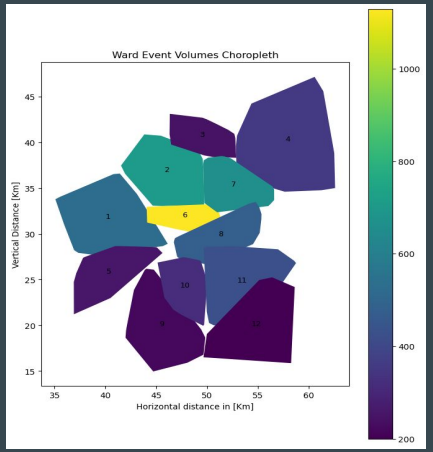
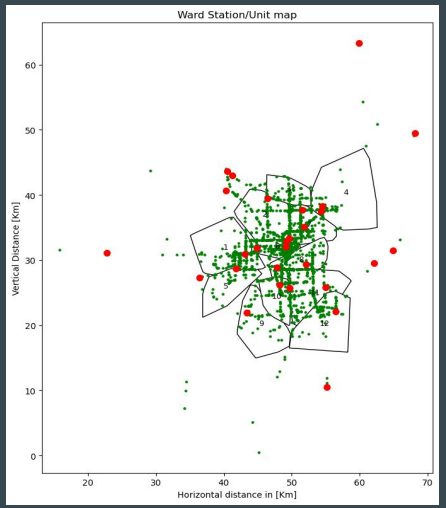
SMS Analyst 2024 EDA Report

By Bilal Mustafa

General Information

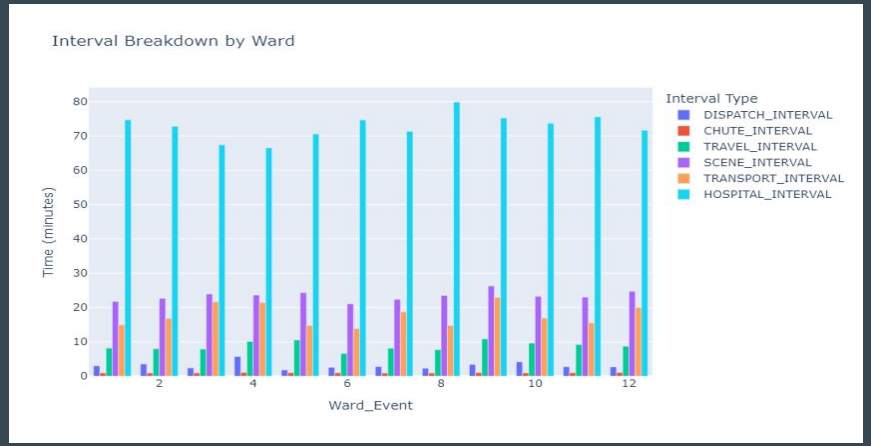
- Dataset contained 8069 rows and 23 columns, capturing 5553 unique events occurring inside an unknown Alberta City/Town/location. (estimated city is Edmonton, but cannot confirm)
- The locale is split into 12 distinct wards, with each ward containing a mix of cases with different acuity levels. For most wards the acuities are an even split.
- EMS data consists of all units that were notified, dispatched and arrived on site. Units that were not dispatched to event site were not included in analysis.
- Ward 6 had the highest number of cases received, it was also identified to be the innermost ward of the location.
- All datasets are from the year 2004 and may not represent the most up to date information about the wards
- The objective of this report is to identify discrepancies in resource allocation and possible causes, research was conducted via literature review and personal interviews

