Youth Suicide Rates and Mormon Religious Context:

An Additional Empirical Analysis

by Dr. Benjamin Knoll

Note: this post is intentionally long so as to provide as full and comprehensive picture as possible about the analysis that it describes. For those not interested in the details, read the first few paragraphs and then skip to the "summary" section at the end.

Much has been written recently regarding the incidence of LGBT youth suicides (http://www.sltrib.com/news/lds/3473487-155/suicide-fears-if-not-actual-suicides) in the Mormon community in the wake of the November 2015 handbook policy change (http://www.sltrib.com/home/3144035-155/new-mormon-policy-would-make-apostates) that categorizes same-sex married couples as "apostates" and forbids baptism to children in same-sex married households. While there is a great deal of anecdotal evidence supporting this connection, more rigorous empirical data is harder to come by.

Recently, Daniel Parkinson and Michael Barker presented a wide range of evidence (http://rationalfaiths.com/the-lgbtq-mormon-crisis-responding-to-the-empirical-research-on-suicide/) examining direct, indirect, and anecdotal evidence examining the relationship between LGBT culture/norms and youth suicide rates in the Mormon community. They conclude that while there is little direct evidence, there is sufficient indirect and anecdotal evidence that, when combined with the direct evidence, strongly points to a link between these factors.

One of the data points presented was the rate of suicide among youth aged 15-19 in Utah compared to other comparable states over the past several years. They argue: "Suicide is the number one cause of death of all Utah youth; this is not the case nationally. More alarming, the teen suicide rate in Utah has doubled since 2011. ... While Utah had a doubling of suicides among teens, the rest of the country did not see a substantial increase in their suicide rate."

While this piece of evidence is important and, when considered in light of the other evidence they

present, certainly supports the argument that the approach to LGBT issues in the LDS Church are strongly influencing suicide rates among young Mormons, the analysis is also somewhat limited in that we cannot be certain, as Parkinson and Barker readily admit, that this relationship is not "spurious." That is, it is also possible that there are other factors which affect suicide rates that are also higher in Utah that could be causally affecting these tragic outcomes.

Previous research has identified a number of aggregate factors that affect suicide rates in communities. These include demographic factors like race/ethnicity, age, education, income, and divorce. They also include things like population density and rates of mental illness and gun ownership. (See http://isites.harvard.edu/fs/docs/icb.topic668880.files/RegressionReportKirkBenson10910.pdf, http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=4622&context=etd, and http://www.hsph.harvard.edu/news/magazine/spr08gunprevalence/, for example.)

It is possible to control for these factors by using a statistical tool called "multivariate regression analysis" (https://en.wikipedia.org/wiki/Regression_analysis) In essence, a regression analysis identifies the unique effect of Variable X on Variable Y while simultaneously controlling (http://methods.sowi.uni-mannheim.de/publications/Gschwend03StatisticalControl_UncorrectedVersion.pdf) for the effect of all the other variables that could also be causing Y. In this case, we further examine the relationship reported by Parkinson and Barker by analyzing the prevalence of Mormonism in a community on suicide rates while statistically controlling for these other factors that also contribute to suicide rates, such as demographics, gun ownership, and mental illness.

To perform this analysis, I examine the effect of the proportion of individuals in all U.S. states that identify as Mormon on the per-capita rates of suicide among youth in those states aged 15-19 in

both 2009 and 2014, the latter being the latest year that such data is currently available from the CDC (http://www.cdc.gov/injury/wisqars/).[1] I look both at 2009 and 2014 to see if there is a change during that five-year interval, as the disconnect between LDS church rhetoric and societal views on LGBT issues has arguably drastically diverged in many ways during that time (more detail available in the original Parkinson and Barker post, which shows that rates were fairly stable before 2009).

I obtained the % Mormon in each state from the 2014 Pew Religious Landscape Survey (http://www.pewforum.org/religious-landscape-study/). The CDC lists suicide rates in a state only if there are more than 10 in any particular year, thus some states are excluded from the analysis. In all, the CDC provides sufficient information so that 46 states are included in the full statistical analysis and 42 are included in the analysis of the rate of change in suicide rates between 2009 and 2014 (more details below). This is also important as Parkinson and Barker examine suicide rates in Utah, Arizona, and Colorado. Here we are able to extend the analysis *the majority of all U.S. states* to examine whether these trends are generalizeable to the entire country.

