National Early Warning Score (NEWS) and the care of surgical patients
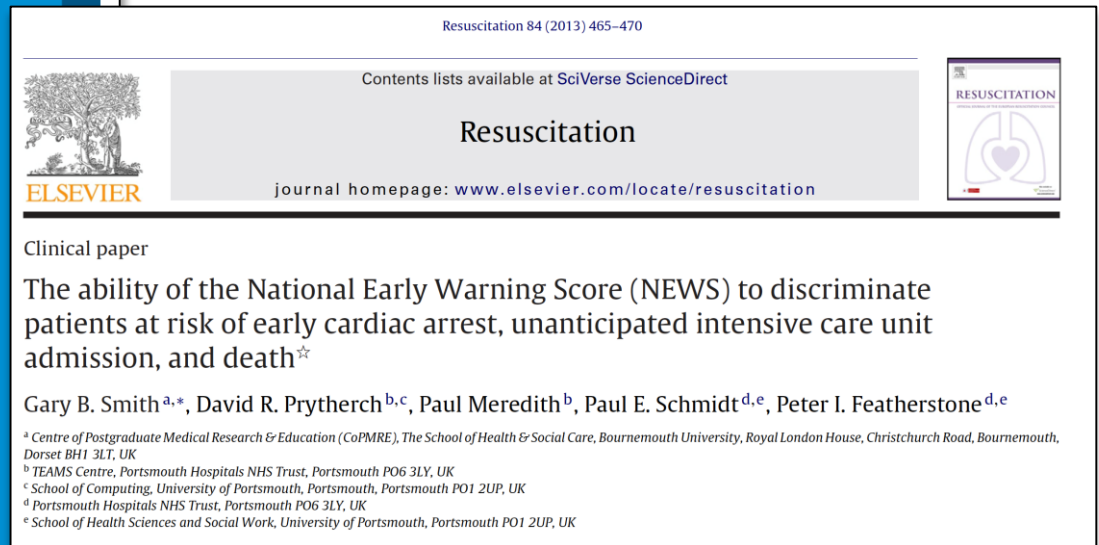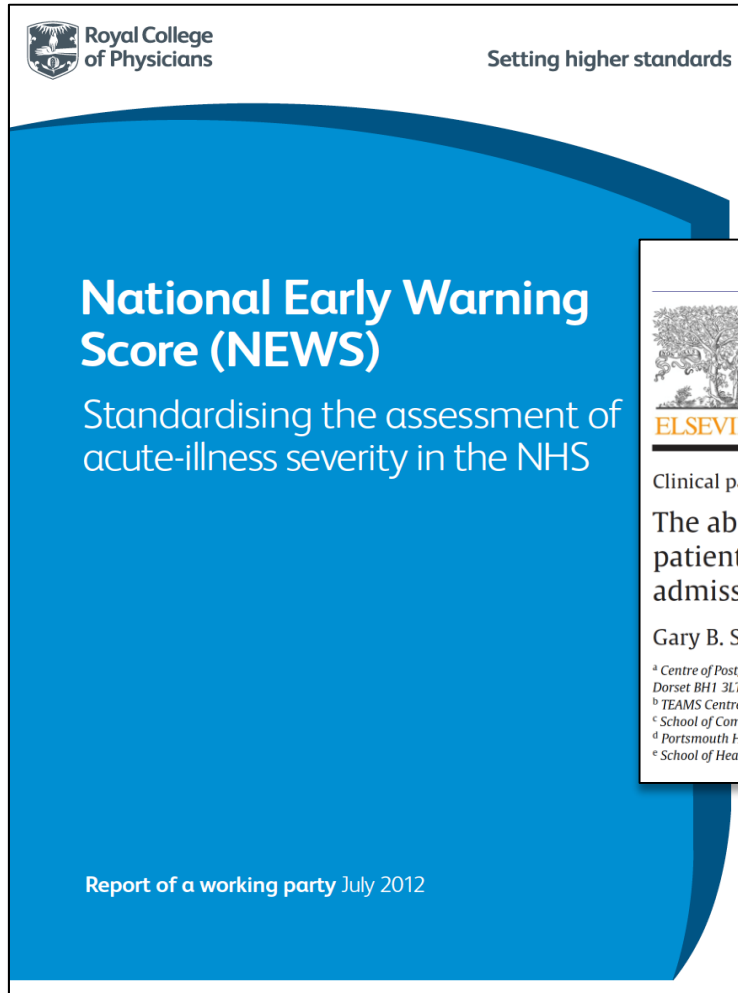
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Background

