BC Emergency Health Services

Air Ambulance and Critical Care Transport Resource Allocation Process Review

Chris Nickerson
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Section A. Executive Summary & Organizational Response

BC Emergency Health Services (BCEHS) operates a provincial ambulance service through the operating entity BC Ambulance Service (BCAS). Two of the primary service delivery areas are the Critical Care Transport Program and Air Ambulance Operations. In light of organizational changes and a report from the Office of the Auditor General (OAG) of British Columbia, BCEHS undertook a review of resource allocation decisions and anecdotal staff concerns to gain a better understanding of the operating environment and identify areas for improvement.

BCEHS operates air ambulances across a spectrum of clinical and operating environments. These services include accessing remote communities for initial emergency calls from citizens, providing on-scene response by rotor wing aircraft in support of ground ambulance operations, to providing interfacility transport across all patient demographics and needs. The clinical care provided encompasses the entire scope of practice of paramedics (i.e. from patients requiring specialized critical care transport to patients requiring a basic life support escort) and across the spectrum of urgency – from patients with time dependent illness and injury to non-urgent pre-scheduled interfacility transport.

BCEHS serves as both a regulator (i.e. system design and oversight) and service provider (i.e. operator) of the air ambulance service. This dual role can complicate lines of accountability and potentially lead to a focus on day to day provision of services. This can further lead to a loss of focus on oversight functions such as ongoing system development, continuous quality improvement, performance measurement, reporting and ensuring clear accountability for the system.

BCEHS is in the desirable position of being responsible for ground and air ambulance systems, providing oversight to the province for the trauma system, and in-patient bed coordination across health authorities. This integrated and centralized coordination role can be leveraged to provide seamless care and transportation of patients across the province. One of the critical components to successfully achieving an integrated and seamless system is to ensure appropriate structure and governance of the operating entities within the organization.

BCEHS contracted a consultant to conduct a review of structures, processes, systems and outcomes related to resource allocation decisions of critical care and air ambulance resources. Further, issues and complaints raised by frontline staff were provided to determine validity of concerns raised. Finally, the consultant was asked to try and quantify impacts of resource allocation decisions from a financial standpoint. This review specifically did not review the clinical quality of care provided by critical care teams or the program. The analysis, findings and recommendations are strictly operational in nature as opposed to clinical. It is clearly recognized that a balance between operational/system quality and clinical quality is ideal.
The Consultant initially undertook a review of internal policies, procedures, reports and organizational information. Initial interviews provided further information for consideration prior to an on-site visit. The on-site visit included over twenty interviews with a variety of staff, managers and executive and a representation of external stakeholders. In addition, the on-site visit included job shadowing sessions in two entities responsible for informing or making resource allocation decisions. Operational reports, first hand observations and interviews of staff provided the basis for the findings and recommendations. Targeted questions to management and executive on key components of critical care transport and/or air ambulance operations were used to help validate observations and findings.

During the course of the project it became evident that data, both operational and financial, would take some time to obtain after the site visit. Given this fact, the Consultant provided a verbal update to senior leadership of BCEHS in November of 2013. It is recognized that due to the time frame of the site visit in October of 2013, several structures and processes discussed in the report have changed as a result of findings within the report and a variety of other factors. Changes are not reflected within this report – the report reflects the status of the system at time of site visit.

The following provides details of the review undertaken and outlines some of the challenges in providing seamless and integrated service delivery in a complex provincial setting. The collision of two complex environments, critical care transport medicine and aviation, occur in air ambulance operations. Dual legislative accountability, multiple reporting and performance accountabilities and the complexity of providing appropriate care for some of the most ill and seriously injured patients in the province make the environment difficult to manage. Defining the mandate of the Critical Care Program and the Air Ambulance Operations of the service are key to defining the future for BCEHS. Measuring performance against defined objectives will help guide a quality improvement focus into the future.

The report provides 24 recommendations. These recommendations should be undertaken with the explicit guidance and direct involvement of clinical, quality and operational expertise.
Carl Roy, President of BC Emergency Health Services and CEO, Provincial Health Services Authority, provides the following organizational response:

May 30, 2014

BC Emergency Health Services engaged the services of the Consultant to provide an external lens on process-related issues identified as having the potential to impact patient care either directly (through issues such as transfer delays) or indirectly (through decision-making that could impact resource availability). The context of the Consultant’s work was limited to movement of our patients involving aircraft and/or the provision of care at the Critical Care Paramedic level. The efforts undertaken to compile the information were significant, touching several program areas within BCEHS – the Patient Transfer Network (PTN), the BC Ambulance Service Patient Transport Coordination Centre (PTCC) and Critical Care Programs (CCP). The work needed to bring the information to life in the form of this report was, unfortunately, interrupted by substantive leadership changes within BCEHS. As such it represents a “snapshot in time” and in order to properly understand the context, changes implemented since the information was gathered are also appropriate for inclusion within this report.

The following change initiatives have either been fully implemented since the report information was gathered or are formally underway. As some span several of the recommendations, they are presented here under the category headings of governance, process and decision-making, systems, outcomes and culture.

GOVERNANCE

- Operational teams have been realigned under the unified leadership umbrella of the Chief Operating Officer, BC Emergency Health Services. This enables a common decision-making platform with consolidated budget oversight and brings together the patient care operations components of the PTN, PTCC and Critical Care programs.

PROCESS AND DECISION-MAKING

- Standard Operating Procedures for the Dispatch Centre have been updated and are currently under review. Critical Care Programs, PTN and Medical Programs have had an opportunity to provide input.

- A project to evaluate the Early Fixed Wing Activation program is in early development.

- A single integrated intake process now is in place for all “red” calls (i.e. those patients requiring a higher level of care requiring defined by critical time lines). All red calls come through PTN and are case managed with a Clinical Transfer
Nurse (CTN) with an Emergency Physician On-line Support (EPOS) physician who is now immediately brought in up front.

- Both the PTN and the PTCC have adopted the “Red Yellow Green Blue” or R/Y/G/B Patient Acuity Matrix for coding patient acuity approved by Medical Programs.

- Critical Care Transport Advisors are being incorporated into the EPOS group to allow a focused role for critical care physicians in supporting transfer planning and critical care interfacility transport.

**SYSTEMS**

- Flight Following practices were immediately instituted with an identified individual each shift ensuring a single point of accountability for tracking all air resources.

- A Request for Proposal for a call-taking technology solution for PTN includes an interface with the Computer-Aided Dispatch program following assessment of business needs. The contract is expected to be signed shortly.

- Standardized training requirements for PTCC are in place including four days of classroom time and one block each of mentored practice time to cover Call Taking, Non Critical Care Dispatch, Critical Care Coordination and Critical Care Dispatch (Flight Following). Each segment has check off lists and will be extended as required to ensure consistent operation.

**OUTCOMES**

- Work has been undertaken to enhance quality-related processes:
  
  - Refined committee structures are now in place ensuring cross program inclusion in quality reviews
  - Quality resources dedicated to CCP have been added
  - A recent announcement ensures quality resources across the organization will be aligned for standardized process and methodologies as well as centralized strategic oversight

- Current focus has been on retrospective review of reported safety concerns; project currently underway to develop and implement standardized audit process within PTCC.

- Quality management program:
Daily huddles implemented, performance walls introduced in PTN

Focused Rapid Process Improvement Workshops (RPIW) on targeted areas of improvement are ongoing and include cross program participation and involvement.

**CULTURE**

- Significant organizational efforts have been made to improve feedback to reporters of patient safety concerns. These efforts are PHSA-wide and are monitored through regular reports to the Board of BCEHS as well as the BCEHS Provincial Quality Council.

- Overdue events in the relevant program areas are being reviewed and monitored.

- Incident reporting and management policies have been implemented across BCEHS. Data capture for these issues is through the Patient Safety and Learning System (PSLS), which is used by all Health Authorities to capture patient-safety related events or hazards. Opportunities to explore the use of PSLS as a broader capture tool for issues tracking is under active consideration.

- Accreditation related initiatives support a culture of best practice and improvement:
  - BCEHS is participating in Accreditation Canada’s National Standards Working Group re: Medical Transport.
  - BCEHS is actively pursuing accreditation through Accreditation Canada’s QMentum process in October 2015. While not specifically detailed re: air medical transport systems, the Leadership Standards address overarching requirements for a robust quality and safety management system.
  - Critical Care Paramedical Training Program received accredited status through the Canadian Medical Association.

Also worthy of specific note and comment is the change this report signals. BCEHS acknowledges all of the recommendations summarized in this report and commits to a transparent response. A recommendations work plan is under development and will be published on the BCEHS website by the end of June 2014 with executive level accountability assigned. Regular monitoring will be instituted through the new organizational leadership structure and progress reports will be published. This report and the BCEHS response demonstrates a firm commitment to our patients, their families and our health care partners through a focus on continuous quality improvement driven and supported by evidence and best practice.
I would like to take the opportunity to thank all who contributed to this transformational work. Those familiar with quality improvement methodology in a health care setting will understand that the first step is identification of the issues with a validation through analysis and baseline understanding. The hard work begins as we develop, implement and monitor the strategies necessary to make the changes we need. I am confident in the organizational capacity and commitment to carry this work forward.

Carl Roy
President, BC Emergency Health Services
Section B. Introduction

BCEHS has undergone several internal organizational changes over the past couple of years. These changes include structural and process changes related to call taking, triage and resource allocation decisions of the air ambulance and critical care programs.\(^1\) In addition, the Office of the Auditor General of British Columbia released a report in March of 2013 entitled *Striving for Quality, Timely and Safe Patient Care: An Audit of Air Ambulance Services in BC* (the ‘OAG Report’). The OAG Report has numerous findings and recommendations around clinical and system performance, reporting and broader system design of the air ambulance program.\(^2\)

Senior executives with BCEHS reported receiving complaints and potential operational issues from Critical Care Paramedics and external stakeholders such as Regional Health Authorities (RHAs)\(^3\). The feedback to senior executives was consistent across several themes - types of calls being allocated to the critical care and air ambulance programs, allegations of incorrect resource allocation recommendations at point of dispatch, allegations of incorrect triaging of patients, allegations of improper recommendations of aircraft, and allegations of delays for calls that ideally would have an immediate launch of resources.

In September 2013, Chris Nickerson (the ‘Consultant’) began a review of the BCEHS Critical Care Program. The Consultant was contracted by the BCEHS and reported to the President of BCEHS. The Consultant was specifically asked to conduct a review of decisions concerning allocation of critical care and air ambulance resources and impacts of improper decisions. Further, the Consultant was asked to review adhoc complaints and operational issues raised by critical care paramedics concerning the operation of the program area. The Consultant was asked to try and establish the validity of the concerns being raised and provide a sense of importance to any issues identified.

A few critical points must be made at the outset of this report. First, it should be noted that the scope of the review is limited to resource allocation decisions, impacts of improper decisions, complaints, and issues as provided by the organization. The clinical care provided by the critical care teams was not reviewed. It should be noted that physician and clinical stakeholders interviewed expressed absolutely no concerns with clinical care provided by the critical care teams – adult and infant transport teams alike. Additionally, the very nature of the report is such that it was focused on areas the organization already suspected required improvement.

This report *does not* represent a comprehensive review of the system, system design, structures, processes and outcomes of either the Critical Care Program or the Air

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1. BCAS Management (2013, September). Preparatory Interviews. (C. Nickerson, Interviewer)
Ambulance System. Rather, the review focuses on those system components with a
direct or major indirect influence on resource allocation decisions and the frontline staff
issues provided for review. It is recognized that air ambulance and critical care systems
are highly complex and multifaceted in design – from clinical quality of care, to aviation
statutes and regulations, safety practices, cultural influences within organizations, etc.

For the purposes of this report, a distinct separation of air ambulance operations and
critical care transport is made. Air ambulance operations relate to utilization of an
aircraft to complete a request for service regardless of aircraft type, regardless of whether
it is provided by a contracted aircraft (i.e. dedicated to BCEHS) or standing agreement
agency and independent of the medical team providing care. Critical care transport is
defined as movement of a patient requiring or potentially requiring intensive care level
management (including specialty critical care teams in pediatric, neonatal and high risk
perinatology patients). As will be illustrated in the report, this becomes very important
for establishing mandate and performance objectives of air ambulance systems and
critical care programs.
**Section C. Statement of Work**

The statement of work for the Review includes:

- Review existing structure, processes, policies and procedures that guide allocation and decision making processes utilized by the Patient Transfer Network (PTN) and Patient Transport Coordination Center (PTCC) to dispatch critical care resources for interhospital and pre-hospital responses within BC.

- Review key financial and operational indicators to understand dispatch and resource allocation implications of current policies and procedures.

- Provide recommendations with respect to structure, process, policy and procedures aimed at improving workflows and decision making between the PTN and PTCC.

- Review complaints and issues raised by frontline staff and provided by the organization to the Consultant in an attempt to validate.

The statement of work included out-of-scope items including:

- Clinical review of missions and evaluation of care provided by air medical crews including patient care procedures, policies, protocols and patient care records.

- Review of equipment, infrastructure or aircraft and related documents, agreements or contracts.

- Recommendations on specific geographic placement or requirements for additional aircraft or staff.

