

*Updated February 17, 2018*

## **LED Street Lights Brief from the Lawrence-DG County Health Department:**

### **Generalized Summary of Research:**

- This is a complicated issue, because most of the research in the field is primarily for artificial light at night (ALAN) or LED lights in general. At this time there is a dearth of research into LED street lights specifically.
- There were two Health Impact Assessments (HIA) completed on the effects of converting to LED street lights. Both made the recommendation to continue with conversion to LED lights (one using 3500K and one using 4000K). Both are discussed in further detail below.
  - Both HIAs note that there is limited evidence in the field and recommendations were made on “plausible effect... rather than on a proven effect.”
  - Both HIAs noted that with the 4000K LEDs, there are likely to be more citizen complaints. A handful of cities installed 4000K lights and then had to re-install 3000K lights to meet citizen demands.
  - There does not seem to be any health risks specifically associated with LED street lights that are not already noted for artificial or LED lights in general.
- LED lighting should be installed with prudence as with any other lighting: minimize discomfort to individuals and to only light what is necessary.
- Public health is concerned with the whole health of the community and as such it is wise to consider additional public safety concerns, such as crime prevention and road safety. Literature shows a modest support for reduction of crime and improved road safety with brighter lights, although the research does not look LED street lights specifically.
  - Local injury data from the Kansas Syndromic Surveillance Data Program indicates that there has not been significant changes related to number of motor vehicle accidents since 2014. Additionally, injury data related to pedestrian versus car and cyclist versus car accidents vary year-to-year without a noticeable trend. The majority of pedestrian and cyclist versus vehicle accidents occur during the day and not during low-light conditions.
- There is research within the public health field to support the use of Twitter as a tool to gauge public concern and interest related to diseases. Using the Twitter platform to search for interest/concern in LED street lights by geocoded location of Lawrence, KS yielded few notable results.

### **Summary of American Medical Association<sup>1</sup> (2016) Report:**

- Recommendations:
  - AMA does support transition to LED lighting, as long as the conversion is done with recommendations in mind.
  - Using the lowest emission of blue light possible.
  - Encourage 3000 Kelvin or lower.
  - Lighting should be properly shielded.
- Considerations:
  - Filters to block blue light
  - The ability to dim lights during off period times.

Recommendation/ Consideration	Research	Potential Health Impacts
Recommendation: Lowest emission of blue light possible	<ul style="list-style-type: none"> <li>● Studies show that intense blue light leads to increased visual discomfort and disability glare</li> <li>● Glare and discomfort can be intensified by blue light, leading to worse nighttime driving conditions</li> <li>● Older drivers are more at-risk for glare and discomfort</li> </ul>	<ul style="list-style-type: none"> <li>+ Lower levels would reduce discomfort/glare</li> <li>+ Better nighttime visibility, potential for safer roads</li> <li>+ Safer driving from older populations</li> </ul>
Recommendation: Use 3000K or lower	<ul style="list-style-type: none"> <li>● Human eye perceives 4000K as harsh white color</li> <li>● Only 21% of white emission is in the blue part of the spectrum, compared to 29% of blue light</li> <li>● Estimated that a white LED lamp is 5 times more powerful at disrupting circadian rhythms than other lights</li> <li>● Better received by citizens</li> </ul>	<ul style="list-style-type: none"> <li>+ Light is more visually pleasing to humans</li> <li>- White light can lead to disruption of sleep cycle, delayed bedtime, increased sleepiness during the day</li> <li>+ Fewer citizen complaints</li> </ul>
Recommendation: Shielded lighting	<ul style="list-style-type: none"> <li>● Luminance level of unshielded lighting exceeds level of visual discomfort</li> <li>● Unshielded light leads to pupillary constriction, causing worse nighttime vision and “veil of illuminance” beyond the light</li> </ul>	<ul style="list-style-type: none"> <li>+ Decreased visual discomfort</li> <li>+ Better vision at night</li> <li>+ Increased road safety</li> <li>+ Fewer citizen complaints (if light is shielded from invading homes)</li> </ul>
Consideration: Dimmable lights during off-hours	<ul style="list-style-type: none"> <li>● Exposure to artificial nighttime light led to later bedtimes, shortening of sleep duration, and increased daytime sleepiness; but this is artificial light in general and not LED street lights in particular</li> </ul>	<ul style="list-style-type: none"> <li>+ Better sleep quality</li> <li>+ Fewer citizen complaints</li> </ul>