Smith et al. Resuscitation 2013;84:465-470

NEWS

National Early Warning Score (NEWS)*

PHYSIOLOGICAL PARAMETERS	3	2	1	0	1	2	3
Respiration Rate	≤8		9 - 11	12 - 20		21 - 24	≥25
Oxygen Saturations	≤91	92 - 93	94 - 95	≥96			
Any Supplemental Oxygen		Yes		No			
Temperature	≤35.0		35.1 - 36.0	36.1 - 38.0	38.1 - 39.0	≥39.1	
Systolic BP	≤90	91 - 100	101 - 110	111 - 219			≥220
Heart Rate	≤40		41 - 50	51 - 90	91 - 110	111 - 130	≥131
Level of Consciousness				A			V, P, or U

*The NEWS initiative flowed from the Royal College of Physicians' NEWS Development and Implementation Group (NEWSDIG) report, and was jointly developed and funded in collaboration with the Royal College of Physicians, Royal College of Nursing, National Outreach Forum and NHS Training for Innovation

Background

Original article

Comparison of the National Early Warning Score in non-elective medical and surgical patients

C. Kovacs[1], S. W. Jarvis[1,4], D. R. Prytherch[1,2], P. Meredith[2], P. E. Schmidt[3], J. S. Briggs[1] and G. B. Smith[5]

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Kovacs et al. BJS 2016;103:1385-1393

NEWS validated in 20,626 surgical admissions.

- Compared NEWS in non-elective medical and surgical patients

- Indicated similar (good) discrimination for in-hospital mortality in emergency surgical and emergency medical patients.

- Suggested that different NEWS trigger levels might be required for medical & surgical patients

Analysis - using RStudio

- Can connect to database via **odbc** package

- SQL Server queries can be processed in *Rmarkdown/Rnotebook* code chunks

- Pre-process data: check for NAs, NULLs etc.

- May need to recode outcome variables to 0 or 1 – instead of "dead" or "alive" etc

- Check date formats – see next slide

- Reduce dataset to required variables only

- Add National Early Warning Score (NEWS)
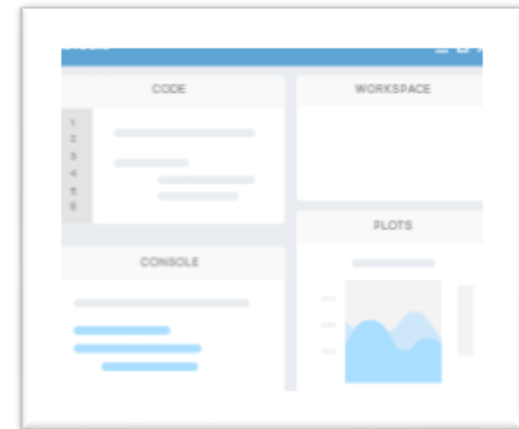
Data prep

Sample code…

```
# format date/times
y$obs_dt <- format(as.POSIXct(y$obs_dt, format =
"%d/%m/%Y %H:%M:%S", tz="GMT"))


# Add age on admission
y$adm_age <- as.numeric(difftime(y$adm_dt, y$dob,
units = 'days')/365)
y$adm_age <- floor(y$adm_age)
```

AUROCs

- **A**rea **U**nder the **R**eceiver **O**perating **C**haracteristic curve
- **pROC** package

