care on fatality of patients with acute myocardial infarction: effect of resuscitation and thrombolytic treatment. *Heart*. 1998;80:114–120.
  51. Evenson KR, Rosamond WD, Morris DL. Prehospital and in-hospital delays in acute stroke care. *Neuroepidemiology*. 2001;20:65–76.
  52. Chang KC, Tseng MC, Tan TY. Prehospital delay after acute stroke in Kaohsiung, Taiwan. *Stroke*. 2004;35:700–704.
  53. Lefler LL, Bondy KN. Women's delay in seeking treatment with myocardial infarction: a meta-synthesis. *J Cardiovasc Nurs*. 2004;19:251–268.
  54. Horne R, James D, Petrie K, Weinman J, Vincent R. Patients' interpretation of symptoms as a cause of delay in reaching hospital during acute myocardial infarction. *Heart*. 2000;83:388–393.
  55. Goff DC Jr, Feldman HA, McGovern PG, Goldberg RJ, Simons-Morton DG, Cornell CE, Osganian SK, Cooper LS, Hedges JR. Prehospital delay in patients hospitalized with heart attack symptoms in the United States: the REACT trial. Rapid Early Action for Coronary Treatment (REACT) Study Group. *Am Heart J*. 1999;138:1046–1057.
  56. Dracup K, Moser DK. Beyond sociodemographics: factors influencing the decision to seek treatment for symptoms of acute myocardial infarction. *Heart Lung*. 1997;26:253–262.
  57. Zerwic JJ. Patient delay in seeking treatment for acute myocardial infarction symptoms. *J Cardiovasc Nurs*. 1999;13:21–32.
  58. Goldberg RJ, Gurwitz JH, Gore JM. Duration of, and temporal trends (1994–1997) in, prehospital delay in patients with acute myocardial infarction: the second National Registry of Myocardial Infarction. *Arch Intern Med*. 1999;159:2141–2147.
  59. Zapka JG, Oakes JM, Simons-Morton DG, Mann NC, Goldberg R, Sellers DE, Estabrook B, Gilliland J, Linares AC, Benjamin-Garner R, McGovern P. Missed opportunities to impact fast response to AMI symptoms. *Patient Educ Couns*. 2000;40:67–82.
  60. Rosenfeld AG. Women's risk of decision delay in acute myocardial infarction: implications for research and practice. *AACN Clin Issues*. 2001;12:29–39.
  61. Cooper RS, Simmons B, Castaner A, Prasad R, Franklin C, Ferlinz J. Survival rates and prehospital delay during myocardial infarction among black persons. *Am J Cardiol*. 1986;57:208–211.
  62. Clark LT, Bellam SV, Shah AH, Feldman JG. Analysis of prehospital delay among inner-city patients with symptoms of myocardial infarction: implications for therapeutic intervention. *J Natl Med Assoc*. 1992;84:931–937.
  63. Canto JG, Taylor HA Jr, Rogers WJ, Sanderson B, Hilbe J, Barron HV. Presenting characteristics, treatment patterns, and clinical outcomes of non-black minorities in the National Registry of Myocardial Infarction 2. *Am J Cardiol*. 1998;82:1013–1018.
  64. Borzak S, Joseph C, Havstad S, Tilley B, Smith ST, Housholder SD, Gheorghiadu M. Lower thrombolytic use for African Americans with myocardial infarction: an influence of clinical presentation? *Am Heart J*. 1999;137:338–345.
  65. Meshack AF, Goff DC, Chan W, Ramsey D, Linares A, Reyna R, Pandey D. Comparison of reported symptoms of acute myocardial infarction in Mexican Americans versus non-Hispanic whites (the Corpus Christi Heart Project). *Am J Cardiol*. 1998;82:1329–1332.
  66. Goff DC Jr, Sellers DE, McGovern PG, Meischke H, Goldberg RJ, Bittner V, Hedges JR, Allender PS, Nichaman MZ. Knowledge of heart attack symptoms in a population survey in the United States: the REACT Trial. Rapid Early Action for Coronary Treatment. *Arch Intern Med*. 1998;158:2329–2338.
