Reviewer Comments:

Kim

1. In general, very nice presentation style, speaking and transitions.
2. Great explanation of conceptual model.
3. 95% of respondents reported no health care cost barriers. Most people are exposed. How does this impact the ability to predict the outcome?
4. Interpreting main effect from models with interaction term need to take the interaction term into account.

For example, if your model is: Flu vaccine = Health care cost barrier + age group + general health+ Race/ethnicity +race/ethnicity\*health care cost barrier

To look at the association between flu vaccine and health care cost barrier in whites adjusted for age group and general health, you would exponentiate the beta for health care cost barrier. For blacks, you would exponentiate the beta for health care cost barrier + the beta for black\*health care cost barrier. For Hispanics, you would exponentiate the beta for health care cost barrier + the beta for Hispanic\*health care cost barrier.

Kyle

1. Excellent overview of the issue and rationale for the study.
2. Thorough review of sample, variables and measures, and DAG.
3. Good review of results - would have liked to see other variables in Table 2, to better understand differences between the models.
4. It does not seem like there was a discussion of your results in the context of other studies regarding flu vaccines and cost barriers.

Reviewer Questions for Follow-up:

1. Please either stratify by race and by sex and present a table with stratum-specific estimates for the association between health care cost barrier and flu vaccine or solve the model as describe above. You can get stratified results by creating race and sex specific datasets and running the models on those datasets or using something called contrasts. Either way is acceptable. Tutorial on contrasts: <https://stats.idre.ucla.edu/r/faq/how-can-i-test-contrasts-in-r/>
2. Provide a brief (paragraph) discussion of your study in the context of other studies that examine cost barriers and flu vaccinations (or other vaccination if these studies aren’t common).

**Response to Item #1:**

With race\*medcost as interaction term:

Call:

glm(formula = FLUSHOTb ~ MEDCOSTb + AGEb + GENHLTHb + RACEb +

RACEb \* MEDCOSTb, family = "binomial", data = data.cc)

Coefficients:

Estimate Std. Error z value Pr(>|z|)

(Intercept) -0.41646 0.27150 -1.534 0.1250

MEDCOSTbYes 0.40787 0.30622 1.332 0.1829

AGEb70 to 74 -0.03191 0.15385 -0.207 0.8357

AGEb75 to 79 -0.05697 0.17029 -0.335 0.7380

AGEb80 or older -0.13184 0.16103 -0.819 0.4129

GENHLTHbFair -0.36870 0.29778 -1.238 0.2157

GENHLTHbGood -0.08671 0.26960 -0.322 0.7477

GENHLTHbVery good -0.18867 0.27012 -0.698 0.4849

GENHLTHbExcellent 0.12878 0.28620 0.450 0.6527

RACEbBlack Non-Hispanic 0.68721 0.27509 2.498 0.0125 \*

RACEbOther or Multiracial 0.77570 0.32701 2.372 0.0177 \*

RACEbHispanic -0.06070 0.37743 -0.161 0.8722

MEDCOSTbYes:RACEbBlack Non-Hispanic -1.74300 1.22859 -1.419 0.1560

MEDCOSTbYes:RACEbOther or Multiracial -1.57835 1.24054 -1.272 0.2033

MEDCOSTbYes:RACEbHispanic -0.78466 0.97037 -0.809 0.4187

Exponentiated:

OR 2.5 % 97.5 %

(Intercept) 0.6593766 0.384239633 1.117969

MEDCOSTbYes 1.5036188 0.818239160 2.738003

AGEb70 to 74 0.9685929 0.716020922 1.309128

AGEb75 to 79 0.9446250 0.675489060 1.317492

AGEb80 or older 0.8764785 0.638473615 1.200809

GENHLTHbFair 0.6916335 0.386215032 1.244820

GENHLTHbGood 0.9169425 0.542468605 1.566454

GENHLTHbVery good 0.8280605 0.489449848 1.416239

GENHLTHbExcellent 1.1374453 0.651045903 2.005461

RACEbBlack Non-Hispanic 1.9881707 1.158764107 3.423976

RACEbOther or Multiracial 2.1721145 1.146107253 4.168885

RACEbHispanic 0.9411064 0.433096069 1.930932

MEDCOSTbYes:RACEbBlack Non-Hispanic 0.1749953 0.007972399 1.605877

MEDCOSTbYes:RACEbOther or Multiracial 0.2063158 0.009270579 1.942918

MEDCOSTbYes:RACEbHispanic 0.4562770 0.054090212 2.823756

With sex\*medcost as interaction term:

