

## Controversy in the use of lights and sirens

Shorter emergency medical services (EMS) response times are associated with improved outcomes for certain medical conditions (O’Keeffe et al. 2011). To achieve shorter response times, lights or sirens (L/S) are often used during patient response or transport. L/S are now known to be associated with increased risk of ambulance crashes, especially in the transport phase (Watanabe et al. 2019). The National Highway Transportation and Safety Administration (NHTSA) has made specific recommendations on the use of lights and sirens based upon available scientific evidence (Kupas 2017). Given the continued focus on reducing response times and the recent evidence around the risks of using L/S, the State EMS Committee in Oregon chose to explore the use of lights and sirens in Oregon EMS.

EMS transport agencies are required to report electronic patient care reports (ePCRs) to the Oregon Public Health Division Oregon EMS Information System (OR-EMSIS).<sup>1</sup> These data were queried specifically to address the following questions:

- How often are lights or sirens used by EMS when responding to a scene?
- How often are lights or sirens used by EMS in patient transport?
- What dispatch reasons are commonly associated with the use of L/S?
- How are individual agencies using L/S?

## EMS COMPASS Metrics

From 2014-2016, the EMS Compass initiative (supported by both the NHTSA Office of EMS and the National Association of State EMS Officials) developed a range of performance metrics for EMS.<sup>2</sup> The Compass Process Measures Safety-01 (Lights and Sirens Response to Scene Rate) and Safety-02 (Lights and Sirens Transport Rate) concern the use of L/S in response and transport.

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<sup>1</sup> Frequently Asked Questions about mandated EMS reporting are posted online at [healthoregon.org/or-emsis](http://healthoregon.org/or-emsis)

<sup>2</sup> To learn about EMS Compass metrics, go to <https://nasemso.org/projects/ems-compass/>

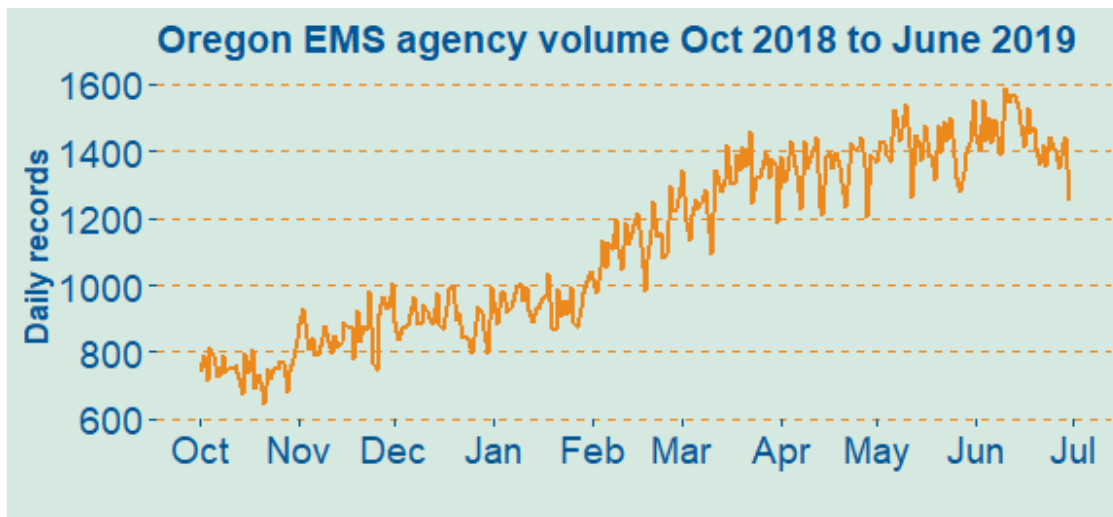
## Reported ambulance crashes in Oregon

The Oregon Department of Transportation (ODOT) collects statistics about significant crashes in the state involving ambulances using L/S.