For the control variables, I include % black, % Latino, % Asian, % bachelor's degree, % divorced, median income, and median age as given by the 2014 American Community Survey (1-year estimates) (https://www.census.gov/programs-surveys/acs/). I also include % LGBT as the research summarized by Parkinson and Barker show a link between LGBT identity and suicide risk. This data comes from the Gallup organization and reported at http://www.lgbtmap.org/equality-maps/lgbt_populations. The rate of serious mental illness rates among the 18-25 population (averaged 2013/2014) is obtained from the Department of Health and Human Services (http://www.samhsa.gov/data/population-data-nsduh/reports). While the 18-25 demographic is not identical to the 15-19 age group under consideration, it is the closest age group currently available from the DHHS. Gun ownership rates per state obtained from 2015 data available at http://www.businessinsider.com/gun-ownership-by-state-2015-7.[2]
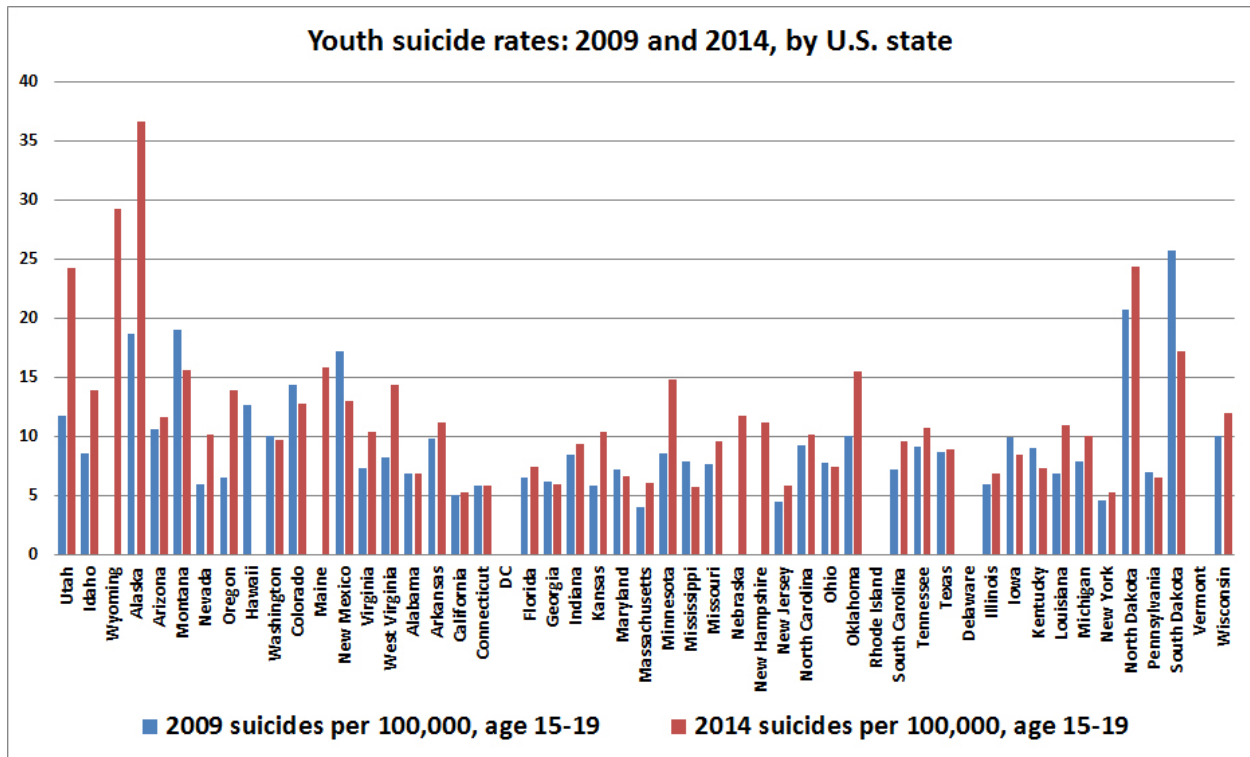
First, I present the correlations (https://en.wikipedia.org/wiki/Pearson_product-moment_correlation_coefficient) between % Mormon in a particular state and the rates of suicide among 15-19 year-olds in 2009, 2014, and the rate of change in suicide rates in each state during that 5-year interval.

