

Ch4: V1 2019 USCOTS Workshop 1

Teaching Statistical Literacy

Chapter 4: Using and Describing Ratios

by
Milo Schield

*Half-Day Workshop
USCOTS May 16, 2019*

www.StatLit.org/pdf/2019-Schild-USCOTS-Slides4.pdf

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Workshop Schedule

Start	Topic
1:00	1 Statistical Literacy Intro
1:30	2 StatLit Details
2:15	3 Measurements
2:45	4 Named Ratio Grammar
3:30	5 Comparing Count Ratios
4:00	6 Untangling Statistics

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Ratios: Chapter 4 Outline

Per grammars:

- Percent grammar
- Percentage grammar
- Reading half tables and tables w/o margins
- Rate grammar

Ordinary Preposition grammars:

- Chance grammar
- Ratio grammar

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Stat Literacy: Study Statistics as Evidence in Arguments

The Point or the Target

The more disputable the point,
the stronger the evidence must be.

Statistic As Evidence

“All Statistics are Socially Constructed”
So, “Take CARE”!!
Statistics may be influenced by:

C	A	R	E
Context	Assembly	Randomness	Error

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Evaluate these Using Just Assembly/Assumptions

1. One in five children face hunger [2019 billboard in St. Paul]
2. Two absences per month = Likely to fail a grade
3. Ninth-grade attendance better predicts graduation than 8th grade test score
4. Attendance alone explains 31% of the variance in performance
5. Budget cuts lead to deaths in Federal prisons
6. 22 million victims of human trafficking trapped worldwide.
7. The National Rifle Association is a terrorist organization.
8. Ban assault weapons
9. 2016 Memphis. 228 homicides. Down 500 police officers.

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Forming Ratios

CONTROLLING FOR CONFOUNDERS	
Take into account (mental)	
Can do by hand	Calculator/Computer
1 Select/Stratify	4 Linear Regression
2 Form Ratios	5 Logistic Regression
3 Standardize	6 Multivariate Regress

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From Comparisons to Ratios: Using Prepositions

ARITHMETIC COMPARISONS
Using Conjunctions or 'Change -By'

Difference: <i>more (greater) than</i> increase by #	Ratio: <i>times [as much as]</i> increase by a factor of	Relative Difference: <i>% (times) more than</i> increase by X%
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RATIOS (Using Prepositions)

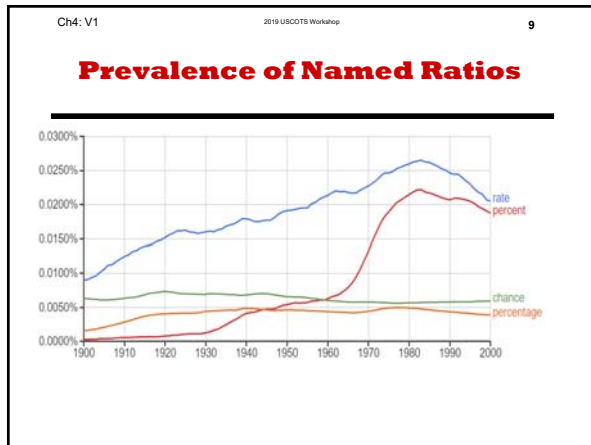
Common Prepositions: <i>Of, in, for, To [4 to 3; 4-3; 4:3]</i> 4 out of [every] 5; cut in half	Per Grammar: <i>miles per gallon; mph</i> deaths per 1,000 men
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RATIOS (Using Prepositions)

Common Prepositions: <i>Of, in, for, To [4 to 3; 4-3; 4:3]</i> 4 out of [every] 5; cut in half	Per Grammar: <i>miles per gallon; mph</i> deaths per 1,000 men
Named-Ratios	Named-Ratios
Ratio Grammar: <i>ratio of women to men</i> student-teacher ratio	Percent Grammar: <i>85% of military personnel are men</i>
Chance Grammar: odds/risk/probability <i>chance of [our] winning;</i> <i>chance that we will win</i> <i>chance to win; chance for a win</i>	Percentage Grammar: fraction/share <i>percentage of men who bet</i>
	Rate Grammar: prevalence, incidence <i>rate of n per d</i> <i>Men died at a rate of n per d</i>

Light-edge boxes need clause for part and whole (cannot compare ratios).
Dark-edge boxes have part and whole in phrases (can compare ratios)

