The Odds of Justice

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A few years after I arrived at AU I got a notice urging me to contribute to a retirement plan.

Why not – it looked good – the University would match what I put in up to a certain amount?

But then they made the mistake of sending me a chart of the benefits I could expect upon retirement- which at the time seemed a long way away. The plan is what is known as a **defined contribution plan.** You put the money in, but the risk of whether it grows to provide any defined benefit is up to you, unlike defined contribution plans where the risk is that of the employer.

Then to the figures on the chart – a projected monthly benefit upon retirement based on how much was in the fund -

with two columns, one for females and the other, **15% more,** **for males**

• This after years of accumulated funds were already likely to be a lot less for women – years when it was hard, particularly in higher education, for women to get any job – except at women's colleges whose near demise has still restricted the job market especially since it was invaded by males.

But by the time I arrived in academe,

non-discrimination laws had been in effect

for a few years so I called the insurer to alert

them that their blurbs needed to be adjusted

as discrimination on the basis of sex was **illegal.**

Oh no, was the reply. We are discriminating on the basis of longevity, not sex

and everyone knows that women live longer than men so eventually they will receive more monthly benefits and it will all even out.

"You guarantee me I will live longer than a similarly situated male colleague and thus attain equality," I asked.

No, no, was the reply —-on the **average** you will live longer. Arguing that average lifetime payments do not pay today's grocery bill, got me nowhere **–"you just don't understand statistics,"** I was told.
I considered that a typical male response to any challenge about numbers made by a female, but also a challenge that I was willing to accept.

Of course today we might see

Can you help us understand some pending technical lawsuits?
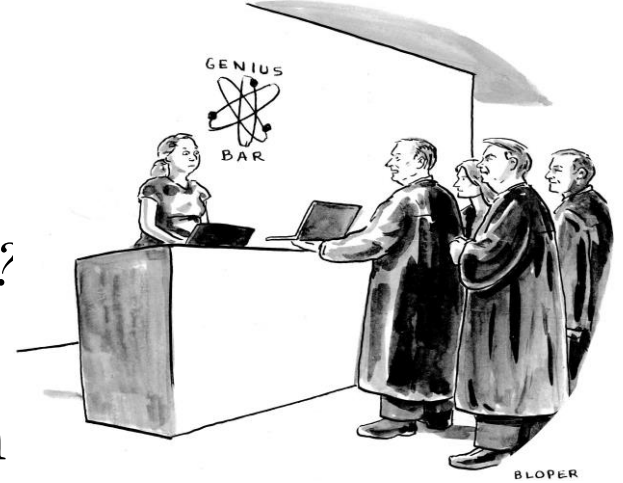
I discovered that another university with the same plan as AU's was being sued by the U.S. Department of Labor for discrimination on the basis of sex. I signed on to work with the lead attorney.

I argued that men died sooner in part because of their life style for which they should not be be rewarded.

I also noted that in the life insurance plan of the same insurer women were not give a matching favorable treatment of paying less than men for the same coverage.

Likelihood of Being in a Traffic Accident
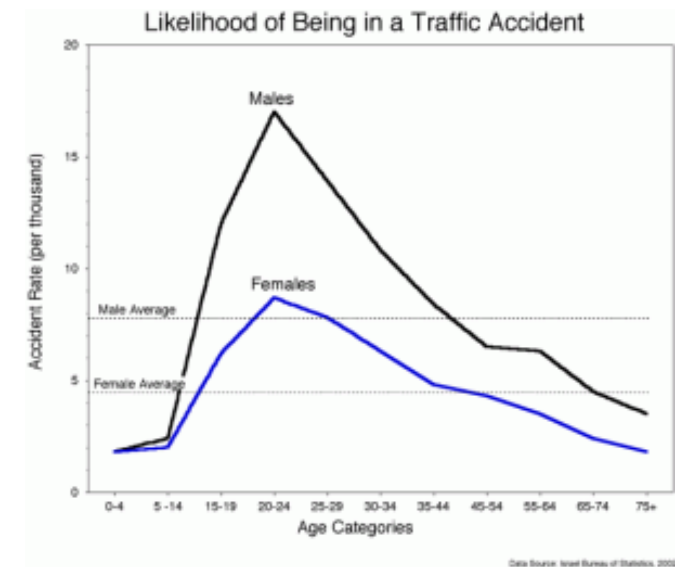
Then I asked why, if the plan was based on longevity, African American men were not paid larger monthly benefits since their left expectancy was shorter.