	State % Mormon	2009 youth suicide rate	2014 youth suicide rate	5-year rate change
State % Mormon	1			
2009 youth suicide rate	0.099	1		
2014 youth s uicide rate	0.411*	0.703*	1	
5-year rate change	0.436*	-0.209	0.475*	1

An asterisk (*) indicates that the relationship is "statistically significant," meaning that there is a 95% chance that the relationship we observe is real and not due to random sampling error. (See more at http://www.measuringu.com/blog/statistically-significant.php) Relationships that are not statistically significant may simply have appeared at random.
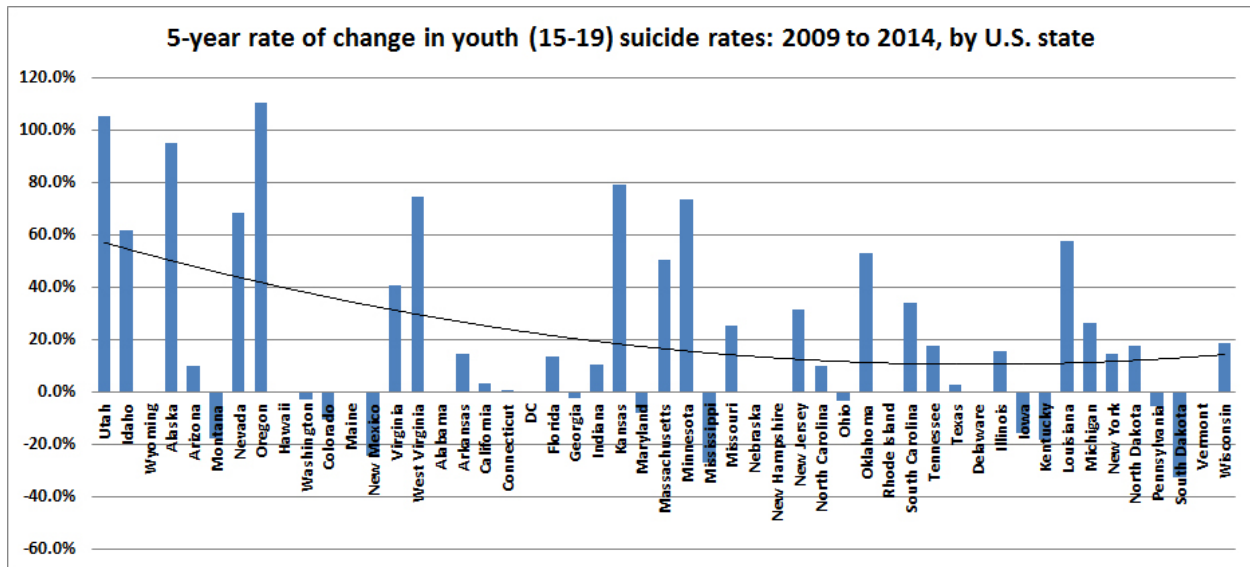
Here we see that there is no statistically significant relationship between the proportion of Mormons in a state and suicide rates among youth aged 15-19 in 2009. We do see, though, that there is a positive and statistically significant relationship between the two in 2014. This means that suicide rates for 15-19 year-olds in 2014 were higher in states where there were a higher proportion of self-identified Mormons. The correlation is 0.41 which is a moderately strong relationship for social and demographic variables. We also see a similar correlation between % Mormon in a state and the *rate of increase* in suicide rates in a state between 2009 and 2014. This means that the more Mormons there are in a state, the faster the suicide rate increased over a five-year period, regardless of the objective levels of suicide rates in both 2009 and 2014.

