HQCA
Health Quality Council of Alberta

Alberta Health Services
Emergency Medical Services
Incident Review

December 2022

Improving Healthcare Together

The Health Quality Council of Alberta is a provincial agency that brings together patients, families, and our partners from across healthcare and academia to inspire improvement in patient safety, person-centred care, and health service quality. We assess and study the healthcare system, identify effective practices, and engage with Albertans to gather information about their experiences. Our responsibilities are outlined in the *Health Quality Council of Alberta Act*.

Please contact the Health Quality Council of Alberta for more information: info@hqca.ca, 403.297.8162.

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FOREWORD

When conducting a review of any aspect of our healthcare system, the outcome is a formal and often complex report. But always at the heart of the work is the patient. They are at the forefront of our thinking throughout the process. The family and friends of Betty Ann Williams, whose wait for healthcare was the focus of this review, lost a loved one under traumatic, and very public, circumstances. We offer them our deepest condolences. We also extend our gratitude and sympathies to the many people who supported Betty that day: the neighbours and first responders who were at her side, and the people working in emergency services behind the scenes.

This was a difficult event for all involved. People set out to do the right thing and yet there were times when the system was not operating at its best. Our work was to understand and identify the system issues and contributing factors involved in each aspect of the event. On the surface, this might seem a simple event to review; but in fact, emergency response is a complex system involving several organizations, teams, individuals, processes, policies, norms, tools, and equipment. We looked at the actions of individuals only in the context of understanding how all these factors affect how people work within that system. We learned that there was no single action or activity that by itself slowed the ambulance response time that day. Rather, it was a series of factors, each contributing to the delay in EMS response, some more significant than others, but all important to understanding and addressing opportunities to improve. This event reminds us how circumstances can come together on a given day to create conditions that undermine optimal system performance.

The larger context for this event must also be considered when reviewing this report. Animal attacks are exceedingly rare. These events made up approximately 0.17 per cent of all events reported to EMS over a two-year period in Alberta. Thus, the protocols for emergency response to this type of event are rarely put into practice. And not to be understated, this event took place in a healthcare system under tremendous strain. These are not typical times in healthcare. Efforts within government and across the many stakeholders involved in emergency medical response services in Alberta are working to address the many challenges across our province to improve the delivery of EMS. Our hope is that the recommendations in this report are implemented, as another step to improving emergency medical services in Calgary and beyond.

We thank Alberta Health Services for asking us to conduct this independent review, and the many agencies and individuals who very willingly supported our work by sharing information and participating in interviews. It takes courage to speak openly about an event in which one's own actions may be scrutinized, and to recount the upsetting details of an event such as this. All parties involved displayed a genuine interest in learning how the system can, and should, do better in the future.

Charlene McBrien-Morrison
Chief Executive Officer

EXECUTIVE SUMMARY

Background

On June 5, 2022, an 86-year-old woman sustained injuries in a dog attack in the alley behind her Calgary home that resulted in her death. Alberta Health Services (AHS) requested the Health Quality Council of Alberta (HQCA) conduct an independent quality assurance review (QAR) of the EMS response time to this event under Section 9 of the *Alberta Evidence Act.* The HQCA's focus for this work was on system-related factors. Assessing the actions or decisions made by individuals is not the focus of a QAR.

The scope of this review included reviewing the event and related records:

- Calls/records/data from Calgary 911 (C911), Calgary Police Service (CPS), Calgary Fire Department (CFD), and AHS EMS Dispatch Communications and Deployment.
- Protocols/processes/procedures/policies that guided the actions of emergency communications officers (ECOs) from C911 and AHS EMS Dispatch Communications and Deployment.
- EMS response times, staffing levels, and availability of ambulance resources.
- The extent to which other system-related factors may have contributed to the EMS response to this event.

Methods

Fifty-eight (58) semi-structured interviews were held between July 11 and October 20, 2022 to better understand the events of June 5 and the policies and procedures that were in place to guide the actions of staff that day. EMS dispatch subject matter experts and independent call evaluators were also interviewed. Documents provided by AHS EMS Dispatch Communications and Deployment, C911, CPS, and CFD were reviewed.

In addition:

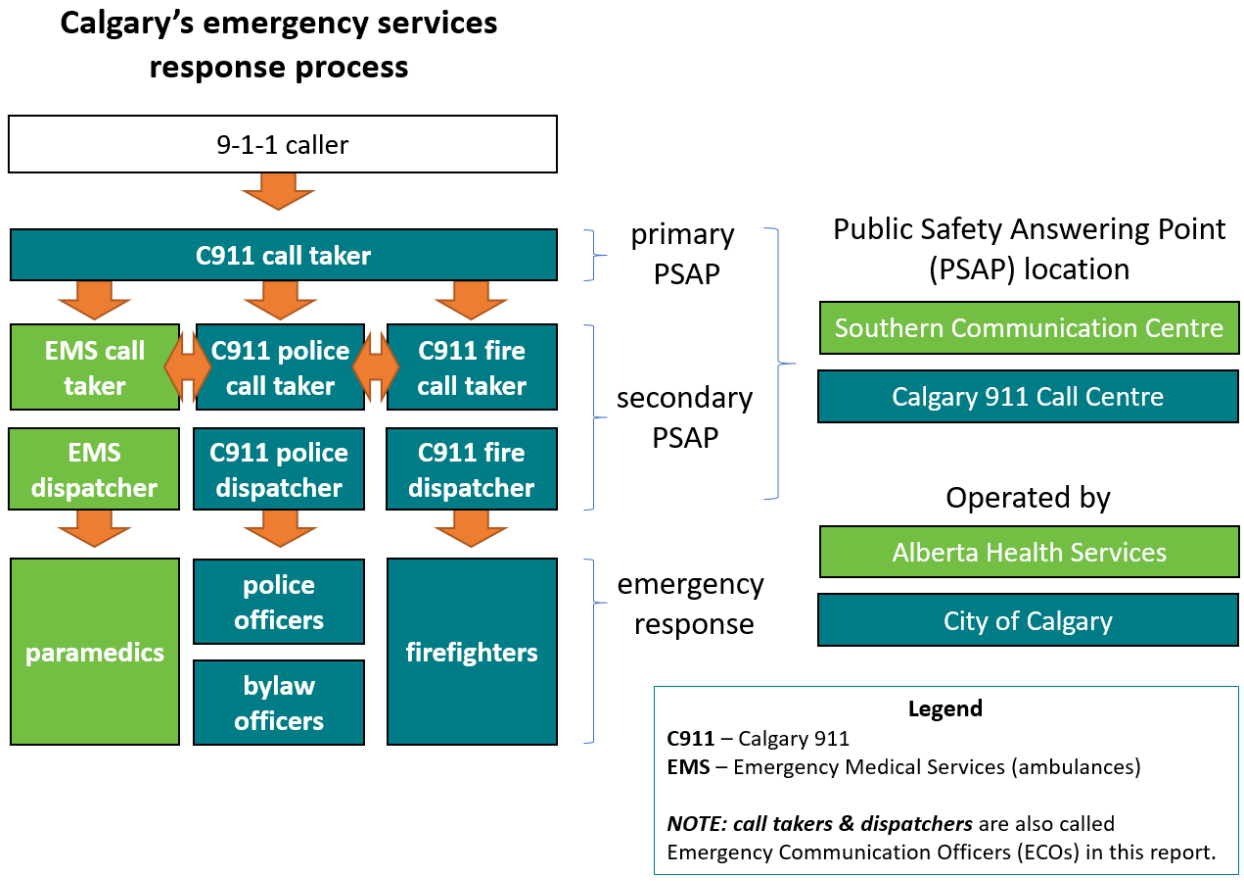
- The review team toured the two call centres involved (C911 and AHS Southern Communications Centre (SCC)).
- A rapid scoping review of the literature was conducted to assist in identifying best and leading practices in emergency medical services dispatch (Appendix A - Rapid narrative review of best practices and issues in EMS dispatch).
- Analysis of AHS EMS data to determine if this day was typical of the 14 days before and 14 days after June 5, and the Sundays between March 27 and August 8.

Calgary's public safety answering points

The phone number used to report an emergency is 9-1-1 (911). In Calgary, this number is answered by the primary public safety answering point (PSAP) operated by C911. The 911 call taker asks a few standard questions to determine which emergency service would be the most appropriate to lead the response: police, fire, or ambulance. The 911 call taker then transfers the 911 caller to the secondary PSAP call taker for the lead agency where more detailed questions about the emergency are asked. This is known as evaluating the call.

Call takers and dispatchers are known as emergency communications officers (ECOs). In Calgary, calls for police and fire are evaluated and dispatched from the C911 call centre by C911 employees who are not part of CPS / CFD. Calls for an ambulance in Calgary are evaluated in one of three AHS EMS call centres and dispatched from the AHS EMS Southern Communications Centre (SCC). ECOs between the C911 call centre and the AHS EMS SCC communicate on dedicated phone lines. The diagram below shows the relationship between the partner agencies involved in responding to emergencies in Calgary.

Diagram 1: Calgary's emergency services response process



Evaluating calls

The call taker representing the lead agency (police, fire, or ambulance) asks specific questions of the 911 caller, using emergency dispatch protocols designed to draw out the most important information quickly, determine the required level of response and urgency, and provide pre-arrival instructions as required.

> *Because this event involved a dog attack and potential for risk to public safety, the C911 call taker assigned police as the lead agency.*

The lead agency is responsible for including other agencies in the response as required. If the lead agency determines a secondary agency is required – for example, during the call evaluation of a police matter it becomes apparent someone on the scene requires medical attention – a process known as co-evaluation is recommended. In co-evaluation the lead agency establishes a three-way call between the 911 caller, the lead agency, and the secondary agency. The ideal is to have the call taker speak directly to the person closest to the on-scene situation to gain information that is as accurate as possible.

> *In this situation, when the call between the C911 police call taker and the 911 caller ended, the **C911 police call taker** phoned an **EMS call taker** to request an ambulance to the scene; co-evaluation was not used and the EMS call taker did not speak to the 911 caller.*

Dispatch

Based on the call evaluation, the lead agency's dispatcher sends an emergency service to the emergency (e.g., police, fire, or ambulance). EMS call takers follow an algorithm of medical protocols using either a manual card set or a computerized application known as ProQA, which guides the EMS call takers in gathering essential information, dispatching resources, and creating documentation.

When an EMS call taker has evaluated the call, a 'determinant' is generated that best describes the emergency, the medical condition of the person involved, and a recommended level of response (priority). Determinants have three parts:

> **Problem code** – this is the primary nature of the emergency or the main complaint, listed alphabetically with corresponding ascending numbers as the problem code.
>
> **Level/priority** – based on answers given by the 911 caller to a series of standardized questions, the problem code is further defined using descriptors of seriousness, such as level of consciousness, breathing, hemorrhage, injury location, time of onset, etc.
>
> **Sub-determinant** – provides more specific information about the patient's condition and is rated numerically, descending somewhat relative to urgency.

In response to the current significant resource and demand conflict, EMS Dispatch Communications and Deployment recently implemented a response plan for which each determinant was assigned a

colour priority (Table 4). This colour is automatically assigned when the event determinant is entered in the computer-aided dispatch (CAD) system.

Table 4: Colour coding in relation to determinant priority and urgency of response

Colour	Definition
Purple	Immediately life threatening – cardiac or respiratory arrest
Red	Immediately life threatening or time critical
Orange	Urgent – potentially serious but not life threatening
Yellow	Non urgent – not serious or life threatening
Blue	Minor, non-serious

As call evaluation continues, ProQA generates a determinant. Determinants that are life threatening are coded as echo and delta, and are the highest priority, meaning they require emergency resources to respond as quickly as possible. For less-critical determinants, coded as charlie, bravo, alpha, and omega (in descending order of urgency), response time becomes less of a factor in the response plan.

> *This event was assigned a bravo priority level determinant labelled as 03B01 (event involves an animal bite or attack involving a possibly dangerous body area). Calls assigned this determinant are automatically given a yellow priority response – non urgent – not serious or life threatening.*

When the number of calls requiring an ambulance exceeds the available resources, they are placed on a pending list.

> *There were no ambulances available at the time of this call (red alert). The event was put on the 'pending' list to wait for an ambulance to become available. There were 20 other events on the pending list at the time, 14 of which were of an equivalent priority level (yellow), and six of a higher priority level (orange).*

City of Calgary Bylaw Services are dispatched to events through the C911 police dispatcher. This dispatcher monitors the radio for **all** CPS events for a section of the city.

> *The C911 police dispatcher dispatched the bylaw officer, who was the first to arrive at the scene of the dog attack. The C911 police dispatcher was monitoring another high-intensity CPS event on the radio, making it difficult for the bylaw officer to provide information to them about the patient's condition.*

Communication between the secondary PSAP agencies occurs through a dedicated phone line and is guided by processes intended to streamline the communication. The medical SEND (Secondary

Emergency Notification of Dispatch) protocol is intended to be used when an officer trained in the protocol provides information about the condition of a patient to their dispatcher to be shared with the EMS call takers. The SEND protocol includes key questions to help the EMS call taker evaluate the call from the other PSAP ECO.

> *When the C911 police dispatcher provided the information from the bylaw officer to the EMS call taker, not all the SEND protocol questions were addressed.*

Sequence of key events on June 5, 2022

The following table summarizes the sequence of key events that took place. Details are provided in the main body of the report that are important to understanding fully what transpired that day.

In some instances, the time in seconds was not available, so the seconds are indicated by 'xx.'

Table 1. Sequence of events[1]

Time	C911, CPS, Bylaw, CFD, EMS response
14:01:59	A 911 caller phones C911 stating "we just found somebody that has been attacked by a dog."
14:02:16	After asking the 911 caller standardized questions, the C911 call taker assigns police as the lead agency. The 911 caller is transferred to a C911 police call taker to assess for scene safety.
14:02:52	The C911 police call taker gathers information from the 911 caller about the location of the dogs and the need for an ambulance.
14:07:29	At the end of the 911 call, the C911 police call taker phones an EMS call taker to request an ambulance to go to the alley of the patient's home. This phone call is made on a dedicated phoneline for C911 ECOs to convey information regarding a new event. Because all other EMS call takers were on calls, the phone is answered by a specialized dispatcher (SSM coordinator) as a backup call taker. While this role has the skillset and is qualified to answer and evaluate calls, the role is not intended to do so unless required under exceptional circumstances.
14:07:46	The SSM coordinator (as a backup EMS call taker) enters the event in the CAD terminal.
14:08:34	The C911 police dispatcher dispatches a bylaw officer to the scene.
14:10:09	The SSM coordinator (as backup EMS call taker) assigns bravo (serious but not life threatening) priority level to this event (using a manual card set for animal bites/attacks): 03B01 (yellow). The event (as bravo) is added to the pending list (no ambulances available).

[1] Important contextual information from the body of the report has been added to this executive summary table for clarity, so it differs slightly from the table of sequence of key events found in the report.

Time	C911, CPS, Bylaw, CFD, EMS response
14:10:19	The bylaw officer arrives on scene and radios the C911 police dispatcher that EMS is required immediately due to severity of injuries.
14:10:45	The C911 police dispatcher calls the EMS call taker at SCC; hangs up just after one minute as call is not answered. This phone call is made on a dedicated phone line for C911 ECOs to convey updates regarding an established event.
14:12:xx	An unrelated, high-intensity CPS event begins – CPS radio traffic impacted
14:14:xx	The bylaw officer tries to provide an update on the patient's condition on busy CPS radio; was asked to stand by (wait) by the C911 police dispatcher.
14:17:55	The bylaw officer makes a phone call directly to a C911 police resource desk (to a person in a role called Res1) to request help contacting EMS and the call is transferred to EMS call taker at SCC. The bylaw officer disconnects before the call is answered (55 seconds later).
14:19:47	The bylaw officer radios the C911 police dispatcher a third time with a patient condition update and seeking ETA for EMS.
14:20:25	The C911 police dispatcher calls EMS call taker at SCC on the update line; hangs up after 37 seconds (needed to attend to other CPS event). Requests assistance from two adjacent C911 police dispatchers to call EMS.
14:23:18	Adjacent C911 police dispatcher (1) contacts an EMS call taker on the new event line; provides information about worsening condition. The EMS call taker asks questions related to patient's condition from the SEND protocol.
14:23:24	Adjacent C911 police dispatcher (2) contacts another EMS call taker on the update line; requests EMS services 'hot' (urgently).
14:25:49	The C911 police dispatcher messages the C911 police dispatch lead (a support role for dispatchers) suggesting the C911 police dispatcher needed help, but the C911 police dispatch lead position had been reassigned and the message went to an empty desk.
14:26:57	The event is updated from bravo (serious but not life threatening) to delta (life threatening) by the SCC EMS deployment manager.
14:27:16	CFD is dispatched to the scene (automatic for delta events).
14:28:03	An ambulance is assigned to event.
14:29:02	The bylaw officer requests update on EMS arrival status from the C911 police dispatcher; notes patient is barely conscious.
14:29:05	The C911 police dispatcher contacts an EMS call taker for an update using the update line and is told EMS is seven minutes away.
14:31:38	CFD arrives on scene and is directed to back alley by the bylaw officer.
14:38:08	EMS arrives on scene at front door; then moves to back alley. Initial assessment of patient is made at 14:40:42.

Time	C911, CPS, Bylaw, CFD, EMS response
14:40:44	CPS arrives on scene at front door.
14:42:35	A firefighter moves ambulance to the back alley.
14:42:51	EMS requests backup EMS unit 'hot' (urgently).
14:48:47	Backup EMS arrives.
14:55:09	EMS transports patient to Foothills Medical Centre (FMC).
14:59:55	EMS arrives at FMC.
15:01:00	FMC trauma team assumes care of patient.

Event response time

The EMS response time for this event was 30 minutes and 22 seconds. This is calculated from the time when the EMS call taker entered the event into the CAD terminal (14:07:46) until the first EMS unit arrived on scene (14:38:08). From when the 911 call was made, EMS arrived 36 minutes and 9 seconds later.

The response time for this event from the time it was updated to a delta event (14:26:57) to arrival on scene was 11 minutes and 11 seconds.

The response time target for life-threatening (delta and echo) events:

- For every 10 calls, at least five of those calls must have a response time of eight minutes or less (median response-time target).
- For every 10 calls, at least nine must have a response time of 12 minutes or less (90th percentile response-time target).

Modelling done post-event demonstrates that if the event had been assigned an 03D03 determinant (Problem Code 03: life threatening condition; Priority D: delta; Sub-determinant 03: not alert) at the time of the initial call evaluation by EMS call taker, EMS could have responded to the event in 14 minutes and 26 seconds. This would have reduced the EMS response time by 15 minutes and 56 seconds.

Issues, contributing factors, and recommendations

This QAR identified five issues that contributed to the prolonged EMS response time. For each issue, contributing factors were identified. An analysis of each factor provides context in which to understand how they relate to the issue. There are 16 recommendations that address the issues and contributing factors.

PROJECT OVERVIEW

Background and purpose

On June 5, 2022, an 86-year-old woman sustained injuries in a dog attack in the alley behind her Calgary home that resulted in her death. Alberta Health Services (AHS) requested the Health Quality Council of Alberta (HQCA) conduct an independent review of the EMS response time to this event under section 15(2) of the *Health Quality Council of Alberta Act*, which states: 'the Council may assess or study matters respecting patient safety, person-centred care and health service quality that are referred to it by a health authority.'

This Quality Assurance Review (QAR) was conducted by the HQCA in accordance with Section 9 of the *Alberta Evidence Act*.

Objectives

The objectives of the review:

1. To identify and analyze the structures, processes/protocols, and system factors that contributed to the EMS response time to the event.
2. To identify areas for improvement and make recommendations.

Scope

The QAR focused on understanding how system-related factors may have contributed to the prolonged EMS response time, which included:

- Levels of training, experience, and education of employees.
- Workplace factors such as distractions, fatigue, and the ability to effectively communicate.
- Existence and clarity of protocols/processes/procedures/policies.
- Adequacy of equipment or technology.
- The ability to adhere to organizational policies, standards of practice, or regulatory guidelines and expectations.

Assessing accountability of the actions or decisions made by individuals involved is not the focus of a QAR and would typically involve a separate process conducted by the individual's employer.

The scope of this review included reviewing the event and related records, including:

- Calls/records/data from Calgary 911 (C911), Calgary Police Service (CPS), Calgary Fire Department (CFD), and AHS EMS Dispatch Communications and Deployment.
- Protocols/processes/procedures/policies that guided the actions of emergency communications officers (ECOs) from C911 and AHS EMS Dispatch Communications and Deployment.
- EMS response times, staffing levels, and availability of ambulance resources.
- The extent to which other system-related factors may have contributed to the EMS response to this event.

Areas that were out of scope for this review included:

- Assessment of the care provided at the scene, and enroute to or at the hospital.
- Contemplation of a different outcome for the injured person had EMS response been different.
- Assessment of individual decisions or actions for disciplinary purposes.
- Processes of partner agencies that were deemed to have no impact on the EMS response (e.g., event determinant processes for police).
- Review of public safety answering point (PSAP) processes in other parts of Alberta beyond C911 and the AHS Southern Communications Centre.

PROJECT GOVERNANCE

HQCA Quality Assurance Committee

Responsibility for this review lies with the HQCA Quality Assurance Committee (QAC) who oversees all HQCA Quality Assurance Reviews:

- Charlene McBrien-Morrison, MBA, CHE, Chief Executive Officer, and QAC Chair
- Dr. Greg Powell, OC, MED FRCPC
- Masood Peracha, MBA, CPA
- Mollie Cole, RN, MN, GNC (C), Senior Director, Health System Improvement and Review Lead
- Markus Lahtinen, PhD, CHE, CRP, Senior Director, Health System Analytics, and Adjunct Professor School of Public Health, University of Alberta

HQCA QAC Subcommittee

The review activities were completed by a subcommittee appointed by the QAC:

- Anila Hussaini, BSN, MPH, Lead, Health System Improvement
- Charlene McBrien-Morrison, MBA, CHE, Chief Executive Officer, and Review Sponsor
- Claudia Gonzalez, Executive Assistant to the CEO
- James Hodge, P.Eng, HQCA Patient and Family Advisory Committee
- James Stroud, RN, MHS, Lead, Health System Improvement
- Jennifer Badock, Administrative Assistant, Health System Improvement
- Jonas Shultz, MSc EDAC CRP, Human Factors Specialist, and Adjunct Lecturer, Department of Anesthesiology, Perioperative and Pain Management, University of Calgary (Interview Lead)
- Kevin Smith, Chief Systems and Strategy Officer, BC Emergency Health Service, and former Chief of Niagara Emergency Medical Services (Subject Matter Expert)
- Lisa Brake, ABC, CHE, Senior Director, Communications & Engagement
- Markus Lahtinen, PhD, CHE, CRP, Senior Director, Health System Analytics, and Adjunct Professor School of Public Health, University of Alberta
- Melissa Rolfe, MA, APR, Senior Communications Advisor
- Mollie Cole, RN, MN, GNC (C), Senior Director, Health System Improvement (Review Lead)
- Paulo Sousa, MA, Senior Analyst, Health System Analytics

METHODS

Data collection focused on interviews and the review of records of the event and other supporting documents and was guided by the HQCA's Systematic System Analysis.[i] This process includes creating a detailed timeline of the event and organizing the collected data for analysis in the 'SAFER Matrix,' which considers the structures and processes that, in this case, may have contributed to the delayed Emergency Medical Services (EMS) response.

In addition to interviews and the review of documents:

- Analysis of AHS EMS data was done to determine if this day was typical of the 14 days before and 14 days after June 5, and the Sundays between March 27 and August 8.
- The review team toured the two call centres involved (Calgary 911 (C911) and AHS Southern Communications Centre (SCC)).
- A rapid scoping review of the literature was conducted to assist in identifying leading practices in emergency medical services dispatch (Appendix A - Rapid narrative review of best practices and issues in EMS dispatch).
- Emergency communication officer (ECO) call recordings were evaluated by independent call evaluators with subject matter expertise.

Interviews

An ARECCI Ethics Screening Tool was completed before the review began (Appendix B - ARECCI ethics screening tool report) to assist in identifying potential harm to interviewees and to establish mitigating strategies to reduce unintended consequences. Mitigation strategies included: offering the opportunity to bring a support person to the interviews; outlining in the interview preamble the possibility that talking about the events might elicit emotions; and assuring interviewees that the interview could be delayed or stopped as needed (Appendix C – Interview preamble script).

An explanation of the scope of the review and protections provided under Section 9 of the *Alberta Evidence Act* were stated prior to each interview (Appendix C). The preamble was adapted based on the individuals being interviewed. The names of individuals invited to participate and whether or not they participated have been, and will be, kept confidential.

Fifty-eight (58) semi-structured interviews were completed between July 11 and October 20, 2022. The purpose of the interviews was to better understand the events of June 5 and the policies and procedures that were in place to guide the actions of individuals that day. EMS PSAP subject matter experts and independent call evaluators were also interviewed.

Review of documentation

Documents provided by AHS EMS Dispatch Communications and Deployment, C911, CPS, and CFD were reviewed and the data was used to develop a timeline and understanding of the activities of June 5, 2022.

Documentation reviewed:

- Records concerning the event on June 5.
- Policies, procedures, and other documentation that guided the activities of the personnel involved in the response to this event, such as C911 and AHS EMS Dispatch Communications and Deployment standard operating procedures (SOP) for call taking, call evaluation, and dispatch practices.

Analysis of records was completed to better understand the context of the system on the day of the event (e.g., call volume, ambulance availability, and staffing levels). Data for June 5 were compared with records for the 14 days prior to and 14 days after the event. Data for Sundays (as the event occurred on a Sunday) between March 27 and August 8 were also compared with June 5.

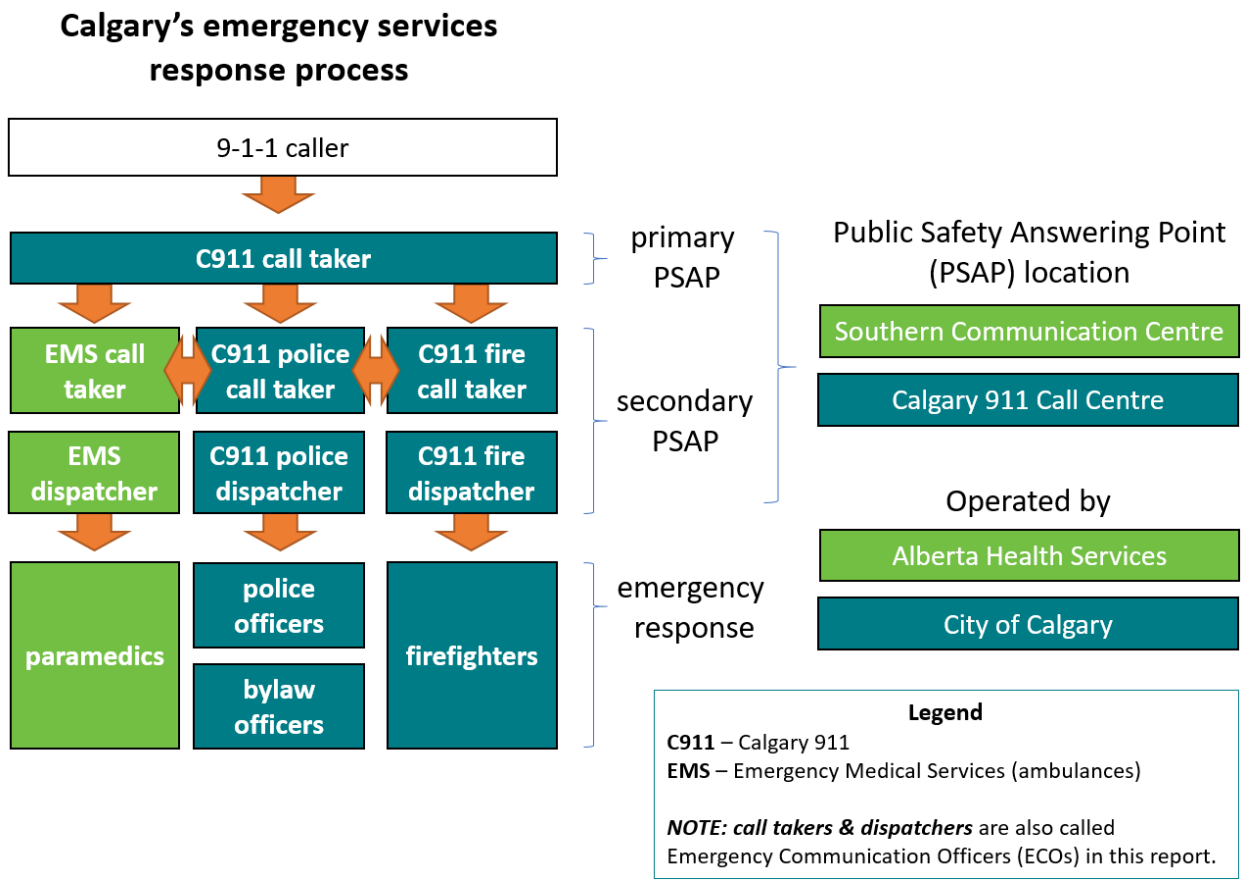
OVERVIEW OF CALGARY'S PUBLIC SAFETY ANSWERING POINTS (PSAP)

Identifying the partner agencies

In Calgary, the phone number used to report an emergency and request emergency services is 9-1-1 (911). This number is answered by a public safety answering point (PSAP) operated by Calgary 911 (C911) and is known as the primary PSAP (the first answering point). The term **C911 call taker** will be used to identify the people who initially answer calls made to 911, and who determine which emergency service will be assigned the lead agency to respond.

In Calgary three services are commonly dispatched to emergency scenes, following 911 calls: Calgary Police Service (CPS), Calgary Fire Department (CFD), and AHS EMS (EMS). Before a service can be sent to the scene, the call must be evaluated to determine the appropriate response. The call takers for police, fire, and ambulance are known as a secondary PSAP (the second answering point). Figure 1 shows the relationship between the partner agencies involved in responding to emergencies in Calgary.

Figure 1: Calgary's emergency services response process



PSAPs can operate as either a stand-alone or integrated model. A stand-alone PSAP is responsible for a single function, either to provide primary PSAP service or act as a secondary PSAP for a single agency type. An integrated PSAP is responsible for two or more functions or agency types. In this model, when the PSAP is operating as both a primary and secondary PSAP, a PSAP call taker answers a 911 call, asks the standard initial questions to determine the lead agency, and, if the primary PSAP agency also acts as a secondary PSAP for that lead agency, does not transfer the call. Instead, the primary PSAP call taker continues with a more detailed call evaluation on behalf of the lead agency to formulate the response.

C911 operates as an integrated PSAP. It provides primary and secondary PSAP services for CFD and CPS with slightly different processes for each. Primary PSAP call takers can evaluate calls on behalf of the CFD. That is, when fire is identified as the lead agency, the 911 caller remains with the primary PSAP call taker who assesses the call.

For calls in which police are selected as the lead agency, the C911 primary PSAP call taker transfers the caller to the C911 police secondary PSAP. Police PSAP is within C911, is not part of CPS, and is designated to provide services as the secondary PSAP on behalf of CPS. C911 is currently cross-training its PSAP call takers to evaluate both police and fire calls.

When EMS is identified as the lead agency, C911 transfers the call to an EMS secondary PSAP operated by AHS. AHS operates as a stand-alone model: a secondary PSAP for EMS only.

The information provided to a PSAP originates from one of four possible sources:

1. **First-party caller** –person calling for themselves (i.e., they are the patient, victim, etc.)
2. **Second-party caller** –person calling is present at the scene of the emergency or has direct knowledge of the situation and/or current condition
3. **Third-party caller** –person calling is not present at the scene nor has direct knowledge of the situation and/or current condition (e.g., driving past an apparent emergency scene)
4. **Fourth-party caller** –person calling is from a connected partner agency. The person is requesting a response from the agency or providing/requesting information on a situation. This includes emergency agencies such as police, fire, or ambulance as well as alarm companies, poison control, etc.

The call takers, dispatchers, and other support roles in the call centres for police, fire, and ambulance are known as emergency communication officers (ECOs), but for clarity the following titles will be used to differentiate the roles they performed in the response to this event. ECOs who evaluate calls for police services and dispatch CPS officers (and in this case, bylaw officers) are referred to as **C911 police call takers** and **C911 police dispatchers**; the people who evaluate calls for EMS and dispatch ambulances are called **EMS call takers** and **EMS dispatchers**.

In Calgary two organizations participate as PSAPs in responding to emergencies: C911 (for police and fire) and AHS EMS Dispatch Communication and Deployment (for ambulance).

C911 ECOs work from the C911 call centre or a satellite office. AHS EMS Dispatch Communication and Deployment ECOs are located at the **Southern Communications Centre (SCC)** in Calgary.

Personnel in both call centres communicate with each other through dedicated phone lines. Interviewees described two lines, one phone line used to inform EMS of a new event and another phone line used to provide event updates and request status updates.

Both call centres have additional roles to support the call takers and dispatchers, such as leads and resource dispatchers. (Appendix D: Detailed description of Calgary's public safety answering points and AHS EMS response) contains descriptions of the support roles for the SCC. These roles are described briefly in the report where relevant.

Computer-aided dispatch (CAD) systems are used by all Calgary PSAP dispatchers, call takers, and 911 call takers to prioritize and record incident calls, identify the status and location of responders in the field, and effectively dispatch responder personnel.

Responding to emergency calls

Determining the lead agency

The lead agency can be either police, fire, or ambulance, and is responsible for including other agencies as required. The decision regarding who will be assigned the lead agency in any 911 response is based on the initial information provided to the **C911 call taker** by the 911 caller, in answering a standard line of questions including the nature of the emergency, the location, and whether it involves weapons or violence (see Appendix D for a detailed description of this process including the direction provided in provincial standards for how these calls are to be answered in Alberta).

Once the lead agency is determined, the **C911 call taker** transfers the 911 caller to the lead agency's call taker for evaluation.

Evaluating calls

The call taker representing the lead agency (police, fire, or ambulance) asks specific questions of the 911 caller, using emergency dispatch protocols designed to draw out the most important information quickly and effectively to determine the required level of response and urgency, and provide pre-arrival instructions as required. Call takers for all three services use the agency-specific Emergency Priority Dispatch System provided by Priority Dispatch Corporation for medical (ambulance), police, and fire. EMS call takers are employees of AHS. Police and fire call takers are employees of C911.

EMS call takers follow an algorithm of medical protocols (Medical Priority Dispatch System - MPDS), using either a manual card set or a computerized application known as ProQA. This technology guides emergency call takers in gathering essential information, dispatching resources, and creating documentation about the event.

When an EMS call taker has evaluated a call using medical protocols a "determinant" is generated that best describes the emergency event, the medical condition of the person involved, and a recommended level of response (priority). These determinants have three parts: problem code, level/priority, and sub-determinant.

Problem code – this is the primary nature of the emergency or the main complaint, listed alphabetically with corresponding ascending numbers as the problem code. As an example, Table 1 shows the first five of 36 possible problem codes in MPDS.

Table 1: First five problem codes listed alphabetically

Nature of emergency/chief complaint	Problem code
Abdominal pain	1
Allergic reaction	2
Animal bites / attacks	3
Assault	4
Back pain	5

Level/priority – based on answers given by the 911 caller to a series of standardized questions, the problem code is further defined using descriptors of seriousness, such as level of consciousness, breathing, hemorrhage, injury location, time of onset, etc. The descriptors are then matched to a level or priority code.

Table 2: Medical Priority Dispatch System: priorities and description

Level/priority	Description
Echo	Life threatening – cardiac or respiratory arrest
Delta	Life threatening other than cardiac or respiratory arrest
Charlie	Serious not life threatening – immediate
Bravo	Serious not life threatening – urgent
Alpha	Non serious or life threatening
Omega	Minor illness or injury

Sub-determinant – provides more specific information about the patient's condition and is rated numerically, descending somewhat relative to urgency. The following sub-determinant example is for problem code 3 (animal bites/attacks) delta:

Table 3: Sub-determinant description

Determinant	Sub-determinant description
03D01	Arrest
03D02	Unconscious
03D03	Not alert
03D04	Chest or neck area (with difficulty breathing)
03D05	Dangerous body area
03D06	Large animal
03D07	Exotic animal
03D08	Mauling or multiple animals
03D09	Attack in progress

In the example above a determinant labelled as a '03D01' would refer to a patient who has been attacked by an animal (problem code 03), is a life-threatening priority (delta), and in cardiac arrest (sub-determinant 01). All told, there are more than 1,800 possible determinants in the MPDS protocols covering different emergencies and patient conditions.

Call takers for police and fire follow a similar process to establish an event determinant using service specific protocols; however, analysis of these were outside of the scope of this review.

Multiple agency response

In many emergencies, multiple agencies may be required to attend. When the **C911 call taker** determines the most appropriate lead agency to initiate a response, the lead agency is responsible for including other agencies as required (Appendix D contains more details about this process).

Co-evaluation

During lead agency call evaluation, if it is determined that a secondary agency is required – for example, during the evaluation of a police matter it becomes apparent someone on the scene requires medical attention – a process known as co-evaluation is an option to share pertinent information directly between the 911 caller and the secondary agency. The ideal is to have the call taker speak directly to the person closest to the on-scene situation to gain information that is as accurate as possible.

In co-evaluation the lead agency establishes a three-way call between the 911 caller, the lead agency, and the secondary agency. Co-evaluation is initiated at the 'send point' of call evaluation – the point at which the lead agency has collected enough information to dispatch an emergency resource, while staying on the line to determine what further actions may be needed. Call evaluation using ProQA can then be done by each agency with the other listening in to determine the most appropriate actions.

Currently there is no provincial standard for co-evaluation procedures across Alberta PSAPs. C911 has developed a co-evaluation standard operating procedure that applies to police and fire calls. The rationale stated in this co-evaluation procedure[ii] is that "failure to provide timely updates on an

event can have serious consequences." This process is intended to ensure competing priorities are managed in a methodical way, keeping scene safety, patient care, and police investigative needs as the priorities.

Considerations to initiate co-evaluation include [*cited directly from source, condensed*]:

- Imminent Scene Safety
- Critical Hazards
- Preservation of Life (e.g., life-threatening injury)
- Any event where there is an urgent need for a partner agency to attend

In these situations, the **C911 police** or **C911 fire call taker** is to bring the secondary agency on the line at the appropriate time and work together to complete the call evaluation process.

AHS EMS Dispatch Communications and Deployment also has a Service Standard for Provincial Co-evaluation supported by a standard operating procedure (SOP) - *Emergency Call Evaluation Process* that directs the EMS call taker to:

- bring C911 police or fire call takers on the line with the caller as directed by medical protocol
- allow C911 police or fire call takers to ask questions when able to do so
- attempt to work in tandem to gain call details needed to complete the evaluation
- complete medical call evaluation in full unless imminent life-threatening danger to the caller, patient, or responders

SEND protocol

EMS ECOs and **C911 police ECOs** are trained in both the police and medical SEND (Secondary Emergency Notification of Dispatch) protocols. The SEND protocol is intended to guide emergency dispatchers to evaluate and record the on-scene assessment of the responding personnel (e.g. EMS or CPS) using an abbreviated call evaluating process.[iii] EMS dispatchers can use the police SEND protocol to request police when there is a paramedic on scene, and police can use the medical SEND protocol to request EMS when there is a CPS officer on scene.

The medical SEND protocol includes seven key questions, of which six are asked depending on whether the emergency is medical (illness) or trauma (accident or injury) related (Figure 2).

Figure 2: SEND protocol questions

The SEND protocol's scripted questions are provided by the Priority Dispatch Corporation. C911 police ECOs and EMS ECOs use either a manual card set (shown above) reading from a physical hard copy of the protocol or accessing the SEND protocol questions on the computer aided dispatch (CAD) screen. Priority Dispatch Corporation has developed an Advanced SEND protocol that is built into ProQA that is not currently used by AHS EMS Communications Dispatch and Deployment. A rapid narrative review of best practices and issues in EMS dispatch indicated that using the Advanced SEND protocol in ProQA reduced over-triaging by dispatch personnel and over-sending resources. Calls coded using the Advanced SEND protocol in ProQA were accurately evaluated and an appropriate response was coordinated (Appendix A).

SEND is intended for use when a first responder (CFD, CPS, EMS) is on the scene and is able to relay second-party information to their dispatcher. The information provided in response to the key questions is conveyed from the first responder's dispatcher to the secondary agency's dispatcher to determine the appropriate response from the secondary agency.

The SEND protocol requires and relies on the knowledge and skills of trained first responders[2] at the scene to recognize serious versus minor injuries and the necessity of a lights-and-siren EMS response.[iv]

EMS dispatch

As the EMS call taker is evaluating a call and entering information into the CAD, at the point of address verification a 'pre-alert' is sent to the EMS dispatcher advising them a call is being taken and to prepare to receive the details. As call evaluation continues, ProQA generates a determinant, and the dispatcher can assign the appropriate resource. The actions to implement a response are guided by several decision-aiding tools such as 'Recommend Monitor' and response plans.

[2] First responder: Includes a firefighter, law enforcement officer, paramedic, emergency medical technician, or other individual (including an employee of a legally organized and recognized volunteer organization, whether compensated or not), who, in the course of his or her duties, responds to fire, medical, hazardous material, or other emergency events.

