

Streetlight and Transport Walking

Tharindu Bandara

2024-03-07

Contents

1	Data preparation	5
2	Streetlight count	7
2.1	Descriptives	9
2.2	One-way ANOVA tests	11
3	Sample Profile	13
4	Cross Sectional Analysis	15
4.1	Wave 1 - 2007	15
4.2	Wave 2 - 2009	19
4.3	Wave 3 - 2011	19
4.4	Wave 4 - 2013	19
4.5	Wave 5 - 2016	19
5	Longitudinal Analysis	21

Chapter 1

Data preparation

The same steps followed as Gavin did for his 2014 paper (chapter 3).

- Excluded the participants who moved residence in between surveys
- Excluded the respondents who were not the same person at each wave
- Excluded the respondents who had missing values for transport walking for all waves
- Excluded the participants who had missing values for education

Chapter 2

Streetlight count

Streetlights is the built environment attribute of interest.

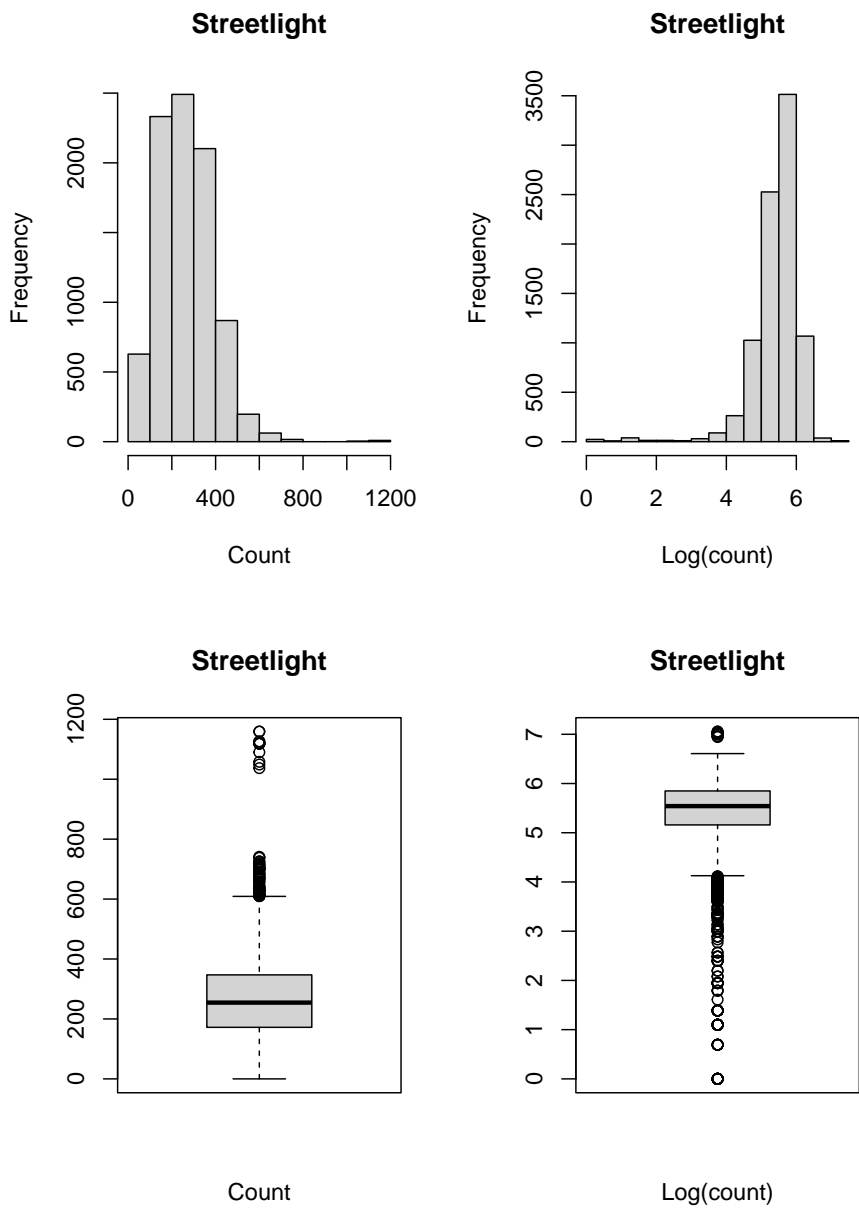
- Street light BE attribute is measured as 1km network buffer of residence.