  67. Klingler D, Green-Weir R, Nerenz D, Havstad S, Rosman HS, Cetner L, Shah S, Wimbush F, Borzak S. Perceptions of chest pain differ by race. *Am Heart J*. 2002;144:51–59.
  68. Lee H, Bahler R, Chung C, Alonzo A, Zeller RA. Prehospital delay with myocardial infarction: the interactive effect of clinical symptoms and race. *Appl Nurs Res*. 2000;13:125–133.
  69. Brown AL, Mann NC, Daya M, Goldberg R, Meischke H, Taylor J, Smith K, Osganian S, Cooper L. Demographic, belief, and situational factors influencing the decision to utilize emergency medical services among chest pain patients. Rapid Early Action for Coronary Treatment (REACT) study. *Circulation*. 2000;102:173–178.
  70. Doescher MP, Saver BG, Franks P, Fiscella K. Racial and ethnic disparities in perceptions of physician style and trust. *Arch Fam Med*. 2000;9:1156–1163.
  71. Hall MA, Dugan E, Zheng B, Mishra AK. Trust in physicians and medical institutions: what is it, can it be measured, and does it matter? *Milbank Q*. 2001;79:613–639, v.
  72. Murray-Garcia JL, Selby JV, Schmittiel J, Grumbach K, Quesenberry CP Jr. Racial and ethnic differences in a patient survey: patients' values, ratings, and reports regarding physician primary care performance in a large health maintenance organization. *Med Care*. 2000;38:300–310.
  73. Friedman E. Money isn't everything: nonfinancial barriers to access. *JAMA*. 1994;271:1535–1538.
  74. Williams DR, Neighbors HW, Jackson JS. Racial/ethnic discrimination and health: findings from community studies. *Am J Public Health*. 2003;93:200–208.
  75. Brodie BR, Stuckey TD, Wall TC, Kissling G, Hansen CJ, Muncy DB, Weintraub RA, Kelly TA. Importance of time to reperfusion for 30-day and late survival and recovery of left ventricular function after primary angioplasty for acute myocardial infarction. *J Am Coll Cardiol*. 1998;32:1312–1319.
  76. Maynard C, Weaver WD, Lambrew C, Bowlby LJ, Rogers WJ, Rubison RM. Factors influencing the time to administration of thrombolytic therapy with recombinant tissue plasminogen activator (data from the National Registry of Myocardial Infarction). Participants in the National Registry of Myocardial Infarction. *Am J Cardiol*. 1995;76:548–552.
  77. Rucker D, Brennan T, Burstin H. Delay in seeking emergency care. *Acad Emerg Med*. 2001;8:163–169.
  78. Leslie WS, Urie A, Hooper J, Morrison CE. Delay in calling for help during myocardial infarction: reasons for the delay and subsequent pattern of accessing care. *Heart*. 2000;84:137–141.
  79. Kentsch M, Rodemerk U, Muller-Esch G, Schnoor U, Munzel T, Ittel TH, Mitusch R. Emotional attitudes toward symptoms and inadequate coping strategies are major determinants of patient delay in acute myocardial infarction. *Z Kardiol*. 2002;91:147–155.
  80. Hackett TP, Cassem NH. Factors contributing to delay in responding to the signs and symptoms of acute myocardial infarction. *Am J Cardiol*. 1969;24:651–658.
  81. McKinley S, Moser DK, Dracup K. Treatment-seeking behavior for acute myocardial infarction symptoms in North America and Australia. *Heart Lung*. 2000;29:237–247.

82. Raczynski JM, Finnegan JR Jr, Zapka JG, Meischke H, Meshack A, Stone EJ, Bracht N, Sellers DE, Daya M, Robbins M, McAlister A, Simons-Morton D. REACT theory-based intervention to reduce treatment-seeking delay for acute myocardial infarction. Rapid Early Action for Coronary Treatment. *Am J Prev Med.* 1999;16:325–334.
