DOHMH Roadmap: DALY Estimates

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Contents

Background

Objective

The objective of this analysis is to estimate DALYs lost in New York City due to the following major categories of conditions (with about 100 conditions in total within these categories):

- Major depression
- Alcohol use
- Marijuana use
- Heroin use
- Cocaine use
- Stimulant use
- Sedative use
- Tranquilizer use

Definition of Key Terms

DALY

Disability-adjusted life years. The DALY is a year of life lived in perfect health and consists of two elements: YLLs and YLDs. The DALY is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death. It was developed in the 1990s as a way of comparing the overall health and life expectancy of different countries.

$$DALY = YLL + YLD$$

YLL

Years of life lost. Years of life lost is an estimate of the average years a person would have lived if he or she had not died prematurely.

$$YLL = (Number\ of\ deaths) * (Standard\ life\ expectancy\ at\ age\ of\ death\ in\ years)$$

YLD

Years of life lost due to disability. This is the morbidity component of the DALY score. To estimate YLD for a particular cause in a particular time period, the number of incident cases in that period is multiplied by the average duration of the disease and a weight factor that reflects the severity of the disease on a scale from 0 (perfect health) to 1 (dead). The basic formula for YLD is the following:

$$YLD = (number\ of\ incident\ cases) * (disability\ weight) * (average\ duration\ of\ disease)$$

Methods

Data Sources

- 2013 NYCHANES - prevalence estimates
- 2002-2008 NSDUH - drug use prevalence estimates
- 2013 NYC Vital Statistics - mortality estimates
- 2010 Global Burden of Disease Study - national YLD/YLL rates
- 2013 NYC American Community Survey - population estimates

The challenge with using NYCHANES and NSDUH data to estimate the prevalence of a condition is that the **n** may be too small. To increase their utility of these surveys, we will aggregate age groups into the following strata: childhood (0-14), late adolescence/early adulthood (15-24), adulthood (25-64), and later life (65+).

DALY Estimation

YLLs

To estimate compute NYC YLLs, we will use NYC mortality counts stratified by age, sex, and race. In concodrance with the literature on DALY estimation, life expectancy estimates based on the life expectancy in Japan (82.5 years for women and 80.0 years for men) were used for the calculation of YLL. In order to remain consistent with the methodology of the 2010 Global Burden Disease Study, no age weighting or discounting was applied.

YLDs

To compute NYC YLDs, we will use the two approaches described below:

2005 NYC DOHMH / Michaud (2006)   In order to compare the magnitude of the DALY scores to the 2005 NYC DOHMH study, we will replicate the previous study's methodology, which was based on Michaud CM, et al. The burden of disease and injury in the United States 1996. Population Health Metrics 2006,4:11.

"For NYC YLD, U.S. Census Bureau population estimates for New York City in 2005 by sex were used to calculate years lived with disability (YLD) by applying national YLD rates and ratios from the Michaud et al. study. If the national YLL:YLD ratio was less than 10, then the NYC YLD was equal to the national YLD:YLL ratio multiplied by NYC YLL. If the national YLD:YLL ratio was greater than or equal to 10 (producing unreliable City estimates), then NYC YLD was equal to the national YLD rate multiplied by the NYC population."

Implementing the Michaud approach will thus require the following data elements:

- NYC Population by age, sex
- National YLD rates by age, sex
- NYC YLLs by age, sex

In order to remain consistent with the demographic weighting approach used by NYC DOHMH for the 2013 NYCHANES data, NYC population estimates were obtained from the 2013 American Community Survey, which is available on the NYC Department of City Planning website. Since the data from the Michaud study are from 1996 and patterns of disease and disability have changed, we will update the approach using national YLD/YLL rates from the 2010 Global Burden of Disease Study.

Prevalence-based YLDs   Years lived with a disability (YLD) due to each disease can be calculated on the basis of either the incidence or the prevalence of the disease. The initial GBD studies estimated YLD on the basis of the incidence of each disease. Thus, in the 1990 study for example, the YLD estimates measured the future loss of health resulting from disease episodes that began in 1990. One advantage of this approach is that it is consistent with that used for mortality: YLL measure the future loss of life resulting from deaths in a particular year.

The 2010 GBD study adopted the alternative approach and calculated YLD based on the prevalence of the impairments resulting from each disease in the year for which the estimates are made. This approach has the advantage that it assigns YLD to the ages at which they are lived, rather than to the age at which the disease episode that produced them began.

Because prevalence is approximately incidence x duration, prevalence YLD for a condition (across all ages) is approximately the same as the no frills incidence YLD. As such, we can estimate YLDs using the following formula:

$$YLD = (number\ of\ prevalent\ cases) * (disability\ weight)$$

We can estimate the number of prevalent cases for each condition using survey data from 2013 NYCHANES. Annual prevalence for drug use can be estimated using data from 2002-2008 NSDUH. Disability weights can be extracted from the 2010 Global Burden of Disease study.However, we should note that the prevalence YLD for a condition may be quite different in magnitude to the incidence-based YLD, depending on how age weighting and discounting are applied. As such, comparisons to previous NYC DALY studies should be done with caution.

Further information about estimating DALYs can be found from the Global Burden of Disease concept paper (WHO, 2006).

Disease Rankings

Since our goal is to communicate the burden of diseases in New York City, we will rank each condition in decreasing order of the DALY score. We will also test the stability of the rankings by comparing the results generated from the Michaud approach and the prevalence-based YLDs approach. Moreover, since the 2010 GBD study also provides 95% confidence intervals around point estimates for disability weights and national YLD/YLL rates, further stability checks can be conducted by reporting DALY estimations with their respective upper and lower bounds.

However, we should note that since the DALY estimations are not inclusive of all disease conditions, we will not be able to report our findings as the "top X conditions contributing to DALYs." Instead, we can only report mental health DALYs in reference to other highly prevalent chronic diseases.

Estimation of Substance Use Dependence

Prevalence estimates of substance use cannot be directly substituted for prevalence of drug dependence or abuse disorders. We make the following assumptions about the average proportion of dependence among users (National Addiction Centre, 2003):

- Alcohol - 15.4%
- Cocaine - 16.7%
- Heroin - 23.1%
- Cannabis - 9.1%

DALY Estimation

Michaud YLD Approach

This section contains an implementation of the Michaud approach described in the above methods section. We first create a search index containing all the disease conditions of interest.

This search index is then fed through the `calculateDALY` workhorse function to estimate DALYs for each disease condition. The result is a `data.frame` object containing the following columns: `cause_name`, `sex`, `yll`, `yld`, `yld_upper`, `yld_lower`, `daly`, `daly_upper`, `daly_lower`.

Prevalence-Based YLD Approach

Similar to the section, we implement the prevalence-based YLD approach here using the same search index.

Results

Michaud YLD Approach

Raw results for this approach can be found under the `results` directory under the filename `nyc_daly_michaud.csv`. The file can be opened in Excel and manipulated with a pivot table for aggregation and stratification purposes.

2013 NYC DALY Estimates, Total

```
##                                       cause_name         yll         yld
## 1                                Diabetes mellitus  89921.8593  75004.5038
## 2                                      Lung cancer 148291.6356   2242.9612
## 3                        Hypertensive heart disease 136003.5344   4455.7610
## 4                                   Ischemic stroke  79787.1576  54618.9896
## 5            Chronic obstructive pulmonary disease  65616.6564  57924.3517
## 6                            Ischemic heart disease 112699.3626  10745.5490
## 7         Alzheimer's disease and other dementias   68064.1642  46430.6034
## 8              Other musculoskeletal disorders      14183.9916  99856.4516
## 9              Lower respiratory infections        102769.2461   5474.2794
## 10                                          Asthma  14317.4262  80967.8293
## 11                        Major depressive disorder      0.0000  83953.4440
## 12                                    Breast cancer  68867.0554  12738.7979
## 13                                         HIV/AIDS  65584.2354  13821.0196
## 14                           Alcohol use disorders   23367.4429  55797.8826
## 15                        Colon and rectum cancers   71883.4068   4926.7991
## 16                                       Poisonings  61951.4430    345.3933
## 17                                         Homicide  54727.1791          NA
## 18                                Anxiety disorders      0.0000  52051.1850
## 19                             Congenital anomalies  28760.0643   5247.0472
## 20                          Motor vehicle accidents  26587.8134   6120.9172
## 21                                   Osteoarthritis    643.1706  26968.3798
## 22                              High blood pressure      0.0000  23051.4893
## 23                        Bipolar affective disorder     0.0000  16820.2498
## 24                           Cannabis use disorders      0.0000  14302.9941
## 25                            Cocaine use disorders      0.0000  13584.4544
## 26                        Amphetamine use disorders      0.0000   5546.6613
##        yld_upper    yld_lower        daly  daly_upper  daly_lower
## 1   108498.2802  49557.68891  164926.363  198420.140  139479.548
## 2     3954.0205   1054.45769  150534.597  152245.656  149346.093
## 3     7743.7734   2146.86933  140459.295  143747.308  138150.404
## 4    67602.9376  42427.48230  134406.147  147390.095  122214.640
## 5    90860.6617  32740.18649  123541.008  156477.318   98356.843
## 6    15616.1724   7032.87825  123444.912  128315.535  119732.241
## 7    61713.3788  32776.61067  114494.768  129777.543  100840.775
## 8   121723.6960  77041.06298  114040.443  135907.688   91225.055
## 9     8303.9475   3354.63057  108243.525  111073.194  106123.877
## 10  128691.7057  44033.85664   95285.256  143009.132   58351.283
## 11  121099.5658  55076.00007   83953.444  121099.566   55076.000
## 12   19278.9232   8233.44871   81605.853   88145.979   77100.504
## 13   22434.1402   7110.37787   79405.255   88018.376   72694.613
## 14   85682.7067  33915.45149   79165.325  109050.150   57282.894
## 15    8225.5483   2835.32887   76810.206   80108.955   74718.736
## 16     912.0096     48.92806   62296.836   62863.453   62000.371
## 17          NA           NA   54727.179          NA          NA
## 18   75104.5772  34951.04848   52051.185   75104.577   34951.048
## 19    8241.7517   3153.12659   34007.112   37001.816   31913.191
## 20    9229.5870   3914.37900   32708.731   35817.400   30502.192
## 21   41201.1994  16315.88023   27611.550   41844.370   16959.051
## 22   31082.1570  15615.43900   23051.489   31082.157   15615.439
## 23   25727.1579  10011.62505   16820.250   25727.158   10011.625
## 24   21780.4478   8642.25054   14302.994   21780.448    8642.251
```