- Review or provision of recommendations regarding the aviation components of the system (i.e. contracts, safety, performance, etc.)
Section D. Overview of Air Ambulance Systems

Air ambulance systems have developed rapidly across North America over the last 20 years and the trend is continuing\(^4\). During development of the ground EMS systems, a significant focus was placed on operational management, system design and performance measurement. As air ambulance systems developed later than ground systems, operational evidence and research regarding effective air medical systems is still evolving. In fact, even today, many operational and clinical questions exist around the design, use and efficiency of air medical transport systems.\(^5\)

There are a few key points about air ambulance systems that are either generally accepted or seem to be emerging as generally accepted across the industry and/or published literature:

1. The level of complexity involved in the regulation, oversight, design, management, operation, quality improvement, safety and logistics of air systems varies in many aspects from ground operations.\(^6\)
2. Air medical transport is/should be primarily utilized for critical care transport across the patient spectrum (adult, pediatric, neonatal and maternal) and across multiple systems of care and disease processes (trauma, sepsis, cardiovascular, stroke, etc.).\(^7,8\)
3. Jurisdictions have additional needs being met by air medical systems such as accessing remote or isolated patients and conducting non-critical care interfacility transport over significant geography with fixed wing aircraft. This would be especially prevalent in areas responsible for large geographic areas and/or numerous remote/isolated communities prevalent in all Canadian jurisdictions.
4. Systems use highly trained medical personnel in critical care teams of many different compositions (E.g. many combinations exist of Registered Nurses (RN), Respiratory Therapists (RT), Paramedics, etc., including Paramedic/Paramedic teams, RN/Paramedic, RN/RT, RN/RN, etc.)

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\(^5\) Ibid.

\(^6\) Ibid.


5. Differences exist in the ability of fixed wing jet (‘FWJ’), fixed wing turbo-prop aircraft (‘FWT’), and rotor wing (‘RW’). Each type of aircraft has different flight characteristics and capabilities related to range, weather, capacity, landing, etc. 9

6. Diversity exists in the design and application of air ambulance systems in Canada (i.e. varied mandates of operations). Canadian jurisdictions vary from not having an air ambulance system to having highly complex multi-purpose systems; from high performance exclusive critical care systems to low acuity long distance air systems; from dedicated aircraft to standing arrangement contracts; and using medical teams across the spectrum of scope of practice and care provider. 10.....

7. Many systems struggle with effective integration of air medical systems with ground ambulance systems and within the broader healthcare system. The differences between air and ground systems and often the level of care provided cause difficulties in moving patients requiring complex management effectively and seamlessly.

8. Oversight of air medical transport is a responsibility of both provincial and federal government agencies for Canadian jurisdictions.

It is imperative to understand the significant differences between air and ground ambulance operations, a number of basic concepts and definitions, and how each of these relate to the BC Critical Care Transport and Air Ambulance Programs. The differences between air and ground ambulance design and operations include (but are not limited to):

- Air resources (i.e. aircraft) are finite and very limited in number compared to ground ambulances. 17 This is extremely relevant to the impacts that resource allocation decisions have on the capacity of the air ambulance system as will be discussed later pertaining to the BC system. Further, the associated high cost per mission of air medical systems means inappropriate resource allocation decisions

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13 BCAS Management (2013, September). Preparatory Interviews. (C. Nickerson, Interviewer)
17 BCAS Management (2013, September). Preparatory Interviews. (C. Nickerson, Interviewer)
also represent a higher cost to the organization than those in the ground ambulance system.\(^{18}\)

- Air missions are complex and require significantly more logistical planning and effort to ensure safe and effective system performance compared to standard ground calls or ground interfacility transports.\(^{19}\)

- Critical care transport teams (i.e. critical care paramedics in BC) are also a finite resource and often very limited in number in most jurisdictions. Inappropriate deployment of finite critical care teams can result in a loss of capacity to effectively and rapidly move critical care patients. Matching critical care teams with appropriate modes of transport is critical to ensuring effective overall system performance.

- Critical care patients often require complex care. Teams providing critical care in a variety of transport environments require appropriate supports such as communication equipment, medical oversight and appropriate equipment for providing care.

- Combining air medical modes of transport with critical care transport results in a need to effectively receive, process and manage all aspects of missions. Failure to manage requests for service and mission logistics can result in poor patient outcomes, system inefficiencies and avoidable costs.

- ‘Critical care’ - this refers to a level of care required by patients that is equivalent to that provided in hospital-based intensive care units. Often critical care is referenced to mean simply the scope of practice of a specific practitioner (in BC’s case, critical care paramedics). In BC, critical care is often incorrectly synonymous with air ambulance operations. \textit{For the context of this report, critical care refers to the highest acuity and most complex patients requiring or potentially requiring intensive-care level management and is separated from the urgency of the transport and from the mode of transport.}

Air ambulance operations are the integration of two complex industries – aviation and transport (primarily critical care) medicine. Once mandate and desired outcomes are established within a system, attention can be placed on structures, processes, and systems that will achieve the desired outcomes (both clinically and operationally).

System design, applied in prehospital/interfacility transport, is defining why a system exists (i.e. what specific purpose(s) does it serve), defining the outcomes to measure whether it is achieving the purpose, and designing the processes, systems and structures

\(^{18}\) BCAS Management (2013, October). BCAS Financial Services Interviews. (C. Nickerson, Interviewer)

to best operate the system to achieve the desired outcomes. These same principles apply to air ambulance and critical care transport systems alike. As a specific example, a helicopter EMS system may be designed to achieve timely transport of major trauma patients within a specific geographic area. Operational performance (i.e. excluding clinical) in this case could be measured by indicators such as mission reliability or time interval measures (e.g. total call time). This example contrasts with a system using a low acuity (i.e. basic life support) fixed wing air ambulance program designed to limit/reduce out of hospital and/or transport time for lower acuity patients requiring transport over very long distances. Performance in this case could be focused on mission reliability and financial efficiency (E.g. high utilization with elimination of empty flight legs).

The system design, mandate and objectives of the two simulated examples above are a very basic example of how different systems can be designed and performance measured. BC’s air ambulance and critical care systems operate across the spectrum of possible uses of air medical resources and critical care teams – from isolated response, prehospital scene calls; to both high and low acuity interfacility transport. Appendix ‘A’ shows a mapping of BCEHS air and critical care operations with sample potential mandate, structures, processes and performance indicators.

One of the key components of system design is the governance model implemented to provide oversight and management of the system. It is imperative to have clear lines of accountability and responsibility internally within the organization(s). In Canada, air ambulance operations from a clinical and non-aviation operational perspective (i.e. excluding federal oversight of the aviation component of the system) are the responsibility of the provincial governments.

There are currently a variety of governance models across the provinces and territories including (not necessarily limited to):

1. Governments that contract for provision of all air ambulance service components including clinical care, medical oversight and aviation;
2. Governments that contract for each system component individually (i.e. one contract for aviation services, separate contract for clinical services, etc.);
3. Governments that regulate through the setting of provincial standards and measures compliance to those standards of a variety of operators;
4. Governments that operate services directly or indirectly through an agency, commission or other public entity; and
5. Governments that enter into an interprovincial agreement for provision of services from another jurisdiction or provider.

Key considerations when reviewing structure and governance of the system is the linkage to accountability, system design and oversight of the system. There should be clear and

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stated accountability for the system regardless of governance model. This could vary in nature from specifically defined contracts (e.g. performance-based or level-of-effort) to legislative requirements within the jurisdiction. Validation of performance and accountability is critical to ensure the system is functioning as it was designed to. This can be achieved through a variety of methods including audits, inspections, accreditation, reporting, etc.

Once governance of the system is defined, it is critical to ensure mandate and desired outcomes of the system are clearly articulated. This key step will inform other pieces of system design. If a jurisdiction desires effective and efficient long distance transport of patients regardless of acuity, a specific system design can be used to achieve desired outcomes. If the system is specifically designed for rapid prehospital response to trauma patients in an urban setting, a different system design, structures, processes and systems are required. In cases where multiple applications of air ambulance and critical care teams are desired, such as BC, it becomes paramount to articulate priorities and for processes to reflect the stated priorities. If mandate, objectives, and priorities are not clearly stated and defined, the system will have competing priorities with no clear direction on how to handle given situations. This can be at the individual mission level or at the macro-system level.

For ease of discussion within this report, resource allocation processes will be broken into three basic phases; input, throughput and output. Input is defined as call receipt and initial navigation to a triage system. Throughput will be defined as the triage process while the resource allocation decision will be defined as the ‘output’.

Throughout the report the term ‘over-triage’ is used. For clarity, over-triage is used within the context of this report to be synonymous with inappropriate use of aircraft and/or critical care teams (in some cases either resource or team and in some cases, both). In other words, it is used to describe missions where sending an aircraft and/or critical care team to a patient that did not require or potentially require the clinical capability of the team or a specific mode of transport that had a reasonable and safe alternative. These missions can also be referred to as a ‘false positive’ mission. It is recognized that certain over-triage or false positive rates are, in fact, required to mitigate under-triage of patients in critical care transport systems – especially in prehospital and remote community responses (i.e. a decision not to send an aircraft and/or critical care team to a patient that would have clinically benefited from such services). If not managed appropriately across the system, inappropriate or high over-triage rates may result in resources allocated on lower priority missions and unavailable for priority missions. This can be system dependent based on a variety of system design factors. This will be discussed in detail pertaining to the BC system.

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The specific over triage benchmark(s) selected by a jurisdiction should be dependent on the system mandate, system design, objectives and mission profile. In other words, a low acuity FW aircraft will have a very different launch threshold and performance objectives than that of a critical care RW operation. Over-triage will vary depending on the triage processes and resource allocation decisions used on a given mission. For example, higher over-triage rates in a given system may be associated with prehospital or community system of care missions compared to those interfacility transfers where a physician-led diagnosis is being used to help triage the mission request.

There are several position papers and standards that are available to help a system establish a comprehensive process for weighing all factors in dispatching critical care and air ambulance resources. Appropriate over-triage rates can be defined using standards, industry guidelines and published literature as guidance. Such standards and criteria include those published by the Commission on Accreditation of Medical Transport Systems (CAMTS) and position papers such as those published by the National Association of EMS Physicians (NAEMSP) and the Association of Air Medical Services (AAMS).
Section E. Methodology

The Review was conducted in three phases.

Phase 1

Phase 1 was preparatory in nature and included initial framing of the project with staff from the Critical Care Program. Supervisory staff and management from PTCC and PTN were interviewed.

The Consultant requested data related to the operation of Critical Care Transport Program and Air Ambulance Program. There were no ‘regular’ reports provided or reported to be in use by the organization on the operational performance of the air ambulance system.23

The list requested from the organization included:

- Any documentation around how BCEHS measures time intervals for air missions from time call received to time crew/aircraft back in service at receiving facility (or back at base). This could be in chart format, list format, etc.
- Call interval definitions - any performance standards used or reported by team, call type, aircraft type, etc.
- System of care or disease-specific performance standards used in broader healthcare system (cardiovascular, trauma, sepsis, stroke, etc.)
- Patient and/or stakeholder satisfaction surveys
- Mission volumes by aircraft type (5 years of trending) divided into:
  - Rescue/scene missions by dedicated/adhoc aircraft – community 911 calls to initial receiving facility
  - Scene missions by dedicated aircraft
  - Interfacility missions by acuity level and by diagnosis/chief complaint
- Mission reliability statistics
  - Total number of requests for air ambulance response
    - Disposition of mission request by:
      - Accepted clinically and completed
      - Accepted clinically and not completed by specific reasons (e.g. weather, all resources on missions, mechanical issue, etc.)
      - Rejected clinically – final disposition of requested transfer
    - Any statistics on true positives/negatives and false positive/negatives
- Response time reliability:
  - Total call times by mission type (adhoc versus dedicated) by aircraft type (rotor, turbo, jet) by team type and by patient type
  - Reaction times by same criteria
  - Response times by same criteria

23 BCAS Management (2013, September). Preparatory Interviews. (C. Nickerson, Interviewer)
o Scene times by same criteria
• Adhoc Missions for fixed wing (turbo and jet)
  o Volume
  o Response times
  o Total call times
  o Referral information (origination and destination)
  o Completing entity
• Stakeholder satisfaction (may be on a number of areas – reliability, response times, professionalism, communication, etc.)
  o Patients
  o Staff/Crew
  o RHA staff
  o Patients’ families
  o Dispatch staff

Phase 1 was commenced on contract signing and included receiving the following specific information from the client organization:

- BCAS Detailed Response – Audit of Air Ambulance Services, 2013
- BCAS Factsheet, Air Ambulance Service Audit Response, 2013
- Organizational charts of BCEHS, PTN and BCAS
- Policies and procedures of Critical Care Program, PTN and PTCC
- Dispatch School - PTCC Orientation Course Outline
- PTCC Improvement Project, Final Report, QPSA
- EMS – Safety Attitudes Questionnaire, Final Evaluation, QPSA
- Financial performance information
- Available job tools and process maps for PTN and PTCC
- Information related to adhoc complaints and inquiries from frontline staff and stakeholders

Phase 1 activities also included:

- research and review of relevant literature
- review and analysis of information provided by client organization
- telephone interviews with key leadership personnel within BCEHS, BCAS, PTN and PTCC
- scheduling of phase 2 site visit

Phased 2

Phase 2 was an on-site visit in Vancouver. On-site visits and interviews were conducted at:
• the Vancouver Regional Office of the BCAS and PTN
• station visit of BCAS Station 280
• Vancouver General Hospital
• PHSA Headquarters in downtown Vancouver

This week-long site visit enabled:

• in-person interviews with key leadership personnel and frontline staff across all organizations/divisions involved in the review
• further telephone interviews with internal and external stakeholders
• job-shadowing of:
  o PTCC Communications Officers and Call Coordinators
  o PTN Patient Transfer Coordinators (PTCs)
  o PTN Clinical Transfer Nurses (CTNs)

Upon completion of the Phase 2 site visits conducted October 21st – 25th, 2013, a teleconference was conducted with senior leadership from BCAS, PTN, and BCEHS. The purpose of the teleconference was to provide a summary of findings, provide any priority recommendations, discuss gaps in data or information required to complete the report and to allow the organization to immediately commence action on priority items identified.

