**Appendix 3 Computation of time-series studies effect sizes using R statistical software**

The calculations for all of the effect sizes were done using the statistical software R [1] (version 3.1.2). There is a subset for each study indexed by a reference identifier and by the first author and year. The studies considered in this meta-analysis have either accidents or deaths as the outcome. The outcome being count, a Poisson regression model was used to estimate the effects of intervention after adjusting for a linear trend in time. Specifically, we fitted a model of the form:

Where,

·: The logarithm of the expected count prior to intervention (pre intervention period)

·: The additional effect of intervention in the logarithmic scale i.e. the difference in the log number of counts for the post versus pre intervention period. Thus, it is the change relative to pre intervention and is the effect size. A negative effect size (-) signifies that post intervention period has a reduced number of counts than the pre intervention period. The percentage change relative to post intervention can also be computed as

·: The additional effect of time

**Road engineering**

Nadesan-Reddy 2013

Nadesan-Reddy used an observational, interrupted time-series before-and-after study design that assessed vehicle and pedestrian-vehicle collision (PVC) data on school route roads over a 5-year period; two consecutive years prior (2003-2005) and two consecutive years (2006 - 2008) following the implementation of speed humps with the year the speed humps were installed being excluded from the analysis. Each road acted as its own control. Using a non-probability convenience sample, 19 schools in Chatsworth and 15 in KwaMashu were selected [Sample size: 1267, Primary outcomes: road traffic death counts and the number of road accident causalities]

s2<-read.csv("E:\\data analysis\\Manisha\\N Nadesan (2013).csv")
s2.name<-c("Nadesan-Reddy 2013")
s2.y1<-s2[c(1:2,4:5),2 ]
s2.y2<-s2[c(1:2,4:5),3 ]
s2.int<-c(rep(0,2),rep(1,2))
s2.time<-1:4
s2.glm1 <- glm(s2.y1 ~ s2.int + s2.time, data=s2,family=poisson(link=log))
s2.glm2 <- glm(s2.y2 ~ s2.int + s2.time, data=s2,family=poisson(link=log))
s2.results1 <- data.frame( es = s2.glm1$coefficients[2],v = vcov(s2.glm1)[2,2],
se = summary(s2.glm1)$coefficients[2,2] )
rownames(s2.results1)<- paste(s2.name,"-casualties :")
s2.results1

## es v se
## Nadesan-Reddy 2013 -casualties: -0.2629215 0.01580278 0.1257091

s2.results2 <- data.frame( es = s2.glm2$coefficients[2],v = vcov(s2.glm2)[2,2] ,
se = summary(s2.glm2)$coefficients[2,2])
rownames(s2.results2)<- paste(s2.name,"-deaths:")
s2.results2

## es v se
## Nadesan-Reddy 2013 -deaths: -1.098612 0.6666667 0.8164966

Radin Umar 1995b

Radin Umar presents a preliminary analysis on the impact of the motorcycle lane on motorcycle casualties along Federal Route F02 within the Shah Alam, Malaysia. Accident data was extracted from the four-year pilot project data. Analysis of the data was carried out using the cross tabulation facilities available in MAAP, the time series cumulative plot'2 of six months records of "before" (03/1993 - 11/1993) and "after" (12/1993 - 08/1994) analysis'. In this preliminary analysis only the total motorcycle casualties were used [Sample size: 4319, Primary outcome: number of road traffic casualties].

s5<-read.csv ("E:\\data analysis\\Manisha\\Radin Umar RS etal. (1995).csv")[1:18,]
s5.name<-c("Radin Umar 1995b")
s5.y<-s5[,2]
s5.int<-c(rep(0,9),rep(1,9))
s5.time<-s5[,4]
s5.glm <- glm(s5.y ~ s5.int + s5.time, data=s5,family=poisson(link=log))
s5.results <- data.frame( es = s5.glm$coefficients[2],v = vcov(s5.glm)[2,2],
se = summary(s5.glm)$coefficients[2,2] )
rownames(s5.results)<- paste(s5.name,"-casualties :")
s5.results