25   24968.4984   6553.68863   13584.454   24968.498   6553.689
26   9689.3818   2694.25267   5546.661   9689.382   2694.253

Leading Causes of DALYs, NYC 2013
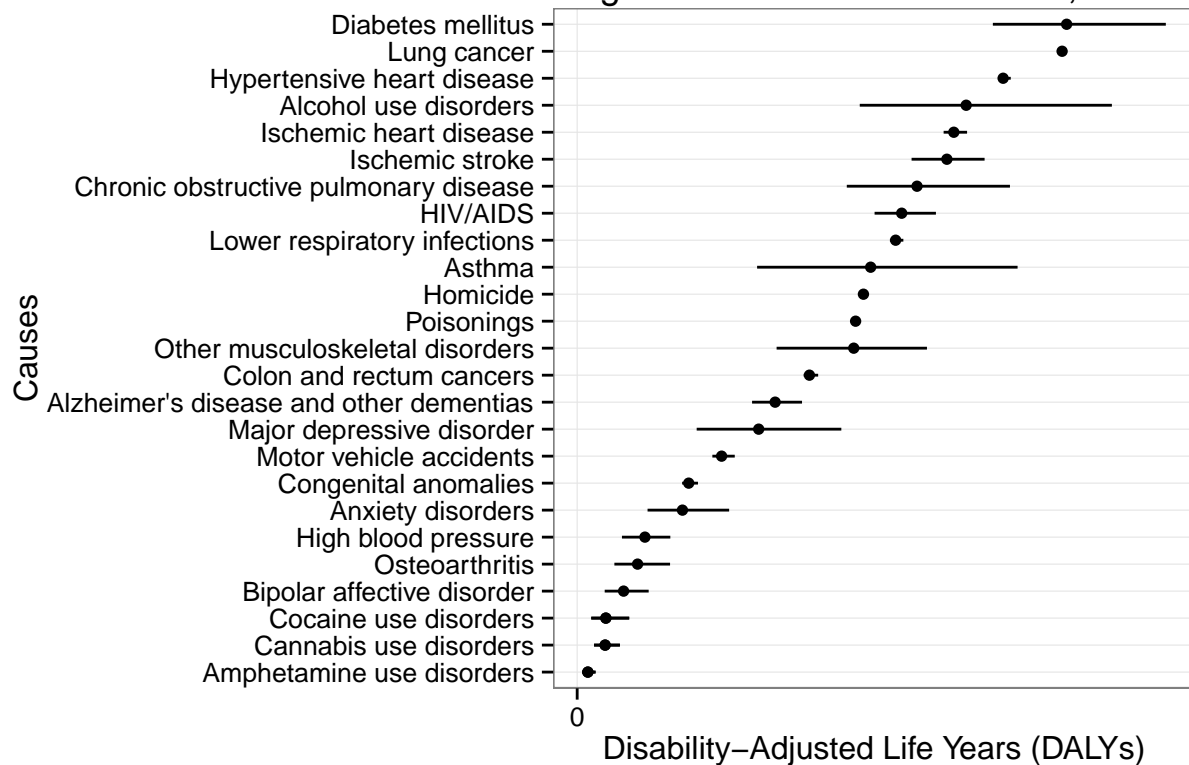

Leading Causes of DALYs, NYC 2013
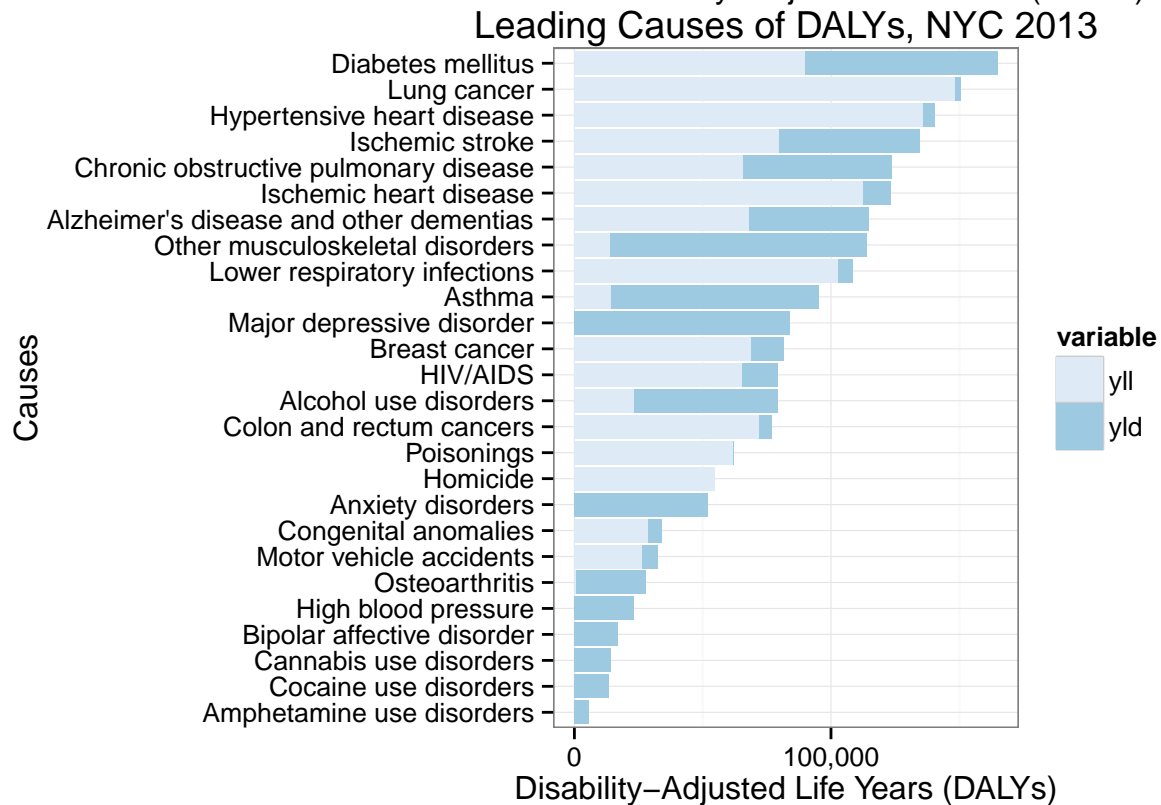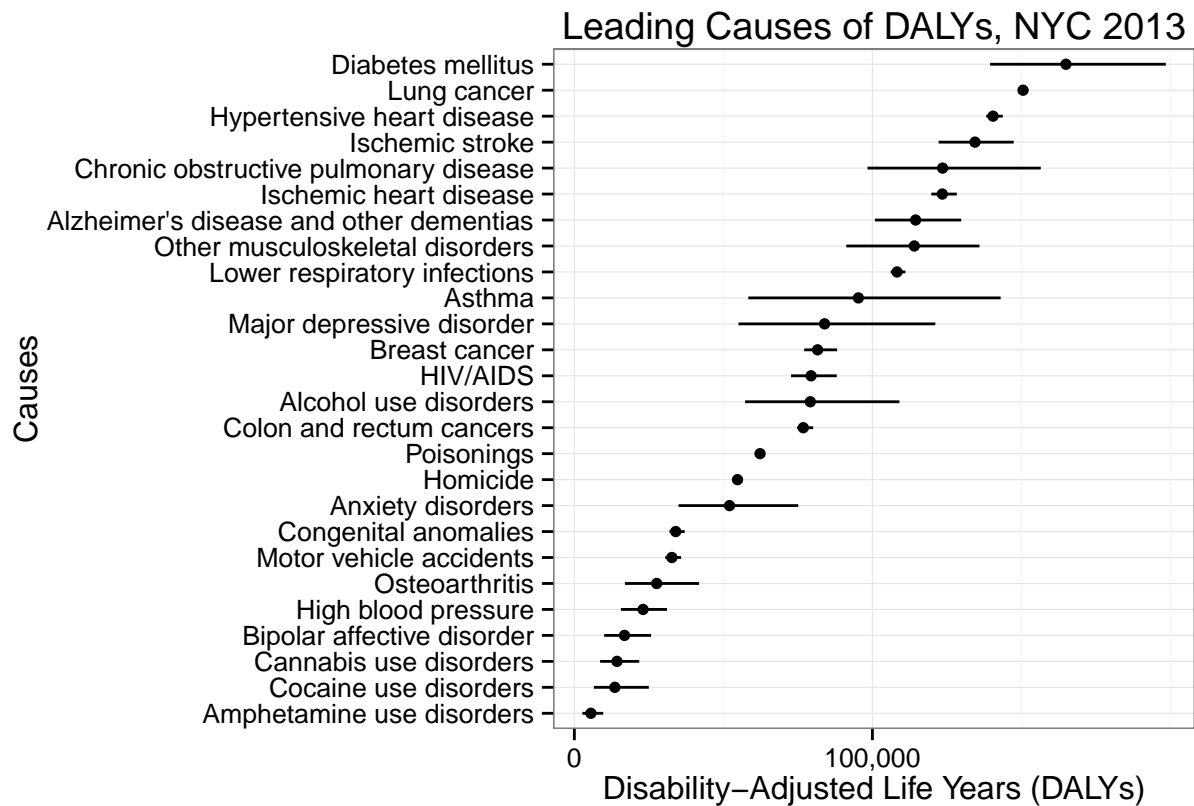
- Diabetes mellitus is the leading cause of disease in 2013, but has a wide range of uncertainty
- Disaggregated drug use disorders ranked relatively low, particulary for non-alcohol-related substances
- Major depressive disorder just missed the top 10 cutoff