We don't ask about race they said, so we don't have that information.

My proposed solution

Don't ask about sex was not well-received.

But the last straw was when I also learned that the Supreme Court had just decided that a **defined benefit plan must pay men and women the same**, no matter what it might cost to do so?

Why should there be this difference I asked attorneys for the retirement plan, depending on who bore the risk, so to speak, of a longer life expectancy? Why should not defined contribution plans operate the same non-discriminatory way as defined benefit plans?

The wheels of justice turn slowly …

Oh, they now conceded, you may understand statistics but "you don't understand the law!"

By the time the case of gender neutral retirement had turned through the justice system, I had finished law school and had become a member of the U.S. Supreme Court Bar, so I was able not only to formulate the supporting statistical arguments, but write a brief myself. Bottom line – we won! What enlightened the Justices is not always clear, but I liked the analysis I presented.

Statistics → Law

The legal requirement is that "similarly situated" men and women should be treated the same in various situations, including employment wages and benefits. So are men and women similarly situated or do longevity differences mean that they are not?

Consider a cohort of 1000 men and 1000 women at age 65 and plot their ages of death. Some men will die at 66 as will some women. Some men will live to 100 as will some women. We can match up the death ages of men and women for 86% of this group. Left over are 7% of the group who are men who die young unmatched by the deaths of women and 7% of the group who are women who live longer unmatched by men.
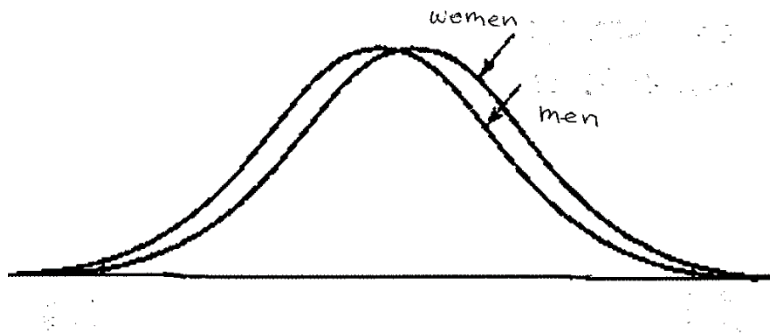
BUT as to 86% of the group they are *similarly situated* and thus entitled to the same monthly benefits as men.

And the US Supreme Court agreed.

Norris v. Arizona Governing Committee (1986)

Similar arguments could be made about various risk groups in other contexts, of course

Insurance

In the early days of what has variously been described as the first, second or third wave of modern feminism there were not many women who were using statistical analysis to study the multitude of issues we know today. Thus the 70's and 80's whenever those of us working on social justice issues in general and gender discrimination in particular needed to be able to understand and pursue anything quantitative. I found myself flying around the country testifying in state legislatures, working on cases of pay discrimination as an expert witness, or advising in general on anything that need numbers.

A memory I will always have of my era combatting discrimination in insurance is after testifying in the legislature in a snow storm in Helena being driven across the state to the only airport still open to catch a flight – the small plane following the snow plow down the runway   – to Spokane to connect to another flight to get to Salem to address the Oregon legislature the next day.

More insurance

Sorry to say that much of this was less successful than the retirement issue battle; the insurance lobby is very powerful and in any case it is hard to focus attention, as no one wants to think in the context of insurance – accidents or end of life – you are insuring your retirement, the insurer betting on your dying soon. Keep in mind that insurance is for the most part a state, not a federal issue so that there are 50 – well, we in DC would hope for 51- battles to fight. Not that I have given up. In a recent column in the statistics magazine *Chance* I contrast statisticians who believe everyone should be treated equally with insurers whose goal is to treat each person unequally.

But there was another issue that grew to rely on statistical analysis: pervasive discrimination in education. Title IX came along in 1972 to broaden coverage on non-discrimination in federally-funded education – both for teachers and for students.