Call:

glm(formula = FLUSHOTb ~ MEDCOSTb + AGEb + GENHLTHb + SEXb +

SEXb \* MEDCOSTb, family = "binomial", data = data.cc)

Coefficients:

Estimate Std. Error z value Pr(>|z|)

(Intercept) -0.2590349 0.2699749 -0.959 0.337

MEDCOSTbYes 0.0008525 0.3445472 0.002 0.998

AGEb70 to 74 -0.0255913 0.1532052 -0.167 0.867

AGEb75 to 79 -0.0457133 0.1694128 -0.270 0.787

AGEb80 or older -0.1532791 0.1607831 -0.953 0.340

GENHLTHbFair -0.3463169 0.2924579 -1.184 0.236

GENHLTHbGood -0.1022480 0.2643983 -0.387 0.699

GENHLTHbVery good -0.2337618 0.2640070 -0.885 0.376

GENHLTHbExcellent 0.0987570 0.2815921 0.351 0.726

SEXbMale -0.1791572 0.1211588 -1.479 0.139

MEDCOSTbYes:SEXbMale 0.3449059 0.5508110 0.626 0.531

Exponentiated:

OR 2.5 % 97.5 %

(Intercept) 0.7717961 0.4513443 1.305175

MEDCOSTbYes 1.0008528 0.4996576 1.949111

AGEb70 to 74 0.9747334 0.7214905 1.315809

AGEb75 to 79 0.9553158 0.6843376 1.330173

AGEb80 or older 0.8578903 0.6252053 1.174691

GENHLTHbFair 0.7072883 0.3992726 1.260297

GENHLTHbGood 0.9028056 0.5397504 1.527033

GENHLTHbVery good 0.7915503 0.4735800 1.337819

GENHLTHbExcellent 1.1037980 0.6376325 1.928838

SEXbMale 0.8359745 0.6587723 1.059442

MEDCOSTbYes:SEXbMale 1.4118571 0.4747070 4.170512

In the table below, for Model 3, the OR 1.50 is the association between flu vaccine and health care cost barrier in whites adjusted for age group and general health, calculated by exponentiating the beta for health care cost barrier. OR 1.68 is the exponentiated beta for health care (1.50) plus the exponentiated beta for Black \* health care cost barrier (0.175), and so on for Other/Multiracial and Hispanic. The confidence intervals are calculated in the same manner. For Model 4, the OR 1.00 is the association between flu vaccine and health care cost barrier in females adjusted for age group and general health, calculated by exponentiating the beta for health care cost barrier. OR 2.41 is the exponentiated beta for health care (1.00) plus the exponentiated beta for Male \* health care cost barrier (1.412).

I attempted the contrast method in R using the multcomp library, but did not get the same results for a test scenario where race = Black. The code is in line 174-189 in the most recent version in Github. I welcome your corrections and suggestions on what I am doing wrong, as I am also confused about how to present and interpret these new results.

|  | **Flu vaccine** | | | |
| --- | --- | --- | --- | --- |
|  | **Model 1a**  **OR (95% CI)** | **Model 2b**  **OR (95% CI)** | **Model 3c**  **OR (95% CI)** | **Model 4d**  **OR (95% CI)** |
| **Health care cost barrier** | 1.17 (0.69-1.97) | 1.15 (0.67-1.95) | -- | -- |
| **Race/ethnicity** |  |  |  |  |
| White Non-Hispanic | -- | -- | 1.50 (0.82-2.74) | -- |
| Black Non-Hispanic | -- | -- | 1.68 (0.83-4.34) | -- |
| Other or Multiracial | -- | -- | 1.71 (0.83-4.68) | -- |
| Hispanic | -- | -- | 1.96 (0.87-5.56) | -- |
| **Sex** |  |  |  |  |
| Female | -- | -- | -- | 1.00 (0.50-1.95) |
| Male | -- | -- | -- | 2.41 (0.97-6.12) |