2013 NYC DALY Estimates, Male

```
##                                    cause_name  sex        yll        yld
## 1                          Diabetes mellitus Male 44350.2597 34179.2699
## 2                                Lung cancer Male 76727.5088  1073.4292
## 3                  Hypertensive heart disease Male 66787.3957  1551.5667
## 4                      Alcohol use disorders Male 18467.5988 43944.2346
## 5                     Ischemic heart disease Male 55740.9066  4685.5329
## 6                            Ischemic stroke Male 34381.1722 24933.7621
## 7       Chronic obstructive pulmonary disease Male 29087.5511 25436.1167
## 8                                    HIV/AIDS Male 42537.5495  9527.5167
## 9               Lower respiratory infections Male 48779.8376  2313.7384
## 10                                     Asthma Male  7320.0714 39768.0782
## 11                                   Homicide Male 45926.7164         NA
## 12                                 Poisonings Male 44405.4957   264.4099
## 13         Other musculoskeletal disorders Male  4854.9161 39516.5937
## 14               Colon and rectum cancers Male 35103.8723  2158.4156
## 15 Alzheimer's disease and other dementias Male 19116.5536 12644.7087
## 16                 Major depressive disorder Male     0.0000 29121.7638
## 17                   Motor vehicle accidents Male 19023.4258  4148.8107
## 18                       Congenital anomalies Male 15210.3239  2684.3674
## 19                         Anxiety disorders Male     0.0000 16888.1881
## 20                       High blood pressure Male     0.0000 10871.5697
## 21                             Osteoarthritis Male   307.6397  9383.8038
## 22                 Bipolar affective disorder Male     0.0000  7448.7748
## 23                     Cocaine use disorders Male     0.0000  4600.9626
## 24                     Cocaine use disorders Male     0.0000  4600.9626
## 25                     Cannabis use disorders Male     0.0000  4486.3505
## 26                     Cannabis use disorders Male     0.0000  4486.3505
## 27                 Amphetamine use disorders Male     0.0000  1711.4472
## 28                 Amphetamine use disorders Male     0.0000  1711.4472
##      yld_upper   yld_lower       daly daly_upper daly_lower
## 1   50092.6831 22339.66951 78529.530  94442.943 66689.9292
## 2    1835.5390   552.42866 77800.938  78563.048 77279.9374
## 3    2772.9602   726.84613 68338.962  69560.356 67514.2418
## 4   67319.8291 26869.84596 62411.833  85787.428 45337.4447
## 5    6813.3881  3052.60257 60426.439  62554.295 58793.5092
## 6   30985.2622 19269.71803 59314.934  65366.434 53650.8903
## 7   40347.4100 14170.01592 54523.668  69434.961 43257.5671
## 8   15020.5207  5179.74703 52065.066  57558.070 47717.2966
## 9    3550.9975  1397.14831 51093.576  52330.835 50176.9859
## 10  63336.0811 21549.29019 47088.150  70656.153 28869.3616
## 11         NA          NA 45926.716         NA         NA
## 12    670.9745    43.52524 44669.906  45076.470 44449.0209
## 13  51263.2757 27139.66096 44371.510  56118.192 31994.5771
## 14   3558.7848  1248.81817 37262.288  38662.657 36352.6905
## 15  16956.4678  8941.37768 31761.262  36073.021 28057.9313
## 16  42380.4459 19171.86261 29121.764  42380.446 19171.8626
## 17   6260.4445  2667.35247 23172.236  25283.870 21690.7782
```

```
## 18   4172.2215   1627.16383 17894.691   19382.545 16837.4878
## 19 24380.0577 11291.23403 16888.188   24380.058 11291.2340
## 20 14945.9569   7182.75016 10871.570   14945.957   7182.7502
## 21 14596.6142   5660.76344   9691.444   14904.254   5968.4032
## 22 11473.0601   4413.85914   7448.775   11473.060   4413.8591
## 23   8346.6274   2259.42317   4600.963     8346.627   2259.4232
## 24   8346.6274   2259.42317   4600.963     8346.627   2259.4232
## 25   6858.2744   2705.22634   4486.351     6858.274   2705.2263
## 26   6858.2744   2705.22634   4486.351     6858.274   2705.2263
## 27   2949.7666     839.42626   1711.447     2949.767     839.4263
## 28   2949.7666     839.42626   1711.447     2949.767     839.4263
```

Leading Causes of DALYs in Males, NYC 201

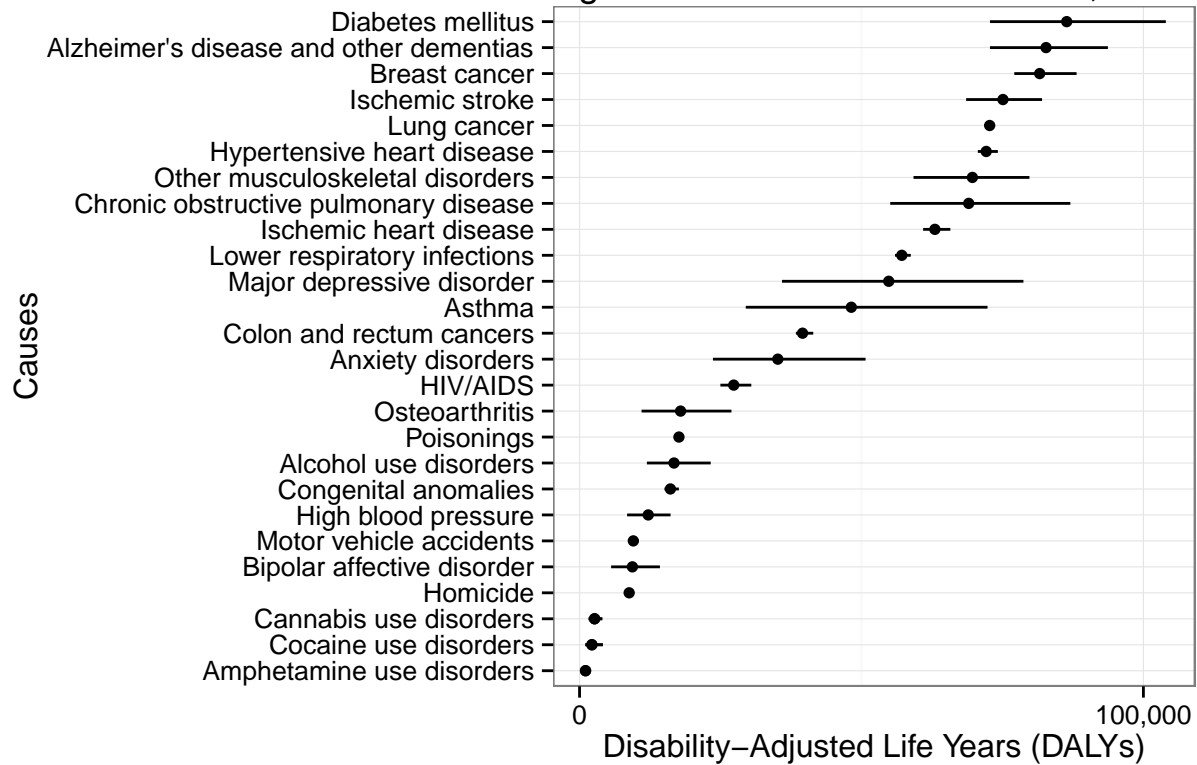## Leading Causes of DALYs in Males, NYC 2013
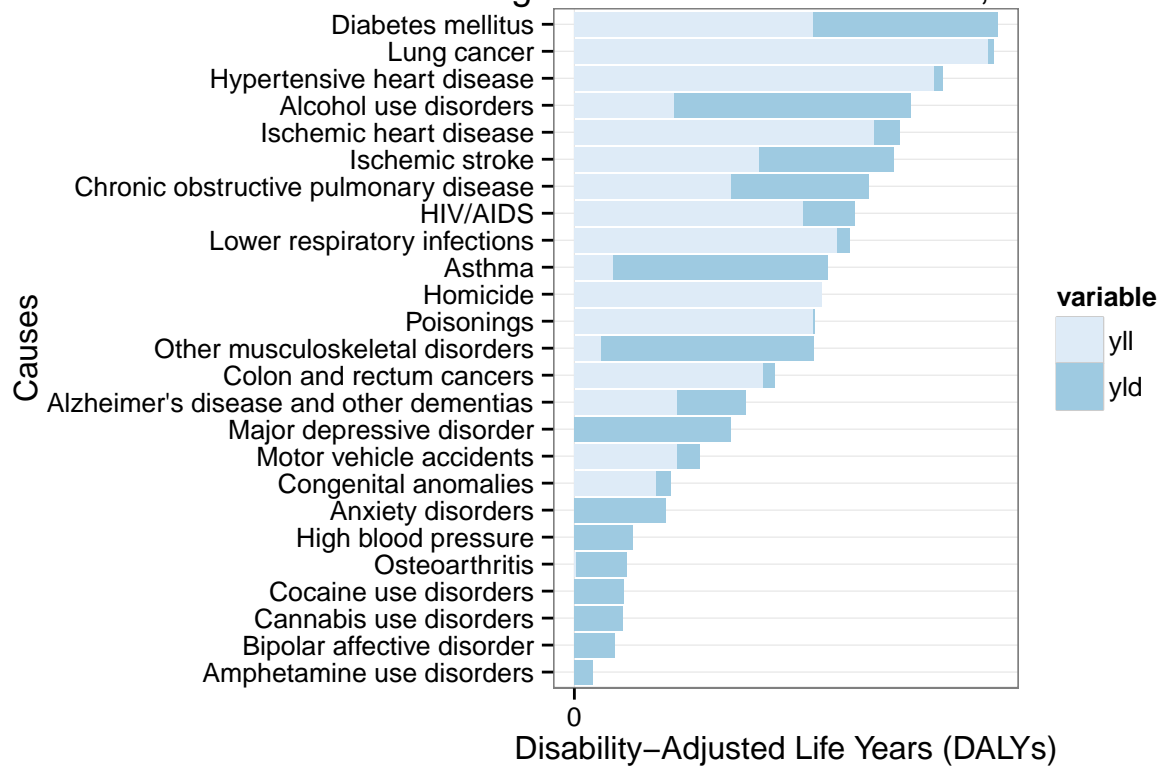
- Alcohol use disorders rises to the #4 slot
- Homicide and accidental deaths such as poisonings and motor vehicle accidents rise in rankings

