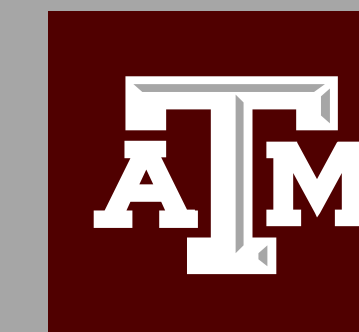




# LET THERE BE LIGHT! USING ALTERNATE LIGHT SOURCES TO DETECT AND IMPROVE CUTANEOUS BRUISE VISIBILITY

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## Background

Six million violent victimizations occur in the US each year; bruising is the most common injury. Bruises can be difficult to visualize due to time since injury, age, body mass, and skin color. Alternate light sources (ALS) of different wave lengths may improve visibility. However, there are limited data to support its use, and little is known how skin color affects bruise visibility comparing normal light and ALS.



## Methods

Data are a sub sample from one site in multi-site randomized-controlled trial examining the use of ALS to improve bruise visibility across time in 6 known skin color categories. Skin color was calculated with the Minolta® CM-600D spectrophotometer, into very light (VL), light, intermediate, tan, brown, and dark (D).

We induced deep bruises on randomly selected deltoids of participants using a paintball. Trained nurses used the Bruise Visibility Scale (BVS) developed by the PI to rate bruise visibility on a 1-5 scale from “barely” to “clearly” visible. Bruises were visualized in normal (LED) light, UV (365nm) and visible (415nm, 450nm, 475nm, 495nm, 515nm, 535nm) spectrums using yellow, orange, and red filters.

We examined BSV scores from 62 observations and all 6 skin colors on Days 2, 4, and 8. We compared BVS scores with normal vs. 415nm/yellow goggles using *t*-tests. We compared BVS scores between 19 VL and 19 D observations using paired *t*-tests.

### WERE BRUISES MORE VISIBLE WHEN USING BVS415/Y? (ACROSS SKIN TONES, BRUISES WERE NOT MORE VISIBLE WITH ALS415/Y)

LIGHT SOURCE	N	Mean	Std. Err.	Std. Dev.	LL 95% CI	UL 95% CI
BVSNatural	62	2.61	0.13	1.05	2.34	2.88
BVS415	62	2.75	0.13	1.05	2.49	3.02
DIFFERENCE	62	-0.15	0.11	0.83	-0.36	0.63

Pairwise t-test, same raters. Mean(DIFF) = mean(BVSN - BVS415/Y)  
*t* = -1.40, *df* = 61, *p* = 0.17 Not Significant

### WERE BRUISES EQUALLY VISIBLE ON VERY LIGHT and DARK SKINNED SUBJECTS? (USING BVSN, BRUISES WERE RELATIVELY EASIER TO SEE ON VL SKIN TONES)

SKIN TONE	N	Mean	Std. Err.	Std. Dev.	LL 95% CI	UL 95% CI
VERY LIGHT	19	2.88	0.17	0.75	2.52	3.24
DARK	19	2.20	0.28	1.21	1.62	2.79
DIFF	38	0.68	0.33		0.013	1.34

Two-sample t-test with equal variances. DIFF = mean(VL) – mean(D)  
*t* = 2.07, *df* = 36, *p* = 0.045