To examine this visually, consider the following graphs. The first presents per-capita age 15-19 suicide rates in 2009 and 2014 among all U.S. states for which CDC data is available (i.e. higher than 10 suicides per 100,000). The states are ranked left-to-right in order of proportion of Mormon residents.

Youth suicide rates: 2009 and 2014, by U.S. state

■ 2009 suicides per 100,000, age 15-19   ■ 2014 suicides per 100,000, age 15-19

Note that on the left side of the graph (the states with the highest % Mormon), the difference between the blue bars (youth suicides per capita, 2009) and red bars (youth suicides per capita, 2014). Then compare with the bars in the rest of the graph. States with the highest % Mormon tend to have much higher objective youth suicide rates in 2014 as well as higher increases in youth suicide rates over the 5-year period.

This graph plots the percent change in youth suicide rates from 2009 to 2014:

5-year rate of change in youth (15-19) suicide rates: 2009 to 2014, by U.S. state

Observe the obvious trend line: 5-year changes in youth suicide rates increase as a state has an increasingly high proportion of Mormon residents.

As stated previously, it is important to remember that "correlation does not imply causation"(https://en.wikipedia.org/wiki/Correlation_does_not_imply_causation). There could be other factors correlated with both the % Mormon in a state as well as suicide rates for high school-aged youth in states, making the relationship between the two spurious.

Thus, here are the results of three multivariate regression analysis which determines the effect of % Mormon in a state on youth suicide rates in 2009, 2014, and the 5-year rate of change between them.

	2009 youth suicide rates	2014 youth suicide rates	5-year rate of change, 2009-2014
% Mormon	-10.92 (7.70)	19.63 (8.67)*	1.84 (0.90)*
Population density	-.00 (.00)	-.00 (.00)	.00 (0.00)
% black	-16.2 (6.02)*	-17.11 (7.48)*	-.35 (.70)
% Latino	4.40 (5.39)	-9.07 (7.08)	-.1.14 (.65)
% Asian	.55 (7.37)	-22.76 (34.96)	3.61 (3.33)
% bachelor's degree	-26.56 (21.55)	-39.20 (26.00)	1.52 (2.50)
Median age	-.16 (.37)	-.36 (.41)	-.02 (0.04)
Median income	.00 (.00)	.00 (.00)*	.00 (0.00)
% divorced	-96.39 (40.29)*	63.41 (52.19)	4.93 (4.81)
% gun ownership	8.43 (6.79)	23.86 (7.34)*	.84 (0.80)
% LGBT	-135.27 (96.33)	77.27 (117.49)	18.66 (11.89)
% serious mental illness	-.03 (.02)	.01 (.03)	-.00 (.00)
N	43	46	42
Adj R-squared	.65	.69	.25

For a primer on how to interpret regression statistics, see http://blog.minitab.com/blog/adventures-in-statistics/how-to-interpret-regression-analysis-results-p-values-and-coefficients. For the rest of us, this is what to pay attention to:

- There are asterisks next to some variables but not others. As explained before, the asterisks indicate that the variable is "statistically significant," indicating that we are highly confident (at least 95% confident in this case) that the relationship is real and did not appear randomly. The variables without asterisks are not clearly linked to the outcome variables (in this case, suicide rates) and could simply be random.

- Look at whether the first number (the one not in parenthesis) next to the variable is positive or negative. If it is positive it means that as that variable increases, so does the outcome variable (in this case, suicide rates). If it is negative it means that as the variable decreases, the outcome variable (suicide rates) increases.

What do we learn from this multivariate regression analysis?

First, the proportions of Mormons living in a state had no relationship with youth suicide rates in the state in 2009, as observed earlier with the correlation analysis.