**Phase 3**

Phase 3 was designed for synthesis, report writing, and follow up interviews as required. Phase 3 was designed to help fill any gaps in data from the phase 1 data request on system performance.

The report is formatted into current state, findings and recommendations and grouped according to structures, processes, systems and outcomes related to resource allocation decisions. The frontline staff complaints and issues raised are summarized in the ‘Outcomes’ findings and recommendations.

Processes related to resource allocation decisions are summarized as ‘Input’ processes, ‘Throughput’ processes and ‘Output’ processes. These are defined specifically in the appropriate sections and relate specifically to call taking, triaging, planning, and dispatch of both critical care and air medical resources.

Systems related to resource allocation decisions are information management systems related to input, throughput and output processes in PTN and PTCC.

Outcomes are defined as findings related to the summation of structures, processes and systems to achieve resource allocation decisions. Where possible, resource allocation decisions were reviewed according to established policy, procedure or stated organizational objectives.
As detailed in the Executive Summary, the report reflects status as of site visit in October 2013. Due to a variety of factors including the initial findings reported to the organization in a teleconference in November 2013, several structures and processes have changed and/or are contemplated for change. The report does not comment on changes since the site visit.

**Limitations of Review**

There are several limitations to note concerning this report. First, the validity and availability of the data significantly impacted the ability to fully assess the impacts of resource allocation decisions. Data that was provided was sourced from two areas of BCEHS to try and validate information provided. In every case, it was noted that data was not comparable across the systems. Not until the end of February 2014 was reliable data reported to the Consultant. This data was limited in nature and reported within.

The review of issues and complaints were strictly limited to non-clinical analysis of issues. The operational focus of the report should in no way diminish the importance of the clinical aspect of decisions and operations of the system.

The review of safety systems was out-of-scope of the review. However, where safety management system issues were identified to the Consultant, the organization was immediately notified for resolution.
Section F. Structures Related to Resource Allocation of Air Ambulance and Critical Care Resources – Current State

The Emergency Health Services Act (the Act) establishes BC Emergency Health Services as the corporate entity empowered to operate ambulance and emergency health care services within the province of BC. BCEHS is governed by a board of directors appointed by the Minister of Health. Current board members are also appointed to the Board of the Provincial Health Services Authority (PHSA). PHSA provides corporate management services to BCEHS under a management services agreement. The Act also establishes other frameworks for the ambulance and emergency health services systems. Paramedic scope of practice is determined under the Emergency Medical Assistants Regulation and the fee schedule for ambulance services within BC is set out under the Emergency Health Services Regulation.

There are no statutes, regulations, standards, statement of mandate, or performance measures relating to operational oversight of air ambulance operations in BC. This means that BCEHS is required to establish and define the system design internally and has direct oversight and accountability for the performance of the system. Accountability is to the BCEHS Board of Directors and to the PHSA.

PHSA central support services provide human resource, labour relations, financial services and other support services to all BCEHS entities.

Patient Care Quality Office (PCQO) and Quality and Patient Safety (QPS)

The Patient Care Quality Office of the PHSA serves to fulfil the legislated requirement for all health authorities in BC to provide a formal mechanism for patients or their families to register care or quality complaints (or provide compliments). For all PHSA entities, the PCQO coordinates review and response to these matters, including for BCEHS. PCQO also serves to receive all internal or external patient safety events. The event information is entered into the Patient Safety and Learning System and PCQO staff ensure the event is appropriately assigned for review and closure by the relevant program.

For those events identified as severe to catastrophic harm to patient (or potential if near miss) the Quality and Patient Safety division (QPS) is the lead. Accountability for these events is to the Board of Directors of PHSA. Events categorized as minor or no harm are forwarded to local or programmatic quality committees for action and follow up.

Safety events are followed up through occupational health and safety mechanisms including a provincially mandated reporting system.

24 BCAS Management (2013, September). Preparatory Interviews. (C. Nickerson, Interviewer)
27 BCAS Management (2013, September). Preparatory Interviews. (C. Nickerson, Interviewer)
Events that have multiple factors (patient care, safety, etc.) are reviewed using a joint investigation process between the different quality and safety programs. The organization ensures expertise specific to the event are specifically involved in any review process.

As the transition to PHSA is still in early stages, complete and integrated rollout of the Patient Safety and Learning System (PSLS) had not been completed at time of site visit. The PSLS is designed to be a frontline interactive event and issue reporting mechanism for all staff.

**BCAS**

At the time of the site visit, the BCEHS operates three primary entities; the BCAS, the PTN and Trauma Services British Columbia (TSBC). The Medical Programs section of BCEHS provides medical oversight to all three operating entities of BCEHS.

Structures and processes noted herein do not represent a complete representation across the organization. Discussion is limited to those related to resource allocation decisions of air ambulance and critical care resources. For the purposes of this Report, there will be a focus solely on the BCAS Operations Division. The Operations Division is subdivided into:

- Metro Operations
- Rural Operations
- Service Delivery
- Provincial Programs

At the time of the site visit, Provincial Programs included Provincial Scheduling, Emergency Management Office, Fleet Operations and the Critical Care Program which includes Aviation Services. Since the time of the site visit, Provincial Scheduling has been moved out of the Provincial Programs portfolio.

Air ambulance operations are a subsection of Provincial Programs under the BCAS Operations Division. Financial accountability and operational accountability for air ambulance contracts are the responsibility of the Critical Care Transport Program in Provincial Programs. Aviation safety is handled through the individual air carriers with compliance monitored through Aviation Services of the Critical Care Transport Program.

Service Delivery is divided into four primary service areas. Three of the service areas conduct prehospital call taking, dispatch and communications services and are based out of Kamloops, Victoria and Vancouver. The fourth, PTCC, is located within the Vancouver Communications Center and is responsible for coordinating all air and ground interfacility requests for the province.
Critical Care Transport Programs and Air Ambulance Operations

Critical care operations, under the oversight of the Critical Care Transport Program, are conducted by air and ground modes of transport across the province from five locations (Greater Vancouver (multiple locations), Nanaimo, Kelowna, Kamloops and Prince George. The Vancouver based resources include provincially-responsible specialty teams (neonatal, pediatric, high risk maternal) under the name Infant Transport Teams (ITT). Critical care teams are ideally matched to patients requiring or potentially requiring intensive care level management during transport.

Critical care teams based in Vancouver share aviation resources on a flexible staffing configuration. The critical care team in Nanaimo is a ground-based unit primarily for transport to/from Victoria. A similar dedicated ground critical care unit is located in Langley.

ITT critical care teams operate from the BC Women’s and Children’s hospital using all modes of transport.

Air ambulance operations in BC are divided into three main service functions:

1. Providing service to remote or isolated communities;
2. Providing patients with time-dependent injuries or illnesses timely transport directly from a prehospital scene to (primarily) definitive care; and
3. Interfacility (hospital) transportation of patients including specialty team (ITT) across all acuity levels from patients requiring basic life support to requiring critical care.

To accomplish the three main service functions of air ambulance operations in BC, there are dedicated aircraft contracts and standing agreement (adhoc) contracts with air carriers. Dedicated aircraft are utilized and on standby for the exclusive use of the BCAS while standing agreement or adhoc contracts allow for a preplanned relationship with a given air carrier, but not dedicated aircraft. The dedicated aircraft are based in Vancouver, Kelowna, Kamloops, Prince George and Prince Rupert. The aircraft currently under dedicated contract with BCAS includes rotor wing, fixed wing turbo-prop and a fixed wing jet.

Ideally, the most appropriate aircraft is matched with the most appropriate medical team (dedicated air medical or ground based paramedics) depending on the geographic location of the call and nature of the patient’s illness or injury. Expanding on the notion of matching aircraft to medical team, the air ambulance and critical care programs in BC attempts to match critical care patients with the appropriate critical care team using the most appropriate available mode of transport.
Table 1 illustrates the call distribution across dedicated and adhoc fixed wing and rotor wing aircraft from Sept 1, 2012 to Aug 31, 2013.28

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<tr>
<th></th>
<th>FW</th>
<th>RW</th>
<th>Total</th>
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<tr>
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<td>1,524</td>
<td>5,813</td>
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<tr>
<td>Adhoc</td>
<td>161</td>
<td>39</td>
<td>200</td>
</tr>
<tr>
<td>Total</td>
<td>4,450</td>
<td>1,563</td>
<td>6,013</td>
</tr>
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</table>

To fully understand the current use of air ambulance and critical care resources across the province, the three functional service areas are explored further:

A. Providing service to remote or isolated communities;

This category of response exists as no other reasonable, clinically appropriate, timely and/or safe option exists. An example of this mission category in BC is the response to a remote or isolated island community. Air resources are often used when water or ground access is not feasible or appropriate.

This category of mission in BC is conducted primarily by utilizing ground paramedics with standing agreement (adhoc) air carriers. These missions are primarily staffed with basic life support (BLS) or advanced life support (ALS) providers, depending on the specific location of the mission. On occasion, dedicated critical care paramedics with dedicated aircraft are used to respond.

The noted exception to using standing agreement air carriers with BLS staff for remote missions is the Prince Rupert base staffed with dedicated BLS paramedics in a dedicated RW aircraft. These paramedics are provided with additional aviation and transport medicine education.

Remote and isolated mission requests are received by the Service Delivery division staff in one of the three ground communications centers. Requests for air support are forwarded to the PTCC for a resource allocation decision. These missions typically originate directly from the public and are triaged using the ground ambulance call taking tool and dispatch systems.

28 BCAS Management (2013). Email from Service Delivery Branch.
B. Providing patients with time-dependent injury or illnesses rapid transport directly from scene to definitive care;

One of the primary reasons air medical (in particular, Helicopter EMS (HEMS)) systems exist is to provide timely transport for critically ill trauma patients directly to definitive care.29 Over time, other systems of care developed to the point where eliminating delays caused by distance or traffic benefit patient outcomes, depending on specific program and/or clinical areas (e.g. stroke, sepsis, S-T segment elevation myocardial infarction, etc.).

This category of mission is similar to ground ambulance from a performance point of view; that is, the organization providing service is usually paying high fixed costs for a given capacity to respond to the next emergency. In addition, from a system performance point of view, quality of care, mission reliability (the likelihood the next call can be serviced) and response/reaction times are key performance indicators to measure.30

BC has taken the notion of responding in a timely manner to time-dependent injury a step further in pre-alerting and dispatching fixed wing aircraft in areas of BC the greatest distance to definitive care (i.e. northern BC). This program, entitled Early Fixed Wing Activation (EFWA), has demonstrated some success at reducing response times to distant rural settings within the province.31 This ensures as timely as possible transport to definitive care whether that is determined as being provided at the regional hospital in Prince George or in Vancouver at a tertiary care center.

This category represents a higher call volume than remote/isolated response but still only a small portion of overall air ambulance calls within the BC system.

C. Interfacility transport of patients

Interfacility transport of patients requiring a medical escort completed by BCAS include all acuity levels of patients, across all modes of available transport and with varying degrees of urgency. Interfacility transport represents the majority of missions in the BC air ambulance system.32

BCAS currently utilizes both fixed and rotor wing for completing interfacility air missions for adult patients. In addition to critical care missions, air transport is

31 BCAS Management (2013, October). On-Site Interviews. (C. Nickerson, Interviewer)
32 BCAS Management (2013, October). On-Site Interviews, Statistics from Service Delivery Branch. (C. Nickerson, Interviewer)
currently utilized for patients requiring only a medical escort (i.e. basic life support paramedic) and facing over 5 hours ground transport in one leg of the mission regardless of acuity or urgency.

There are two dedicated adult critical care teams, one in Greater Vancouver and one in Nanaimo that primarily utilize a ground-based critical care ambulance. These teams are capable of responding to facilities that are within specific geographic response zones where responding a rotor wing would not be feasible.

Adult patients requiring prolonged interfacility transport or require critical care transport are typically transported by aircraft utilizing either critical care paramedics or by the ‘low acuity’ fixed wing based out of Kelowna.

The adult patient critical care paramedics are supported medically by online Critical Care Transport Advisors (CCTAs). ITT is supported by specialty physicians in medical oversight roles.

Across the systems of care described, aviation services are provided by a variety of models within BC including:

1. Dedicated rotor wing (RW) with bases in Vancouver, Kamloops and Prince Rupert;
2. Dedicated fixed wing turbo-prop (FWT) with bases in Prince George, Kamloops, Kelowna and Vancouver;
3. Dedicated fixed wing jet (FWJ) based in Vancouver;
4. Standing agreement (adhoc) arrangements with RW, FWT and FWJ providers.

PTCC

PTCC is responsible for coordinating all ground and air interfacility transport resources. PTCC is also responsible for dispatching all adhoc (standing agreement) air ambulance responses when dedicated BCAS air ambulances are unavailable or not appropriate as a response modality.

Call taking in PTCC is currently completed by 911 Call Takers shared with the Vancouver Communications Center. Call Coordinators (separated into ground and air coordinators) are responsible for logistical planning and dispatch of air ambulance resources and critical care teams.

PTCC, as discussed later, is staffed with non-clinical staff and uses algorithmic processes for determining priority of air ambulance and critical care team interfacility mission requests.
Medical Programs

Medical Programs are responsible for providing clinical leadership through medical oversight to the entire BCEHS system. This is achieved through a number of medical oversight entities providing a variety of services.