Year	Fatal Crashes	People Injured	Total crashes
2016	0	6	5
2015	0	9	4
2014	0	0	3
2013	0	5	3
Total	0	20	18

## Oregon EMS Data

OR-EMSYS data from October, 2018 through the present are displayed below. This snapshot captures 306,517 records from 164 EMS agencies using 7 different ePCRs. Daily ePCR counts have increased since January, 2019 due to the new mandate for reporting for EMS transport agencies.



## Use of Lights and Sirens in Response to Patient

The Compass metric Safety-01 identifies eResponse.24 (“Additional Response Mode Descriptors”) as the primary indicator of L/S in EMS response to patient. eResponse.24 is a required variable in the National EMS Information System (NEMSIS) data set, meaning that a value must always be provided for this variable but that “Not applicable” and “Not Recorded” are acceptable responses. In Oregon EMS data, we can see that eResponse.24, or use of lights and sirens in response to patient, is not documented in 44.6 % of total EMS calls and 42.9 % of 911 responses. In reviewing use of this variable, some agencies in the state are not populating it at all (100% of their ePCRs have lights and sirens use marked as “Not applicable”).

$$Safety\ 01 = \frac{\text{Responses reporting lights or sirens}}{\text{Total responses originating from a 911 request}}$$

Table 2: Documented use of lights or sirens in 911 responses, October 2018 through June 2019, Oregon.

Lights and Sirens (eResponse.24)	Number	Percent of total
Any Lights, any Sirens	117,975	42.4
No Lights or Sirens	41,080	14.8
Not Recorded or Not Applicable	119,397	42.9
Total	278,452	-

Using eResponse.24 alone would likely underestimate the true rate of use of lights and sirens due to the amount of missing data in this variable. However, eResponse.23 (Response Mode to Scene) is commonly used as a proxy for the use of lights and sirens, where “emergent” response is equated to use of L/S. Whereas a large proportion of data for eResponse.24 is missing, eResponse.23 (a mandatory variable) is almost universally populated (it is populated in 99.8% of calls). When both eResponse.23 and eResponse.24 were both reported there was a strong correlation between emergency response, and the use of lights and sirens; >95%.

## Estimating Compass metric for lights and sirens in EMS response

The first finding of this report is that agencies are inconsistent in reporting use of L/S. To better estimate statewide use of L/S, eResponse.23 (Response Mode to Scene) provides an estimate of use of L/S where eResponse.24 is blank. Combining information from both variables (where eResponse.24 is missing information), we can estimate use of lights and sirens for nearly all 911 dispatch calls in this report timeframe.

Table 3: Creating a hybrid lights and sirens metric where eResponse.24 is blank, October 2018 through June 2019, Oregon.

eResponse.23	Hybrid Lights and Sirens Metric	Number	Percent of total
Emergent (Immediate Response)	Any Lights, any Sirens (or Emergent)	69,177	58.0
Emergent Downgraded to Non-Emergent	Any Lights, any Sirens (or Emergent)	6,221	5.2
Non-Emergent	No Lights or Sirens (non-emergent)	43,593	36.5
Non-Emergent Upgraded to Emergent	Any Lights, any Sirens (or Emergent)	363	0.3
	Total	119,354	-