**Response to Item #2:**

Research has identified numerous factors that are associated with an individual’s intention to get vaccinated and actual uptake of the flu vaccine, including perceived susceptibility to influenza, perceived severity of the disease, trust in vaccine safety and efficacy, concern with adverse side effects, and influence of social networks and professional opinion.1–10 The evidence for cost barriers is inconclusive, as the significance and magnitude of the association with flu vaccine intention and uptake varies between studies. A cross-sectional survey of 383 college students found that only 22% of respondents who had not been vaccinated reported that cost was a barrier.1 Among older adults, a survey of 1,961 adults aged 50-75 years found that Latino respondents were significantly more likely to report cost barriers as the main reason for non-vaccination compared to white respondents, with cost being the third most common reason cited; however, among all other races and ethnicities, 2% or less of respondents reported cost barriers as the main reason for non-vaccination.2 In another survey of adults aged 65 or older, knowledge that vaccines were covered by Medicare was associated with lower odds of reporting cost barriers to vaccination, but cost was not found to be a significant predictor.6 On the other hand, a systematic review found that free vaccination was strongly associated with vaccine uptake, with 4.5 – 7.8 greater odds of vaccination among respondents with access to no-cost flu vaccination.9 In summary, my findings that there was no significant relationship between health care cost barriers and the odds of receiving a flu vaccine among older adults in Boston, after adjusting for age and general health (aOR = 1.15, 95% CI 0.67-1.95), and that neither race nor sex significantly modified the effect of health care cost barriers on flu vaccination, are not inconsistent with previous research.

References

1. Benjamin SM, Bahr KO. Barriers Associated with Seasonal Influenza Vaccination among College Students. *Influenza Research & Treatment*. March 2016:1-5.
2. Chen JY, Fox SA, Cantrell CH, Stockdale SE, Kagawa-Singer M. Health Disparities and Prevention: Racial/Ethnic Barriers To Flu Vaccinations. *Journal of Community Health*. 2007;32(1):5-20.
3. Cheung K, Ho SMS, Lam W. Factors affecting the willingness of nursing students to receive annual seasonal influenza vaccination: A large-scale cross-sectional study. *Vaccine*. 2017;35(11):1482-1487.
4. Cohen B, Ferng Y-H, Wong-Mcloughlin J, Jia H, Morse SS, Larson EL. Predictors of flu vaccination among urban Hispanic children and adults. *Journal of Epidemiology and Community Health*. 2010;66(3):204-209. doi:10.1136/jech.2009.099879
5. Harrison N, Poeppl W, Miksch M, et al. Predictors for influenza vaccine acceptance among patients with inflammatory rheumatic diseases. *Vaccine*. 2018;36(32):4875-4879. doi:10.1016/j.vaccine.2018.06.065
6. Madhavan SS, Borker RD, Fernandes AW, Amonkar MM, Rosenbluth SA. Assessing Predictors of Influenza and Pneumonia Vaccination in Rural Senior Adults. *Journal of Health & Social Policy*. 2003;18(2):71-93. doi:10.1300/j045v18n02\_05
7. Ratnapradipa KL, Norrenberns R, Turner JA, Kunerth A. Freshman Flu Vaccination Behavior and Intention During a Nonpandemic Season. *Health Promotion Practice*. 2017;18(5):662-671.
8. Yang ZJ. Predicting Young Adults’ Intentions to Get the H1N1 Vaccine: An Integrated Model. *Journal of Health Communication*. 2015;20(1):69-79.
9. Yeung MPS, Lam FL, Coker R. Factors associated with the uptake of seasonal influenza vaccination in adults: a systematic review. *Journal of Public Health*. June 2016. doi:10.1093/pubmed/fdv194
10. Gu Q, Sood N. Do People Taking Flu Vaccines Need Them the Most? *PLoS ONE*. 2011;6(12). doi:10.1371/journal.pone.0026347