Prospective, retrospective and concurrent medical oversight for critical care paramedics are provided by:

- Critical care transport advisors (CCTAs) (concurrent during critical care missions);
- A medical director of the Critical Care Program (prospective and retrospective oversight)

The CCTAs are a group of critical care transport physicians with an established history with the program. There are a limited number of CCTAs that provide online support. CCTAs primarily have a background in critical care/intensive care specialties. CCTAs specialize in providing online medical oversight to critical care paramedics while conducting missions.  

Concurrent medical oversight for triaging air ambulance and critical care requests are conducted by a separate group of physicians known as Emergency Transport Physician (ETP) group. The ETP group is made up of approximately 43 provincially-distributed (primarily) emergency medicine or critical care physicians providing concurrent medical oversight at the request of PTN or PTCC. This group was formed and implemented in April 2013 as part of the Emergency Physician Online Support (EPOS) program. EPOS physicians are also responsible for providing non-critical care concurrent medical oversight to primary and advanced care ground paramedics.

PTN

PTN was launched in 2011 to enhance a collaborative effort between Regional Health Authorities (RHA’s), BCAS and other partners in efficient coordination of interfacility transports. PTN was implemented to replace BC Bedline to provide improved, comprehensive and integrated coordination for interfacility transportation and repatriation requests across the province. The PTN is comprised of Patient Transfer Coordinators (PTCs) and Clinical Transfer Nurses (CTNs). An administrative and quality support structure exists to support PTN operations.

33 BCAS Management (2013, October). On-Site Interviews. (C. Nickerson, Interviewer)
The goal of PTN is to provide clinical coordination and to enhance the coordination of interfacility transport requests. This is accomplished through using a combination of non-clinical PTC staff to initially screen incoming calls and provide bed coordination services and using CTNs to provide clinical oversight for high acuity transfer requests.\(^{35}\)

\(^{35}\) Ibid.
Section G. Structures Related to Resource Allocation of Air Ambulance and Critical Care Resources – Findings and Recommendations

This section outlines findings related to structures involved in resource allocation decisions and is divided into themes demonstrated during interviews and findings related to specific structural components of the organization.

Findings during interviews

During the interview portion of the project, themes were articulated by personnel at various levels of the organization – from frontline staff to senior executives. One primary theme was focused on a perception of disconnection between the Critical Care Transport Program and the two triage and dispatch entities, PTCC and PTN. Further, a lack of clarity on governance and accountability for system performance and issues management was clearly articulated by frontline critical care staff and management. Of note was the acknowledgement from frontline paramedics, supervisors, managers, directors, and medical directors alike that the system was felt to be likely having a negative impact on patients36 and inappropriately resourced missions were increasing operating costs to the organization.37 Investigation and validation of the perception of potential clinical impacts on patients was out of scope of this report but an important consideration for the organization in moving forward.

The lack of trust between entities was articulated by staff in a number of ways. Executives and managers in many areas of the organization felt that the Service Delivery section, responsible for PTCC and ground communications, is isolated within the organization and not responsive to the needs or feedback from other parts of the organization – in this case, Critical Care Transport Program. Other feedback included the perception of competing priorities within specific program areas preventing alignment of strategic planning and quality improvement initiatives.

A perceived lack of responsiveness to the needs and concerns expressed by frontline air and ground ambulance critical care staff have led to a feeling of a lack of trust of management. Staff interviewed also stated that the lack of trust also stems from a perception of a lack of leadership and accountability from the organization. The lack of leadership and accountability was related to numerous operational and organizational issues that have been brought forward by staff over a period of time. Staff indicated that for the vast majority of issues and concerns raised there had not been any feedback provided and no resolution has been communicated. The recent influx of issues to senior executive was attributed to the fact that paramedics now feel the operational issues have evolved into safety issues for staff and patients alike. Critical care paramedic staff, in

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36 BCAS Critical Care Paramedics, Supervisors, Management, Medical Programs staff (2013, October). On-site Interviews. (C. Nickerson, Interviewer)
37 BCAS Management. (2013, October). On-Site Interviews. (C. Nickerson, Interviewer)
many instances, feel they have become the ‘gate keepers’ of safe and clinically appropriate air and critical care operations. This perception, in at least a number of the complaints and issues provided for review, was validated.

Additional Findings

Several findings are related to governance, accountability, mandate, objectives and performance measurement.

As noted earlier, governance and accountability of air ambulance and critical care systems should be clearly articulated. While an organizational chart was provided to the Consultant showing direct reporting relationships, the functional reporting and accountability of the program is not clearly defined nor demonstrated in practice to be effective. Specific examples raised during interviews are provided to illustrate this point:

- Escalations of issues, complaints and inquiries internally from staff were forwarded to managers within the Critical Care Transport Program. The cases were then forwarded to Service Delivery (PTCC) and PTN for follow up and action as required. Critical care staff and management have limited access to necessary systems and data to conduct direct research or case reviews. The outcomes of these inquiries were not communicated to staff.
- The Critical Care Transport Program required approval from either Service Delivery and/or PTN on policy, procedure or practice affecting or involving air and/or critical care resources. This results in expertise and policy direction from direct service delivery entities (Critical Care Transport or Air Ambulance Programs) not being implemented. An example of this is stated in later sections – the lack of flight following policies and procedures for aviation missions discovered during the on-site interviews. Flight following policy and procedure was only implemented after Service Delivery agreed to implement such a practice and explicit direction from Senior Executive.  
- During the site visit, the Consultant was made aware of a major process improvement focused on dispatch procedures related to air ambulance and critical care teams. The chair of the Service Delivery committee hosting the process improvement workshop contacted the Consultant who was meeting with a manager in the Critical Care Transport Program at that time. Critical Care Transport Program leadership was not aware the process improvement workshop was being conducted despite the direct impact on policy decisions of what aircraft to dispatch to specific missions. This illustrates disconnect between program areas in process mapping involving air and critical care resources.

The organization is structured currently that Service Delivery (i.e. PTCC) and PTN design and implement resource allocation procedures and practices usually in the absence of input, oversight or direction from the Critical Care Transport Program. This practice

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38 BCAS Management. (2013, November). Follow up Interviews. (C. Nickerson, Interviewer)
39 BCAS Management (2013, October). On-site Interviews, Service Delivery Management. (C. Nickerson, Interviewer)
and structure is inverted to proper alignment of a patient-centric and performance-based system. Consideration should be given to Critical Care and Air Ambulance Programs clearly defining the ‘what’ of system performance (i.e. mandate and performance objectives) and jointly working with PTCC and PTN to implement the ‘how’ of processes and policies to achieve stated objectives and desired system outcomes.

Table 2 illustrates the current distribution of calls by time of day and acuity level (by time of day mission commenced). The lack of clear performance expectations results in critical care teams conducting low acuity missions (Alpha, Bravo and Charlie) during night time hours when risk to air operations is demonstrated to be higher\(^40\) and when limited resources are available to provide services to the province. When mapped to the supply of critical care crews, the supply and demand mismatch is illustrated. Multiple medical crews are available during daytime peak demand hours when limited aircraft are available.

Table 3 maps demand of low acuity (alpha, bravo and charlie) and high acuity (delta and echo) missions against air medical crew availability regardless of team or aircraft type from Sept 1, 2012 to Aug 31, 2013. \textit{In this chart, the relationship of demand volume and air medical crew supply is key – not the direct correlation to volume and quantity (i.e. where the Air Medical Crew resources line extends above call demand line does not correlate to inadequate resources – or vice versa for if it extends below the demand line).} Further analysis and research is warranted to fully map the supply and demand of resources for the system.

Tables 2 & 3 illustrates that during hours of limited air medical crew availability, low acuity missions are regularly being dispatched. BCAS’ practice of using critical care air medical crews to conduct alpha, bravo and charlie non-critical care missions, especially at night with limited resources, influences the availability of critical care (and air) resources to respond to critical care mission requests.

These tables can be used to illustrate the distribution of missions completed and to illustrate how over-triage rates can have differing effect depending on mandate and objectives. In the current system configuration, there is one critical care adult team available overnight, with multiple aircraft and ground transport options. If an alpha, bravo or charlie mission is accepted and tasked to the lone crew available, it is at the expense of provincial critical care coverage. In that circumstance, the system should define that mission as ‘over-triaged’. The impact of the over-triaged mission is that any critical care and/or urgent/emergent mission cannot be performed within a timely manner by the BC dedicated crew, potentially delaying a response to a critical patient by hours and causing avoidable financial cost due to an out-of-province resource completing the mission. The same crew doing a low acuity mission during the day when multiple dedicated crews are available for critical care transport would not necessarily be ‘over-

triaeg for the system (although potentially over-triage for the critical care team). This is where clear definition of mandate and objectives are required by the service for clarity of when low acuity calls are appropriate to be completed by air and/or critical care resources.

Appendix ‘A’ illustrates a sample matrix of operational mandate and interlinks across the air and critical care systems. The interplay and impacts of prioritizing one category of mission over another (i.e. one resource or team over another) must be fully understood and ideally proactively mapped by the organization.

It is also important to note that the reports populating Tables 2 & 3 were generated solely for the purpose of this report and is not regularly produced for BCEHS management.
Table 2. Distribution of Air Missions Sept 1, 2012 to Aug 31, 2013

<table>
<thead>
<tr>
<th>Hour</th>
<th>Alpha</th>
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<th>Charlie</th>
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</table>
Recommendations:

1. It is recommended that BCEHS defines the governance model and implements an accountability framework for critical care transport and air medical operations within the province. This will enable clear accountability for establishing mandate, objectives and measuring, reporting and improving performance.  

2. It is recommended BCEHS aligns strategic and business planning across all operating entities. This will help ensure that processes and systems are aligned to achieve outcomes desired for the patients served by the system.

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3. It is recommended BCAS articulates a clear mandate and objectives of the air ambulance and critical care transport programs. Consideration should be given to:
   a. Implementing a strategic advisory committee or similar structure with internal and external stakeholders that would assist in developing mandate, objectives, etc.
   b. Ensuring appropriate expertise in areas such as clinical care, critical care, aviation, communications, safety and quality improvement are involved in the further development of the program areas.
   c. Enhancing the role of critical care/intensive care transport medical oversight and clinical expertise within the organization.
   d. A clear understanding of critical care transport (focused on the level of care) and air medical transport (use of air resources) needs to develop to best understand the performance, interlinks and potential of both programs.

Discussion

In the current organizational structure, Critical Care Transport and Air Ambulance Programs needs to define mandate and objectives including policies and procedures for operation of the critical care programs and air ambulance programs. Processes should be implemented by Service Delivery and PTN to achieve desired outcomes of the Critical Care Transport and Air Ambulance Programs. A parallel within the organization can be made to the Resource Allocation Plan (RAP) for ground ambulance. The organization uses operational, cultural and published evidence to inform resource allocation decisions in the ground ambulance – Service Delivery uses the RAP to make decisions on ground ambulance resources and are held accountable by the organization to adhere to the RAP.

Articulating the mandate of the air ambulance and critical care program will assist in defining performance objectives, understanding demand, and determining required resources for the system. The OAG Report touched on the need to ensure appropriate geographic placement of aircraft and crews. Prior to establishing or contemplating change to geographic distribution, team composition, or aircraft type, a clear statement of mandate and objectives for the system are required to enable demand mapping and a comprehensive review of system design. As an example, referral patterns of accurately and consistently triaged critical care patients by time of day and day of week may suggest an additional nighttime resource are required. Conducting a demand analysis based on specific mandate and performance objectives may indicate another low acuity resource is required, a change of geographic location of a resource is indicated, or no changes are required. A comprehensive analysis may suggest both of these can be accomplished by redistribution (temporal, geographic or both) of resources.

One of the challenges for BCAS in establishing a clear mandate and performance standards is the lack of industry-accepted standards in Canada. The fact that BC uses both dedicated and adhoc aircraft, dedicated air medical teams and ground ambulance paramedics in aircraft, and utilizes different combinations of the above to provide
prehospital service to remote/isolated communities, autolaunch/EFWA and interfacility transport significantly complicates how BCAS can prove effectiveness across all operations. Each program area and function must be defined and a mandate and/or objectives developed to ensure appropriate performance of the system. Appendix A provides an example of how BCEHS could define operations and performance across the areas of operation within the Critical Care Transport and Air Ambulance Programs.
Section H. Processes – Current State

The processes related to resource allocation decisions within BCEHS were categorized as inputs, throughput and output processes. Input processes include call receipt processes, throughputs include triaging of mission requests and outputs are decision making processes for final mission acceptance and dispatch of resources.

Additionally, the review looked at processes related to logistical support while missions are underway. These processes primarily included flight following and operational awareness processes within PTCC.

Input and Throughput Processes – Call taking and triage

To understand the variety of call taking, triage and resource allocation processes and the impacts on resource allocation it is important to recall that there are three primary sources of demand on air ambulance resources in BC: requests for remote/isolated response, requests for prehospital/autolaunch/early fixed wing activation (EFWA), and requests for interfacility transport. Each of the three categories of calls is processed differently within BCEHS and has multiple entities responsible for call taking, call triage and resource decisions. These multiple pathways result in inconsistent triaging of missions and mission requests within a specific mission category. While there are different criteria and processes for triaging across the three systems of care, the number of pathways for triage to take place within each category of mission should be limited.

Call taking and triage processes are so closely interlinked that these process categories will be discussed together. It must be noted that PTN, besides fulfilling initial call taking and triaging functions, also serves to coordinate in-patient bed availability for interfacility transports – a critical function to complete for efficient interfacility transport.