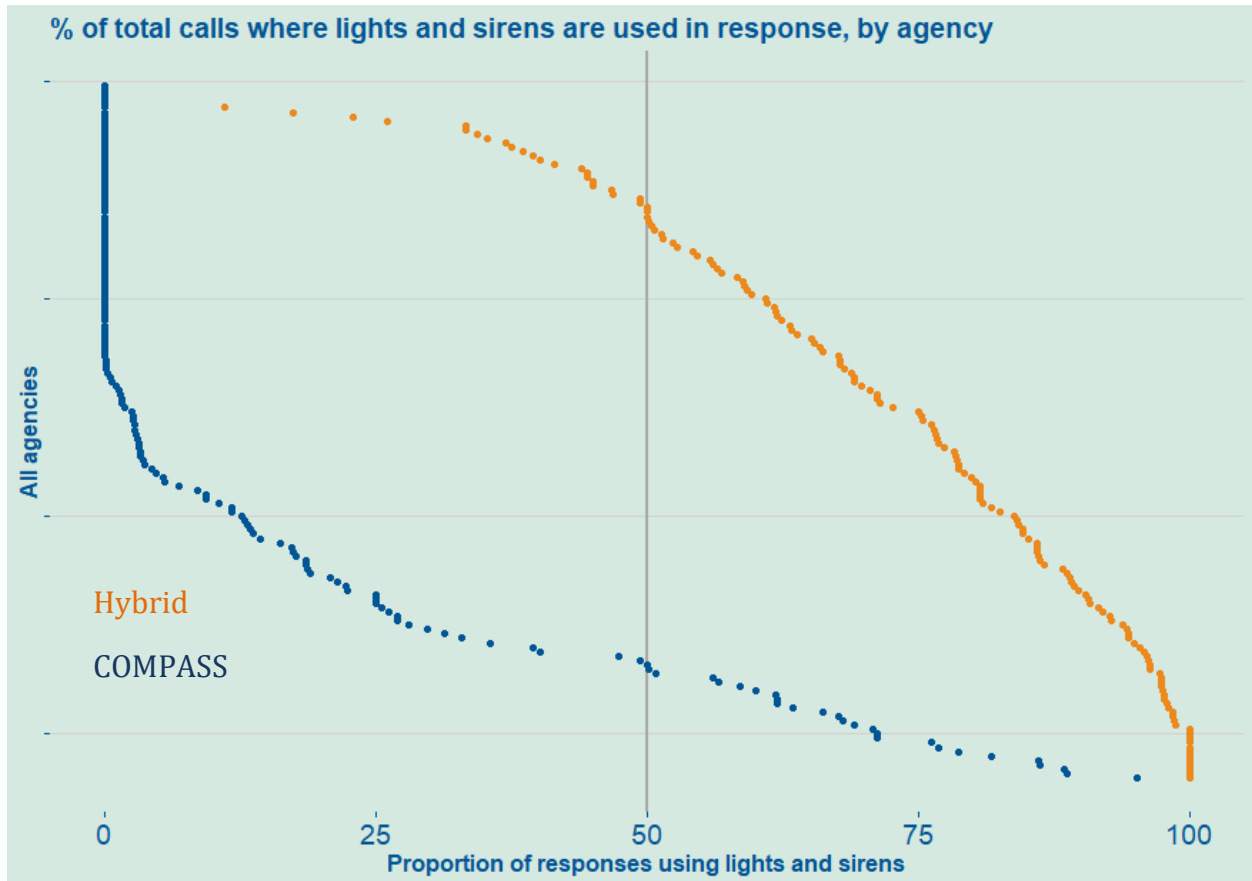
Using this method (as described in the table above) we estimate the average, statewide use of L/S in EMS patient response is 69.6%. NHTSA recommends L/S be used in no more than 50% of responses as only a small proportion of patient encounters are time-sensitive emergencies (Kupas 2017).

Table 4: Use of Lights and Sirens in Response, October 2018 through June 2019, Oregon.

Hybrid Lights and Sirens metric	Number	Percent of total
Any Lights, any Sirens (or emergent)	193,658	69.6
No Lights or Sirens (non-emergent)	84,750	30.4
Total	278,408	-