2013 NYC DALY Estimates, Female

```
##                                  cause_name    sex        yll         yld
## 1                          Diabetes mellitus Female 45571.5997 40825.23391
## 2   Alzheimer's disease and other dementias Female 48947.6106 33785.89475
## 3                              Breast cancer Female 68867.0554 12738.79793
## 4                            Ischemic stroke Female 45405.9854 29685.22751
## 5                                Lung cancer Female 71564.1269  1169.53195
## 6                 Hypertensive heart disease Female 69216.1387  2904.19435
## 7              Other musculoskeletal disorders Female  9329.0754 60339.85786
## 8      Chronic obstructive pulmonary disease Female 36529.1052 32488.23499
## 9                     Ischemic heart disease Female 56958.4560  6060.01617
## 10              Lower respiratory infections Female 53989.4085  3160.54100
## 11                 Major depressive disorder Female     0.0000 54831.68020
## 12                                    Asthma Female  6997.3548 41199.75113
## 13                 Colon and rectum cancers Female 36779.5345  2768.38346
## 14                         Anxiety disorders Female     0.0000 35162.99685
## 15                                  HIV/AIDS Female 23046.6859  4293.50298
## 16                            Osteoarthritis Female   335.5308 17584.57596
## 17                                Poisonings Female 17545.9474    80.98334
## 18                     Alcohol use disorders Female  4899.8441 11853.64796
## 19                      Congenital anomalies Female 13549.7404  2562.67983
## 20                      High blood pressure Female     0.0000 12179.91963
## 21                  Motor vehicle accidents Female  7564.3877  1972.10646
## 22                Bipolar affective disorder Female     0.0000  9371.47498
## 23                                  Homicide Female  8800.4627          NA
## 24                   Cannabis use disorders Female     0.0000  2665.14650
## 25                   Cannabis use disorders Female     0.0000  2665.14650
## 26                    Cocaine use disorders Female     0.0000  2191.26455
## 27                    Cocaine use disorders Female     0.0000  2191.26455
## 28                Amphetamine use disorders Female     0.0000  1061.88339
## 29                Amphetamine use disorders Female     0.0000  1061.88339
##     yld_upper    yld_lower        daly daly_upper daly_lower
## 1  58405.5971 27218.019398 86396.834 103977.197 72789.6191
## 2  44756.9110 23835.232988 82733.505  93704.522 72782.8436
## 3  19278.9232  8233.448706 81605.853  88145.979 77100.5041
## 4  36617.6754 23157.764263 75091.213  82023.661 68563.7496
## 5   2118.4816   502.029026 72733.659  73682.608 72066.1559
## 6   4970.8132  1420.023201 72120.333  74186.952 70636.1619
## 7  70460.4202 49901.402016 69668.933  79789.496 59230.4774
## 8  50513.2517 18570.170568 69017.340  87042.357 55099.2758
## 9   8802.7843  3980.275681 63018.472  65761.240 60938.7317
## 10  4752.9500  1957.482259 57149.949  58742.358 55946.8907
## 11 78719.1199 35904.137465 54831.680  78719.120 35904.1375
## 12 65355.6246 22484.566452 48197.106  72352.979 29481.9213
## 13  4666.7635  1586.510706 39547.918  41446.298 38366.0452
## 14 50724.5194 23659.814445 35162.997  50724.519 23659.8144
## 15  7413.6195  1930.630841 27340.189  30460.305 24977.3167
## 16 26604.5852 10655.116785 17920.107  26940.116 10990.6476
## 17   241.0352     5.402819 17626.931  17786.983 17551.3502
## 18 18362.8776  7045.605530 16753.492  23262.722 11945.4497
## 19  4069.5302  1525.962762 16112.420  17619.271 15075.7031
## 20 16136.2000  8432.688834 12179.920  16136.200  8432.6888
## 21  2969.1424  1247.026528  9536.494  10533.530  8811.4142
```

```
## 22 14254.0978 5597.765905 9371.475 14254.098 5597.7659
## 23         NA          NA 8800.463        NA        NA
## 24  4031.9495 1615.898924 2665.147  4031.950 1615.8989
## 25  4031.9495 1615.898924 2665.147  4031.950 1615.8989
## 26  4137.6218 1017.421149 2191.265  4137.622 1017.4211
## 27  4137.6218 1017.421149 2191.265  4137.622 1017.4211
## 28  1894.9243  507.700071 1061.883  1894.924  507.7001
## 29  1894.9243  507.700071 1061.883  1894.924  507.7001
```

Leading Causes of DALYs in Females, NYC 20[...]

Leading Causes of DALYs in Females, NYC 2013
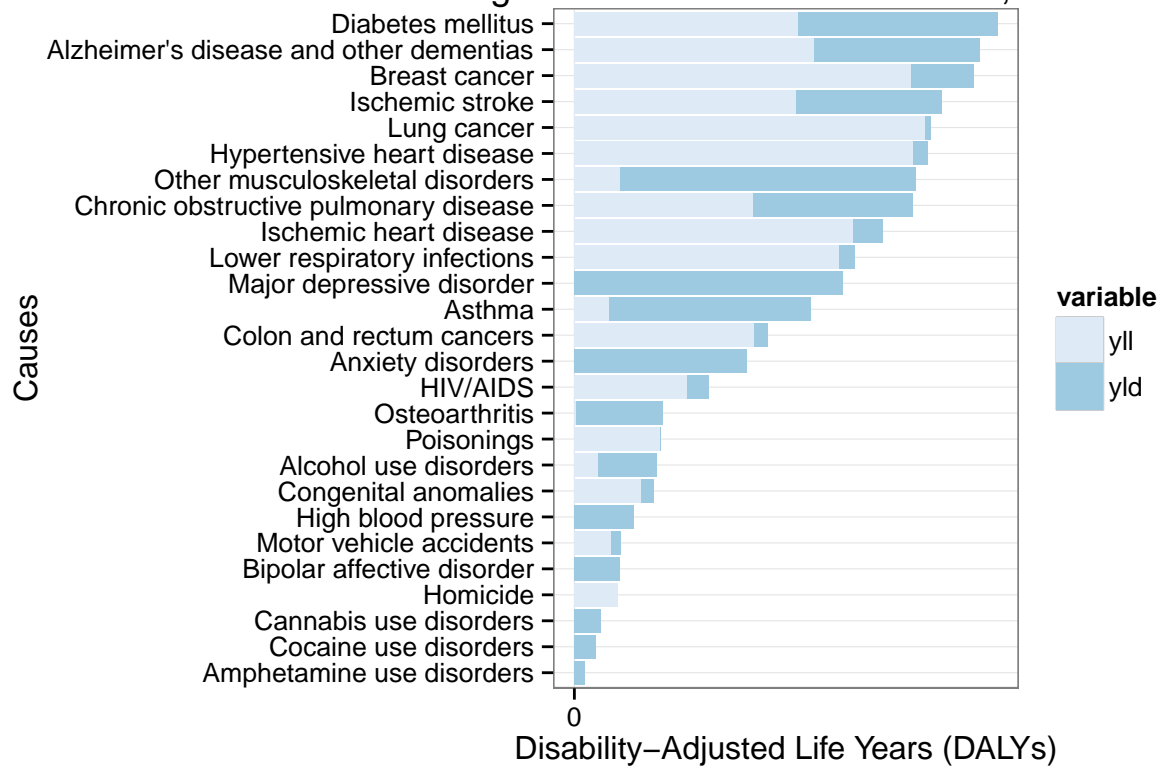
- Breast cancer makes the top 3
- Alzheimer's disease and other dementias ranks very high
- Drug-related disorders get pushed to the bottom