To illustrate the multiple possibilities for call taking and triage of air ambulance and critical care missions, Table 4 shows initial call receipt distribution across each of the BCAS and PTN entities based on call type. Multiple boxes connected to one mission type indicate that multiple possibilities exist depending on caller, entity capacity, etc. (E.g. interfacility transport call taking agency).

Remote community access missions and autolaunch requests are initially handled by one of the three ground communications centers. Interfacility requests, including call receipt and processing of requests, is handled by PTCC and the PTN. At the time of site visit, approximately 80% are handled by the PTCC and 20% are handled by PTN.43

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Table 4. Inputs (Call Receipt)

<table>
<thead>
<tr>
<th>Mission Type</th>
<th>Initial Call Taking Agency</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote community access</td>
<td>Ground Communications Center</td>
<td>Received primarily through 911 system – request made to PTCC for air launch</td>
</tr>
<tr>
<td>Autolaunch/EFWA/Prehospital</td>
<td>Ground Communication Center</td>
<td>Received primarily through 911 system or by field activation by paramedics – request made to PTCC for air launch</td>
</tr>
<tr>
<td>Interfacility Transport</td>
<td>PTCC</td>
<td>Received by Vancouver Comm Center Call Taker – forwarded to PTCC Call Coordinator</td>
</tr>
<tr>
<td></td>
<td>PTN (desired end state)</td>
<td>Receives approx. 20% currently. Received by PTC – forwarded to CTN or PTCC</td>
</tr>
<tr>
<td></td>
<td>Specialty Team Medical Oversight Physician</td>
<td>Direct requests from sending facility into receiving facility physicians who are also functioning as specialty team (ITT) medical oversight.</td>
</tr>
<tr>
<td></td>
<td>(Pediatric, Perinatology, Neonatology)</td>
<td></td>
</tr>
</tbody>
</table>

PTN Call Handling and Triage

PTN is involved in the call receipt and processing of interfacility requests and therefore plays at least an indirect role in resource allocation decisions for interfacility missions. PTN is not directly involved in the resource allocation process for autolaunch, early fixed wing activation, field activation by paramedics or remote/isolated community response of critical care and/or air medical resources. PTN does provide bed coordination for EFWA missions.

Utilizing the PTN call taking algorithm, the PTC establishes whether the sending facility staff classifies the patient as in ‘life, limb, organ threatened’ (LLTO) category (Red), unscheduled higher level of care (Yellow) category, scheduled (Green) or repatriation (Blue) category. If the call is deemed in the Red or Yellow category, the call is transferred to a Clinical Transport Nurse (CTN). If a CTN is not available due to volume of calls or lack of staffing, calls categorized as Red or Yellow are directed to PTCC.
The CTN completes the questions in the PTN Case Manager software and provides a code ‘91’ determinant – coded either Charlie or Delta (at time of site visit). This is not transferrable or similar to the PTCC ‘Card 49’ determinants. The ‘91’ code and call information is then forwarded to PTCC.

ETPs can be consulted on any call by the CTN for additional clinical expertise. ETPs can override software determinants based on physician to physician consultation with the sending and receiving physicians. By policy, PTCC will accept triage priorities from both CTNs and ETPs.

It is important to note that once the sending facility indicates that the mission request is either LLTO or an unscheduled higher level of care transport, the CTN is limited to 91D or 91C determinants by the Case Manager software. The potential impacts of this narrow triage output will be discussed later.

**PTCC Call Handling and Triage**

As indicated in Table 4, there are three general types of missions involving air ambulance resources that are received and processed by BCAS. Those types of calls are triaged and prioritized differently due to the nature of the request and needs of the patient.

The three ground communications centers are responsible for requesting aircraft response for autolaunch/EFWA and missions to remote communities. The ground communication centers forward the request to PTCC for coordination. The autolaunch process is driven by an evidence-informed protocol translated from the Advanced Medical Priority Dispatch System © (AMPDS). Initial call receipt and processing in the PTCC is conducted by the broader call-taking group within the Vancouver Dispatch/Communications Center.

Interfacility mission requests received by PTCC are processed using a ‘Card 49’ triage tool, if not previously triaged by a CTN, ETP or Specialty CCTA. The output of card 49 triage tool includes the coding ’49’, a letter determinant of Alpha, Bravo, Charlie, Delta or Echo to prioritize urgency, a numeric determinant of 1-5 for level of care required and suffix coding (if applicable).

Table 5 summarizes the potential call triaging entity and the related process or tool used to triage requests for air medical and critical care missions.
Table 5. Throughputs (Call Triage Process)

<table>
<thead>
<tr>
<th>Mission Type</th>
<th>Triaging Entity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote community</td>
<td>Ground Communication</td>
<td>Triaged using AMPDS call determinant</td>
</tr>
<tr>
<td>access</td>
<td>Centers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autolaunch/EFWA</td>
<td>Ground Communication</td>
<td>Triaged using AMPDS call determinant</td>
</tr>
<tr>
<td>Prehospital Request</td>
<td>Centers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paramedics</td>
<td>Field trauma triage activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interfacility Transport</td>
<td>PTN</td>
<td>CTN using Case Manager software – results</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in card ‘91’ determinant</td>
</tr>
<tr>
<td></td>
<td>ETPs</td>
<td>Consulted by CTN or PTCC – may result</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in either Card 91 or 49</td>
</tr>
<tr>
<td></td>
<td>Specialty CCTAs</td>
<td>Consulted by CTN or PTCC – results normal in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Card 49 code</td>
</tr>
<tr>
<td></td>
<td>PTCC</td>
<td>Triages 80% currently using Card 49</td>
</tr>
</tbody>
</table>

Output Processes - Resource Allocation Decisions

The previous two sections outline the potential pathways and tools used for receiving and triaging requests for air ambulance resources and critical care teams across the province. This section will discuss the PTCC roles and responsibilities in determining whether the call is appropriate for air ambulance response, whether the call is appropriate for critical care team response and final determination on which resource to allocate to a mission. The primary focus will be on the decision to use air resources and determining which resource to send. A secondary focus will discuss the use of the critical care teams.

The end result of the call taking and triaging processes discussed in the previous sections is a mission request received by the PTCC Call Coordinator. The Call Coordinator is responsible for determining whether an air resource is appropriate, as required seek the appropriate approval for launch, and dispatch air and critical care resources.

The PTCC Call Coordinator potentially receives requests from three ground communications centers, the PTN (missions that are triaged and that are not triaged), ETPs and specialty CCTAs. This results in potentially six different triage pathways and
processes leading to a request for a resource. The requests will vary in the level of triage performed - from citizen input using algorithmic determinants (e.g. Autolaunch) to clinically driven decisions directly from specialty team CCTAs or CTNs.

Once the determinant or mission request is received, the Coordinator must prioritize and decide dynamically what resource(s) should be allocated. Unlike the BCAS ground system, there is no comprehensive resource allocation plan available for PTCC Call Coordinators. In fact, there were limited job tools provided to the Consultant that are available to Call Coordinators to help inform resource allocation decisions.

PTCC’s resource allocation decisions are based on aircraft capability, aircraft availability, and availability of medical teams. If a low acuity mission request is received, the mission is ideally resourced with the low acuity fixed wing aircraft. Missions not able to be resourced by dedicated critical care teams and/or dedicated aircraft often result in use of adhoc aircraft and/or out-of-province resources. Adhoc aircraft and out-of-province resources are less cost effective than those covered under the dedicated aircraft contracts.

PTCC Call Coordinators are provided limited guidance as to resources to be allocated. There is not a ‘preferred’, ‘ideal’ or pre-determined option for response based on mission location, type or priority. A very basic map illustrating range for aircraft based in Vancouver is provided within the PTCC Policy Manual. A few electronic-based charts outlining basic airport information (e.g. runway length and access procedure) are available to the Call Coordinator. During interviews, it was noted that most of the ‘how to’ of the Call Coordinator position is learned in ‘real time’.

**Mission Support Processes – Current State**

PTCC has a satellite-based software tracking program capable of tracking positions of dedicated aircraft within the system. There are no policies related to the use of the software or maintaining flight following standards. Contracted air carriers (adhoc and dedicated) are required to maintain flight following standards and policies for their aviation resources. There is limited information in the PTCC Orientation Manual related to flight following or mission support processes. There is limited policy on declaration of inflight emergency procedures and no policy related to a post-accident or incident plan, aircraft separation, communications emergencies, etc.
Section I. Processes – Findings and Recommendations

It is critical to understand that the call receipt, triaging, prioritization, planning and logistical support required to perform safe, effective and consistent air ambulance and critical care missions is significantly more complex than ground ambulance communications processes. It was reported by staff and management that, while a ground call or interfacility transport might take up to ten communication transactions to complete, air and critical care transports can exceed forty individual communication transactions.

This section will be based on important differences between air and ground EMS systems, including:

- All decisions to send an air ambulance and/or critical care team have an impact on the ability to respond to the next critically injured patients. Over-triage has the potential to negatively impact patients and result in avoidable costs.  
- Patients requiring interfacility transport in BC have typically had some degree of physician-led assessment and at least minimal diagnostic testing resulting in a more accurate and complete clinical picture than those patients in the prehospital setting.  
- Air operations frequently require well-coordinated and timely ground ambulance support to be effective (E.g. FW patients transported to/from airports).  
- Communications personnel responsible for air ambulance operations should have education and mentorship in a variety of topics not included in a typical ground ambulance call taker or dispatch education.

Call Receipt and Triage (Input and Throughput Processes)

Remote and Isolated Response

Remote and isolated patient mission requests are answered by a ground ambulance communications center call taker and are triaged according to the AMPDS software. There were no findings regarding the call taking and triaging of these requests. There are, however, findings related to the resource allocation decision for these mission types discussed in a later section.

45 BCAS Management (2013, October). On-site Telephone Interviews – Medical Programs Staff. (C. Nickerson, Interviewer)
Prehospital, Autolaunch and EFWA Missions

Findings related to prehospital, autolaunch and EFWA missions were primarily related to processes in the ground communications centers. A number of missions were provided illustrating where communications center staff were not following established criteria for launch or not requesting an air resource when requested by ground paramedics based on field triage. This finding was verified by both frontline and management staff within Service Delivery.

Recommendations for this section are linked to output processes of autolaunch discussed later.

Interfacility Transport

Call taking and triage processes for interfacility transport in BC are complex and result in multiple pathways of how a request for service could be handled. It was stated by PTCC staff, critical care staff and management interviewed that the same hypothetical request for interfacility transport would be handled in different ways and result in differing resource allocation decisions. The potential impact to patients of this lack of consistency was well documented in the Office of the Chief Coroner for Ontario’s report on the transport related deaths.48

The net result of the current structures and processes is that the system is designed to receive inputs (interfacility requests) into two communications centers and throughputs (call processing/triage) from two different triage tools plus potentially two physician groups. The result of having multiple call receipt, triage tools and processes is that the entity responsible for making the final resource allocation decision, PTCC, has determinants and priorities from potentially six or more input sources and throughput pathways. This leads to inconsistencies in resource allocation decisions. The PTCC Coordinator is left trying to determine appropriate resource allocation of finite resources with non-comparable determinants and triage priorities. This, coupled with a lack of a formal resource allocation plan, guidelines, and performance expectations results in inefficiency, inconsistency and inappropriate use of aircraft and critical care resources.

Concerns were voiced from the medical community interviewed on the sole reliance on the sending facility to make the determination on urgency of interfacility transport:

“…significant concern over the universal acceptance of the sending facility determination of urgency, they trump everyone…”49 Such factors as geographic location, staffing

49 BCAS Management (2013, October). On-site Telephone Interviews – Medical Programs Staff. (C. Nickerson, Interviewer)
levels and comfort level of sending physicians will vary with the same patient and will end up skewing the proper triage level of missions.

It is noted that when conflicting missions arise, ETPs can be consulted to provide physician-led oversight to help prioritize missions. However, this practice does not assist the PTCC Coordinator in individual decisions of missions (e.g. when to use the last provincial air ambulance and/or critical care team, leaving the province with no capacity to respond for several hours). This is evident in basic call distribution data provided by BCAS discussed in later sections.

At time of writing this report, it was noted that PTN processes a maximum of 20% of the total ground and air interfacility mission requests. The breakdown of the acuity or urgency of these patient transport requests was not known. The low uptake is attributed by the PTN during site interviews to poor utilization rates by some Regional Health Authorities combined with, at the time of site visit, limited initial human resource (HR) capacity within PTN (additional staff was being recruited during the time of this project).

‘Transfer planning’ was a function that was described as a responsibility of PTN during site interviews with PTN management. However, at the time of site visit, this function did not routinely or as a matter of policy or process, involve any personnel from PTCC, Air Medical Programs or the Critical Care Transport Program. PTN staff further identified that PTN is not involved in ‘transport logistics’. It was stated that transfer logistics is the responsibility of BCAS. Neither PTN nor PTCC had policy to define what comprised transfer planning nor transport logistics functions.

These statements further illustrated disconnect between PTN, PTCC, Air Medical Programs, and Critical Care Transport Programs. Safe, appropriate, efficient and effective interfacility transport involves every entity with any responsibility for receiving, processing, planning, dispatching, and supporting resources to complete the patient transport. A patient-centered approach is recommended in the development of any system or process.

**Output Processes (Resource Allocation Decisions) – Findings and Recommendations**

This section will speak specifically to the output processes – the decisions to send (or not send) an air resource and/or a critical care resource to a request for service. For clarity, the categories of calls – remote/isolated, autolaunch/EFWA/prehospital and interfacility transport will be utilized.