## Use of lights and sirens for response within agencies

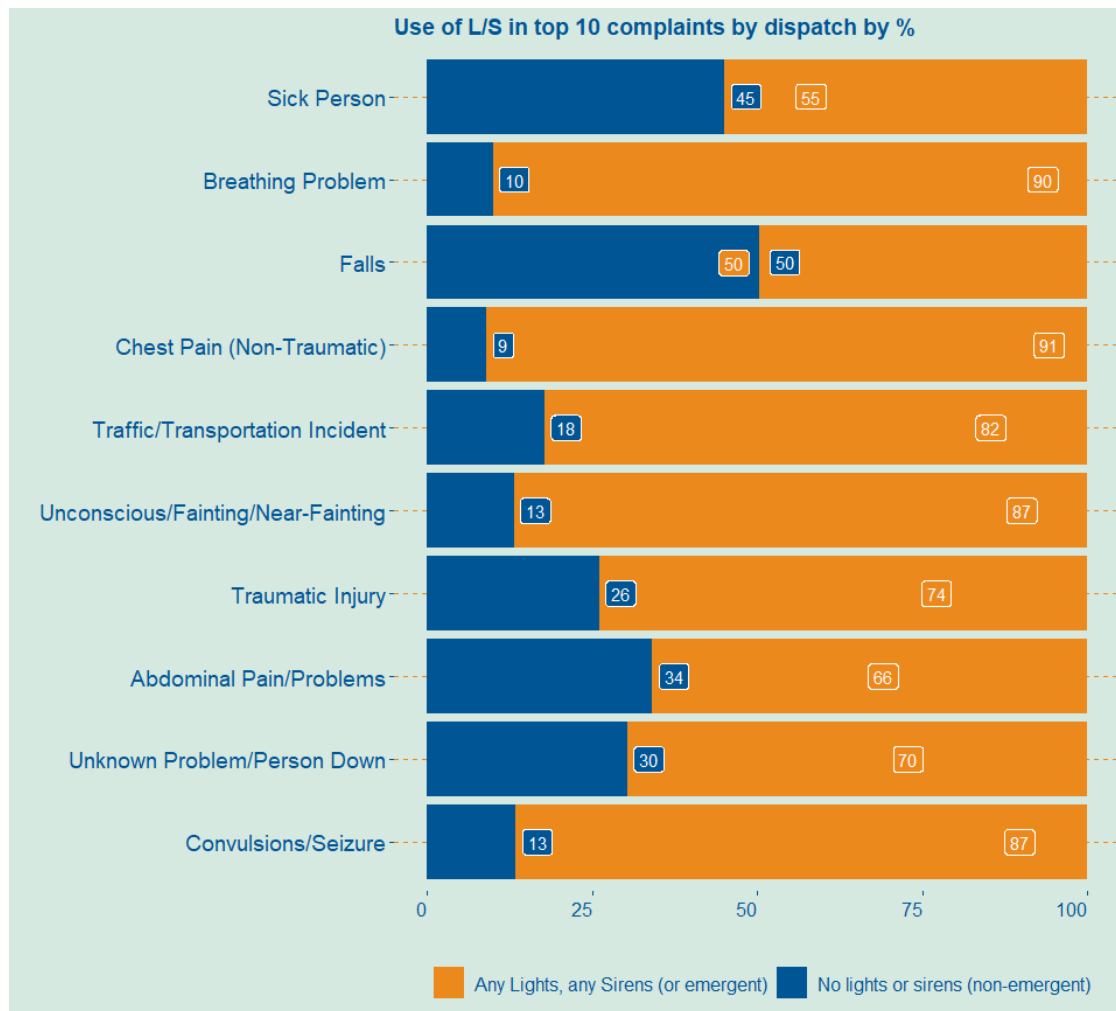
Using the pure COMPASS metric Agency use of L/S in response varies from 0% to 95% with a median use of 3%. This is well below NHTSA 50% recommendation. However, using the Hybrid metric the usage looks quite different with 11% to 100% of reported responses using L/S within each agency and a median use of 76.9% of responses. The chart on the following page displays the pattern of use of L/S within agencies for patient response for both pure COMPASS and Hybrid measures.