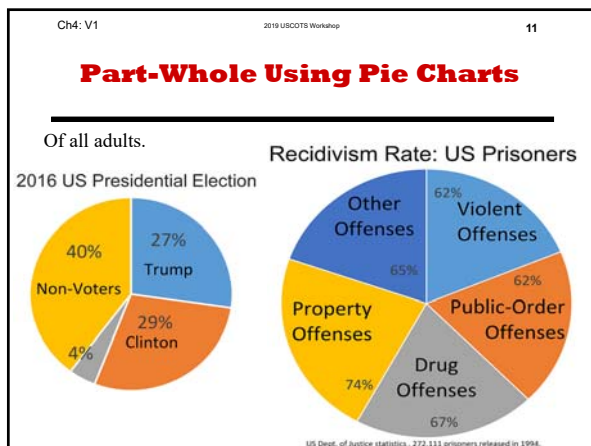


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Two Kinds of Percents

Which kind of percents are these: part-whole or percent compare?

- The youngest child's share of the candy.
- Interest charged per year by the Mafia (criminals).
- People live 100% longer on average in US than in Swaziland.
- The advertisement said "40% off".



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Four Different Grammars; Confusion of the Inverse

- 40% of US adults did not vote for president in 2016.
- The *percentage* of US adults who didn't vote was 40%.
- The non-voter *rate* among US adults in 2016 was 40%.
- There was a 40% *chance* that an adult was a non-voter.

Confusion of the inverse exchanges part with whole.

- "The percentage of men who are in the military" .NE. "the percentage of the military who are men".
- The percentage of smokers among women .NE. "the percentage of smokers who are women".

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Use Percent Grammar
<X% of Whole are Part>

Describe the 30%

Describe the 36%

US Students Grades 9-12 Using Tobacco or Marijuana in Last 30 days

Toy table

2015 CDC MMWR October 16

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Tables: Use Percent Grammar
<X% of Whole are Part>

1. What percentage of men are art majors?
2. What percentage of art majors are men?
3. What percentage of students are male art majors?

Students	Men	Women	ALL
Humanities	28	72	100
Arts	4	36	40
Science	48	12	60
ALL	80	120	200

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100% Tables: Percent Grammar
<X% of Whole are Part>

Describe the 10%

Students	Men	Women	ALL
Humanities	28%	72%	100%
Arts	10%	90%	100%
Science	80%	20%	100%
ALL	40%	60%	100%

Describe the 5%

Students	Men	Women	All
Humanities	35%	60%	50%
Arts	5%	30%	20%
Science	60%	10%	30%
ALL	100%	100%	100%

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Use Percent Grammar
<X% of Whole are Part>

Table 33: World Population by Religion and Continent (1996)

(Millions)	Total	Asia	Europe	North Am	Other
Total	5,804	3,513	728	296	1,563
Christian	1,955	303	556	256	1,096
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Table 1333. 1997 U.S. Statistical Abstract.

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Percentage Grammar
Four form

1. The percentage of seniors who smoke is 15%.
2. Among seniors, the percentage who smoke is 15%.
3. Among Seniors, the percentage of smokers is 20%.
4. Among men, the percentage of seniors who smoke is 20%

Numbers 3 and 4 are problems.
“OP” introduces whole in percent grammar.

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Percentage Grammar
Sports Grammar

Sports grammar is readily understood with a natural whole:

- *percentage of defective cans; percentage of tire failures*

Without a natural whole, sports grammar is ambiguous.

- *percentage of female smokers;*
- *percentage of working males*
- *percentage of infant deaths;*
- *percentage of single mothers*

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Half Tables when Parts of 100% Table are Binary

Describe the circled 60%. Use percent grammar.

Class Last Year	Percentage who are Retained	Percentage who are Not Retained	All
Freshman	60%	40%	100%
Sophomore	75%	25%	100%
Junior	90%	10%	100%
Senior	10%	90%	100%
ALL	70%	30%	100%

If 60% returned, what percentage did not return?
So, the right two columns are redundant.
Eliminating them will save space!