Title IX of the Civil Rights Act of 1972, among other things, requires that the representation of women in activities, including sports, should be *substantially proportionate* to their representation in the student body

The early cases involved athletics, capped by

Brown University v. Cohen, 101 F.3d 155 (1st Cir. 1996)

In the case of Brown, where the percentage of women among students was   51%
and the percentage of women among athletes was   39%, what does substantially
proportionate mean, and is Brown in compliance?

- Difference?   51%-39% = 12%

- Ratio?   39%/51% = .76

- Pass rates?   12%/20% = .60

- Statistically significant? $p < .001$

Again, who knows what moved the courts –

In this case district and circuit courts liked the probability approach and persuaded the Supreme Court to let it stand, effectively ending the string of such suits – not that they haven't reappeared

The comparison of proportions has a long history in discrimination litigation

How representative of his/her peers was the jury that convicted a defendant to death

How representative is the selection of sergeants relying on a police exam to the pool of applicants

How representative of the faculty is of the pool of qualified applicants as we put it of underrepresented groups – of promotion to full professor from the lesser ranks

How well do you think the parties, lawyers and judges understand statistics

How to measure

I once testified before a federal court judge who refused to believe that if a man started at a $50,000 salary and an equally qualified woman at $40,000, and each received a 10% raise the difference in salaries remained the same. After all, they got the same % raise!!

But worse, for years the EEOC used (and probably still do) the 4/5 rule. That is, there is **discrimination** only if the "selection" rule falls below 80%. The selection can be promotion in rank, admission to graduate school, eligibility for jury duty. The difficulty is that the EEOC used the 4/5 rule regardless of the sample size and we all know how misleading that could be.

But what if the women and men of Brown were not similarly situated?

Interests, physical characteristics, backgrounds, etc.

Can we control for the ways in which the women and men may be different?

"The men are bigger"   Temple University case

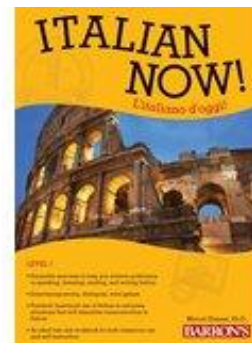So Title IX improved the performance of the US team in the Olympics, but what about STEM?

Philadelphia Girls High – Act I

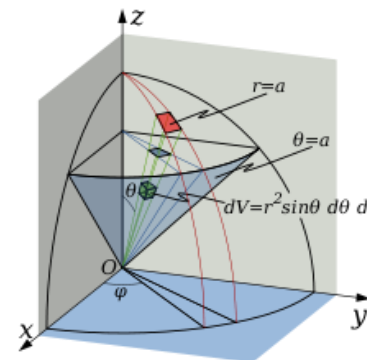"separate but equal" is okay with respect to gender

Vorchheimer v. School District of Philadelphia, 430 U.S. 703 (1977).

Girls High – Act II

Offering Italian instead of Calculus II is not "equal" found success under PA law

Prosecutor's fallacy

People v. Collins (1968)

	Probability
Partly yellow automobile	1/10
Man with mustache	1/4
Woman with ponytail	1/10
Blond woman	1/3
Black man with beard	1/10
Interracial couple in a car	1/1000

Probability:

$$(1/10)\times(1/4)\times(1/10)\times(1/3)\times(1/10)\times(1\times1000)$$

$$= 1/12{,}000{,}000$$

p(more than one given at least one) =
p(more than one)/p(at least one)

$$p(\text{more than one}) = 1 - p(0) - p(1)$$
$$= 1 - 1/e - 1/e$$
$$= .26$$
$$p(\text{at least one}) = 1 - p(0)$$
$$= 1 - 1/e$$
$$= .63$$

p(more than one given at least one) = .26/.63 = .43

Hardly "beyond a reasonable doubt"!

SID

The appellate judge in *Collins* commented:

Mathematics, a veritable sorcerer in our computerized society, while assisting the trier of fact in the search for truth, must not cast a spell over him. We conclude that on the record before us defendant should not have had his guilt determined by the odds and that he is entitled to a new trial.

