

IMSA  
INTEGRATED MEDICAL  
SYSTEMS ASSOCIATES  
LIMITED

CLMP  
NHS

CLARENDON LODGE MEDICAL PRACTICE

When it rains. It pours...

Hussain Al-Zubaidi

# Acknowledgments

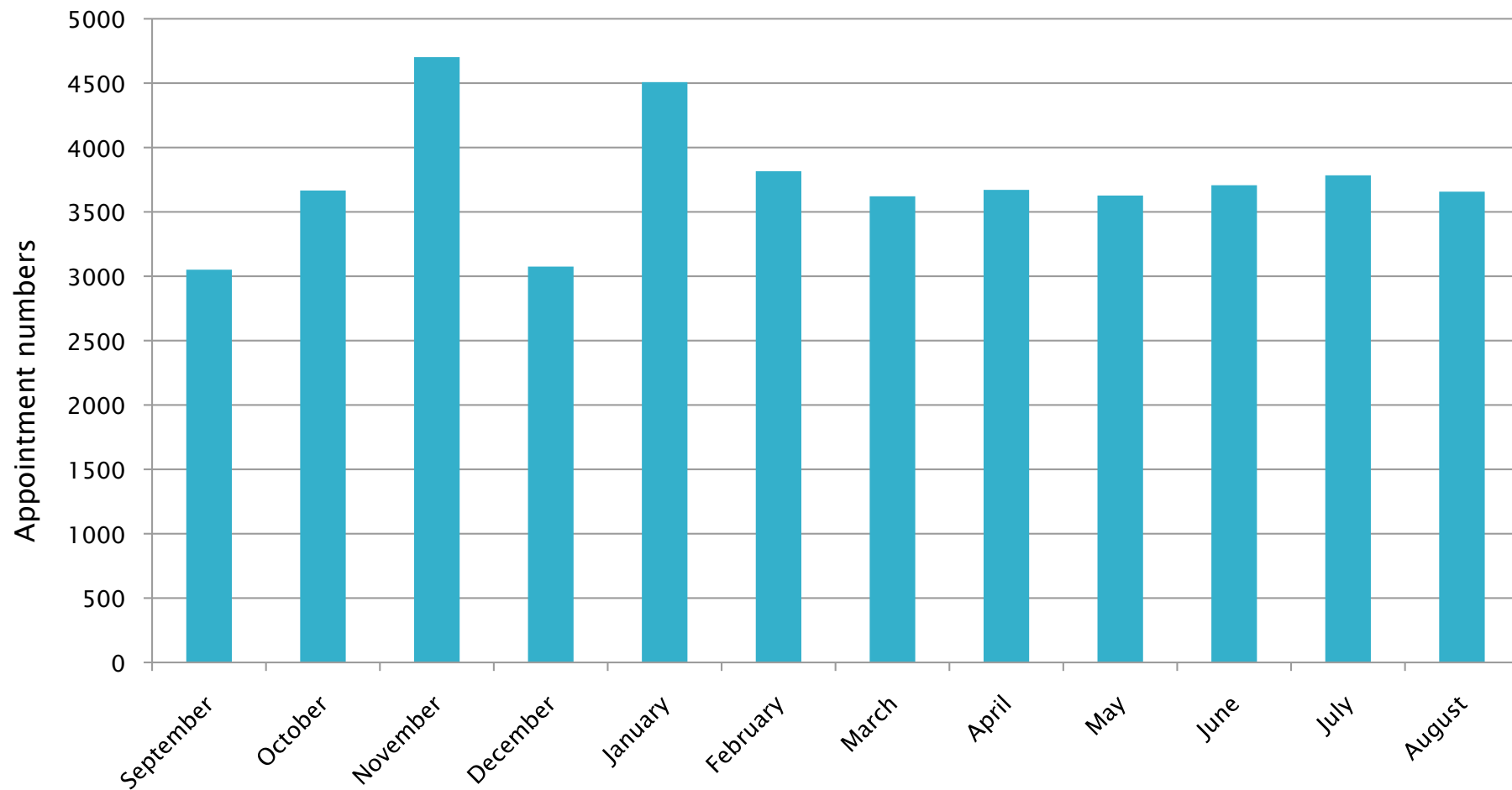
- ▶ Mr Stephen Gallagher (Practice Manager)
- ▶ Dr James Farley Nicholls (Weather analyst)
- ▶ Dr Jumana Al-Zubaidi (Associates consultant)
- ▶ Oliver Lawton (GP Partner, North Leamington Network Clinical Director)