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Confounding

Mortality by Hospital

Hospital	Total	Died	Death Rate
City	1,000	55	5.5%
Rural	1,000	35	3.5%
Both	2,000	90	4.5%

Predictor
Hospital:
City vs. Rural

Outcome
Died

Confounder
Patient Condition: Poor vs. Good

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Ratios:

Chapter 4 Outline

Per grammars:

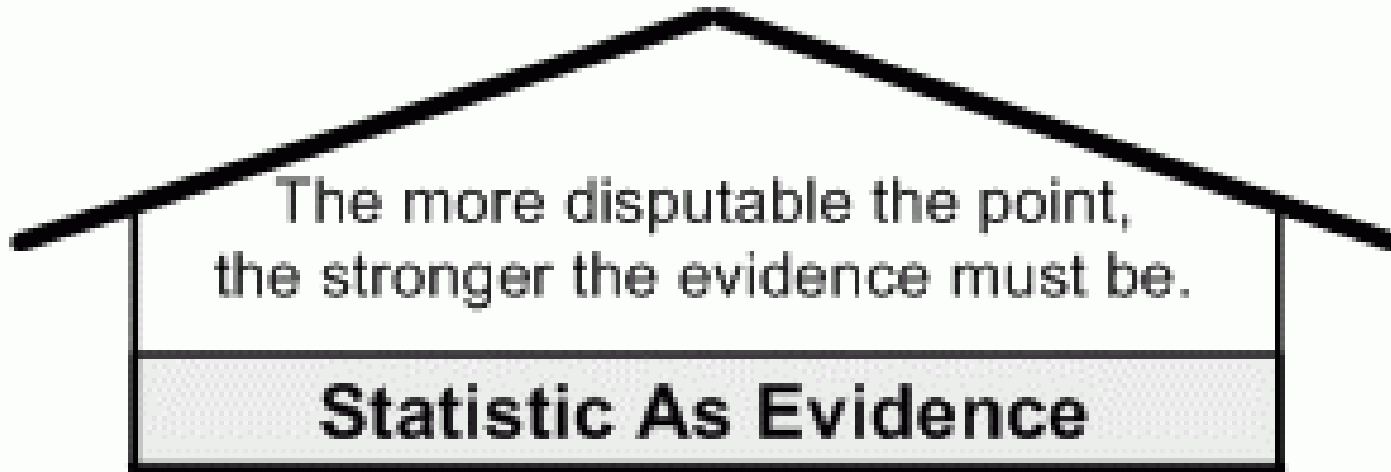
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times [as much as]
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Relative Difference :

% (times) more than
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Per Grammar:

miles per gallon ; mph
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*ratio of women to men
student-teacher ratio*

Chance Grammar: odds/risk/probability

*chance of [our] winning;
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chance to win; chance for a win*

Per Grammar:

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Named-Ratios

Percent Grammar:

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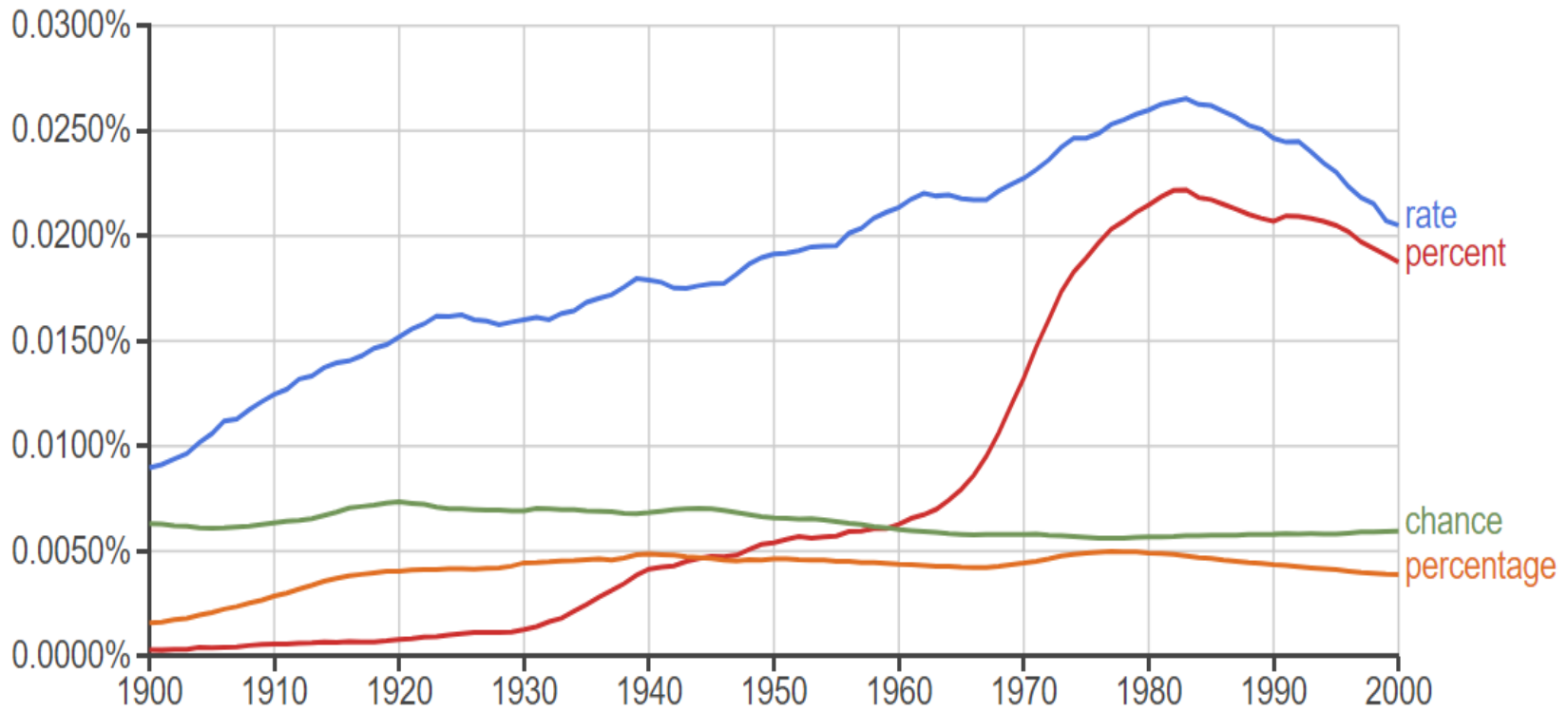
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Prevalence of Named Ratios