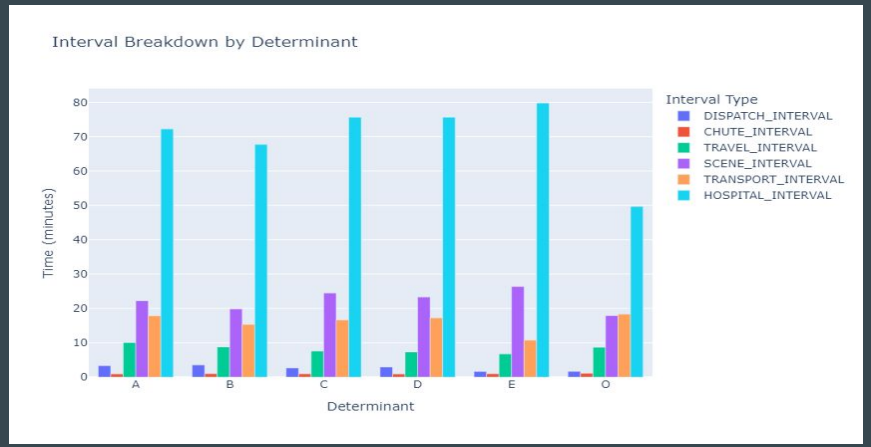


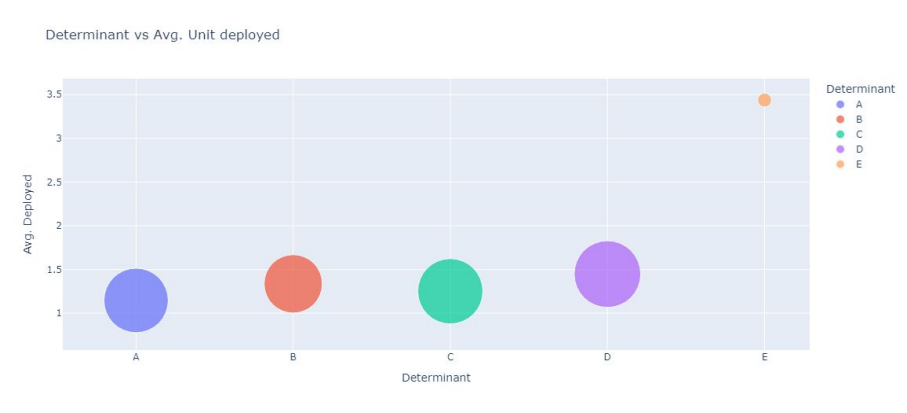


Time Interval Analysis

- Columns were added on to assess the various time intervals per incidence.
  - **Dispatch Interval:** Call received to Unit dispatch time
  - **Chute Interval:** Unit prep time
  - **Travel Interval:** Unit travel time to event
  - **Response Interval** : Time from call to unit placement at event site
  - **Scene Interval:** Time spent at the scene
  - **Transport Interval:** Time to transport patient to hospital (if needed)
  - **Hospital Interval** : Time taken to off load patient to ED
  - **Event Interval:** Total event time
- The Hospital Interval contributed the most to the total event time across all wards and acuity levels.
- Placing a resource in the ER for handover could reduce unit time and decrease event intervals.
- Scene Interval is the next largest contributor to event time, with longer scene times as acuity levels increase.