Recommend Monitor

The EMS CAD tracks the location and availability (status) of EMS response resources (e.g., ambulances) in real time. When a call is entered into the CAD, the Recommend Monitor tool provides a ranked listing of the four resources that could respond to the call. The ranking is determined by distance to the scene and estimated arrival time based on route and posted speed limits. It also considers whether the resource is available immediately or available soon.

An 'available soon' resource is completing an event but expected to return to service shortly, pending confirmation they can leave the event they are currently assigned to. 'Available soon' also refers to units responding to lower-priority calls that could be diverted to higher-priority events if they have not reached the patient (Preempt and Divert Procedure[v]).

Response plans

Response plans ensure limited emergency resources (e.g., ambulances) are managed efficiently by assigning, to the extent possible, the required resource(s) within the appropriate time. When properly evaluated through ProQA, the determinant (event) informs the appropriate response, including the resource type.

Determinants that are life threatening are coded as echo and delta, and are the highest priority, meaning they require emergency resources to respond as quickly as possible. For less-critical determinants, coded as charlie, bravo, alpha, and omega (in descending order of urgency), response time becomes less of a factor in the response plan.

AHS EMS Dispatch Communications and Deployment recently implemented a response plan known as the Clinical Response Model (CRM) in response to the current significant resource and demand conflict. Each determinant was assigned a colour priority to assist in decision-making for the dispatch of resources (Table 4). This colour is automatically assigned when the event determinant is entered in the CAD.

Table 4: Colour coding in relation to determinant priority and urgency of response

Colour	Definition
Purple	Immediately life threatening – cardiac or respiratory arrest
Red	Immediately life threatening or time critical
Orange	Urgent – potentially serious but not life threatening
Yellow	Non urgent – not serious or life threatening
Blue	Minor, non-serious

When the number of calls requiring an ambulance exceeds the available resources, they are placed on one of two lists: 'held' or 'pending.' Events on the held list (lower acuity or truly non-emergency events) are deliberately kept in a queue, even if a resource is or becomes available, to preserve a supply of ambulances until more are available in the system overall. Events are put on the pending list when they need an ambulance but none are available. As resources are freed up, calls on the list

are assigned a response. The decision on which calls to assign first is based on colour code (level of urgency) and time in the queue.[vi]

If a high-priority call is received by EMS and there are no available units to respond (red alert) a procedure diverts an ambulance away from a lower-priority call to the higher-priority call (Preempt and Divert Procedure). The lower-priority call is then added to the pending list.

Paramedic response

Dispatch assigns an ambulance using digital paging, voice radio, or a mobile data terminal (MDT) known as a mobile CAD. The mobile CAD is the primary means of notifying paramedics of a call and provides detailed information specific to the response. The mobile CAD is a laptop mounted in the cab of the vehicle.

Paramedics respond to the incident and upon arrival confirm their safety to their dispatcher. In situations where the scene needs to be secured, paramedics 'hold back' until CPS arrive and deem the situation safe. Paramedics assess the patient, provide any required care and treatment, and take the patient to the most appropriate healthcare facility if required.

Interoperability

When responding to a call or when on scene, if an EMS or CPS responder needs to communicate with the other agency, the responder must communicate back to their respective dispatcher who then relays the message to the other agency. While it is possible for dispatchers to patch responders from different agencies onto one radio channel, this approach is typically reserved for prolonged cases (e.g., mass causality events) as the patching process is complex and time consuming to set up.

In Calgary, the AHS EMS Dispatch Communications and Deployment CAD system interfaces with the CFD CAD system and shares data for shared events. Due to information security requirements, the CPS CAD does not interface with either CFD or AHS EMS CAD.

Destination determination and transfer of care

When a patient needs to be taken to a hospital or other healthcare facility, paramedics typically follow established guidelines or policies to determine the most appropriate site. Several factors can influence this decision, such as specialized care required (i.e., trauma, cardiac, stroke, etc.) and the current capacity at receiving facilities. When the ambulance arrives at the emergency department (ED), the patient remains under the care of paramedics in the ED until the transfer of care can occur.[vii] AHS EMS has a target time of 90 minutes to transfer care and be ready to be dispatched to another event. Backlogs in the ED can result in EMS offload delays.

To reduce hospital offload delays and improve patient flow, initiatives have been implemented with Calgary-area hospitals and EMS, including a new Integrated Operations Centre (IOC), a surge process, and a Real Time Operations Centre. These programs and processes are described in Appendix D.

SEQUENCE OF EVENTS

On June 5, 2022, an 86-year-old woman sustained significant injuries in a dog attack in the alley behind her Calgary home. The following describes the sequence of events in obtaining emergency help for her injuries.

Initial call to 911 for help (14:01:59 to 14:07:29)

A bystander called Calgary 911 (C911) at 14:01:59. As the primary public safety access point (primary PSAP), the **C911 call taker** asked, "What is the emergency?" The 911 caller stated, "We just found somebody that has been attacked by a dog."

Based on that response, and the Calgary location[3] of the 911 caller, the C911 call taker determined that police should be the lead agency in the event. This portion of the call took 17 seconds. The 911 caller then waited for 36 seconds while the call was connected to a **C911 police call taker** for call evaluation.

For the next four minutes and 25 seconds, a C911 police call taker gathered information from the 911 caller. Some of the questioning from the C911 police call taker involved scene safety pertaining to the dogs (i.e., their breed and whereabouts) and some involved the medical needs of the person who was injured. When the call between the C911 police call taker and the 911 caller ended, the **C911 police call taker** phoned the AHS EMS Southern Communications Centre (SCC).

EMS call evaluation and ambulance dispatch (14:07:29 to 14:10:09)

Calls between the EMS and C911 police call takers follow an abbreviated call-evaluation process to be as efficient as possible. During the call, the **C911 police call taker** made a request to the **EMS call taker** for an ambulance for a patient who had been attacked by three dogs, and requested of the EMS call taker that EMS join CPS and bylaw at the scene. The C911 police call taker indicated "we'll be in the alley." The call between the C911 police call taker and the EMS call taker lasted one minute and 15 seconds, ending at 14:08:44.

The EMS call taker at the SCC who answered the call from the C911 police call taker was working in the role of EMS System Status Management (SSM) Coordinator (responsible for monitoring and moving unassigned ambulances to the most needed coverage areas across the city and throughout the suburban rural and rural areas of the zone). Although this person was qualified to take calls, their assignment at the time was not as a call taker. This person was acting as a backup to the usual **EMS call takers** and **EMS dispatchers** who otherwise would have answered this call. However, they were busy taking other calls as the SCC was short staffed that day.

[3] C911 receives calls from other communities (e.g., cell phone and VOIP technology may route calls to C911 from other locations outside of Calgary)

Meanwhile, at 14:08:34, the **C911 police dispatcher** dispatched a bylaw officer to this animal attack event and informed the CPS patrol sergeant.

The **EMS call taker** then needed to determine and assign an event determinant code after receiving the information from the **C911 police call taker**. The determinant is required to prioritize events and dispatch the most appropriate ambulance with the right crew.

As part of the abbreviated call process, the back-up **EMS call taker** used a manual card set for animal bites/attacks and assigned the code 03B01 (yellow). The '03' represents the problem code for animal bites/attacks. The 'B' represents the level/priority of 'bravo' assigning it as serious but not life threatening. The '01' is the sub-determinant indicating the dog bite/attack involves a "possibly dangerous body area." This information was entered into the computer aided dispatch (CAD). According to AHS EMS's event priority system, the determinant 03B01 (animal bites/attack – possible dangerous area) is automatically assigned a response level priority of 'yellow' meaning "non-urgent – not serious or life threatening."

An **EMS dispatcher** then reviewed the CAD to assign the call to an EMS resource. There were no ambulances available at the time of this call (red alert). The event was put on the 'pending' list to wait for an ambulance to become available. There were 20 other events on the pending list at the time, 14 of which were of an equivalent priority level (yellow), and six of a higher priority level (orange).

Bylaw officer is first on scene, makes multiple attempts to provide patient updates (14:10:19 to 14:25:49)

A **bylaw officer** was the first to arrive on scene, arriving one minute and 45 seconds after being dispatched by the **C911 police dispatcher**. Upon arrival, noting that the patient's injuries were extensive, the **bylaw officer** made a radio call to the **C911 police dispatcher** indicating EMS was required immediately. To relay this information, the **C911 police dispatcher** called the **SCC,** on the update line. The **C911 police dispatcher** hung up just after one minute, as the call was not answered at the SCC and the **C911 police dispatcher** needed to deal with another, unrelated, high-intensity CPS event that started around this same time. The **C911 police dispatcher** did not attempt to call the SCC again. The C911 police dispatcher was busy supporting the other CPS event on the same radio channel and it was consuming much of the radio traffic.

Approximately four minutes later, the **bylaw officer** radioed the **C911 police dispatcher** again, but was directed to standby (wait) due to the heavy radio traffic related to the other CPS event. The **C911 police dispatcher** did not re-engage the **bylaw officer** as the **C911 police dispatcher** remained busy with the other high-intensity CPS situation.

Approximately three minutes later (14:17:55) the **bylaw officer** made a phone call directly to a C911 police resource desk (to a person in a role called Res1) to request help contacting EMS. The person at the C911 police resource desk attempted to transfer the **bylaw officer's** call to an **EMS call taker**. As this call was made from the C911 police resource desk, the line used for this call does not appear on the call logs for either the new event line or the update line. The bylaw officer

disconnected before the call was answered by an **EMS call taker**. It took the **SCC** 55 seconds to answer the call that was being monitored by Res1.

Two minutes later, the **bylaw officer** contacted the **C911 police dispatcher** a third time to provide an update on the status of the patient and to request an estimated time of arrival (ETA) for the ambulance. The **C911 police dispatcher** attempted to call an **EMS call taker** again, on the update line, but disconnected after the call went unanswered for 37 seconds. At this point, the **C911 police dispatcher** asked the two adjacent C911 police dispatchers to try to call EMS. Both called EMS, one using the new event line, and one using the update line, and were able to get through at 14:23:18 and 14:23:24.

A short time later (at 14:25:49), the **C911 police dispatcher** messaged the C911 police dispatch lead (a support role for dispatchers) suggesting the C911 police dispatcher needed help, but the C911 police dispatch lead position had been reassigned and the message went to an empty desk.

Event determinant changed; EMS and CFD are dispatched (14:23:18 to 14:29:02)

At 14:23:18, one of the adjacent **C911 police dispatchers** provided an update on the patient's condition to an **EMS call taker**, via the new event line, noting serious bleeding from the patient's head. With the additional information provided, and in consultation with the AHS EMS **deployment manager** (manager who can escalate calls beyond usual processes), the event determinant code was changed from 03B01 (yellow), to 03D03 (red). The new determinant code describes a patient who had been attacked by an animal (problem code: 03), is in a life-threatening condition (priority: D for delta) and is not alert (sub-determinant: 03). The term 'red' indicates the event is automatically assigned a priority of immediately life threatening or time critical.

With the change in determinant code and priority, an ambulance was diverted from a less-urgent orange event (potentially serious but not life threatening) and dispatched to this red priority event at 14:28:03.

Events with a delta determinant automatically prompt the involvement of the Calgary Fire Department (CFD), and a fire unit was dispatched at 14:27:16.

At 14:29:02, the bylaw officer radioed the **C911 police dispatcher** to provide another patient update, indicating the patient was barely conscious. The **C911 police dispatcher** called the **EMS call taker** with the update and was told EMS was seven minutes away.

CFD, EMS, CPS arrive on scene (14:31:38 to 14:55:09)

A CFD truck and crew arrived on scene in the back alley (directed there by the bylaw officer) at 14:31:38, approximately five minutes after being dispatched, and provided advanced first aid to the injured person.

An EMS ambulance and crew arrived at the front door of the house at 14:38:08, 10 minutes after being assigned to the event. After realizing the patient was in the alley, the paramedics moved to

the back of the house to reach the patient in the alley and begin their assessments. Seeing the severity of the injuries, the crew radioed for a backup EMS unit to be dispatched.

A CPS officer arrived at the front door at 14:40:44.

A firefighter moved the ambulance from the front of the house to the alley (14:42:35), and the patient was moved on a stretcher to the ambulance for further assessment and care. The backup EMS unit arrived on scene to assist, approximately four and a half minutes after being dispatched (14:48:47). The crew contacted the emergency department triage desk at the Foothills Medical Centre (FMC) informing them of their pending transfer.

Patient transported to Foothills Medical Centre (14:55:09 to 15:01:00)

Two firefighters accompanied EMS to hospital, one driving and one in back assisting with patient care. The paramedic from the backup EMS unit also accompanied the crew to hospital and assisted with patient care. The ambulance arrived at the FMC at 14:59:55, and care was transferred to the trauma team at 15:01:00.

Sequence of key events

The following table identifies the sequence of key events that took place. Certain time stamps varied slightly between CPS records and EMS records. This may reflect differences such as when a call was initiated compared with when it was picked up, or the time difference between completing an action and recording it. In some instances, the time in seconds was not available, so the seconds are indicated by 'xx.'

Table 5: Sequence of events

Time	C911, CPS, Bylaw, CFD, EMS response
14:01:59	A 911 caller phones C911 stating "we just found somebody that has been attacked by a dog."
14:02:16	The C911 call taker assigns police as lead agency. The 911 caller is connected to a C911 police call taker.
14:02:52	The C911 police call taker gathers information from the 911 caller.
14:07:29	On a dedicated phone line for C911 ECOs to convey information regarding a new event, the C911 police call taker phones the SCC to request an ambulance. An EMS SSM coordinator (as back-up EMS call taker) answers and evaluates the call because all EMS call takers were already on calls.
14:07:46	The SSM coordinator (as a back-up EMS call taker) enters the event into the computer aided dispatch (CAD) terminal.
14:08:34	The C911 police dispatcher dispatches a bylaw officer to the scene.
14:10:09	The SSM coordinator (as back-up EMS call taker) assigns bravo (serious but not life threatening) priority level to this event.
14:10:09	The event is added to the pending list (no ambulances available).
14:10:19	The bylaw officer arrives on scene and radios the C911 police dispatcher that EMS is required immediately due to severity of injuries.

Table 5: Sequence of events (continued)

Time	C911, CPS, Bylaw, CFD, EMS response
14:10:45	The C911 police dispatcher calls the EMS call taker at SCC; hangs up just after one minute as call is not answered. This phone call is made on a dedicated phone line for C911 ECOs to convey updates regarding an established event.
14:12:xx	*High-intensity CPS event begins – CPS radio traffic impacted*
14:14:xx	The bylaw officer tries to provide an update on the patient's condition on busy CPS radio; asked to stand by (wait).
14:17:55	The bylaw officer makes a phone call to the C911 police Res1 and the call is transferred to SCC. The bylaw officer disconnects before the call is answered (55 seconds later).
14:19:47	The bylaw officer radios the C911 police dispatcher with a patient condition update and seeking ETA for EMS.
14:20:25	The C911 police dispatcher calls EMS call taker at SCC on the update line; hangs up after 37 seconds (needed to attend to the other CPS event). Requests assistance from two adjacent C911 police dispatchers to call EMS.
14:23:18	Adjacent C911 police dispatcher (1) contacts an EMS call taker on the new event line; provides information about worsening condition. The EMS call taker asks questions related to patient's condition.
14:23:24	Adjacent C911 police dispatcher (2) contacts another EMS call taker on the update line; requests EMS services 'hot' (urgently).
14:25:49	The C911 police dispatcher messages the C911 police dispatch lead (a support role for dispatchers) suggesting the C911 police dispatcher needed help, but the C911 police dispatch lead position had been reassigned and the message went to an empty desk.
14:26:57	The event is updated from bravo (serious but not life threatening) to delta (life threatening) by the AHS EMS deployment manager.
14:27:16	CFD is dispatched to the scene (automatic for delta events).
14:28:03	An ambulance is assigned to event.
14:29:02	The bylaw officer requests update on EMS arrival status from the C911 police dispatcher; notes patient is barely conscious.
14:29:05	The C911 police dispatcher contacts an EMS call taker for an update using the update line and is told EMS is seven minutes away.
14:31:38	CFD arrives on scene and is directed to back alley by the bylaw officer.
14:38:08	EMS arrives on scene at front door; then moves to back alley. Initial assessment of patient is made at 14:40:42.
14:40:44	CPS arrives on scene at front door.
14:42:35	A firefighter moves ambulance to the back alley.
14:42:51	EMS requests backup EMS unit 'hot' (urgently).
14:48:47	Backup EMS arrives.
14:55:09	EMS transports patient to FMC.
14:59:55	EMS arrives at FMC.
15:01:00	FMC trauma team assumes care of patient.

Event response time

The EMS response time for this event was 30 minutes and 22 seconds. This is calculated from the time when the EMS call taker entered the event into the computer aided dispatch terminal (CAD) (14:07:46) until the first EMS unit arrived on scene (14:38:08). From when the 911 call was made, EMS arrived 36 minutes and 9 seconds later.

The response time for this event from the time it was updated to a delta event (14:26:57) to arrival on scene was 11 minutes and 11 seconds.

The response time target for life-threatening (delta and echo) events:[viii]

- For every 10 calls, at least five of those calls must have a response time of eight minutes or less (median response-time target).
- For every 10 calls, at least nine must have a response time of 12 minutes or less (90th percentile response-time target).

ISSUES, ANALYSIS, AND RECOMMENDATIONS

ISSUE 1: Event initially assigned a bravo priority level

The initial information given to the SCC by the C911 police call taker was "we have an approximately 86-year-old female that was attacked by three dogs and she has a bite injury to the head." Following the established standard operating procedure for this type of event[ix] the EMS call taker used a manual card set to assign a priority level. A bravo priority level (serious but not life threatening) determinant labelled as 03B01 (event involves an animal bite or attack involving a possibly dangerous body area) was assigned. Calls assigned this determinant are automatically given a yellow priority response (non-urgent – not serious or life threatening).

Given that the C911 police call taker also shared that three dogs were involved, it would have been more appropriate, according to the card set, to assign a delta priority (life threatening) determinant labelled as 03D08 (event involves a mauling or multiple animals). Calls assigned this determinant are given a red priority response (immediately life threatening or time critical). If assigned a red priority level, this call would have taken priority over other calls waiting for an ambulance to be dispatched. Additionally, ambulances from outside the city would also have been considered for dispatch.

The HQCA engaged three subject matter experts (SMEs) to assess this call. The first was a certified Q auditor (qualified to audit call evaluations for EMS calls) and quality assurance specialist from an EMS organization outside of Alberta. The other two were independent reviewers from the International Academies of Emergency Dispatch (IAED); one focused on the medical (ambulance) protocols, the other on the police protocols. These SMEs provided their perspective, described below, on the determinant that would have been most appropriate given the information provided by the C911 police call taker to the EMS call taker.

When the SMEs used the same manual card set to select a determinant (as the EMS call taker did in this event), both SMEs independently selected 03D08 (mauling or multiple animals). When the SMEs used the ProQA software (computer-based version of the manual card set) to select a determinant, ProQA generated 03D03 (patient not alert) for the event. Although it was not known during the call if the patient was alert, the ProQA software, using an algorithm, assumed she was not alert given other unknowns regarding the patient's condition. In both cases, the most accurate determinant was a delta priority level. Either of these delta codes would have been considered a red priority response. For this event, the call was not updated to a 03D03 (patient not alert, red priority) until after an EMS call taker received additional information about the patient from a C911 police dispatcher in a subsequent call and with input from the EMS deployment manager.

Modelling done post-event demonstrates that if the event had been assigned a 03D03 determinant during the initial call to EMS, the first EMS ambulance could have responded to the event in 14 minutes and 26 seconds. This would have reduced the EMS response time by 15 minutes and 56 seconds.

Several factors, described below, are believed to have contributed to the event being assigned a bravo priority level (serious but not life threatening).

Contributing factors

1. Interpretation of the standard operating procedure (SOP) varies as to whether the primary PSAP should assess scene safety for dangerous animal attacks

Analysis

Primary PSAP refers to those who answer 911 calls (C911 call taker) and determine which agency should lead the response (police, fire, or ambulance). Secondary PSAP refers to those who answer calls or dispatch emergency services on behalf of the agency they represent (e.g., a C911 police call taker evaluates calls where a police service response is indicated, EMS call takers evaluate calls where an ambulance response is indicated). Emergency communication officer (ECO) is the generic term for call takers and dispatchers.

When a 911 call is received in Calgary the call is answered by a C911 call taker who assigns police, fire, or ambulance as the lead agency for the event. A lead agency is "the agency with the protocol best suited to ensure safety of the citizens and responders."[x] This decision occurs by asking two or three standardized questions of the caller. When asked "what is the emergency?", the 911 caller in this case stated "we just found somebody that has been attacked by a dog." Based on this information and the city of the 911 caller, the C911 call taker assumed the scene was not safe and assigned police as the lead agency for this event. The call was then transferred to a C911 police call taker for call evaluation.

The HQCA engaged a subject matter expert from the National Emergency Number Association to review the primary PSAP call. The expert review indicated that the call was handled according to standard operating procedures and appropriately selected police as the lead agency based on information communicated in the call. The expert also indicated that there is no best practice as to whether scene safety should be assessed as part of the primary PSAP function. Instead, the decision is to be made locally. If scene safety assessment is determined to be within the primary PSAP function, it should be consistently assessed.

Calgary 911's (C911) Answering Incoming Calls Standard Operating Procedure (SOP) requires the C911 call taker to determine, for some calls, if there are scene safety concerns.[xi] For example, calls where EMS is being considered the primary (or lead) agency, the SOP states [*cited directly from source*]:

> The [Primary PSAP] ECO will then ask, "Are there any weapons or violence?"
>
> a. If yes, perform a supervised transfer to the appropriate police agency.
>
> b. If no, perform a supervised transfer to EMS.
>
> *c.* If unknown, addressing the primary concern takes precedence; perform a supervised transfer to EMS.

The SOP defines conditions when police should be identified as the primary [or lead] agency as follows [*cited directly from source, bolding for emphasis*]:

> Supported by Priority Dispatch Guidelines, for incidents requiring a joint Police response with Fire or EMS, the **ECO will transfer the call to Police** to enable interrogation using EPD Police Protocol **if weapons or violence are present** for all cases reported as:
>
> - Assaults
> - Sexual Assaults
> - Shootings
> - Stabbings
> - Suicide Attempts
> - Violent or Disruptive Psychiatric Events
> - **Dangerous Animal Attacks**
> - Riots
> - Fights
> - Suspected Terrorist Attacks
> - Any other cases involving violent crimes and in-progress or just occurred crimes where suspects may be present and may interfere with responders

Interpretations of this SOP, and the process to follow, varied between interviewees from C911. For incidents requiring a joint police response with fire or ambulance, some indicated the ECO will transfer the call to a C911 police call taker to determine scene safety including assessing for weapons or violence. In this case, as an animal attack requires police involvement, the primary PSAP ECO (C911 call taker) would not ask about weapons or violence before transferring the call to a C911 police call taker.

Others indicated scene safety should be assessed before determining the lead agency. For dog bites, some indicated they would deviate from the SOP and instead of asking about violence or weapons, would ask if the dogs were confined to assess scene safety. If the dogs were confirmed to be confined, some indicated the lead agency would be determined to be an ambulance and the 911 caller would be transferred to an EMS call taker.

In this event, scene safety was not assessed as part of the primary PSAP (C911 call taker) call.

Recommendation:

1. Calgary 911's Answering Incoming Calls Standard Operating Procedure (SOP) should be revised to enhance clarity on when and how to assess scene safety. This should be supported with training to primary C911 PSAP call takers.

2. EMS PSAP did not speak directly with the 911 caller for call evaluation

Analysis

Secondary PSAP refers to the ECOs who evaluate calls on behalf of the agency they represent (e.g., C911 police call takers evaluate calls where a police service response is indicated, EMS call takers evaluate calls where an ambulance response is indicated).

As previously described, police were selected as the lead agency, and the 911 caller was transferred to a C911 police call taker for call evaluation. During the call evaluation, the 911 caller expressed the need for a medical response to the C911 police call taker by describing in detail the severity of the condition of the patient, and by asking how far away the ambulance was. It was clear the 911 caller thought an ambulance was needed.

C911 police PSAP, as the lead agency on this call, had the ability to bring together the partner agencies needed to respond to the event. Co-evaluation is the "active tandem process of allowing all agencies to gather the information they require in a timely manner."[xii] Considerations for co-evaluation are listed in the SOPs. Co-evaluation would have converted a fourth-party call (PSAP to PSAP) to become a second-party call (person on scene to PSAP) to enable the EMS call taker to receive the best possible information about the situation (see co-evaluation section earlier in the report and Appendix D for more detail on co-evaluation). Simply stated, co-evaluation would have connected the 911 caller directly with the EMS call taker.

A working group sponsored by the Alberta Emergency 9-1-1 Advisory Association (Appendix E – Alberta Emergency 9-1-1 Advisory Association Co-evaluation Working Group membership) drafted a *Provincial Co-Evaluation Best Practice* document on Sept. 14, 2021.[xiii] This document indicates that co-evaluation should be required as soon as possible for a situation including, but not limited to [*cited directly from source*]:

- Imminent Scene Safety (e.g. offender on scene, weapons involved)
- Critical Hazards (e.g. chemical suicides, structure fire, live wires)
- Preservation of Life (e.g. serious or life-threatening injury/illness, stabbing, gunshot wound)
- Any event where there is an urgent need for a partner agency to attend or provide instructions.

Furthermore, the document states "procedures for how to manage co-evaluation will be defined by the PSAP's internal policies." The working group advocated for these best practices to be included in the Alberta 9-1-1 Standards. Alberta 9-1-1 Standards Version 2.0, which was in force at the time of the dog bite event, did not require or mention co-evaluation. Version 3.0 of the Standards was approved and brought into force by Ministerial Order on December 1, 2022. This version requires PSAPs to either have a local co-evaluation policy to manage 911 calls requiring multiagency evaluation or follow the co-evaluation best practices detailed in the Provincial Co-Evaluation Best Practice document, which was included in the appendices of the Standard. Version 3.0 does not include a requirement for partner agencies to collaboratively develop an MOU or SOP for co-evaluation.

At the organizational level, the decision to co-evaluate is made by the lead agency PSAP. The *AHS EMS Dispatch Communications and Deployment Provincial Co-Evaluation Practice Support Document* was approved and became effective on April 18, 2022, less than seven weeks before the dog bite event. C911 has an SOP called *Co-evaluation and Multi-Agency Event Notifications* (first introduced Dec 30, 2015 and updated as of May 16, 2022*)*, however, Calgary ECOs interviewed shared that co-evaluation does not occur often in practice. The C911 ECOs have recently received training on the co-evaluation SOP.

The C911 SOP (used by the C911 police call taker) lists the same criterion noted in the co-evaluation best practice document and indicates that the C911 police call taker will co-evaluate with the other agency immediately after reaching the send point. The send point is the "point at which the call evaluation protocol determines there is enough information to enter an event for dispatch and return to the protocol." The C911 police call takers evaluate calls using protocols within the Police Priority Dispatch System (PPDS). In the dog attack police protocol, the send point is once it is confirmed that the dogs are confined.

Two minutes into the call, the 911 caller indicated that the dogs were contained, and that no one on scene was in danger. At this point, because scene safety was confirmed, there was an opportunity to have an EMS call taker, as a secondary agency, evaluate the call from a medical response perspective. This is the 'send point' on the PPDS card for events involving animals. The instructions to the person evaluating the call is "send and return to questioning."[xiv]

Interviews with AHS EMS PSAP and C911 personnel indicated that the process to co-evaluate is not commonly understood, with significant variations among individuals and organizations in how it should occur. Some referenced a process where each agency involved in the co-evaluation takes turns asking a question. Others described a process where one agency partially or fully evaluates the call and then invites the other agency to participate in the call evaluation process. Some noted it occurs frequently; others have never co-evaluated a call. The general sentiment is that co-evaluation is not done frequently and could be done more. Co-evaluation did not occur for the event that occurred on June 5.

After assessing the call, the C911 police call taker phoned the EMS call taker to request an ambulance. The 911 caller was not transferred to the EMS call taker for call evaluation. The C911 police call taker had prior EMS call evaluation experience and was familiar with the medical protocol for dog bites, and assumed that a delta priority level would be triggered by communicating to the EMS PSAP that three dogs were involved in the attack.

If the EMS call taker had been given the opportunity to talk to the 911 caller directly, either by being selected as the lead agency or through co-evaluation, it would have triggered a more detailed and structured call evaluation process focused on the patient's medical needs. Specifically, the Local Service Standard[xv] indicates that 911 calls sent to EMS PSAP are to be evaluated using the computerized ProQA application if available; and if not available, the manual card set is to be used. Both ProQA and the manual card set follow protocols within the Medical Priority Dispatch System (MPDS).

Using a PSAP-to-PSAP communication process (a C911 police call taker to an EMS call taker) to request an EMS response relied on the C911 police call taker to ask, capture, and relay pertinent information from the 911 caller to the EMS call taker to assign a response priority level to the call. The IAED experts, who evaluated the call, noted that the C911 police call taker did not provide patient condition information (i.e., significant bleeding), nor did the EMS call taker request it.[xvi]

Had the call been transferred to EMS PSAP for call evaluation, MPDS would have guided the EMS call taker to ask questions about patient bleeding and would have included Dispatch Life Support (DLS) 'instructions for control bleeding', a protocol for the call taker to relay instructions to the caller to potentially help control bleeding. DLS instructions for control bleeding were not available to the C911 police call taker because the version of PPDS in use at the time did not contain these instructions. C911 police PSAP has since upgraded to a version of PPDS that will include DLS instructions for control bleeding. The 911 caller did not receive any instructions to help control bleeding.

Recommendations:

2. Leaders at all secondary PSAP in Calgary (C911 and EMS) should collaborate to establish a coordinated and structured memorandum of understanding (MOU) or standard operating procedure (SOP) for co-evaluation. The MOU or SOP should specify that C911 police and fire PSAPs should transfer all first- and second-party 911 calls requiring an ambulance response to EMS PSAP for call evaluation when possible and safe.
3. The Government of Alberta should include a requirement in the Alberta 9-1-1 Standards that applicable partner agencies should collaboratively co-develop an MOU or SOP for co-evaluation.

3. No discernable call standard guided the four calls from C911 police PSAP to EMS PSAP

Analysis

PSAP refers collectively to all personnel who evaluate calls (call takers) and who dispatch emergency services. Emergency communications officer (ECO) is the term to describe both call taker and dispatch personnel. Secondary PSAP refers to the emergency call management processes that are completed on behalf of an emergency service (e.g., police, fire, EMS). First- and second-party callers are defined as being on the scene. Fourth-party callers are from partner agencies and are not on the scene (i.e., calls between PSAPs).

During this event, four calls took place between C911 police PSAP and EMS PSAP. None of these calls followed a discernable call standard. This was verified by IAED expert opinion.[xvii] EMS PSAP has two protocols that can be used to evaluate a call: MPDS and the Secondary Emergency Notification of Dispatch (SEND) protocol. In addition, the 911 caller provided their phone number to the C911 police call taker, and this information was not communicated to the EMS call taker even though C911 policy requires it.[xviii] ECOs from both EMS and C911 police PSAPs indicated that protocols are often not used during fourth-party calls between partner agencies. EMS ECOs

interviewed indicated contact information is rarely asked or provided during calls from C911 police call takers and that this information would be helpful. The AHS EMS Dispatch Communications and Deployment's service standard for call evaluation[xix] does not include a requirement for contact information to be communicated between PSAPs for fourth-party callers.

MPDS is used by EMS PSAP when conducting a call evaluation with a member of the public (first- or second-party caller) and contains the questions needed for a full call evaluation. Embedded in these standard questions is information on the "four commandments": chief complaint, age, status of consciousness, and status of breathing.[xx] If the patient is not awake or breathing, the EMS call taker activates a process to dispatch an ambulance with high urgency. If the patient is breathing and awake, the call taker selects the appropriate chief complaint medical protocol and asks the remaining key questions from that protocol.

The four commandments and key questions that were stated (asked or offered) during each of the four calls are listed in Table 6, as well as what information was recorded in the CAD. Responses to these questions are used to determine the most appropriate EMS response priority level. None of the calls gathered information for all of the commandments or key questions. Furthermore, at no point was information communicated as to the status of breathing, type of dog,[4] or when the event occurred. The IEAD expert indicated that questions focusing on bleeding, level of consciousness, and breathing status extract a lot of vital information and would have been beneficial had they been asked or shared during the calls.

Table 6: MPDS protocol information communicated from C911 police PSAP to EMS PSAP during the June 5 event

Green shading indicates the information was asked, offered, or known via prior CAD entry. Yellow shading indicates the information was partially stated (indicating it was a dog, but not the type of dog). Red shading indicates the information was not provided or requested.

Time of C911 police PSAP call to EMS PSAP	14:07:29	14:23:18	14:23:24	14:29:05
four commandments				
Chief complaint	stated	stated	in CAD	stated
Age	stated	stated	in CAD	in CAD
Status of consciousness		requested but unknown		stated
Status of breathing				
key questions for animal bites/attacks				
What kind of animal is it?	partially (dog, not breed)	in CAD (partially)	in CAD (partially)	partially
Where is the animal now?	stated	in CAD	in CAD	in CAD
Is there any serious bleeding (spurting or pouring)?		stated	in CAD	in CAD
Unconscious or arrest?		requested but unknown		stated

[4] MPDS indicates as an axiom on the protocol *(an established rule or principle or a self-evident truth*) that "some dogs (pit pulls, rottweilers) are capable of inflicting serious injuries. In these rare cases, a maximal response is indicated."

key questions for animal bites/attacks				
Is s/he completely alert (responding appropriately)?		requested but unknown		stated
What part of the body was injured/bitten?	stated	stated	in CAD	stated
Difficulty breathing? (if chest or neck injured/bitten)	N/A	N/A	N/A	N/A
What kind of injuries does s/he have?	stated	stated	in CAD	stated
When did this happen?				

The medical SEND protocol is an abbreviated protocol used to streamline communication between a non-medical trained first responder (e.g., a police officer) at the scene and the EMS call taker (through the C911 police dispatcher) with the aim of collecting and sharing key medical information that can be used between the dispatchers. The SEND protocol focuses on questions that have been proposed by experts in the field as the most relevant to the EMS call takers in determining an appropriate response.

The medical SEND protocol questions that were stated (asked or offered) during each of the four calls between C911 police PSAP and EMS PSAP are listed in Table 7. None of the calls gathered information for all SEND questions and at no point was information communicated as to whether the patient was breathing.

Table 7: Medical SEND protocol information communicated from C911 police PSAP to EMS PSAP during the June 5 event

Green shading indicates the information was stated (or asked) during the call or was known via prior CAD entry. Red shading indicates the information was not stated or asked.

Time of C911 police PSAP call to EMS PSAP	14:07:29	14:23:18	14:23:24	14:29:05
What is the chief complaint?	stated	stated	in CAD	stated
What is the approximate age of the patient?	stated	stated	in CAD	in CAD
Is the patient conscious?		requested but unknown		stated
Is the patient breathing?				
Is there chest pain? (if illness case, age 35 years or older)	N/A	N/A	N/A	N/A
Is there severe bleeding? (if accident or injury case)		stated	in CAD	in CAD
Do you need a lights-and-siren response?		stated	stated	stated

How the medical SEND protocol should be used is inconsistent among EMS PSAP personnel at the SCC (ECOs, managers). Most individuals interviewed thought that the SEND protocol is applicable during the initial call from an agency requesting an EMS response. In follow-up calls (or 'callbacks'), the SEND protocol was generally believed to be applicable if the patient condition had changed. Some ECOs believed all calls, including all callbacks, from agencies trained in the SEND protocol (including police) should follow the SEND protocol even when an officer trained in SEND protocol

has not arrived on scene. There was significant disagreement among ECOs within and between EMS and C911 police PSAPs as to whether SEND protocol questions should be asked by EMS call takers or automatically provided by C911 police ECOs (or other SEND-trained agencies) (see Appendix D for list of SEND-trained agencies).

The AHS EMS Local Service Standard[xxi] notes that fourth-party caller events should use the SEND protocol and ask the SEND questions as applicable. It does not delineate initial calls from follow up calls (or 'callbacks'), nor does it describe a need for a first responder to be on scene. C911 has a SEND protocol SOP[xxii] that states the SEND protocol is only to be used when a field unit (i.e., patrol) is requesting the other agency. The C911 SOP does not make SEND applicable when CFD is on scene, nor does CFD use the SEND protocol when requesting EMS. The C911 SOP also notes that the dispatcher or delegate will "provide the answers to" the SEND questions. Interviews with C911 police PSAP interpreted this to mean asking the SEND questions is a responsibility for EMS PSAP ECOs. The C911 SOP does not provide clarity on the role of C911 police PSAP to obtain answers to SEND questions from non-medical trained first responders on the scene, or for them to provide this information. ECOs from both C911 police PSAP and EMS PSAP expressed frustration around use of the SEND protocol, because answers are often not known and additional time is taken to ask about unknown information. Consequently, this can result in EMS ECOs having minimal information to code an event.

Per the IAED, the medical SEND protocol is not designed for interagency communication if there is not a trained responder on scene assessing the patient's condition. On June 5, at the time of the first C911 police call to an EMS call taker, there were no first responders on scene to evaluate the patient's condition; hence, the SEND protocol was not applicable per the IAED definition. This is consistent with the C911 SEND protocol SOP but inconsistent with the EMS Local Service Standard.

CPS did not arrive on scene until after the fourth call from C911 police PSAP to EMS PSAP. A bylaw officer arrived on scene first and initiated all subsequent calls from C911 police dispatch to the EMS call takers. Neither the EMS Local Service Standard nor the C911 SEND protocol SOP provides clarity as to whether the SEND protocol is applicable when a bylaw officer is on scene. The IAED indicated that the SEND protocol is appropriate for other public safety professionals if those types of calls occur with some regularity. Bylaw officers interviewed indicated they increasingly need to request an EMS response (almost daily) for substance-use events.

Additionally, the IAED requires that an on-scene officer requesting an EMS response using the SEND protocol be trained in the SEND protocol.[xxiii] Each agency (e.g., ambulance, police) is responsible for training its employees and/or officers in this protocol. In Calgary, EMS and C911 police PSAP ECOs receive training on the SEND protocol during orientation. Ongoing SEND protocol training is not provided. EMS dispatch accreditation with IAED considers SEND protocol training as part of the accreditation process. C911 police PSAP is not accredited and therefore there is no system in place for monitoring the uptake or use of this protocol. On February 11, 2021 CPS communicated internally about the SEND protocol to their membership. No confirmation was obtained to indicate frontline officers (CPS or bylaw) are trained in using the SEND protocol. The IAED expectation[xxiv] is that the agency will provide the required officer training prior to the protocol being enabled and used. The officer training video for the protocol is available through the

College of Emergency Dispatch and is approximately 15 minutes long. IAED recommends the video be presented by a representative from the local dispatch agency so questions can be answered and rationale provided.

When a trained officer is not on scene, PSAP options for requesting an EMS response include co-evaluation and call transfer described previously. CAD-to-CAD transfer is another way of requesting EMS response; however, this option is not currently possible between CPS and EMS due to CPS information security requirements, though it is being explored between CPS and CFD. Another option for sharing information is a PSAP-to-PSAP call. As previously noted, C911 police PSAP requested an EMS response for this event through a PSAP-to-PSAP call.

For PSAP-to-PSAP communication, the general practice at the SCC is for the EMS ECO to ask the C911 police ECO requesting an EMS response a generic, open-ended question (i.e., "tell me what is happening"). It is not common convention to ask the SEND protocol questions, despite the EMS Local Service Standards. Per expert opinion, best practice is to use the "four commandments" to assess the medical need, ask clarifying questions, and enter the information into the ProQA software to generate a determinant.[xxv]

SEND protocol questions are not embedded in ProQA at the SCC. IAED has recently introduced Advanced SEND as Protocol 38 in MPDS, allowing Advanced SEND to be embedded directly in ProQA. The main difference between SEND and Advanced SEND is a change in the first question. Advanced SEND requires communicating the main problem using a list of specific call types. AHS EMS PSAP tried but abandoned Advanced SEND because it was found that many of the answers to the questions were "unknown", frustrating the agencies using it.

When evaluating calls where the SEND protocol is used, EMS ECOs bring up SEND protocol questions as a PDF document by clicking the SEND button in the CAD. Audits of the use of this PDF are possible and have revealed inconsistent data as ECOs commonly open the SEND protocol PDF once at the beginning of their shift and refer to the questions throughout the day. This means that SEND questions are not 'noted' on each event record where they may have been used, making audit data difficult to interpret.

To further complicate the situation, interviews with EMS ECOs from the SCC revealed that all calls from C911 police ECOs were referred to as SEND calls because they came from CPS, an agency approved to use SEND, regardless of the content of the call, the source of the information, or if the SEND protocol had been used.

Recommendations:

4. Leaders at the secondary PSAPs in Calgary (C911 and EMS) and operational leaders for first responders (e.g., CPS, Calgary Bylaw, CFD, and EMS) should collaborate to establish a coordinated and structured standard operating procedure (SOP) for the medical SEND protocol. The SOP should incorporate all of the following:
    - follow best practices from IAED
    - consider use of Advanced SEND

- specify the role of frontline officers, C911 police ECOs, and EMS ECOs to gather, provide, and ask pertinent SEND information
- specify training requirements for ECOs and first responders, including first responder training by a dispatch representative
- specify a process to audit compliance

5. Leaders at the secondary PSAPs in Calgary (C911 and EMS) should collaboratively develop a standard operating procedure for fourth-party requests (PSAP-to-PSAP calls) for an EMS response. The SOP should include all of the following:
    - use of the medical SEND protocol (or Advanced SEND) when a first responder is on scene
    - co-evaluation when medical SEND is not applicable and the 911 caller is available
    - communicating information regarding the four commandments when the medical SEND protocol and co-evaluation is not applicable
    - communicating 911 caller details (i.e., phone number)
    - a process for fourth-party call-backs
6. AHS EMS Dispatch Communications and Deployment should audit fourth-party calls to assess coding appropriateness, identify lessons learned, and develop plans to address issues. Include these audits in the routine individual ECO coding audits currently in place.

