INTRODUCTION

The idea of providing out-of-hospital medical care and emergency transport to the public is a relatively new concept, gaining federal recognition in the late 1960s.1 The current structure of EMS systems is based on an amalgamation of several evolutions of this service as new technologies, public demands, and proposed or capricious systems of health care continue to emerge.2 Currently, EMS focuses on providing medical interventions to reduce morbidity and mortality associated with existing illness or injury. However, as EMS continues to evolve, its focus may broaden to include a variety of public health activities, including monitoring individual and community health, providing primary prevention programs, and participating in health systems coordination.

Insufficiencies in the current healthcare system are also shifting the expectations of EMS from caring exclusively for an individual’s emergent medical needs to becoming more integrated in public health efforts focused on ensuring the organization of health surveillance, emergency preparedness, and community-based medical programs. EMS may be well suited for this evolution because it is the “frontline” of medical care for communities and provides interventions where disease and injury are first encountered. An extension of this concept is the recent application of the “exception to informed consent” methodology to EMS interventional trials. In such trials, the public health perspective in emergency research is used (i.e., beneficence to the critical patient and community at-large, coupled with social justice, outweighs patient autonomy in select circumstances).

This chapter will introduce the reader to broad areas of community-oriented public health that are (and will likely be increasingly) influenced by the day-to-day activities of EMS. Some of the discussion may seem futuristic, yet the structure and attributes of EMS systems place them in a unique position to influence public health at the state, community, and individual patient levels. The discussion will be organized from a public health perspective, incorporating essential services of local public health programs. The role of EMS in key public health priorities including education, emergency preparedness, healthcare coordination, and research will also be addressed.

PUBLIC HEALTH SURVEILLANCE

EMS personnel are in a unique position to identify and document public health concerns that exist in the neighborhoods and communities they serve.3 Pub-
lic health professionals recognize the well-known fact that physical or emotional illness/injury is often caused, influenced, or exacerbated by environmental or social factors. EMS personnel may be the only healthcare professionals who view the actual environment and individual circumstances that surround a healthcare incident. Whether approaching a patient in his or her home or approaching the scene of an injury, EMS personnel gain a unique understanding of the circumstances relating to the healthcare event. Observing the interaction between a patient and his or her environment offers a unique perspective that is almost impossible to adequately capture during a “patient history” collected in the detached environment of an emergency department.

A similar observation can be made when considering environmental surveillance at the community level. A common pragmatic objection among local leaders to state-level emergency response plans is, “How is this plan going to work in our town?” This question is an important one. Experience suggests that assumptions regarding the adequacy of service delivery models, emergency communications, and decision-making are “community idiosyncratic.” However, these community-specific factors are, to a large degree, understood by local EMS personnel. EMS personnel find a way to rapidly transport critical patients even during rush hour by using side streets and “lights and sirens.” They also respond to the needs of multiple victims at a single scene using just their available resources. These constant adjustments provide them with a unique understanding of pitfalls in community emergency plans at the ground level. The same case can be made for syndromic surveillance, which is highly dependent on local human and environmental factors. Local EMS experience may be grossly underrepresented in many syndromic surveillance and emergency preparedness plans.

The EMS Agenda for the Future states, “EMS represents the intersection of public safety, public health, and health care systems.” EMS personnel have the opportunity to view this juncture first hand as it relates to a patient facing a healthcare crisis. This perspective on EMS care is well described in an innovative article suggesting that EMS care providers could serve as “public health sentinels” within communities. Table 27.1 provides a list of essential services provided by public health, as defined by the Health Resources and Services Administration, and pilot or model EMS projects that have investigated the role of EMS in supporting these services.