Second, *even after statistically controlling for a host of demographic and other relevant variables such as state density, gun ownership, serious mental illness, etc.* the proportion of Mormons in a state is associated with higher levels of youth suicide rates in that state in 2014. Further analysis (not shown) shows that, controlling for all these other factors, youth suicide rates increase from 11.1 per 100,000 to 21.9 per 100,000 as the % Mormon moves from its minimum in a state (less than 1%) to its maximum in a state (55% in Utah). These are objectively small numbers, but it means that (again, controlling for other factors) youth suicides are *twice as high* in

states with the highest levels of Mormon residents compared to states with the lowest levels of Mormon residents.

By way of comparison, the effect of gun ownership on youth suicide rates is roughly a factor of four, meaning that youth suicide rates are four times as high in states with the highest levels of gun ownership (62% in Alaska) compared to the states with the lowest levels of gun ownership (5% in Delaware). Again, by way of comparison, this means that the effect of % Mormon in a state on youth suicide rates is about half that of gun ownership. Or in other words, Mormon prevalence in U.S. states doubles youth suicide rates, while gun ownership quadruples them.

Third, *even after statistically controlling for a host of demographic and other relevant variables such as state density, gun ownership, serious mental illness, etc.* the proportion of Mormons in a state is associated with faster increases in the rate of youth suicides over a five-year period between 2009 and 2014. Further analysis (not shown) shows that the rate of change in youth suicides in a state moves from 17.3% to 118.9% as a state moves from less than 1% Mormon to 55% Mormon. As shown by Parkinson and Barker (http://rationalfaiths.com/the-lgbtq-mormon-crisis-responding-to-the-empirical-research-on-suicide/), suicide rates among Utah youth more than doubled over this five year period. It is also notable that there are no other factors that reliably predict increases in youth suicide rates during that same time period except for % Mormon in a given state[3]

IMPORTANT CAVEATS:

It is important to specify what this analysis does NOT say. As was explained by Parkinson and Barker, it is nearly impossible to accurately measure the sexual orientation of those who commit suicide (as sexual orientation is not included on death certificates). Thus, we cannot definitively say one way or the other that the youth suicides recorded by the CDC and used in

this analysis are LGBT individuals. Nonetheless, there is a host of indirect and anecdotal evidence (http://rationalfaiths.com/the-lgbtq-mormon-crisis-responding-to-the-empirical-research-on-suicide/) that strongly suggests that LGBT youth are likely a significant proportion of these suicides in the states with higher proportion of Mormon residents.

Also, because this analysis relies on aggregate data, we cannot definitely say one way or the other the religious identification of those youth who committed the suicides reported by the CDC. It may or may not be the case that those youth are Mormons; we cannot say for sure based on this evidence because individual relationships cannot be inferred from aggregate patterns (https://en.wikipedia.org/wiki/Ecological_fallacy). It is impossible to definitely know from this data, for example, whether 1) a higher % Mormon in a community drives more Mormon youth suicides OR 2) a higher % Mormon in a community drives non-Mormon youth to commit suicides at higher rates (or some combination of the two).

Further, this data comes from 2009 and 2014 so we cannot say anything definitive *from this evidence alone* about the effect of the November 2015 handbook policy change on youth suicide rates in Mormon communities. Further data and research would be needed to speak specifically to that topic.

As an additional check, I repeated each of the correlational and regression analyses presented above substituting % Evangelical and % weekly church attendance for % Mormon. This was to see whether the effects shown above also applied to other religious traditions with conservative LGBT rhetoric and perspectives (Evangelical) or whether it applied to religious environments in general. Neither % Evangelical nor % weekly church-attendance are correlated with the three youth suicide variables analyzed above. Further, neither of these variables is predictive of an increase in youth suicides when substituted for % Mormon in the regression analyses displayed above. In fact, there is some evidence that % Evangelical actually

decreases the rate of youth suicides in 2014 (p=0.07) and also the 5-year rate of change between 2009 and 2014 (p=0.07). This effect, though, could be an artifact of the reality that more Mormons in a state is correlated with fewer Evangelicals in a state.[4]

SUMMARY:

Despite these limitations, what we can say with some degree of confidence is this:

1 In 2014, a higher proportion of Mormons in a state was associated with a higher level of suicides among those aged 15-19 in that state, controlling for a host of other relevant factors that are also linked to aggregate suicide rates. All other things being equal, the presence of Mormon residents in a state doubles the rate of youth suicides as the rate of Mormon residents moves from its minimum to maximum value.