Prevalence-Based YLD Approach

Raw results for this approach can be found under the `results` directory under the filename `nyc_daly_prevalence.csv`. The file can be opened in Excel and manipulated with a pivot table for aggregation and stratification purposes.
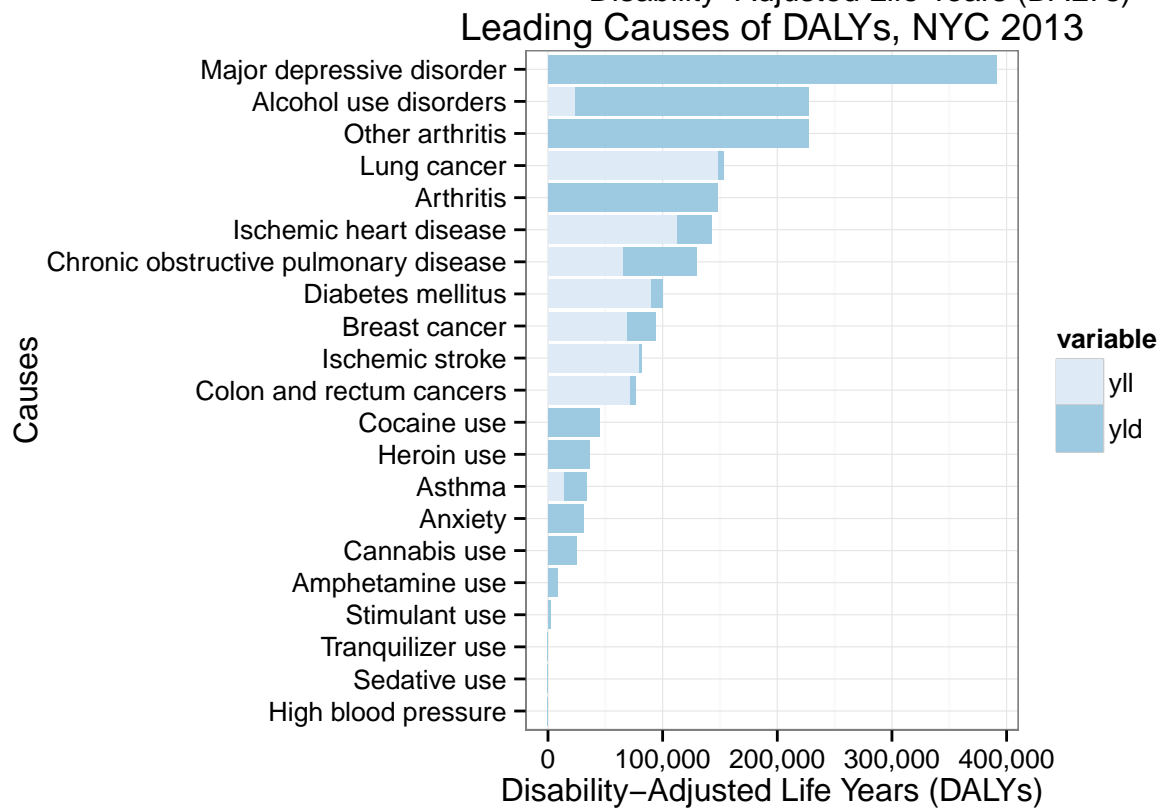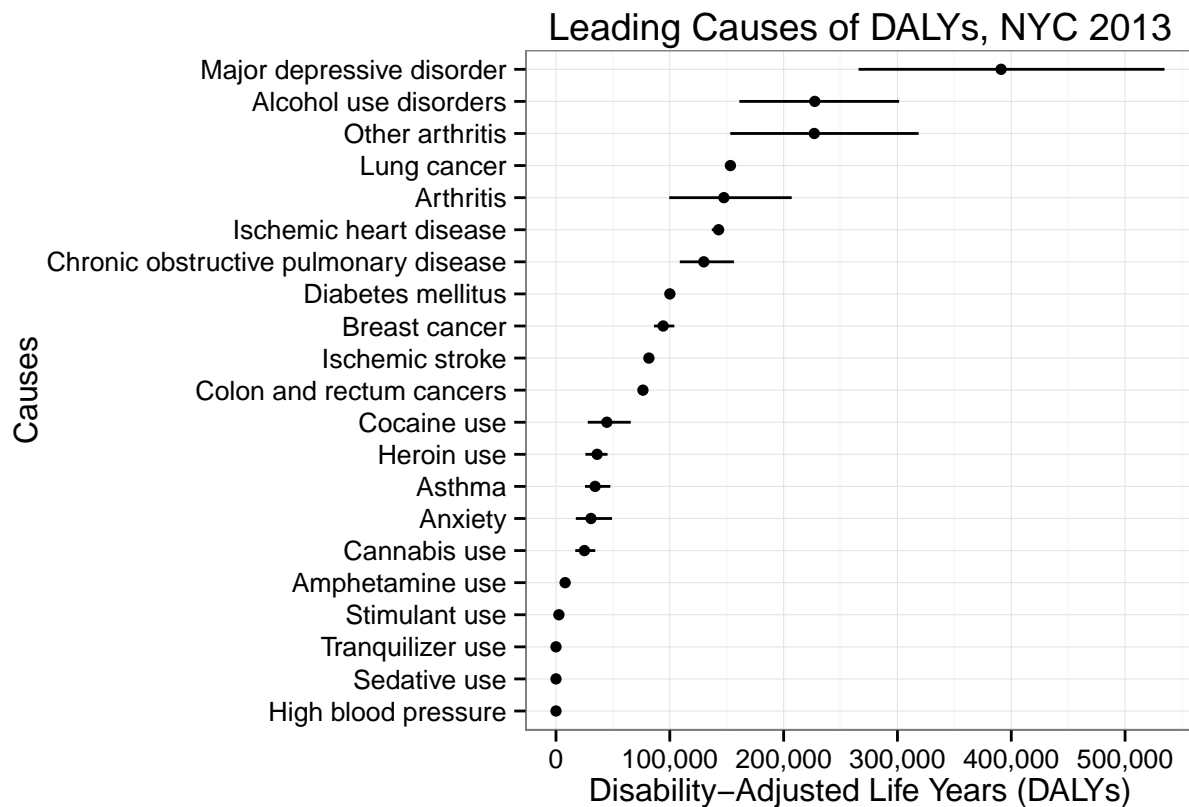
2013 NYC DALY Estimates, Total

```
##                                  cause_name       yll        yld  yld_upper
## 1                   Major depressive disorder        NA 391052.610 534646.723
## 2                      Alcohol use disorders  23367.44 203982.931 278110.749
## 3                            Other arthritis        NA 226917.872 318617.560
## 4                                Lung cancer 148321.18   4937.436   6902.334
## 5                                  Arthritis        NA 147503.216 207110.680
## 6                     Ischemic heart disease 112699.36  30185.820  34498.080
## 7     Chronic obstructive pulmonary disease  65616.66  64252.608  90689.879
## 8                          Diabetes mellitus  89921.86  10119.135  12142.962
## 9                              Breast cancer  69366.71  24768.618  34625.517
## 10                           Ischemic stroke  79787.16   1819.986   3206.642
## 11                  Colon and rectum cancers  71913.23   4471.446   6250.899
## 12                               Cocaine use        NA  44665.457  65691.483
## 13                                 Heroin use        NA  36138.504  45271.793
## 14                                    Asthma  14317.43  20058.084  33430.140
## 15                                   Anxiety        NA  30752.130  49203.408
## 16                              Cannabis use        NA  24990.840  34561.800
## 17                           Amphetamine use        NA   8049.876  11972.195
## 18                             Stimulant use        NA   2548.660   3790.500
## 19                        High blood pressure       NA      0.000      0.000
## 20                               Sedative use        NA      0.000      0.000
## 21                           Tranquilizer use        NA      0.000      0.000
##      yld_lower        daly daly_upper daly_lower
## 1  265843.756 391052.610  534646.72 265843.756
## 2  137741.051 227350.374  301478.19 161108.494
## 3  153091.852 226917.872  318617.56 153091.852
## 4    3342.006 153258.618  155223.52 151663.188
## 5   99514.156 147503.216  207110.68  99514.156
## 6   24196.570 142885.183  147197.44 136895.933
## 7   43169.721 129869.264  156306.54 108786.377
## 8    8095.308 100040.994  102064.82  98017.167
## 9   16765.153  94135.331  103992.23  86131.866
## 10    953.326  81607.144   82993.80  80740.484
## 11   3026.591  76384.673   78164.13  74939.818
## 12  27915.910  44665.457   65691.48  27915.910
## 13  25877.650  36138.504   45271.79  25877.650
## 14  11143.380  34375.510   47747.57  25460.806
## 15  17426.207  30752.130   49203.41  17426.207
## 16  16939.080  24990.840   34561.80  16939.080
## 17   4902.899   8049.876   11972.19   4902.899
## 18   1552.300   2548.660    3790.50   1552.300
## 19      0.000      0.000       0.00      0.000
## 20      0.000      0.000       0.00      0.000
## 21      0.000      0.000       0.00      0.000
```

- `Major depressive disorder` ranks number one, beating out the number two slot by almost twice the

number of DALYs However, DALY estimates appear to be unstable, taking a wide range of possible values.

- Not enough information to calculate DALY estimates for `sedative use`, `stimulant use`, `tranquilizer use`.