### TABLE 27.1

<table>
<thead>
<tr>
<th>Service</th>
<th>Project or Initiative</th>
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<tr>
<td>Monitor health status to identify community health problems.</td>
<td>EMS personnel identify fall hazards among the elderly in homes.</td>
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<td>Investigate health hazards in the community.</td>
<td>EMS records used to identify dangerous highway intersections.</td>
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<td>Inform, educate, and empower people about health issues.</td>
<td>EMS personnel offer drowning prevention education.</td>
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<td>Mobilize community partnerships to identify and solve health problems.</td>
<td>Incorporation of EMS into state public health emergency plan.</td>
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<td>Develop policies and plans that support individual and community health efforts.</td>
<td>Implementation of EMS trauma triage transport guidelines.</td>
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<td>Link people to needed personal health services and ensure the provision of health care when otherwise unavailable.</td>
<td>Use of automated external defibrillators among EMS in rural areas.</td>
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<td>Ensure a competent public health and personal healthcare workforce.</td>
<td>Challenges associated with maintaining an EMS workforce.</td>
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<tr>
<td>Evaluate effectiveness, accessibility, and quality of personal and population-based health services.</td>
<td>Evaluation of helicopter versus ground transport.</td>
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<tr>
<td>Conduct research to attain new insights and innovative solutions to health problems.</td>
<td>Evaluation of using EMS to identify child abuse.</td>
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IDENTIFICATION OF PUBLIC HEALTH CONCERNS

An important role of public health is to identify public health concerns and make appropriate referrals for services to ameliorate the problem. EMS personnel can make timely referrals to appropriate public agencies, such as social service agencies or nonprofit counseling services, that can circumvent much of the morbidity and physical harm that may result when referrals are delayed. Early detection and prompt action are crucial to effective prevention efforts.

Several published studies have evaluated the ability of EMS to identify populations at risk as well as their effectiveness in providing timely referrals to public agencies.8–11 Most of these studies focus on efforts to identify environmental, social, and medical risks among specific population segments, such as the elderly. For example, Krumperman notes that 50 referrals were made within 19 months after EMS providers were given training to identify persons at risk for injury and taught how to place social service referrals.11 This study and others indicate that EMS personnel can identify individuals at risk and serve as an important link in the process of providing early referrals to appropriate public services. However, additional work is needed to establish whether these referrals have a positive effect on patient outcome.

Medical and public health investigators have advocated for the development of integrated, region-wide referral centers to serve as centralized locations for the initiation and processing of referrals between agencies such as EMS, social service organizations (e.g., welfare agencies and public clinics), police, ancillary medical services (e.g., substance abuse programs), and aging services.8 Such referral centers would facilitate referrals within a community and at the same time provide valuable data necessary to augment injury and disease surveillance efforts and provide valuable information to support educational and legislative initiatives.

ROLE OF EMS IN PUBLIC HEALTH EDUCATION

Several studies have demonstrated that individuals are most receptive to targeted educational efforts when they are in the process of seeking medical care for an illness or injury.16,17 For example, patients seen for in-line skating injuries were receptive to injury prevention education at the time of treatment in the ED.18,19 This “window of opportunity” for prevention education is wide open to EMS personnel. In fact, providing prevention education in a patient’s home or at the scene of injury may prove more poignant because the patient is still in the environment that may have contributed to the illness or injury.
Efforts by EMS agencies to provide prevention education have been demonstrated through one-on-one counseling, media campaigns, legislative advocacy, and formal educational programs. These findings suggest that EMS providers are respected as healthcare providers and patients are receptive to their instruction. As an example, a study conducted by Meischke et al. demonstrated that the proportion of senior adults with intentions to seek appropriate care for heart symptoms was significantly increased if EMS personnel delivered the educational information. It is important to note, however, that additional published research formally evaluating the effectiveness of EMS-initiated prevention programs is desperately needed. Very few articles are in the peer-reviewed literature similar to that of Meischke et al. in providing scientific evidence regarding the effectiveness of educational programs initiated by EMS.

ROLE OF EMS IN EMERGENCY PREPAREDNESS

As frontline providers in a mass casualty event, EMS providers should play an important role in development of emergency preparedness plans. Emergency preparedness plans provide an assessment of risks and hazards that might trigger an emergency response and assess the adequacy of available resources including hospital capacity, personnel, and supplies and contingency protocols for surge capacity and ancillary resource allocation. Additionally, assessments must be made of available personnel, existing training levels, and protocols for patient triage, transport, and destination. EMS can play an essential role in the accuracy of these assessments.

