Teaching Confounding: Covid Deaths Case Study

Milo Schield

Consultant: Univ. New Mexico

Fellow: American Statistical Association

Elected Member: International Statistical Institute

US Rep: International Statistical Literacy Project

President: National Numeracy Network

ASA Birds of Feather Aug 12, 2021

Paper: www.StatLit.org/pdf/2021-Schield-ASA-BOF.pdf

Slides: www.StatLit.org/pdf/2021-Schield-ASA-BOF-Slides.pdf

Deaths Among Covid Delta Cases by Vaccination & Age

Population	----- Covid Delta Cases -----	
Group	Vaccinated	Unvaccinated
Cases	117,114	151,054
Deaths	481	253
Mortality Rate	0.41%	0.17%
Risk Ratio (Vac/UnV)	245.2%	

Population	----- Delta Cases <50 -----		----- Delta Cases >=50 -----	
Group	Vaccinated	Unvaccinated	Vaccinated	Unvaccinated
Cases	89,807	147,612	27,307	3,440
Deaths	21	48	460	205
Mortality Rate	0.02%	0.03%	1.68%	5.96%
Risk Ratio (Vac/UnV)	71.9%		28.3%	

Converting Math Problem From Factual to Informative

1. Form risk ratios > 1
2. Eliminate deaths: keep cases (weights) and death rates
3. Create total data: cases, deaths and death rate
4. Write a two-group comparison for each table
5. Calculate prevalence of vaccinated for each age group
6. Check math in generating observed weighted averages
7. Standardize on group prevalence of vaccinated

Making Informative Comparisons

2. Eliminate deaths: keep cases (weights) and death rates
3. Create total data: cases, deaths and death rate

Population	----- Covid Delta Cases -----		
Group	Vaccinated	Unvaccinated	Total
Cases	117,114	151,054	268,168
Mortality Rate	0.41%	0.17%	0.27%
Risk Ratio (Vac/UnV)	2.45		

Population	----- Delta Cases <50 -----		----- Delta Cases >=50 -----	
Group	Vaccinated	Unvaccinated	Vaccinated	Unvaccinated
Cases	89,807	147,612	27,307	3,440
Mortality Rate	0.02%	0.03%	1.68%	5.96%
Risk Ratio (UnVac/V)	1.39		3.54	

Making Informative Comparisons Step 4: Write Comparisons

Write a two-group comparison for each table

Among all Delta cases, vaccinated are 2.45 times as likely to die as unvaccinated.

Among Delta cases under 50, unvaccinated are 1.4 times as likely to die as are vaccinated.

Among Delta cases age at least 50, unvaccinated are 3.5 times as likely to die as are vaccinated.

Informative Comparisons Step 5: Explaining

Compute the weights: prevalence among 2 groups

			Crude		Number of Cases				----Weights -----	
Death rates	<50	50+	All		<50	50+	All		<50	50+
Un-vac	0.03%	5.96%	**0.17%**		147,612	3,440	151,054		0.977	0.023
Vaccinated	0.02%	1.68%	**0.41%**		89,807	27,307	117,115		0.767	0.233
			2.47		237,419	30,747	268,169		**0.885**	**0.115**

Students can see the imbalance: 233 vs. 23.

Students can describe the imbalance:
"*Seniors (at least 50) are 10 times as prevalent among the vaccinated as among the unvaccinated.*"

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Informative Comparisons Step 7: Fixing the problem

Standardize weighted averages on group mixture

			Crude		Number of Cases			----Weights -----		Standard
Death rates	<50	50+	All		<50	50+	All	<50	50+	All
Un-vac	0.03%	5.96%	**0.17%**		147,612	3,440	151,054	0.977	0.023	**0.71%**
Vaccinated	0.02%	1.68%	**0.41%**		89,807	27,307	117,115	0.767	0.233	**0.21%**
			2.47		237,419	30,747	268,169	**0.885**	**0.115**	3.38

Crude Comparison: mixed-fruit comparison

0.17% = 0.977*0.03% + 0.023*5.96%

0.41% = 0.767*0.02% + 0.233*1.68%

Standardized: Both groups have same mix

0.71% = **0.885***0.03% + **0.115***5.96%

0.21% = **0.885***0.02% + **0.115***1.68%

50+ are 10 times as prevalent among the vaccinated (23%) as among the unvaccinated (2.3%).

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009243/Technical_Briefing_20.pdf

Among Covid Delta cases, unvaccinated are 3.4 times as likely to die as vaccinated *after controlling for age.*

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Result: Students should be able to:

recognize Simpson's paradox
describe it using ordinary English
recognize that it may be a crude comparison

calculate the appropriate weights
calculate an adjusted weighted-average
present the results in ordinary English

Understand "control for" or "take into account"

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Statistical Educators Should Offer a Course that:

Asserts that *Association is Not Causation*
Asserts that *Disparity is Not Discrimination*

Focuses on the *Story Behind the Statistics*

Shows how a *crude association* (mixed fruit comparison) may conceal the real story!

Shows students how to *control for* confounders

Shows students these things *without computers*

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University of New Mexico is offering such a course!

Offering 4 sections fall 2021

Statistical Literacy

UNM UNIVERSITY CATALOG

MATH 1300 (3)

Participants will study the social statistics encountered by consumers. Investigate the story behind the statistics. Study the influences on social statistics. Study the techniques used to control these influences. Strong focus on confounding.

Meets New Mexico General Education Curriculum Area 2: Mathematics and Statistics.

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Study Confounder-Based Statistical Literacy

Statistical Literacy: The Diabolical Denominator
www.StatLit.org/pdf/2021-Schield-MathFest.pdf

Statistical Literacy: Teaching Confounding
www.StatLit.org/pdf/2021-Schield-USCOTS.pdf

University of New Mexico Offers Math 1300
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www.StatLit.org/Schield-Pubs.htm

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