**Trafford Health Impact Assessment<sup>2</sup>:** Completed prior to the AMA report

- Trafford recommended 3500K white lights.
- Conclusion, no large health impacts noted, if recommendations are followed. There is some research regarding the negative effects of LED lighting, but the research is limited and being street lights, the exposure is considered to be smaller. May even be a small positive impact.
- Recommendations for lighting:
  - Light color should be white, preferably 3500 Kelvin

- Color rendering index should be greater than 80
- Fixtures should be downfiring
- Lights should not be visible to pedestrians, drivers, etc unless directly under the light
- Controls for dimming
- Ground pattern should be overlapping ovals

**Stockport Health Impact Assessment<sup>3</sup>:** Completed after the AMA report (February 2017)

- Stockport looked at using 4000K blue lights.
- Looked at 3 potential health impacts: sleep disturbance, disruption of circadian rhythms, and visual discomfort/reduced visibility
  - All 3 were listed as “none or minor negative impact,” although it was noted that they would likely generate citizen complaints.
- Artificial Light at Night: significant public health risks, such as negative effects on psychological, cardiovascular and/or metabolic functions; but this was artificial light in general and not LED street lights, specifically.
- Recommendations for 4000K lights:
  - Lighting should be directed downwards, dispersed as little as possible.
  - Lighting units in residential areas are installed with shields
  - Design the light so that hotspots are not visible within the road user’s normal field of view

Recommendation	AMA	Trafford HIA	Stockport HIA
As little blue light as possible	X	X	N/A
3000K or lower	X		N/A
3500K		X	N/A
Shielded lights	X	X	X
Downfiring		X	X
Dimmable	X	X	
Ground pattern overlapping ovals		X	
Minimize hotspots			X

**Additional Public Health Considerations:**

- Public health looks at the whole health of the community and as such there are additional areas of public health to be considered.
- Public Safety:

- There is limited evidence that improved street lighting leads to a reduction of crime in residential neighborhoods.<sup>4-5</sup> The research to support this is not overwhelming and it did not look at LED street lights specifically, just brighter or improved lights.
- Other studies have found no effect from street lights.
- Road Safety (Drivers, Cyclists, and Pedestrians)
  - The World Health Organization (WHO) highlights adequate street lighting as an important aspect of pedestrian and cyclist safety, noting that it is a health equity issue for vulnerable road users. The report does not mention LED street lights specifically and street lights are not a majority focus of the lengthy report.<sup>6</sup>
  - Other studies found street lights can reduce road traffic crashes, injuries, and fatalities.<sup>7-8</sup>