Leading Causes of DALYs, NYC 2013

Leading Causes of DALYs, NYC 2013

2013 NYC DALY Estimates, Male

```
##                                    cause_name  sex        yll        yld
## 1                  Major depressive disorder Male         NA 146547.662
## 2                      Alcohol use disorders Male 18467.5988 109295.729
## 3                             Other arthritis Male         NA  79497.292
## 4                                 Lung cancer Male 76757.0552   1925.994
## 5                      Ischemic heart disease Male 55740.9066  13079.052
## 6  Chronic obstructive pulmonary disease Male 29087.5511  32495.040
## 7                           Diabetes mellitus Male 44350.2597   4769.880
## 8                                   Arthritis Male         NA  47958.372
## 9                    Colon and rectum cancers Male 35103.8723   1835.148
## 10                            Ischemic stroke Male 34381.1722    607.635
## 11                                     Asthma Male  7320.0714   7268.832
## 12                                Cocaine use Male         NA  12568.070
## 13                                Cocaine use Male         NA  12568.070
## 14                                    Anxiety Male         NA  11398.980
## 15                                  Heroin use Male         NA   9979.689
## 16                                  Heroin use Male         NA   9979.689
## 17                                Cannabis use Male         NA   8053.920
## 18                                Cannabis use Male         NA   8053.920
## 19                             Amphetamine use Male         NA   2514.454
## 20                             Amphetamine use Male         NA   2514.454
## 21                               Stimulant use Male         NA   1609.680
## 22                               Breast cancer Male   499.6573      0.000
## 23                          High blood pressure Male        NA      0.000
## 24                                 Sedative use Male        NA      0.000
## 25                             Tranquilizer use Male        NA      0.000
##     yld_upper yld_lower         daly  daly_upper  daly_lower
## 1  201639.650 99306.914 146547.6620 201639.6500 99306.9140
## 2  149014.023 73802.786 127763.3281 167481.6215 92270.3850
## 3  111622.910 53633.447  79497.2920 111622.9100 53633.4470
## 4    2692.461  1303.649  78683.0492  79449.5162 78060.7042
## 5   14947.488 10484.002  68819.9586  70688.3946 66224.9086
## 6   45865.395 21832.605  61582.5911  74952.9461 50920.1561
## 7    5723.856  3815.904  49120.1397  50074.1157 48166.1637
## 8   67338.810 32355.477  47958.3720  67338.8100 32355.4770
## 9    2565.462  1242.158  36939.0203  37669.3343 36346.0303
## 10   1070.595   318.285  34988.8072  35451.7672 34699.4572
## 11  12114.720  4038.240  14588.9034  19434.7914 11358.3114
## 12  18484.422  7855.044  12568.0700  18484.4221  7855.0437
## 13  18484.422  7855.044  12568.0700  18484.4221  7855.0437
## 14  18238.368  6459.422  11398.9800  18238.3680  6459.4220
## 15  12501.857  7146.143   9979.6893  12501.8572  7146.1425
## 16  12501.857  7146.143   9979.6893  12501.8572  7146.1425
## 17  11138.400  5459.040   8053.9200  11138.4000  5459.0400
## 18  11138.400  5459.040   8053.9200  11138.4000  5459.0400
## 19   3739.628  1531.466   2514.4543   3739.6275  1531.4665
## 20   3739.628  1531.466   2514.4543   3739.6275  1531.4665
## 21   2394.000   980.400   1609.6800   2394.0000   980.4000
## 22      0.000     0.000    499.6573    499.6573   499.6573
## 23      0.000     0.000      0.0000      0.0000     0.0000
## 24      0.000     0.000      0.0000      0.0000     0.0000
## 25      0.000     0.000      0.0000      0.0000     0.0000
```
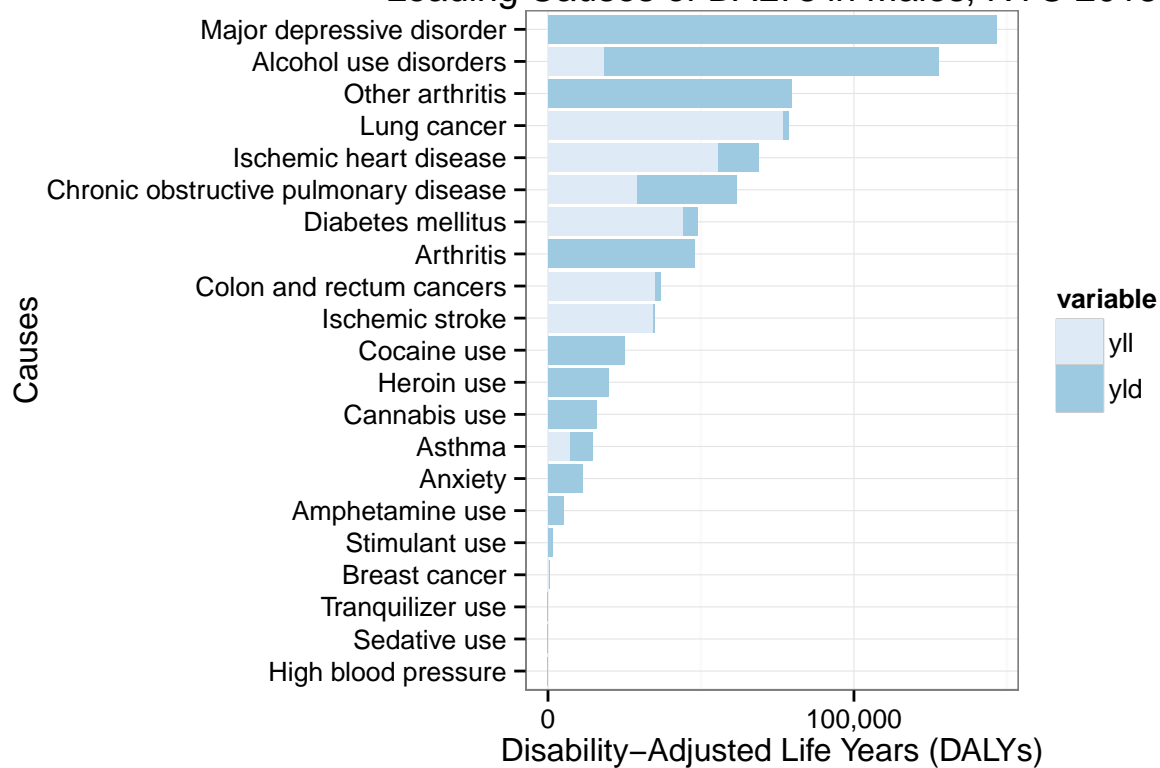
Leading Causes of DALYs in Males, NYC 2013
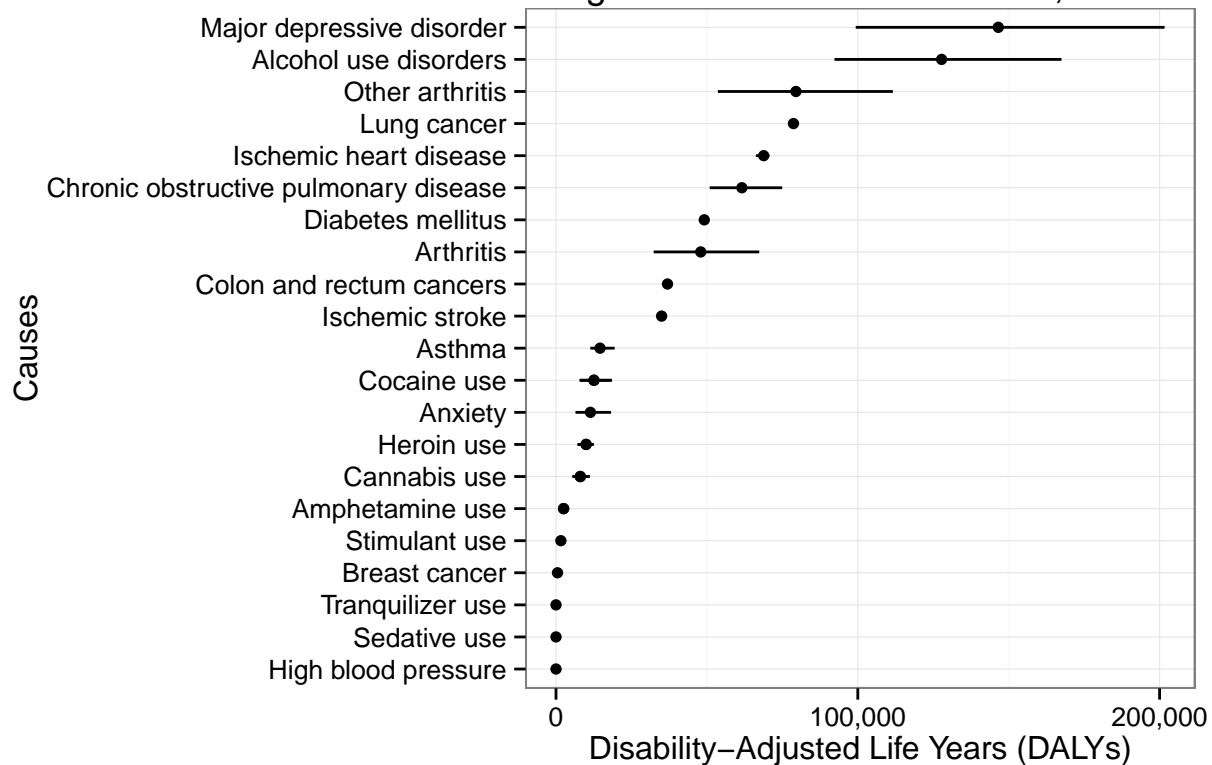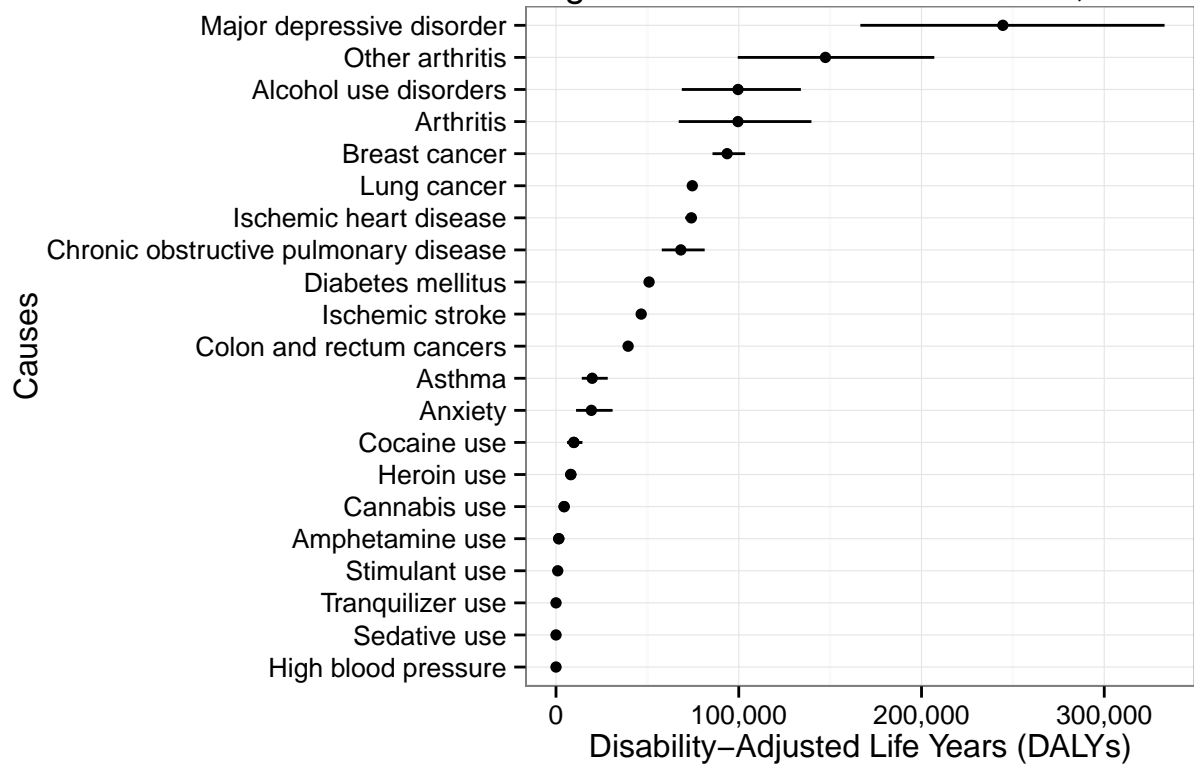