83. Perry K, Petrie KJ, Ellis CJ, Horne R, Moss-Morris R. Symptom expectations and delay in acute myocardial infarction patients. *Heart.* 2001; 86:91–93.
84. Bouma J, Broer J, Bleeker J, van Sonderen E, Meyboom-de Jong B, DeJongste MJ. Longer pre-hospital delay in acute myocardial infarction in women because of longer doctor decision time. *J Epidemiol Community Health.* 1999;53:459–464.
85. Reilly A, Dracup K, Dattolo J. Factors influencing prehospital delay in patients experiencing chest pain. *Am J Crit Care.* 1994;3:300–306.
86. Schmidt SB, Borsch MA. The prehospital phase of acute myocardial infarction in the era of thrombolysis. *Am J Cardiol.* 1990;65:1411–1415.
87. Theisen ME, MacNeill SE, Lumley MA, Ketterer MW, Goldberg AD, Borzak S. Psychosocial factors related to unrecognized acute myocardial infarction. *Am J Cardiol.* 1995;75:1211–1213.
88. Alonzo AA, Reynolds NR. The structure of emotions during acute myocardial infarction: a model of coping. *Soc Sci Med.* 1998;46: 1099–1110.
89. Meischke H, Mitchell P, Zapka J, Goff DC Jr, Smith K, Henwood D, Mann C, Lovell K, Stone E, Taylor J. The emergency department experience of chest pain patients and their intention to delay care seeking for acute myocardial infarction. *Prog Cardiovasc Nurs.* 2000; 15:50–57.
90. Hedges JR, Feldman HA, Bittner V, Goldberg RJ, Zapka J, Osganian SK, Murray DM, Simons-Morton DG, Linares A, Williams J, Luepker RV, Eisenberg MS. Impact of community intervention to reduce patient delay time on use of reperfusion therapy for acute myocardial infarction: rapid early action for coronary treatment (REACT) trial. REACT Study Group. *Acad Emerg Med.* 2000;7:862–872.
91. Ruston A, Clayton J, Calnan M. Patients' action during their cardiac event: qualitative study exploring differences and modifiable factors. *BMJ.* 1998;316:1060–1064.
92. Meischke H, Ho MT, Eisenberg MS, Schaeffer SM, Larsen MP. Reasons patients with chest pain delay or do not call 911. *Ann Emerg Med.* 1995;25:193–197.
93. Ho MT, Eisenberg MS, Litwin PE, Schaeffer SM, Damon SK. Delay between onset of chest pain and seeking medical care: the effect of public education. *Ann Emerg Med.* 1989;18:727–731.
94. Zerwic JJ. Symptoms of acute myocardial infarction: expectations of a community sample. *Heart Lung.* 1998;27:75–81.
95. Finnegan JR Jr, Meischke H, Zapka JG, Leviton L, Meshack A, Benjamin-Garner R, Estabrook B, Hall NJ, Schaeffer S, Smith C, Weitzman ER, Raczynski J, Stone E. Patient delay in seeking care for heart attack symptoms: findings from focus groups conducted in five US regions. *Prev Med.* 2000;31:205–213.
96. Johnson JA, King KB. Influence of expectations about symptoms on delay in seeking treatment during a myocardial infarction. *Am J Crit Care.* 1995;4:29–35.
97. Herlitz J, Bang A, Karlson BW, Hartford M. Is there a gender difference in aetiology of chest pain and symptoms associated with acute myocardial infarction? *Eur J Emerg Med.* 1999;6:311–315.
98. Meischke H, Larsen MP, Eisenberg MS. Gender differences in reported symptoms for acute myocardial infarction: impact on prehospital delay time interval. *Am J Emerg Med.* 1998;16:363–366.
99. van Tiel D, van Vliet KP, Moerman CJ. Sex differences in illness beliefs and illness behavior in patients with suspected coronary artery disease. *Patient Educ Couns.* 1998;33:143–147.
100. Sheifer SE, Rathore SS, Gersh BJ, Weinfurt KP, Oetgen WJ, Breall JA, Schulman KA. Time to presentation with acute myocardial infarction in the elderly: associations with race, sex, and socioeconomic characteristics. *Circulation.* 2000;102:1651–1656.