## es v se
## Radin Umar 1995b -casualties: -0.7504757 0.07611868 0.2758961

**Traffic law enforcement and regulation**

Espitia-Hardeman 2008

Espitia-Hardeman examines the effects of the interventions designed to prevent the deaths of the motorcyclists in the city of Cali during 1993-2001. Data for this analysis was taken from the monitoring system of fatal injuries of Cali. Interrupted time series analysis was performed to assess the effects of the various interventions and to determine if post-intervention data (01/2000 - 12/2000 01/2001 - 12/2001) is significantly different from pre-intervention data (01/1993 - 04/1994, 05/1994 - 06/1996). Period 07/1996 - 2/1999 being the mandatory helmet use for motorcycle riders and passengers as well as nighttime curfew was excluded from the analysis. Thus, the assessment evaluated whether one intervention or the combination of some of them had a bigger impact: enforcing the use of helmets among drivers of motorcycles; enforcing the use of helmets for both drivers and passengers of motorcycles; enforcing the use of reflective vests for motorcyclists 24 hours per day, forbidding the use of motorcycles during the December holidays as well as enforcing the mandatory attendance of a road safety course for motorcyclists violating the law [Sample size: unknown, Primary outcome: road traffic death counts]

s1<-read.csv ("E:\\data analysis\\Manisha\\Espitia-Hardman etal. (2005).csv")
s1.name<-c("Espitia-Hardeman 2008")
s1.y<-s1[c(1:2,4:5),2 ]
s1.int<-c(rep(0,2),rep(1,2))
s1.time<-1:4
s1.glm <- glm(s1.y ~ s1.int + s1.time, data=s1,family=poisson(link=log))
s1.results <- data.frame( es = s1.glm$coefficients[2],v = vcov(s1.glm)[2,2],
se = summary(s1.glm)$coefficients[2,2] )
rownames(s1.results)<- paste(s1.name,"-deaths:")
s1.results

## es v se
## Espitia-Hardeman 2008 -deaths: -1.792843 0.02897989 0.1702348

Radin Umar 1995a

This paper presents short-term time series before and after analysis of motorcycle casualties and the impact of the `running headlight Campaign and Regulation" in the pilot project areas, Seremban and Shah Alam, Malaysia. This study was based primarily on a specially created police accident form POL27. The number of different types of motorcycle casualties six-months before (1/1992 - 06/1992) and after (07/1992 - 12/1992) the campaign were presented in the analysis [Sample size: 3662, Primary outcome: number of road traffic casualties].

s3<-read.csv("E:\\data analysis\\Manisha\\Radin Umar etal (1995).csv")
s3.name<-c("Radin Umar 1995a")
s3.y<-s3[,2]
s3.int<-c(rep(0,6),rep(1,6))
s3.time<-s3[,4]
s3.glm <- glm(s3.y ~ s3.int + s3.time, data=s3,family=poisson(link=log))
s3.results <- data.frame( es = s3.glm$coefficients[2],v = vcov(s3.glm)[2,2],
se = summary(s3.glm)$coefficients[2,2] )
rownames(s3.results)<- paste(s3.name,"-casualties :")
s3.results

## Es v se
## Radin Umar 1995a -casualties: -0.4125307 0.02473182 0.1572635

Radin Umar 2005

Radin Umar used a time series before and after analysis to measure the effect of frontal conspicuity intervention as a low cost safety policy to reduce casualties involving motorcycle in Malaysia. The before time included 06/1991 to 07/1992 and the after time period from 07/1992 to 06/1993. Data were classified according to daytime and nighttime casualties involving conspicuity related, single motorcycle casualties and non-conspicuity related casualties. We have used all conspicuity related casualties for our analysis occurring during daytime and nighttime [Sample size: unknown, primary outcome: number of road traffic casualties]

s4<-read.csv("E:\\data analysis\\Manisha\\Radin Umar etal (2005).csv")
s4.name<-c("Radin Umar 2005")
s4.y<-s4[,2]
s4.int<-c(rep(0,12),rep(1,12))
s4.time<-s4[,4]
s4.glm <- glm(s4.y ~ s4.int + s4.time, data=s4,family=poisson(link=log))
s4.results <- data.frame( es = s4.glm$coefficients[2],v = vcov(s4.glm)[2,2],
se = summary(s4.glm)$coefficients[2,2] )
rownames(s4.results)<- paste(s4.name,"-casualties :")
s4.results

## Es v se
## Radin Umar 2005 -casualties: -0.5210369 0.01325003 0.1151088

**Road engineering: primary outcome number of ‘road traffic casualty'**

road\_eng<-allresults[c(2,6),-2]
ma2 <- rma.uni(es,sei=se,data=road\_eng,method="DL")
road\_eng1<-rbind(road\_eng,cbind(es = as.numeric(ma2$b) ,se = as.numeric(ma2$se),
lower = as.numeric(ma2$ci.lb),upper = as.numeric(ma2$ci.ub)))
rownames(road\_eng1)[3]<-"Mean Effect Size "
road\_eng1[,-2]