4. The Southern Communications Centre (SCC) was short staffed

Analysis

Unlike calls transferred from C911, which can be answered at any of the three provincial AHS EMS PSAP call centres, calls requesting a medical response from the C911 police PSAP go directly to the AHS EMS PSAP located in Calgary at the Southern Communications Centre (SCC). These calls are usually answered by an EMS call taker. If a call taker is not available, an ECO working at the dispatch resource desk (an ECO who supports the dispatchers at the SCC) takes the call. And if these individuals are not available, the System Status Management (SSM) coordinator takes the call. The SSM coordinator role is referred to as the 'backup for the backup' for taking calls from a partner agency such as C911 police. The main role of the SSM coordinator is to move unassigned ambulances to the most-needed coverage areas. While this role has the skillset and is qualified to answer and evaluate calls, the role is not intended to do so unless required under exceptional circumstances.

On the afternoon of June 5, the SCC was short-staffed seven ECOs (three call takers, three dispatchers, and one lead position assigned to support ECOs). The expected daytime staffing[5] for

[5] Staffing count excluded the interfacility transfer dispatchers and the Dispatch Manager.

that day at 2 p.m. was 19 ECOs,[xxvi] whereas there were 12 on duty at that time, and one of those ECOs was on a scheduled break at 2 p.m.

When the C911 police call taker for the June 5 event first called the EMS PSAP, all EMS call takers and the ECOs sitting at the resource desks were already on calls and unable to answer. Consequently, the SSM coordinator (backup for the backup) answered and evaluated the call. Although qualified, SSM coordinators complete fewer call evaluations compared with most ECOs at the SCC because the SSM coordinator, given their seniority, has a different responsibility: overseeing all EMS resources from the SSM desk.

The SSM desk is not currently set up to effectively evaluate calls. An established SOP for this type of call event[xxvii] indicates that the SSM coordinator is to use a manual card set to assign a priority level, but there was no manual card set at the desk – although one was available (and accessed) from the adjacent desk. ProQA, an alternative, was installed on the SSM computer at the desk but was not launched because it is intended for use with first- and second-party callers, and this was a fourth-party call (between PSAPs); the SSM coordinator does not evaluate first- and second-party calls.

Recommendation:

7. All AHS EMS PSAP desks where call taking might occur should be fully set up and ready for call evaluation.

5. ProQA was not used for call evaluation by the EMS PSAP

Analysis

The SSM coordinator used a manual card set to select a determinant and priority level, as directed by the practice support document for evaluating fourth-party calls.[xxviii] The determinant was selected using information about the location of injury (bite injury to the head) with less focus on other information, such as the number of dogs involved in the attack. If the patient is alert, a bite injury to the head is considered a possible dangerous body area.

Additional pertinent information shared by the 911 caller regarding the patient's condition (e.g., bleeding) was not included in the information shared by the C911 police call taker, nor were details about the patient's condition requested by the EMS SSM coordinator. The severity of bleeding and the breed of the dogs involved in the attack, two elements listed in the medical protocol for animal bites, can result in an increase to level of determinant assigned. The event was consequently coded as a bravo priority response (serious but not life threatening) instead of a delta priority response (immediately life threatening or time critical).

As previously noted, three subject matter experts (SMEs) were engaged for their perspective regarding the most appropriate determinant based on this call. They evaluated the call and found the most appropriate determinant varied depending on whether a manual card set was used to select a determinant (as was done in this event) or the ProQA software. The difference occurs because a ProQA algorithm assumes the patient is not alert based on other unknown answers to key questions about the patient's condition (information not known at the time of the call). ProQA would have also provided prompts to ask for additional information, and likely would have resulted

in a different determinant and priority level being selected. In addition, ProQA is updated based on clinical research more frequently than the manual card set, and as such should always be used instead of the manual card set[xxix]). According to the IAED, ProQA can and should be used to process appropriate medical SEND events using MPDS Protocol 38: Advanced SEND (direct communication IAED).

Recommendation:

8. AHS EMS ECOs should use ProQA (not manual card sets) for call evaluation and determinant selection for all calls, including fourth-party callers, and when using the medical SEND protocol. Backup processes should be in place when the EMS PSAP centre is offline, such as the use of tablets with ProQA installed.

ISSUE 2: Challenges providing updates on the patient's condition

Under Alberta's *Peace Officer Act*, bylaw officers do not provide emergency response and do not require training beyond standard first aid. Typically, CPS, CFD, and/or EMS are already on the scene when a bylaw officer arrives to a medical event. In this event, a bylaw officer was close by at the time of dispatch, was the first on scene, and was the only resource on scene for 21 minutes.

The bylaw officer tried multiples times to provide the C911 police dispatcher with information on the patient's condition and to request an ambulance. However, due to a competing high-intensity police event occurring at the same time, there were delays in communication between the bylaw officer and the C911 police dispatcher. Additionally, there were challenges relaying information about the patient to EMS PSAP. Consequently, there was a 13-minute delay from when the bylaw officer arrived on scene (14:10:09) until EMS received an update on the patient's condition (14:23:18).

Contributing factors

1. Bylaw officer on scene could not provide timely updates regarding the patient's condition

Analysis

The C911 police dispatcher is the primary line of communication for a first responder dispatched by C911, including CPS officers and City of Calgary bylaw officers. At the time of this event, another high-intensity police event was demanding the C911 police dispatcher's attention, and the associated high volume of radio traffic was making it difficult for the bylaw officer to provide on-scene updates to, and receive updates on the estimated arrival time for EMS from, the C911 police dispatcher.

The bylaw officer tried three times to contact the C911 police dispatcher to convey the seriousness of the patient's injuries. They also attempted to reach EMS directly through the C911 police resource desk (Res1) at C911 but disconnected before the call was answered by EMS.

According to the C911 internal report of the incident, and confirmed by interviewees, the verbal phrase 'break break' can be used to interrupt other radio traffic and get the dispatcher's attention when there is significant radio traffic. Bylaw policies and procedures do not describe this process and bylaw officers are not trained on the use of this phrase. Some bylaw officers were aware of this process through informal learnings.

Another method of signalling for help is the Code 200 button on an officer's radio. This button is designed to indicate an officer is in danger and to request CPS backup support. The button is not typically used to request urgent medical help for a patient. Leaders from Bylaw Services reported they are exploring the use of both the 'break break' phrase and the use of the Code 200 button as part of their staff training.

Recommendation:

9. Calgary Community Standards should create or update an SOP to enable bylaw officers to interrupt radio traffic (i.e., use 'break break' and/or expand use of Code 200).

2. C911 police PSAP could not provide timely updates to EMS PSAP

Analysis

When the bylaw officer at the scene provided information on the extent of injuries, the C911 police dispatcher was unable to reach EMS PSAP in two attempts. The C911 police dispatcher disconnected the first call after it went unanswered for just over one minute and disconnected the second call after it went unanswered for 37 seconds. Both calls were made using the update phone line. Best practice is for ECOs to stay on the line until the partner agency answers the phone. However, in this case, the C911 police dispatcher was unable to stay on the line due to the radio traffic and tasks related to the competing CPS event. When a C911 police dispatcher is unable to complete a request or task it is the responsibility of the dispatcher to delegate the task to a colleague.[xxx]

Each dispatcher at C911 is supported by an emergency communications lead (ECL). The ECL supports the C911 police dispatchers by monitoring the radio in high-volume periods, assisting dispatchers by making calls to partner agencies if requested, and notifying CPS patrol sergeants as appropriate. A transfer in ECL responsibilities at the time of the June 5 event led to the ECL being unaware of the event until approximately 15 minutes after the event had started.

The call from the bylaw officer to the C911 police Res1 desk at 14:17:55 that was transferred to SCC, rang for 55 seconds before an ECO at SCC answered. As this call was made from the C911 police resource desk, the line used for this call does not appear on the call logs for the new event line or the update line. By this time the bylaw officer had disconnected. The C911 police Res1 ECO remained on the line when an EMS ECO from SCC answered the call, but because the bylaw officer had disconnected, the C911 police Res1 ECO was unaware of the dog event and was unable to provide the EMS ECO with any information.

When the C911 police dispatcher was unable to connect with EMS PSAP a second time, the dispatcher asked two adjacent dispatchers for help contacting EMS PSAP. These calls occurred

nearly simultaneously and were answered at 14:23:18 and 14:23:24. EMS PSAP was updated on the extent of the injuries and EMS services were requested 'hot' (implying urgently).

AHS EMS phone data confirms there were two unanswered calls on the update phone line provided to C911 police PSAP to use to contact the EMS PSAP (14:10:45 and 14:20:25). The call log for this event indicates the new event line was generally answered more quickly than the update line.

Over the course of this event, up to three different phone lines were used between C911 police PSAP and EMS SCC to convey information. There was not a clear understanding of how these phone lines should be used.

Recommendation:

10. AHS EMS SCC and C911 police PSAP should review the current use of the phone lines used to communicate between the PSAPs, including the new event and update lines, and establish clear procedures regarding their purpose and use.

In addition, see Recommendation 11.

ISSUE 3: Demand for EMS exceeded available resources

Analysis

At 2 p.m. on June 5:

- Southern Communications Centre (SCC) was short staffed
- only 31 of 38 (82%) of ambulances assigned to the Calgary Metro were staffed
- EMS was in red alert (i.e., no ambulances available to respond to events)
- there were 20 events on the pending list at the SCC (i.e., 20 events in a queue waiting for an ambulance to become available)
- 18 ambulances were in Calgary EDs and two ambulances were transporting patients to Calgary EDs

Multiple people interviewed commented that Sundays are often harder to staff the SCC and EMS crews, and there are fewer hospital discharges, which leads to greater crowding in emergency departments as patients wait to be admitted to hospital.

Contributing factor

1. Southern Communications Centre (SCC) was short staffed

EMS PSAP call volume

As AHS EMS is a provincial system, a call to EMS PSAP can be answered by an EMS call taker at any of the three AHS EMS communication centres. On June 5, across the province there were 1,301 911 calls requesting EMS. This call volume was typical within the expected range of variation for a

Sunday or for any day in the four weeks around June 5 based on the data reviewed (see Appendix F). EMS PSAP call volume was as expected for that time period.

EMS dispatch volume at SCC

The dispatching of an ambulance is done by the communication centre responsible for that service area. For Calgary, all ambulances are dispatched by the SCC. On June 5, 638 ambulances were dispatched by the SCC. The number of events dispatched by the SCC that day was within expected limits of variation based on analysis of four weeks of data around June 5 and historically on Sundays for the 10 weeks before and 10 weeks following June 5 (i.e., the number of ambulances dispatched by the SCC on June 5 was as expected for that time period) (see Appendix F).

EMS PSAP staffing at SCC

Although 911 call volume was considered typical, or as expected for that time period, the SCC was short of staff to process the calls. As noted above, the SCC was short seven ECOs at the time of the 911 call. The chart below (Chart 1) indicates that although the SCC was short staffed on June 5, this staffing situation was similar (i.e., within the expected variation) to other days in the month surrounding June 5 and for the Sundays between March 27 and August 7.

On June 5, the Northern Communications Centre was short two of eight positions on the day shift, and the Central Communications Centre was short one of 16 positions on the day shift. As 911 calls are distributed to all three communication centres, these other two centres were able to respond to more 911 calls than the Southern Communications Centre (SCC). Calls from C911 police PSAP in Calgary are made through a dedicated phone line directly to the SCC and are only answered by EMS ECOs (call takers or dispatcher) from this centre with no back up help from the other communications centres for these local calls.

Because the SCC was short staffed on June 5, the call from the C911 police call taker was answered by the SSM coordinator, not an assigned EMS call taker or an EMS dispatcher working at the resource desk (all of whom were on other calls). Prior research has indicated that understaffing of ECOs can lead to a decrease in productivity and accessibility to emergency call centres.[xxxi]

Chart 1: Staffing at 2 p.m. at AHS EMS Southern Communications Centre (14 days before and 14 days after June 5)[6]

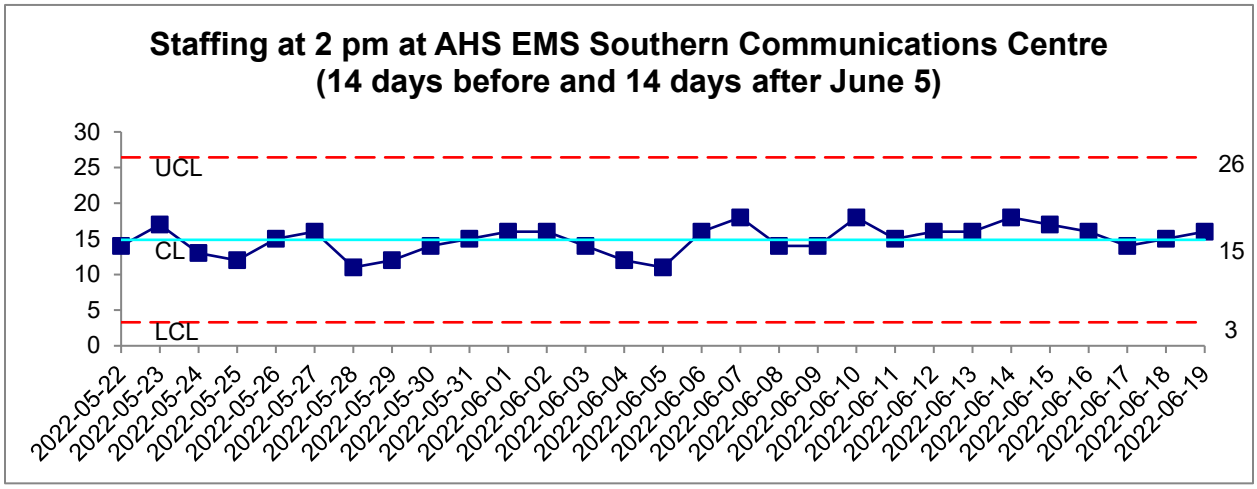
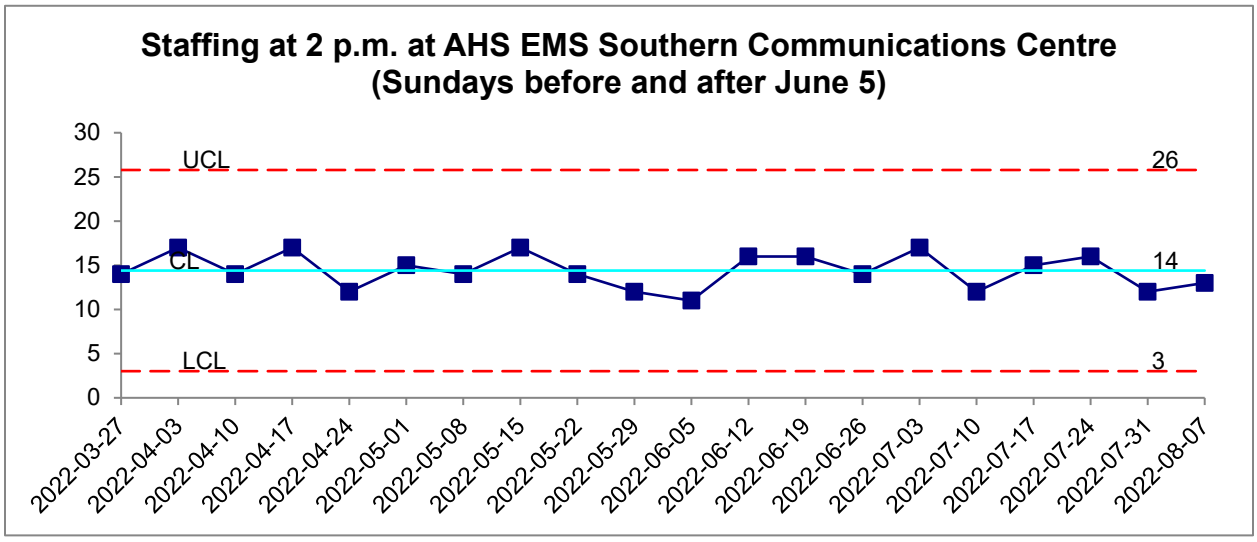


Chart 2: Staffing at 2 p.m. at AHS EMS Southern Communications Centre (Sundays before and after June 5)



Recommendation:

11. When the SCC is understaffed, and call volumes cannot be managed, AHS EMS should develop a strategy to route a higher volume of 911 calls to other AHS EMS communication centres to create capacity for local fourth-party calls.

[6] UCL on all charts in the report indicates the upper control limit of the expected variation of the data; CL indicates the centre line (or average), and LCL indicates the lower range of the expected variation in the data. See Appendix F for more detail.

2. No ambulances were available to respond to lower-priority events

Ensuring there are adequate paramedics and ambulances available to respond is a complicated undertaking with multiple strategies for improving the current state. AHS EMS is in the process of implementing the EMS 10 Point Plan.[xxxii] The plan is intended to address continued system pressures and create capacity within the EMS system (see https://www.albertahealthservices.ca/ems/Page17851.aspx#details for updates on the plan implementation).

On June 5, following standard process, events with a life-threatening determinant (delta and echo) were assigned an ambulance as a priority. This resulted in no ambulances being available to respond to lower-priority events such as the dog attack event with a determinant of 03B01 (yellow).

EMS response times

Response time is the time from when a call is received by EMS PSAP until the first ambulance arrives on scene. EMS has set response-time targets for life-threatening (delta and echo) events:

- For every 10 calls, at least five of those calls must have a response time of eight minutes or less (median response-time target).
- For every 10 calls, at least nine must have a response time of 12 minutes or less (90th percentile response-time target).

Response times on June 5 were longer than the targets stated above. The median response time for life-threatening events that day in the Calgary metro[7] area was 12 minutes and 48 seconds. The 90th percentile response time for life-threatening events was 37 minutes and 19 seconds.

Based on four weeks of data around June 5 (the 14 days before and 14 days after June 5), both the median and the 90th percentile response times on June 5 were atypical; i.e., the response times were longer on June 5 than would be expected based on the expected variation in the data (see charts 3 and 4 below).

[7] The metro Calgary EMS response area is the geographic area (City of Calgary) which is divided into four districts, plus the city core.

Chart 3: Median response times for life-threatening events (delta and echo) in Calgary Metro services area (14 days before and 14 days after June 5)

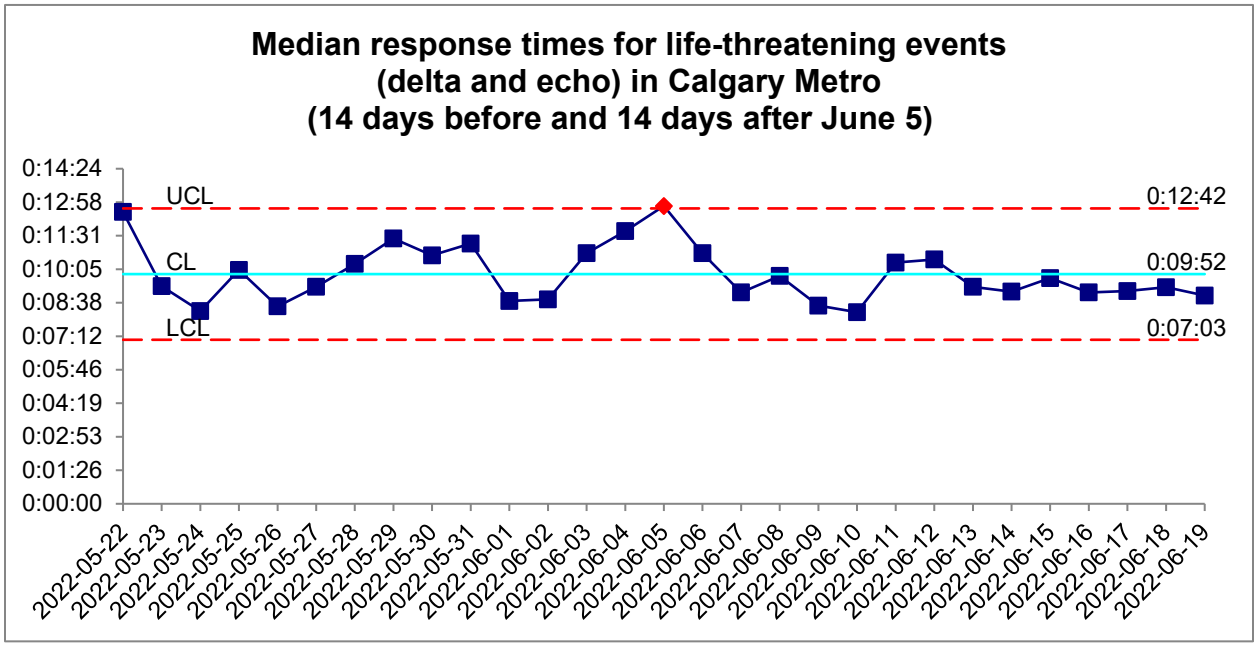
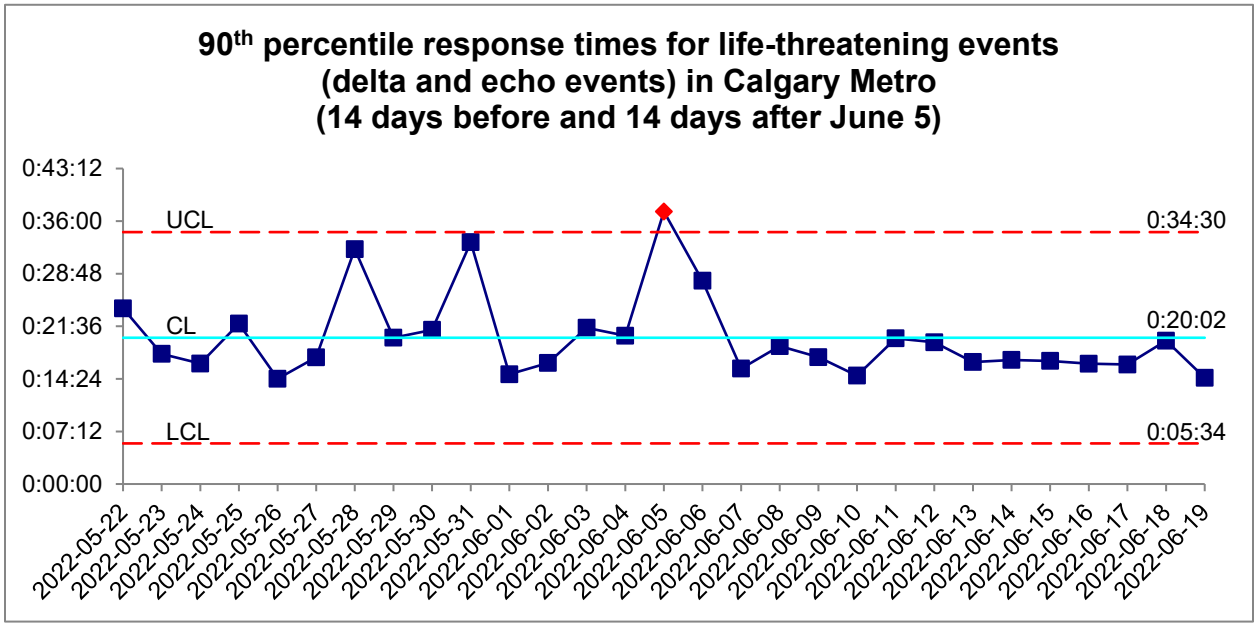


Chart 4: 90th percentile response times for life-threatening events (delta and echo) in Calgary Metro (14 days before and 14 days after June 5)



When analyzing data for Sundays, however, the median and 90th percentile response times on June 5 were what would be expected for a Sunday (see Appendix F for charts). Interestingly, the average response time for the four weeks of data around June 5 was shorter (average median response time

of 9 minutes and 52 seconds) than for the Sundays between March 27 and August 7, 2022 (average median response time on Sundays of 11 minutes and 10 seconds).

EMS total time in red alert

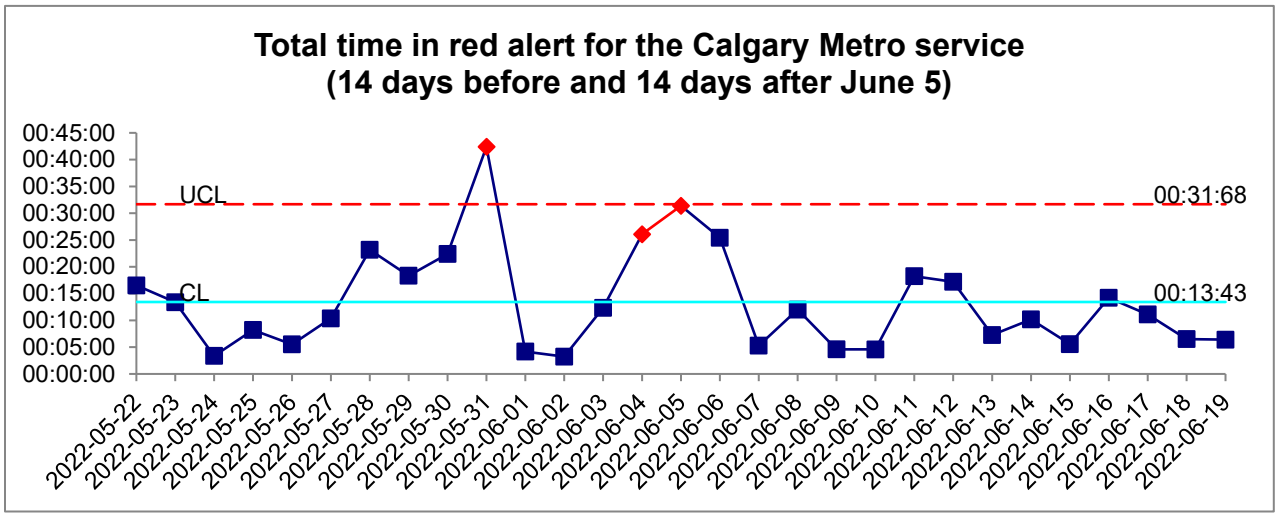
To meet response-time targets in Calgary Metro, EMS requires 13 or more ambulances to be available to respond to an event. At no point on June 5 were 13 ambulances available, despite 31 ambulances being in service that day. For more than 18 hours that day, there were only between one and three units available. Table 8 provides a summary of ambulance availability in the Calgary dispatch group[8] for the 24-hour period on June 5.

Table 8: Calgary Metro ambulance availability by number of units and length of time on June 5

Red alert (0 units)	Level 3 (1-3 units)	Level 2 (4-7 units)	Level 1 (8-12 units)	Level 0 (13+ units)
00:31:38	18:11:31	05:04:46	00:12:05	00:00:00

The total length of time in red alert on June 5 was atypical based on four weeks of data around June 5. In other words, the amount of time in red alert was longer on June 5 than would be expected based on the expected variation in the data.

Chart 5: Total time in red alert for the Calgary Metro service (14 days before and 14 days after June 5)



When analyzing data for Sundays, the duration of time in red alert on June 5 is what would be expected for a Sunday based on the expected variation in the data. The four weeks of data around June 5 had less time in red alert (average time in red alert: 13.43 minutes) than the data for

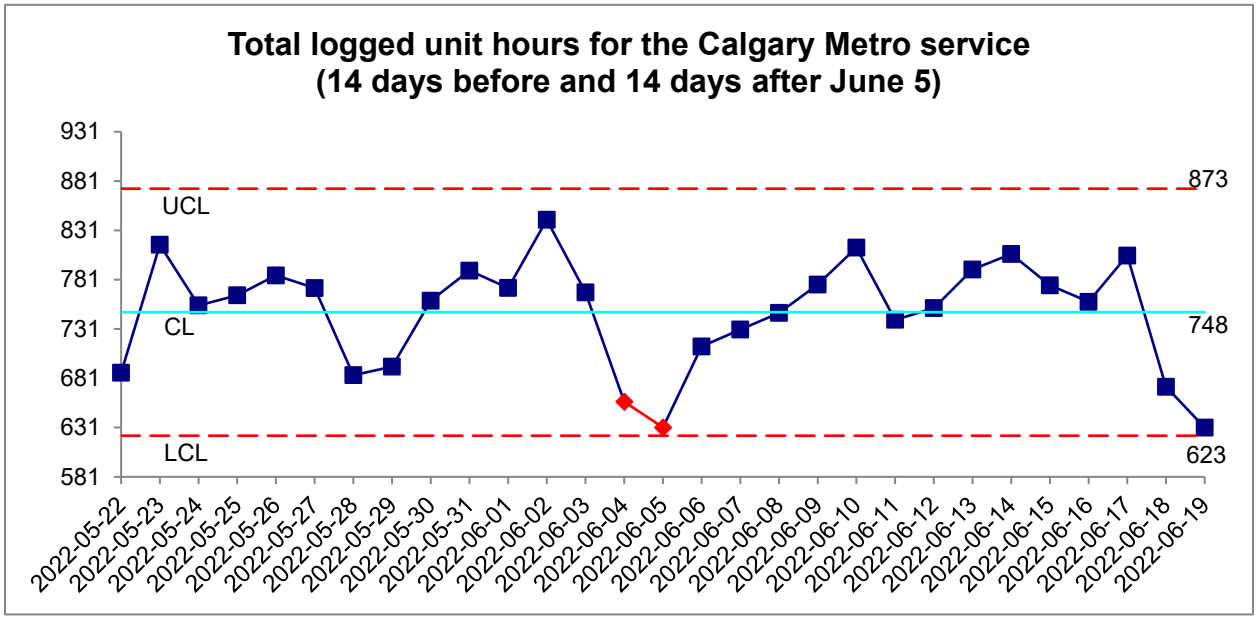
[8] The Calgary dispatch group includes transport capable units that are part of Calgary Metro Services, excludes single paramedic response units (PRU's), and is calculated regardless of geographic location for each unit.

Sundays between March 27 and August 7, 2022 (average time in red alert on Sundays: 23.70 minutes; see Appendix F).

Ambulances in service

On the day of the event, 31 out of the scheduled 38 metro[9] ambulances were operating in the city of Calgary. Over that 24-hour period, the metro fleet of ambulances operated for a combined 631 unit hours. The number of logged hours on June 4 and 5 were lower than expected in the two weeks before and after, per the expected variation in the data. When analyzing Sunday data, June 5 was typical for a Sunday. The four weeks of data around June 5 had fewer total logged hours (average logged hours: 748) than the data for Sundays between March 27 and August 7, 2022 (average logged hours on Sundays: 687; see Appendix F).

Chart 6: Total logged unit hours for the Calgary Metro service (14 days before and 14 days after June 5)



Ambulance utilization

Ambulance utilization tracks the percentage of time ambulances[10] spend in each of five categories: 1) available, (2) moving, (3) on event[11] (e.g., with patient) but not at the destination, (4) on event destination only[12] (e.g., at the ED with patient), or (5) out of service.

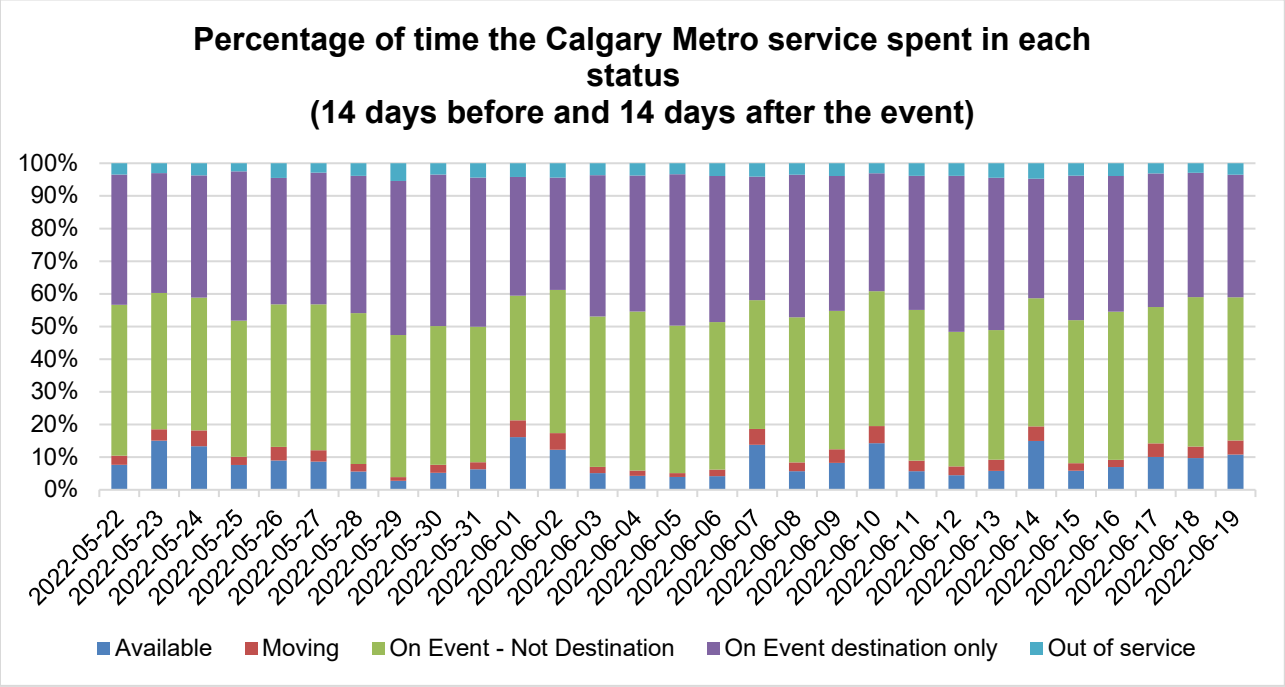
Each of these categories was analyzed, the percentage of time spent within each category was typical based on four weeks of data around June 5 and historically on Sundays; i.e., the percentage

[9] The metro Calgary EMS response area is the geographic area (city of Calgary) which is divided into four districts, plus the city core.

[10] ALS and BLS units (advanced and basic life support) / transport capable units / ambulances
[11] On event-not destination: time unit spent on an event, excluding the time spent at the transport destination (e.g. hospital or facility)
[12] On event-destination: time unit spent at the transport destination (e.g. hospital or facility) during an event

of time spent in each category was typical for that time period, per the expected variation in the data (see Appendix F).

Chart 7: Percentage of time the Calgary Metro service spent in each status (14 days before and 14 days after the event)



Resources for life-threatening events

Preserving the availability of ambulances by queuing low-acuity or non-emergency calls until sufficient resources are available is important to help build residual capacity to be able to respond to life-threatening calls.

This approach was supported in the literature review of leading practices, as was directing low-acuity calls to alternate care pathways (e.g., nurse consultation lines, primary care referrals) (Appendix A). The AHS EMS 10 Point Plan describes how EMS is working to transfer some non-emergency or low-priority calls to other agencies such as the Poison and Drug Information Service (PADIS) and Health Link 811 when appropriate, and in consultation with EMS physicians based in the communication centre. AHS EMS is also working to delay non-emergency responses to low-acuity or non-emergency calls when safe and appropriate to do so, in conjunction with physician advice and oversight. This allows EMS to focus on prioritizing ambulances for those with the most urgent medical need. For instance, the 20 minutes prior to this event, SCC received and dispatched ambulances to six high-priority calls (five delta and one echo), which is considered a high number.[xxxiii]

Pending events

At 2 p.m. on June 5, not only was Calgary in red alert (no ambulances available), there were also 20 calls on the pending list (events requiring an ambulance when none are available). The number of pending events on June 5 was higher than expected when compared to the data for the two weeks before and two weeks after this date, and for the data for Sundays between March 27 and August 7 (see charts below).

Chart 8: Pending events at 2 p.m. on June 5 (14 days before and 14 days after June 5)

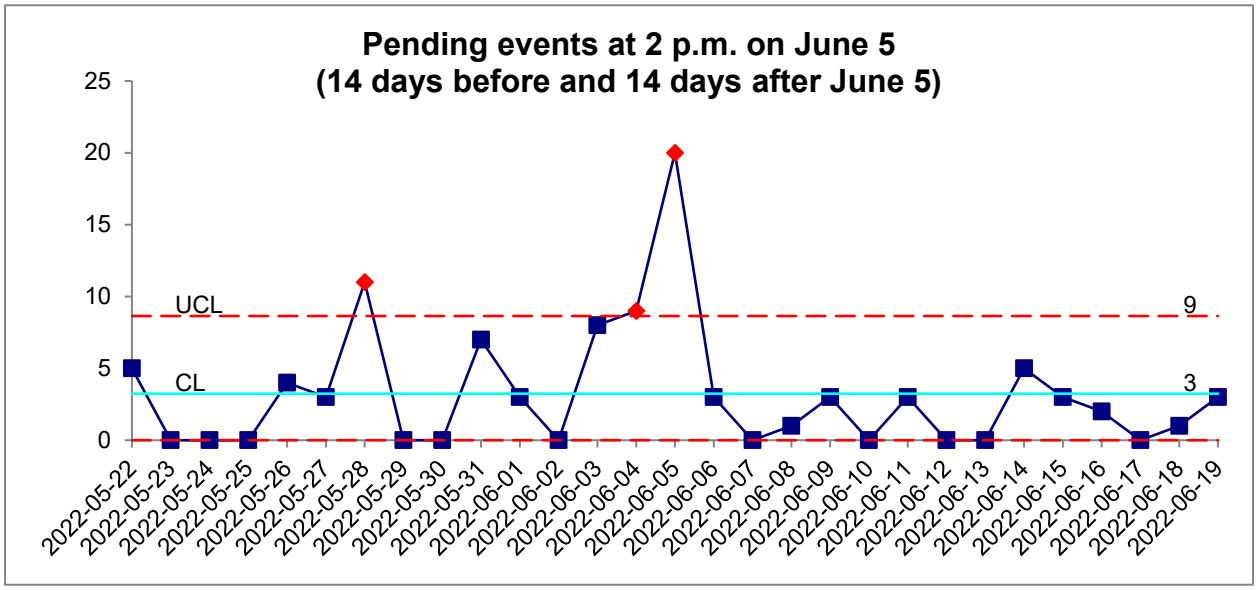
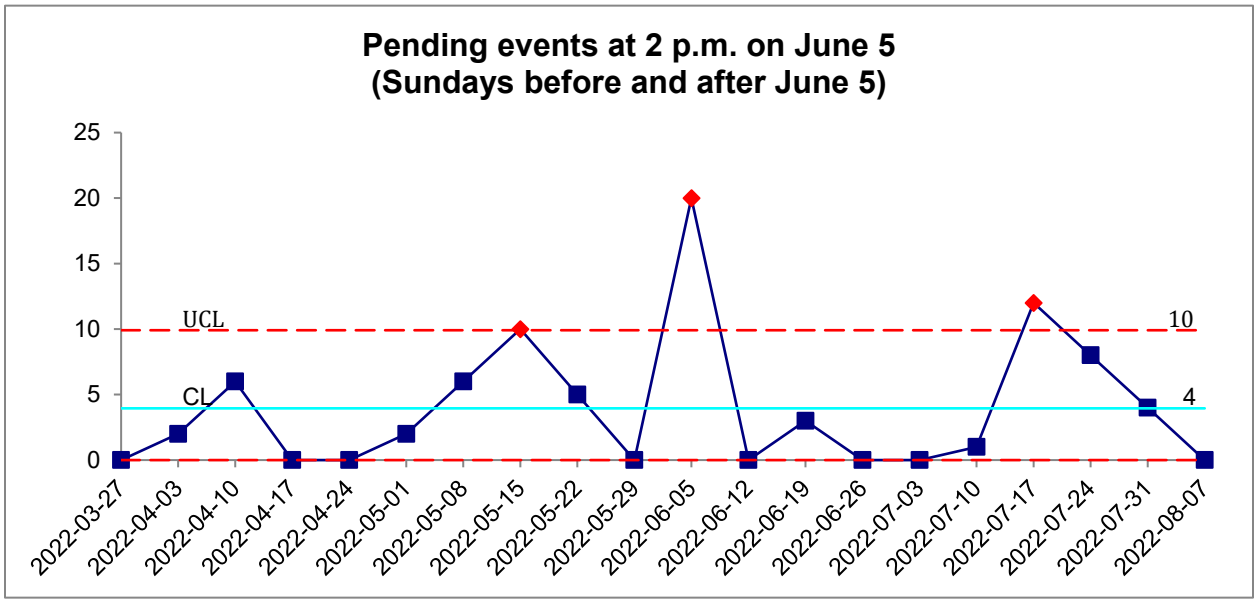


Chart 9: Pending events at 2 p.m. on June 5 (Sundays before and after June 5)



When an ambulance is not available for a life-threatening event, ambulances enroute to lower-priority calls are diverted to higher-priority events. Seven of the 20 pending events, which are events that are deemed to need an ambulance, had resources diverted from them at least once; one event ended up being diverted seven times before EMS arrived.