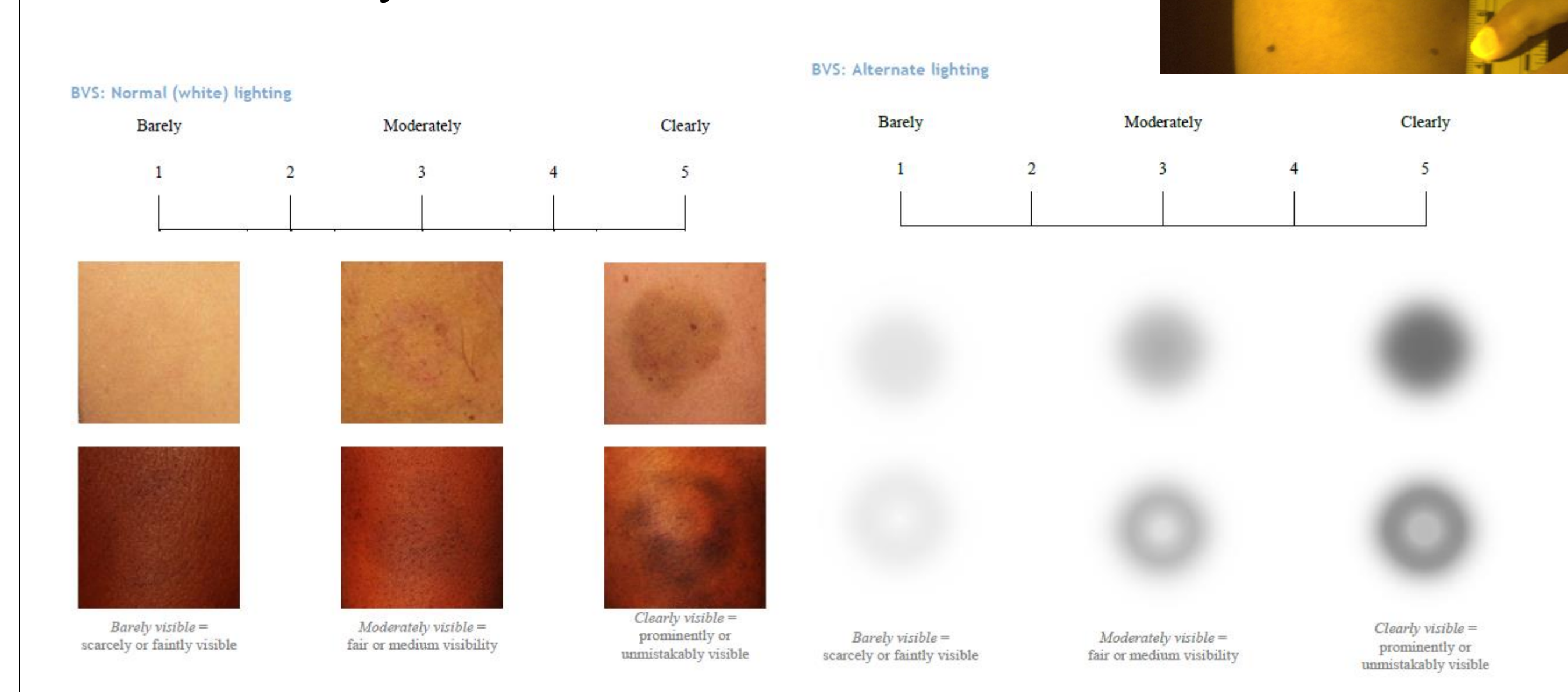
### WERE BRUISES EQUALLY VISIBLE ON VERY LIGHT and DARK-SKINNED SUBJECTS? (USING BVS415, SKIN TONE DID NOT PRODUCE MARKEDLY DIFFERENT VISIBILITY)

SKIN TONE	N	Mean	Std. Err.	Std. Dev.	LL 95% CI	UL 95% CI
VERY LIGHT	19	2.96	0.19	0.83	2.56	3.37
DARK	19	2.37	0.26	1.15	1.82	2.92
DIFF	38	0.59	0.32		0.06	1.25

Two-sample t-test with equal variances. DIFF = mean(VL) – mean(D)  
*t* = 1.83, *df* = 36, *p* = 0.076



## Bruise Visibility Scale – Normal and ALS.



## Discussion

Results support bruise visibility is better in VL vs. D skin using normal light and ALS. 415nm ALS/yellow goggles did not appear to improve bruise visibility in this sub-sample.

There was more variation in BVS scores using ALS than normal light, suggesting reliability of BVS ratings is lower when raters use ALS. There was also more variation in BVS ALS ratings of bruises on dark-skinned vs. light-skinned participants.

These are preliminary results from a small subset of data at a single study site. Results suggest no improvement of bruise visibility using one ALS wavelength/goggle color. However, results could also indicate raters require more training to reliably use the BVS, especially in dark-skinned persons. We conducted inter-rater reliability checks for all nurse raters, but do not present those data here. It is possible we might find differences using more data, other ALS/goggle colors, and between other skin tones.

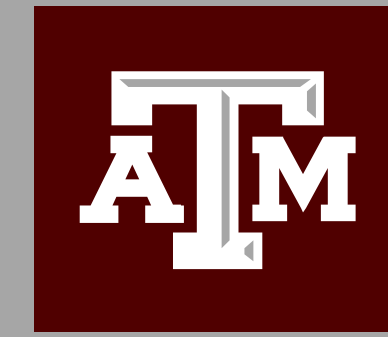
## Conclusion

It is more difficult to visualize bruises in dark-skinned persons. While our data did not demonstrate an improvement of ALS over normal light, differences might be found in the larger data set. More training using BVS might improve reliability of BVS ratings.

## Acknowledgments

This study was funded by the National Institute of Justice 2016-DN-BX-0147 (Katherine Scafide, George Mason University, PI), \$449,437. Richard J. Bogue, PhD, FACHE, University of Iowa, provided guidance with statistical analyses.





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