101. Schoenberg NE, Peters JC, Drew EM. Unraveling the mysteries of timing: women's perceptions about time to treatment for cardiac symptoms. *Soc Sci Med.* 2003;56:271–284.
102. Meischke H, Eisenberg MS, Schaeffer SM, Larsen MP, Henwood DK. Impact of direct mail intervention on knowledge, attitudes, and behavioral intentions regarding use of emergency medical services for symptoms of acute myocardial infarction. *Eval Health Prof.* 1994;17: 402–417.
103. Wielgosz AT, Nolan RP, Earp JA, Biro E, Wielgosz MB. Reasons for patients' delay in response to symptoms of acute myocardial infarction. *CMAJ.* 1988;139:853–857.
104. Kenyon LW, Ketterer MW, Gheorghiane M, Goldstein S. Psychological factors related to prehospital delay during acute myocardial infarction. *Circulation.* 1991;84:1969–1976.
105. Broer J, Bleeker JK, Bouma J, de Jongste MJ, Erdman RA, Meyboom-de Jong B. Regional differences in prehospital time delay for patients with acute myocardial infarction; Rotterdam and Groningen, 1990–1995 [in Dutch]. *Ned Tijdschr Geneesk.* 2000;144:78–83.
106. Pattenden J, Watt I, Lewin RJ, Stanford N. Decision making processes in people with symptoms of acute myocardial infarction: qualitative study. *BMJ.* 2002;324:1006–1009.
107. Hutchings CB, Mann NC, Daya M, Jui J, Goldberg R, Cooper L, Goff DC Jr, Cornell C. Patients with chest pain calling 9-1-1 or self-transporting to reach definitive care: which mode is quicker? *Am Heart J.* 2004;147:35–41.
108. Zapka J, Estabrook B, Gilliland J, Leviton L, Meischke H, Melville S, Taylor J, Daya M, Laing B, Meshack A, Reyna R, Robbins M, Hand M, Finnegan J. Health care providers' perspectives on patient delay for seeking care for symptoms of acute myocardial infarction. *Health Educ Behav.* 1999;26:714–733.
109. Manhapra A, Canto JG, Barron HV, Malmgren JA, Taylor H, Rogers WJ, Weaver WD, Every NR, Borzak S. Underutilization of reperfusion therapy in eligible African Americans with acute myocardial infarction: role of presentation and evaluation characteristics. *Am Heart J.* 2001; 142:604–610.
110. Zweifler RM, Mendizabal JE, Cunningham S, Shah AK, Rothrock JF. Hospital presentation after stroke in a community sample: the Mobile Stroke Project. *South Med J.* 2002;95:1263–1268.
111. Kothari R, Jauch E, Broderick J, Brott T, Sauerbeck L, Khoury J, Liu T. Acute stroke: delays to presentation and emergency department evaluation. *Ann Emerg Med.* 1999;33:3–8.
112. Rosamond WD, Gorton RA, Hinn AR, Hohenhaus SM, Morris DL. Rapid response to stroke symptoms: the Delay in Accessing Stroke Healthcare (DASH) study. *Acad Emerg Med.* 1998;5:45–51.
113. Menon SC, Pandey DK, Morgenstern LB. Critical factors determining access to acute stroke care. *Neurology.* 1998;51:427–432.
114. Nedelchev K, Arnold M, Brekenfeld C, Isenegger J, Remonda L, Schroth G, Mattle HP. Pre- and in-hospital delays from stroke onset to intra-arterial thrombolysis. *Stroke.* 2003;34:1230–1234.
115. Casetta I, Granieri E, Gilli G, Lauria G, Tola MR, Paolino E. Temporal trend and factors associated with delayed hospital admission of stroke patients. *Neuroepidemiology.* 1999;18:255–264.
116. Streifler JY, Davidovitch S, Sendovski U. Factors associated with the time of presentation of acute stroke patients in an Israeli community hospital. *Neuroepidemiology.* 1998;17:161–166.