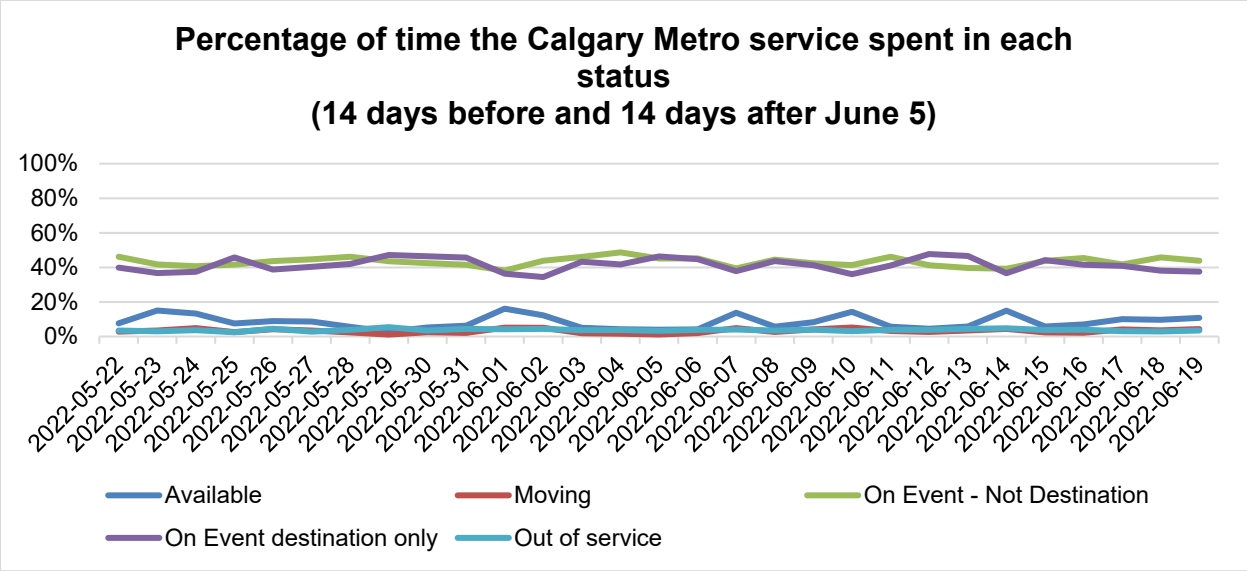
When in red alert with pending events, dispatchers continually review the list of pending events and make decisions on how to deploy resources as they become available. This often means that lower-priority events may be in a queue for many hours while ambulances are working to respond to the higher-priority events. At 2 p.m., one call had been pending for three hours and 15 minutes. AHS EMS has a process for holding low-priority events includes an event review by the EMS deployment manager and a callback process. There is no process for managing the events that are on the pending list, such as providing notifications to caller or other PSAPs, or checking on the status of the patient to see if their condition had changed.

Interviews with partner agencies (C911, CPS, and CFD) indicated that it would be helpful to know when an ambulance is not immediately available to respond to a call. Although the response plan would not change with this information, it would help first responders with decision-making, such as reaching out to an emergency medicine physician located at an AHS EMS PSAP (referred to as Online Medical Control) sooner in order to assess any alternatives. At no point in this event was C911 police PSAP informed by EMS PSAP that an ambulance was not immediately available. Instructions are not available to guide EMS ECOs when to provide this information, and there is no policy or SOP requiring them to do so. The leading practice literature review identified that call takers or dispatchers should inform the caller of their priority rating (high, medium, low) based on current activity, and that contact should be made with the 911 caller or partner agency if the response is delayed (> 20 minutes) for red and orange determinants to get updates on the patient's condition and review priority of the incident (Appendix A).

Offload delays at hospitals

On average, EMS crews spent 41 per cent of their time waiting at hospitals to transfer a patient to the emergency department (ED) (purple line on Chart 10: ambulance utilization 14 days before and 14 days after event - presented earlier) between May 22 and June 19. Offload delays occur when the EDs do not have capacity to accept EMS patients into their care. This happens when EDs are busy and all ED beds are occupied and/or the hospital is at capacity and unable to move patients from the ED into a hospital bed.

Chart 10: Percentage of time the Calgary Metro service spent in each status (14 days before and 14 days after June 5)



Offload delays at hospitals contribute to the availability of ambulances in the community. EMS has set a target for a 90-minute turnaround time at hospitals; however, because of delays in transfer of care, that time is often exceeded. On June 5 at the FMC, the 90-minute turnaround time was met 67 per cent of the time.

In the 12 weeks preceding the event, the 90-minute turnaround time target was met 50 per cent of the time at the four major Calgary hospitals (Foothills Medical Centre (FMC), Peter Lougheed Centre (PLC), Rockyview General Hospital (RGH), South Health Campus (SHC)).

At the time this event was ready to be dispatched (e.g., the event determinant had been established) there were 18 ambulances waiting at Calgary EDs (referred to as EMS on-site). Five of those 18 ambulances had exceeded their 90-minute turnaround time, with the longest delay at four hours and 55 minutes. Six patients were in the care of EMS paramedics at Calgary EDs (EMS park[13]). Two other ambulances were transporting patients to Calgary hospitals at that time.

All Calgary hospitals had patients who were waiting in the ED for a hospital bed (these patients are called emergency inpatients or EIPs). The patient wait status for most of the Calgary sites was 'red' at the time of the event, meaning, there were not enough physician resources in the ED to meet the patient demand.

Table 9 presents EIPs and EMS on-site at Calgary hospitals at the time of the event.

[13] EMS park represents the number of **patients** in this area who are in the care of CPS, EMS or Offload RN. This number indicates the number of patients, not the number of EMS crews.

Table 9: Offload delay indicators at the time of the event in Calgary hospitals.

	EIP	Site Status*	EMS On-site	> 90 min turnaround	EMS Park	EMS Incoming
FMC	12	Yellow	4	0	1	0
PLC	19	Orange	4	1	1	0
RGH	13	Orange	2	1	4	1
SHC	18	Orange	3	2	0	1
ACH	3	Orange	4	1	0	0
SCHC (urgent care)	0 or n/a	Red	1	0	0	0

*Site status colour on Table 9 represents specific trigger values and thresholds. The possible statuses are [*cited directly from source*]:

- Green – resources are meeting current demand
- Yellow – demands are beginning to stretch available resources
- Orange – high demand/activity levels at the site
- Red – extremely high demand/activity levels at the site
- SURGE – indicates a high number of EMS incoming numbers. Trigger value has been reached and EMS crews will be diverted to another site.

The AHS EMS 10 Point Plan describes the creation of the Calgary Integrated Operations Centre (IOC), which opened in May 2022. The IOC is a collaboration between paramedic leaders and AHS zone and hospital leaders for better integration between EMS and the hospital system. The objective is improved overall flow – to provide a balanced, even distribution of patients to help expedite care, decrease patient wait times, and limit offload delays (see Appendix D for a description of these activities).

The dog attack event was initially coded as a 03B01 determinant (yellow) which means it was considered serious but not life threatening. Because there were not enough ambulances to respond immediately to all events on June 5, this event, as a lower-priority event, was put on the pending list. The data supports the statement that there were no ambulances available to respond to lower-priority events: there were extended response times on June 5, increased time in red alert, lower than expected ambulances in service, larger than expected pending event list (events deemed to need an ambulance), and increased offload delays at hospitals.

Recommendations:

12. AHS should develop a process for the EMS PSAP to improve the management of pending events that includes all of the following:
    - utilizes clinical expertise to prioritize ambulance response based on patient condition and acuity
    - implements secondary triaging to identify and promote alternate care pathways (non-ambulance) for low-acuity (non-urgent) patients
    - establishes callback procedures to callers (i.e., 911 caller or partner agency) for events that exceed 20 minutes on the pending list
13. AHS EMS PSAP should develop a process and instructions to inform 911 and fourth-party callers when an ambulance is not being deployed immediately (i.e., added to pending lists) and/or will be delayed (i.e., per Preempt and Divert Procedure).

ISSUE 4: EMS arrived at the front door of the patient's home and not the alley (location of event)

Analysis

When EMS paramedics arrived on scene, they went to the front door of the patient's home, but the patient was in the alley behind the house. The paramedics went to the back of the house when no one answered the front door, and that is when they saw the patient and the other first responders from the CFD and bylaw. The CPS officer initially went to the front door, and the firefighters went to the alley after being flagged down by the bylaw officer who was first on scene.

When calculating the official response time, the clock stops when the EMS unit arrives at the patient's home, not at the patient's side. In this case, the time spent at the front door, walking to the back alley, and any delays in care before moving the ambulance to the back alley are not included in the response time. Although the added time from when the ambulance arrived at the front door until the paramedics reached the patient is unknown, the ambulance arrived in the back alley (driven by a firefighter) four minutes and 27 seconds after it arrived at the front of the house.

For all three agencies (police, fire, and ambulance), location-specific information, such as 'in the alley', can be captured in two places in the CAD – in the location information line and/or in the event comments section. Per AHS *EMS's Emergency Call Evaluating Processes Local Service Standard* where location-specific information is entered depends on when during the call it is shared by the caller and/or gathered by the ECO.

If the location-specific information is obtained **before** selecting 'pre-alert' in CAD (pre-alert notifies dispatch of the event), the ECO should enter it in the location information line. If the information is obtained **after** selecting "pre-alert," the ECO should enter it in the CAD event comments.

Once an address is confirmed, the EMS ECO selects 'pre-alert' on CAD to start the ambulance dispatch process while continuing to collect event information. After 'pre-alert' is selected, address

changes and updates cannot be made in the location information line, they can only be made in the event comments section or it will not update in the ambulance's mobile data terminal (MDT), which is why the address-specific information can end up in two different places in the CAD.

There are varied approaches among the EMS ECOs on how location-specific information is entered in the CAD when the location is not the front door (e.g., alley). One ECO suggested that information in the location information line is not transferred to the paramedic's MDT and should only be entered in the event comments field. This hypothesis was tested by an ECO at SCC and found to be untrue for the equipment used in the test, but it was reported that there are different versions of MDTs in use in Alberta, some MDTs can accept this information after the pre-alert, and some cannot. Another ECO indicated that best practice is to enter location-specific information multiple times in the event comments so that the paramedics do not miss it. Other ECOs suggested location-specific instructions can be shared with the paramedics by the EMS dispatcher by radio.

In this case, the location-specific information ("in alley") was entered as part of the first comment in the event comments section of the CAD. There was an opportunity to enter this information in the location information field since this information was gathered before the ECO selected 'pre-alert'. However, the ECO said they were trained to enter the location-specific details in event comments with the understanding that the location information line is not transferred to the paramedic's MDT.

On June 5, the paramedics did not see the location-specific information in the CAD that indicated the event was taking place in the alley. As it was the first comment in the CAD, it appeared at the bottom of the paramedic's MDT. As new entries about the event are added, they appear above previous entries. To view previous entries, the paramedic must scroll through all the comments to reach the first one. New entries cause the screen to jump back to the top. Multiple new entries can make it difficult to view earlier entries. There were many entries being added for this case, especially during the time the ambulance was driving to the event, which is when they would have been scrolling through the screen.

For safety and 'hold back' alerts, a pop-up message appears on the MDT in the ambulance to inform responding paramedics of any safety issues at the scene. Paramedics need to acknowledge the message by selecting a button on the MDT. EMS PSAP dispatchers will radio the crew if the button is not pressed. Interviewees recommended using a similar process to inform paramedics when the location is not the front door.

Recommendation:

14. AHS EMS PSAP should inquire of the CAD vendor to see if location-specific information, when it is not the front door, can be displayed more prominently. This could include using a pop-up message, or having the information displayed/pinned in a prominent location on the MDT. In the interim, or if this is not possible, identify a process that does not rely on a buried comment to inform the responding paramedics (i.e., radio transmission) of the patient location (when it is not the front door) for life-threatening events.

ISSUE 5: The relationship between Calgary 911 PSAP and AHS EMS PSAP impacts interoperability

Analysis

AHS EMS PSAP consolidation

In January 2021 AHS completed the consolidation of EMS PSAP services into a provincial model. At that time, EMS PSAP services were relocated from the C911 call centre to a separate call centre (the SCC). Prior to this move, EMS PSAP services for Calgary had been provided by C911 under contract to AHS EMS. During interviews it was evident that the tension stemming from this move continues between the two PSAP organizations (C911 and AHS EMS Dispatch Communications and Deployment).

Change in AHS EMS PSAP physical location

Before the AHS EMS dispatch consolidation, the Calgary PSAP services (police, fire, and ambulance) were in a shared building and could communicate in person. When EMS ECOs were on site at the C911 call centre, sharing of information was reported to be more 'free flowing' between the three secondary PSAPs (police, fire, and ambulance). However, when AHS EMS moved to a different physical location, many reported the relationship between the agencies became strained.

There is a sentiment at C911 that the quality of the information shared between agencies has eroded since EMS moved to a different physical location, as they can no longer rely on in-person communication to resolve issues in real time. Opinions were shared that response times in this event would have been better had ECOs been in the same location. Others who worked in the C911 call centre recall that before EMS PSAP consolidation there was little communication between the C911 police call takers and dispatchers and the C911 fire/EMS call takers and dispatchers. There was no evidence provided that suggested co-location of the C911 and EMS PSAPs would have improved the response times for the June 5 event. Specifically, the C911 police dispatcher who needed help due to competing priorities was unable to ask for help from their lead or adjacent dispatchers until 14:20:25. This situation would not have been improved if the PSAPs for the two agencies were co-located. At various points in this event, all EMS call takers and dispatchers were otherwise engaged and would not have been able to hear someone 'twist and shout' for help even if they were co-located.

Perception that calls and information are not appropriately shared between agencies

C911 call takers ask a series of brief questions to determine the emergency service required by a 911 caller. Those questions are used to assign a lead agency to the event. At the time of the EMS PSAP consolidation (January 2021), C911 changed the first question asked by C911 call takers from "Do you require police, fire, or ambulance?" to "9-1-1, what is your emergency?" and added the question "Are there any weapons or violence?" for some calls. The Alberta 9-1-1 Standards do not prescribe a specific first question. Each primary PSAP determines how best to get the required information based on its own policies.

There is sentiment among AHS EMS Dispatch Communications and Deployment leaders and ECOs located in Calgary (the SCC) that the change in the first question and the addition of a scene safety question about weapons and violence has led to C911 call takers assigning more calls than necessary to police as a means of retaining control of information. In fact, analysis of the data over the past three years from C911 shows that the average of daily percent of calls where EMS was assigned lead was slightly higher in the post-consolidation period (25.4%) than before the consolidation (23.7%). Some C911 interviewees shared that this question was added to ensure C911 police PSAP had awareness of any calls that may need a police response before the caller was transferred to EMS. There is a perception that EMS PSAP would not share relevant information with C911 police PSAP or not co-evaluate with C911 police PSAP once the call was transferred outside of C911.

CPS specific notifications

Provincially, the EMS ECOs are required to notify police or RCMP of specific types of calls (Table 10)

Table 10: Provincial police notifications

Protocol	Code	Protocol description
3	All	Animal bites /attacks
4	All	Assault / sexual assault
7	E suffix	Burns / explosion
8	B,R,N suffix	Carbon monoxide / inhalation / hazardous materials
9	B01, E04, E05	Cardiac or respiratory arrest / death
14	D01	Drowning (near) / diving / scuba accident (unconscious)
22	D	Inaccessible incident / other entrapments (non-vehicle)
23	Q,R,S,T,V,W suffix	Overdose / poisoning ingestion
25	B,T,V,W suffix	Psychiatric / abnormal behaviour / suicide attempt
27	All	Stab / gunshot / penetrating trauma
29	All	Traffic / transportation accidents
34	All	Automatic crash notification

When these types of determinants are entered in the EMS CAD system, the dispatcher is reminded to call police to notify them of the event.

CPS has additional requirements for notification beyond those expected of all other police agencies in the province (Table 11). This was initiated when EMS consolidation occurred. The rationale for this additional list of required notifications, according to EMS and C911 police ECOs, was to ensure C911 police PSAP was aware of events that historically they had been notified of by EMS ECOs when they were located in the C911 call centre.

Table 11: CPS specific notifications

Protocol	Code	Protocol Description
ECHO	All	
9	All	Cardiac or respiratory arrest / death
14	All	Drowning / diving / scuba accident
17	Delta	Falls - override
23	All	Overdose / poisoning ingestion
25	All	Psychiatric / abnormal behaviours / suicide attempt
30	All if on City of Calgary property	Traumatic injuries
32	Except medical alarms with NO access issues	Unknown problem

Because these notifications are beyond the standardized provincial list, there is no built-in reminder in CAD prompting the EMS dispatcher to notify C911 police of the event. All notifications require a phone call, so the addition of these CPS specific notifications increases the workload of the EMS ECOs.

Some EMS ECOs indicated the required CPS notifications contribute to the tension between the two agencies. It was not clear to these individuals why CPS was attending certain events, such as cardiac events and overdoses where scene safety was not a concern. EMS ECOs interviewed shared that when they call C911 police PSAP to provide the required notifications, the answering C911 police ECOs do not always know why they are being notified about these events.

ECO event communication

Some emergencies require multiple agencies to respond. In some cases, the lead agency will phone a secondary agency to request a response. When a phone call is received from a lead agency to AHS EMS requesting EMS response to an event, it is generally assumed the lead agency provides all known pertinent information. Rarely are additional questions asked of the lead agency ECO by AHS EMS ECOs. Some AHS EMS ECOs indicated that in the past when asking medical SEND protocol questions, the C911 police call takers expressed frustration at being asked questions for which they had no information. In addition, some EMS ECOs said because of the strained relations between the two agencies, they feel even more hesitant to ask clarifying questions of the C911 police ECOs. Personnel from the Central Communications Centre (CCC) in Edmonton indicated they too perceive a level of tension when responding to calls from C911 police ECOs that they do not experience when dealing with calls from Edmonton Police Service ECOs.

Calgary 911 governance

C911 is a public service provided by the City of Calgary and administered by the Emergency Management and Community Safety Division within the Community Services Department. Accountable to the city manager and city council, C911 is overseen by a board of governors. The board consists of three voting members: Director of Emergency Management and Community Safety, Deputy Chief for the Bureau of Community Policing and Calgary fire chief. The board meets

quarterly and is accountable for the overall provision of C911 as the primary PSAP responsible for answering 911 calls and assigning the appropriate lead agency. In addition to oversight, the board is responsible for decision-making, performance monitoring, and reporting related to C911 operations. There are various sub-committees that report to the board with membership from C911, CPS, CFD, Bylaw, and other City of Calgary departments. The board of governors is a governance body for system-level decisions concerning C911. Unresolved issues are elevated to the general manager of Community Services.

Cross-agency concerns

There are two groups who meet biweekly to discuss PSAP issues that involve AHS EMS Dispatch Communications and Deployment. One group is known as 'Stakeholders' which is a forum for PSAP leaders to discuss system issues, review processes, and make recommendations for system changes. Membership in this group include C911, CPS, CFD, Calgary Bylaw Services, AHS EMS SCC Dispatch Communication and Deployment, and other agencies. The second group is known as the 'Process Improvement working group', which provides opportunities to review PSAP events and business processes between CFD, CPS, C911 and the AHS EMS SCC. Both groups are administered through the C911 Operational Effectiveness Team (e.g., setting agendas, note taking). No terms of reference were provided for either group.

Since consolidation of the EMS PSAP to a provincial model through AHS, the SCC has dedicated a full-time ECO to review cases and resolve issues between AHS EMS and the other Calgary primary and secondary (C911 police and fire) PSAPs. In 2022, approximately 40 per cent of the concerns identified between AHS EMS PSAP and C911 police PSAP were about co-evaluation and miscommunication regarding the medical SEND protocol. Interviews indicated there has not been a need for an equivalent role in Edmonton.

Recommendations:

15. Leaders at the PSAPs in Calgary (C911 and EMS) should collaborate and agree on a structure and processes for shared decision-making that support effective and efficient PSAP interoperability including a concerns management and resolution process, coordinated policy development and cooperative process improvement.
    - Also applicable to recommendations 2, 4 & 5.
16. Calgary Police Service adopt the Provincial Law Enforcement Response Plan for specific event notification and reconsider the need for any additional notifications.

GLOSSARY

03B01 determinant (yellow): Describes a patient, as per the Medical Priority Dispatch System (MPDS), who has been bitten or attacked by an animal (Problem Code: 03), in "serious but not life threatening" condition (Priority: B or bravo), with an injury was to a possibly dangerous body area (Sub-determinant: 01). The term 'yellow' refers to the paramedic response priority level of non-urgent – not serious or life threatening.

03D03 determinant (red): Describes a patient, as per the Medical Priority Dispatch System (MPDS), who has been bitten or attacked by an animal (Problem Code: 03), is in "life-threatening" condition (Priority: D or delta), and is not alert (Sub-determinant: 03). The term 'red' refers to the paramedic response priority level of immediately life threatening or time critical.

Advanced SEND: Advanced SEND is an evolution of the Secondary Emergency Notification of Dispatch (SEND) process that is now included in the protocol-based ProQA software. It is designed to help answer calls for medical assistance from police and other on-scene officers. The Advanced SEND protocol guides emergency dispatchers to more efficiently and effectively evaluate and record a reporting officer's on-scene assessment, and send the most appropriate resources to them.

Bravo priority level: Refers to medical events which are serious but not life threatening, indicating an urgent response.

Computer-aided dispatch (CAD): An electronic platform utilized by dispatchers and call takers to prioritize and record incident calls, identify the status and location of responders in the field, and effectively dispatch responder personnel.

Calgary Metro: The metro Calgary EMS response area is the geographic area (city of Calgary) which is divided into four districts, plus the city core.

Call evaluation: When a person phones 911 and is connected to a call taker, the call taker evaluates the call using their agency-specific Emergency Priority Dispatch System protocol to determine what type of response is required.

Co-evaluation: Active tandem process of allowing multiple agencies to gather the information they require in a timely manner.

Dispatch Life Support (DLS): The provision of life-supporting advice and directions by telephone to a layperson who is awaiting the arrival of emergency responders to an out-of-hospital emergency.

First-party caller: A 911 caller who is calling for themselves (i.e., they are the patient, victim, etc.)

First responder: Includes a firefighter, law enforcement officer, paramedic, emergency medical technician, or other individual (including an employee of a legally organized and recognized volunteer organization, whether compensated or not), who, in the course of his or her duties, responds to fire, medical, hazardous material, or other emergency events.

Four commandments: The four commandments include chief complaint, age, status of consciousness, and status of breathing. These questions are the springboard for selecting and using the appropriate chief complaint protocol.

Fourth-party caller: A 911 caller who is from a connected partner agency. The person is requesting a response from the agency or providing/requesting information on a situation. This includes emergency agencies such as police, fire, or EMS as well as alarm companies, poison control, etc.

Interoperability: The ability of emergency personnel to communicate between jurisdictions, disciplines, and levels of government, using a variety of systems, as needed and as authorized.

Lead agency: The agency with the protocol best suited to ensure safety of the citizens and responders.

Manual card set: The card set delivers the medical, police and fire protocols in a durable, 18″ x 10″ flip-file format with individual protective card pockets. The card set allows call takers to manually move through case entry and key questioning following the same protocols found in ProQA. Determinants clearly display the response configuration specifically assigned to the code by local agency authorities. Additional information and pre-arrival and post-dispatch instruction cards are clearly linked and easy to access, as well as important case completion and dispatch life support information.

Medical Priority Dispatch System (MPDS): A medically approved, unified system that is used by medical dispatch centres to dispatch appropriate aid to medical emergencies, which includes: systematized caller interrogation, systematized pre-arrival instructions, and matching the call taker's evaluation of the injury or illness type and severity with the AHS defined response configuration.

Offload delay: A prolonged time between ambulance arrival at hospital and patient placement in an emergency department care space.

Pending events: Medical events where an ambulance is needed but no ambulance is available. Pending events are added to a pending list. As ambulances are freed up, events on the lists are assigned a response. The decision on which calls to assign first is based on colour code (response priority) and time in the queue.

Police Priority Dispatch System (PPDS): A unified system that is used by police dispatch centres to dispatch appropriate police resources, which includes: systematized caller interrogation and systematized pre-arrival instructions.

Primary public safety answering point (PSAP): A call centre with the role to answer initial 911 calls, and quickly identify which type of emergency service (typically police, EMS, and fire) is best suited to be the "lead" agency to respond to the emergency.

ProQA: A computer program incorporating adaptive software, that gives the call taker scripted panel-logic caller interrogation questions that utilize International Academies of Emergency Dispatch (IAED) protocols to expedite a response that best assists the caller/patient.

Red alert: A term used to indicate that there are no ambulances currently available to respond to events.

Response time: The elapsed time from when a computer-aided dispatch (CAD) event is created until the first EMS unit arrives on scene.

Second-party caller: A 911 caller who is present at the scene of the emergency or has direct knowledge of the situation and/or current condition.

Secondary Emergency Notification of Dispatch (SEND) protocol: The intent of the medical SEND protocol, through the International Academies of Emergency Dispatch (IAED), is to allow law enforcement and other public safety field personnel access to the benefits of the medical priority dispatch model on scene. This is intended for use by trained agencies to guide emergency dispatchers to more efficiently and effectively evaluate and record a reporting officer's on-scene assessment and send the most appropriate resources to them.

Secondary public safety answering point (PSAP): A PSAP to which 911 calls are transferred from a primary PSAP to complete the call evaluation process by dispatching police, medical, fire, or other first responders.

Send point: The point during call evaluation at which the secondary public safety answering point (PSAP) agency has collected enough information to dispatch an emergency resource.

Third-party caller: A 911 caller who is not present at the scene of the emergency nor has direct knowledge of the situation and/or current needs (e.g., driving past an apparent emergency scene).

ACRONYMS

AHS – Alberta Health Services

C911 – Calgary 911

CAD – Computer Aided Dispatch

CFD – Calgary Fire Department

CPS – Calgary Police Service

DLS – Dispatch Life Support

ECL – Emergency Communications Lead

ECO – Emergency Communications Officer

ED – Emergency Department

EIP – Emergency Inpatient

EMS – Emergency Medical Services

FMC – Foothills Medical Centre

HQCA – Health Quality Council of Alberta

IAED – International Academies of Emergency Dispatch

IOC – Integrated Operations Centre

MDT – Mobile Data Terminal

MOU – Memorandum of Understanding

MPDS – Medical Priority Dispatch System

PLC – Peter Lougheed Centre

PPDS – Police Priority Dispatch System

PSAP – Public Safety Answering Point

QAC – Quality Assurance Committee

QAR – Quality Assurance Review

Res1 – Resource Desk

RGH – Rockyview General Hospital

SCC – Southern Communications Centre

SEND – Secondary Emergency Notification of Dispatch

SHC – South Health Campus

SME – Subject Matter Experts

SOP – Standard Operating Procedure

APPENDICES

APPENDIX A: Rapid narrative review of best practices and issues in EMS dispatch

APPENDIX A

A RAPID NARRATIVE REVIEW OF

Best Practices and Issues in Emergency Medical Services Dispatch

REPORT FOR THE HEALTH QUALITY COUNCIL OF ALBERTA

August 15, 2022

Authors Ana Mladenovic, MPH[1]
Jill de Grood, MA, PMP[1]
Surakshya Pokharel, MPH[1]
Katie Vantil, MSc[1]
Marcus Vaska, MLIS[2]

Contributors Grace Bailey[1]
Ariet Okuori[1]
Anila Hussaini[3]
Kevin Smith[4]

Affiliations [1] W21C Research and Innovation Centre, O'Brien Institute for Public Health, Cumming School of Medicine, University of Calgary, AB

[2] Knowledge Resource Service, Tom Baker Cancer Centre, Calgary, AB

[3] Health Quality Council of Alberta, Calgary, AB

[4] British Columbia Emergency Health Services, Vancouver, BC

Correspondence Ana Mladenovic, MPH (she/her)
Ana.mladenovic@ucalgary.ca
w21c.org
GD01, TRW Building, 3280 Hospital Drive NW, Calgary, AB

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Abbreviations

A&E	Accident and emergency
ACS-COT	American College of Surgeons Committee on Trauma
AHS	Alberta Health Services
ALS	Advanced life support
BC	British Columbia
BCEHS	British Columbia Emergency Medical Services
BLS	Basic life support
CAD	Computer assisted/aided dispatch
CBD	Criteria Based Dispatch
CFR	Community First Responder
CPR	Cardiopulmonary resuscitation
CRM	Clinical Response Model
ED	Emergency department
EMCC	Emergency Medical Communication Centre
EMD	Emergency Medical Dispatcher
EMDC	Emergency Medical Dispatch Centres
EMS	Emergency Medical Services
ESS	Emergency signs and symptoms
GP	General Practitioner
GPS	Global positioning system
HQCA	Health Quality Council of Alberta
LA-TDS	Los Aneles Tiered Dispatch System
MI	Medical Index

MPDS	Medical Priority Dispatch System
NACA	National Advisory Committee for Aeronautics
NHS	National Health Service
PERS	Public Emergency Reporting Services
PSAP	Public Safety Access Points
RETTS-A	Rapid Emergency Triage and Treatment System – Adapted
RN	Registered Nurse
RRU	Rapid response unit
SETS	Swiss Emergency Triage Scale
TRP	Telephone Referral Program
UPC	Unclear problem category

1 Executive Summary

In July 2022, the Health Quality Council of Alberta (HQCA) was contracted by Alberta Health Services to investigate an Emergency Medical Services (EMS) response to a fatal dog attack that occurred in Calgary on June 5, 2022. The incident was initially triaged as "non-life threatening", leading to questions about dispatch and triage in EMS operations. The HQCA approached W21C Research and Innovation Centre (W21C) to conduct a review of the literature with the goal of identifying:

1) best practices and issues in: (i) triage and prioritization of calls, and (ii) communication and coordination when multiple agencies are responding to an incident;
2) tools for triage used in dispatch settings; and
3) documented system factors that can impact response time to an incident.

The W21C conducted a review of academic and grey literature and found that EMS dispatch is an under-researched field. For example, we identified and describe several tools used for triage in dispatch operations, however empirical evidence of their performance is limited, if available at all.

Best practices (and corresponding evidence) in both triage and communication/coordination with other agencies was scarce, therefore in this report we summarize different practices and models in various jurisdictions that show some potential to improve dispatch operations, but we are reluctant to apply the "best practice" moniker. Based on the review, some practices and approaches to consider in improving triage accuracy and dispatch processes include:

- Optimized coordination of low acuity calls
- Community first responder schemes and rapid response units
- EMS consolidation
- Dynamic deployment of EMS units
- Frameworks for medical surge planning; and
- Advanced SEND System

Identified practices to improve communications and coordination when multiple agencies are responding to an incident include EMS consolidation; using a Shared Mental Model, especially when parties are not co-located; and implementation of multi-agency dispatch systems, including systems such as Advanced SEND Protocol and BCE Global system.

Similarly, literature regarding issues related to triage and communication/coordination with other agencies in dispatch operations was not abundant. Issues related to triage accuracy included utilization of non-medical professionals, over-reliance on computer assisted dispatch (CAD) systems, liberal use of an "unclear problem" category, and communication and language barriers. Issues related to communication and coordination with other agencies included lack of standardized protocols and lack of resources.

Finally, we were surprised to find limited information regarding system issues that impact EMS response times, and it may be that such factors are knowledge held by industry insiders that are not documented. System issues that we did identify were related to health care models and approaches to EMS delivery; impact of destination interval or turnaround time on EMS availability; impact of payment models on EMS transport; and the importance of time of day and geographic location considerations in resource planning.

2 Introduction

Emergency Medical Service (EMS) dispatch, often referred to as Public Safety Access Points (PSAP), play a critical role in triaging and prioritizing incoming calls, dispatching and relaying information to appropriate providers, and offering first aid instructions to callers prior to first responders arriving [1]. Trends show a steady increase in the frequency of calls to PSAPs, along with an increase in subsequent dispatches. This increased frequency creates situations where multiple simultaneous requests may occur, requiring decisions around prioritizing and appropriate emergency services to dispatch.

There have been increasing reports of long wait times for EMS response in Alberta, with questions around the negative impact of these response delays on patient outcomes. In the first six months of 2022 in Calgary, there were instances where no ambulance was available to respond to an emergency an average of 420 times per month [2].

In July 2022, the Health Quality Council of Alberta (HQCA) was contracted by Alberta Health Services (AHS) to conduct an investigation of an Emergency Medical Services (EMS) response to a fatal dog attack that occurred in Calgary on June 5, 2022. The incident was initially triaged as “non-life threatening”, leading to questions about dispatch and triage in EMS operations. Furthermore, EMS dispatch operations have been a contentious discussion since the consolidation of all ambulance dispatch in Alberta into Alberta Health Services in centralized dispatch centres [3], where more localized dispatch was previously available. The HQCA approached the W21C Research and Innovation Centre (W21C) to conduct a review of best practices and issues in EMS dispatch and triage, reported herein.

3 Report Aims and Objectives

The Health Quality Council of Alberta (HQCA) is a provincial organization that brings together patients, families, and partners from healthcare and academia to promote patient safety, person-centered care, and health service quality. The HQCA collaborated with W21C, a research and innovation initiative based in the University of Calgary's O'Brien Institute for Public Health to conduct a review of the literature focusing on emergency medical services dispatch, with the goal of better understanding best practices in EMS triaging and dispatch. The review provides a rapid narrative synthesis with the overall goals of:

1. Identifying best practices and issues related to triage/call prioritization,
2. Identifying and summarizing triage tools and protocols,
3. Identifying best practices and issues related to communication and coordination with multiple agencies responding to the same emergency, and
4. Identifying system factors known to impact EMS response times.

4 Methodology

The review followed the systematic methodology described in the Cochrane Collaboration Handbook of Systematic Reviews and utilized a comprehensive search strategy to obtain relevant records from electronic databases as well as grey literature sources (see search strategy in **Appendix A**). Records were screened in two phases (title-abstract screening and full-text screening) by two researchers from July 18

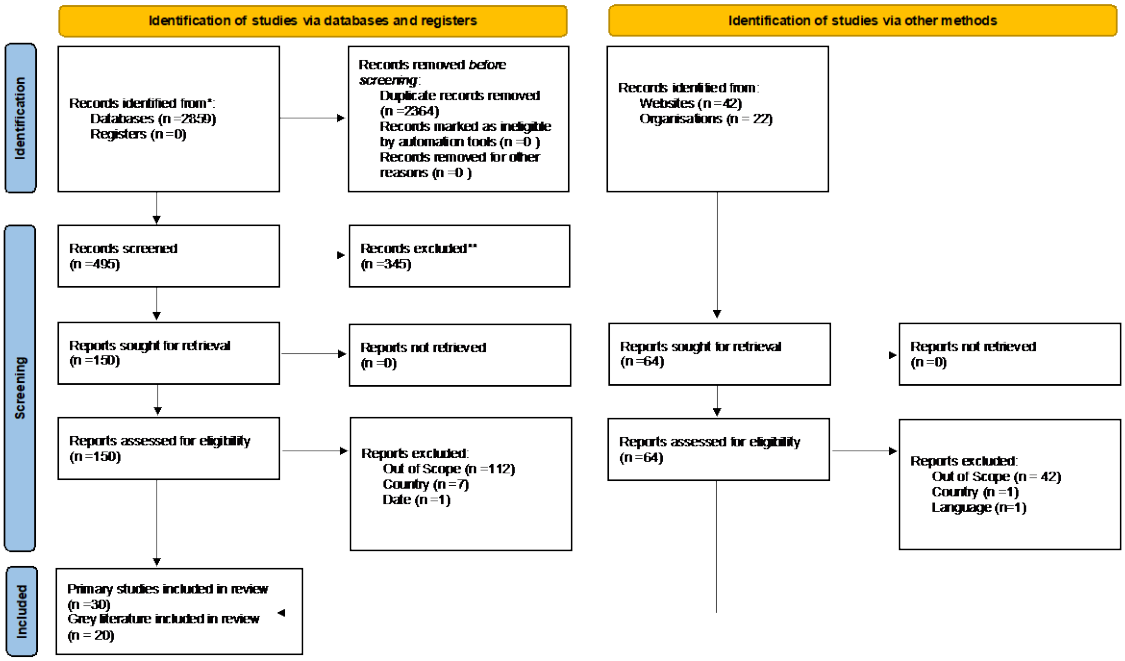
to 25, 2022 and information was extracted using a predefined data extraction tool that met project objectives.

5 Findings

5.1 Overview of Reports Synthesized

The primary electronic database search found 30 relevant records that satisfied the inclusion criteria for the study. Relevant grey literature was also searched (see **Appendix A** for search strategy), yielding 20 unique grey literature records included in this report. **Figure 1** depicts the reporting of records that were identified, screened, and included in the report synthesis.

Figure 1 Modified PRISMA flow diagram



The majority of studies were from the United States (n=13) and Scandinavian countries (n=12), followed by Canada (n=12), six from Western European countries, five from the United Kingdom, and two from Australia. The years of publishing ranged from 2012 to 2022.

The primary studies reviewed in this report (n= 30) were mostly observational (n=18; 60%); the most common study designs were retrospective cohorts (n=7; 23%), cross-sectional studies (n=2; 13%) and before-and-after cohort designs (n=1; 3%).

5.2 Practices with Potential to Improve Triage in Dispatch Operations

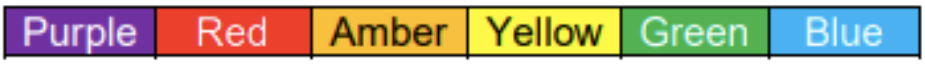
A total of 11 publications related to practices to improve triage of emergency calls were identified. A majority of these were from Canada (n=6), followed by the United Kingdom (n=2), Australia (n=2) and the United States (n=1). Publications included reports, white papers, and observational studies using various designs. In this section, we summarize general principles for dispatch, strategies for optimized coordination of low acuity calls, and dynamic deployment.

General Principles

A white paper from the UK [4] presented a set of general principles for dispatchers. The author paired the principles with a Dispatch Cross-Reference table, using a colour coding system to represent severity in descending priority order (see **Figure 2**). These principles follow:

1. "The nearest available resource shall be tasked to a Purple (cardiac arrest) determinant without delay
2. The nearest available paramedic ambulance shall be tasked to a Purple, Red, or Amber determinant in that priority order
3. Call-takers and Dispatchers shall have discretion to override a determinant and assign a higher priority to an incident based on the information received
4. An ambulance tasked to lower priority incident may be diverted to higher priority incident when resources are limited
5. The Dispatcher may preserve the availability of ambulances by queuing Green and Blue determinants until sufficient resources are available
6. An EMT ambulance may be deployed for Yellow, Green and Blue determinants but not at the expense of their primary role, patient transport
7. When a response is delayed Call-takers / Dispatchers shall inform the caller of their priority rating (high, medium, or low) based on current activity
8. Contact shall be made with the caller if the response is delayed (> 20 minutes) for Red and Amber determinants to verify patient's condition and review priority of the incident
9. Any recommended resource should only be tasked if it has a reasonable expectation of making patient contact. Tasking a resource to an incident to strictly meet control time targets when knowingly aware that the resource is highly unlikely to make patient contact is not acceptable practice".

Figure 2. Dispatch Cross-Reference Table Determinant Codes



Optimized Coordination of Low Acuity Calls

In a current state and best practices review of Nova Scotia EMS Operations, Fitch and Associates LLC determined that low acuity patients, identified through structured interrogation, require additional evaluation by dispatch personnel to determine the appropriate level of response [5]. Similarly, a review of fire and paramedic services optimization in the Greater Sudbury region found that there is a need to better manage and divert lower acuity calls from emergency services, by directing these calls to alternate care pathways [6]. While these two reviews do not provide guidance to operationalize these recommendations, secondary triage may be an avenue to consider for treating low acuity calls.

Secondary Triage

Four publications recommended some form of secondary triage of emergency calls, following the initial triage conducted by dispatch personnel. The publications typically discuss a tiered approach, wherein calls classified as having a low acuity level are re-assessed by another party to determine the appropriate level of response.

A retrospective study in an American context found that in all low acuity cases except those relating to seizure, secondary triage was appropriate [7]. The authors reviewed over 16,000 cases where secondary triage was utilized and found that only 1.1% were transported lights-and-siren. British Columbia Emergency Health Services (BCEHS) partnered with HealthLink BC nurses by directing low acuity calls to the telephone service; between March 2016 and June 2017, there was a 35% decrease in ambulances assigned to low acuity calls, compared to the reference period [8].

Two Australian studies assessed a secondary triage service for low acuity calls provided by Ambulance Victoria, known as the Referral Service. The Referral Service provides secondary telephone triage for cases that have been identified as low-acuity following initial triage. One of these studies reported that between 2009 and 2012, 68% of calls received by the Referral Service were referred to the emergency department (ED), 28% of which were by emergency ambulance; 32% of cases were referred to alternative service providers or given home care advice [9]. The study did not report on appropriateness of the referrals, or whether the referral rates differed from previous years. The second study concerning the Referral Service assessed ED suitability of referrals over the same period and found that the ED suitability for planned ED presentations (i.e., those referred to ED by the Referral Service) was significantly higher than the ED suitability for the average Victorian ED presentations (70.6%-77.8% vs 61%, respectively; p=0.046) [10]. The studies cite that the Referral Service can minimize unnecessary ambulance demand by better matching patient cases with appropriate care pathways.

Based on this evidence, secondary triage conducted by a clinical professional may be a resource-efficient method of diverting low acuity cases away from emergency departments and ambulance services. However, given that these studies had retrospective observational designs and did not assess cost-effectiveness or outcomes related to cases of under-triage, more investigation is needed to confirm the utility of secondary triage.