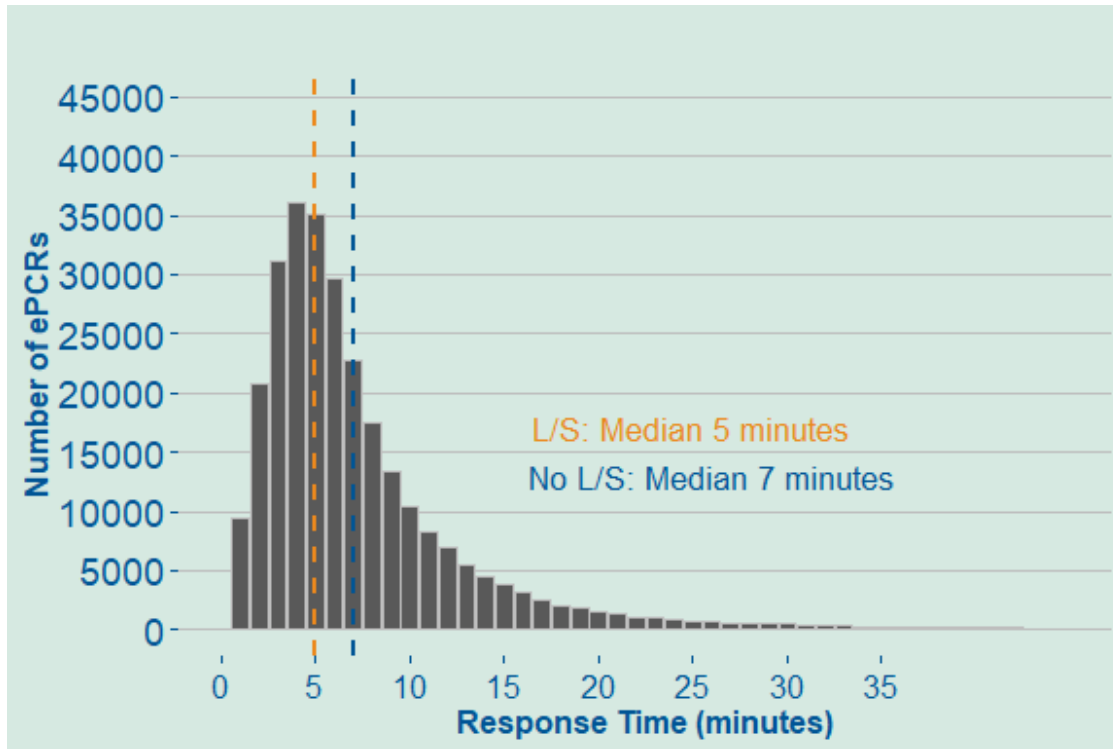
The chart above shows the proportion of total responses where L/S is reported. Using the Hybrid Compass metric described above, several agencies are estimated to use L/S in all reported patient responses.

### Use of lights and sirens in response, by dispatch type

The top ten reasons for dispatch are listed below, sorted by most common to least. Within each reason for dispatch, use of L/S is assessed. Dispatch protocols across the state may guide response protocols (e.g., information provided by dispatch determines mode of response, including use of L/S). With often limited information about the patient illness or status, and often no medical care provided before EMS arrival, shortening response time is thought to be more important than transport time (Murray and Kue 2017). Considering “Sick Person” and “Unknown Problem/Person Down” are both in the top ten most common dispatch reasons, the quality of the information provided at dispatch may not allow for much nuance in the use of L/S (e.g., knowing when these tools are not needed).



## Response time and use of lights and sirens



In Oregon EMS, for the timeframe of this report, median response time is 2 minutes faster with use of L/S than without use of L/S. An assessment of use of L/S has similarly identified time savings with use of L/S (Murray and Kue 2017). Nevertheless, whether this time difference is relevant to patient care (did patient status worsen due to extra time in transport?) is much more difficult to assess. In a small urban study assessing the use of L/S, similar estimates of time savings were pertinent in very few patient outcomes (Brown et al. 2000).

## Use of lights and sirens in patient transport

Upon arrival at patient scene, EMS administers critical care and stabilizes the patient. Only a small number of conditions represent “time sensitive emergencies” (e.g., breathing, bleeding or heart conditions) that can’t be stabilized in the field and require immediate transport and subsequent use of L/S during transport. With this in mind, NHTSA recommends that use of lights and sirens be kept to a benchmark of no more than 5% of all transport calls (Kupas 2017). Using the Safety-02 metric (number of lights and sirens used during transport out of all 911 requests), we can estimate the use of L/S in patient transport.

$$Safety\ 02 = \frac{Transports\ reporting\ lights\ or\ sirens}{Total\ patient\ transports\ originating\ from\ a\ 911\ request}$$

## Estimating Compass metric for lights and sirens in transport

As with the first Compass calculation, use of L/S in patient transport is not documented in 34 % of 911 responses.