Xavier Robin, Natacha Turck, Alexandre Hainard, Natalia Tiberti, Frédérique Lisacek, Jean-Charles Sanchez and Markus Müller (2011). pROC: an open-source package for R and S+ to analyze and compare ROC curves. BMC Bioinformatics, 12, p. 77. <doi:10.1186/1471-2105-12-77> <http://www.biomedcentral.com/1471-2105/12/77/>

Efficiency curves…

Options for function

```
# Arguments:
# - scores:    a vector of EWS scores (eg data$news)
# - outcomes: a vector indicating outcomes (eg
data$DEATH24)
# - maxscore: the maximum score encountered for the
EWS under consideration, e.g. maxscore =
max(data$news)
```

f.gen.effcurve.R (1)

```r
gen.effcurve <- function(scores, outcomes,maxscore=21){
  posscores <- 0:maxscore
  totaleps <- length(scores)
  totaloutcomes <- sum(outcomes)
  trigs <- vector()
  ints <- vector()
  for(score in 1:length(posscores)){
   trigs[score] <- 100 * length(union(which(

     scores >=  posscores[score])))/totaleps
   ints[score] <- 100 * sum(outcomes[union(which(

      scores >= posscores[score])))])/totaloutcomes
  }
```

f.gen.effcurve.R (2)

- *# make sure final member of each vector is 0 so there's a 0,0 point for area under curve*
```
  trigs[length(posscores) + 1] <- 0
  ints[length(posscores) + 1] <- 0
  ec <- data.frame(trigs_pc = trigs, ints_pc = ints)
  if(plot){
    source("functions/f.plot.effcurve.R")
    plot.effcurve(ec, ...)
  }
  return(ec)
}
```

Calling function…

```
SAny24EC <-  gen.effcurve(Surgmindata$NEWS,
  Surgmindata$P_Any24,
    maxscore =   max(Surgmindata$NEWS))


MAny24EC <-  gen.effcurve(Medmindata$NEWS,
Medmindata$P_Any24,
    maxscore = max(Medmindata$NEWS))
```

