# Lit review outline

Highlighted articles are articles I haven’t read in-depth yet…

1. Context of traffic stop studies
   1. Ridgeway 2010: survey of current tests for discrimination
   2. Goel 2017: judicial relevance, current events, baseline problems
2. Overcoming baseline/denominator unknown: Natural experiment as a way of overcoming unknown baseline
   1. Veil of darkness: grogger, taniguchi, Kalinowski
   2. Stanford’s attempt of overcoming baseline problem… (nature 2020), marijuana natural experiment
   3. Seat belt laws: riddell 2020
3. Pedestrian stop-related studies trying to find discrimination
   1. goel 2016: NY pedestrian stop
   2. hannon 2019: Chicago
4. other ways of testing for disparities, not directly proving discrimination but rather how disparities are related to one another
   1. shoub 2017: local black representation
   2. Rosenfeld 2012: age

As both traffic and pedestrian stop data have become more readily available to the public, researchers have explored novel methods of testing for discrimination. The fundamental problem of traffic stop data is the lack of accompanying *traffic* data – although we know who was stopped in a given time and location, we do not know the fellow motorists of this unlucky motorist who was pulled over. If we consistently find that this unlucky motorist is Black or Hispanic/Latinx while his/her/their fellow motorists are white, then this may provide evidence of racial profiling. However, the demographic information of these fellow motorists remains unknown. The lack of a denominator (which would convey who else is driving at a given time and location) has motivated a range of attempts to circumvent the baseline driving population through natural experiments, experimental designs, and analyses of post-stop outcomes.

<Ridgeway 2010>. (for ridgeway, please talk about the different benchmarks!) <Transition to Goel: The interdisciplinary work towards developing a definitive test of racial profiling is grounded in social and political relevance – the true extent of racial profiling would be crucial tool for informing police department trainings, protecting Fourth Amendment rights of minority defendants, and validating the qualitative experiences of historically-oppressed groups. <Goel 2017>.

<Transition to VOD, Stanford, and seat belt: one common way of circumventing the lack of a baseline is to use natural experiment.> <VOD is a method based on the assumption that as the sun sets, the race of a motorist becomes more difficult or impossible to discern. Comparing stops that happen within a certain period of time, throughout the year, taking advantage of natural variation in the sunset time and daylight savings time. Controls for potential shifts in driving patterns by examining the same time period?> <Grogger 2006 uses logistic regression to calculate the probability that a driver is stopped with dependent variables… .> <Taniguchi 2017 incorporates more variables.> <Kalinowski 2019 adds some nuance to the VOD approach by noting that policing behavior changes from day to night.> <Pierson 2020>

<Transition to marijuana laws, seatbelt laws. Another natural experiment opportunity results with marijuana legalization and changes in enforcement of driving infractions, namely seat belt laws. The former results in less stops, the latter results in more stops. Either way, we can compare the magnitude to which these legislative changes affect the number of stops for different racial groups.>

<Another body of literature focuses on pedestrian stops, which has the benefit of being more detailed with the location of the stop and the type of location that the stop is. There are less studies in this category probably due to limited data, but for the data that do exist, it is quite extensive. We see a similar baseline problem of – we do not know who the fellow pedestrians are. >

< The final category we have reviewed of traffic stop-related literature looks at the determinants of disparities and the relative sizes of disparities.>

Such methods are the culmination of statistical, criminological, economic, and statistical analyses resulting from the elusive nature of proving discrimination from a data that do not

Previous studies that have analyzed traffic stop data are extensive. They have identified a host of difficulties in conducting analysis on traffic stop data. They have also identified the relevance of traffic stop data in applications to the Fourth Amendment, especially as the War on Drugs has qualitatively been shown to disproportionately affect minority races, namely Black and Hispanic/Latinx populations. We refer to Black and Hispanic/Latinx drivers as because of…

# Previously discussed articles

## Pierson 2020

Pierson, E., Simoiu, C., Overgoor, J., Corbett-Davies, S., Jenson, D., Shoemaker, A., ... & Goel, S. (2020). A large-scale analysis of racial disparities in police stops across the United States. *Nature human behaviour*, 1-10.

## Riddell 2020

Riddell, C. A., Kaufman, J. S., Torres, J. M., & Harper, S. (2020). Using change in a seat belt law to study racially-biased policing in South Carolina. *Preventive medicine*, *130*, 105884.