Table 5: Documented use of lights or sirens in transport originating from 911 calls, October 2018 through June 2019, Oregon.

eDisposition.18	Number	Percent of total
Any Lights, any Sirens	9,092	5.0
No Lights or Sirens	111,205	61.0
Not Recorded or Not Applicable	62,013	34.0
Total	182,310	-

Table 6: Use of Lights and Sirens in Transport, October 2018 through June 2019, Oregon.

Proxy Lights and Sirens Metric	Number	Percent of total
Any Lights, any Sirens (or emergent)	20,002	11.0
No Lights or Sirens (non-emergent)	162,246	89.0
Total	182,248	-

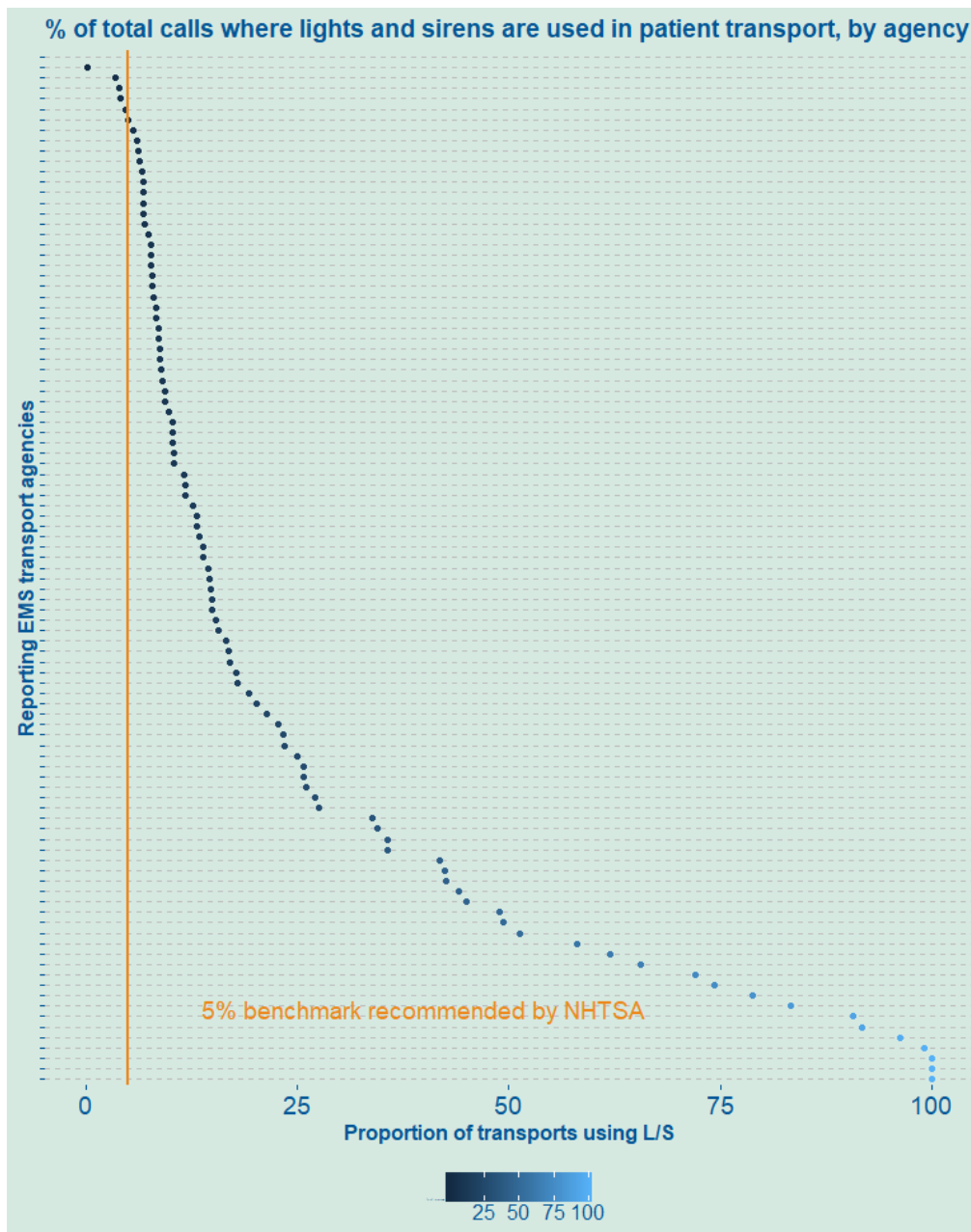
Using a similar approach as for the first Compass calculation, eDisposition.17 (Transport Mode from Scene), was used to estimate use of L/S in patient transport where eDisposition.18 (specified in the Compass calculation) is blank.