Cases such as this are an example of what is termed *prosecutor's fallacy*, namely assuming that the prior probability of a random match is equal to the probability that the defendant is innocent.

So is there a *defendant's fallacy?*

This can take various forms, but generally one might argue that a DNA match is not unique – that is, you might expect 10 other matches in a large data base, ignoring the other evidence that contributes to the probability of the defendant's guilt.

Maryland v. Wilson (2002) Are SID deaths in the same family independent?

During rebuttal closing argument, the State's Attorney referred to the statistics that the experts relied on in forming their opinion that Garrett's death was criminal homicide, and argued the probability of petitioner's innocence.

The State's Attorney did not merely argue that there was a low probability that two SIDS deaths would occur in one family; he argued that there was a low probability that petitioner was innocent.

He told the jury, "if you multiply his numbers, instead of 1 in 4 million, you get 1 in 10 million that the man sitting here is innocent. That was what a doctor, their expert, told you." (prosecutor's fallacy)

Defense counsel's motion for a mistrial was denied and, instead, the court gave a curative instruction. Wilson was convicted but on appeal the conviction was overturned and he was released from prison.

Misuse of statistics in British courts led to review of 250 convictions of murder in possible SIDS ("cot death") cases. At issue also was the assumption that multiple deaths in a family were independent events.

And today?

For my column in *Chance*, I am currently addressing the controversial topic of **intersectionality**. It turns out that we have been dealing with it statistically for many years, but quantitative approaches are still lacking among feminists following the introduction of the term in the late 80's.

If we think of intersectionality as interrelated forms or causes of discrimination, we might use a Venn diagram as an illustration.
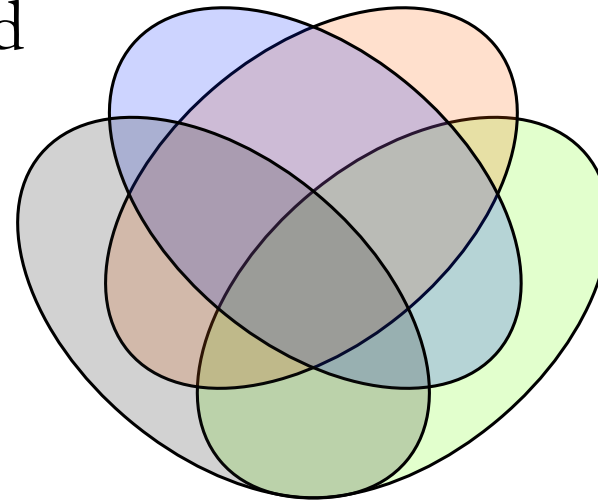
Or explicitly
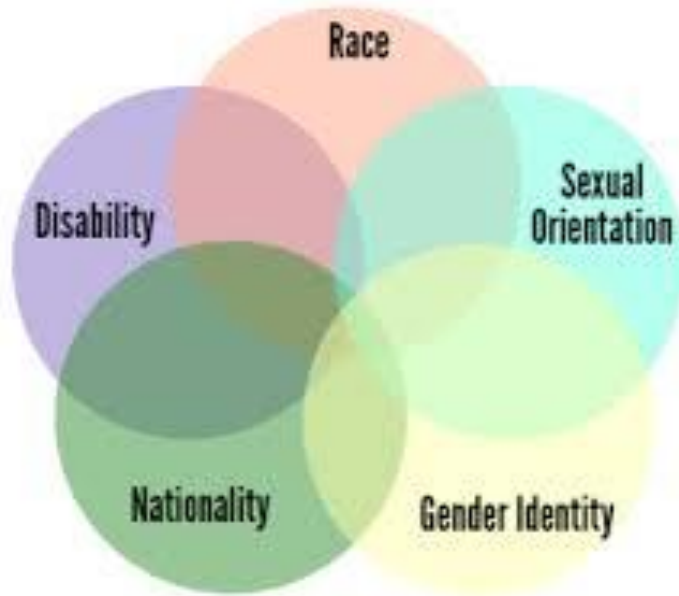
And we have been looking at the same interaction issues in salary studies for years. And still are ...