Leading Causes of DALYs in Males, NYC 2013

- Alcohol use disorders rises in proportion to major depressive disorder

17

2013 NYC DALY Estimates, Female

```
##                                    cause_name     sex        yll         yld
## 1                 Major depressive disorder  Female          NA  244504.948
## 2                           Other arthritis  Female          NA  147420.580
## 3                     Alcohol use disorders  Female    4899.844   94687.202
## 4                                 Arthritis  Female          NA   99544.844
## 5                             Breast cancer  Female   68867.055   24768.618
## 6                               Lung cancer  Female   71564.127    3011.442
## 7                    Ischemic heart disease  Female   56958.456   17106.768
## 8   Chronic obstructive pulmonary disease  Female   36529.105   31757.568
## 9                         Diabetes mellitus  Female   45571.600    5349.255
## 10                          Ischemic stroke  Female   45405.985    1212.351
## 11                 Colon and rectum cancers  Female   36809.355    2636.298
## 12                                   Asthma  Female    6997.355   12789.252
## 13                                  Anxiety  Female          NA   19353.150
## 14                              Cocaine use  Female          NA    9764.658
## 15                              Cocaine use  Female          NA    9764.658
## 16                               Heroin use  Female          NA    8089.563
## 17                               Heroin use  Female          NA    8089.563
## 18                             Cannabis use  Female          NA    4441.500
## 19                             Cannabis use  Female          NA    4441.500
## 20                           Amphetamine use Female          NA    1510.483
## 21                           Amphetamine use Female          NA    1510.483
## 22                            Stimulant use  Female          NA     938.980
## 23                       High blood pressure Female          NA       0.000
## 24                             Sedative use  Female          NA       0.000
## 25                          Tranquilizer use Female          NA       0.000
##      yld_upper   yld_lower         daly  daly_upper  daly_lower
## 1   333007.073  166536.8420  244504.948   333007.07  166536.8420
## 2   206994.650   99458.4050  147420.580   206994.65   99458.4050
## 3   129096.726   63938.2652   99587.046   133996.57   68838.1093
## 4   139771.870   67158.6790   99544.844   139771.87   67158.6790
## 5    34625.517   16765.1530   93635.673   103492.57   85632.2084
## 6     4209.873    2038.3570   74575.569    75774.00   73602.4839
## 7    19550.592   13712.5680   74065.224    76509.05   70671.0240
## 8    44824.484   21337.1160   68286.673    81353.59   57866.2212
## 9     6419.106    4279.4040   50920.855    51990.71   49851.0037
## 10    2136.047     635.0410   46618.336    47542.03   46041.0264
## 11    3685.437    1784.4330   39445.653    40494.79   38593.7875
## 12   21315.420    7105.1400   19786.607    28312.77   14102.4948
## 13   30965.040   10966.7850   19353.150    30965.04   10966.7850
## 14   14361.319    6102.9115    9764.658    14361.32    6102.9115
## 15   14361.319    6102.9115    9764.658    14361.32    6102.9115
## 16   10134.039    5792.6824    8089.563    10134.04    5792.6824
## 17   10134.039    5792.6824    8089.563    10134.04    5792.6824
## 18    6142.500    3010.5000    4441.500     6142.50    3010.5000
## 19    6142.500    3010.5000    4441.500     6142.50    3010.5000
## 20    2246.470     919.9828    1510.483     2246.47     919.9828
## 21    2246.470     919.9828    1510.483     2246.47     919.9828
## 22    1396.500     571.9000     938.980     1396.50     571.9000
## 23       0.000       0.0000       0.000        0.00       0.0000
## 24       0.000       0.0000       0.000        0.00       0.0000
## 25       0.000       0.0000       0.000        0.00       0.0000
```
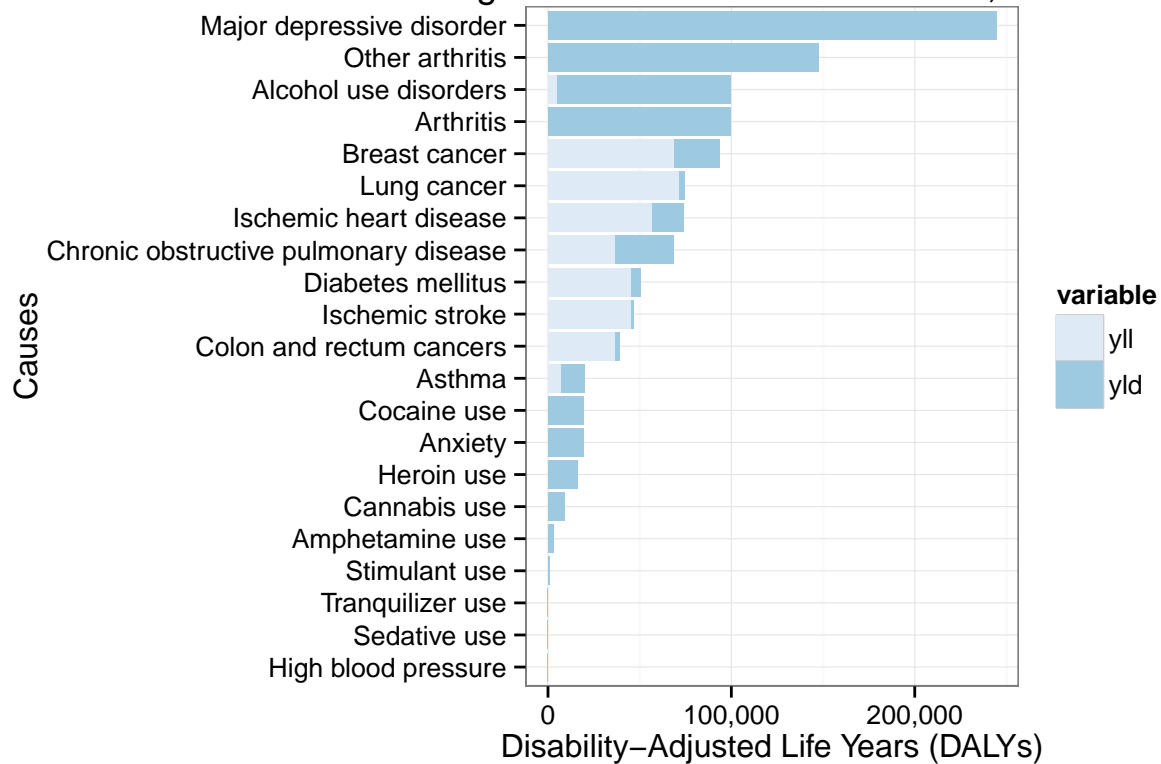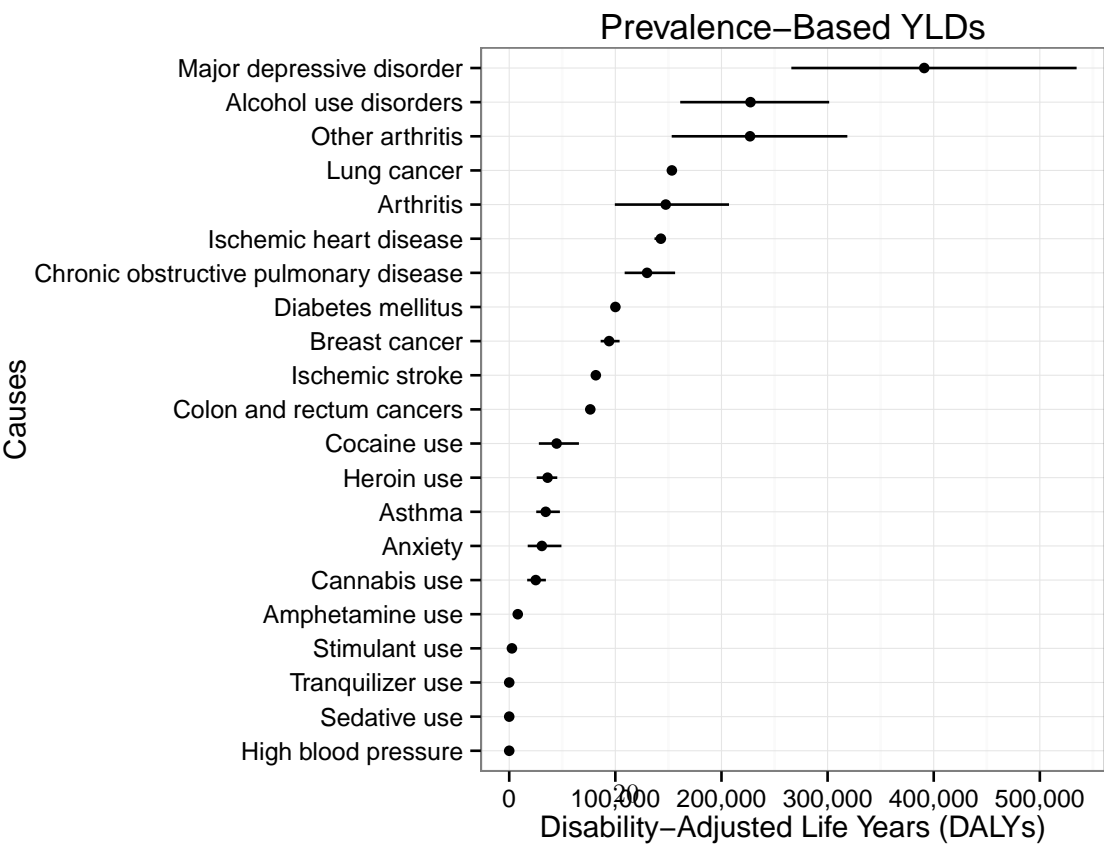
Leading Causes of DALYs in Females, NYC 201

Leading Causes of DALYs in Females, NYC 2013

Michaud YLDs vs. Prevalence-Based YLDs: Side-by-Side Comparison

Total

Male

Michaud YLDs

Causes (top to bottom):
Diabetes mellitus
Lung cancer
Hypertensive heart disease
Alcohol use disorders
Ischemic heart disease
Ischemic stroke
Chronic obstructive pulmonary disease
HIV/AIDS
Lower respiratory infections
Asthma
Homicide
Poisonings
Other musculoskeletal disorders
Colon and rectum cancers
Alzheimer's disease and other dementias
Major depressive disorder
Motor vehicle accidents
Congenital anomalies
Anxiety disorders
High blood pressure
Osteoarthritis
Bipolar affective disorder
Cocaine use disorders
Cannabis use disorders
Amphetamine use disorders

Disability−Adjusted Life Years (DALYs)

Prevalence−Based YLDs

Causes (top to bottom):
Major depressive disorder
Alcohol use disorders
Other arthritis
Lung cancer
Ischemic heart disease
Chronic obstructive pulmonary disease
Diabetes mellitus
Arthritis
Colon and rectum cancers
Ischemic stroke
Asthma
Cocaine use
Anxiety
Heroin use
Cannabis use
Amphetamine use
Stimulant use
Breast cancer
Tranquilizer use
Sedative use
High blood pressure

Disability−Adjusted Life Years (DALYs)

0   100,000   200,000

Female

Michaud YLDs

Causes (top to bottom):
Diabetes mellitus, Alzheimer's disease and other dementias, Breast cancer, Ischemic stroke, Lung cancer, Hypertensive heart disease, Other musculoskeletal disorders, Chronic obstructive pulmonary disease, Ischemic heart disease, Lower respiratory infections, Major depressive disorder, Asthma, Colon and rectum cancers, Anxiety disorders, HIV/AIDS, Osteoarthritis, Poisonings, Alcohol use disorders, Congenital anomalies, High blood pressure, Motor vehicle accidents, Bipolar affective disorder, Homicide, Cannabis use disorders, Cocaine use disorders, Amphetamine use disorders

Disability–Adjusted Life Years (DALYs) — 0, 100,000

Prevalence–Based YLDs

Causes (top to bottom):
Major depressive disorder, Other arthritis, Alcohol use disorders, Arthritis, Breast cancer, Lung cancer, Ischemic heart disease, Chronic obstructive pulmonary disease, Diabetes mellitus, Ischemic stroke, Colon and rectum cancers, Asthma, Anxiety, Cocaine use, Heroin use, Cannabis use, Amphetamine use, Stimulant use, Tranquilizer use, Sedative use, High blood pressure