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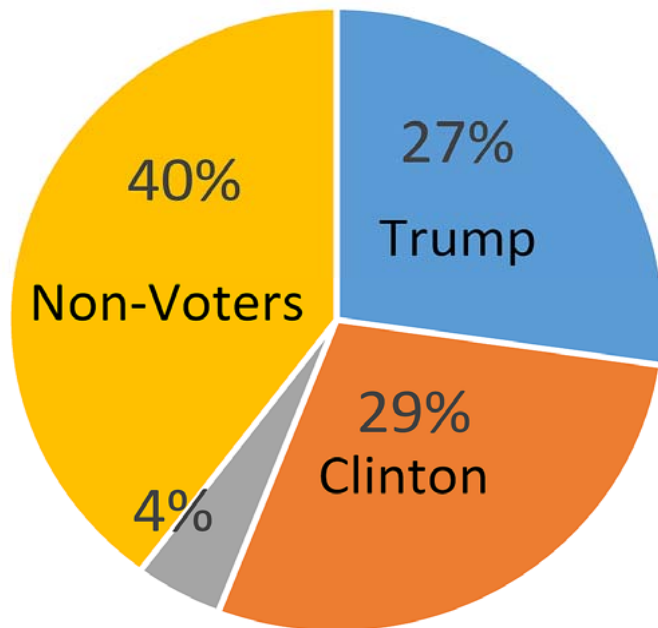
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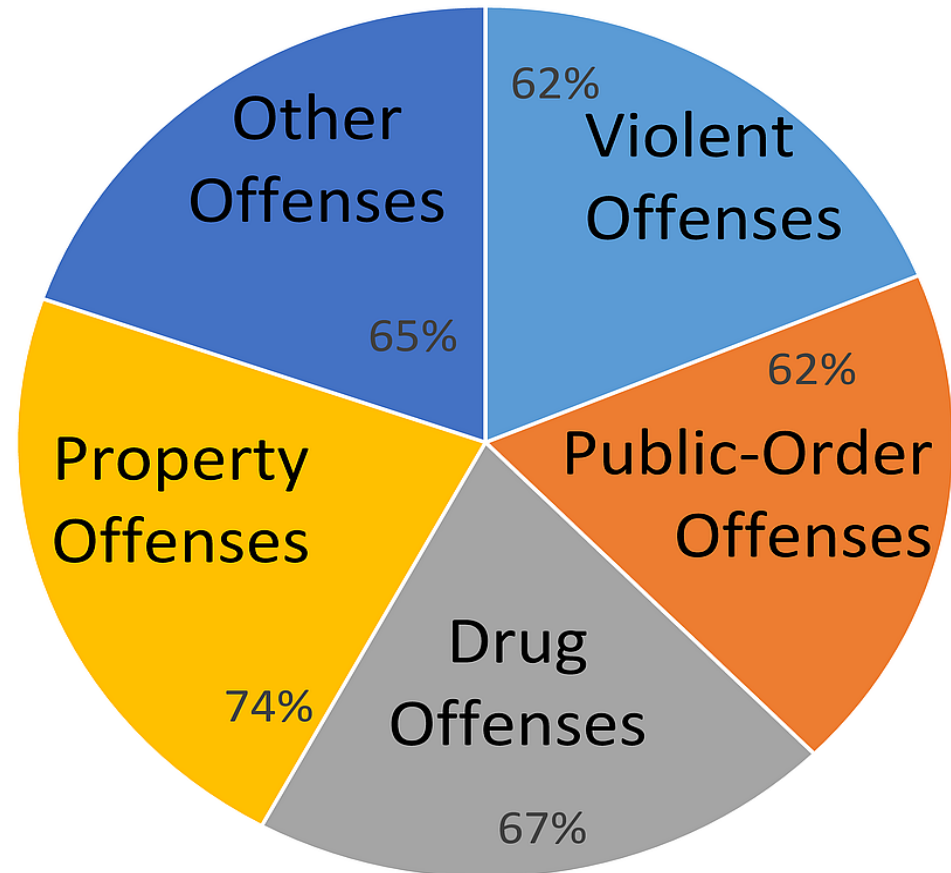
Part-Whole Using Pie Charts