	Streetlight summary				
	2007	2009	2011	2013	2016
Min.	0.0000	0.0000	0.0000	0.0000	0.0000
1st Qu.	172.0000	165.0000	200.0000	215.0000	214.0000
Median	254.5000	252.0000	285.0000	296.0000	302.0000
Mean	264.8033	254.7097	290.1867	302.0529	306.6352
3rd Qu.	347.0000	349.0000	371.0000	382.0000	389.0000
Max	1159.0000	1170.0000	1226.0000	1232.0000	1264.0000
Missing	0.0000	2760.0000	3637.0000	4002.0000	5078.0000

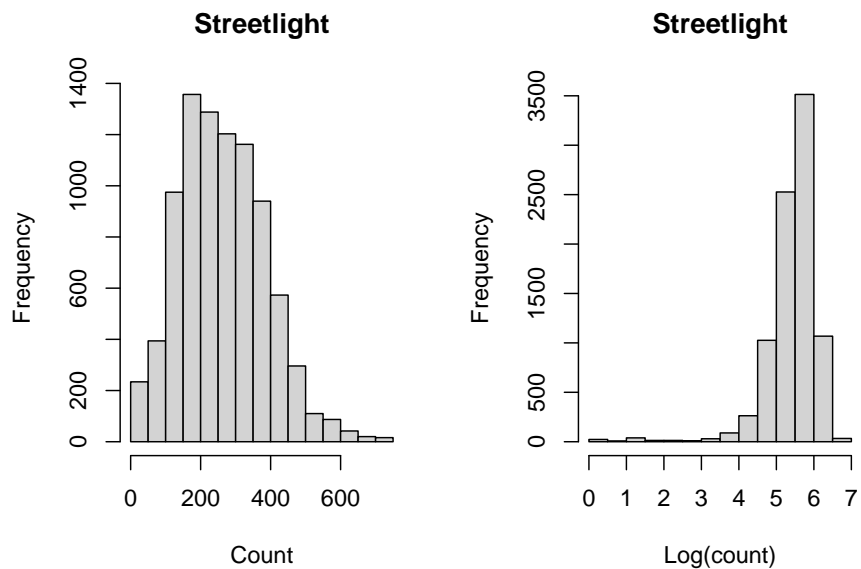
2.1 Descriptives

2.1.1 Descriptive statistics of Streetlight counts at each wave.

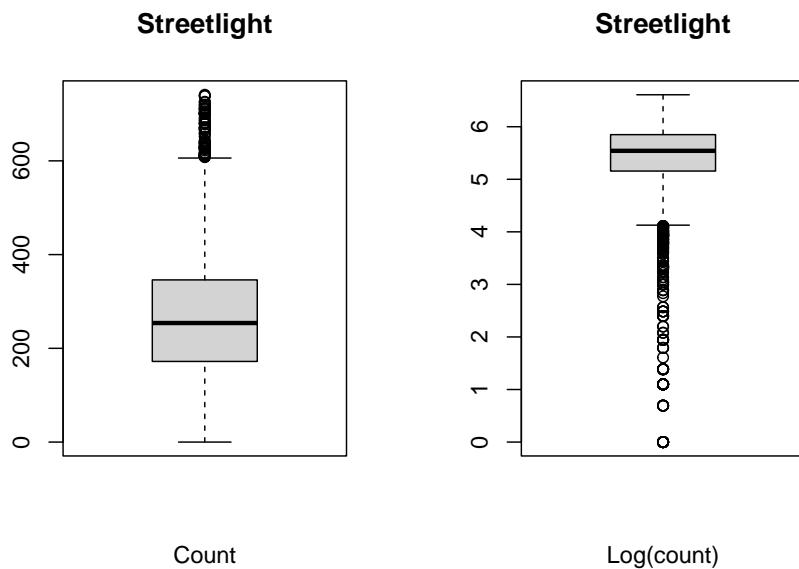
2.1.2 Distribution



There were 13 participants having grater than 1000 streetlight counts, others have less than 800 streetlight counts. Following plots are without these partici-



pants.



2.2 One-way ANOVA tests

```
##              Df    Sum Sq Mean Sq F value Pr(>F)
## habneigh1      1 39020790 39020790    3325 <2e-16 ***
## Residuals    8708 102180176    11734
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

ANOVA test for Log transformed streetlight counts

```
##              Df Sum Sq Mean Sq F value Pr(>F)
## habneigh1      1    731   730.6    1818 <2e-16 ***
## Residuals    8667   3483     0.4
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Following one-way ANOVA tests without the 13 records

```
##              Df    Sum Sq Mean Sq F value Pr(>F)
## habneigh1      1 36284234 36284234    3298 <2e-16 ***
## Residuals    8695 95650812    11001
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

ANOVA test for Log transformed streetlight counts

```
##              Df Sum Sq Mean Sq F value Pr(>F)
## habneigh1      1    711   710.7    1772 <2e-16 ***
## Residuals    8654   3471     0.4
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Chapter 3