But it is not only in the U.S. that there is a need for statistics and the law to work together

I have looked at problems in schools in Iraq, Palestine, Myanmar, Czechoslovakia and refugee camps around the world. Most of what I have done is pretty simple and straightforward although there has been some sophisticated and effective work done by others, especially Patrick Ball, including the conviction of Slobodan Milošević in the International Criminal Court. One experience was less than satisfactory, as we worked on a survey of Syrian refugees 10 years ago – particularly among question asked was: do you intend to return to your homes after the fighting? As you are probably aware, the opportunity has not yet arisen.

# AAAS, American Bar Association survey of Syrian refugees

Population: refugees in Jordan and Lebanon.

It was difficult to come up with an adequate sampling design and even more difficult to carry out the interviewing process.

Questions to be answered:
where did the refugees come from
what was their background
    ethnicity, race, religion
    education, politics
were they injured
were their homes destroyed
    by whom
what other violence did they see
how do they see their future

Distribution of Refugees' Previous Residency

Refugees/Governorate
[0,1]
(1,34.5]
(34.5,52]
(52,309]
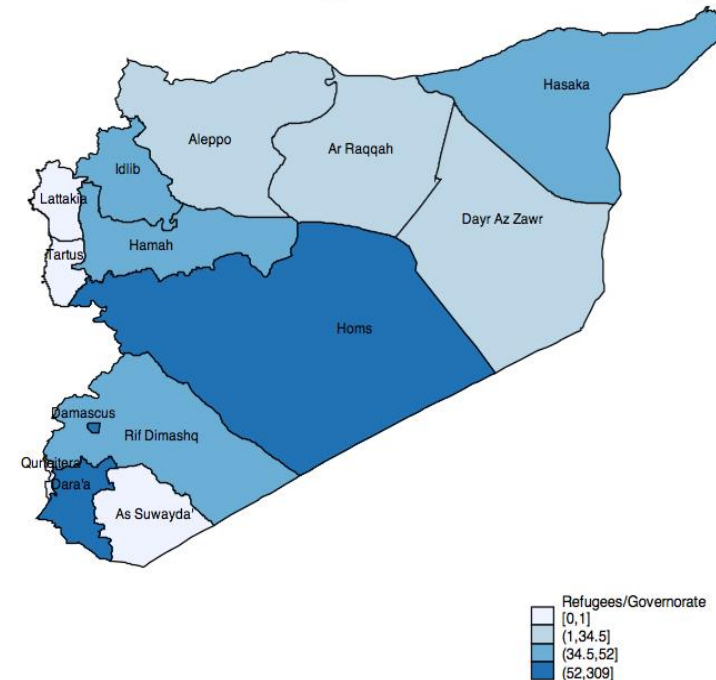
HelpAge

- But that was when we thought that asking "Do you plan to go back?" was a reasonable question. Ten years later various organizations are still surveying the Syrian refugees, but my next experience was with a NGO based in London, HelpAge.

- HelpAge was funded for a study of the special problems encountered among elder refugees. Based on anecdotal evidence from various refugee sites, it was conjectured that abuse and even starvation might be prevalent

- HelpAge sought the assistance of "Scientists On Call," a project of the American Association for the Advancement of Science. So I am one of many "Scientists On Call."

- An international advisory committee designed the original project with implementation supervised and carried out locally. But where to start?

Kyrgyzstan has a relatively stable refugee population and available local expertise – however, after the survey design was set up and personnel engaged, local government approval could not be secured

In Jordan the UNHCR wanted a survey of access to assistance rather than of abuse.
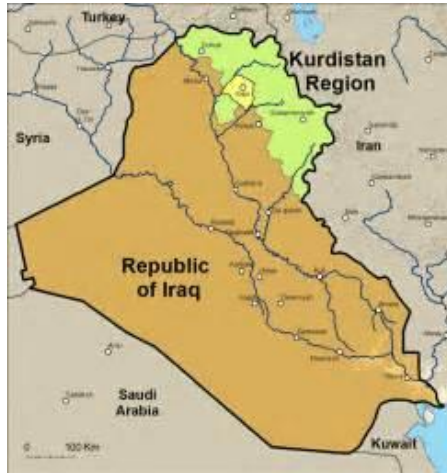
Where else could we go?