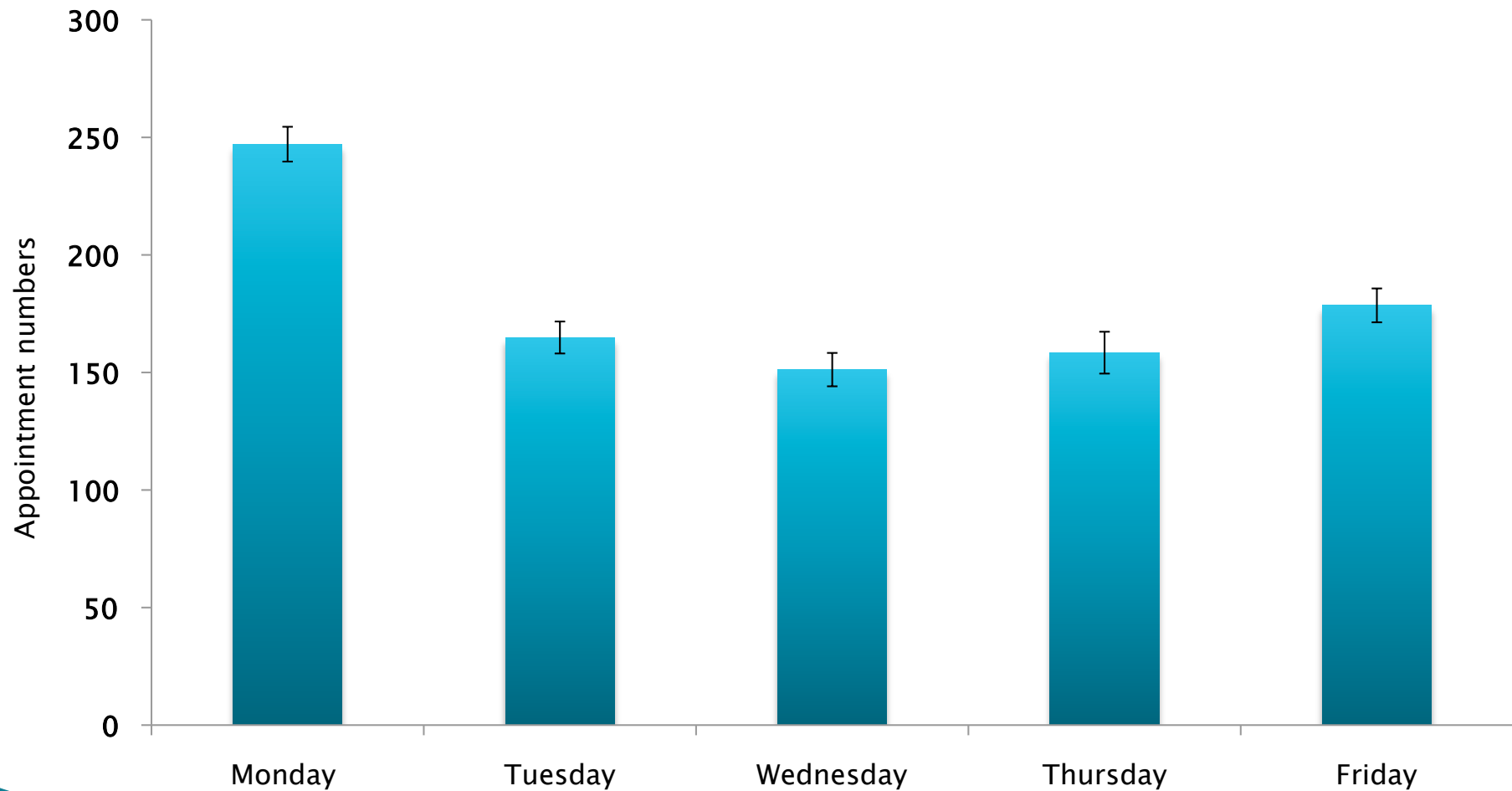


Weather  
Sporting events  
Health media  
Staffing

# Actual Demand



# Working Week



# Aims

- ▶ To explore what independent variables impact patient demand
- ▶ To be able to predict the number of telephone appointments made on a given day