Supplementary First Responders

In some urgent, but not emergent situations, it may be important for a patient to have a responder assist them promptly, even if it is not a priority for ambulance dispatch. Three publications discussed models where supplementary first response personnel were able to assist patients who require ambulance support but may have to wait in the queue.

Community First Responder Schemes

One study from the United Kingdom discussed the implementation of a Community First Responder (CFR) scheme to support ambulance services in an inner-city setting, made up of medical students in their final two years of training [11]. Over a period of 12 months, medical students trained in emergency response attended emergency calls in an inner-city setting, alongside the West Midlands Ambulance Service. The mean CFR response time across all calls was an average of 3 minutes and 8 seconds less than ambulance crew response times. The largest difference was to calls relating to falls (12 min).

Rapid Response Units

Rapid Response Units (RRU) are typically staffed by a single Paramedic without transport capability, but equipped with standard emergency response equipment. The County of Simcoe (Southern Ontario) and regions throughout New Brunswick have implemented RRUs, in situations where local emergency responders may require reinforcement, as well as in rural areas at risk due to geographic isolation [12, 13]. These sources did not assess whether implementation of RRUs improved emergency response capabilities.

EMS Consolidation and Dynamic Deployment

In a review of Ontario's ambulance services, Deloitte identified jurisdictions where EMS consolidation and centralization has been taking place, considering this an approach to "better optimize resources and standardize procedures" [14]. The New Brunswick Department of Health referred to consolidation as a "best practice" in EMS dispatch [13], and other jurisdictions in Ontario are also investigating the feasibility of consolidation [6].

Along with consolidation, the New Brunswick Department of Health identified dynamic deployment as an assurance of a functioning integrated system [13]. In a dynamic deployment approach, ambulances are "shifting their positions in real time in response to emergent events" [13]. The benefit of dynamic deployment is that no region is unattended at any given time. However, it may remove a unit from its local community to cover a deficiency in another area.

We did not find a great deal of empirical evidence of improvements in response times associated with EMS consolidation or dynamic deployment. One dissertation we identified found dynamic deployment performed as well or better than static deployment is response metrics, using mathematical modelling [15]. The author suggests that dynamic deployment may enable EMS systems to improve their response times with fewer vehicles than static deployment, which may result in savings to the system in some circumstances. More research may be required to establish dynamic deployment as a best practice in dispatch.

Medical Surge Planning

At the request of HQCA, we flagged any literature related to medical surge planning (n=3); including a framework for surge planning, and two examples of responses during surges caused by the COVID-19 pandemic. These are described below.

CDC Framework for Expanding EMS System Capacity During Medical Surge

The Centers for Disease Control and Prevention (CDC)'s Framework for Expanding EMS System Capacity During Medical Surge recommends a tiered dispatch approach to assign resources most appropriately in the event of a medical surge [16]. The described approach is similar to secondary triage, which we have discussed previously. The CDC advises the following steps for implementing a tiered dispatch system:

1. "Meet with PSAP and dispatch directors, assess capacity, and identify resources needed to expand services during an emergency;
2. Develop staffing plans to expand dispatch center capacity;
3. Identify other call centers for referral of non-life-threatening calls for medical advice;
4. Identify hosting solutions for a scalable response (to assure interoperability between call centers); and
5. Develop standard methodology and protocols (consider additional protocol questions for emerging infectious diseases".

The CDC Framework is a useful toolkit, that can be worked through in its entirety to plan for a future medical surge.

Responses to Medical Surge Caused by COVID-19

The medical surge caused by the COVID-19 pandemic has prompted EMS agencies to reassess their protocols due to increases in call activity and limited staff resources. A recent study from France assessed the impact of two-level filtering on Emergency Medical Communication Centres (EMCC) performance during the COVID-19 outbreak [17]. The implemented system consisted of a first-line call taker who determined serious conditions requiring immediate dispatch within 30 seconds. If the call was deemed to be a serious condition, the first-line call taker transferred the call to a dispatching physician. For non-serious conditions, the call was immediately transferred to a second-line call taker to obtain further information, therefore enabling the first-line caller to handle other incoming calls. Compared to the single-line call taker system, the two-level call filtering system helped to reduce the time gap between call placement and dispatch evaluation.

There has also been concern for the health and safety of EMS workers during the COVID-19 pandemic. To approach this problem, an ambulance spilt model was proposed, in which specified ambulances only carry infected and suspected cases of uninfected individuals [18]. Using optimization techniques on a data set provided by ambulance dispatching center in Munich, Germany, it was found that an ambulance split would not reduce the average response time. However, a sensitivity analysis demonstrated that under conditions that required long isolation times and high infection probabilities, an ambulance split would be a beneficial method to reduce response time and probability of infection for EMS personnel.

5.3 Issues Related to Triage in Dispatch Operations

Six publications discussed issues related to triage in dispatch operations, including utilization of non-medical professionals, use of computer assisted dispatch systems, liberal use of an “unclear problem” category, and communication and language barriers.

Utilization of non-Medical Professionals in Dispatch Operations

In one publication from the UK, high acuity calls determined to require emergency department attendance by dispatch personnel were re-assessed by General Practitioners (GP) [19]. This study found only 27% agreement between dispatchers’ referral decisions and those of GPs, indicating that referrals to the ED would have been inappropriate in 73% of cases prior to review by GPs. However, dispatch personnel in this area lack clinical training and rely heavily on computer assisted decision support systems. Notably, another study compared call accuracy of calls handled by an emergency medical dispatcher (EMD) with and without support by a registered nurse (RN) and found no improvement in accuracy with the support of an RN [20].

Over-Reliance on Computer Assisted Dispatch

A recent systematic review found that dispatching systems are insufficient on their own [21]. Dispatching systems have been described as “front-loaded” and “risk-averse” by users and in the literature, and typically over-triage, resulting in wasted resources [14, 21]. However, the authors point out that there is very low to low level of evidence on the accuracy of medical dispatching systems available in the literature and common standards of reporting need to be created before the accuracy of the systems can be determined.

Overuse of "Unclear Problem" Category in Triage

A recent study from Denmark reported that 11.4% of all emergency calls are being categorized using the "unclear problem category" (UPC), and that the category was used most frequently to categorize calls from elderly patients [22]. The UPC is meant to be used conservatively (2-5%), and in the event of an unclear problem, an EMS vehicle may be sent to respond unnecessarily. Using an EMS register of 296,398 calls, the authors found that among those categorized as UPC, 34.7% of the EMS vehicles ended up being cancelled. The study reported a reduction of use of the UPC following education to sensitize dispatchers to the implications of its overuse, however the details of this education program were not explained.

Communication and Language Barriers

Communication and language barriers may impact quality of service. Registered nurses (RNs) have described that managing difficult calls to emergency medical dispatch centres (EMDC) can lead to incorrect triage decisions, which can hamper patient safety and resource allocation [23]. Difficult calls were described as those with immediate life-threatening conditions, calls from rude callers, callers with psychiatric illness, or third-party callers making it harder to assess.

Another study examining overall factors influencing RN's assessment of calls to the EMDC also indicated that the barriers appeared in callers' descriptions of unclear symptoms, paradoxes, and the responding RN's lack of communication strategies during the call [24]. RN's assessment of calls could be improved with the implementation of communication strategies for dealing with difficult callers to the EMDC [23, 24]. Use of technology such global positioning systems (GPS) is suggested for best geolocation of patients [25], however it will not address issues such as language or cultural barriers that may impact an individual's ability to contact EMS, and more research is required to make dispatch operations more inclusive for patients with diverse backgrounds.

5.4 Tools to Support Triage in Dispatch Operations

In this section we summarize the triage tools that were identified in the literature and provide information on performance, where available (see **Table 1**). Performance of tools refers to accuracy, and may include sensitivity and specificity (26), positive predictive values and negative predictive values (27), as well and over- and under-triage. Our assessment of the tools is based on the data that were available.

The American College of Surgeons Committee on Trauma (ACS-COT) considers an over-triage rate of 25-30% acceptable, while an under-triage rate of <5% is considered acceptable [27]. Under-triage is typically of greater concern, as it carries a risk to patient safety, while over-triage can place extra burden on the health care system.

A systematic review published in 2018 assessed accuracy of medical dispatch systems and found a very low level of accuracy for identifying cardiac arrest, acute coronary syndrome, stroke, and major trauma, as well as an over-triage rate of 71%-78% when using a dispatch priority tool [21]. This study also reported that the most commonly used dispatch tools internationally are Medical Priority Dispatch System (MPDS) and Criteria Based Dispatch (CBD); however, they perform similarly, and no consensus exists on which tool should be recommended [21]. Given the less structured nature of CBD, this approach may be more appropriate in settings where dispatch personnel have clinical training and can draw on clinical knowledge and experience for triage. MPDS may be more appropriate in settings with lower education and training entry standards into the field of dispatch.

Table 1. Tools and Protocol for Triage in Emergency Response

Tool/Protocol	Features	Performance	Citation(s) that Included Tool
Clinical Response Model (CRM)	• CRM triages patients similarly to the MPDS • Allows for six levels of prioritization • Ensures EMS vehicles are not overworked and enough vehicles are able to respond to an emergency at any point in a shift • Shifts from a time-based response model to a clinically-based model	• Implemented in British Columbia Emergency Health Services in 2018. Call times before and after implementation either stayed the same or saw slight reductions.	[33]

Criteria-Based Dispatch (CBD)	• Guidelines, not protocol, used to determine appropriate levels of care, determine whether to send advanced life support (ALS) or basic life support (BLS) units
	• "All Callers Interview" used to gather caller information and chief complaint
	• RESPONSE MODES:
	  ○ MEDIC – Medic unit (ALS response) and Basic Life Support unit (BLS response) sent
	  ○ BLS Code Red – BLS unit responds with lights and siren
	  ○ BLS Code Yellow – BLS unit responds obeying speed limits and traffic laws. BLS criteria may not always be emergent. Use of BLS Red or BLS Yellow is determined by local agency policy
	  ○ TRP – (Telephone Referral Program) – Calls are transferred from dispatch to a consulting nurse line. No BLS unit is sent. If police request a response for a patient that meets TRP criteria, a BLS unit should be sent
		• Similar ability to recognize cardiac arrest as MPDS
		• Pre-arrival CPR instructions offered more frequently with CBD than MPDS
		Rates of over-triage and under-triage in use of CBD were found to be 78% and 4.6% respectively
			[30], [31]

Danish Index	• Developed using CBD guideline • Leads to specific questions that enable the medical dispatcher to initiate the appropriate and corresponding priority level (ranging from A-E): ○ Level A includes life threatening/potentially life-threatening symptoms	• No information provided	[22]

	○ Level B includes urgent, yet not life-threatening symptoms ○ Level C is for non-urgent conditions that still require an ambulance ○ Level D has non-urgent cases requiring supine patient transport ○ Level E is for cases that merely require medical advice		
Los Angeles Tiered Dispatch System (LA-TDS)	• Developed in 2014 to replace MPDS at LA Fire Department (where 9-1-1 calls are processed) • Emphasizes rapid, streamlined set of questions to identify nature of the emergency • Promotes early recognition and rapid dispatch for select time-critical emergencies • Minimizes questions to establish a better rapport with callers • uses effective emergency instructions to prompt callers to provide life-saving care before EMS first responders arrive on scene	• Performed better than MPDS among critical EMS patients • Critical under-triage rate was 0.20% using MPDS and 0.12% using LA-TDS, largely driven by improved triage of cardiac arrest • Over-triage rate in this setting was 33% using LA-TDS vs 44% using MPDS • No benchmarks specifically for under- and over-triage rates in critical patients	[35]
Medical Index (MI)	• Developed using CBD guideline • Three-graded priority protocol containing 30 chapters based on the main complaint • Each chapter contains listed medical conditions divided into priority levels • The telecommunicator assigns a priority level from 1 (the most urgent) to 3 (least urgent) based on the assessed medical condition • A fourth level is assigned to callers not requiring medical assistance but transportation • Also known as Swedish Medical Index to Emergency Assistance	• More accurate than RETTS-A (55% of simulated calls were assessed correctly with Medical Index vs 48% RETTS-A) • Sensitivity for highest priority level was 83% for Medical Index vs 54% for RETTS-A • Over-triage rate varied depending on study (26% [20]- 38% [32]); under-triage rate reported in one study was higher than acceptable level (6%)	[20],[32]
Medical Priority Dispatch System (MPDS)	• Establishes a universal standard for emergency dispatchers taking calls • Current version is 13.3.326	• British Columbia Emergency Health Services has used the tool. In 2015, 71% of Omega calls (calls involving low acuity injury) were assigned to an ambulance	[6],[21],[28],[29],[30]

	• Dispatchers use a call processing structure ('key questioning') to gather information from the caller that leads to a specific code • 38 protocols and over 2000 determinant codes are applied through call processing • Software based • Also known as Advanced Medical Priority Dispatch System OR Dispatch Priority Card Index	• When BCEHS collaborated with HealthLink BC's Nursing Services, there was a 35% reduction in ambulances assigned • In a region of Peel report, it was cited that using the Dispatch Priority Card Index resulted in 75% of all calls for service as requiring Code 4 'lights and sirens' response . Notably, in Toronto and Niagara, where MPDS was being used, only 40% of the calls were dispatched this way • Similar ability to recognize cardiac arrest as Criteria Based Dispatch	
National Health Service Pathways Software	• Introduced along with National Health Service (NHS)' triage and advice line, 111, in 2014 • Staffed by non-clinical call handlers • Allows call handlers to check symptoms and signs to arrive at a disposition • Requires yes or no answers to questions and is designed to deliver risk averse outcomes when used by non-clinician • Uses certain triggers which result in transferring the caller to a clinical advisor (usually a nurse or paramedic)	• Criticized in its early days, including concerns that the service was sending too many patients to A&E departments, contributing to the rise in A&E attendance	[19], [36]
Norwegian Index for Emergency Medical Assistance	• Developed in 1994 • Index organized into operative chapters, with corresponding sets of criteria and user guidance for accidents, medical conditions, and special circumstances (e.g., major incidents) ○ Emergency calls get logged as incidents with associated dispatch criterion leading to dispatch of EMS resources	• A 2015 observational study in south-east Norway identified there was under-triage of physician-staffed EMS dispatch that ranged between 20 – 32% when adjusted for availability and response and/or transport times • The study found dispatch criteria were vague	[34]
Rapid Emergency Triage and	• Adapted from RETTS (used in Swedish emergency departments and ambulances) for dispatching	• RETTS-A was less accurate than Medical Index (48% of calls were assessed correctly vs 55% for MI)	[32]

Treatment System-Adapted (RETTS-A)	• Four graded priority protocol consisting of algorithm for vital signs and flowcharts for "emergency signs and symptoms" (ESS) • Five parameters in the vital signs algorithm; airway, breathing, circulation, mental status, and environment/body temperature	• Sensitivity to detect highest priority level was 54% for RETTS-A vs 83% for MI • Over-triage and under-triage rates on high end of acceptable (29%); under-triage rate higher than acceptable level (23%)	
(Unnamed) – Geneva Emergency Medical Communication Centre Self-Developed EMS dispatch system	• After assessing consciousness and quality of breathing, EMS personnel select the most relevant symptom from a list of 53 symptoms from the Swiss Emergency Triage Scale (SETS). • Once symptoms have been assessed, Geneva's EMD determines one of five triage levels, with Level 1 being most severe.	• One study found the under-triage rate is 15.7% and the over-triage rate is 41%. It also found a sensitivity of 36.2% and a specificity of 93.2%, when using a comparison to a National Advisory Committee for Aeronautics (NACA) scale of greater than or equal to 4. • Overall, the tool was found to have good specificity but low sensitivity for sending emergency physicians	[28]

5.5 Practices with Potential to Improve Communication and Coordination among Agencies Responding to Same Incident

We identified five publications discussing practices or tools to improve communication and coordination among agencies responding to the same emergency. Some relevant findings follow.

Shared Mental Model and Team Effectiveness

The shared mental model is a concept in the team effectiveness field that holds the view that "effective performance during high workload operations relies upon a shared description, understanding and prediction of the occurring events" [37]. A shared mental model, combined with trust among team members and closed-loop communication, are considered coordinating mechanisms that enable greater team effectiveness. Unsurprisingly, this is more challenging to achieve in an environment where team members are not co-located.

The use of technology to ensure that team members all have access to the same information at the same time, are connected to one another and in constant communication with one another may be an approach to foster a shared mental model and nurture team effectiveness.

Public Emergency Reporting Services

A review of the Manitoba EMS System indicated that the best practice EMS dispatch centres are designed to accommodate Public Emergency Reporting Services (PERS) and phase II wireless (network to network interface of wireless providers) [38]. These mandatory connections facilitate wireline, cellular, voice over internet protocol, automatic crash notification, patient alerting system devices and other public 911 access to the Emergency Medical Services System. Voice, video, telemetry, and other data communications conduits are utilized as necessary to best enhance real-time information management for patient care.

Multi-Agency Dispatch Systems

SEND/Advanced SEND Protocol

Our database and grey literature search did not yield any results related to the SEND protocol. Based on a request by the HQCA, a targeted post-hoc search led us to the Priority Dispatch Corporation website, wherein we were able to extract some information regarding the SEND protocol.

The original SEND Protocol, also known as the "Medical Miranda", was developed by Dr. Jeff Klassen in the 1970s [39]. Along with the Salt Lake City Fire and Police, he determined a set of questions which evolved into a multi-agency protocol to enable information flow between parties responding to an emergency. SEND cards were made available to law enforcement officers and were initially used by officers reporting incidents to a dispatch centre. By using the SEND protocol, dispatch personnel were able to coordinate an appropriate response to any incident where a trained professional was on scene evaluating the situation.

Advanced SEND incorporates the Medical Priority Dispatch System (MPDS) Protocol 38, which allows EMS dispatchers to better evaluate an emergency. The specific information gathered includes chief complaint or incident type, number of patients, approximate age, level of consciousness and breathing status; and assesses the presence of illness or chest pain, presence of severe bleeding, and need for a

lights-and-siren response. This level of assessment requires the knowledge and skills of trained professionals, and relies on the following principles:

1) "it is reasonably considered that a police offer at scene can reliably recognize serious injuries, and the patient(s) in these cases are provided with this benefit of the doubt
2) it is reasonably considered that a police officer at scene can reliably recognize minor injuries. There appears to be any doubt the EMD can override the recommended code
3) it is reasonably considered that a police officer at scene can reliably recognize uncontrollable hemorrhage
4) it is reasonably recognized that a police officer at scene can reliably judge the necessity of a lights-and-siren EMS response".

Advanced SEND also integrates with the ProQA medical dispatch system, which provides dispatch personnel with pre-arrival instructions to provide to responders at a scene.

Although to our knowledge no independent research has been conducted to evaluate the SEND protocol, a research poster by the International Academies of Emergency Dispatch provides some performance data [40]. Out of a ProQA dataset of 1377 calls, 658 calls were compliant with Protocol 38 (47.8%). The poster reports that in cases where Protocol 38 was not utilized or patient information was not provided, the result was over-triaging by dispatch personnel and over-sending resources. Calls coded at the Delta level using Protocol 38 (i.e., life-threatening emergencies) were accurately triaged and an appropriate response was coordinated. However, due to vague description of methodology and results, the quality of the study is uncertain.

BCE Global

Our grey literature search yielded a BCE Global Product Information Sheet. BCE Global offers a computer-aided dispatch (CAD) system that can be configured to user agencies' needs; includes GIS mapping; and integration with Records Management Systems, Mobiles and GPS/AVL, Station Alerting, Paging, E-Mail, Police Query Databases and, like Advanced SEND, ProQA triage software [41]. BCE Global also boasts the ability to mine data, as well as data security through encryption and two-factor authentication. We did not identify any independent literature related to BCE Global or the effectiveness of its dispatch tool.

5.5 Issues Related to Communication and Coordination among Agencies Responding to Same Incident

We identified 11 publications discussing issues related to communication and coordination among agencies responding to the same emergency, including lack of standardized protocol, lack of resources and poor coordination.

Lack of Standardized Protocol

Lack of standardized protocol between agencies has led to difficult collaborative approaches. A number of reports suggest that EMS teams provide the transport but are currently excluded from transport planning and advising on most appropriate level of care during transport [42, 43, 44]. Reports also suggest there is an imbalance in provincial control over EMS services resulting in dissatisfied municipal parties [43, 44]. Local concerns are unmet as there seems to be a lack of accountability framework and has resulted in failing to appropriately prioritize calls for service and over prioritizes calls leading to increase call shares with fire and police [43]. To streamline communication between agencies, a need for standardized and validated triage protocol and dispatch process is seen [42, 43, 44, 45]. Municipal

parties have also asked for an independently operated system, which they say will result in more accountability, transparency, and efficiency in addressing local concerns [43, 44].

Lack of resources

Lack of resources available to staff during calls has led to delayed and inefficient services. Such resources include incompatibility of patient care record from ambulance to hospitals leading to delay in obtaining important patient information [14], inaccurate triaging of patients to EMS services due to limited resource capacity at community and hospital sites [46], understaffing of call agents leading to decrease in productivity and accessibility to emergency call centers [47, 48], and call agents' inability to properly determine caller's location to relay dispatch proving to be detrimental to patient outcomes [49]. To improve triage, it has been suggested not to overload call centres and perhaps for every five call centre workers there should be nine instead to ensure the best response time to calls and most accurate triaging [48]. Other suggestions include identifying different delivery models to address unique needs and realities of patients in different locations [45], integrating parallel call systems and having them interface similarly [14], and having a better system in place for the referral coordination of patients [46].

Lack of Coordination/Clear Communication

A lack of coordination between EMS, emergency departments (ED), and system-wide management was found to contribute to ambulances staying at hospitals for extended periods of time in the City of Baltimore [50]. To address this issue, the Baltimore City Fire Department assigned a senior EMS paramedic to act as a medical duty officer within the fire communication bureau, the area responsible for triaging and dispatching emergency calls. The medical duty officer helped inform decisions about transport destinations based on current ED volume and communicated with hospital ED representatives to better distribute workload throughout the hospitals. Various outcomes were compared pre- and post- implementation of the medical duty officer model, including an additional comparison to a "seasonal match control" to adjust for seasonal variation in volume. The study indicated that the average at-hospital time decreased by 1.35 minutes from pre- to post-intervention periods and 4.53 minutes from the pre- to seasonal match control. This represented a statistically significant decrease, indicating that perhaps a qualified medical professional should be in place as a mediator for efficient communication and coordination.

Another study evaluated the communication between general practitioners (GP) requesting rapid ambulance response and staff at the EMDC in Southern Denmark [51]. In Denmark, individuals have the option of dialing 1-1-2 to obtain emergency assistance from fire, police, or EMS. However, they can also call their GP or a regional after-hours call centre if they need sudden medical attention. At times GPs will call the EMDC to order an ambulance directly if needed, which may include sending extra resources such as a mobile emergency care unit. An audit of calls within this model found that in 18% of all calls, there was not sufficient information to assess whether the case required additional resources along with the dispatch of an ambulance. In 72% of these cases, it was determined that the staff at the EMDC did not ask relevant questions that would have aided in this decision. Notably, in 78% of the calls, the GP has not actually seen the patient, which may also have been a factor in the information available.

5.7 System Factors Impact on Response Times

System factors were categorized as aspects of the broader environment and health system that may impact EMS dispatch and response. Overall, there was scarcity of literature in this area, with only five articles involving some aspect of system factors. The articles identified found international comparisons in EMS and health care models; approaches to EMS delivery such as the use of community paramedics;

impact of destination interval or turnaround time on EMS availability; impact of payment models on EMS transport; and the importance of time of day and geographic location considerations in resource planning. While a summary of each of these areas is provided below, more research may be needed to determine the true effect due to the lack of available literature.

International Comparison

Page et al., provide a high-level summary of EMS systems across various countries [52]. Of note, in Table 6 (page 88), they provide a comparison of countries across a number of categories, some of which could be categorized as health system factors: whether the Anglo-American model or the Franco-German model is used; if the country has a public health care system; if there are EMT's available with knowledge of basic life support, intermediate life support, and advanced life support; and the average response time for EMS systems. They highlight highly trained doctors providing pre-hospital care, motorcycle use for first responders, and desire for constant improvements as strengths across the countries, while non-homogeneous practices across the country are deemed a weakness. Of note, they do not actually reference how these strengths and weaknesses were determined. While the authors do make these comparisons across various countries, they do not correlate any of the summary categories with outcomes related to EMS response. As such, it is difficult to determine the impact of any of the summary categories related to health systems factors on response times and patient outcomes.

Community Paramedic Program

Lazarenko and Thain provide a summary of the Calgary Zone Community Paramedic Program (CPP) that has been in operation since 2012 [46]. At the time of the report, ten FTE Community Paramedics (CP) and seven causal staff provided coverage from 6:00 a.m. and 10:00 p.m., 7 days per week, including holidays, 365 days per year. CPs respond to calls in a sports utility vehicle, which is equipped for assessment and treatment, without ambulance transport capability. The CPs are able to use real-time physician consultation by establishing contact with the patient's primary physician or through the Medical Consultation Network.

There is significant demand for the program, and in 2015 CPs provided care for 400-500 patients per month, with ~6000 events expected over the total year. The program has been shown to positively impact both health outcomes and health care system outcomes. In a sample of patients evaluated seven days after a CP visit, 95% of patients improved in the community and only 5% required hospitalization. 80% of the patients that were visited by CPs were treated in their homes as opposed to being transported to hospital by EMS to receive assessment and treatment. In 2014 alone, nearly 2,400 EMS and emergency department/hospital admissions were avoided. Cost avoidance or cost capacity building was estimated to be $1.4 million in 2014 and given the program more than doubled the capacity from 2014, 2015 cost capacity back to the health care system was estimated to be $4.8 million.

Destination Interval

Lazarenko and Thain state that the greatest challenge affecting current availability of EMS resources was the EMS transfer care times at tertiary hospitals in major cities [46]. The 'destination interval', often referred to as 'turnaround time', is measured from when the ambulance arrives at the hospital to when the ambulance has been cleared and available to take another call.

The Calgary Zone AHS EMS and Calgary Zone Emergency Departments conducted a Destination Interval Study to better understanding inefficiencies in processes and technologies, develop an understanding of key hand-off points, and identify opportunities for process improvement. The study found that destination interval was impacted by:

- “EMS line at triage
- Waiting for paperwork/admitting
- EMS crew asked to wait in hallway for a “few minutes”/bed pending
- Triage being interrupted during report to answer phone, speak to colleagues, or answer physician questions
- Crew taking lunch/bio/snack breaks
- Bedside report delayed
- Delay waiting for housekeeping
- Delay as EMS providing patient care
- ED testing/treatment occurring in hallway
- EMS searching for a wheelchair to transport patient”

Payment Models

In an EMSWORLD editorial, Overton discusses how the payment and financial incentive models can greatly impact the way dispatch and resource allocation occurs [53]. For example, in the United Kingdom, an initial Medical Priority Dispatch system is used when someone calls into 9-9-9. Traditional emergency resources are dispatched immediately for clinically necessary events (e.g., stroke, major trauma, cardiac arrest). However, calls determined low acuity are either transferred to specially trained National Health System nurses or a solo advanced care practitioner may be dispatched to their location for treatments such as sutures and antibiotics. Overton discusses how in the United States specifically, payment models that focus on payment for services (i.e., EMS agencies get paid for transporting patients to the emergency department) create the wrong incentives because if the agency is not transporting patients, they do not get paid. He states that single payer systems encourage the allocation of “the right resource to the right patient at the right time” given transportation to the emergency department costs the system money and there is incentive to reduce that cost if the transfer is not necessary. Further, Overton explains that when health systems have payment models where they earn revenue when more patients come to the emergency department, such as in some United States settings, there is little incentive for participation in systems that reduce EMS transports to the hospital. Payment models are an important consideration when exploring ways to ensure patients are only transported when medically necessary and not because of the way the system is financially incentivized.

Geographic Location and Time of Day

Hegenberg et al. examined the use of pre-hospital EMS in urban and rural municipalities in Germany over a 10-year period [54]. While the specific data is not relevant to this review given the German context, it is important to note that they did find a significant difference between emergency rates in rural and urban regions, with higher rates in urban municipalities. Both Hegenberg et al. and Lazarenko and Thain found a clear temporal distribution of emergencies [54, 46]. In the Calgary context within the Community Paramedic Program, peak hours tended to be from 10:00 a.m. to 6:00 p.m. [46]. For Hegenberg et al., emergency rates seemed to peak midday, with another peak occurring around 5:00 p.m. [54]. These variations in emergencies based on geography and time of day need to be considered during resource planning and allocation.

6 Summary and Recommendations

The W21C conducted a review of academic and grey literature and found that EMS dispatch is an under-researched field. For example, we identified and describe several tools used for triage in dispatch operations, however empirical evidence of their performance is limited, if available at all.

Best practices (and corresponding evidence) in both triage and communication/coordination with other agencies was scarce, therefore in this report we summarize different practices and models in various jurisdictions that show some potential to improve dispatch operations, but we are reluctant to apply the "best practice" moniker. Based on the review, some practices and approaches to consider in improving triage accuracy and dispatch processes include:

- Optimized coordination of low acuity calls
- Community first responder schemes and rapid response units
- EMS consolidation
- Dynamic deployment of EMS units
- Frameworks for medical surge planning; and
- Advanced SEND System

Identified practices to improve communications and coordination when multiple agencies are responding to an incident include EMS consolidation; using a Shared Mental Model, especially when parties are not co-located; and implementation of multi-agency dispatch systems, including Advanced SEND Protocol and BCE Global system.

Similarly, literature regarding issues related to triage and communication/coordination with other agencies in dispatch operations was not abundant. Issues related to triage accuracy included utilization of non-medical professionals, over-reliance on computer assisted dispatch systems, liberal use of an "unclear problem" category, and communication and language barriers. Issues related to communication and coordination with other agencies included lack of standardized protocols and lack of resources.

Finally, we were surprised to find limited information regarding system issues that impact EMS response times, and it may be that such factors are knowledge held by industry insiders that are not documented. System issues that we did identify were related to health care models and approaches to EMS delivery; impact of destination interval or turnaround time on EMS availability; impact of payment models on EMS transport; and the importance of time of day and geographic location considerations in resource planning.

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8 APPENDIX A

Search Strategy

Keywords:

Concept	Synonyms
Emergency Medical Service (EMS)	"emergency medical service*" [Keyword]; emergency medical services [MeSH]; EMS [Keyword]; "emergency care" [Keyword]; "emergency health service*" [Keyword]; emergicenter* [Keyword]; emergicentre* [Keyword]; "emergency medical technician*" [Keyword]; emergency medical technicians [MeSH]; EMT [Keyword]; "emergency paramedic*" [Keyword]; "emergency responder*" [Keyword]; emergency responders [MeSH]; "emergency first responder*" [Keyword]; "first responder*" [Keyword]; "emergency medical service communication system*" [Keyword]; emergency medical service communication systems [MeSH]; "EMS communication system*" [Keyword]; "emergency medical dispatcher*" [Keyword]; "prehospital emergency care" [Keyword]; paramedic* [Keyword]; "emergency medical responder*" [Keyword]
Dispatch	"emergency medical dispatch" [Keyword, MeSH]; "911 dispatch" [Keyword]; "9-1-1 dispatch" [Keyword]; "emergency medical dispatcher*" [Keyword]; emergency medical dispatcher [MeSH]; "911 dispatcher*" [Keyword]; "9-1-1 dispatcher*" [Keyword]; "medical emergency service*" [Keyword]; "call center*" [Keyword]; "call centre*" [Keyword]; call centers [MeSH]; "public safety answering point" [Keyword]; PSAP [Keyword]; "primary public safety answering point" [Keyword]; "primary PSAP" [Keyword]; "secondary public safety answering point" [Keyword]; "secondary PSAP" [Keyword]; "central ambulance communications centre" [Keyword]; "central ambulance communications center" [Keyword]; CACC [Keyword]; "ambulance communications services" [Keyword]; ACS [Keyword]; EMD [Keyword]; "system status controller" [Keyword]; SSC [Keyword];
Response	"response time" [Keyword]; time* adj3 response*; deployment [Keyword]; "deployment plan" [Keyword]; "system status management"

	[Keyword]; “dynamic deployment” [Keyword]; “static deployment” [Keyword]; “fluid deployment” [Keyword]; “response time performance plan” [Keyword]; “response plan” [Keyword]; “temporal analysis” [Keyword]; “temporal trend*” [Keyword]; “clinical response plan” [Keyword]; “clinical response model” [Keyword];
Call Priority	triage [Keyword, MeSH]; priorit* [Keyword]; “health priorities” [Keyword, MeSH]; “priority sequence” [Keyword]; “call priority” [Keyword]; priorit* adj3 call*; “incoming call*” [Keyword]; “simultaneous call*” [Keyword]; “medical priority dispatch” [Keyword]; “medical priority dispatch system” [Keyword]; “triage system” [Keyword]; “emergency triage” [Keyword]; “emergency triage system” [Keyword]
Communication with Other Agencies Involved in Emergency Response	Communication [Keyword, MeSH]; coordination [Keyword]; “communication barrier*” [Keyword]; communication barriers [MeSH]; “communication method*” [Keyword]; communication methods, total [MeSH]; “health communication” [Keyword, MeSH]; “emergency medical service communication system*” [Keyword]; emergency medical service communication systems [Keyword]; collaboration [Keyword]; “intersectoral collaboration” [Keyword, MeSH]; “cooperative behavior” [Keyword, MeSH]; “cooperative behaviour” [Keyword]; “interagency relation*” [Keyword]; “interinstitutional relation*” [Keyword]; interinstitutional relations [MeSH]; “consolidated dispatch” [Keyword]; “dispatch consolidation” [Keyword]; “integrated dispatch” [Keyword]; “co-facilitated dispatch” [Keyword]; “computer assisted dispatch” [Keyword];
Health System Issues Impacting Response Times	“health system issue*” [Keyword]; issue* [Keyword]; problem* [Keyword]; concern* [Keyword]; glitch* [Keyword]; “technical glitch” [Keyword]; “technical error*” [Keyword]; “call overload*” [Keyword]; overload* adj3 call*; “system malfunction” [Keyword]; error* [Keyword]; “system error*” [Keyword]; “low acuity” [Keyword]; “primary care” [Keyword]; “primary health care” [Keyword, MeSH]; “hospital offload delay*” [Keyword]; “ambulance offload delay*” [Keyword]; “ambulance ramping” [Keyword]; “ambulance wait time*” [Keyword];

	“call volume” [Keyword]; “paramedic shortage*” [Keyword];

Suggested Search Strings:

(paramedic* OR “emergency medical responder*”) AND (“public safety answering point”OR PSAP OR “primary public safety answering point” OR “primary PSAP” OR “secondary public safety answering point” OR “secondary PSAP” OR “central ambulance communications center” OR “central ambulance communications centre” OR CACC OR “ambulance communications services” OR ACS OR EMD OR “system status controller” OR SSC)

(paramedic* OR “emergency medical responder*”) AND (“public safety answering point”OR PSAP OR “primary public safety answering point” OR “primary PSAP” OR “secondary public safety answering point” OR “secondary PSAP” OR “central ambulance communications center” OR “central ambulance communications centre” OR CACC OR “ambulance communications services” OR ACS OR EMD OR “system status controller” OR SSC) AND (“medical priority dispatch” OR “medical priority dispatch system” OR “triage system” OR “emergency triage” OR “emergency triage system”)

(paramedic* OR “emergency medical responder*”) AND (“public safety answering point”OR PSAP OR “primary public safety answering point” OR “primary PSAP” OR “secondary public safety answering point” OR “secondary PSAP” OR “central ambulance communications center” OR “central ambulance communications centre” OR CACC OR “ambulance communications services” OR ACS OR EMD OR “system status controller” OR SSC) AND (“consolidated dispatch” OR “dispatch consolidation” OR “integrated dispatch” OR “co-facilitated dispatch” OR “computer assisted dispatch”)

(paramedic* OR “emergency medical responder*”) AND (“public safety answering point”OR PSAP OR “primary public safety answering point” OR “primary PSAP” OR “secondary public safety answering point” OR “secondary PSAP” OR “central ambulance communications center” OR “central ambulance communications centre” OR CACC OR “ambulance communications services” OR ACS OR EMD OR “system status controller” OR SSC) AND (“low acuity” OR “primary care” OR “primary health care” OR “hospital offload delay*” OR “ambulance offload delay*” OR “ambulance ramping” OR “ambulance wait time*”OR “call volume” OR “paramedic shortage*”)

(paramedic* OR “emergency medical responder*”) AND (deployment OR “deployment plan” OR “system status management” OR “dynamic deployment” OR “static deployment” OR “fluid deployment” OR “response time performance plan” OR “response plan” OR “temporal analysis” OR “temporal trend*”OR “clinical response plan” OR “clinical response model”)

(paramedic* OR “emergency medical responder*”) AND (deployment OR “deployment plan” OR “system status management” OR “dynamic deployment” OR “static deployment” OR “fluid deployment” OR “response time performance plan” OR “response plan” OR “temporal analysis” OR “temporal trend*”OR “clinical response plan” OR “clinical response model”) AND (“medical priority dispatch” OR “medical priority dispatch system” OR “triage system” OR “emergency triage” OR “emergency triage system”)

(paramedic* OR “emergency medical responder*”) AND (deployment OR “deployment plan” OR “system status management” OR “dynamic deployment” OR “static deployment” OR “fluid deployment” OR “response time performance plan” OR “response plan” OR “temporal analysis” OR “temporal trend*”OR “clinical response plan” OR “clinical response model”) AND (“consolidated dispatch” OR “dispatch consolidation” OR “integrated dispatch” OR “co-facilitated dispatch” OR “computer assisted dispatch”)

(paramedic* OR “emergency medical responder*”) AND (deployment OR “deployment plan” OR “system status management” OR “dynamic deployment” OR “static deployment” OR “fluid deployment” OR “response time performance plan” OR “response plan” OR “temporal analysis” OR “temporal trend*”OR “clinical response plan” OR “clinical response model”) AND (“low acuity” OR “primary care”

OR “primary health care” OR “hospital offload delay*” OR “ambulance offload delay*” OR “ambulance ramping” OR “ambulance wait time*”OR “call volume” OR “paramedic shortage*”)

(“emergency medical service*” OR EMS OR “emergency care” OR “emergency health service*” OR emergicenter* OR emergicentre* OR “emergency medical technician*” OR EMT OR “emergency paramedic*” OR “emergency responder*” OR emergency responders OR “emergency first responder*” OR “first responder*” OR “emergency medical service communication system*” OR “EMS communication system*” OR “medical emergency service*” OR “prehospital emergency care”) AND (“emergency medical dispatch” OR “911 dispatch” OR “9-1-1 dispatch” OR “emergency medical dispatcher*” OR “911 dispatcher*” OR “9-1-1 dispatcher*” OR “call center*” OR “call centre*”)
(“emergency medical service*” OR EMS OR “emergency care” OR “emergency health service*” OR emergicenter* OR emergicentre* OR “emergency medical technician*” OR EMT OR “emergency paramedic*” OR “emergency responder*” OR emergency responders OR “emergency first responder*” OR “first responder*” OR “emergency medical service communication system*” OR “EMS communication system*” OR “medical emergency service*” OR “prehospital emergency care”) AND (“emergency medical dispatch” OR “911 dispatch” OR “9-1-1 dispatch” OR “emergency medical dispatcher*” OR “911 dispatcher*” OR “9-1-1 dispatcher*” OR “call center*” OR “call centre*”) AND (triage OR priorit* OR “health priorities” OR “priority sequence” OR “call priority” OR “incoming call*” OR “simultaneous call*”)
(“emergency medical service*” OR EMS OR “emergency care” OR “emergency health service*” OR emergicenter* OR emergicentre* OR “emergency medical technician*” OR EMT OR “emergency paramedic*” OR “emergency responder*” OR emergency responders OR “emergency first responder*” OR “first responder*” OR “emergency medical service communication system*” OR “EMS communication system*” OR “medical emergency service*” OR “prehospital emergency care”) AND (“emergency medical dispatch” OR “911 dispatch” OR “9-1-1 dispatch” OR “emergency medical dispatcher*” OR “911 dispatcher*” OR “9-1-1 dispatcher*” OR “call center*” OR “call centre*”) AND (Communication OR coordination OR “communication barrier*” OR “communication method*” OR “health communication” OR “emergency medical service communication system*” OR collaboration OR “intersectoral collaboration” OR “cooperative behavior” OR “cooperative behaviour” OR “interagency relation*” OR “interinstitutional relation*”)

(“emergency medical service*” OR EMS OR “emergency care” OR “emergency health service*” OR emergicenter* OR emergicentre* OR “emergency medical technician*” OR EMT OR “emergency paramedic*” OR “emergency responder*” OR emergency responders OR “emergency first responder*” OR “first responder*” OR “emergency medical service communication system*” OR “EMS communication system*” OR “medical emergency service*” OR “prehospital emergency care”) AND (“emergency medical dispatch” OR “911 dispatch” OR “9-1-1 dispatch” OR “emergency medical dispatcher*” OR “911 dispatcher*” OR “9-1-1 dispatcher*” OR “call center*” OR “call centre*”) AND (“health system issue*” OR issue* OR problem* OR concern* OR glitch* OR “technical glitch” OR “technical error*” OR “call overload*” OR “system malfunction” OR error* OR “system error*”)

(“emergency medical service*” OR EMS OR “emergency care” OR “emergency health service*” OR emergicenter* OR emergicentre* OR “emergency medical technician*” OR EMT OR “emergency paramedic*” OR “emergency responder*” OR emergency responders OR “emergency first responder*” OR “first responder*” OR “emergency medical service communication system*” OR “EMS communication system*” OR “medical emergency service*” OR “prehospital emergency care”) AND “response time*”

("emergency medical service*" OR EMS OR "emergency care" OR "emergency health service*" OR emergicenter* OR emergicentre* OR "emergency medical technician*" OR EMT OR "emergency paramedic*" OR "emergency responder*" OR emergency responders OR "emergency first responder*" OR "first responder*" OR "emergency medical service communication system*" OR "EMS communication system*" OR "medical emergency service*" OR "prehospital emergency care") AND "response time*" AND (triage OR priorit* OR "health priorities" OR "priority sequence" OR "call priority" OR "incoming call*" OR "simultaneous call*")
("emergency medical service*" OR EMS OR "emergency care" OR "emergency health service*" OR emergicenter* OR emergicentre* OR "emergency medical technician*" OR EMT OR "emergency paramedic*" OR "emergency responder*" OR emergency responders OR "emergency first responder*" OR "first responder*" OR "emergency medical service communication system*" OR "EMS communication system*" OR "medical emergency service*" OR "prehospital emergency care") AND "response time*" AND (Communication OR coordination OR "communication barrier*" OR "communication method*" OR "health communication" OR "emergency medical service communication system*" OR collaboration OR "intersectoral collaboration" OR "cooperative behavior" OR "cooperative behaviour" OR "interagency relation*" OR "interinstitutional relation*")
("emergency medical service*" OR EMS OR "emergency care" OR "emergency health service*" OR emergicenter* OR emergicentre* OR "emergency medical technician*" OR EMT OR "emergency paramedic*" OR "emergency responder*" OR emergency responders OR "emergency first responder*" OR "first responder*" OR "emergency medical service communication system*" OR "EMS communication system*" OR "medical emergency service*" OR "prehospital emergency care") AND "response time*" AND ("technical error*" OR "call overload*" OR "system malfunction" OR error* OR "system error*")

Databases:
CINAHL; Cochrane Database of Systematic Reviews; EMBASE; MEDLINE (Ebsco); MEDLINE (Ovid); PsycINFO; PubMed; Web of Science
Grey Literature:
AHS Insite; Alberta College of Paramedics; Google; Google Scholar; International Academies of Emergency Dispatch; National Association of EMS Physicians; National Fire Protection Association; OAISter; Paramedic Association of Canada
Limits:
Language: English
Publication Date: last 10 years (2012 – present)
Geography:

APPENDIX B: ARECCI ethics screening tool report

ARECCI Ethics Screening Tool Report

arecci.albertainnovates.ca

Form Submitted: 30/06/2022

This does not constitute / represent a formal ethics ruling. Individuals are advised to additionally follow the policies or consult their local ethics authority. ARECCI helps project leads address and mitigate ethical risks by providing decision support tools, training opportunities, and project ethics consultation. albertainnovates.ca/programs/arecci/

Scoring Explanation

Score Result	Risk & Recommended Ethics Review
47 or Greater	**Definitely greater than minimal:** Organization's recognized review process* using ARECCI Ethics Guidelines for Quality Improvement and Evaluation Projects. *Review by a duly constituted group independent of the project team, that is trained to do project ethics reviews and whose decisions are recognized by the organization.
8 - 46	**Somewhat more than minimal:** Second Opinion Review** using ARECCI Ethics Guidelines for Quality Improvement and Evaluation Projects. **Review by an individual trained to do project ethics reviews who has no vested interest in the outcome of the project.
0 - 7	**Minimal:** Project leader uses ARECCI Ethics Guidelines for Quality Improvement and Evaluation Projects

Project Details

Project Title: EMS incident

Your score is 78

The project involves Definitely Greater Than Minimal Risk and should receive full review consistent with local policies.