Kurdish region of Iraq

Relatively homogeneous population, local expertise, government cooperation

Uganda – two camps, one primarily with refugees from South Sudan the other with refugees from DRC, Burundi, etc.

HelpAge refugee survey

Iraqi Kurdistan

Do older refugees experience gender-based violence?

Pakistan

Uganda

Panama
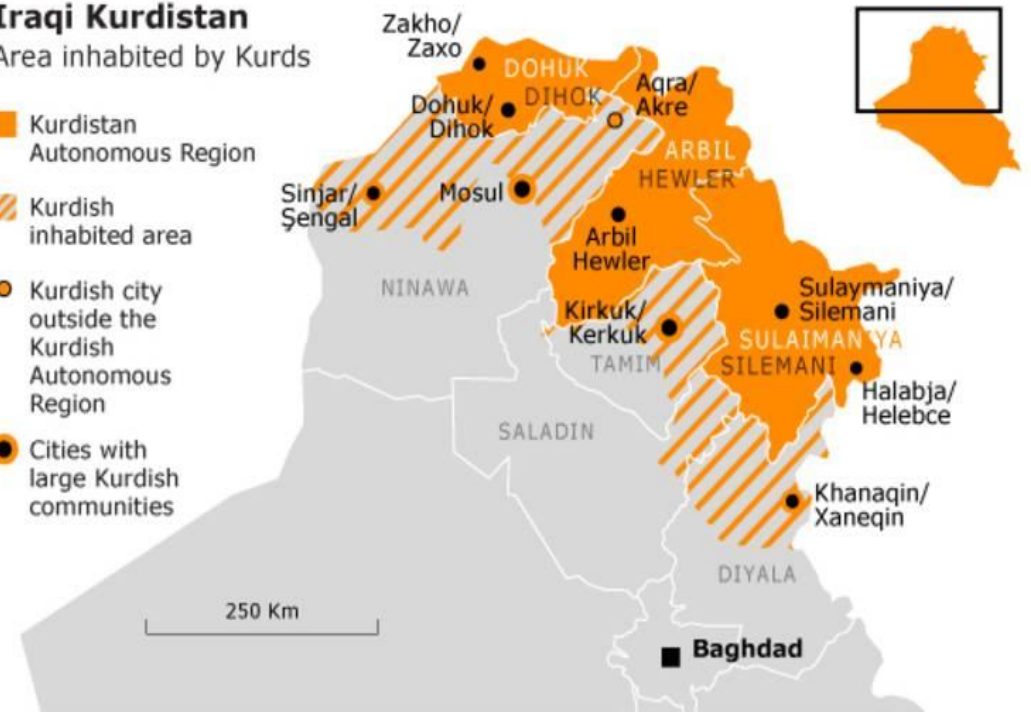
Twenty years after we invaded Iraq, what can we say?

where are the schools?

Who lives in Kirkuk?

Genocide in Rwanda
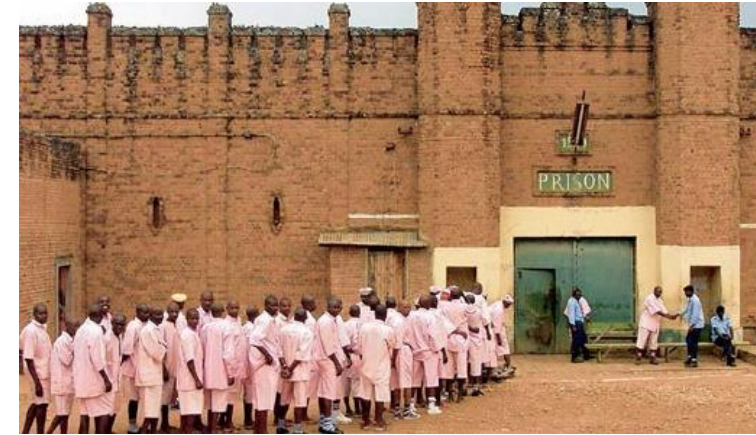
Question: How to bring to justice those responsible for the deaths of 800,000 in a country attempting to recover from the Genocide?

Sampling?