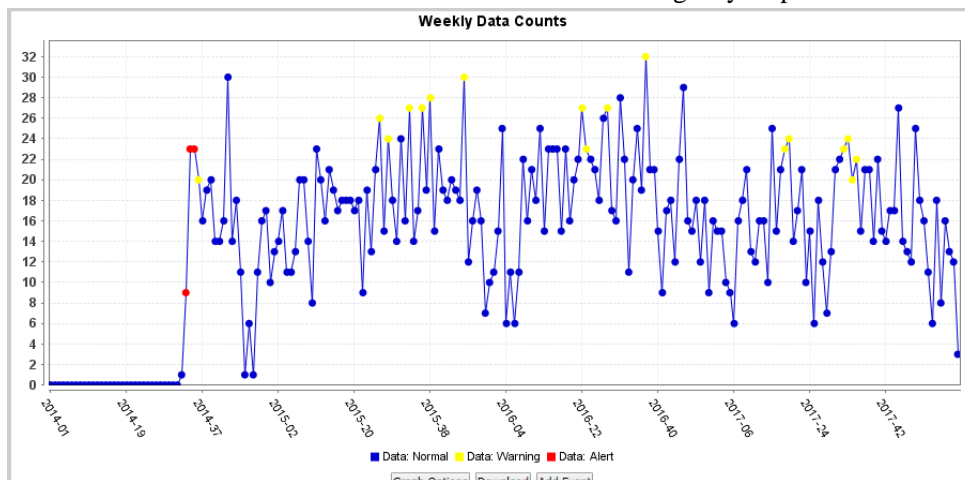
**Injury Data Analysis:**

Methodology: Used data generated through the Kansas Syndromic Surveillance Data Program to review injury presentations at the emergency department related to three fields: motor vehicle crashes, pedestrian versus car accidents, and cyclists versus car accidents. Used time of year and time of day to estimate (subjective) whether it was likely a low-light situation or not. Data is available from August 2014 to present.

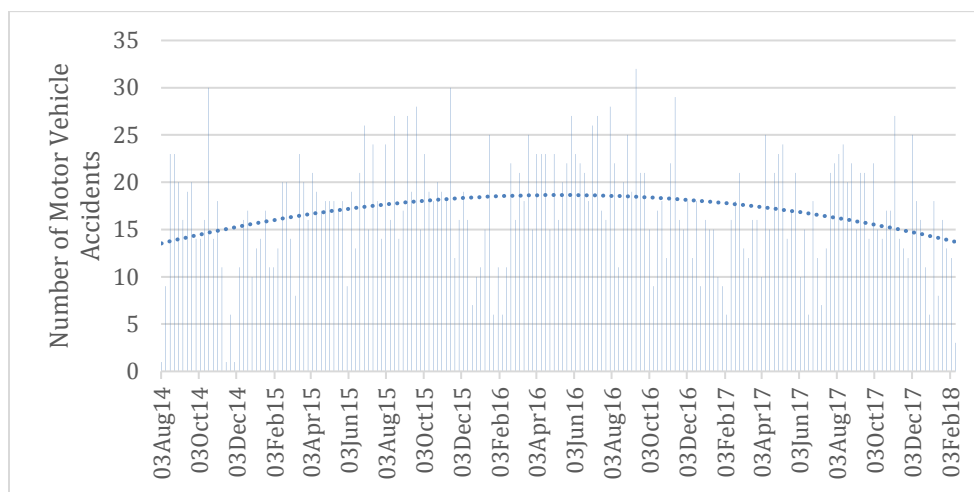
Potential Limitations: Limited to patients who reported to the emergency department following accident; system generally casts a wide net, subjective review undertaken to clean out cases that did not meet the intent of the search (i.e. pedestrian often brought up cases of patients who referred from “peds”); data unavailable prior to August 2014.

**Results:**

1. Motor Vehicle Wreck Patient Presentation at Emergency Department from 8/3/2014 to Current



Plotted Data of Motor Vehicle Accidents with Patient Presentation with Trend Line:



2. Pedestrian versus Car Accidents Patient Presentation at Emergency Department Based on Discharge Diagnosis Codes from 8/3/2014-Current

	<b>Dark</b>	<b>Daylight</b>	<b>Total</b>
<b>2014</b>	2 (25%)	6 (75%)	8
<b>2015</b>	6 (60%)	4 (40%)	10
<b>2016</b>	8 (66.6%)	4 (33.3%)	12
<b>2017</b>	11 (33.3%)	19 (63.3%)	30
<b>2018</b>	1	1	2
<b>Total</b>	28 (45.2%)	34 (54.9%)	62

3. Cyclist versus Car Accidents Patient Presentation at Emergency Department Based on Chief Complaint Search from 8/3/2014-Current

	<b>Dark</b>	<b>Daylight</b>	<b>Total</b>
<b>2014</b>	2 (50%)	2 (50%)	4

<b>2015</b>	4 (36.4%)	7 (63.6%)	11
<b>2016</b>	2 (33.3%)	4 (66.7%)	6
<b>2017</b>	2 (33.3%)	4 (66.7%)	6
<b>2018</b>	0	0	n/a
<b>Total</b>	10 (37.0%)	17 (63.0%)	27

**Twitter Analysis:**

Literature: There is evidence in the field of public health that Twitter is an accurate tool for measuring public sentiment in regards to disease activity, public concern, and public interest.<sup>9</sup>

Methodology: Examined tweets using Lawrence’s geocoded location (38.9716690, -95.2352500) with a 30 km radius using a variety of search terms related to LED street lights. Search completed on February 14th and reviewed on February 15th.