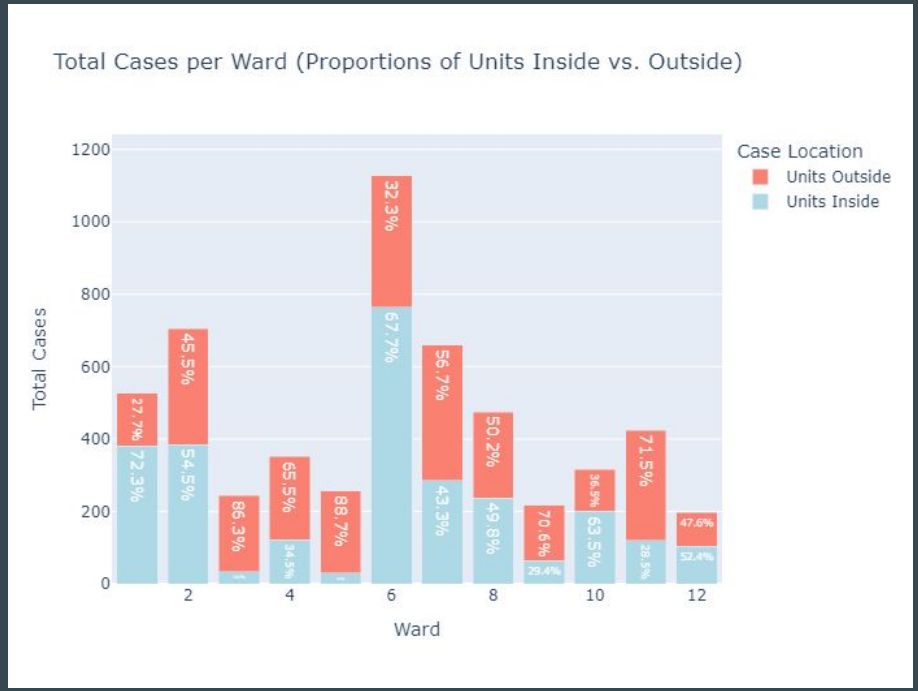




- The increase in scene time could be due to units arriving with insufficient or inaccurate information about the scene. More data from dispatch centers is needed to identify cause.
- The intervals offer insight into event lifecycles, but more data is needed to fully understand root causes highlighting the need for effective resource allocation.
- Unit dispatch across wards and acuity levels highlights resource disparities, with higher event wards receiving fewer resources on average.
- Reallocating units from lower caseload wards can better support underserved areas.
- Resource allocation increases with acuity levels, but the highest acuity, despite fewer events, receives disproportionately more resources. A re-evaluation and stricter controls are needed.
- A slight, statistically insignificant difference in resource allocation was noted between Acuity B and Acuity C.

Ward Units Dispatch Analysis

- With resources being scarce in the given locale, it is important to understand if units being dispatched to the wards are within the ward or outside it.
- This gives us an idea as to how often units are crossing over to other wards to address the needs of a particular ward
- It was observed that 7 out of 12 wards had more than half of their events attended to by moving units from other wards.
- Wards with higher case volumes had more internal resources, while wards with fewer cases relied mostly on external support..
- This suggests a possible relocation of units from busier wards to serve other wards, affecting system performance.



Proposed Solution

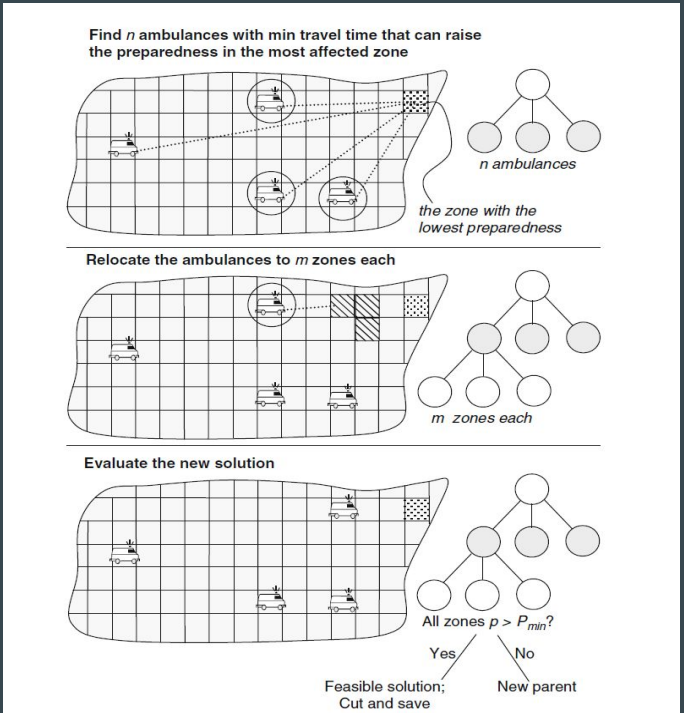


Figure 3.1 Illustrating the tree-search heuristic that solves the DYNAROC model

- Literature review offers a unique perspective into the nature of unit placement and dispatch methodology.
- According to T. Andersson and P. Varbrand, the Preparedness Level (PL) can be implemented in each ward along with a dynamic tree-search based algorithm, reducing unit time intervals while enhancing care provided.
- This methodology divides a locale into subregions, each with its own PL based on historical call volume data. The algorithm then optimizes unit allocation by recommending shifts to improve the PL index in wards falling below the benchmark.
- The proposed idea utilizes dynamic placement of units to support each ward according to its needs, this method does not rely purely on strategic station placements as a measure for subregion preparedness.
- As per the directive of the Support System Management, the solutions proposed would support the initiatives and help create the borderless system proposed.

References

Bélanger, Vincent, Alejandro Ruiz, and Pablo Soriano. "Decision Support Tools for Ambulance Dispatch and Relocation." Operational Research for Emergency Planning in Healthcare, edited by Navonil Mustafee, vol. 1, Palgrave Macmillan, 2016, pp. 125-156.