**Remote/Isolated Output Processes - Findings**

While it was noted earlier there were no significant findings for the call receipt and processing of requests for isolated and remote air missions, there are several notable findings related to output processes. These will be discussed as they relate to impacts to patients and financial resources.
It was noted by PTCC staff and management interviewed that there were very limited tools available to the PTCC Call Coordinators to help in resource allocation decisions. Complaints were provided where geography of the area and capabilities of the aircraft were not understood by call taking and processing entities including:

- Missions requiring multiple remote refueling stops for adhoc rotor wing aircraft when a fixed wing was available and could have performed without refueling; and
- Missions where critical care staff with dedicated aircraft were requested for low acuity prehospital missions where a reasonable alternative existed for the specific circumstances.

Impacts of these decisions can include:

- Communities with limited (or no) emergency ground ambulance coverage while the mission is ongoing. It is recognized this may be necessary for some priority missions in any system. However, it is also recognized that often alternative safe modes of transport can be utilized that are appropriate for the patient and maximizes continued emergency coverage for the geographic area served.
- Delays to mission for refueling stops where patients and paramedics are offloaded during refueling;
- Increased takeoffs and landings; and
- Increased costs per mission.

Numerous other anecdotal cases were discussed with staff and management across the organization. The Consultant was unable to validate concerns due to a lack of data readily available. However, the consistent theme was that often there is disconnect between what the patient clinically requires, resources available and the appropriate resource allocation decision.

**Recommendations:**

4. It is recommended that BCAS develops job tools for PTCC Call Coordinators to provide options and appropriate decision making processes for use of adhoc air resources, dedicated air ambulances and critical care resources. This should be informed by evidence wherever possible.
5. It is recommended that a comprehensive air medical communications program be developed and implemented that includes topics such as those defined in industry accepted guidelines and standards that would support appropriate air medical operations.  

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6. It is recommended that policies and procedures that are evidence-informed are implemented to guide air ambulance and critical care operations.

**Autolaunch/EFWA/Prehospital Output Processes – Findings**

Complaints from frontline staff were provided to the Consultant that demonstrated a misunderstanding of the autolaunch process as contrasted to field-requested air medical response from on-scene paramedics. Complaints were provided where field paramedics and critical care paramedics felt the specific circumstances met autolaunch criteria and the helicopter was not launched.

These complaints and findings included:

- delays to autolaunch when indicated by established policy
- launching on calls not indicated by policy
- not launching when requested by ground ambulance paramedics based on field triage protocols
- superfluous communication on what was unfolding in the field as ground ambulance calls were being dispatched

Overall, it was noted a number of times during interviews of staff and management that ground and air paramedics do not trust the level of consistency of launch decisions for time-dependent prehospital critical care missions. PTCC validated the complaints referenced in the bullets above with examples of each.

**Recommendations:**

7. It is recommended that BCAS establish clear policy and process for prehospital activation, autolaunch, and EFWA missions.
8. It is recommended a comprehensive quality program be developed and implemented to ensure a focus on ongoing quality improvement within the air ambulance and critical care programs.
9. Quality mechanisms should include investigation and follow up of potential cases of deviation from policy and procedure.
Interfacility Transport Output Processes – Findings

PTN and PTCC’s triaging of calls and determination of acuity and urgency is done in isolation from direction or a policy framework from those accountable for the air ambulance and critical care transport system. This lack of mandate and objectives of the two program areas creates a void that is filled with differing policy and operating principles between entities. The end result, at a minimum, is operational inconsistency, increased risk of potential negative impacts to patients and staff, and increased operating costs.

PTCC Call Coordinators stated that many resource allocation decisions are based on the individual situational circumstances and interpreted differently depending on the Call Coordinator. Safe, appropriate and consistent resource allocation is then governed solely by the knowledge and experience of the specific Coordinator on duty at a given time. Issues provided demonstrated critical care paramedics on-duty trouble-shooting missions and offering options for moving patients to avoid inappropriate use of aircraft and critical care teams.

To be clear, it was evident that both PTN and PTCC frontline staff are trying to perform their duties to the best of their training, skills, and abilities with the job tools provided. Significant opportunity exists to improve the education, training and tools used by both PTN and PTCC.

Issues from frontline staff were validated that demonstrate the inconsistencies of resource allocation decisions. These include RW use for ambulating patients that were scheduled for admission to non-critical care units in a geographic area served by only one critical care team and one RW resource. These types of missions clearly demonstrate inappropriate use of rotor wing and critical care resources.52,53 These patients were accessible by alternative modes of transport, were deemed not to have a time-dependent illness or injury (retrospectively by critical care paramedic review) and did not require or reasonably require the skills or abilities of a critical care team. These missions have direct financial impacts to the system. From a quality perspective, missions should be reviewed to establish whether a justifiable deviation from industry practice for helicopter EMS and critical care transport was warranted. If not warranted, root causes should be understood and mitigation strategies should be implemented.

The Consultant requested post-mission review statistics for validation of pre-mission/pre-arrival triage levels for critical care missions. The Consultant was advised the organization does not track post-mission acuity levels to compare with pre-mission triage

levels. The lack of a quality mechanism to validate the utilization of air and critical care resources creates a void in validating appropriate service to patients – a key characteristic of appropriate air medical model design.\textsuperscript{54}

The Consultant was provided with data from critical care paramedic student preceptorship experiences. This data was provided as a result of interviews with critical care paramedics – it is not tracked routinely by management of the organization. Table 6 shows the levels of care required by 593 patients transported by critical care paramedic students during clinical preceptorship with dedicated critical care paramedic staff across all BCAS critical care bases. This data was recorded during mandatory post-mission review for critical care paramedic students. It was noted the data was summarized without complete submission from all critical care bases.

The ‘Critical Care Paramedic Complex, Very Complex and Simple’ ratings are subjective levels of complexity but clearly required care only in the scope of critical care paramedics. However, it clearly represents a significant portion of critical care and air ambulance missions that are within basic life support and advanced life support scopes of practice and could be completed by non-critical care teams. This excludes the Prince Rupert RW and Kamloops low acuity fixed wing aircraft and medical teams.

Table 6. Acuity Statistics for CCP Students (Mid May to Sept. 2013)

<table>
<thead>
<tr>
<th>Level of Care Required</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Life Support</td>
<td>73</td>
</tr>
<tr>
<td>Advanced Life Support</td>
<td>16</td>
</tr>
<tr>
<td>Critical Care Paramedic - Simple</td>
<td>310</td>
</tr>
<tr>
<td>CCP Complex</td>
<td>76</td>
</tr>
<tr>
<td>CCP Very Complex</td>
<td>22</td>
</tr>
<tr>
<td>CCP Vented</td>
<td>96</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>593</strong></td>
</tr>
</tbody>
</table>

The triage tool used in the PTN is significantly different from the triage tool used by PTCC. It is understood that the PTN tool was adopted for use from another jurisdiction, including the processes and definitions to achieve coding for triaging patients.\textsuperscript{55} It must


\textsuperscript{55} BCAS Management (2013, October). On-site Telephone Interviews – PTN Staff. (C. Nickerson, Interviewer)
be noted that the jurisdiction from which this tool was obtained has a significantly different governance model, accountability framework, resources and program mandate than that of BC. It is unclear as to the analysis conducted regarding the differences in mandate and number of resources between the systems involved when this tool was adopted. Further, there was no available analysis or quality metrics provided showing the impact this change has had on the BC system.

Whether arbitrary or well-planned, significant impacts can result when the criteria for either mission acceptance, team composition and/or mission urgency is changed. Making changes without measuring effect can potentially result in undetected, undesired and/or unmeasured consequences. In the absence of a stated mandate, objectives, and performance measures, a change may occur without even understanding the consequences. It is imperative to plan change and have appropriate quality and performance measurement to ensure the change achieves its desired goals and does not have unintended negative consequences.

It was also noted that having critical care paramedics in FW aircraft landing in Vancouver with very low acuity patients and then having to accompany the patients into the receiving facilities delays return-to-service of the limited critical care teams. While patient hand-off is recognized potential patient safety issue, especially for critical care patients, many systems, including the BCAS ground ambulance system, rely on multiple crew transfers of care for low acuity long distance transport. Opportunity exists to explore much more efficient transport of low acuity patients while maintaining a higher capacity for critical care transport.

It should be noted that the process used within BCAS that parallels industry guidelines for call taking and triage process is currently used by the specialty CCTAs in considering missions for the ITT. Currently, a conference between the CCTA and sending facility physician establishes the clinical priority, level of care required and level of urgency of pediatric, neonatal and maternal patients. The specialty CCTAs then communicate the urgency to the PTCC who work to ensure the most appropriate mode of transport is utilized to effect transport. This process closely mirrors standards and literature on appropriate clinical and logistical determination of patient needs, appropriate clinical team composition, urgency and mode of transport.\textsuperscript{56} Specifically, this process utilizes concurrent medical oversight to inform mission acceptance/rejection, team requirements and determination of acuity. The medical oversight group providing concurrent medical oversight is very familiar with the teams and transport modes.\textsuperscript{57} It was noted during the site visit interviews that, while exceptions exist, the vast majority of ITT calls using this process were seamless and triaged appropriately. Analysis and consideration to paralleling this process in principle (i.e. use of CCTAs for adult critical care mission request triaging functions) should be considered by the organization.

\textsuperscript{56} Association of Air Medical Services. (2012). \textit{Model State Guidelines}. Retrieved from Association of Air Medical Services: \url{http://www.aams.org/}

\textsuperscript{57} BCAS Management (2013, October). On-site Interviews. (C. Nickerson, Interviewer)
The educational gap within PTN and PTCC related to air operations has resulted in a number of inefficiencies and issues related to air ambulance operations. These issues have ranged from inappropriate tasking of the last available provincial critical care and air ambulance resource on a low acuity non-urgent mission, using a combination of aircraft to accomplish what one aircraft could seamlessly complete in one mission, and missions where out-of-province resources are required due to urgent high acuity missions at significant expense because all BC resources are tasked – many on low acuity transports.

It should be noted that a significant change occurred in BCAS when the Provincial Air Ambulance Communications Center (PAACC) was moved into Service Delivery in 2009 and subsequently relocated from Victoria to Vancouver Ground Communications Center. It was reported to the Consultant that only one Air Medical Communications staff, with significant operational experience and knowledge in air ambulance operations, accepted the reassignment. This resulted in a significant knowledge transfer gap. The organization did utilize a critical care paramedic in the PTCC for an approximate six month transition period. In addition, the previous PAACC orientation program was a six month education program including on-the-job mentoring. This had to be complete prior to being able to conduct air ambulance operations. It was reported to the Consultant that the current training program is 4-8 days (including 4 shifts) and varies in completeness depending on the instructor and staff availability.

**Recommendations:**

10. It is recommended BCEHS implements a single integrated process for call taking for all critical care and air ambulance interfacility mission requests.

11. It is recommended BCEHS implement a single integrated process for determining the patient’s clinical needs, urgency and appropriate mode of transport for interfacility transport requests. This process needs to be evidence-informed wherever possible and follow published standards and guidelines.

12. It is recommended medical oversight be provided concurrently for determining the clinical needs and urgency of critical care interfacility patients. Ideally, this would be provided by the same physicians that would be providing concurrent medical oversight to the paramedics during transport and be limited to those with significant understanding, education and experience in critical care transport medicine and medical oversight of EMS systems.

13. It is recommended the policy on requesting federal air resources is reviewed for accuracy and revised as required. It is recommended adherence to the policy is monitored.

14. It is recommended that policies are developed and implemented to address situations and guide actions when air missions are rejected by an air transport provider for weather or other aviation-related safety or operational reasons.

**Mission Logistic Processes - Findings**
It was clearly noted by PTCC staff and leadership within BCAS that, at the time of site visit, there is no policy, procedure or practice for flight following for air missions. This refers to a practice above and beyond what is required and performed by air carriers. That is, there is no requirement to proactively ensure the safety and location of the air ambulance crew through direct and indirect communication means. Discussion was held during the site visit around whether it was the responsibility of the ground communications centers or the PTCC for even communicating with the aircraft and crews during missions. The lack of flight following processes by PTCC also creates a significant gap in basic operational awareness and proactive planning in support of air operations.

Staff also indicated that there was no specific post-accident/incident plan or procedures for aircraft/air medical crew communication failures. Further, it was indicated that there were no annual or semi-annual drills related to in-flight emergency scenarios. A review of the applicable policy simply indicates to contact management staff on-duty.

It was stated by critical care and PTCC staff that the lack of operational awareness contributes to delays at landing sites while air crews wait for ground transportation, often with patients on board. Air medical crews related numerous anecdotes of landing with no ground crew present for significant periods of time – not due to a lack of ambulances, but a lack of awareness of the status of the flight by ground communications centers and PTCC. Most disconcerting, was statements that air medical crews interviewed have stopped reporting incidents of delays and issues as the perception is that the organization has not undertaken any changes to make improvements or change practice.

**Recommendations:**

15. It is recommended the organization institute a detailed flight following policy and practice. It is recommended all PTCC staff responsible for mission support are educated on the policy and practices.
16. It is recommended the organization institute a detailed post-accident/incident plan including policies related to loss of communication, loss of aircraft, aircraft emergencies, and other topics as outlined by various accrediting bodies, industry guidelines and published literature.
17. It is recommended BCAS undertake a comprehensive review of the safety management program and initiatives for the program areas.
Section J. Systems – Current State

This section will discuss issues related to the design and use of information management systems to capture information during the call receipt, triage and allocation decision processes. It should be noted that the Consultant is not an IT or IM expert, rather, the principles of data collection and reporting that are critical to effective air ambulance operations were reviewed.