Of all adults.

2016 US Presidential Election



Recidivism Rate: US Prisoners



US Dept. of Justice statistics . 272,111 prisoners released in 1994.

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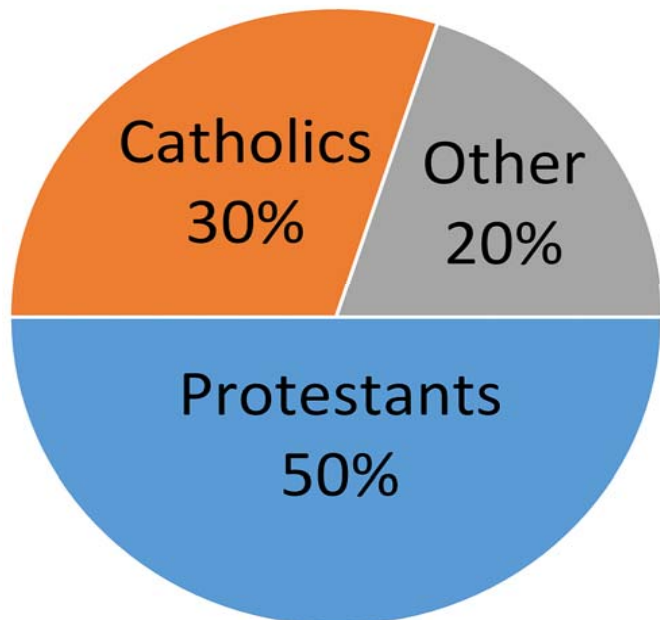
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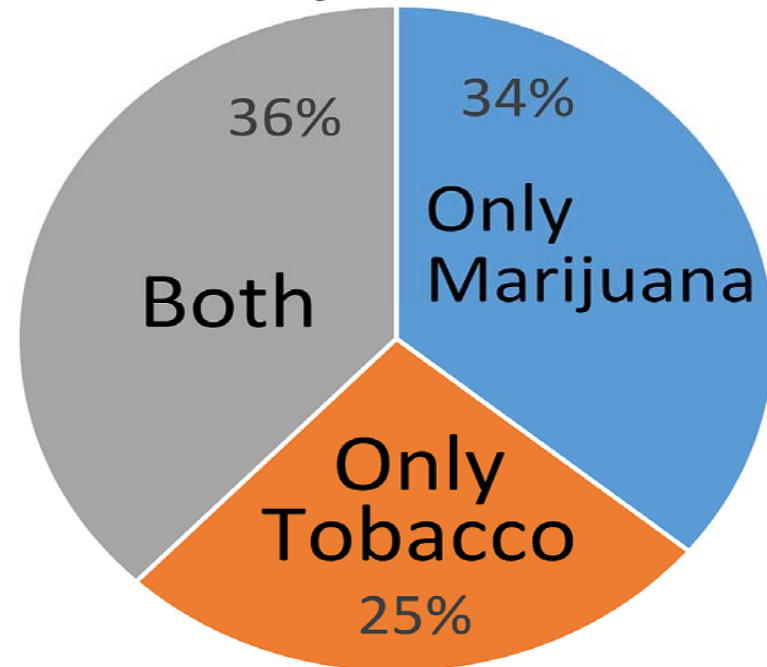
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