117. Williams LS, Bruno A, Rouch D, Marriott DJ. Stroke patients' knowledge of stroke: influence on time to presentation. *Stroke.* 1997; 28:912–915.
118. Fogelholm R, Murros K, Rissanen A, Ilmavirta M. Factors delaying hospital admission after acute stroke. *Stroke.* 1996;27:398–400.
119. Pistollato G, Ermani M. Time of hospital presentation after stroke: a multicenter study in north-east Italy. Italian SINV (Societa Interdisciplinare Neurovascolare) Study group. *Ital J Neurol Sci.* 1996;17: 401–407.
120. Lannehoa Y, Bouget J, Pinel JF, Garnier N, Leblanc JP, Branger B. Analysis of time management in stroke patients in three French emergency departments: from stroke onset to computed tomography scan. *Eur J Emerg Med.* 1999;6:95–103.
121. Evenson KR, Schroeder EB, Legare TB, Brice JH, Rosamond WD, Morris DL. A comparison of emergency medical services times for stroke and myocardial infarction. *Prehosp Emerg Care.* 2001;5: 335–339.
122. Madias JE, Chintalapaly G, Choudry M, Chalavarya G, Kegan M. Correlates and in-hospital outcome of painless presentation of acute myocardial infarction: a prospective study of a consecutive series of patients admitted to the coronary care unit. *J Investig Med.* 1995;43: 567–574.
123. Libman RB, Kwiatkowski TG, Hansen MD, Clarke WR, Woolson RF, Adams HP. Differences between anterior and posterior circulation stroke in TOAST. *Cerebrovasc Dis.* 2001;11:311–316.
124. Ottesen MM, Kober L, Jorgensen S, Torp-Pedersen C. Determinants of delay between symptoms and hospital admission in 5978 patients with

- acute myocardial infarction. The TRACE Study Group. Trandolapril Cardiac Evaluation. *Eur Heart J*. 1996;17:429–437.
125. Lawrence ES, Coshall C, Dundas R, Stewart J, Rudd AG, Howard R, Wolfe CD. Estimates of the prevalence of acute stroke impairments and disability in a multiethnic population. *Stroke*. 2001;32:1279–1284.
  126. Pancioli AM, Broderick J, Kothari R, Brott T, Tuchfarber A, Miller R, Khoury J, Jauch E. Public perception of stroke warning signs and knowledge of potential risk factors. *JAMA*. 1998;279:1288–1292.
  127. Schneider AT, Pancioli AM, Khoury JC, Rademacher E, Tuchfarber A, Miller R, Woo D, Kissela B, Broderick JP. Trends in community knowledge of the warning signs and risk factors for stroke. *JAMA*. 2003;289:343–346.
  128. Hand M, Brown C, Horan M, Simons-Morton D. The National Heart Attack Alert Program: progress at 5 years in educating providers, patients, and the public and future directions. *J Thromb Thrombolysis*. 1998;6:9–17.
  129. National Heart Attack Alert Program Committee Working Group on Educational Strategies to Prevent Prehospital Delay in Patients at High Risk for Acute Myocardial Infarction. Educational strategies to prevent prehospital delay in patients at high risk for acute myocardial infarction: a report by the National Heart Attack Alert Program. *J Thromb Thrombolysis*. 1998;6:47–61.
  130. Alberts MJ, Perry A, Dawson DV, Bertels C. Effects of public and professional education on reducing the delay in presentation and referral of stroke patients. *Stroke*. 1992;23:352–356.
  131. Barsan WG, Brott TG, Broderick JP, Haley EC Jr, Levy DE, Marler JR. Urgent therapy for acute stroke: effects of a stroke trial on untreated patients. *Stroke*. 1994;25:2132–2137.
  132. Zweifler RM, Drinkard R, Cunningham S, Brody ML, Rothrock JF. Implementation of a stroke code system in Mobile, Alabama: diagnostic and therapeutic yield. *Stroke*. 1997;28:981–983.
  133. Harbison J, Massey A, Barnett L, Hodge D, Ford GA. Rapid ambulance protocol for acute stroke. *Lancet*. 1999;353:1935.