Potential Limitations: Users have to have set their location to allow for geocoding; tweets open to the public; Twitter is generally a younger audience.

Results: For full detailed results please see Table 1 in appendix

- 24 unique searches entered into Twitter
- Generated 208 total tweets (this includes redundant tweets from multiple searches)
  - 3 related to LED street lights (two were actually just one tweet repeated in search results twice)
- January 2011-February 16<sup>th</sup>, 2018.

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Table 1: Results of Twitter Analysis for Searches of LED Street Lights by Geocoded Location for Lawrence, KS

(Searches that generated LED street light tweets in bold)

Search Term	Total Number of Tweets Generated by Search	Number of Tweets Related to LED Street Lights	Notable:
Blue Light	5	0	n/a
<i>Sample tweet: Jayhawks playing, boys all in. Bonus red and blue light show. #rcjh #oet #babyspam</i>			
Bright Light	31	0	3 that could potentially have been about LED street lights, but they were in 2012
<i>Sample tweet: My dog hates when I have insomnia. The light on my phone is too bright she keeps sighing. Lol what a diva.</i>			
Bright Lights	29	0	n/a
<i>Sample tweet: Through the long nights and the bright lights dont you worry</i>			
Bright Street	1	0	n/a
<i>Sample tweet: On the bright side Mass street is lookin dapper</i>			
Bright Street Light	0	0	n/a
Can't Sleep Bright	0	0	n/a
Can't Sleep Light	3	0	n/a
<i>Sample tweet: I can't go to sleep if any of my apps need to be updated, but will drive my car with the check engine light until it explodes</i>			
<b>City Light</b>	<b>15</b>	<b>1</b>	<b>Reply from City of Lawrence account about LED light installation</b>
<i>Sample tweet: For our first Valentine's Day together, my now fiance and I went to Kansas City's Power and Light district, in part because they have a PBR bar, unaware PBR here stood for Professional Bull Riding and not Pabst Blue Ribbon</i>			
City Lights	20	0	n/a
<i>Sample tweet: Drive until city lights fade into country side...</i>			
LED Eye(s)	0	0	n/a
LED Glare	0	0	n/a
LED Light	2	0	n/a
<i>Sample tweet: Forever blinding people with my LED light when I text.</i>			
LED Sleep	0	0	n/a
<b>LED Street</b>	<b>2</b>	<b>1</b>	<b>Article in LJWorld</b>
<i>Sample tweet: How long until some teen group does to Nirvana what Greta Van Street has done to Led Zeppelin.</i>			
LED Street Lamps	0	0	n/a
LED Streetlight(s)	0	0	n/a
Light Pole	9	0	
<i>Sample tweet: Don't say nothing about that styrofoam cup behind the light pole on Michigan and 9th. I'll throw t away on my way home.</i>			
New Street Lights	0	0	
<b>New Lights</b>	<b>26</b>	<b>1</b>	<b>Article in LJWorld</b>

<i>Sample tweet: The overnight lights on the new apartment building bother me. Problem #87: annoying yellow lights</i>			
New Light	38	0	
<i>Sample tweet: Steph's check engine light came on so naturally she buys a new car #logic</i>			
Street Lamp	3	0	n/a
<i>Sample tweet: Wescoe is bumpin right now. The street lamp and I.</i>			
Street Lamps	0	0	n/a
Street Lights	16	0	5 tweets requesting more street lights; all prior to 2014
<i>Sample tweet: Dear #Missouri and #Kansas: Please install street lights, reflectors, or at least freshen the lane pain on your freeways</i>			
Streetlights	8	0	
<i>Sample tweet: So happy we got to throw around, even tho it was dark out #streetlights #hotdayscoolnights</i>			

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