Disability–Adjusted Life Years (DALYs) — 0, 100,000, 200,000, 300,000

Disease Conditions with Small Sample Sizes
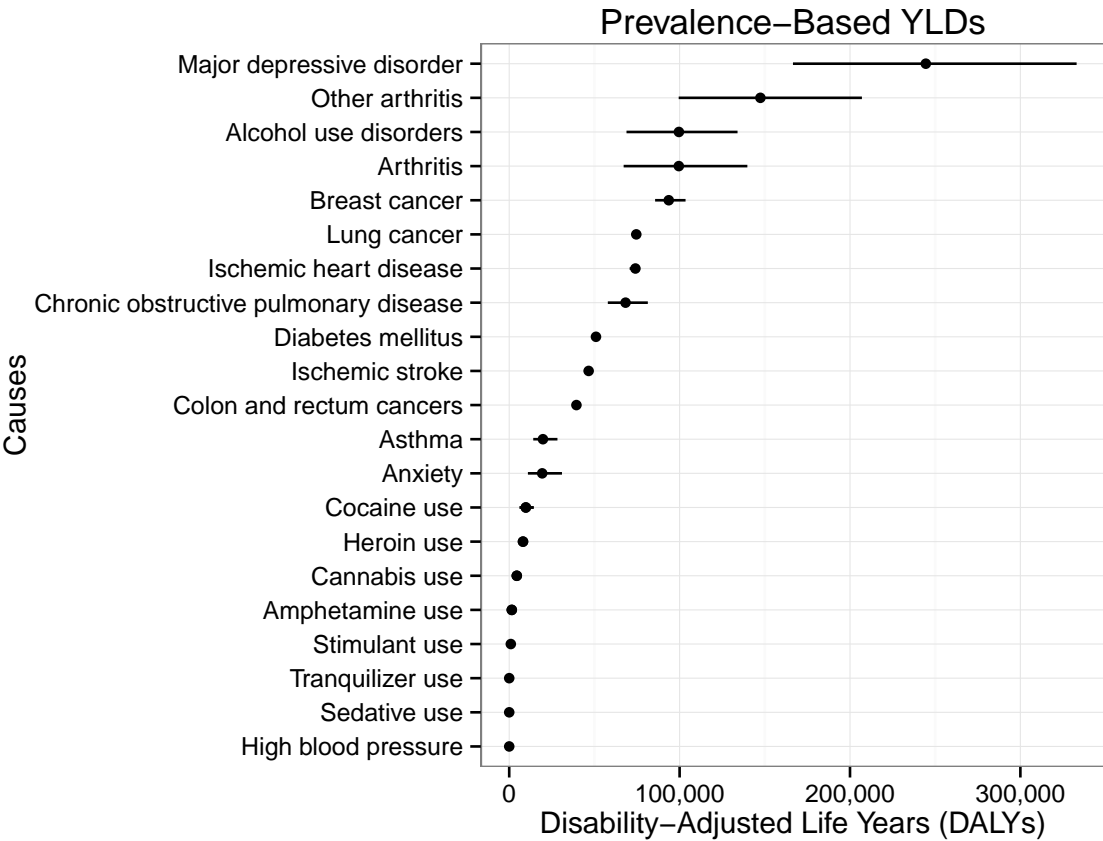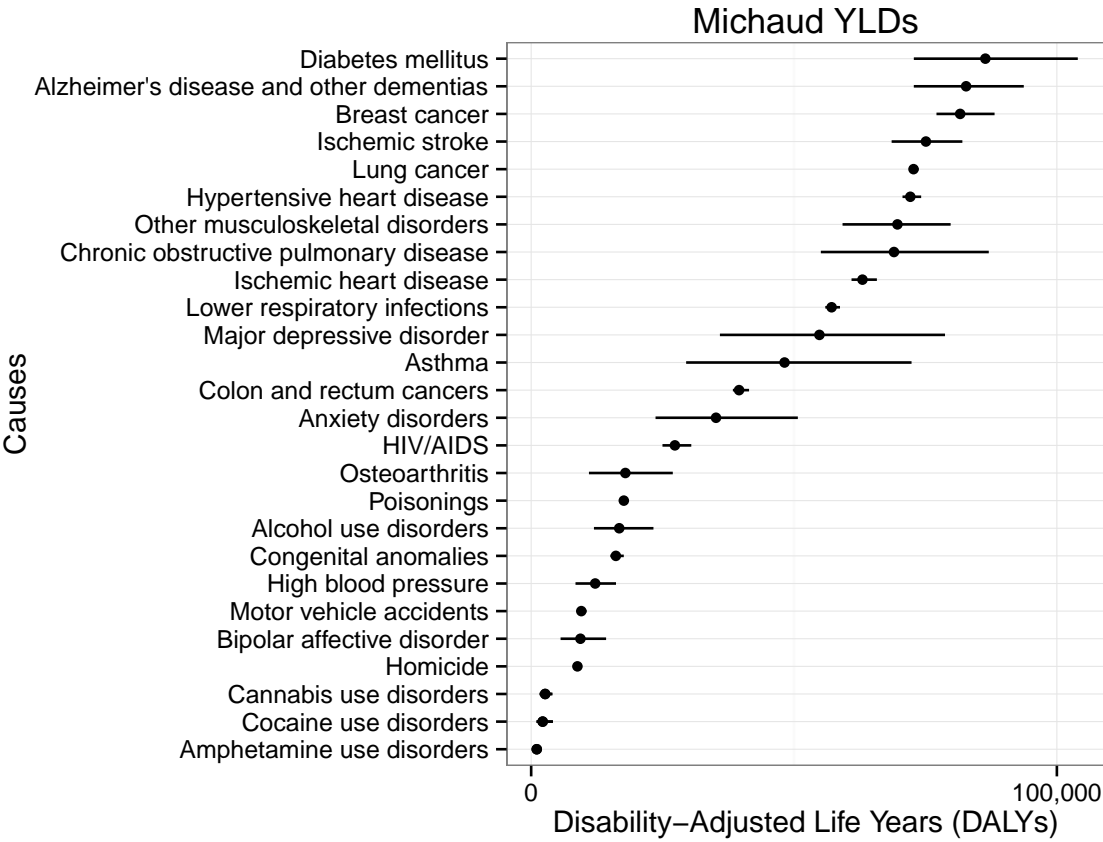
```
##                       cause_name                       sequlae   sex    age
## 25               Breast cancer               Breast cancer    Male 20-39
## 26               Breast cancer               Breast cancer    Male 40-59
## 27               Breast cancer               Breast cancer    Male   60+
## 28               Breast cancer               Breast cancer Female 20-39
## 36                 Cocaine use                 Cocaine use Female   60+
## 37     Colon and rectum cancers     Colon and rectum cancers    Male 20-39
## 38     Colon and rectum cancers     Colon and rectum cancers    Male 40-59
## 39     Colon and rectum cancers     Colon and rectum cancers    Male   60+
## 40     Colon and rectum cancers     Colon and rectum cancers Female 20-39
## 41     Colon and rectum cancers     Colon and rectum cancers Female 40-59
## 42     Colon and rectum cancers     Colon and rectum cancers Female   60+
## 55                   Heroin use                   Heroin use    Male 20-39
## 56                   Heroin use                   Heroin use    Male 40-59
## 57                   Heroin use                   Heroin use    Male   60+
## 58                   Heroin use                   Heroin use Female 20-39
## 59                   Heroin use                   Heroin use Female 40-59
## 60                   Heroin use                   Heroin use Female   60+
## 67       Ischemic heart disease       Ischemic heart disease    Male 20-39
## 70       Ischemic heart disease       Ischemic heart disease Female 20-39
## 73                 Lung cancer                         Lung    Male 20-39
## 74                 Lung cancer                         Lung    Male 40-59
## 75                 Lung cancer                         Lung    Male   60+
## 76                 Lung cancer                         Lung Female 20-39
## 77                 Lung cancer                         Lung Female 40-59
## 78                 Lung cancer                         Lung Female   60+
## 87             Amphetamine use         Methamphetamine use    Male 20-39
## 88             Amphetamine use         Methamphetamine use    Male 40-59
## 89             Amphetamine use         Methamphetamine use    Male   60+
## 90             Amphetamine use         Methamphetamine use Female 20-39
## 91             Amphetamine use         Methamphetamine use Female 40-59
## 92             Amphetamine use         Methamphetamine use Female   60+
## 101 Major depressive disorder         moderate depression    Male   60+
## 105 Major depressive disorder moderately severe depression    Male 20-39
## 106 Major depressive disorder moderately severe depression    Male 40-59
## 107 Major depressive disorder moderately severe depression    Male   60+
## 111             Other arthritis             Other arthritis    Male 20-39
## 125 Major depressive disorder         severe depression    Male 20-39
## 126 Major depressive disorder         severe depression    Male 40-59
## 127 Major depressive disorder         severe depression    Male   60+
## 128 Major depressive disorder         severe depression Female 20-39
## 130 Major depressive disorder         severe depression Female   60+
## 139             Ischemic stroke             Ischemic stroke    Male 20-39
## 140             Ischemic stroke             Ischemic stroke    Male 40-59
## 141             Ischemic stroke             Ischemic stroke    Male   60+
## 142             Ischemic stroke             Ischemic stroke Female 20-39
```

Discussion

There are key limitations to this analysis. First and foremost, the magnitude of the DALY scores should be interpreted and reported with caution. Due to the small sample size of NYC prevalence estimates

and the uncertainty around disability weights and national YLL/YLD rates for some conditions, DALY estimates can assume a wide range of values, changing how one condition ranks against the others (for example, `alcohol use disorders` and `diabetes mellitus`). For this reason, DALY magnitudes obtained via Michaud approach and the Prevalence-based YLDs cannot be directly compared.

Moreover, the accuracy of DALY estimations suffers from potential biases introduced in the data collection and computation processes. For example, comorbidities with respect to chronic diseases means that DALY estimates based on Vital Statistics mortality counts are overestimating the contribution of YLLs. Summation of prevalence YLDs across all causes can result in overestimation of the total average severity-weighted health state prevalence because of comorbidity between conditions (Mathers, 2006). Over-reporting of some conditions due to misclassification (e.g. where symptoms such as joint pain are labeled as osteoarthritis or occasional wheezing as asthma), under-reporting of undiagnosed conditions (e.g. most mental health problems), and lack of information on condition severity (resulting in high prevalences due to inclusion of very minor conditions or minor symptoms) may also contribute to biased DALY estimates.

In order to convey the uncertainty around our estimates, we visualize the range of values that NYC DALY estimates can take for each condition.

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