Sample Profile

	Never-walkers				
	2007	2009	2011	2013	2016
	%	%	%	%	%
Sex					
Male	63.7	60.8	60.4	58.7	55.1
Female	66.7	63.2	64.1	64.1	60.5
Age group					
40–44 years	61.3	59.1	58.0	57.5	52.7
45–49 years	64.4	60.3	58.7	55.8	53.0
50–54 years	66.7	62.3	64.5	64.9	59.3
55–59 years	66.7	62.9	65.5	62.9	61.7
60 and above	69.4	67.0	66.3	68.7	65.4
Neighbourhood disadvantage					
Q5 (Least disadvantaged)	67.3	64.0	64.6	61.6	57.2
Q4	67.3	64.2	64.4	62.4	60.6
Q3	65.2	60.3	61.4	60.4	57.8
Q2	63.4	60.3	60.0	62.4	57.2
Q1 (Most disadvantaged)	61.9	60.2	60.3	61.8	57.4
Highest attained education					
Bachelor's degree or higher	56.8	53.0	54.2	52.4	48.8
Diploma/Associate diploma	63.7	61.2	59.5	60.5	58.4
Vocational (trade/business)	69.6	66.1	66.5	67.3	65.3
School	70.7	68.4	69.0	68.6	65.3
Occupation					
Managers & Professionals	61.7	57.2	56.5	55.9	51.0
White collar	65.0	62.2	63.4	64.0	59.7
Blue Collar	74.2	72.5	71.9	68.7	68.0
Home duties	71.1	68.3	73.4	69.1	70.0
Retired	69.5	65.4	64.7	65.1	65.1
Missing (includes NEC)	60.6	58.0	59.5	60.4	56.9
Household income					
\$130,000 pa or more	64.7	61.1	59.5	57.8	54.3
\$72,800 - \$129,999	64.0	60.2	61.6	60.4	53.4
\$52,000 - \$72,799	63.8	60.7	64.1	63.5	61.4
\$26,000 - \$51,999	67.2	64.7	64.6	63.7	64.4
\$0 - \$25,999	62.1	62.0	61.8	61.7	63.4
Missing	70.0	65.4	64.2	66.0	60.2

Chapter 4

Cross Sectional Analysis

Excluded movers ($n = 1916$ participants), as most of them do not have streetlight counts after the 1st wave. Therefore, streetlight count measured at wave 1 used for this cross-sectional analysis at each wave.

Transport walking:

- Walked or not (logistic regression)
- Minutes of walking (linear regression, only with walkers)

BE attribute:

- Baseline streetlight counts

Covariates:

- Sex
- Baseline age
- Baseline income level
- Baseline education

4.1 Wave 1 - 2007

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :  
## Model failed to converge with max|grad| = 0.0677391 (tol = 0.002, component 1)
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, : Model is nearly  
## - Rescale variables?;Model is nearly unidentifiable: large eigenvalue ratio  
## - Rescale variables?
```

```

## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: walker ~ 1 + envlights1nb1 + envlights1nb1 * sex1 + age1 + edu2 +
##   edu3 + edu4 + occu2 + occu3 + occu4 + occu5 + occu6 + income2 +
##   income3 + income4 + income5 + income6 + nh_Q1 + nh_Q2 + nh_Q3 +
##   nh_Q4 + (1 | habneigh1)
## Data: df_ch4_07
##
##           AIC          BIC    logLik deviance df.resid
## 10690.2 10852.6 -5322.1 10644.2      8599
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.1750 -0.7189 -0.5583  1.0724  2.6664
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## habneigh1 (Intercept) 0.1384    0.372
## Number of obs: 8622, groups: habneigh1, 200
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    0.1282999  0.2766080   0.464 0.642767
## envlights1nb1    0.0014862  0.0006268   2.371 0.017743 *
## sex1           -0.2367527  0.1145370  -2.067 0.038730 *
## age1            -0.0150967  0.0037536  -4.022 5.77e-05 ***
## edu2            -0.2909651  0.0824014  -3.531 0.000414 ***
## edu3            -0.5456479  0.0772788  -7.061 1.66e-12 ***
## edu4            -0.6079788  0.0661624  -9.189 < 2e-16 ***
## occu2            0.1971662  0.0729458   2.703 0.006873 **
## occu3           -0.3101742  0.0873783  -3.550 0.000386 ***
## occu4            0.0012232  0.1134397   0.011 0.991397
## occu5            0.0473297  0.1038047   0.456 0.648427
## occu6            0.2241313  0.0786770   2.849 0.004389 **
## income2          0.1821762  0.0767648   2.373 0.017636 *
## income3          0.1950494  0.0892207   2.186 0.028805 *
## income4          0.1110298  0.0887244   1.251 0.210788
## income5          0.3167521  0.1076488   2.942 0.003256 **
## income6         -0.0151571  0.0909649  -0.167 0.867664
## nh_Q1            0.2604480  0.1233588   2.111 0.034746 *
## nh_Q2            0.1191918  0.1171546   1.017 0.308968
## nh_Q3            0.0562959  0.1205436   0.467 0.640488
## nh_Q4            0.0010240  0.1118931   0.009 0.992699
## envlights1nb1:sex1 0.0002816  0.0003738   0.753 0.451212
## ---

```