Type of Project
- Program Evaluation
- Quality Improvement

Your Location
Calgary
Canada

Questions that affected your final score:

14. Likelihood that a breach of confidentiality could place participants at risk of legal liability, denial of insurance or other damage to financial standing, employability, or reputation?

13 pts

17. Questions that collect information about sensitive issues, illegal behaviour, stigmatizing conditions or behaviours, or religious or cultural beliefs or practices?

2 pts

21. Collection of data from voice, video, digital or image recordings?

2 pts

22. Personally identifiable data, documents, records or specimens originally collected solely for purposes not related to the current study?

2 pts

25. Risks of breaching the confidentiality of any individual's personal information beyond that experienced in the provision of routine service or day-to-day life?

11 pts

26. A person who does not normally have access to participant records and whose use of records is for a secondary purpose?

11 pts

27. Any significant departure from the routine care, program, or service provided to participants or the gathering of information about participants beyond that normally collected?

13 pts

28. Risks or burdens for participants which are beyond what would be experienced in routine care or beyond what a reasonable person might expect in day-to-day interactions?

12 pts

29. Questions or procedures that might cause participants psychological distress, discomfort or anxiety beyond what a reasonable person might expect in day to day interactions?

12 pts

Preliminary Questions

1. Is there an explicit requirement for review of this project by a Research Ethics Board as part of its funding arrangements?
No

2. Are there any local policies that require this project to undergo review by a Research Ethics Board?
No

3. Does the project involve use of a pharmaceutical device, drug or natural health product under Health Canada Food and Drug Act regulations or guidelines?
No

Primary Purpose of the Project

4. Is the project designed to test a specific hypothesis or answer a specific quantitative or qualitative question?
Yes

5. Does the project involve a comparison of control groups?
Yes

6. Is the project designed to support generalizations that go beyond the particular population the sample is being drawn from?
No

7. Does the project impose any additional burdens on participants beyond what would be normally expected or normally experienced during the course of care, program participation or role expectations?
Yes

8. Is the primary purpose of the project to produce the kind of results that could be published in a research journal?
No

9. Will project participants also likely be among those who might potentially benefit from the result of the project as it proceeds?
Yes

10. Is the project intended to develop a better practice within your organization or setting?
Yes

11. Would this project still be done at your site even if the results might not be applicable anywhere else?
Yes

12. Does the language used in the project description refer specifically to features of a particular program, organization, or locale, rather than using more general terminology such as rural vs. urban populations?
Yes

13. Is the current project part of a continuous process of gathering or monitoring data within an organization?
No

Below are your responses to the Screening Tool questions.

These response options are weighted.

- A ✔ indicates a "Yes" response. Affirmative responses are identified as areas of ethical risk. Please review.
- A ✖ indicates a "No" Response.

Your score indicates that the most probable purpose of your project is Quality Improvement or Program Evaluation. Please proceed to determine the category of risk to your participants.

Risk Filter for Quality Improvement and Program Evaluation

Does your project involve...

14. Likelihood that a breach of confidentiality could place participants at risk of legal liability, denial of insurance or other damage to financial standing, employability, or reputation?

- **Yes** ✔
- No

15. A real or potential conflict of interest between an investigator and the sponsor of the investigation?

- **Yes**
- No ✖

16. A power relationship between the investigator and participants (e.g., manager/employee, therapist/client, service provider/recipient, teacher/student)?

- **Yes**
- No ✖

17. Questions that collect information about sensitive issues, illegal behaviour, stigmatizing conditions or behaviours, or religious or cultural beliefs or practices?

- **Yes** ✔
- No

18. Inexperienced project leads?

- **Yes**
- No ✖

19. Collection of data through technical procedures or diagnostic tools routinely employed in the setting?

- **Yes**

- No ✗

20. The use of tests, surveys, interviews, oral history, focus groups, or observation of public behaviour where the participants can be directly or indirectly identified through the information recorded?
- **Yes**
- No ✗

21. Collection of data from voice, video, digital or image recordings?
- **Yes** ✓
- No

22. Personally identifiable data, documents, records or specimens originally collected solely for purposes not related to the current study?
- **Yes** ✓
- No

23. Special populations or any individuals or groups in a socially vulnerable position?
- **Yes**
- No ✗

24. An original or novel process for which it would be difficult to estimate a balance of risk and benefit in advance?
- **Yes**
- No ✗

25. Risks of breaching the confidentiality of any individual's personal information beyond that experienced in the provision of routine service or day-to-day life?
- **Yes** ✓
- No

26. A person who does not normally have access to participant records and whose use of records is for a secondary purpose?
- **Yes** ✓
- No

27. Any significant departure from the routine care, program, or service provided to participants or the gathering of information about participants beyond that normally collected?
- **Yes** ✓
- No

28. Risks or burdens for participants which are beyond what would be experienced in routine care or beyond what a reasonable person might expect in day-to-day interactions?
- **Yes** ✓
- No

29. Questions or procedures that might cause participants psychological distress, discomfort or anxiety beyond what a reasonable person might expect in day to day interactions?

- **Yes** ✓
- No

30. Intended deception or intended incomplete disclosure of the nature of the investigation?
- **Yes**
- No ✗

31. Evaluation of the safety and effectiveness of a mechanical device, drug, or natural health product?
- **Yes**
- No ✗

32. Clinical studies on a device, drug or natural health product where Health Canada review and approval is not required?
- **Yes**
- No ✗

33. Therapeutic procedures that are themselves known to pose considerable risks of harm?
- **Yes**
- No ✗

34. Any procedures related to anesthetics, sedation, or any alteration of medication that is not normally part of participant care or health?
- **Yes**
- No ✗

35. Non-invasive procedures beyond what is normally required for participant care?
- **Yes**
- No ✗

APPENDIX C: Interview preamble script

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Review Scope

I will attempt to set the stage for the interviews. I will describe the scope of the review, the intent of today's conversation, and how the information will be protected. Should you have any questions, I would be happy to respond to those.

In terms of the scope, this is a **Quality Assurance Review** that is looking into the **structure, process, and protocols** related to the EMS response as well as the system factors that may have contributed to the EMS response time to the dog attack on June 5.

In terms of the intention of today's conversation, review team first tried to develop a good understanding of what happened in this event. We create a timeline or chronology of events with all the details that happened. Then we try to understand it within the context of the system, or in this case systems. In this case the systems are quite broad, and includes EMS dispatching processes, the EMS response from paramedics as well as to the emergency department and throughput at the emergency departments. It also includes EMS's partner agencies including Calgary 911 (C911), CPS, Bylaw, and CFD. All of this is to understand what happened in the event in relation to the system that they occurred within. Then we look at what could have or should have occurred. This involves looking at local policies and procedures. It also includes a jurisdictional review to identify best practices from the literature, other organizations, or regulatory agencies. All of that is to create system-level recommendations to help improve the system.

The word system is important, because the scope of our review is really about the system and not about any of the individuals involved. Outside the scope would be assessing accountability of any individuals who may or may not have had a role in any of the event happenings. Instead, we focus on system-level improvements. In other words, what could be done from a system perspective to improve response times in general, and using the information from this event as an anchor for learning to identify those system-level recommendations.

So the intent of today's conversation is get a better understanding of what happened in the event as well as your opinions on how the system can improve. We are really interested to learn what you might know about the event, training, different protocols and so we'll go into all of those. That's really the intent of all of this is. [*Note: This paragraph was tailored to the individual being interviewed*].

In terms of protection of information. The HQCA has established a Quality Assurance Committee. That Quality Assurance Committee has enacted, what's called **Section 9, of the *Alberta Evidence Act***. This section indicates that information obtained for this review can only be used by this review. It also indicates:

- Any recordings of this interview, any notes, or data that's shared as part of any piece of this review can only be used for this Quality Assurance Review and it can't be used for other purposes.

- This allows the people we interview to be able to **speak openly and freely**, **discuss their opinions, share things that are factual or things that might be opinion based**, without worrying that any of that information would be used for any purposes outside of this review, including any legal proceedings.
- If a legal proceeding were to occur, and they asked us to share information, we wouldn't and couldn't share any information that we've learnt though this review.
- The only exemption would be a fatality inquiry. In that case, then we would be required to release any factual information that is shared with us, but nothing that would be opinion based. All of the interviews continue to be protected. Things like documents, or the recommendations from the review, might be releasable.
- All of this to create a final report with recommendations. That report will be made public. The report will not name any of the individuals involved in the event, or any individual we interviewed. In summary, all information you provide today will be protected and remain confidential.

Any questions, of the scope intentions?

My last comment is that we understand that the talking about event might elicit emotions. If at any point during the conversation you feel that you would like to take a short break, have a glass of water, or even end the conversation, that would be very acceptable. We would have no concern if the interview was paused, delayed, or stopped as needed. All I ask is that you let us know if you feel you would like to pause, delay, or stop the interview at any point in the conversation.

APPENDIX D: Detailed description of Calgary's public safety answering point and AHS EMS response

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Public safety answering point (PSAP)

Across Canada the phone number used to report an emergency incident and request emergency first responders is 9-1-1 (911). When calling 911, the call is answered by a public safety answering point (PSAP) call taker who then determines the most appropriate response to the emergency. This decision is based on the initial information provided to the PSAP call taker by the caller, in answering a standard line of questioning by the PSAP call taker.

The National Emergency Number Association (NENA), a non-profit organization that develops voluntary standards for 911 technology and operations, defines best practice methods of preliminary caller interrogation used by PSAPs. This includes [*cited directly from source*]:

- All 911 lines at a primary public safety answering point (PSAP) shall be answered with the phrase "9-1-1" ("Nine One One")
- Agencies may elect to precede "9-1-1" with their agency name
- Additional information or questions may be added, as in:
    - "9-1-1, what is the emergency?"
    - "9-1-1 what is the address of the emergency?"
    - "9-1-1 what is the location and type of emergency?"[14]

In Alberta, legislative standards ensure 911 services across the province are:

> "…efficient, consistent and robust, and meet the Canadian Radio-television and Telecommunications Commission (CRTC) mandated capabilities and timelines and introduce cyber security requirements and increase interoperability to ensure that 911 centres provide agile, dynamic, and dependable 911 services for Albertans."[15]

The Alberta 9-1-1 Standards in place at the time of the event (Ver 2) prescribe the role of the PSAP [*cited directly from source*]:

- Responsible for obtaining the basic information from the caller. At a minimum, this information must include:
    i. Emergency service required
    ii. General location of the incident
    iii. Call back number of the caller
- Each PSAP will determine how to obtain the basic required information within its policies and procedures, such as by asking:

[14] https://cdn.ymaws.com/www.nena.org/resource/resmgr/standards/nena-sta-020.1-2020_911_call.pdf
[15] https://www.alberta.ca/alberta-911-program.aspx

- "What is your emergency?" or "Do you require fire, police, or ambulance?"

- The PSAP obtains from the caller the general location of the incident to determine the appropriate emergency service to transfer the call to, if required. Determining the town or city of the incident would qualify as "general location."[16]

The information provided to a PSAP originates from one of four possible sources:

1. **First-party caller** – the person making the call is calling for themselves (i.e., they are the patient, victim, etc.)
2. **Second-party caller** – the person making the call is present at the scene of the emergency or has direct knowledge of the situation and/or current condition
3. **Third-party caller** – the person making the call is not present at the scene of the emergency nor has direct knowledge of the situation and/or current condition (e.g., driving past an apparent emergency scene)
4. **Fourth-party caller** – the person making the call is from a connected partner agency. The person is requesting a response from the agency or providing/requesting information on a situation. This includes emergency agencies such as police, fire, or EMS as well as alarm companies, poison control, etc.

Primary and secondary PSAP

In Canada, 911 telecommunications services are regulated by the CRTC[17]. The CRTC regulates telephone and cell service companies who create networks that make it possible to connect 911 calls to multiple PSAPs. The operation of the PSAPs fall under the jurisdiction of provincial, territorial, and municipal governments. The model for how this service is provided is at the discretion of the local authority. Multiple configurations of PSAP services exist, with the most common model involving two or more PSAPs identified as a primary and a secondary.

The primary PSAP's only role is to answer the initial 911 call and quickly identify which type of emergency service (typically police, EMS, or fire) is best suited to be the lead agency to respond to the emergency. This is accomplished through a standard set of initial questions asked by the primary PSAP call taker who, depending on the information provided by the caller, then selects the lead agency. Once the lead agency is determined, the primary PSAP transfers the call to the lead agency's communication centre as the secondary PSAP. The secondary PSAP conducts a more detailed interrogation of the caller to determine an appropriate response.

PSAPs can operate as either a stand-alone or integrated model. A stand-alone PSAP is responsible for a single function, either to provide primary PSAP service or act as a secondary PSAP for a single agency type. An integrated PSAP is responsible for two or more functions or agency types. In this model, when the PSAP is operating as both a primary and secondary PSAP, a PSAP call taker answers a 911 call, asks the standard initial questions to determine the lead agency, and, if the

[16] https://open.alberta.ca/publications/alberta-9-1-1-standards-version-2
[17] https://crtc.gc.ca/eng/phone/911/

primary PSAP agency also acts as a secondary PSAP for that lead agency, does not transfer the call. Instead, the primary PSAP call taker continues with a more detailed call evaluation on behalf of the lead agency to formulate the response.

Responding to 911 calls in Calgary: a description of usual processes

When a 911 call is made in Calgary, the call is answered by Calgary 911 (C911), a public service provided within the Emergency Management and Community Safety Department of the City of Calgary. C911 provides primary PSAP services for the City of Calgary as well as for Rockyview County, the Municipal District of Bighorn, and seven additional communities.[18]

When the 911 call is answered by C911, standard questions are asked including:

- "9-1-1, what is your emergency?"
- "In what town or city?"

If at that time the call taker identifies EMS as the lead agency, a third question is asked:

- "Are there any weapons or violence?"[19]

Depending on the response provided, a lead agency is designated by C911 to further assess the call. The lead agency will be either police, fire, or ambulance.

C911 operates as an integrated PSAP. It provides primary and secondary PSAP services for CFD and CPS with slightly different processes for each. Primary PSAP call takers can evaluate calls on behalf of the CFD. That is, when fire is identified as the lead agency, the caller remains with the primary PSAP call taker who assesses the call.

For calls in which police are selected as the lead agency, the C911 primary PSAP call taker transfers the caller to the C911 police secondary PSAP, still within C911 but designated to provide services as the secondary PSAP on behalf of CPS. C911 is currently cross-training its primary PSAP call takers to evaluate police calls (in addition to the fire calls they already evaluate). When this is complete, only calls requiring an ambulance response will be transferred to a secondary PSAP.

When ambulance is identified as the lead agency, C911 transfers the call to an EMS secondary PSAP operated by AHS. AHS operates as a stand-alone model: a secondary PSAP for EMS only.

Whether police, fire, or ambulance, the 911 caller then speaks with a call taker (secondary PSAP call taker) associated with the lead agency who then questions the caller in more detail to develop an appropriate response.

[18] https://www.calgary.ca/structure/911.html
[19] C911: SOP – PSAP – ECO – Answering Incoming Calls (14 July, 2022)

Figure 1: C911 call process from the primary PSAP to secondary PSAP. Calls with police or ambulance as the lead are transferred to secondary PSAPs. Calls with fire as the lead are processed by the C911 primary PSAP call taker.

C911 is physically located in the city of Calgary and hosts on-premises PSAP services for both police and fire. In January 2021, AHS completed the centralization of EMS communications as a consolidated provincial secondary PSAP model with three stand-alone locations:

- Southern Communications Centre (SCC) in Calgary
- Central Communications Centre (CCC) in Edmonton
- Northern Communications Centre in Peace River

Prior to consolidation, EMS dispatch for the Calgary area was operated by C911 as an integrated tri-service delivery model (police, fire, and EMS).

As AHS EMS is a provincial system, calls transferred from the primary PSAP are answered by one of the three AHS secondary PSAPs. While any of the three centres can receive the 911 call, the communications centre designated to provide service for that community completes the dispatching of EMS resources. For example, a call placed in Calgary may be processed in the Central Communications Centre, but the dispatching of resources will be controlled by the Southern Communications Centre as it is responsible for service delivery in Calgary.

Summary of PSAP 911 Call Processes in Calgary

- C911 is the primary PSAP, answering all incoming 911 calls to determine lead agency.
- If fire is the lead agency, the C911 call taker remains on the call and further evaluates the call on behalf of CFD.
- If police is the lead agency, the C911 call taker transfers the call a C911 police call taker trained to evaluate calls on behalf of CPS, thereby acting as a secondary PSAP but located in the same facility.
- If ambulance is the lead agency, the call is transferred to one of three AHS communications centres as a secondary PSAP for EMS call evaluation.

PSAP roles

The response of emergency resources to a 911 event is managed through each agency's communications centre. Various roles conduct specific functions and tasks to promote a smooth workflow of call evaluation, resource assignment, response support, and return to readiness. The primary influencing factor in this process is resource availability in both the communications centre and emergency response assets (i.e., staff and vehicles).

In the AHS Southern Communications Centre (SCC) that provides service for southern Alberta, including Calgary, all personnel in the dispatch centre are identified as ECOs (emergency communications officers) and each ECO is responsible for a specific function:

Call taker – answers 911 calls transferred from C911 (primary PSAP), conducts medical call evaluation to determine a response priority, then transfers the call through a computer-aided dispatch (CAD) to a dispatcher.

Dispatcher – receives the call information such as location, priority, and other key details and assigns an EMS resource (i.e., ambulance) in order of urgency and based on ambulance availability and location.

Resource desk – provides support to the dispatcher for additional resources and task management required for the EMS response, such as answering phones for updates from partner agencies.

System status management (SSM) coordinator – ensures system readiness for other 911 responses through the dynamic deployment of available EMS resources.

Lead – ensures real-time situational awareness of the status of the system and provides supervisory support to the communications centre.

Deployment manager – provides overall system oversight, adjusting resource assignments and deployment to ensure appropriate levels of service and an effective and safe level of resources in the dispatch centre.

These functions are described in more detail below.

Call taker – call evaluation

When a 911 caller is transferred from the primary PSAP to the secondary PSAP, the call taker asks specific questions of the caller, following emergency dispatch protocols designed to draw out the most important information quickly and effectively to determine the required level of response. All three agencies – police, fire, and ambulance – use the Emergency Priority Dispatch System (EPDS) provided by Priority Dispatch Corporation (PDC). The dispatch protocols established by PDC are agency-specific in providing a triage system for medical (ambulance), police, and fire.

Medical Priority Dispatch System™ (MPDS®) – A structured, scripted approach guides call takers to quickly gather the needed information, dispatch help, and when necessary, provide lifesaving support.[20]

Police Priority Dispatch System™ (PPDS®) – Emergency dispatchers can communicate with police officers en route to a call and provide step-by-step instructions to callers while police are on the way.[21]

Fire Priority Dispatch System™ (FPDS®) – Dispatchers can relay important instructions to firefighters en route to a call.[22]

Call takers follow an algorithm of protocols within EPDS using either a physical card set or a computerized application known as ProQA. This technology guides emergency dispatchers in gathering essential information and dispatching resources, while recording each keystroke. The data gathered also helps determine what is happening in the dispatch centres.[23] All the PSAPs serving Calgary use ProQA specific to their discipline to evaluate first-, second-, and third-party callers.

Agencies using ProQA are eligible to be certified as Accredited Centres of Excellence (ACE) if they meet a 20-point set of stringent criteria reflecting globally recognized best practices.[24] This accreditation is governed by the International Academy of Emergency Dispatch (IAED)[25], the standard-setting organization for emergency dispatch and response services worldwide and the leading body of emergency dispatch experts.[26] The three AHS EMS communications centres and the Calgary Fire Department through C911 are ACE certified (AHS recertified in October 2019 and C911 fire PSAP recertified in January 2022). Though unaccredited, C911 uses the PPDS protocols.

When a call has been evaluated using the MPDS protocols, a "determinant" is generated that best describes the emergency event, the medical condition of the person involved, and a recommended level of response (priority). These determinants have three parts: problem code, level, and sub-determinant.

[20] https://prioritydispatch-media.s3.amazonaws.com/prioritydispatch.net/salessheets/PDC_MPDS_Sales_Sheet_v8_web.pdf
[21] https://prioritydispatch-media.s3.amazonaws.com/prioritydispatch.net/salessheets/PDC_PPDS_Sales_Sheet_v6.pdf
[22] https://prioritydispatch-media.s3.amazonaws.com/prioritydispatch.net/salessheets/Fire_7_Sales_Sheet_7_web.pdf
[23] https://prioritydispatch-media.s3.amazonaws.com/prioritydispatch.net/salessheets/PDC_ProQA_Calltaking_Software_FINALweb.pdf
[24] https://www.emergencydispatch.org/what-we-do/accreditation
[25] https://cdn.emergencydispatch.org/iaed/pdf/ace/NAE+EMD+Accred-Re-Accred.pdf
[26] https://www.emergencydispatch.org/who-we-are/about-the-iaed#iaed-about

Problem code – this is the primary nature of the emergency or the main complaint, listed alphabetically with corresponding ascending numbers as the problem code. As an example, Table 1 shows the first five of 36 possible problem codes in MPDS.

Table 1: First five problem codes listed alphabetically

Nature of Emergency/Chief Complaint	Problem Code
Abdominal pain	1
Allergic reaction	2
Animal bites	3
Assault	4
Back pain	5

Level/priority – based on answers given by the 911 caller to a series of standardized questions, the problem code is further defined using descriptors of seriousness, such as level of consciousness, breathing, hemorrhage, injury location, time of onset, etc. The descriptors are then matched to a level or priority code:

Table 2: MPDS priorities and description

Level/Priority	Description
Echo	Life threatening – cardiac or respiratory arrest
Delta	Life threatening other than cardiac or respiratory arrest
Charlie	Serious not life threatening – immediate
Bravo	Serious but not life threatening – urgent
Alpha	Non serious or life threatening
Omega	Minor illness or injury

Sub-determinant – provides more specific information about the patient's condition and is rated numerically, descending somewhat relative to urgency. The following sub-determinant example is for problem code 3 (animal bite) delta:

Table 3: Sub-determinant description

Determinant	Sub-determinant description
03D01	Arrest
03D02	Unconscious
03D03	Not alert
03D04	Chest or neck area (with difficulty breathing)
03D05	Dangerous body area
03D06	Large animal
03D07	Exotic animal
03D08	Mauling or multiple animals
03D09	Attack in progress

In the example above a determinant labelled as a '03D01' would refer to a patient who has been attacked by an animal (problem code 03), is a life-threatening priority (delta), and in cardiac arrest (sub-determinant 01). All told, there are more than 1,800 possible determinants in the MPDS protocols covering different emergencies and patient conditions.

The selected determinant informs the emergency response plan (Figure 2).

Figure 2: Call processing and response using Priority Dispatch System

Multiple agency response

In many emergencies, multiple first responder agencies may be required to attend. When the primary PSAP determines the most appropriate lead agency to initiate a response, the lead agency is responsible for including other agencies as required.

The National Emergency Number Association (NENA) provides best practice guidance on this process stating [*cited directly from source*]:

> When calls need to be transferred to another PSAP, the telecommunicator SHALL advise the caller which PSAP they are being transferred to, in addition to advising the caller to stay on the line while the call is being transferred, such as "Please do not hang up; I am connecting you with (name of the agency)." The telecommunicator SHALL then initiate the transfer without delay. The telecommunicator SHALL stay on the line to announce the call to the transfer PSAP call taker/telecommunicator (a.k.a., "warm transfer" or "attended transfer") and SHOULD relay the pertinent information, including, but not limited to:
>
> - Location
> - Callback number
> - Nature of the call
> - Known safety information

A local or regional policy may exist between primary and secondary PSAPs, or agencies that participate in a regional system, that addresses unattended call transfers; however, NENA recommends against unattended transfers.[27]

The Alberta 9-1-1 Standards (Ver 2)[28] state that for applicable call transfers [*cited directly from source*]:

a) Once the appropriate emergency service or PSAP has been determined, the call shall be transferred to another TC (*Telecommunicator aka ECO*), emergency service or PSAP as quickly as possible according to the minimum standards outlined in Section 3.1 of [the standards].

b) The TC shall instruct the caller not to hang up and shall advise the caller that they are being transferred to the appropriate emergency service.

c) When transferring a 911 call, to another PSAP, secondary PSAP, or dispatch authority, the PSAP TC will perform a supervised transfer, unless extenuating circumstances exist.

d) Non-emergency calls will be dealt with according to existing PSAP protocols.

Formal methods promoted by the IAED to share information between PSAPs include co-evaluation and the SEND (Secondary Emergency Notification of Dispatch) protocol.

Co-evaluation

A tenet of emergency dispatching is to try to convert third- and fourth-party callers to first- or second-party as the person experiencing the emergency or the person at the scene of the emergency has the best possible information about the situation.[29] In other words, the ideal is to reduce indirect sharing of information and have the call taker speaking directly to the person

[27] https://cdn.ymaws.com/www.nena.org/resource/resmgr/standards/nena-sta-020.1-2020_911_call.pdf
[28] https://open.alberta.ca/dataset/6d7e0ae9-a541-487c-880e-456e7b59879f/resource/c50006ae-2c44-4d4b-8b27-b502a88c5e2f/download/ma-alberta-9-1-1-standards-version-2-2021-01-27.pdf
[29] Retrieved from https://prioritydispatch.net/advancedsend/

closest to the on-scene situation. During lead agency call evaluation, if it is determined that a secondary agency is required – for example, a police matter that determines someone on the scene requires medical attention – a process known as co-evaluation is the preferred option to share pertinent information directly between the caller and the secondary agency.

In co-evaluation the lead agency establishes a three-way call between the 911 caller, the lead agency, and the secondary agency. Co-evaluation takes place at the 'send point' of call evaluation – the point at which the lead agency has collected enough information to dispatch an emergency resource, while staying on the line to determine what further actions may be needed. ProQA call evaluation can then be done by each agency with the other listening in to determine the most appropriate actions.

Currently there is no provincial standardization for co-evaluation procedures across Alberta PSAPs. Locally, C911 has developed a co-evaluation standard operating procedure.[30] The rational for this procedure is that "failure to provide timely updates on an event can have serious consequences." This process is intended to:

- Ensure competing priorities are managed in a methodical way, keeping scene safety, patient care, and police investigative needs as the priorities.
- Allow the primary agency who provides scene safety to be involved without delay.
- Update all responding agencies and allow their own policies to dictate their response.

Considerations to initiate co-evaluation include:

- imminent scene safety
- critical hazards
- preservation of life (e.g., serious or life-threatening injury, stabbing, gunshot wound)
- any event where there is an urgent need for a partner agency to attend

In these situations, the lead agency at C911 is to immediately bring the secondary agency on the line at the appropriate time and work together to complete the call evaluation process.

AHS EMS also has a Service Standard for Provincial Co-evaluation supported by an SOP[31] that directs EMS to:

- bring police or fire on the line with the caller as directed by protocol or the EMS Medical Director
- allow police or fire to ask questions when able to do so
- attempt to work in tandem to gain call details needed to complete the evaluation
- medical call evaluation must be completed in full unless imminent life-threatening danger to the caller, patient, or responders.

[30] C911 SOP: Combined – ECO and DISP – Co-evaluation and Multi-Agency Event Notifications (May 16, 2022)
[31] AHS Local Service Standard: Emergency Call Evaluating Processes (January 28, 2022)

SEND protocol

AHS EMS dispatchers and C911 police dispatchers are trained in the police and medical SEND (Secondary Emergency Notification of Dispatch) protocol of Priority Dispatch Corporation (PDC).

The SEND protocol is intended for use by trained agencies to guide emergency dispatchers to evaluate and record a reporting first responders on-scene assessment and send appropriate resources using an abbreviated call evaluating process.[32] EMS can use the police SEND protocol to request police when there is a paramedic on scene, and police can use the medical SEND protocol to request EMS when there is an officer on scene.

The medical SEND protocol includes seven key questions, of which six are asked depending on whether the emergency is medical (illness) or trauma (accident or injury) (Figure 3). In this report, the SEND protocol refers to the medical SEND protocol.

Figure 3: SEND protocol questions provided by Priority Dispatch Corporation

The SEND protocol's scripted questions are provided by PDC as either a manual process – reading from a hard or soft copy of a document – or Advanced SEND, an embedded protocol within ProQA. C911 and Alberta EMS use a manual process, reading from a physical hard copy of the protocol or accessing a soft version on the Computer Aided Dispatch (CAD) computer screen.

SEND is intended for use when a first responder of a trained agency is on the scene with the patient or victim and able to relay second-party information to their PSAP. Answers to the key questions are conveyed from the first responder's PSAP to the secondary agency's PSAP to determine the appropriate response from the secondary agency (Figure 4).

[32] https://prioritydispatch.net/advancedsend/

Figure 4: Intended medical SEND protocol application

The medical SEND protocol requires and relies on the knowledge and skills of trained professionals at the scene to recognize serious versus minor injuries, uncontrollable hemorrhage, and the necessity of a lights-and-siren EMS response.[33] The SEND protocol is not intended for use by untrained agencies or the public.

In addition to CPS, AHS EMS has trained more than 20 agencies on the medical SEND protocol, including:

- Aaron Paramedical Services
- Alberta Children's Hospital – Adult Patients
- Alberta Paramedical Services
- Calgary Airport Authority
- Calgary Airport Security Operations Center
- Camrose Police Service
- Edmonton Transit
- Edmonton International Airport
- Edmonton Police Service
- Grande Prairie Technical Search and Rescue
- Hart Paramedical Services

[33] https://prioritydispatch.net/advancedsend/

- Kananaskis Emergency Services
- Lake Louise Ski Patrol
- Lethbridge Police Service
- Marmot Basin Ski Patrol
- Medicine Hat 911 Dispatch
- Nakiska Ski Patrol
- Odyssey Medical Services
- Royal Canadian Mounted Police
- Sunshine Village Ski Patrol
- WinSport

A rapid narrative review of best practices and issues in EMS dispatch indicated that use of the Advanced SEND protocol in ProQA reduced over-triaging by dispatch personnel and over-sending resources. Calls coded using the Advanced SEND protocol in ProQA were accurately evaluated and an appropriate response was coordinated (see Appendix A).

Dispatch

As the call taker is evaluating a call and entering information into the CAD, at the point of address verification a "pre-alert" is sent to the dispatcher advising them a call is being taken and to prepare to receive the details. As call evaluation continues, ProQA generates a determinant and the dispatcher is able to assign the appropriate resource. The actions to implement a response are guided by several decision-aiding tools, primarily 'Recommend Monitor' and 'Response Plan.'

Recommend Monitor

The EMS CAD tracks the location and availability (status) of EMS response resources (e.g., ambulances) in real time. When a call is entered into the CAD, the Recommend Monitor tool provides a ranked listing of the four resources that could respond to the call. The ranking is determined by distance to the scene and estimated arrival time based on route and posted speed limits. It also considers whether the resource is fully available or available soon.

An 'available soon' resource is completing an event but expected to return to service shortly, pending confirmation they are able to leave the event they are currently assigned to. 'Available soon' also refers to units responding to lower-priority calls that could be diverted to higher-priority events, if they have not reached the patient.[34]

[34] AHS EMS Resource Document: EMS department/business area: EMS Dispatch Communications and Deployment. Preempt and Divert Procedure (February 28, 2022)

Response Plan

Response plans ensure an agency's limited emergency resources are managed efficiently by assigning, to the extent possible, the required resource(s) within the appropriate time. When properly evaluated through ProQA, the determinant (event) informs the appropriate response, including the resource type.

As detailed in Table 2, determinants that are life threatening are coded as Echo and Delta, and are the highest priority, meaning they require emergency resources to respond as quickly as possible. For less-critical determinants, coded as Charlie, Bravo, Alpha, and Omega (in descending order of urgency), response time becomes less of a factor in the response plan.

A safe and effective response plan depends on the correct determinant being selected through the call evaluation process. Achieving and maintaining accreditation in the use of ProQA provides quality assurances that call taking and determinant selection are completed with a high degree of accuracy.

In January of 2022 Alberta Health Services EMS implemented a response plan known as the Clinical Response Model (CRM). In collaboration with British Columbia, New Zealand, and New South Wales, Australia, AHS EMS measured patient outcomes in relation to MPDS determinants to define an appropriate priority of an EMS response. In April 2022, each determinant was assigned a colour priority to assist in decision-making for the dispatch of resources (Table 4).

Table 4: Colour coding in relation to determinant priority and urgency of response

Colour	Definition
Purple	Immediately life threatening – cardiac or respiratory arrest
Red	Immediately life threatening or time critical
Orange	Urgent – potentially serious but not life threatening
Yellow	Non urgent – not serious or life threatening
Blue	Minor, non-serious

When the number of calls requiring an ambulance exceeds the available resources, events are placed in a queue on one of two lists: 'held' or 'pending.' Events on the held list are deliberately kept in a queue, even if a resource becomes available, to preserve a supply of ambulances until more are available in the system overall. Events are put on the pending list when they need an ambulance but none are available. As resources are freed up, calls on the lists are assigned a response. The decision on which calls to assign first is based on colour code (level of urgency) and time in the queue.

If a high-priority call is received by EMS and there are no available units to respond, a pre-empt procedure diverts an ambulance away from a lower-priority call to the higher-priority call (Preempt and Divert Procedure). The lower-priority call would then be added to the pending list.

Resource desk

The dispatch function requires focused attention to many activities and the ability to prioritize tasks while coordinating emergency responses. This role is particularly vital when multiple calls are being responded to simultaneously, a common occurrence in the SCC. The function of the resource desk is to support the dispatcher with priority tasks, such as answering calls from partner agencies (typically police and fire) providing updates on incidents involving a multi-agency response.

Systems status management

Emergency service resources are deployed with the next call in mind – that is, to be best positioned in anticipation of the next emergency call received. Two methods of deployment are used: static and dynamic.

Static – deployment of resources is typically station-based; resources remain idle at a home station until a 911 call requires a response. After the call, the resource returns to the home station and waits for another call. This type of deployment is common for fire services covering a defined geographical area.

Dynamic – the deployment of resources in this model is fluid; the positioning of available resources shifts with changes in supply and demand. Also known as "temporal" deployment, spatial forecasting of 911 calls enables resources to be strategically located in anticipation of the next 911 call. This type of deployment is common for urban- and suburban-based EMS.

Specific to the Calgary Zone, AHS employs a dynamic model known as System Status Management (SSM). This practice is intended to maximize available resource potential in response time for high-priority calls.

Several technologies exist to help agencies with SSM and are particularly useful in larger systems where the volume of resources and activity makes manual tracking difficult. AHS uses Optima Live, a dynamic, real-time view of emergency resources to support dispatch in making critical decisions. In conjunction with the CAD system, Optima Live enables dispatchers to see visual and statistical information about the status, location, and availability of resources.[35]

The role of the SSM coordinator is to oversee all EMS resources and relocate them to be able to respond quickly in anticipation of the next 911 call. This role also serves as an "overflow" to the resource desk when all other ECOs are completing other priority tasks. The SSM coordinator position requires significant training and expertise; only a few ECOs are trained for this role.

Lead

The lead role is responsible for overall supervisory support to the ECOs, requiring high-level situational awareness of the state of the communications centre and the entire EMS system. The lead may need to complete various tasks when the centre is overwhelmed with activity, including being another overflow to the resource desk, secondary to the deputy manager. The lead can liaise

[35] https://www.hmpgloballearningnetwork.com/site/emsworld/product/optima-live

with the leads for both police and fire at C911 via direct phone line. Contact between the leads is intended for incidents requiring escalation beyond the ECOs and major event notification.

Deployment manager

The deployment manager provides overall system oversight, adjusting resource deployment and assignments to ensure appropriate levels of service and a safe, effective level of resources for the dispatch centre. The deployment manager is an advanced care paramedic and can support ECOs in assigning a call determinant and associated resource.

Paramedic response

Dispatch assigns an AHS paramedic unit using digital paging, voice radio (VR), or a mobile data terminal (MDT) known as a mobile CAD. The mobile CAD is the primary means of notifying paramedics of a call and providing detailed information specific to the response. The mobile CAD is a laptop mounted in the cab of the vehicle with a computer touch display that includes:

- call details including the MPDS determinant indicating the response priority
- address information
- routing/mapping to the call location to guide paramedics to the scene
- call notes – free-text entries by the call taker and dispatcher to provide further details about the incident, including the location of the patient if different from the physical address. Text entries appear in chronological order with the newest information on the top.

Paramedics respond to the incident and confirm their safety to their dispatcher upon arrival. In situations where the scene needs to be secured, paramedics "hold back" until police arrive and deem the situation safe. Paramedics assess the patient, provide any required care and treatment, and take the patient to the most appropriate healthcare facility if required.

Destination determination and transfer of care

When a patient needs to be taken to a hospital or other healthcare facility, paramedics typically follow established guidelines or policies to determine the most appropriate site. Several factors can influence this decision, such as specialized care required (i.e., trauma, cardiac, stroke, etc.) and the current capacity at receiving facilities.

Sometimes emergency departments (EDs) are too busy to accept a patient, and the patient remains under the care of paramedics until the transfer of care (TOC) can occur.[36] According to the Statement on Hospital Offload Delays in Canadian Hospital Emergency Departments from the Paramedic Chiefs of Canada:

> "As paramedic resources are committed to continuing care for patients until such time as TOC can be completed, this depletes paramedic resources from being available to respond

[36] https://www.paramedicchiefs.ca/wp-content/uploads/2022/07/PCCStatementonOffloadDelaysJuly2022Final.pdf

to emergencies in the community. This results in longer response times for critical patients and increased stress and fatigue for paramedics and emergency medical dispatchers."

To reduce hospital offload delays and improve patient flow, programs and processes have been implemented with AHS and Calgary-area hospitals, including a new Integrated Operations Centre (IOC) and surge process.