  134. Becker K, Fruin M, Gooding T, Tirschwell D, Love P, Mankowski T. Community-based education improves stroke knowledge. *Cerebrovasc Dis*. 2001;11:34–43.
  135. Wein TH, Staub L, Felberg R, Hickenbottom SL, Chan W, Grotta JC, Demchuk AM, Groff J, Bartholomew LK, Morgenstern LB. Activation of emergency medical services for acute stroke in a nonurban population: the T.L.L. Temple Foundation Stroke Project. *Stroke*. 2000;31:1925–1928.
  136. Harbison J, Hossain O, Jenkinson D, Davis J, Louw SJ, Ford GA. Diagnostic accuracy of stroke referrals from primary care, emergency room physicians, and ambulance staff using the face arm speech test. *Stroke*. 2003;34:71–76.
  137. Culley LL, Henwood DK, Clark JJ, Eisenberg MS, Horton C. Increasing the efficiency of emergency medical services by using criteria based dispatch. *Ann Emerg Med*. 1994;24:867–872.
  138. Alberts MJ, Hademenos G, Latchaw RE, Jagoda A, Marler JR, Mayberg MR, Starke RD, Todd HW, Viste KM, Girgus M, Shephard T, Emr M, Shwayder P, Walker MD. Recommendations for the establishment of primary stroke centers. Brain Attack Coalition. *JAMA*. 2000;283:3102–3109.
  139. Crocco TJ, Kothari RU, Sayre MR, Liu T. A nationwide prehospital stroke survey. *Prehosp Emerg Care*. 1999;3:201–206.
  140. Sahni R. Acute stroke: implications for prehospital care. National Association of EMS Physicians Standards and Clinical Practice Committee. *Prehosp Emerg Care*. 2000;4:270–272.
  141. Gordon DL. The Mississippi Stroke Education Consortium: a state-based template to promote stroke awareness, prevention and emergency treatment. *Neuroepidemiology*. 2000;19:1–12.
  142. Centers for Disease Control and Prevention (CDC). State-specific mortality from stroke and distribution of place of death—United States, 1999. *MMWR Morb Mortal Wkly Rep*. 2002;51:429–433.
  143. Reeves MJ, Arora S, Broderick JP, Frankel M, Heinrich JP, Hickenbottom S, Karp H, LaBresh KA, Malarcher A, Mensah G, Moomaw CJ, Schwamm L, Weiss P; Paul Coverdell Prototype Registries Writing Group. Acute stroke care in the US: results from 4 pilot prototypes of the Paul Coverdell National Acute Stroke Registry. *Stroke*. 2005;36:1232–1240.
  144. California Acute Stroke Pilot Registry (CASPR) Investigators. Prioritizing interventions to improve rates of thrombolysis for ischemic stroke. *Neurology*. 2005;64:654–659.

**Reducing Delay in Seeking Treatment by Patients With Acute Coronary Syndrome and Stroke: A Scientific Statement From the American Heart Association Council on Cardiovascular Nursing and Stroke Council**

Debra K. Moser, Laura P. Kimble, Mark J. Alberts, Angelo Alonzo, Janet B. Croft, Kathleen Dracup, Kelly R. Evenson, Alan S. Go, Mary M. Hand, Rashmi U. Kothari, George A. Mensah, Dexter L. Morris, Arthur M. Pancioli, Barbara Riegel and Julie Johnson Zerwic

*Circulation*. 2006;114:168-182; originally published online June 26, 2006;  
doi: 10.1161/CIRCULATIONAHA.106.176040

*Circulation* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231  
Copyright © 2006 American Heart Association, Inc. All rights reserved.  
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://circ.ahajournals.org/content/114/2/168>

**Permissions:** Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Circulation* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the [Permissions and Rights Question and Answer](#) document.

**Reprints:** Information about reprints can be found online at:  
<http://www.lww.com/reprints>

**Subscriptions:** Information about subscribing to *Circulation* is online at:  
<http://circ.ahajournals.org/subscriptions/>