2 This association did *not* exist in 2009.

3 The proportion of Mormons in a state is the *only* factor of all those included in the analysis (including factors most commonly identified as contributing to suicide rates) that is associated with an *increase* in the rate of youth suicides between 2009 and 2014. As Mormons move from their minimum to maximum population in a state, the rate of increase in high-school aged suicides moves from 17% to 119%. In other words, the more Mormons there are in a state, the faster suicide rates increased between 2009 and 2014.

Because the CDC does not track the sexual orientation of suicide victims, this evidence does not and cannot show a *definitive* link between Mormon religious context and LGBT suicide rates in U.S. states. This should in no way be considered the "final" or "definitive" word on the topic. However, Parkinson and Barker (http://rationalfaiths.com/the-lgbtq-mormon-crisis-responding-to-the-empirical-research-on-suicide/) provide a plethora of evidence supporting the

theorized linking mechanisms between LDS Church rhetoric and policies on LGBT issues and suicide rates among Mormon LGBT youth during this time frame. Thus, the evidence presented here merely provides an additional "data point" which supports the theorized relationship, making it increasingly difficult (yet not impossible) to argue that the recent increase in suicides among Mormon LGBT youth are unrelated to the religious context fostered by the LDS Church and its leaders toward the LGBT community.[5]

Finally, this information is not intended to condemn. Rather, it is presented to contribute to the conversation on this important topic that literally has life-and-death implications. It is clear that there is a problem. The more information we have available to us the sooner we can craft an effective solution.

ABOUT

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NOTES:

1 Suspecting that suicide rates among the 15-19 age group might represent an overly narrow segment of the youth population, I repeated all these analyses for state suicide rates among the 10-29 age group in each state and the link between % Mormon and suicide rates disappeared entirely. This means that the link between % Mormon in a state and youth suicide rates is limited *specifically* to the high school age group 15-19.

2 Also, I originally included % weekly church-going in each state as a control variable on the logic that environments that are more religious in general would also possibly contribute to youth suicide rates. This variable was removed, though, due to multicollinearity as % Mormon and % weekly church-going are very highly correlated (congratulations Mormons!). The substantive results of the analyses shown above were unchanged when % weekly church-going was included, indicating that it is not a significant predictor of youth suicide rates.

3 The state of Wyoming was one of the few states excluded from this analysis because the CDC reports fewer than 10 suicides per 100,000 in 2009, thus we cannot calculate a rate of increase between 2009 and 2014. This is important because Wyoming has the third highest rate of Mormon residents in the country (9%). However, if we assume a rate of 10 in 2009, it makes the rate of increase between 2009 and 2014 192%. Including this assumption in the model increases the substantive effect of % Mormon on increase in youth suicide rates by an additional 61% (17% to 119% not including Wyoming; 18% to 180% including Wyoming).

4 Including both % Mormon and % Evangelical in the regression models leaves both variables statistically insignificant. The variable for % Mormon in 2014, however, is significant at p=0.15. So while in this model we are not able to say with 95% confidence (the traditional standard of confidence) that % Mormon is associated with higher levels of youth suicides when controlling for % Evangelical, we can say that we are 85% confident. A similar effect happens for the effect of % Mormon on 5-year rate of change. Our confidence in the effect of % Mormon of 5-year increases in youth suicides decreases from 95% to 78% (p-values of 0.05 and 0.22, respectively).

5 Interested observes should offer plausible alternative explanations for this observed relationship and then empirically test them with rigorous social science tools. The link between the LDS approach to LGBT issues and LGBT youth suicides is only inferred by these results, but supported by a myriad of indirect, anecdotal, and theoretical arguments. Here we have also shown evidence against other possible explanations including mental health rates, gun ownership rates, and other demographic factors. It is still possible, though, that something else is driving both of these variables. In the absence of a compelling alternative explanation, then, the LGBT link is (in my judgment) the most plausible and compelling offered so far.