Integrated Operations Centre (IOC)

In May 2022, Calgary Zone hospitals and EMS initiated an Integrated Operations Centre (IOC). The team, composed of specially trained paramedics and acute care inpatient capacity leads, navigates patient flow through the healthcare system in real time. Each patient transported by EMS is directed to the most appropriate care facility, based on patient need and site capacity. The objective is to provide a balanced, even distribution of patients to help expedite care, decrease patient wait times, and limit offload delays.

The IOC is coordinated through a technology-enabled 'air-traffic control' perspective, based on information provided by the paramedic crew on scene, as well as real-time data from the hospital sites, including both emergency and acute care capacity.[37]

Surge

In-hospital patient flow and the volume of patients coming to the ED directly impact ED capacity, delaying EMS in transferring care of a patient to the hospital. In turn, this decreases EMS response capacity in communities. EMS data and modelling have demonstrated that 13 units is the minimum required to be available in Calgary Metro at any given time to ensure emergency response times are achieved.[38] As EMS resources deplete, "alerts" are triggered to signify the current state of the system (Table 5).

Table 5: AHS EMS Alert Levels

Alert Level Status	Ambulances available
Red alert	0
Level 3	1-3
Level 2	4-7
Level 1	8-12
Level 0	13+

To increase capacity in both environments (ED and EMS), surge processes have been developed.

Patients in the care of EMS or the offload nurse (a designated nurse caring for EMS patients awaiting transfer to hospital) are categorized as being in 'park.' EMS park targets have been

[37] https://www.albertahealthservices.ca/news/releases/2022/Page16525.aspx
[38] EMS/IOC Community Surge Response July 18, 2022)

established for each hospital site in the Calgary Zone to help expedite the return of EMS resources to the community. The maximums are:

- Foothills Medical Centre – four EMS units
- Peter Lougheed Centre – three EMS units
- Rockyview General Hospital – three EMS units
- South Health Campus – two EMS units

When these targets have been exceeded for a prolonged period and EMS has entered a system red alert status, or a significant event requires an immediate or pending draw on EMS resources, a surge process is implemented. This process includes:

- implementing hospital site-specific capacity processes
- greater reliance on the offload nurse
- consolidating EMS crews (one paramedic crew takes on the care of at least two patients)
- utilizing the transfer of EMS patients to waiting room protocol

Real Time Operations Centre (RTOC)

In addition to the Integrated Operations Centre (IOC), EMS has created a Real Time Operations Centre (RTOC) intended to provide real-time EMS operational support. Implemented in December of 2018, the RTOC is a resource staffed by EMS who:

- have real-time situational awareness of system status and major incidents
- monitor hospital delays to help coordination with the IOC
- oversee staffing – coordinate the fluidity of human resources to optimize resources
- escalate issues of concern
- provide daily reporting

The RTOC is not integrated within the Southern Communications Centre but is located within the same building. Various technologies are used to monitor system status including voice radio communications with dispatch and paramedics.

Interoperability

The voice radio systems used by the three agencies, AHS, CPS, and CFD all operate on a common system (P25), but the radios are not programmed to communicate between the three services. This means that when responding to a call or on scene, the responders from different agencies must communicate back to their respective communications centre for messages to be relayed to an partner agency. While uncommon, dispatchers can bring first responders from different agencies onto a single radio channel so first responders can communicate with one another. This would typically be reserved for large-scale events, such as mass casualty events, as it is time-consuming to patch the responders into a single radio channel.

In situations where two or more agencies respond to an incident, interoperability is defined as the ability of emergency personnel to communicate between jurisdictions, disciplines, and levels of government, using a variety of systems, as needed and as authorized.[39]

In Calgary, interoperability between the secondary PSAPs varies among agencies. The computer-aided dispatch (CAD) is the technological platform that records and processes all details related to every incident or event. In Calgary, EMS PSAP interfaces with C911 fire PSAP and shares data across the CAD. The C911 police PSAP CAD does not interface with CADs from either C911 fire PSAP or EMS PSAP. In some Canadian organizations, such as Winnipeg Fire and Paramedic Services, the CAD systems for fire and paramedic services interface with Winnipeg Police Service for the sharing of data as a means of interoperability.

On the scene of an emergency incident, agencies typically work collaboratively through a common understanding of the specific roles of each service and supporting each other in managing the event as efficiently and effectively as possible.

[39] https://www.publicsafety.gc.ca/cnt/rsrcs/pblctns/ntrprblt-strtg/index-en.aspx

APPENDIX E: Alberta Emergency 9-1-1 Advisory Association Co-evaluation Working Group membership

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- City of Calgary (Chair)
- Alberta Municipal Affairs (Alberta 9-1-1 Program)
- Alberta Health Services
- Regional Municipality of Wood Buffalo
- Lethbridge
- Red Deer
- Taber
- Grande Prairie
- Parkland County
- Strathcona County
- Camrose
- RCMP
- Medicine Hat
- Yellowhead County
- Edmonton Fire

APPENDIX F: Data analysis charts

APPENDIX F: Data analysis charts

Data were collected and analyzed to better understand the context around the events of June 5, 2022 and determine if June 5 was a typical day compared with other days. The reference point chosen for this comparison was two weeks before June 5 to two weeks afterward, or the month around June 5. This time period provided sufficient data points to be able to display with some confidence the likelihood of June 5 being like other days in this one-month reference point. Interview data suggested that Sundays might not be the same as other days of the week, so for some indicators, data were analyzed for Sundays between March 27 and August 7, which provided sufficient data points to compare if Sunday June 5 was like other Sundays in the reference period.

The statistical process control charts below include this data analysis showing both where June 5 was as expected, and where it was unusual. Data elements where June 5 was different from other days are included in the body of the report; chart numbers in the report are included in the charts in this appendix for ease of cross reference.

Statistical Process Control Charts[40]

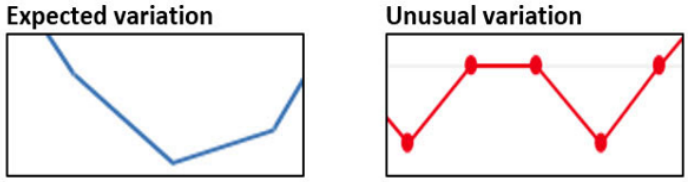
Statistical process control (SPC) is a methodology that can be used to make evidence-informed decisions about actions. In an environment where our systems are complex and constantly changing, where everything varies to some extent, and where improvements happen over time, control charts are the tools by which evidence-informed knowledge is built. They also help healthcare decision-makers take the most appropriate action, when necessary. Below are the chart legends used in the graph:

- Upper control limit (UCL): the upper range of the expected variation of the data elements in the reference period
- Centre line (CL): the average, represented by the mean of the data points on the chart
- Lower control limit (LCL): the lower range of the expected variation of the data elements in the reference period

If a data point is blue, it is displaying expected or common cause variation. Expected variation is natural to the system and taking action on expected variation is not helpful. However, expected variation does not mean that everything is good; it just means that if nothing changes, you can expect the data to continue varying randomly between the control limits. Whether the current levels of performance are acceptable is a discussion that should consider targets, benchmarks, and factors specific to the service area.

If a data point is red, it is displaying unusual or special cause variation. Unusual variation results from things outside the system that can be influenced. These changes are worth investigating further and potentially acting on to deliver or sustain improvements.

[40] https://focus.hqca.ca/wp-content/uploads/2020/02/SPC-FAQs_FINAL_2019.pdf



Unusual variation is found by applying rules based on probability. Unusual variation in these graphs are coloured red, either because there is one point outside the control limits (denoting a sudden change has occurred) or because two out of the three points are near the control limits / in the outer one-third of the chart (denoting a change has occurred).

EMS PSAP call volume

Chart 1: Alberta Health Services (AHS) EMS 911 call volume (14 days before and 14 days after June 5)

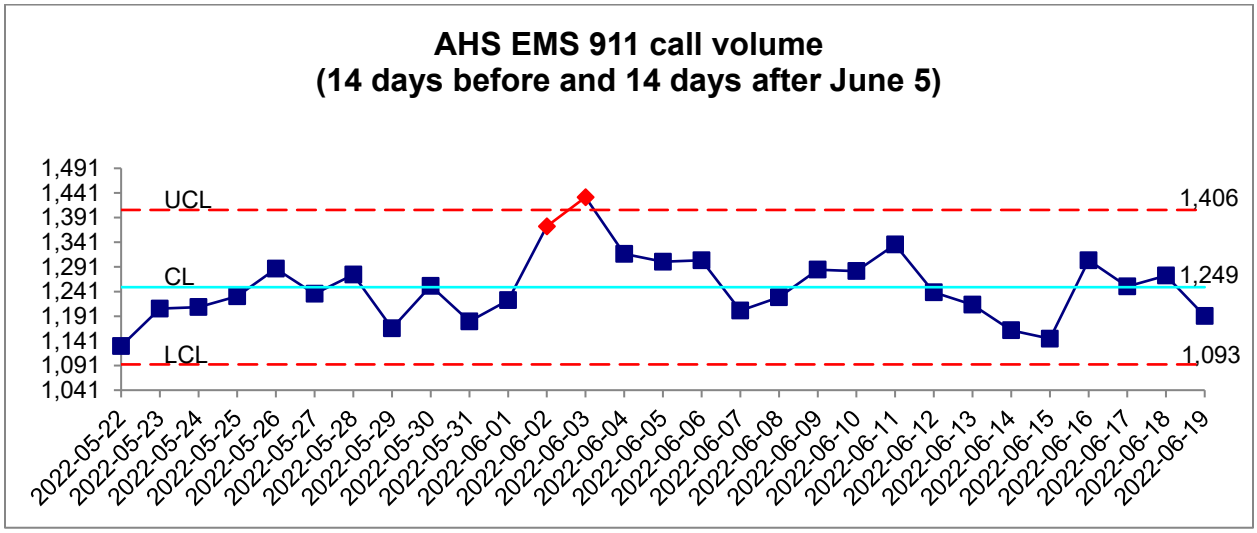
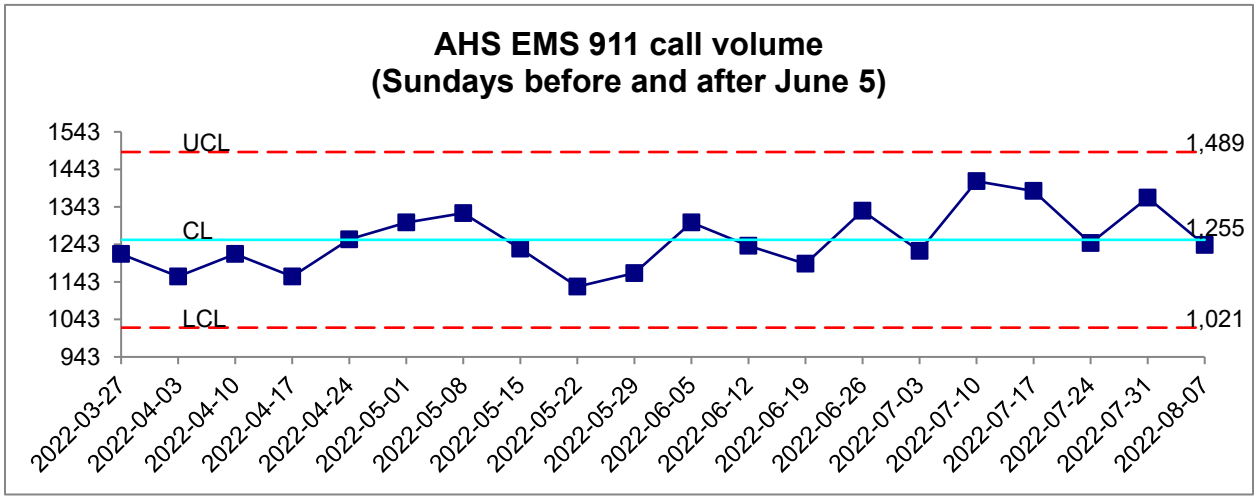


Chart 2: AHS EMS 911 call volume (Sundays before and after June 5)



On June 5, there were 1,301 911 EMS events recorded in Alberta. This call volume was within the usual range of variation for a Sunday or for any day in the four weeks around June 5 based on the data reviewed. In other words, EMS PSAP call volume was as expected for that time period.

EMS dispatch volume at SCC

Chart 3: Events dispatched by AHS EMS Southern Communications Centre (14 days before and 14 days after June 5)

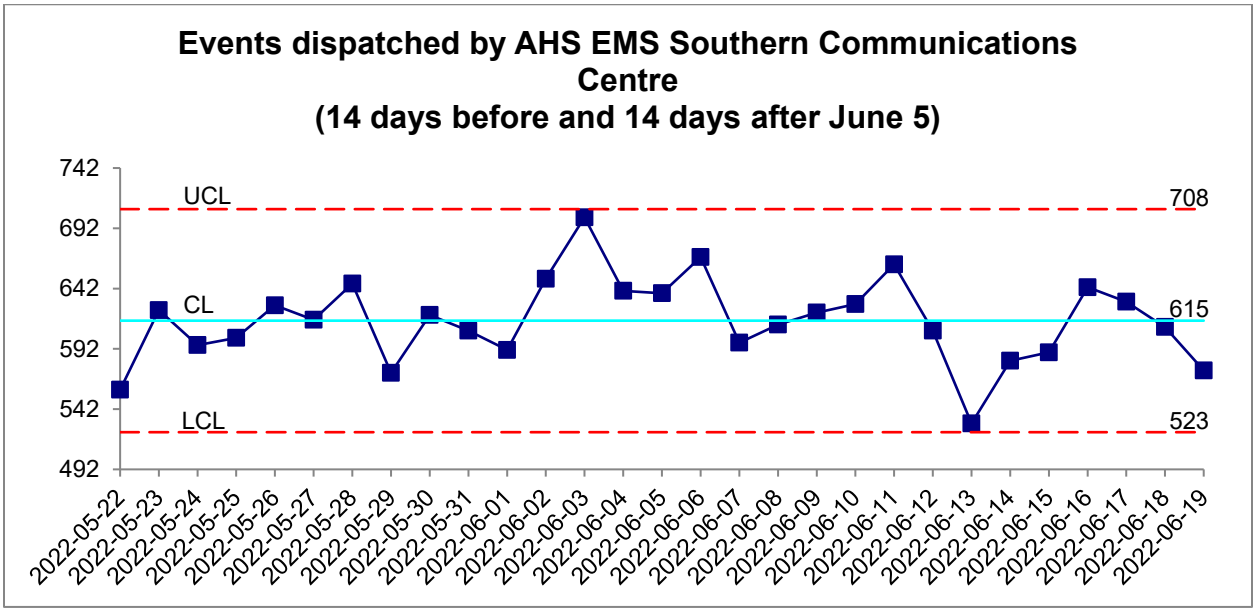
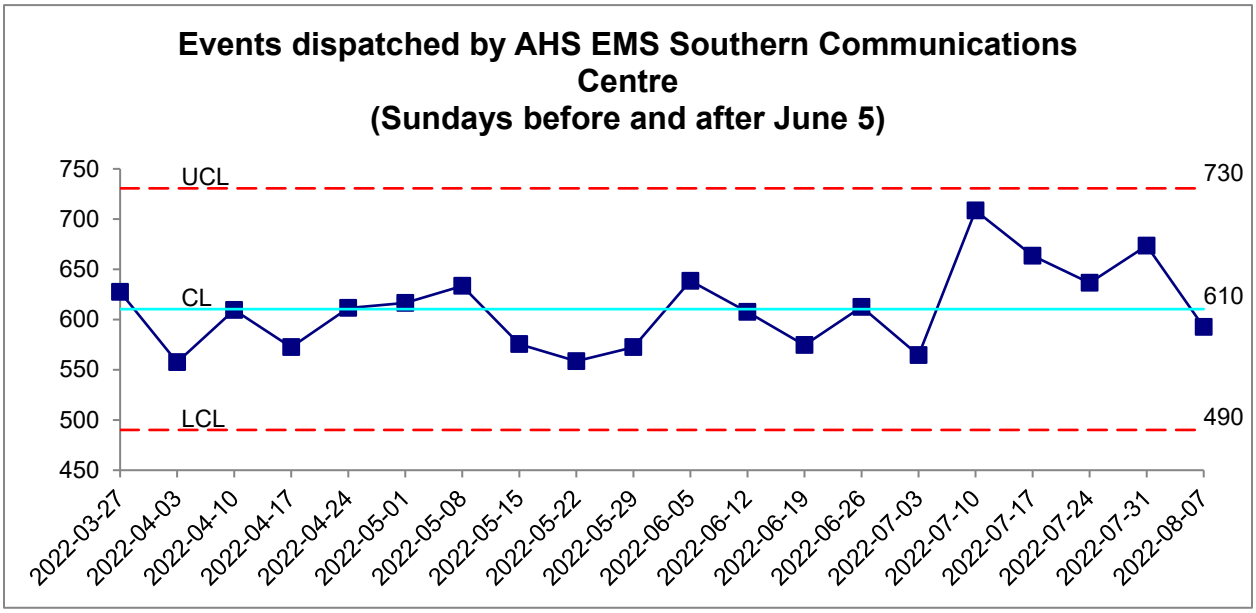


Chart 4: Events dispatched by AHS EMS Southern Communications Centre (Sundays before and after June 5)



On June 5, there were 1,290 events dispatched provincially, of which 638 were dispatched by the SCC. The number of events dispatched by the SCC that day was within the usual limits of variation based on analysis of four weeks of data around June 5 and historically on Sundays for the 10 weeks before and 10 weeks following June 5. In other words, the number of ambulances dispatched by the SCC on June 5 was as expected for that time period.

EMS PSAP staffing at SCC

Chart 5: Staffing at 2 p.m. at AHS EMS Southern Communications Centre (14 days before and 14 days after June 5)

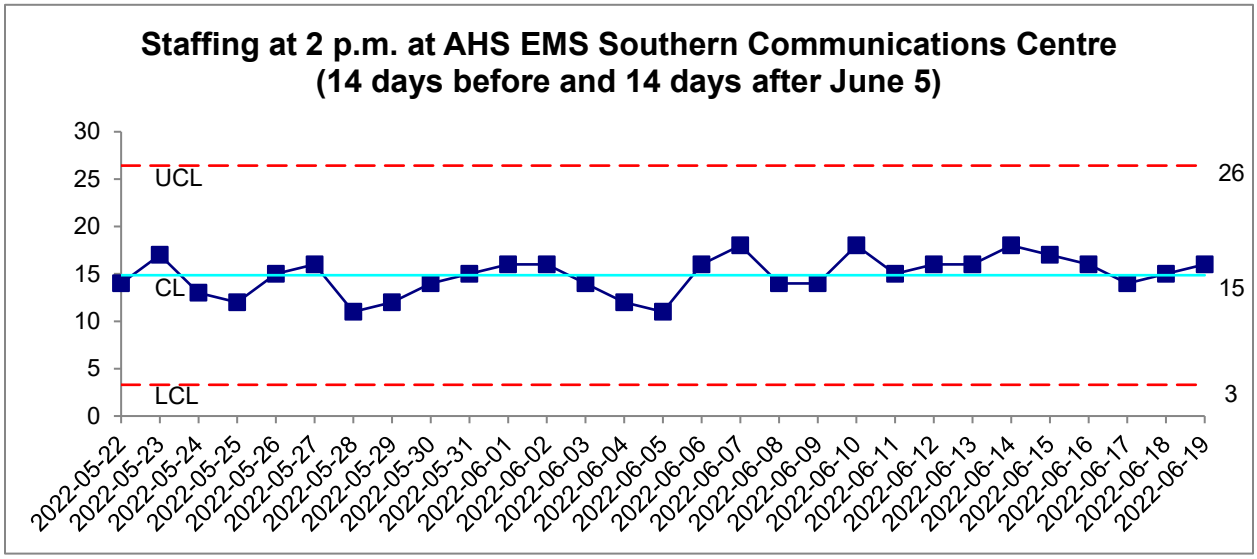
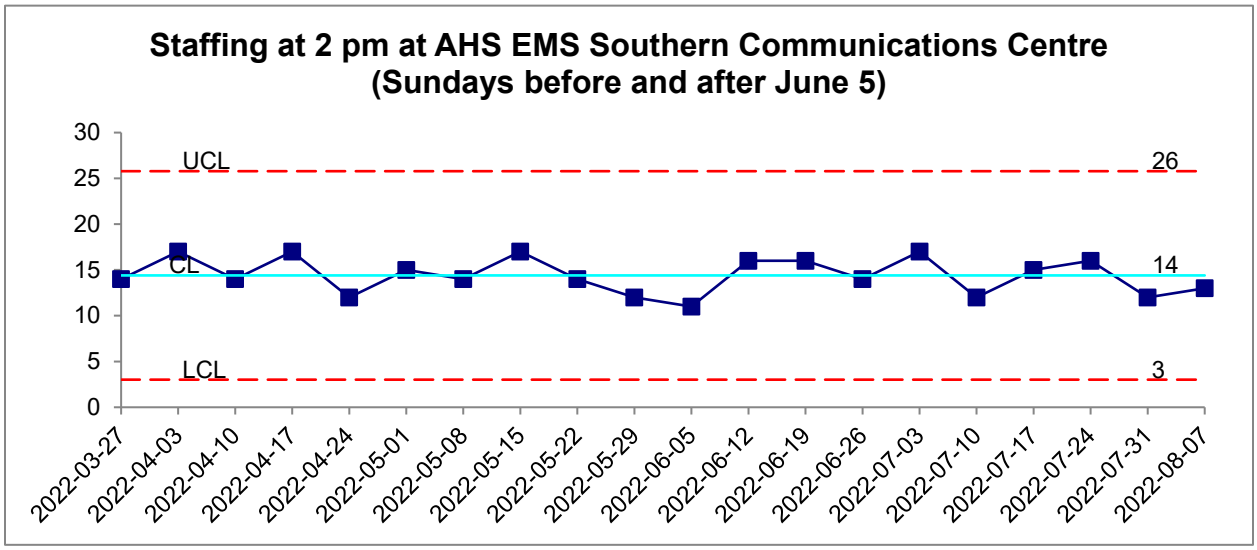


Chart 6: Staffing at 2 p.m. at AHS EMS Southern Communications Centre (Sundays before and after June 5)



The SCC was short seven emergency communications officers (ECOs) on June 5 at 2 p.m. The chart indicates that although the SCC was short staffed on June 5, this staffing situation was similar (i.e., within the expected variation) to other days in the month surrounding June 5 and for the Sundays between March 27 and August 7.

EMS response times for events

Chart 7: Median response times for life-threatening events (delta and echo) in Calgary Metro[41] (14 days before and 14 days after June 5)

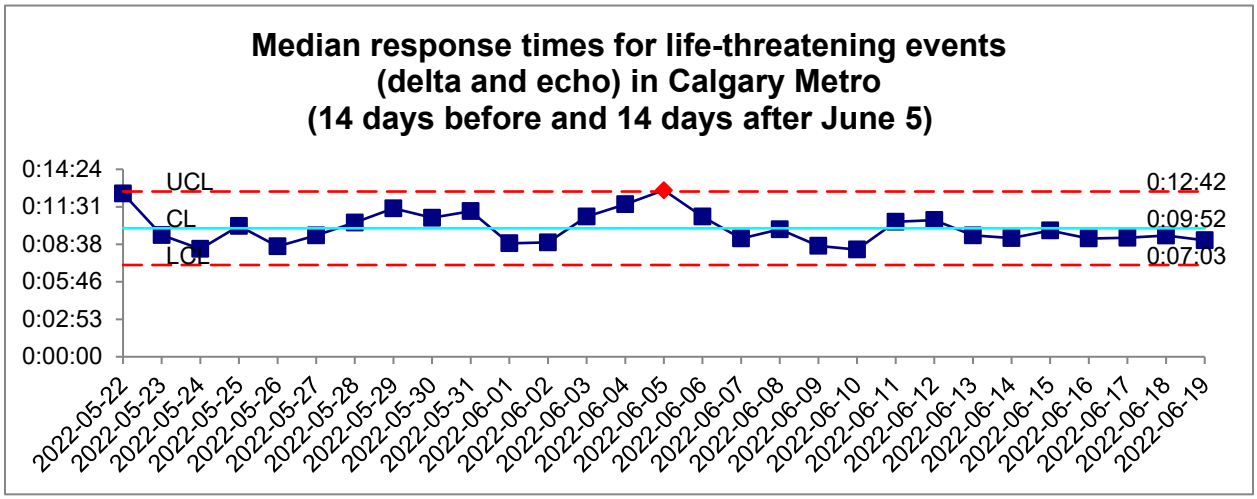
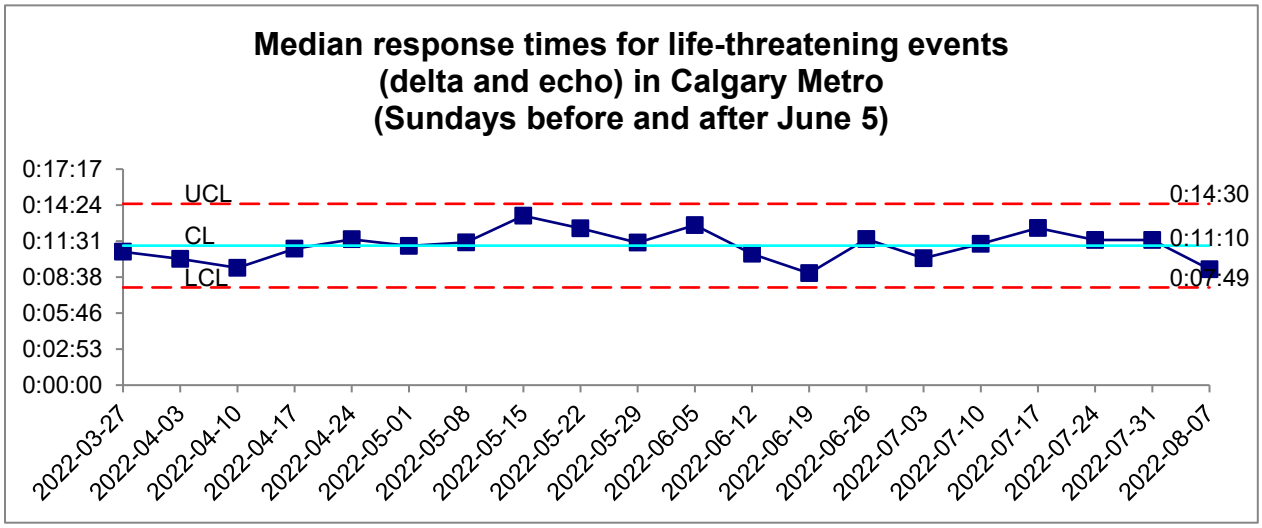


Chart 8: Median response times for life-threatening events (delta and echo events) in Calgary Metro (Sundays before and after June 5)



[41] Calgary metro: The metro Calgary EMS response area is the geographic area (city of Calgary) which is divided into four districts, plus the city core

Chart 9: 90th percentile response times for life-threatening events (delta and echo) in Calgary Metro (14 days before and 14 days after June 5)

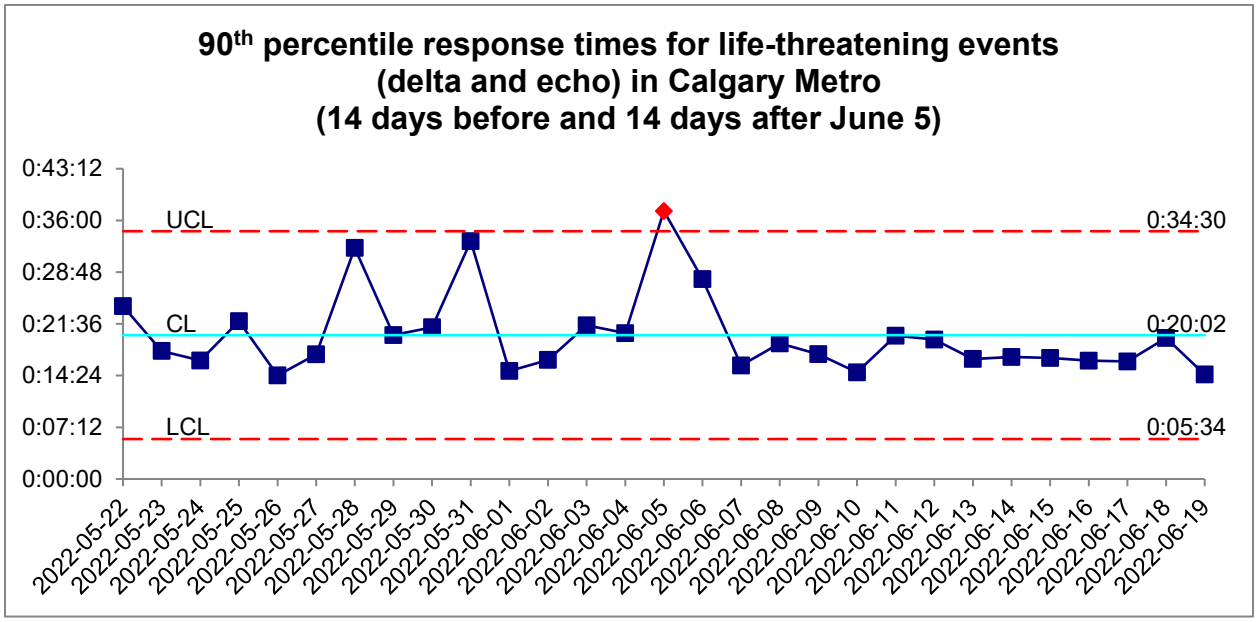
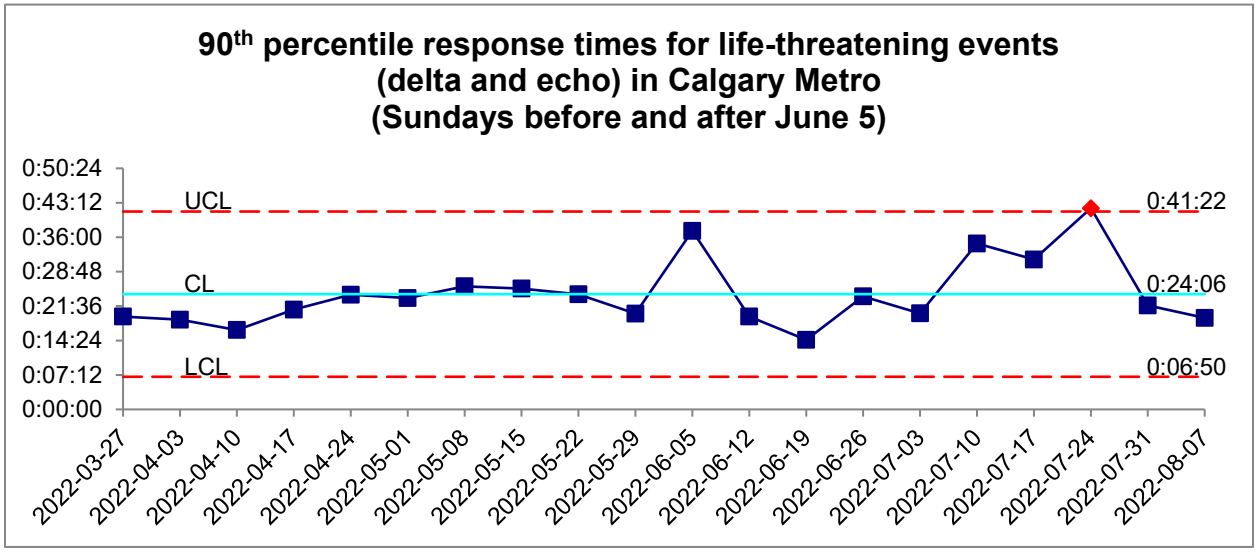


Chart 10: 90th percentile response times for life-threatening events (delta and echo) in Calgary Metro (Sundays before and after June 5)



Response times on June 5 were longer than the targets AHS EMS has set for itself. The median response time for life-threatening events that day in the Calgary metro area was 12 minutes and 48 seconds. The 90th percentile response time was 37 minutes and 19 seconds.

Based on four weeks of data around June 5 (the 14 days before and 14 days after June 5), both the median and the 90th percentile response times on June 5 were atypical. In other words, the

response times were longer on June 5 than would be expected based on the variation within the data.

When analyzing data for Sundays, however, the median and 90th percentile response times on June 5 were what would be expected for a Sunday. The four weeks of data around June 5 had shorter response times (average median response time of 9 minutes and 52 seconds) than the Sundays between March 27 and August 7, 2022 (average median response time on Sundays of 11minutes and 10 seconds), but this Sunday was not unusual, per the variation in the data, from other Sundays in this reference range.

EMS total time in red alert

Chart 11: Total time in red alert for the Calgary Metro service (14 days before and 14 days after June 5)

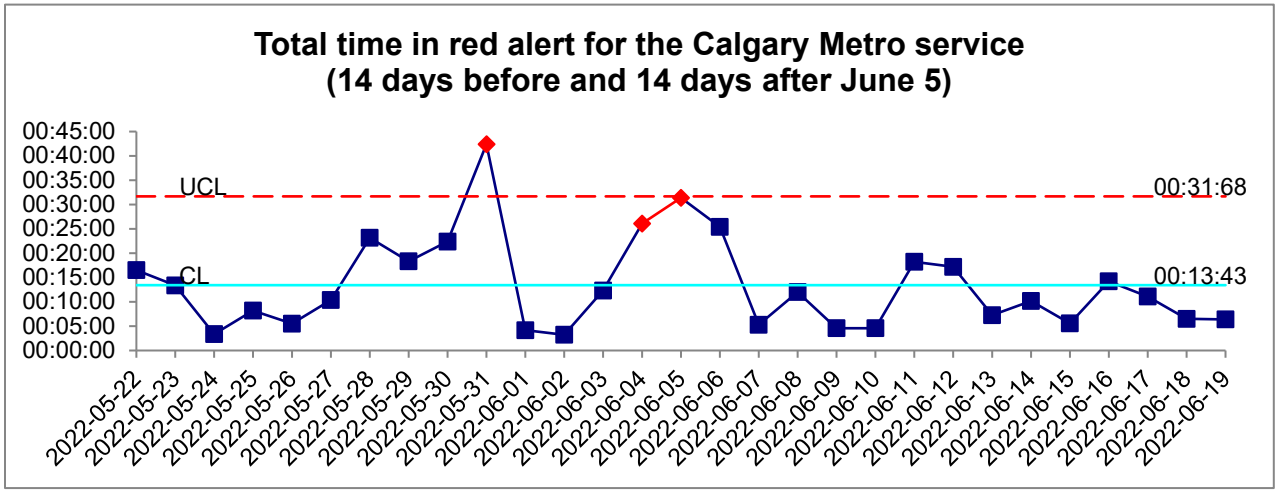
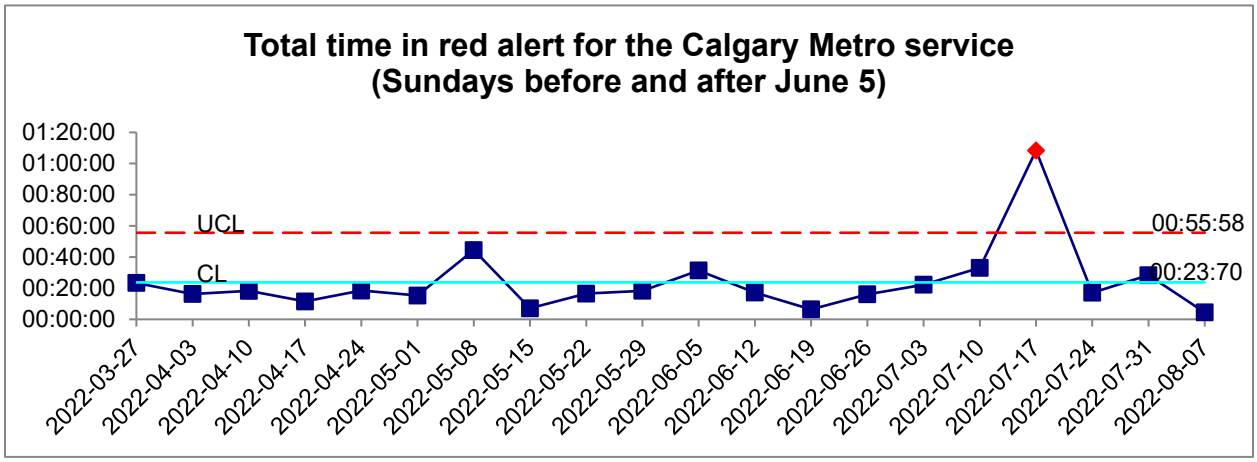


Chart 12: Total time in red alert for the Calgary Metro service (Sundays before and after June 5)



Note: This data represents transport capable units that are part of Calgary Metro service, excludes single paramedic response units (PRUs), and is calculated regardless of the geographic location of the unit.

The total length of time in red alert on June 5 was atypical based on four weeks of data around June 5. In other words, the amount of time in red alert was longer on June 5 than would be expected based on the variation in the data.

When analyzing data for Sundays, however, the duration of time in red alert on June 5 was what would be expected for a Sunday based on the variation in the data. The four weeks of data around June 5 had less time in red alert (average time in red alert: 13.43 minutes) than the data for Sundays between March 27 and August 7, 2022 (average time in red alert on Sundays: 23.70 minutes).

Ambulances in service

On the day of the event, 31 out of the scheduled 38 metro ambulances were running in the Calgary Zone. Over that 24-hour period, the metro fleet of ambulances operated for a combined 631 unit hours. The number of logged hours on June 4 and 5 were lower than expected in the two weeks before and two weeks after, per the variation in the data. When analyzing Sunday data, June 5 was typical for a Sunday. The four weeks of data around June 5 had fewer total logged hours (average logged hours: 748 hours) than the data for Sundays between March 27 and August 7, 2022 (average logged hours on Sundays: 687 hours).

Chart 13: Total logged unit hours for the Calgary Metro service (14 days before and 14 days after June 5)

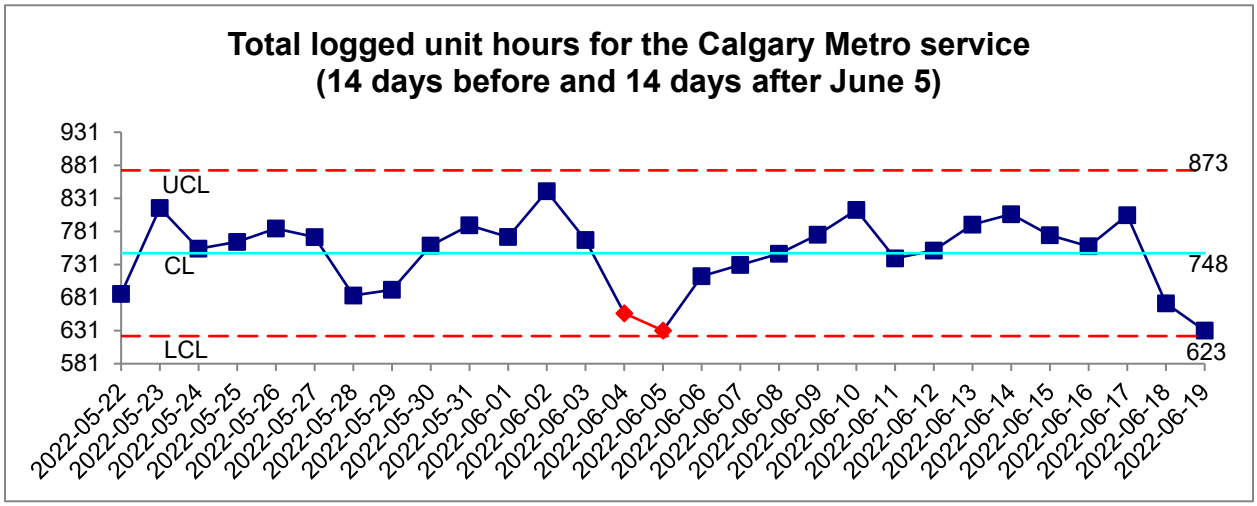
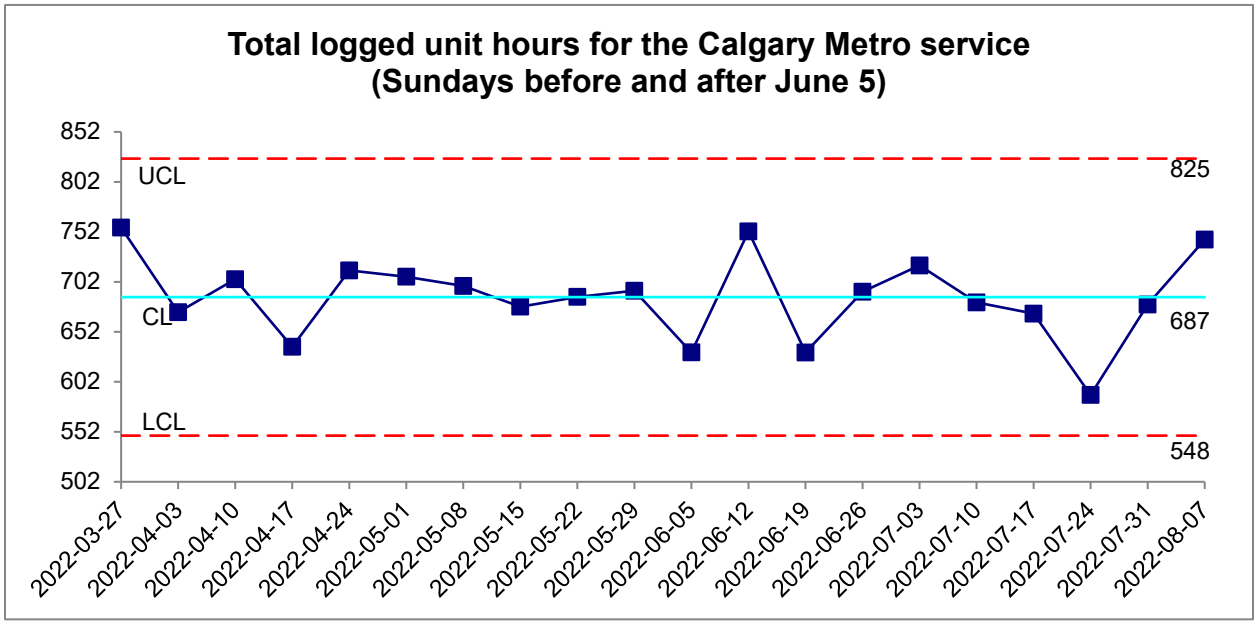


Chart 14: Total logged unit hours for the Calgary Metro service (Sundays before and after June 5)



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Ambulance utilization

Ambulance utilization tracks the percentage of time ambulances[42] spend in each of five status categories:

1) available
2) moving
3) on event[43] (e.g., with patient) but not at the destination
4) on event destination only[44] (e.g., at the ED with patient)
5) out of service.