* Summary: in 2005, SC changed seat belt laws from
  + Two main objectives: (1) did SC’s change of seat belt enforcement (to primary) lead to greater stops of Black/Hispanic drivers than for white? (2) did SC’s change affect search and arrest rates? Hypothesis: traffic stops increase after changing enforcement from secondary to primary, but increase more for Black/Hispanic drivers.
* Background: Primary enforcement of seat belt laws can improve motor vehicle safety, but adding another primary enforcement law may increase risks of racial profiling for at-risk populations.
* Method:
  + Interrupted time series design: pre-primary enforcement seat belt law served as a control for the year after the law was enacted
  + Quasi-poisson regression to see if Black/Hispanic stops were disproportionately increasing (addressing the first question). Looks at *counts* of traffic stops to overcome the unknown denominator.
  + Logistic regression to estimate differential effect of policy change on risk of arrest and search.
* Results:
  + Black drivers stopped 58% higher, white drivers stopped 50% higher, Hispanic drivers stopped 50% higher
  + Stops increased 30%, so denominator for arrest and search rate increased.
    - Arrest rates increased for Hispanic, decreased for Black

## Hannon 2019

Hannon, L. (2019). Neighborhood Residence and Assessments of Racial Profiling Using Census Data. *Socius*, *5*, 2378023118818746.

* Summary: ?
  + Even when analyzing *pedestrian* stops, the people who are stopped often are not residents of the police beat (smallest unit of location).
* Helpful intro
  + Comparing racial composition of residents in an area with racial composition of motorists stopped in an area is problematic. Precedent established in State v. Soto 1996 – not all residents drive, and not all drivers are stopped near their place of residence.
  + However, comparing residential racial composition with pedestrian stop racial composition is still common academic practice.
* Data:
  + Chicago Police data 2016-2018, investigatory pedestrian and vehicle stops that exclude consensual ‘mere encounters’ and probable cause stops. 174k, with 118k being pedestrian stops
  + American Community Survey data for census block groups
* How Does Ignoring Detainee Residence Affect the Assessment of Racial Disproportionately in Pedestrian Stops?
* Continue reading… what is **disproportionality**?

## Kalinowski 2019

Kalinowski, J. J., Ross, M. B., & Ross, S. L. (2019, May). Now You See Me, Now You Don't: The Geography of Police Stops. In *AEA Papers and Proceedings* (Vol. 109, pp. 143-47).

* Summary: pointing out a hole in VOD theory by noting that the *types* of stops from day-to-night change, so the assumption in VOD theory (Grogger 2006) that the types of stops from day-to-night are the same may be flawed!
* Data: Texas (state) patrol, 2010 to 2015. Notable variables: type of stop (Cit. speed;  
  Warn. Equipment; Warn. Paperwork; Cit. other; Warn. Moving; Warn. other), officer ID, district,
* Changes in types of police stops
* Changes in location of stop
* Geographic changes compared to changes in types of stops. “regressing officer average absolute change in violation type on the absolute value of the resource-allocation change” “Officers who reallocate time across counties between daylight and darkness also change the type of stops they make”
* This is an econ paper so it really isn’t that good

## Goel 2017

Goel, S., Perelman, M., Shroff, R., & Sklansky, D. A. (2017). Combatting police discrimination in the age of big data. *New Criminal Law Review: An International and Interdisciplinary Journal*, *20*(2), 181-232.

* Summary: Article gives **context/relevance** for why investigating data on stops (pedestrian and traffic) is important. Although courts often reject statistical evidence of discrimination because such evidence does not confirm INTENT, big data can help craft more equitable strategies of stops that are better than the current program of stop-and-frisk.
  + Largely a narrative article that provides super helpful context of racial profiling and the courts
* Outline: part 1 on litigation, part 2 on how big data is starting to be used to address discrimination, part 3 on how SHR method can potentially reduce discrimination, part 4 on obstacles
  + Part 2: More & better (cleaner, more comprehensive) data is being collected regarding stops
  + Part 3:
* Major points:
  + Stop level hit rate (SHR) from NY data collection helps to pinpoint what categories of Terry stops are unnecessary and what groups of people (minority races) are disproportionately impacted
  + SHR may provide heuristics (alternative is squo program or random stopping)

## Pierson 2017 – don’t include?

Pierson, E., Corbett-Davies, S., & Goel, S. (2017). Fast threshold tests for detecting discrimination. *arXiv preprint arXiv:1702.08536*.