In essence, emergency preparedness plans must be based on the level of community risk planners are willing to accept because no plan can remove all risk. Thus, planners must approximate the realistic risk to human life based on a community’s unique infrastructure and geographic characteristics. Too often, however, general independent bits of information are used to approximate this risk including population density, time of day the event occurs, etc. EMS can play an important role in helping planners understand the interplay between factors that, taken independently, underestimate risk. For example, experienced EMS personnel understand the compounding effect of population density, time of day, surface street configuration, and hospital location to more appropriately estimate risk and needed resources.

Emergency response plans must also detail policy revisions that address the planning and response to all hazards and specific threats. However, the instigation of policy does not automatically translate into changes in protocol or behavior. For example, it is vitally important to re-educate EMS personnel regarding the role of EMS care in light of a disaster. During ordinary operations, EMS effectiveness is measured using speed of response, promptness of field evaluation/treatment, and rapid transport to the appropriate facility. In contrast, effectiveness indicators during a disaster become less individual-patient centered and more about how to achieve the greatest good for the largest number of patients—the public health approach. This is accomplished by focusing EMS actions on those most salvageable. Further, to avert overloading key critical care resources, patients are widely distributed across facilities, using ancillary facilities to treat non–life-threatening injuries and thus avoiding a concentration of patients, EMS providers, and hospital personnel in any one area.

This information barely scratches the surface of emergency preparedness issues that require EMS consideration. EMS personnel and administrators should be deeply involved in decisions that center around the five Ps of disaster preparedness: planning, publishing, pre-positioning, practicing, and performance evaluation. As mentioned, EMS personnel become the frontline providers in a disaster situation; thus, EMS personnel must be directly involved in emergency preparedness decisions to ensure that plans are flexible, easily understood, and adaptable to a variety of situations.

ROLE OF EMS IN HEALTHCARE COORDINATION

EMS system policies regarding the triage, treatment, and transport of trauma patients are a stellar example of healthcare coordination across public health and established healthcare entities. The earliest techniques for prehospital management of injured patients were derived from concepts developed during military conflicts. These early concepts have been refined to provide scene protocols for patient management, direct medical oversight, and field triage decision schemes to ensure that patients with specific (or severe) injuries are rapidly transported to facilities with the nec-
necary resources and expertise to address a patient’s specific needs.

More than three decades of research suggest that trauma systems reduce mortality from injury among the severely injured in urban areas due, in part, to the coordination of care that begins at the scene of injury. State departments of public health have recognized this benefit and now regulate “statewide trauma systems” in more than half of the states in the United States. The existence of organized trauma care and state-level trauma registry data have allowed researchers to refine the care offered to trauma patients at the scene of injury through release from hospital care.

The stage is set for other maladies often treated in the out-of-hospital setting to develop similar connections between public health and traditional health care to ensure rapid and appropriate assessment/treatment at the scene and transport to a specialized facility. A body of literature assesses the use of a coordinated approach to out-of-hospital care when responding to a potential heart attack or stroke to ensure the timely and appropriate use of reperfusion therapy. Recently, much interest has surfaced regarding the development of refined EMS protocols for STEMI (ST-segment elevation myocardial infarction), including the advance transmission of prehospital ECGs and EMS-guided transport directly to catheterization labs.

ROLE OF EMS IN PUBLIC HEALTH RESEARCH

Beginning in the early 1970s, various federal and scientific publications called for the development of a national EMS information system and database to facilitate research in the out-of-hospital setting. Public health data sources were limited to hospital registries or administrative datasets that provided no characterization of the healthcare event or documentation of care provided before hospital arrival.

With support from various professional organizations and funding from federal sources, the National EMS Information System (NEMSIS) project was funded and is now in the process of standardizing EMS data collection across the nation and aggregating standardized state-level EMS data into a national EMS database. This effort has far-reaching implications for the future of public health research by providing standardized out-of-hospital data at the state level and national benchmarking information.

As mentioned earlier, EMS personnel are uniquely situated to collect patient-specific health information important to public health core activities within a community. States that adhere to the NEMSIS standard can use state-level data to assess emergency number use (9-1-1), injury patterns, environmental hazards, patient treatment modalities, transport policies, and other topics important to public health surveillance, epidemiology, and healthcare coordination. With the availability of a method of standardized data collection, the potential to conduct robust EMS research is enhanced.