Each of these categories was analyzed, and the percentage of time spent within each category was typical based on four weeks of data around June 5 and historically on Sundays. In other words, the

[42] ALS and BLS (advanced and basic life support) units / transport capable units / ambulances
[43] On event-not destination: time unit spent on an event, excluding the time spent at the transport destination (e.g. hospital or facility)
[44] On event-destination: time unit spent at the transport destination (e.g. hospital or facility) during an event

percentage of time spent in each category was as expected for that time period, per the variation in the data.

Chart 15: Percentage of time the Calgary Metro service spent in each status (14 days before and 14 days after the June 5 event)

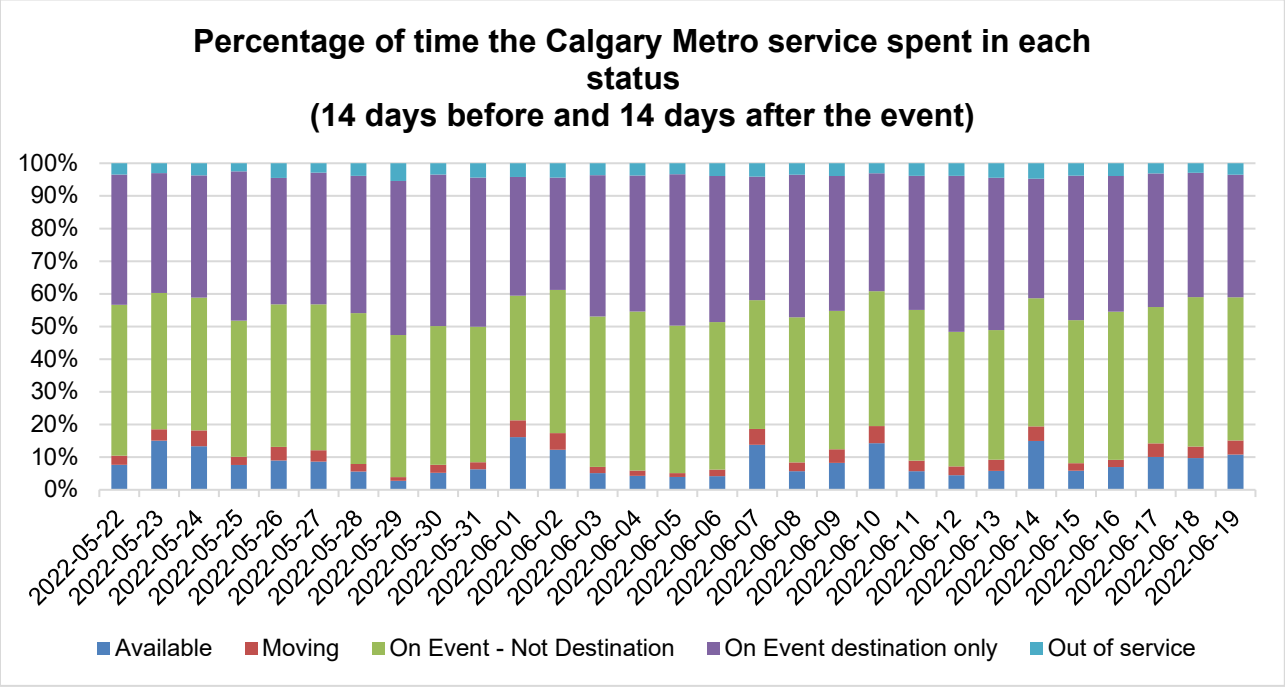


Chart 16: Percentage of time the Calgary Metro service spent in each status category (Sundays before and after June 5)

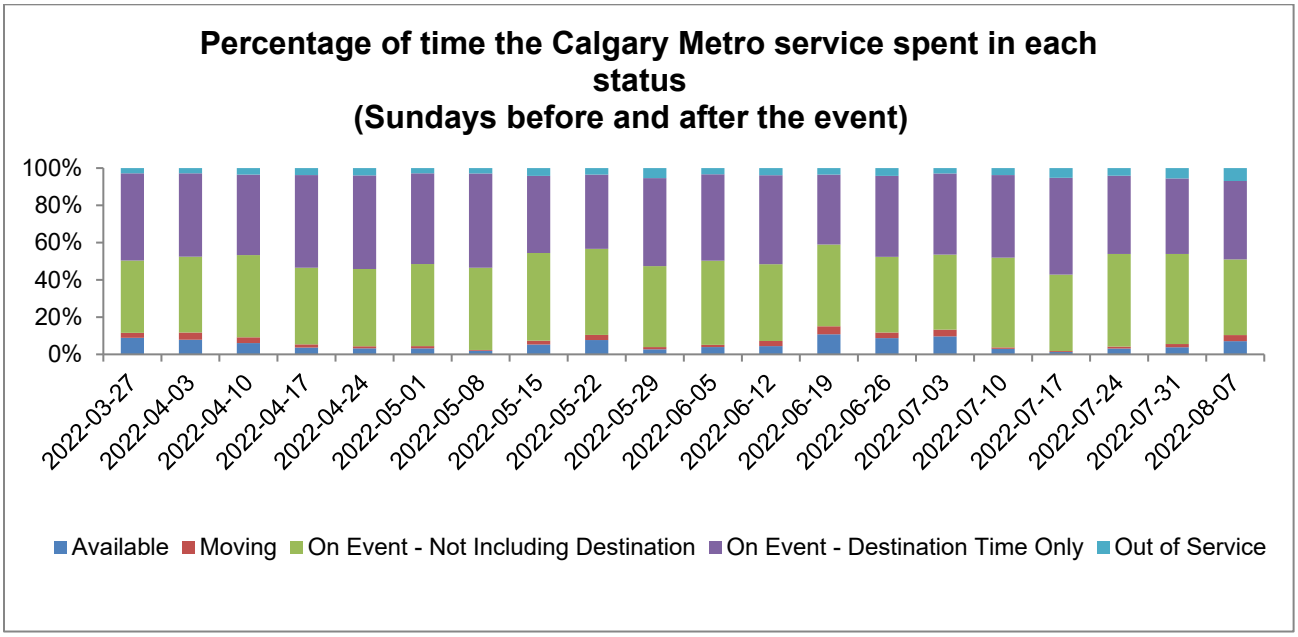


Chart 17: Percentage of time the Calgary Metro service was in the **available status** (14 days before and 14 days after June 5)

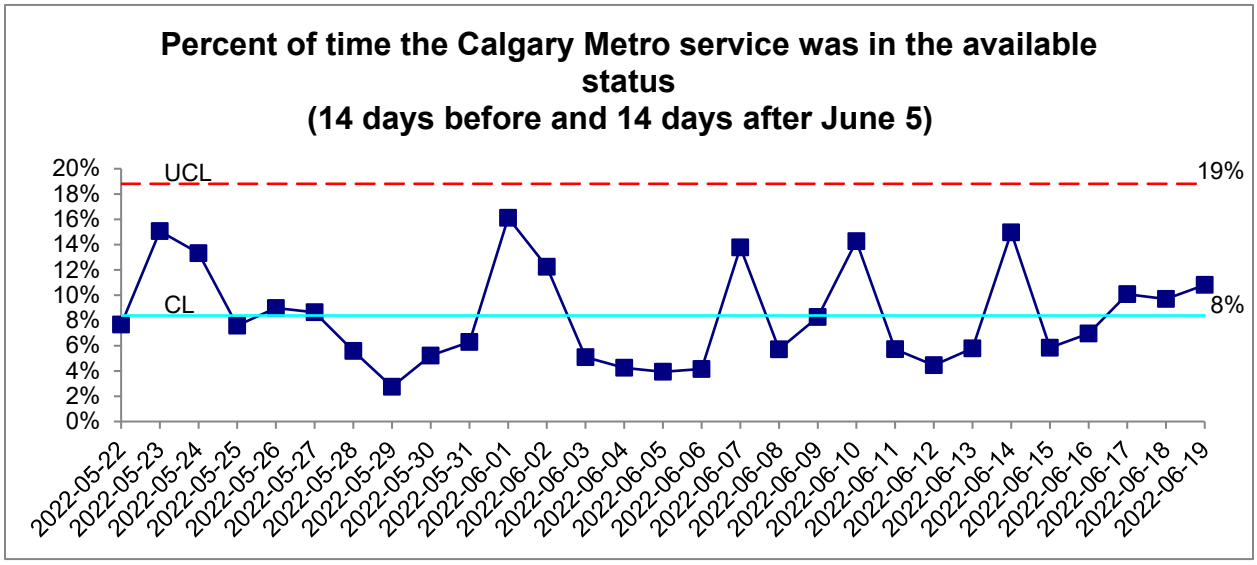


Chart 18: Percentage of time the Calgary Metro service was in the **available status** (Sundays before and after June 5)

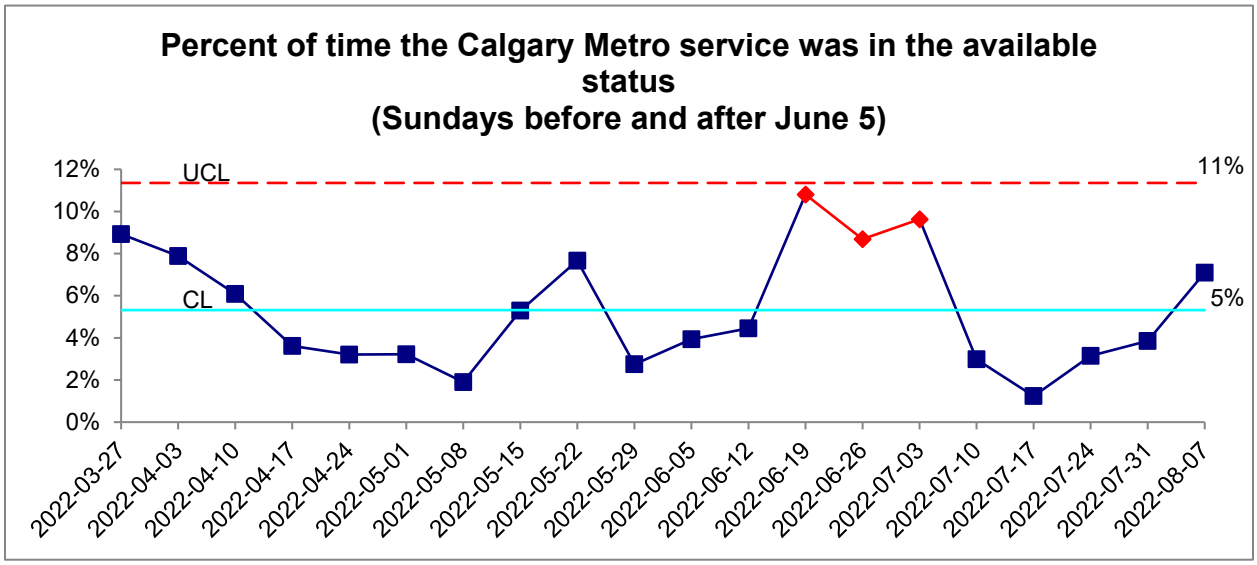


Chart 19: Percentage of time the Calgary Metro service was in the **moving status** (14 days before and 14 days after June 5)

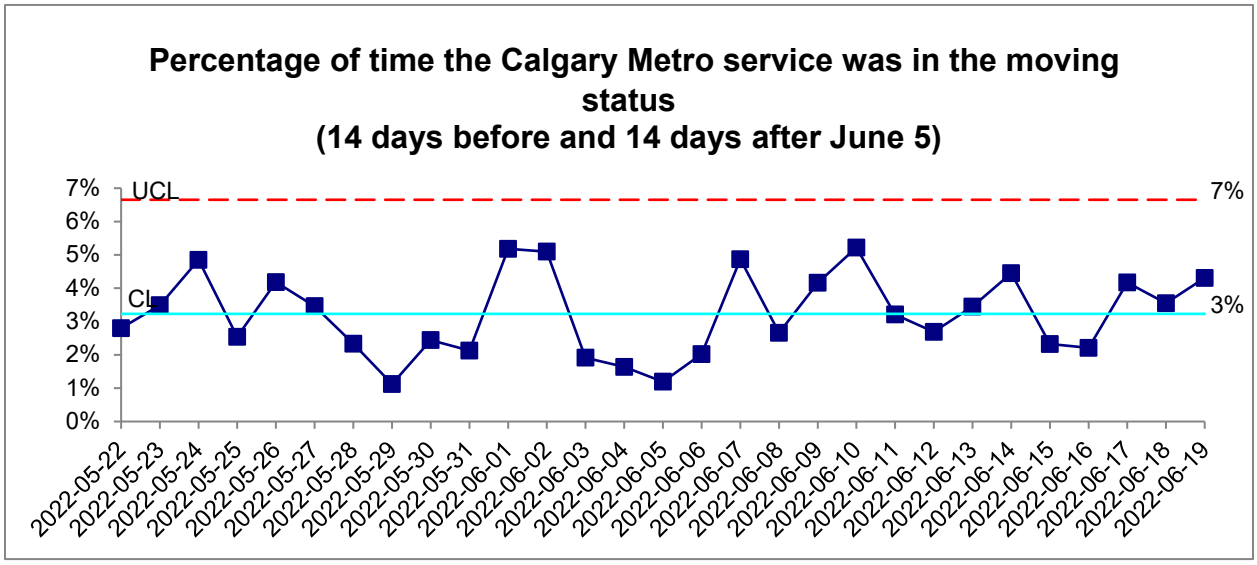


Chart 20: Percentage of time the Calgary Metro service was in the **moving status** (Sundays before and after June 5)

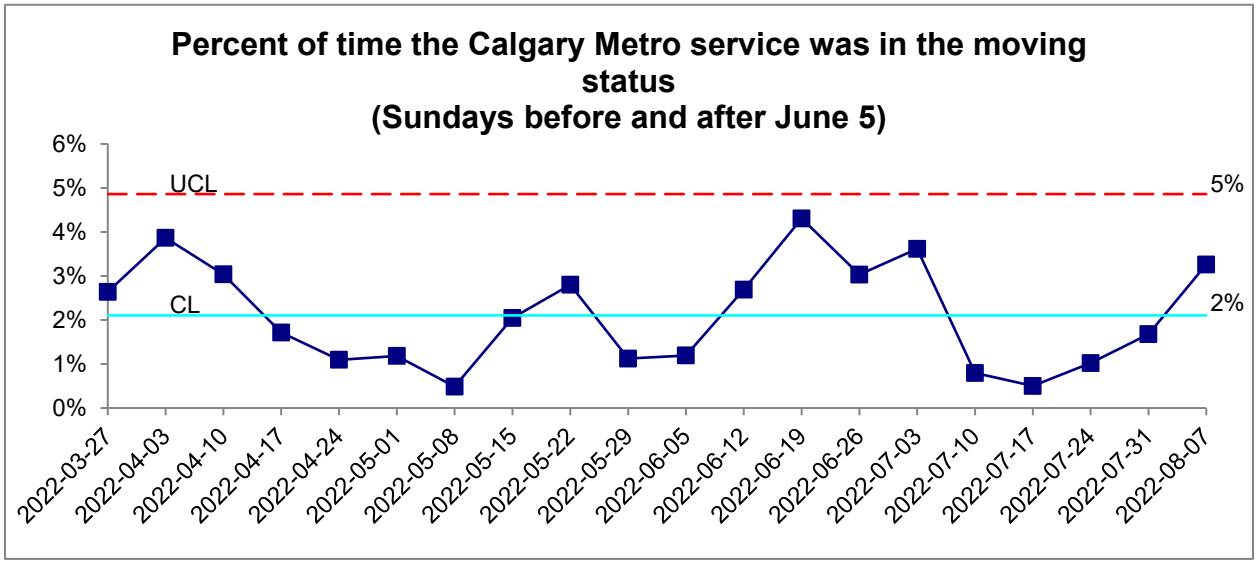


Chart 21: Percentage of time the Calgary Metro service was in the **on event (not destination) status** (14 days before and 14 days after June 5)

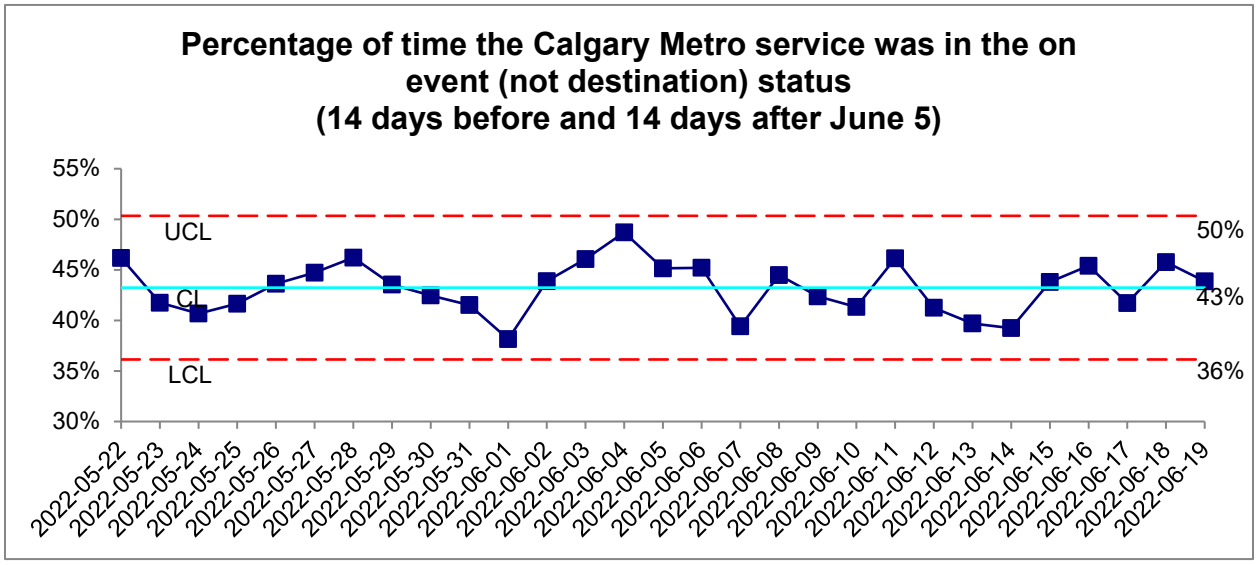


Chart 22: Percentage of time the Calgary Metro service was in the **on event (not destination) status** (Sundays before and after June 5)

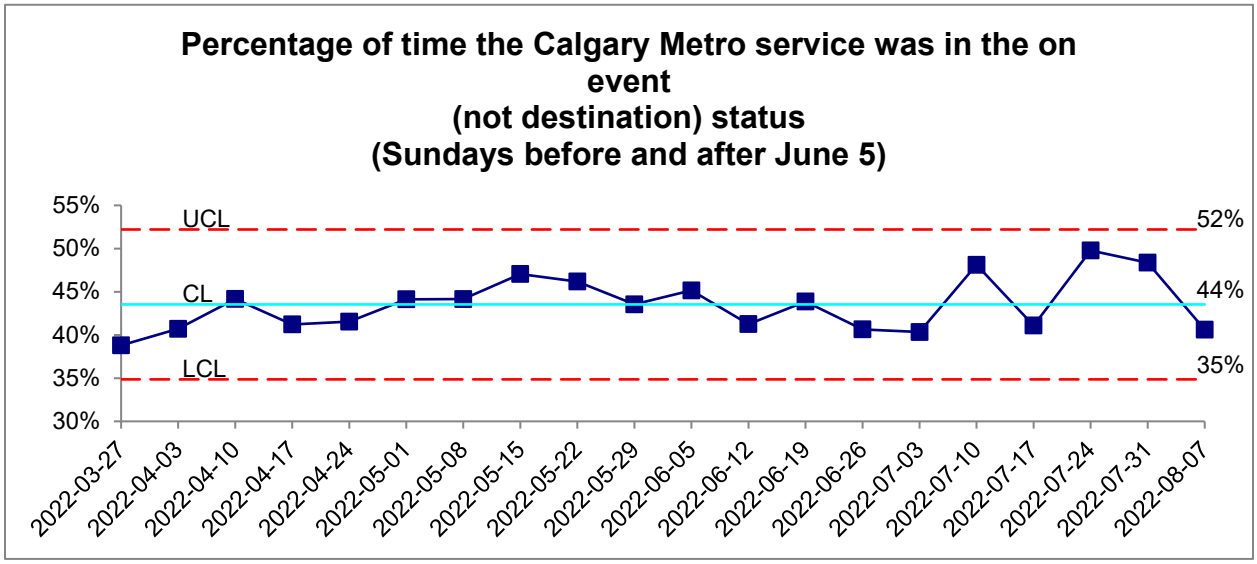


Chart 23: Percentage of time the Calgary Metro service was in the **on event (destination only) status** (14 days before and 14 days after June 5)

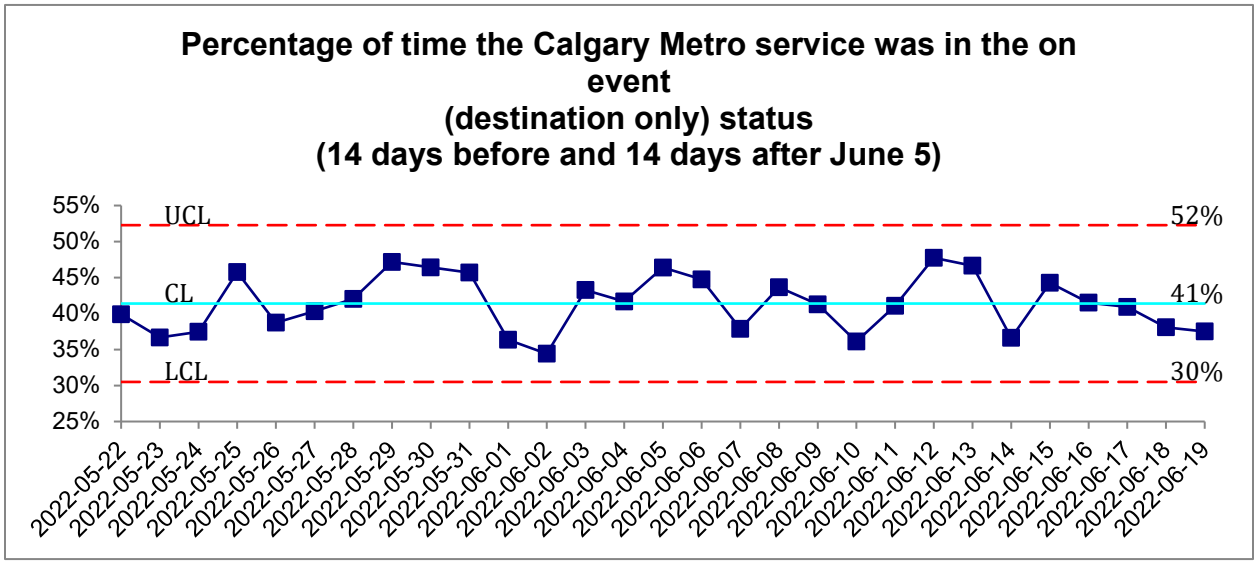


Chart 24: Percentage of time the Calgary Metro service was in the **on event (destination only) status** (Sundays before and after June 5)

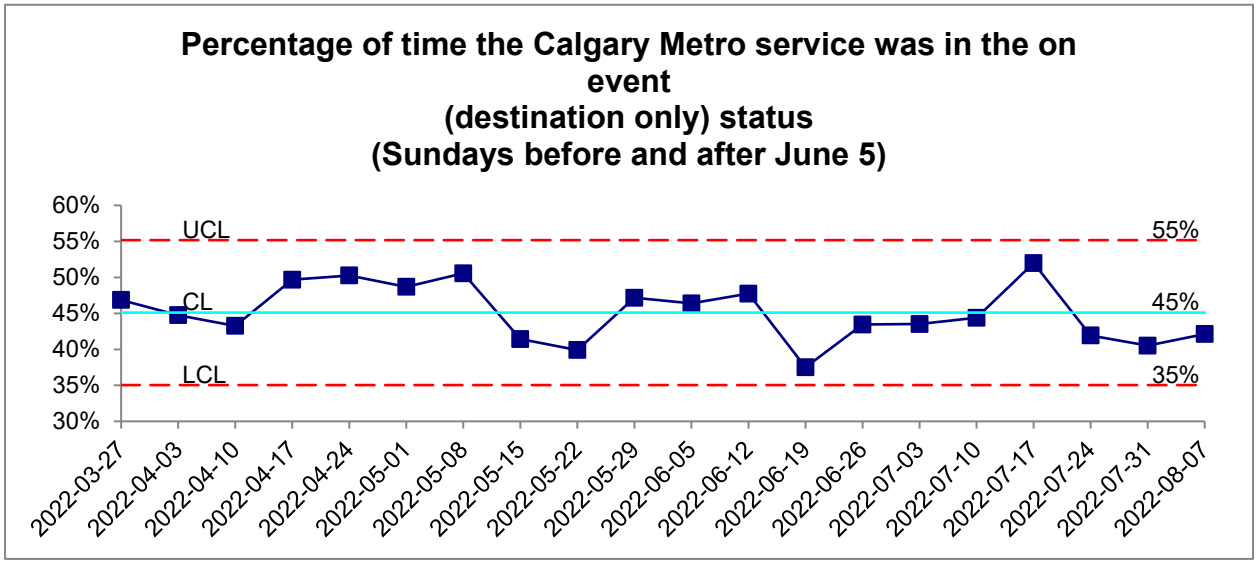


Chart 25: Percentage of time the Calgary Metro service was in the **out of service status** (14 days before and 14 days after June 5)

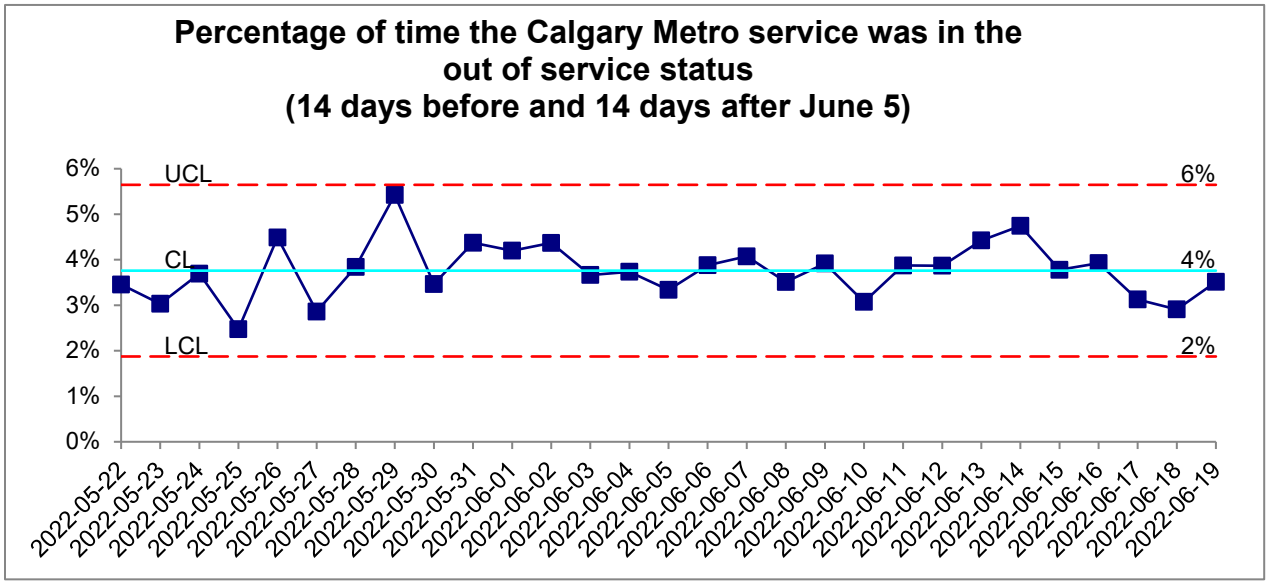
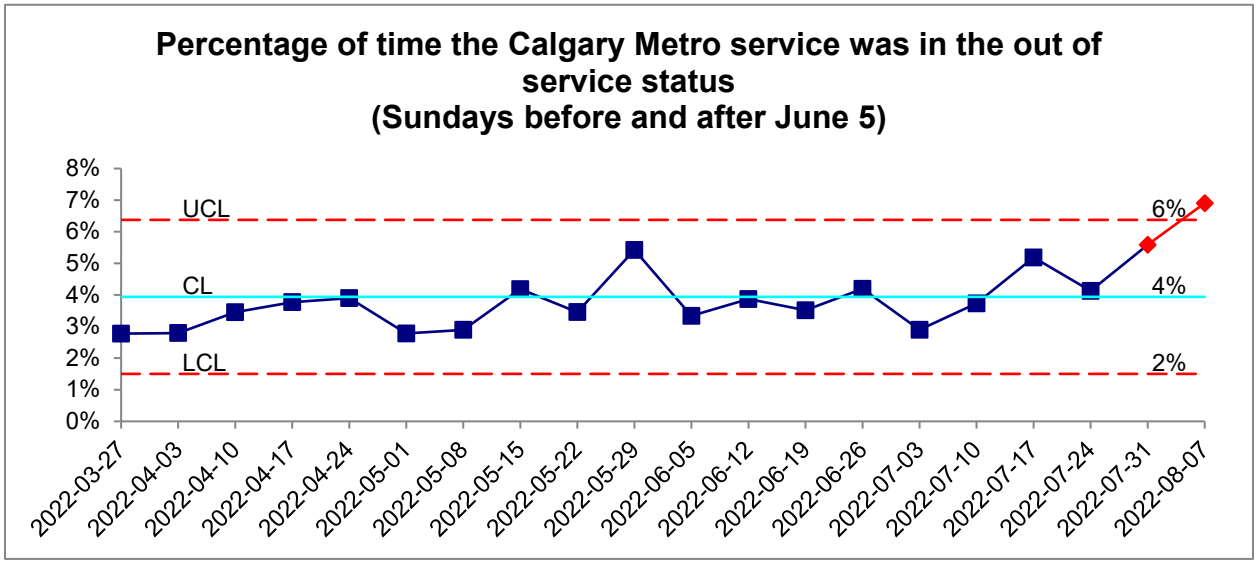


Chart 26: Percentage of time the Calgary Metro service was in the **out of service status** (Sundays before and after June 5)



Pending calls

At 2 p.m. on June 5, there were 20 calls in the pending queue (events requiring an ambulance when none are available). The number of pending events on June 5 was higher than expected when compared with the four weeks around this date, and Sundays between March 27 and August 7.

Chart 27: Pending events at 2 p.m. on June 5 (14 days before and 14 days after June 5)

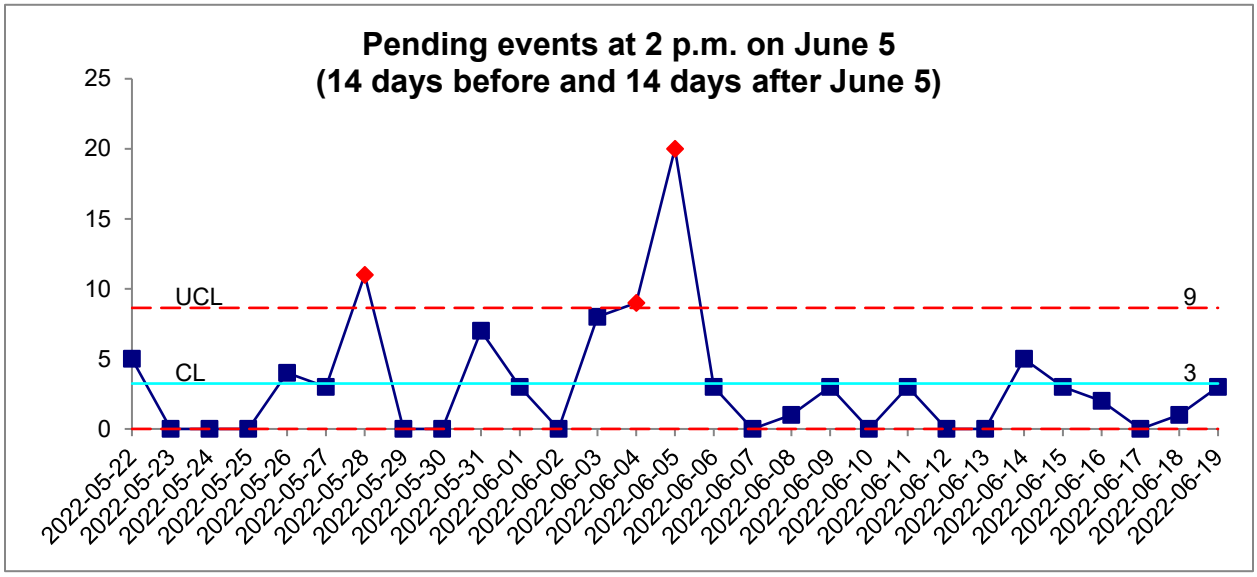
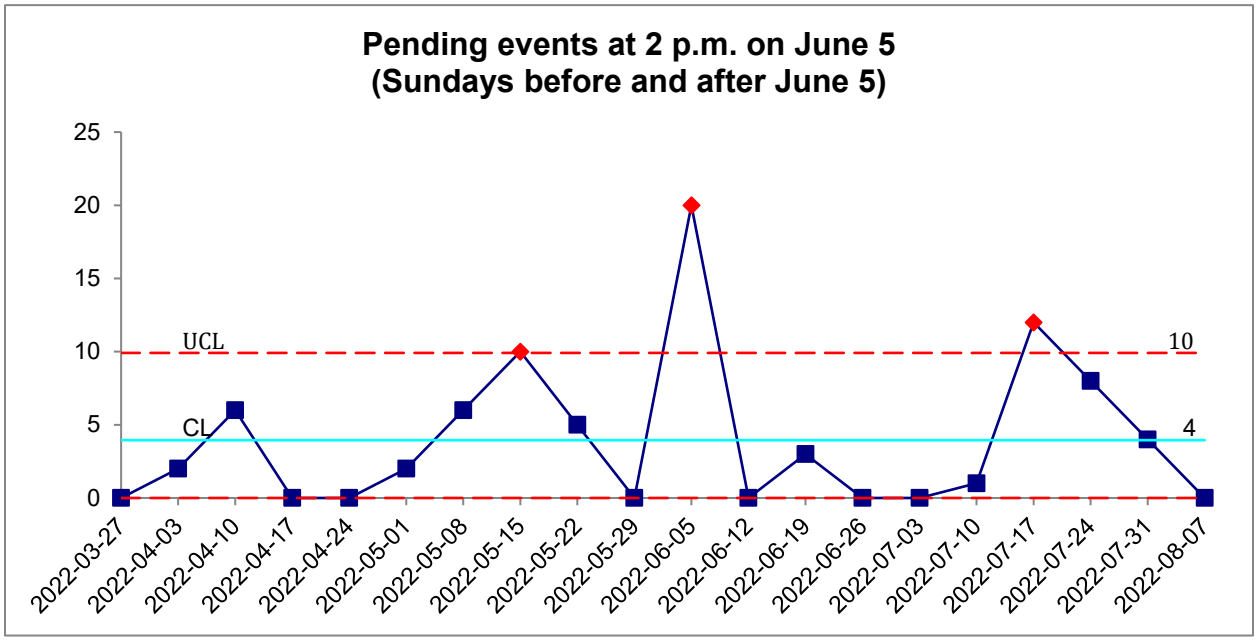
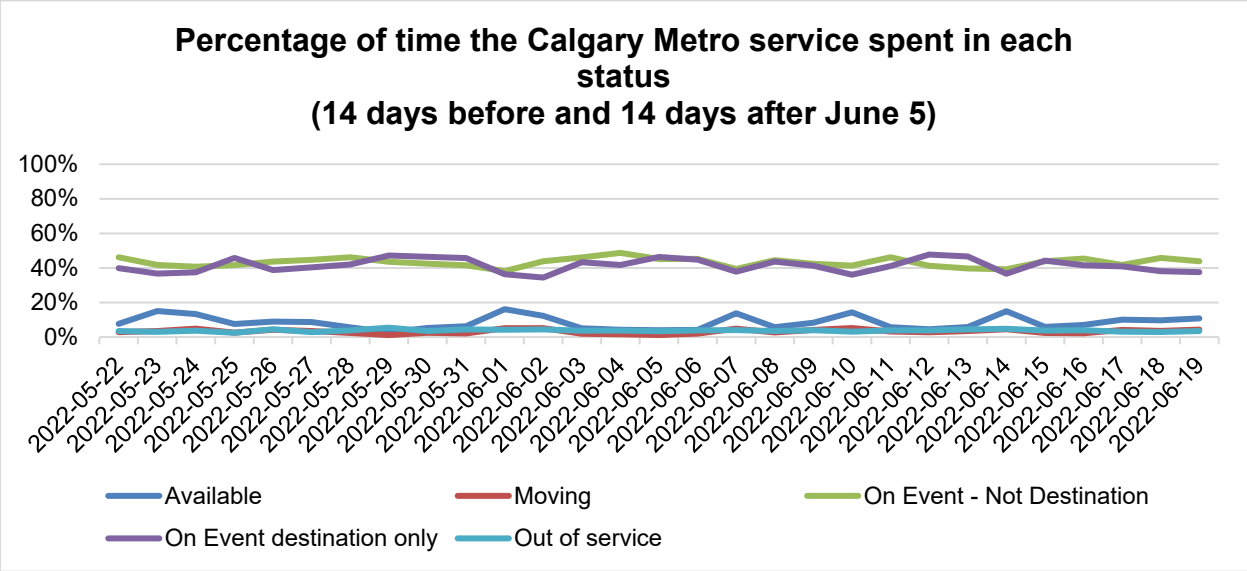


Chart 28: Pending events at 2 p.m. on June 5 (Sundays before and after June 5)



Offload delays at hospitals

Chart 29: Percentage of time the Calgary Metro service spent in each status (14 days before and 14 days after June 5)



On average, EMS spent 41 per cent of their time waiting at a facility to transfer a patient (purple line) between May 22 and June 19.

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[iv] Priority dispatch: https://prioritydispatch.net/advancedsend/

[v] AHS EMS Resource Document: EMS department/business area: EMS Dispatch Communications and Deployment. Preempt and Divert Procedure (February 28, 2022)

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[ix] AHS Local Service Standard: Emergency Call Evaluating Processes (January 28, 2022)

[x] C911 SOP: Combined – ECO and DISP – Co-evaluation and Multi-Agency Event Notifications (February 24, 2022; updated May 16, 2022)

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[xiii] Alberta Emergency Management Agency; Ministry of Municipal Affairs: personal communication (July 21, 2022)

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[xv] AHS Local Service Standard: Emergency Call Evaluating Processes (January 28, 2022)

[xvi] IAED Report Addendum - request for secondary case review (Oct 31, 2022)

[xvii] IAED Report Addendum - request for secondary case review (Oct 31, 2022)

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[xix] AHS Local Service Standard: Emergency Call Evaluating Processes (January 28, 2022)

[xx] https://prioritydispatch.net/emd-cardset/

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[xxiii] IAED personal communication (Oct 21, 2022).

[xxiv] IAED personal communication (Oct 21, 2022).

[xxv] Per expert opinion, best practice is to use the “four commandments” – personal communication (August 18, 2022)

[xxvi] AHS SCC staffing report for June 5, 2022.

[xxvii] AHS Local Service Standard: Emergency Call Evaluating Processes (January 28, 2022)

[xxviii] AHS Local Service Standard: Emergency Call Evaluating Processes (January 28, 2022)

[xxix] IAED personal communication (Oct 28, 2022).

[xxx] Calgary 911, SOP-Police-DISP-Event Management, version 10, approved April 21, 2022

[xxxi] Appendix A – Rapid narrative review of best practices and issues in EMS dispatch

[xxxii] 10 point plan. https://www.albertahealthservices.ca/ems/Page17851.aspx#details

[xxxiii] Subject matter expert on the HQCA review sub-committee, personal communication.

210, 811 – 14 Street NW
Calgary, Alberta, Canada T2N 2A4
T: 403.297.8162 F: 403.297.8258
E: info@hqca.ca **www.hqca.ca**