## Es lower upper
## Nadesan-Reddy 2013 -casualties: -0.2629215 -0.9578489 0.43200585
## Radin Umar 1995b -casualties: -0.7504757 -1.7799817 0.27903027
## Mean Effect Size -0.4448430 -0.9070006 0.01731448

plotdata\_re<-xOrder(road\_eng1)
plotdata\_re$sum=1
plotdata\_re.new<-plotdata\_re
plotdata\_re.new[,c(1)]<-logDiff2Percent(plotdata\_re[,c(1)])
plotdata\_re.new[,c(3)]<-logDiff2Percent(plotdata\_re[,c(3)])
plotdata\_re.new[,c(4)]<-logDiff2Percent(plotdata\_re[,c(4)])
plotdata\_re.new

## Es se lower upper
## Radin Umar 1995b -casualties: -111.80074 0.2758961 -492.9748 24.348300
## Mean Effect Size -56.02453 0.2357990 -147.6882 1.716544
## Nadesan-Reddy 2013 -casualties: -30.07246 0.1257091 -160.6084 35.079442
## xorder sum
## Radin Umar 1995b -casualties: Radin Umar 1995b -casualties: 1
## Mean Effect Size Mean Effect Size 1
## Nadesan-Reddy 2013 -casualties: Nadesan-Reddy 2013 -casualties: 1

p1 <- ggplot(plotdata\_re.new, aes(x=es,
xmax=upper,
xmin=lower,
y=xorder ))
p1 <- p1 + geom\_point()
p1 <- p1 + geom\_point(size=c(3,5,3))
p1 <- p1 + scale\_shape\_manual(values=c(1:3))
p1 <- p1 + geom\_errorbarh(height=0)
p1 <- p1 + scale\_size\_manual(values=c(.5,1))
p1 <- p1 + geom\_vline(xintercept = 0, lty=1,size=.75, colour="black")
p1 <- p1 + scale\_colour\_manual(values=c("grey50","black"))
p1 <- p1 + xlab("Percent (%) Change") +ylab ("")
p1

**Traffic law enforcement and regulation**

**Primary outcome number of ‘road traffic casualty'**

law\_enf<-allresults[c(4,5),-2]
ma3 <- rma.uni(es,sei=se,data=law\_enf,method="DL")
law\_enf1<-rbind(law\_enf,cbind(es = as.numeric(ma3$b) ,se = as.numeric(ma3$se),
lower = as.numeric(ma3$ci.lb),upper = as.numeric(ma3$ci.ub)))
rownames(law\_enf1)[3]<-"Mean Effect Size"
law\_enf1[,-2]

## Es lower upper
## Radin Umar 1995a -casualties: -0.4125307 -1.1897974 0.3647360
## Radin Umar 2005 -casualties: -0.5210369 -1.1860195 0.1439456
## Mean Effect Size -0.4831844 -0.6652368 -0.3011319

plotdata\_re<-xOrder(law\_enf1)
plotdata\_re$sum=1
plotdata\_re.new<-plotdata\_re
plotdata\_re.new[,c(1)]<-logDiff2Percent(plotdata\_re[,c(1)])
plotdata\_re.new[,c(3)]<-logDiff2Percent(plotdata\_re[,c(3)])
plotdata\_re.new[,c(4)]<-logDiff2Percent(plotdata\_re[,c(4)])
plotdata\_re.new

## Es se lower upper
## Radin Umar 2005 -casualties: -68.37727 0.1151088 -227.4023 13.40652
## Mean Effect Size -62.12288 0.0928856 -94.4951 -35.13876
## Radin Umar 1995a -casualties: -51.06359 0.1572635 -228.6415 30.56201
## xorder sum
## Radin Umar 2005 -casualties: Radin Umar 2005 -casualties: 1
## Mean Effect Size Mean Effect Size 1
## Radin Umar 1995a -casualties: Radin Umar 1995a -casualties: 1

p1 <- ggplot(plotdata\_re.new, aes(x=es,
xmax=upper,
xmin=lower,
y=xorder ))
p1 <- p1 + geom\_point()
p1 <- p1 + geom\_point(size=c(3,5,3))
p1 <- p1 + scale\_shape\_manual(values=c(1:3))
p1 <- p1 + geom\_errorbarh(height=0)
p1 <- p1 + scale\_size\_manual(values=c(.5,1))
p1 <- p1 + geom\_vline(xintercept = 0, lty=1,size=.75, colour="black")
p1 <- p1 + scale\_colour\_manual(values=c("grey50","black"))
p1 <- p1 + xlab("Percent (%) Change ") +ylab ("")