The PTN utilizes three software platforms during the call taking and triage process; a telephone platform, the PTN Case Manager and call recording software. The PTN has a decision-making resource based in Excel that functions as a job tool in call processing. All information gathered in the PTN Case Manager software is primarily in free text fields.

The important points relating to the PTN IM platforms are:

- None of the systems within PTN are integrated or interfaced – all patient data must be entered manually
- PTN systems are not interfaced with PTCC systems
- Case review processes require extraction from all PTN systems manually
- PTN does not capture relevant data fields related to air medical transport

The alpha-numeric determinants (‘91’ and ‘49’ codes) allow the triage data to be entered in the PTCC systems, regardless of the agency that received the original call. There is no translation currently for code ‘91’ to code ‘49’ determinants (i.e. an interfacility transfer coded ‘91D1’ has a different meaning from an interfacility transfer coded ‘49D1’).

The PTCC utilizes the Integraph I/Dispatcher system for call taking and dispatching. ProQA/Paramount is used for prehospital call triage. These systems are interfaced and allow for direct transfer of data. Data is stored in a central Oracle database.
Section K. Systems – Findings and Recommendations

IM and IT systems are critical to enable operational processes and capture data for quality improvement and management. The importance of having effective systems is exacerbated in BC by having two entities responsible for call receipt and processing of air ambulance and critical care transport requests.

First, there were no requested reports available to be provided to the Consultant until after the site visit. After the site visit, reports have been provided by a Senior Business Analyst with Service Delivery. These reports have been made by accessing raw data manually within the CAD and creating adhoc reports. There are no linkages to the PTN information within this system so linking PTCC mission data to PTN triage data is only achievable manually and limited at best.

IM systems have been designed specifically for both PTN and PTCC to capture their respective datasets. The systems are not linked. As noted earlier, triage processes have been developed in absence of mandates and objectives of the air ambulance and critical care programs. As a result, the IT and IM systems are not currently configured to capture or report air medical operational or quality information.

Management in Critical Care Transport and Air Ambulance Programs is not able to access PTCC or PTN data directly. Researching issues or reporting on quality from an operations or systems point of view is only completed by requesting information from PTN or PTCC. In most cases, it was reported that information was simply not accessible.

**Recommendations:**

18. It is recommended that IM systems are designed that are compatible and are capable of data capture specifically related to air medical and critical care operations.
   a. These systems need to be capable of generating reports that relate to the performance of the air medical and critical care system – from call receipt to time the mission is completed and resources are back in service – in an integrated fashion.
   b. The systems should be designed from evidence-informed standards, industry guidelines or expert opinion wherever possible.
   c. The system should be capable of reporting missions by queries across multiple fields (e.g. date of service, location of mission, crew completing mission, aircraft type, patient demographic, etc.) to enable facilitated and complete reporting on case reviews for investigators and quality improvement purposes.

19. It is recommended that information is able to be accessed by those accountable for the operation and management of the system in a timely manner.
Section L. Outcomes – Current State

During the course of the review, the Consultant received very limited data that is used on a regular basis by the organization. High-level mission volume data has been provided and but is fairly limited in use. A common theme from the interview phase with Critical Care Transport Program staff was the lack of access to performance data to enable informed decisions about operations and quality improvement of program area.

Feedback related to outcomes of the air ambulance and critical care systems has been limited to feedback from staff and external stakeholders. This feedback, as noted in the introduction, followed themes. These themes included:

- Over-triaging mission requests and placing urgency to calls that could be delayed or resourced differently
- Delays due to geographical lack of knowledge
- Delays due to non-compliance with policy
- High reliance on adhoc and out-of-province resources that incur avoidable costs
- Inaccurate and incomplete clinical information being relayed to air medical crews prior to arrival at scene
- Lack of operational awareness causing unnecessary delays

Financial Outcomes of System Design – Current State

The organization reports the following financial performance for 2012-13:

- Total operating budget - $56M
- Staffing costs - $11.2M
- Rotor wing operations - $18.5M
- FWT operations - $19.8M
- FWJ operations - $6.7M

Additional financial support to Critical Care Paramedic training initiatives is reported at approx. $536k.

Detailed financial reporting is maintained by Financial Services staff. Business intelligence from the financial data captured is not leveraged to its full potential. Significant cost pressures from variable per flight hour/statute mile (SM) flown and human resource costs were reported in the financial staff interviews. Opportunities exist to maximize the utility of dedicated resources and minimize the use of higher cost adhoc and out-of-province resources. This strategy results in higher mission reliability at a lower overall cost.

A simple example of the financial impacts of improper resource allocation decisions in the air and critical care programs can be illustrated by analyzing the fixed wing adhoc (specifically out of province) costs. As with most standing agreements (i.e. compared to
dedicated contracts), costs are highly variable and charged at a per mission rate (normally either by SM flown or per minute/hour flown depending on FW or RW). In principle, BC should be requesting non-dedicated fixed wing resources for long distance critical care urgent missions only. Otherwise, significant costs will be incurred in the use of FW to move low acuity patients. Case in point, BCEHS projects to spend $1.16M on FW services provided by one non-dedicated FW provider. The SM rate of this provider is an all-inclusive rate of $21.91/SM at an average cost to BC of approximately $8700/mission. This rate contrasts to a cost of $2200/mission if conducted by dedicated FWT providers. In this case, 6% of the overall FWT budget (2% of overall budget) is used to pay for approximately 161 missions per year (3% of overall FWT & FWJ volume)). BCEHS could significantly mitigate or eliminate the costs of adhoc aircraft for urgent and non-urgent missions by appropriately triaging and resourcing requests for service within the province.
Section M. Outcomes – Findings and Recommendations

This section contains summative findings related to the outcomes of air ambulance operations and critical care programs. These findings stem from three main activities undertaken during the review; interviews, specific adhoc data requests on system performance and review of issues and complaints. Many of the findings are limited due to the lack of available performance data, as already reported.

**Interviews**

External stakeholder feedback was received and can be summarized at a high level as dissatisfied with services provided. This dissatisfaction included lack of effective communications during requests or actual missions and reliability of services (note: clinical care of patients was not of any concern in any interview). It was clearly articulated that concerns ranged from low mission reliability (i.e. mission completion rate), delays of transport - primarily due to confusion or lack of clarity in PTCC and PTN, and over- and under-triage of calls.

Feedback was received that there was dissatisfaction with processes before the April 1, 2013 implementation of PTN and that no improvements have been realized as of the date of interviews and thoughts expressed that there had been further deterioration. A lack of accountability and quality improvement mechanisms were voiced as a significant concern.

A general lack of trust in the system, in the processes utilized to triage and in resource allocation decisions in a timely manner was evident in the feedback received. Stakeholders felt there were “…internal power struggles…” within BCEHS that were being felt in the field by staff, by sending facilities and indirectly by patients.

**System Data:**

Data was not initially available on air ambulance system performance indicators such as:

- Mission reliability
- Reaction times
- Response times
- Refusal/cancellation rates of missions
- Reasons for cancellation or refusal of missions
- Out of service times of aircraft and crews

The Consultant was provided direct access to a Senior Business Analyst with dispatch CAD data access to attempt to pull meaningful operational data on air ambulance and critical care operations. The Analyst was briefed on differences of air and ground operations and provided sample indicators and data fields recommended for collection for air ambulance operations.
One key finding after review by the Analyst is that the current PTCC systems are capable of being modified to capture data fields related to air operations. Additionally, the Analyst had a number of suggestions related to data capture both in ground communications centers and PTCC that would enable regular and accurate operational reports.

A report was provided that shows PTCC and Ground Communications Centers’ call processing times and the reaction and response times of critical care and dedicated air ambulance operations. This data is shown in Table 7.

**Table 7 - Reaction Times and Dispatch process times - Sept 1, 2012 to Aug 31, 2013**

<table>
<thead>
<tr>
<th>Metric (Time Interval)</th>
<th>Autolaunch</th>
<th>Average</th>
<th>90th Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>PreAlert to Unit Dispatched</td>
<td>Y</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>Dispatched to Enroute</td>
<td>Y</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>Dispatched to Wheels Off</td>
<td>Y</td>
<td>13</td>
<td>21</td>
</tr>
<tr>
<td>Air Request to Unit Dispatched</td>
<td>Y</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>Air Request to Enroute</td>
<td>Y</td>
<td>12</td>
<td>27</td>
</tr>
<tr>
<td>Air Request to Wheels Off</td>
<td>Y</td>
<td>17</td>
<td>25</td>
</tr>
</tbody>
</table>

The time intervals are defined as:

- **PreAlert to Unit Dispatched:**
  - the interval from when a regional dispatch centre (Kam, Van, Vic) first hears about an autolaunch event to when PTCC dispatches the air unit to the event

- **Dispatched to Enroute:**
  - the interval from when PTCC has dispatched the crew to when the crew is enroute to call

- **Dispatched to Wheels Off:**
  - the interval from when PTCC has dispatched the crew to when the air resource is airborne (indicated by wheels off switch on aircraft)

- **Air Request to Unit Dispatched:**
  - the interval from when a regional dispatch centre (Kam, Van, Vic) requested an air resource until PTCC dispatched the air resource

- **Air Request to Unit Enroute:**
  - the interval from when a regional dispatch centre (Kam, Van, Vic) requested an air resource until the air resource is enroute
• Air Request to Wheels Off:
  o the interval from when a regional dispatch centre (Kam, Van, Vic) requested an air resource until the air resource is airborne

The data in Table 7 reflects the following performance:

• For calls received across three dispatch centers, where the determinant meets the ‘autolaunch’ criteria, the following performance occurs:
  
  1. The average time from autolaunch determination to wheels off the ground is 26 minutes;
  2. The 90th percentile from autolaunch determination to wheels off ground is 47 minutes;
  3. The average processing time once an autolaunch request has been made is 6 minutes with a 90th percentile of 17 minutes; and
  4. The average time from once an autolaunch is requested to wheels off is 17 minutes with a 90th percentile of 25 minutes.

In the absence of further data, these times are representative of the processing and reaction times of the system as currently designed for prehospital calls. Remembering from earlier sections, these patients represent a patient population where evidence suggests helicopter EMS systems may be most beneficial to patients suffering from time dependent traumatic injuries (as it applies to the BC Autolaunch program). Beyond safety and clinical metrics, overall reaction, response and total transport times are important to help quantify the effectiveness of the system. Given the complaints raised by field paramedics and by air medical crews on the delays related to dispatching autolaunch missions, this data suggests potential delays in both processing times and reaction times. Further detailed analysis is certainly indicated.

A cautionary note is required that within the reported time intervals in Table 7 is the time required for a decision to fly/not fly made by the Pilot-in-Command (PIC). Research has shown that this sub-interval should not be rushed and subsequently cause a poor decision.\(^{58}\) In other words, PICs need time required to make a safe decision on whether to fly. Aviation experts need to be consulted on how to safely minimize the time intervals required for appropriate pre-mission approvals. However, as shown in the data above, there appears to be ample room for improvement either in data quality, data capture or actual call processing (time from incident recognition to PIC notified as an example) and crew reaction times.

Further research and analysis is required to understand the detailed call intervals and processes related to timely notification and dispatch within the BCEHS system.

It was reported that mission rejection rates, mission reliability, response times and other performance metrics are not measured by the organization.

**Issues and Complaint Review Findings:**

Issues raised by critical care staff were provided to the Consultant for review during Phase 1 of the review. During Phase 2 of the review – additional complaints and issues were provided by staff as examples of issues being submitted to the organization and not having a response or seeing any changes in policy or process.

The complaints and issues provided include the following themes (many utilized previously in the report):

- Over-triage/over-use of critical care teams;
- Lack of operational awareness of air resources and critical care teams;
- Lack of awareness of aircraft and crew capabilities;
- Delays in processing request for critical care patient transport;
- Inappropriate use of dedicated rotor wing aircraft;
- Delays in autolaunch when criteria met;
- Delays in launching aircraft for calls requested by field paramedics;
- Improper prioritization of patients for critical care transport;
- Delays of ground ambulance/patient coordination at FW landing sites;
- Inappropriate dispatch of aircraft based on geographic location of call and limitations of aircraft
- Unnecessary timing out and stranding overnight of crews/aircraft

Staff submitting the issues and complaints indicated that there was little to no feedback from leadership in the organization concerning resolution to the complaints or issues. It was reported that there was no formal record of receiving or processing these events by other entities within the organization. There were no pending actions or investigations related to these events at the time of site visit, despite some of the issues being report several months previous. None of these events had been followed up with the program area or staff.

It should be noted that the Consultant also interviewed members of the Quality and Patient Safety (QPS) office. QPS demonstrated a comprehensive reporting and tracking mechanism for issues raised through the PSLS. The issues reviewed at a high level were deemed to be direct individual patient safety concerns and did not capture or report (at time of site visit) ‘system’ issues such as over-triage, inappropriate use of resources or other items discussed in this report. It is understood that this system is undergoing significant transition with plans to be available to frontline staff as a comprehensive tracking tool for all issues and complaints.
It was stated that the current culture of “ownership of information” (i.e. specific program areas not allowing access to information between programs) has resulted in a lack of a quality improvement culture and a lack of perceived action to mitigate future inappropriate actions and, most importantly, to ensure appropriate patient care and service levels are delivered. This perception, coupled with a lack of performance reporting of the system, has contributed to the stated culture of mistrust and a lack of accountability for the system.

In the CAMTS publication *Safety and Quality in Medical Transport Systems* significant emphasis is placed on the appropriate organizational culture being fostered to ensure safe and effective delivery of medical transportation services.59 The publication is a significant resource for organizations involved in critical care and/or air medical transport. Significant cultural reflection is warranted for all entities involved in these fields.