Using this method (as described in the table above) we estimate the average, statewide use of L/S in EMS patient transport is 11.0%.



## Use of lights and sirens for transport within agencies

Agency use of L/S for patient transport varies from 0.3% to 100% of reported transports within each agency. The median Oregon EMS agency uses L/S in 14.9% of patient transports. NHTSA recommends that use of L/S in transport be limited to no more than 5% of transports (those representing acute, time-sensitive emergencies) (Kupas 2017). The following chart displays the pattern of use of L/S within agencies for patient transport.



## Summary

In conclusion, this report finds variability in reporting use of L/S in patient response and transport in Oregon EMS. Specifically, both fields needed to calculate the available Compass benchmarks (eResponse.24 and eDisposition.18) were under-populated and the Compass metric calculations would therefore have led to an underestimate of the actual use of L/S statewide. Therefore, new Hybrid metrics were devised to estimate use of L/S. A limitation of this approach is that this might over-estimate use of L/S among agencies not reporting eResponse.24 or eDisposition.18 in 100% of records (not using this field at all). Nevertheless, with these methods, we can estimate that use of L/S in response is higher than the benchmark suggested by NHTSA, but that use of L/S in transport is much closer to the suggested benchmark.

When assessing the quality of information provided at dispatch (and its role in the use of L/S), generic categories (“Sick Person”, “Unknown Problem”) were two of the top 10 reasons for dispatch. EMS agencies statewide may be using dispatch protocols to allow for more nuanced use of L/S; nevertheless, the prominence of these generic categories indicates that not all agencies are receiving information at dispatch which would allow them to make decisions about the use of L/S.

Median response time with L/S is faster than without L/S; the benefit of this time-savings is not known (e.g., situations where patient condition would have deteriorated without use of these tools). A further consideration about decreasing the use of L/S is that we might anticipate average regional and statewide response time may increase as L/S are used more infrequently.

## Works Cited

Brown, Lawrence H., Christa L. Whitney, Richard C. Hunt, Michael Addario, and Troy Hogue. 2000. "Do warning lights and sirens reduce ambulance response times?" *Prehospital Emergency Care*. <https://doi.org/10.1080/10903120090941696>.

Kupas, Douglas F. 2017. "Lights and Siren Use by Emergency Medical Services (EMS): Above All Do No Harm." [https://www.ems.gov/pdf/Lights\\_and\\_Sirens\\_Use\\_by\\_EMS\\_May\\_2017.pdf](https://www.ems.gov/pdf/Lights_and_Sirens_Use_by_EMS_May_2017.pdf).

Murray, Brett, and Ricky Kue. 2017. "The Use of Emergency Lights and Sirens by Ambulances and Their Effect on Patient Outcomes and Public Safety: A Comprehensive Review of the Literature." *Prehospital and Disaster Medicine*. <https://doi.org/10.1017/s1049023x16001503>.

O'Keeffe, Colin, Jon Nicholl, Janette Turner, and Steve Goodacre. 2011. "Role of ambulance response times in the survival of patients with out-of-hospital cardiac arrest." *Emergency Medicine Journal* 28 (8): 703–6. <https://doi.org/10.1136/emj.2009.086363>.

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