* Summary: Developed a method that more quickly fits threshold tests that involves probability distribution, “discriminant distribution.” Assists making the Bayesian latent variable model more computationally efficient…?Very technical/ stats paper.
* Builds off of threshold test from **Simoiu 2017**, which considers the decision made and the outcome of the decision. Estimates decision thresholds and risk profiles via BLVM, which is computationally expensive from repeatedly sampling beta distribution. By replacing beta distribution with family of discriminant distributions (subset of logit-normal distribution that approximates beta well enough). In the example of pedestrian stops in NY, this method sped up inference 75x.
  + Lit review helpfully summarizes benchmark, outcome, and threshold tests. Threshold tries to circumvent problem ‘infra-marginality’
* Visualization idea: Inferred thresholds for frisks in the stop-and-frisk data. The thresholds for white pedestrians are plotted on the horizontal axis and the thresholds for minority pedestrians in the same precinct are plotted on the vertical axis. The dotted line denotes equal thresholds. The size of each circle corresponds to the number of stops of minority pedestrians. Axes are logarithmic.

A screenshot of a cell phone

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* Continue reading… *What is the threshold test and can we implement it?*

## Shoub 2017

Shoub, K., Baumgartner, F. R., & Epp, D. A. Policing the Powerless: How Black Political Power Reduces Racial Disparities in Traffic Stop Outcomes.

* Interesting: researchers create an index for black political representation on the local level, using factor analysis on a) black population (census), b) black voter turnout, c) race of mayor and city council members (?)
* Light vs. harsh outcome designator. Analysis on what happens during a stop and what happens after a stop. Helpful insight on what happens during a traffic stop

## Taniguchi, 2017

Taniguchi, T. A., Hendrix, J. A., Levin-Rector, A., Aagaard, B. P., Strom, K. J., & Zimmer, S. A. (2017). Extending the veil of darkness approach: An examination of racial disproportionality in traffic stops in Durham, NC. *Police Quarterly*, *20*(4), 420-448.

* Builds off of Grogger 2006 and 3 other studies that use VOD approach. This study includes 3 innovations and finds disproportionality
* Keep reading…

## Goel 2016

Goel, S., Rao, J. M., & Shroff, R. (2016). Precinct or prejudice? Understanding racial disparities in New York City’s stop-and-frisk policy. *The Annals of Applied Statistics*, *10*(1), 365-394.

* Summary: Examine NY pedestrian stop-and-frisk data for when pedestrian suspected for criminal possession of weapon. Probability of finding a weapon is <1%, and black and Hispanic pedestrians *disproportionately* stopped in these contexts because 1) lower thresholds for stopping pedestrians in high-crime areas, 2) lower thresholds for minority races than for white race.
  + Motivation: to find a stat/legal tool to find 4th amendment violations by looking at outcomes, ex ante probabilities of uncovering a weapon. Ex ante refers to, given characteristics of the person stopped.
* Data: subset into only stops that result from suspected criminal possession of weapon. Disregard searches that lead to arrests, and focus on outcome of uncovering contraband. Advantage to looking at only one crime (not including drugs) because the true population hit rates may be different for different crimes.
* Method: logistic regression!!! LHS: probability of uncovering a weapon, RHS: slew of indicator variables for demographics (sex, race, build), location (public housing, public transit, neither), inside/outside, time/date (month, day of week and time of day, binned into disjoint four-hour blocks), reason for stop. continuous variables for the year, suspect’s height, weight and age, and the time (duration?) for which the officer observed the suspect before conducting (the latter four are all normalized to have mean 0 and variance 1). **Indicative of how** clean & comprehensive data collection severely facilitates the accuracy, power of the model
  + Also added indicator variable for PRECINCT and LOCAL HIT RATE (the latter, researchers calculated themselves)
  + Use stochastic gradient descent to fit the model because efficiency and low memory use
* model is accurate
  + On test data 2011-2012, model has 83% AUC (ROC and AUC: <https://developers.google.com/machine-learning/crash-course/classification/roc-and-auc>)
  + Compare model estimates to empirical hit rates, also successful
  + Random forest estimators yield results largely in line with log reg
  + Model is robust to errors in estimating pedestrian height, weight, age
* **Really cool data visualizations:**

Model-inferred CDF of probability(criminal possession of weapon) (this type of user interaction can be put in a SHINY APP!! Going from the non-disaggregated model to the disaggregated model)

**A close up of a map

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* Lower hit rates for black / Hispanic not necessarily evidence of discrimination b/c POC are stopped in different contexts. Stop-and-frisk is a localized tactic this is often concentrated in places with higher poverty and crime rates, and therefore more POC living there.