20. It is recommended that BCEHS institutes an issues management tracking mechanism and investigation process. This should include:
   a. An easy reporting mechanism for internal and external stakeholders to report issues to the organization.
   b. A detailed process with clear accountabilities and responsibilities for research, investigation and achieving resolution to issues presented.
   c. Staff in the organization with subject matter expertise is used on specific cases as necessary. External expertise is consulted as required.
   d. A rapid escalation process for issues identified as critical, a priority, or potentially negatively impacting patients.
   e. A feedback mechanism to the originator of the issue.
   f. A reporting mechanism to senior leadership on volume, trends, impacts, and resolutions to issues.

21. It is recommended that BCAS institute a comprehensive quality management and performance reporting program relating to remote access missions, autolaunch/EFWA/prehospital missions, and interfacility transports at various acuity levels based on industry standards, evidence and expert opinion. Recognition that BCAS operates across almost every possible spectrum of air ambulance operations and is accountable for moving the most critically ill and injured patients in the province are key considerations in building an appropriate quality and performance framework.

22. It is recommended BCEHS strategically plan on third party validation of air ambulance and critical care programs through accreditation by an appropriate agency for critical care and air ambulance systems. Such accreditation processes should be an integrated part of a comprehensive quality program and serve as validation to the organization and the public as to the quality of services being provided. Accreditation should not be the final objective; rather, a milestone along a continuous quality improvement journey.

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23. It is recommended that BCEHS conducts a detailed demand analysis for the various operational categories of the air ambulance and critical care programs. This demand analysis should include temporal, geographic, acuity, and urgency data. Acuity and urgency should be clearly defined with consistent use of criteria within the analysis.

24. It is recommended that BCEHS determine and ensure appropriate staffing levels of the organization for positions related to air ambulance and critical care operations such as critical care paramedics, PTCC staff, PTN staff, quality management positions, and management positions to ensure consistent and quality operations are achieved.

It is clearly recognized that the issues and complaints submitted represent a very small set of missions completed by BCAS in a given year. The narrow scope of the review focused only on those submitted to the organization – not a complete review of system performance. However, the principles discovered during the course of the review should be given due attention. The fact BCEHS is routinely having complaints and issues raised, including safety concerns and potentially negative patient outcomes, and being submitted to various levels of the organization, is critical. The fact that the cases submitted were not able to be tracked beyond initial submission by Critical Care Programs and have no documented investigation, recommendations or resolution should be resolved immediately.
Section N. Consolidated List of Recommendations

1. It is recommended that BCEHS defines the governance model and implements an accountability framework for critical care transport and air medical operations within the province. This will enable clear accountability for establishing mandate, objectives and measuring, reporting and improving performance.

2. It is recommended BCEHS aligns strategic and business planning across all operating entities. This will help ensure that processes and systems are aligned to achieve outcomes desired for the patients served by the system.

3. It is recommended BCAS articulates a clear mandate and objectives of the air ambulance and critical care transport programs. Consideration should be given to:
   a. Implementing a strategic advisory committee or similar structure with internal and external stakeholders that would assist in developing mandate, objectives, etc.
   b. Ensuring appropriate expertise in areas such as clinical care, critical care, aviation, communications, safety and quality improvement are involved in the further development of the program areas.
   c. Enhancing the role of critical care/intensive care transport medical oversight and clinical expertise within the organization.
   d. A clear understanding of critical care transport (focused on the level of care) and air medical transport (use of air resources) needs to develop to best understand the performance, interlinks and potential of both programs.

4. It is recommended that BCAS develops job tools for PTCC Call Coordinators to provide options and appropriate decision making processes for use of adhoc air resources, dedicated air ambulances and critical care resources. This should be informed by evidence wherever possible.

5. It is recommended that a comprehensive air medical communications program be developed and implemented that includes topics such as those defined in industry accepted guidelines and standards that would support appropriate air medical operations.

6. It is recommended that policies and procedures that are evidence-informed are implemented to guide air ambulance and critical care operations.

7. It is recommended that BCAS establish clear policy and process for prehospital activation, autolaunch, and EFWA missions.

8. It is recommended a comprehensive quality program be developed and implemented to ensure a focus on ongoing quality improvement within the air ambulance and critical care programs.

9. Quality mechanisms should include investigation and follow up of potential cases of deviation from policy and procedure.

10. It is recommended BCEHS implements a single integrated process for call taking for all critical care and air ambulance interfacility mission requests.

11. It is recommended BCEHS implement a single integrated process for determining the patient’s clinical needs, urgency and appropriate mode of transport for
interfacility transport requests. This process needs to be evidence-informed wherever possible and follow published standards and guidelines.

12. It is recommended medical oversight be provided concurrently for determining the clinical needs and urgency of critical care interfacility patients. Ideally, this would be provided by the same physicians that would be providing concurrent medical oversight to the paramedics during transport and be limited to those with significant understanding, education and experience in critical care transport medicine and medical oversight of EMS systems.

13. It is recommended the policy on requesting federal air resources is reviewed for accuracy and revised as required. It is recommended adherence to the policy is monitored.

14. It is recommended that policies are developed and implemented to address situations and guide actions when air missions are rejected by an air transport provider for weather or other aviation-related safety or operational reasons.

15. It is recommended the organization institute a detailed flight following policy and practice. It is recommended all PTCC staff responsible for mission support are educated on the policy and practices.

16. It is recommended the organization institute a detailed post-accident/incident plan including policies related to loss of communication, loss of aircraft, aircraft emergencies, and other topics as outlined by various accrediting bodies, industry guidelines and published literature.

17. It is recommended BCAS undertake a comprehensive review of the safety management program and initiatives for the program areas.

18. It is recommended that IM systems are designed that are compatible and are capable of data capture specifically related to air medical and critical care operations.
   a. These systems need to be capable of generating reports that relate to the performance of the air medical and critical care system – from call receipt to time the mission is completed and resources are back in service – in an integrated fashion.
   b. The systems should be designed from evidence-informed standards, industry guidelines or expert opinion wherever possible.
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19. It is recommended that information is able to be accessed by those accountable for the operation and management of the system in a timely manner.

20. It is recommended that BCEHS institutes an issues management tracking mechanism and investigation process. This should include:
   a. An easy reporting mechanism for internal and external stakeholders to report issues to the organization.
   b. A detailed process with clear accountabilities and responsibilities for research, investigation and achieving resolution to issues presented.
c. Staff in the organization with subject matter expertise is used on specific cases as necessary. External expertise is consulted as required.

d. A rapid escalation process for issues identified as critical, a priority, or potentially negatively impacting patients.

e. A feedback mechanism to the originator of the issue.

f. A reporting mechanism to senior leadership on volume, trends, impacts, and resolutions to issues.

21. It is recommended that BCAS institute a comprehensive quality management and performance reporting program relating to remote access missions, autolaunch/EFWA/prehospital missions, and interfacility transports at various acuity levels based on industry standards, evidence and expert opinion. Recognition that BCAS operates across almost every possible spectrum of air ambulance operations and is accountable for moving the most critically ill and injured patients in the province are key considerations in building an appropriate quality and performance framework.

22. It is recommended BCEHS strategically plan on third party validation of air ambulance and critical care programs through accreditation by an appropriate agency for critical care and air ambulance systems. Such accreditation processes should be an integrated part of a comprehensive quality program and serve as validation to the organization and the public as to the quality of services being provided. Accreditation should not be the final objective; rather, a milestone along a continuous quality improvement journey.

23. It is recommended that BCEHS conducts a detailed demand analysis for the various operational categories of the air ambulance and critical care programs. This demand analysis should include temporal, geographic, acuity, and urgency data. Acuity and urgency should be clearly defined with consistent use of criteria within the analysis.

24. It is recommended that BCEHS determine and ensure appropriate staffing levels of the organization for positions related to air ambulance and critical care operations such as critical care paramedics, PTCC staff, PTN staff, quality management positions, and management positions to ensure consistent and quality operations are achieved.
Section O. Conclusion

BCEHS contracted with the Consultant to undertake a review of specific areas of concern within the Critical Care Transport and Air Ambulance Program. These areas included resource allocation structures, processes and outcomes related to the program areas. As with any focused review, areas for opportunity have been identified with specific recommendations provided.

The complexities of critical care transport medicine coupled with the technical and specialized world of EMS aviation can combine to provide patients safe, timely, consistent, and high quality transport to definitive medical care. Effective management of the system is critical to ensuring safe and quality transport and care of patients. BCEHS provides services across the possible operational spectrum of air ambulance systems and does so in a large geographic area. The Report provides sound advice on potential next steps for the organization in ensuring safe and quality services are delivered to the citizens of British Columbia.

The Consultant would like to thank the organization for presenting this opportunity for feedback. Additionally, a specific note of appreciation for all the staff support in organizing interviews, running reports and organizing the site visit. Finally, a thanks to all of the staff and stakeholders interviewed for being candid and open in the feedback provided.
### Section P. Appendix A. Sample Operating Matrix for BCEHS

#### Sample BC Air Ambulance/Critical Care Mandate and Objectives

This is provided as sample only. Review by clinical expertise and significant operational research is required to accurately populate this chart for a given jurisdiction.

<table>
<thead>
<tr>
<th>System of Care</th>
<th>Rescue</th>
<th>Remote Community Access</th>
<th>Prehospital/Scene Calls¹</th>
<th>Interfacility Transport</th>
<th>Critical Care/Urgent</th>
<th>Critical Care Delayed</th>
<th>Non-Critical Care Urgent</th>
<th>Non-Critical Care Delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Within BC Scope?</strong></td>
<td>Out of BCAS Scope</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Definitions</strong></td>
<td>Patient requires technical and highly specialized skills to access and evacuate to staging area or directly to facility.</td>
<td>Patient cannot be accessed by ground but has a time-dependent diagnosis or injury requiring or for which transport by air may be clinically beneficial. May include remote nursing station.</td>
<td>Patient is accessible by ground but has a time-dependent diagnosis or injury requiring or for which transport by air may be clinically beneficial.</td>
<td>Patients are in a hospital setting and have had physician assessment and at least minimal diagnostic testing to help arrive at diagnosis or in requiring a hospital transfer.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subcategory</strong></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>&lt;1%</td>
<td>&gt;10%</td>
<td>&gt;10%</td>
<td>&gt;10%</td>
<td>&lt;10%</td>
</tr>
<tr>
<td><strong>Proportion of Calls in System</strong></td>
<td>~Sample only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Proprietary Risk to Patient by System of Care</strong></td>
<td>High (pre-medical contact, may be delayed, unknown acuity)</td>
<td>High (pre-medical contact, no other means available, unknown acuity)</td>
<td>Medium (time dependent but ground SRS accessible, may be combined)</td>
<td>High (complex time dependent)</td>
<td>Medium (complex)</td>
<td>Medium (time dependent)</td>
<td>Low (time dependency, low acuity)</td>
<td></td>
</tr>
<tr>
<td><strong>Launch Question</strong></td>
<td>Out of scope - requires local, provincial, federal, or interagency response.</td>
<td>Driven either by pre-determined patient symptoms (AMPAC) or field trauma triage.</td>
<td>Determined by physician triage with receiving physician.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td>Island response area no hury or resource access can be obtained</td>
<td>Hospital to definitive case on critical intervention (e.g. Major trauma, STEMI, death)</td>
<td>Hospital to critical care unit (e.g. Steps 1, 2, 3, system issues such as over capacity ICU)</td>
<td>Hospital to non-critical care unit (e.g. minor orthopedic needs or other services)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Financial Planning</strong></td>
<td>Not applicable</td>
<td>Predetermined and planned response capacity driven on historic volume.</td>
<td>Pre-determined and planned response capacity driven on historic volume and referral patterns.</td>
<td>Predetermined and planned response capacity driven on historic volume.</td>
<td>Delay may allow for planning around pilot days and shift changes.</td>
<td>Delayed response capacity appropriate to compare.</td>
<td>Delayed response capacity appropriate to compare.</td>
<td></td>
</tr>
<tr>
<td><strong>High level system design requirements to be effective</strong></td>
<td>Relationships, job tools - planning for known geographic risks</td>
<td>Effective medical oversight, training, preparedness for referral patterns and risks, logistics section - triage based on diagnosis, not symptoms</td>
<td>Effective medical oversight, training, preparedness for referral patterns and risks, logistics section - triage based on diagnosis, not symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Complexity of response coordination</strong></td>
<td>Usually minimal (system agency compares)</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Often highly complex requiring numerous concurrent multi-stakeholder discussions</td>
<td>Low</td>
<td>Medium - requires significant logistical planning.</td>
<td>Higher or same level of care</td>
<td>Usually same level or same level of care</td>
</tr>
<tr>
<td><strong>Destination</strong></td>
<td>Stayed at ambulance or closest facility</td>
<td>Stayed at ambulance or closest facility</td>
<td>Definitive care</td>
<td>Definitive care</td>
<td>Higher or same level of care</td>
<td>Higher or same level of care</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sample Mandate Statements/Objectives</strong></td>
<td>Minimize time to decision to request rescue assistance</td>
<td>On-scene &lt;1 hour 95th percentile</td>
<td>Total call times, response times, patient outcomes, quality indicators</td>
<td>Total call times, response times, patient outcomes, quality indicators</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sample Performance Measures</strong></td>
<td>Call processing time (all others external)</td>
<td>Response time, reliability, satisfaction (i.e. mission cancelled, mission refused by mission)</td>
<td>Total call times, response times, patient outcomes, quality indicators</td>
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<td></td>
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</tr>
</tbody>
</table>

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¹ Prehospital/Scene Calls include all code 1, 2, and 3 calls.
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