```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

##
## Correlation matrix not shown by default, as p = 22 > 12.
## Use print(x, correlation=TRUE) or
##      vcov(x)          if you need it

## optimizer (Nelder_Mead) convergence code: 0 (OK)
## Model failed to converge with max|grad| = 0.0677391 (tol = 0.002, component 1)
## Model is nearly unidentifiable: very large eigenvalue
## - Rescale variables?
## Model is nearly unidentifiable: large eigenvalue ratio
## - Rescale variables?

## Linear mixed model fit by REML ['lmerMod']
## Formula: TW_topC ~ 1 + envlights1nb1 + envlights1nb1 * sex1 + age1 + edu2 +
##      edu3 + edu4 + occu2 + occu3 + occu4 + occu5 + occu6 + income2 +
##      income3 + income4 + income5 + income6 + nh_Q1 + nh_Q2 + nh_Q3 +
##      nh_Q4 + (1 | habneigh1)
## Data: df_ch4_07_walkers
##
## REML criterion at convergence: 36831.6
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.3737 -0.5503 -0.3005  0.1813  6.3691
##
## Random effects:
##      Groups      Name      Variance Std.Dev.
## habneigh1 (Intercept)    56      7.484
## Residual                13958    118.142
## Number of obs: 2983, groups: habneigh1, 200
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    57.49382   23.63056   2.433
## envlights1nb1     0.13050    0.05151   2.533
## sex1            20.11622   10.41987   1.931
## age1              0.01941    0.33949   0.057
## edu2             -0.74062    7.48557  -0.099
## edu3             -5.47313    7.15601  -0.765
## edu4             -8.88328    6.01299  -1.477
## occu2              1.31870    6.72004   0.196
## occu3             16.56393    8.38685   1.975
## occu4            -12.55409   10.95263  -1.146
```

```

## occu5          -1.76451    9.72682   -0.181
## occu6          15.49565    7.01383    2.209
## income2        -3.10801    6.94062   -0.448
## income3        -9.56399    8.08566   -1.183
## income4         1.30367    8.17041    0.160
## income5         1.92449    9.79962    0.196
## income6        -2.68743    8.54181   -0.315
## nh_Q1           8.38327    8.01754    1.046
## nh_Q2          -2.54581    7.39242   -0.344
## nh_Q3          11.05849    7.55730    1.463
## nh_Q4          -1.80152    6.80436   -0.265
## envlights1nb1:sex1 -0.06371    0.03231  -1.972

##
## Correlation matrix not shown by default, as p = 22 > 12.
## Use print(x, correlation=TRUE) or
##      vcov(x)          if you need it

## Analysis of Deviance Table (Type III Wald chisquare tests)
##
## Response: TW_topC
##              Chisq Df Pr(>Chisq)
## (Intercept)    5.9196  1   0.01497 *
## envlights1nb1    6.4184  1   0.01129 *
## sex1            3.7271  1   0.05354 .
## age1            0.0033  1   0.95441
## edu2            0.0098  1   0.92119
## edu3            0.5850  1   0.44437
## edu4            2.1826  1   0.13958
## occu2           0.0385  1   0.84443
## occu3           3.9006  1   0.04827 *
## occu4           1.3138  1   0.25171
## occu5           0.0329  1   0.85605
## occu6           4.8810  1   0.02715 *
## income2         0.2005  1   0.65430
## income3         1.3991  1   0.23688
## income4         0.0255  1   0.87323
## income5         0.0386  1   0.84431
## income6         0.0990  1   0.75305
## nh_Q1           1.0933  1   0.29574
## nh_Q2           0.1186  1   0.73056
## nh_Q3           2.1412  1   0.14339
## nh_Q4           0.0701  1   0.79119
## envlights1nb1:sex1 3.8875  1   0.04865 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

4.2 Wave 2 - 2009

4.3 Wave 3 - 2011

4.4 Wave 4 - 2013

4.5 Wave 5 - 2016

Chapter 5

Longitudinal Analysis