Village courts

Education decentralization in Myanmar

School financing

Local variation

Mon State

   government schools

    Mon schools

    Monastery schools
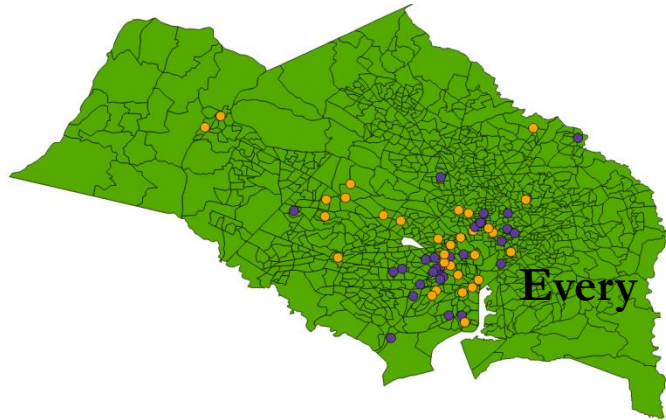
Information technology

Assessment

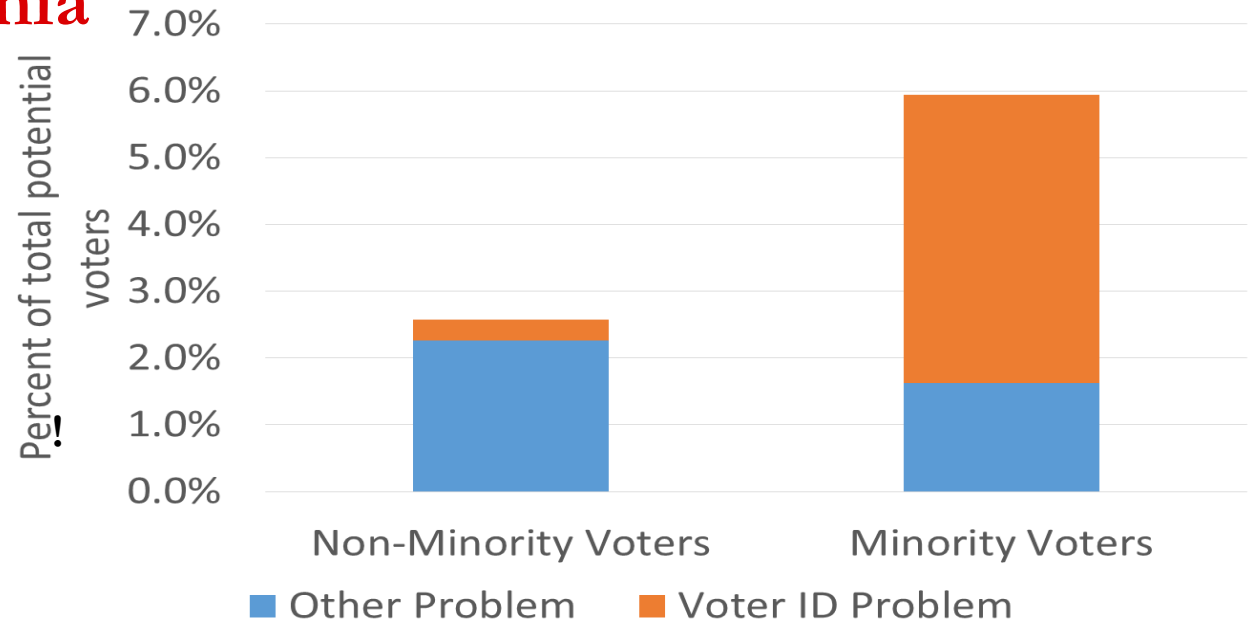Regression in

Fiji

Voting Difficulties in Virginia

minority

majority

670 respondents from Virginia precincts

3.8 % were unable to vote

1.8% were unable to vote because of inadequate voter ID

Every Vote Counts!

Percent of total potential voters

	Non-Minority Voters	Minority Voters

■ Other Problem   ■ Voter ID Problem

Then there are the neglected

Women mathematicians

Middle East and Africa

AWM

Ar home

There is always someone who needs help

Maybe statistics can help

Try it and see!

Thanks for inviting me.