Qualitative geo-spatial analysis (figure 2)

1. seemingly 1 to 1 correspondence between (a) and (b) – stops occur in places with more homicides.

2. high-crime / high homicide areas are poc-majority (b) and (c)

3. racial composition of stops similar to racial composition of neighborhoods (a) and (c)

Hit rate and location-based analysis (figure 3)

1. estimate hit rates, distinguish based on the type of location (public housing, etc). hit rates estimated by averaging model probabilities; provide stable estimates for geographically sparser areas

2. figure 3(a) shows that within each precinct, b/w hit rates are much closer than the city-wide hit rates (indicated by horizontal dashed lines). Weighted average of hit rates (by number of stops) different from precinct to city level

3. in precincts with majority white suspects who are stopped, hit rate is higher!

(size of plot indicates number of stops)

**A close up of a map

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* Method part 2 (adding on the location-specific factors), testing for racial discrimination
  + Took all black pedestrians stopped from 2011-2012 in NY, changed race to *white*, and estimated the hit rate using the model. The hit rate was still *higher* than the empirical black hit rate, but it wasn’t as high as the empirical white hit rate!
* **Stopped reading after section 3.4 improving stop efficiency**
* 211 – 218 on goel 2012 gives a helpful summary

## Rosenfield 2012

Rosenfeld, R., Rojek, J., & Decker, S. (2012). Age matters: Race differences in police searches of young and older male drivers. *Journal of research in crime and delinquency*, *49*(1), 31-55.

* Summary:
  + Main question: Do racial differences in likelihood of being searched DIFFER by driver’s age, comparing for different aspects of driver and officer. Yes.
  + “Race differences in the probability that a driver stopped by the police is searched depend on the driver’s age. Among younger drivers, Blacks are more likely to be searched than Whites. This difference disappears for drivers age 30 and older and, in some analyses, reverses.”
* Method:
  + Two separate logistic regressions for stops of young (under 30) and old white drivers; and young and old black drivers.
  + Propensity score matching. According to Wikipedia: “In the [statistical](https://en.wikipedia.org/wiki/Statistics) analysis of [observational data](https://en.wikipedia.org/wiki/Observational_study), **propensity score matching** (**PSM**) is a [statistical matching](https://en.wikipedia.org/wiki/Matching_(statistics)) technique that attempts to [estimate](https://en.wikipedia.org/wiki/Estimation_theory) the effect of a treatment, policy, or other intervention by accounting for the [covariates](https://en.wikipedia.org/wiki/Covariate) that predict receiving the treatment.”
* Data: 2007 St. Louis Metropolitan Police Department
  + Exclude female drivers because less likely to be searched
  + Did two tests. Goal was to examine stops that resulted in discretionary searches, meaning that an arrest warrant wasn’t already issued. Ran logistic regression on ALL stops resulting in searches, and then ALL stops resulting in searches that didn’t lead to arrests. Results from the model were the same.
  + Chose to keep stops yielding contraband and stops to which the driver didn’t consent as “discretionary” because the search rate (I think..) didn’t really change that much whether or not was included.
  + More variables: officer characteristics (age, sex, education), stop location (city street), driver characteristic (city resident)
* Other interesting notes:
  + First paragraph under results section has descriptive data analysis. First chunk/ section was about “bivariate analysis” that was a nice segue way into the logistic regression
  + Logistic regression results help with interpretation of coefficients! ☺
  + Why doesn’t this log-reg just do age interaction?
  + 2nd to last paragraphs in log-reg result section has a helpful limitations bit: selection bias – that white drivers are not the treatment group for black drivers necessarily. Regression approach of conditioning estimated treatment effect on confounding variables may be inaccurate because of the linear functional form. Use propensity score matching to try to address this limitation
  + Other limitations: city, time span, specification of driver demeanor, unobservable confounding factors, etc.

## Ridgeway 2010

Ridgeway, G., & MacDonald, J. (2010). Methods for assessing racially biased policing. *Race, ethnicity, and policing: New and essential readings*, 180-204.