ROLE OF EMS IN LEGISLATION AND ADVOCACY

Another less commonly used way EMS personnel can influence public health is by advocating for specific legislative actions. If EMS information offers a reliable method for monitoring and reporting community needs, it is possible to use these data to guide the implementation of public policy or aid the actions of public or private agencies.

Often legislative decisions are based on incomplete information or represent a reactionary measure to a major public health event. Reliable information from the community, provided by EMS personnel, could allow public prevention policies to be based on actual sources of potential injury or illness, known unsafe behavior, persons shown to lack primary-care access to the healthcare system, or environmental hazards.

Cost is an important factor driving legislative decision-making regarding public health. The evaluation of the cost of a prevention program uses a cost-benefit ratio analysis. To conduct such an analysis, it is necessary to determine if the program’s potential benefits to the community outweigh the cost of the proposed program. Capturing data to conduct such an analysis is difficult, especially when attempting to determine the formidable financial burden associated with less serious injury and illness. EMS personnel not only have the ability to capture these specific types of data, but also are in the position to make the best use of them by advocating for important changes within their own communities. An example of a cost-benefit study is the work by Nichol et al., which estimated the cost per quality-adjusted life-year for providing a first-responder defibrillation program using
bystanders or responders on an ambulance, fire truck, or police car.\textsuperscript{39,40}

\textbf{COLLABORATION}

Assessing the true impact and costs associated with public health initiatives may become a vital part of the expanding role of EMS agencies. However, if EMS is to serve as a community sentinel, public health resources will need to be integrated into the current services provided by EMS agencies. Expenditures may include the cost of additional training and hardware and the development of communication links between EMS and public service agencies.

\textbf{WHERE DO WE GO FROM HERE?}

It should be noted that the gap between the present structure of EMS and the proposed sentinel and educational role for EMS is not large. For public EMS and fire-based agencies there is a mandate to improve the public’s health. These agencies have a fixed cost of operation. When personnel have on-duty down time, involvement in preventive programs would bring several benefits to the EMS agencies, including public goodwill, heightened EMS personnel awareness of public hazards or at-risk activities, and stronger linkages with the medical and social service communities. These factors enhance the value of the EMS agency to the community and encourage the provision of prevention and early-intervention resources that would otherwise not be made available in the community. Private EMS agencies also are aware that service contracts are dependent on demonstrating value to the community; hence, these agencies are increasingly interested in preventive programs as a means of raising their favorable image in the community.

As call response data become more integrated into EMS databases, the data can be queried and linked with other geographic, census, and economic community data, thus forming a rich source of community illness/injury monitoring.\textsuperscript{41} Using linked data, model systems that integrate data and public policy decision-making should be evaluated. EMS organizations must seek a clear definition regarding the use of patient data for such purposes in light of the Health Insurance Portability and Accountability Act (HIPAA) regulations.\textsuperscript{42} Despite such obstacles, the close monitoring of community and statewide EMS data may be the best means of identifying the emergence of novel mechanisms of injury or new infectious disease outbreaks, whether the result of terrorism, vector transmission, or change in pathogen virulence.

Within prehospital agencies, efforts to refine and systematize data collection within cities, regions, and states should continue with use of the NEMSIS standard. EMS agencies may also consider expanding personnel job descriptions to include community advocacy. Also, it will be important that key federal agencies (such as the National Highway Traffic Safety Administration and the Health Resources and Services Administration) continue to provide funding mechanisms for innovative/model programs so that the ability of EMS services to monitor outcomes in communities and provide targeted primary prevention can be formally tested. These programs should be systematically evaluated to ensure the desired outcomes are achieved. Finally, additional training opportunities should be afforded EMS personnel that would capitalize on the “educational window” available to EMS while treating those in need of care.

\textbf{CONCLUSION}

The tenets of public health include recognition of illness/injury events, determination of underlying causative or facilitative processes, public education regarding these processes, development of appropriate interventions, and surveillance of future events. EMS research can contribute to each of these tenets. EMS is a unique avenue for such research given its existence within the community as opposed to investigation occurring within medical facilities. It also has the benefit of linking multiple disciplines for the purposes of surveillance, education, and interventional approaches. Indeed, the EMS researcher must seek the larger vision and the broader solution.
REFERENCES


42. Public Law 104-191, 42 U.S.C. 1320d.