Plotting (1)

```r
# command to save image as pdf & jpg
pdf(file = "~/CHMI/Rcode/presentations/NHS-R/EC-Any24.pdf",
    width = 12, height = 8)
jpeg(file = "~/CHMI/Rcode/presentations/NHS-R/EC-Any24.jpg",

    width=8, height=5, units="in", res=300)


# plot
plotAny24 <- plot.effcurve(curves = list(SAny24EC,
MAny24EC),
    xname = "% of obs followed by P_D24 at, or above, a given EWS value",
    yname = "% of obs at, or above, a given EWS value",
    ecPtypes = c(15,16), ecCols = c("red", "blue"),

    ecLtypes = c(1, 2), ecLwidths = c(2,2))
```
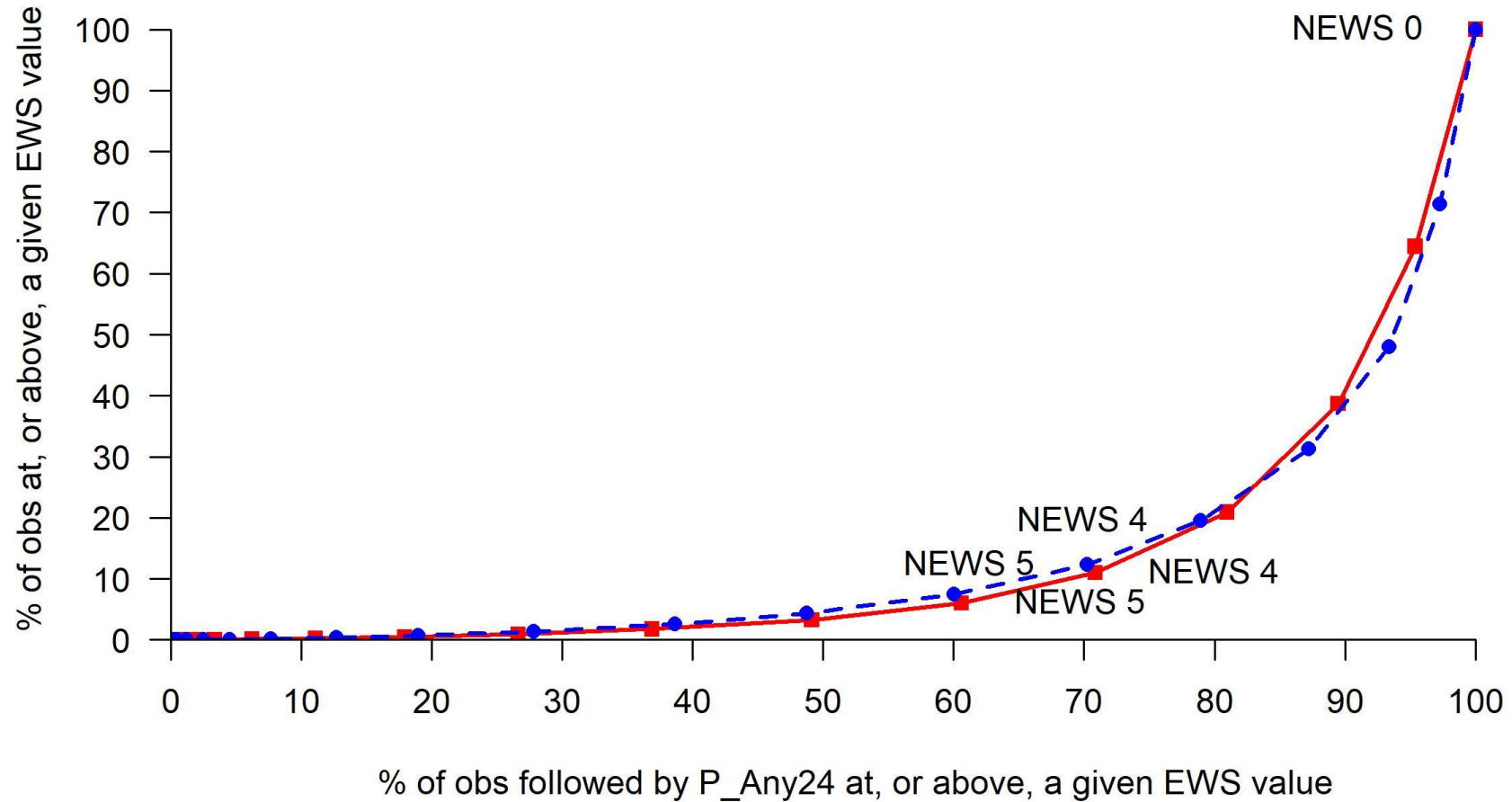
Plotting (2)

```r
# add labels to points for emphasis
text(SAny24EC$ints_pc, SAny24EC$trigs_pc,
     labels = c(NA, NA, NA, NA, "NEWS 4", "NEWS 5"
,NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,
NA), pos = 4, offset = 1.3)

text(MAny24EC$ints_pc, MAny24EC$trigs_pc,
     labels = c("NEWS 0", NA, NA, NA, "NEWS 4",
"NEWS 5" ,NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,
NA, NA, NA, NA, NA), pos = 2, offset = 1.3)


dev.off()
```

EWS Efficiency Curve

Conclusions

- NEWS showed good discrimination for adverse outcomes in surgical patients, irrespective of whether patients underwent surgery or not.

- Lower threshold required for same sensitivity in "surgery" patients as in "no surgery" subgroup.

- There is a difference in NEWS trigger points between "surgery" and "no surgery" for the primary outcome (but not for death within 24 hours)

- Do we need to do anything about it?

Thank you

- http://www.chmi.port.ac.uk/

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Stuart Jarvis
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