* Summary: The search for an appropriate benchmark to determine racial profiling remains elusive! The goal to control for as many factors that are not confounded with race but also collected in the dataset is difficult. Existing benchmarks have their respective strengths and limitations.
* External benchmarks (using census data)
  + Goal is to find race-blind stop rates vs. actual stop rates. But, many explanations behind difference in residential racial composition and drivers stopped racial composition. “combination of police exposure to offending/suspicious activity, the racial distribution of the population involved in those activities, and the potential for racial bias” (3)
  + Other alternatives: racial distribution of licensed drivers (but doesn’t account for non-resident driving proportions in a locality); racial distribution of not-at-fault drivers involved with traffic accidents to reflect racial distribution of population drivers
* Observation benchmarks
* Arrest and crime rate benchmarks (too confounded with stop data)
* Instrumental variables (day vs night)
* Internal benchmarks: internal benchmark, a framework that compares officers’ stop decisions with decisions made by other officers working in similar situational contexts
* Post-stop outcomes: auditing post-stop interactions, hit rates (finding contraband, using NE to argue that this is race-blind... criticism is that differences in hit rate may reflect different in populations’ proclivity for certain crimes), other stop outcomes (length of stop, time of stop, location)
  + the common practice of “adjusting for” potentially confounding factors with multivariate regression is difficult to defend in the analysis of post-stop data. The regression adjustment is only effectively if there is not a strong correlation between race and the other variables in the regression model. If in the case of citizen stops, the distribution of stop features of black differs substantially from the distribution of stop features of whites by neighborhood, type of violation, time of day, etc. it is uncertain whether the estimate of the race effect on police post-stop outcomes sufficiently accounts for these potentially confounding variables. Unless stops of black and white suspects occur in similar circumstances, the regression model will be sensitive to the terms in the model, such as interactions between race and other predictors (e.g., race\*location). Unfortunately, this situation is often overlooked in criminological studies of racial profiling.
* Continue reading… will be a good guide/background for explaining our motivations (with light/night variable, doing logistic regression, etc.)

## Grogger 2006

Grogger, J., & Ridgeway, G. (2006). Testing for racial profiling in traffic stops from behind a veil of darkness. *Journal of the American Statistical Association*, *101*(475), 878-887.

* First attempt of veil of darkness methodology, results are **inconsistent** with evidence of racial profiling (in comparing stop rates during darkness and light)
* Clearly articulates difficulties of finding the “risk set” / baseline to compare the actual racial distribution of stops. “At risk” refers to the population at risk of stops. Difficult to infer how traffic stops in the absence of racial profiling would look like – census data, licensed driver data, car crash data, photographic stop light collection, fail.
  + Driving behavior and police exposure changes for different races
  + Post-stop outcomes, so ignoring the baseline set, is also in the literature.
* VOD model:
  + Assume that if racial profiling exists, then the racial distribution of stops during the day and during the night should be different. This assumes, however, that traffic behavior and patrol behavior remain constant throughout the day?
  + To address the restrictive assumption that traffic patterns from day to night remain the same for all races, researchers use natural variation of daylight during the year – winter has early sunset, summer has late sunset. Limiting the stops analyzed to that time, from 5-9pm, then, makes the assumption less restrictive (now, just assume that traffic patterns from 5-9pm are the same) and can still see differences between night and day.
  + Disregard stops that are part of criminal investigation because you are allowed to use race to identify drivers then.
* Results
  + Simple log reg first (Variables: darkness, clock time, black)
    - Then, added an interaction term for clock time and darkness. To allow for racial profiling to vary with clock time
    - Then, created indicator variables for 6 regions of policing area (Oakland has 35 beats that were aggregated into 6 regions by researchers). Added an interaction term for darkness and policing area.
  + Coefficients are basically all negative, indicating that black motorists have a higher chance of being stopped during the night
* Sensitivity analysis
  + Critical assumptions being made about reporting rates (police reporting the stop doesn’t change from 5-9pm) and risk ratios (driving behavior / true risk of being stop doesn’t change from 5-9pm).

# New articles (for the summer)

## Higgins 2012

Higgins, G. E., Vito, G. F., & Grossi, E. L. (2012). The impact of race on the police decision to search during a traffic stop: A focal concerns theory perspective. *Journal of Contemporary Criminal Justice*, *28*(2), 166-183.

* Focal concerns theory in Louisville, Kentucky
* Literature review: several studies using outcome test, criticism of outcome test(!), slew of city-level studies
* FCT: judges use 3 primary concerns – blameworthiness (punishment fits the crime), protection of community (deterrence), practical constraints
* Data
  + Only looked at searches that *didn’t result in an arrest* because dependent variable was whether or not a *consent* search was conducted. Reduced sample size from 36k to 3k
  + Other variables included measures of blameworthiness, protection of community, and practical constraints
* Continue reading