# Method

- ▶ Data collected by Stephen Gallagher
- ▶ Exclusion Criteria
  - Appointments fully booked
- ▶ Weather data: Met Office, EWA & Citadel
- ▶ Health media: BBC website
- ▶ Sport dates: BBC website



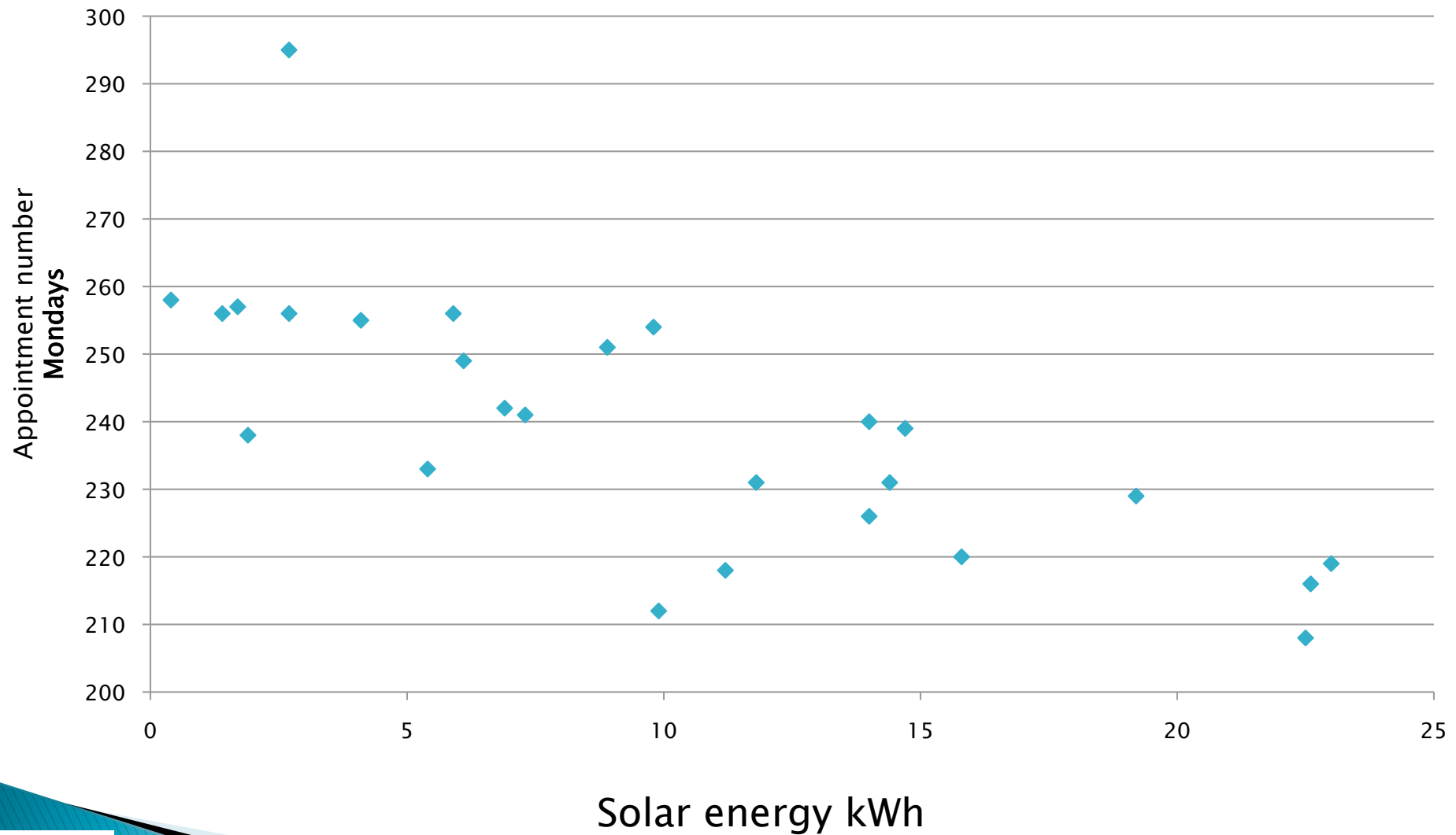
# Weather Data

- ▶ Weather category
- ▶ Temperature
- ▶ Precipitation
- ▶ Solar energy

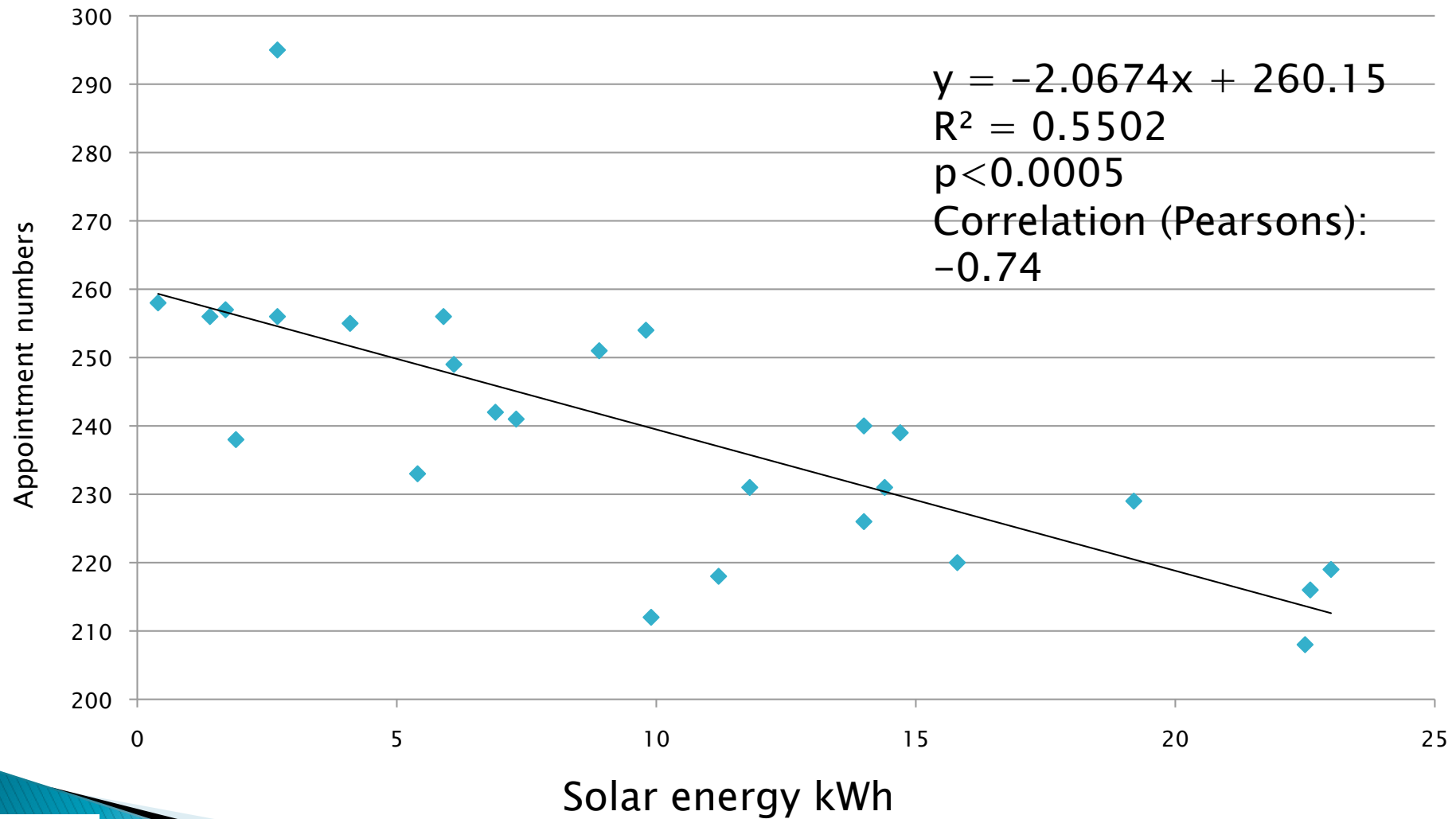
| Weather Category           | Group | Pictogram                                                                             |
|----------------------------|-------|---------------------------------------------------------------------------------------|
| Snow                       | 6     |    |
| Heavy rain (>6mm/12 hours) | 5     |    |
| Light rain                 | 4     |    |
| Overcast                   | 3     |    |
| Cloudy                     | 2     |   |
| Sunny intervals            | 1     |  |
| Sunny day                  | 0     |  |



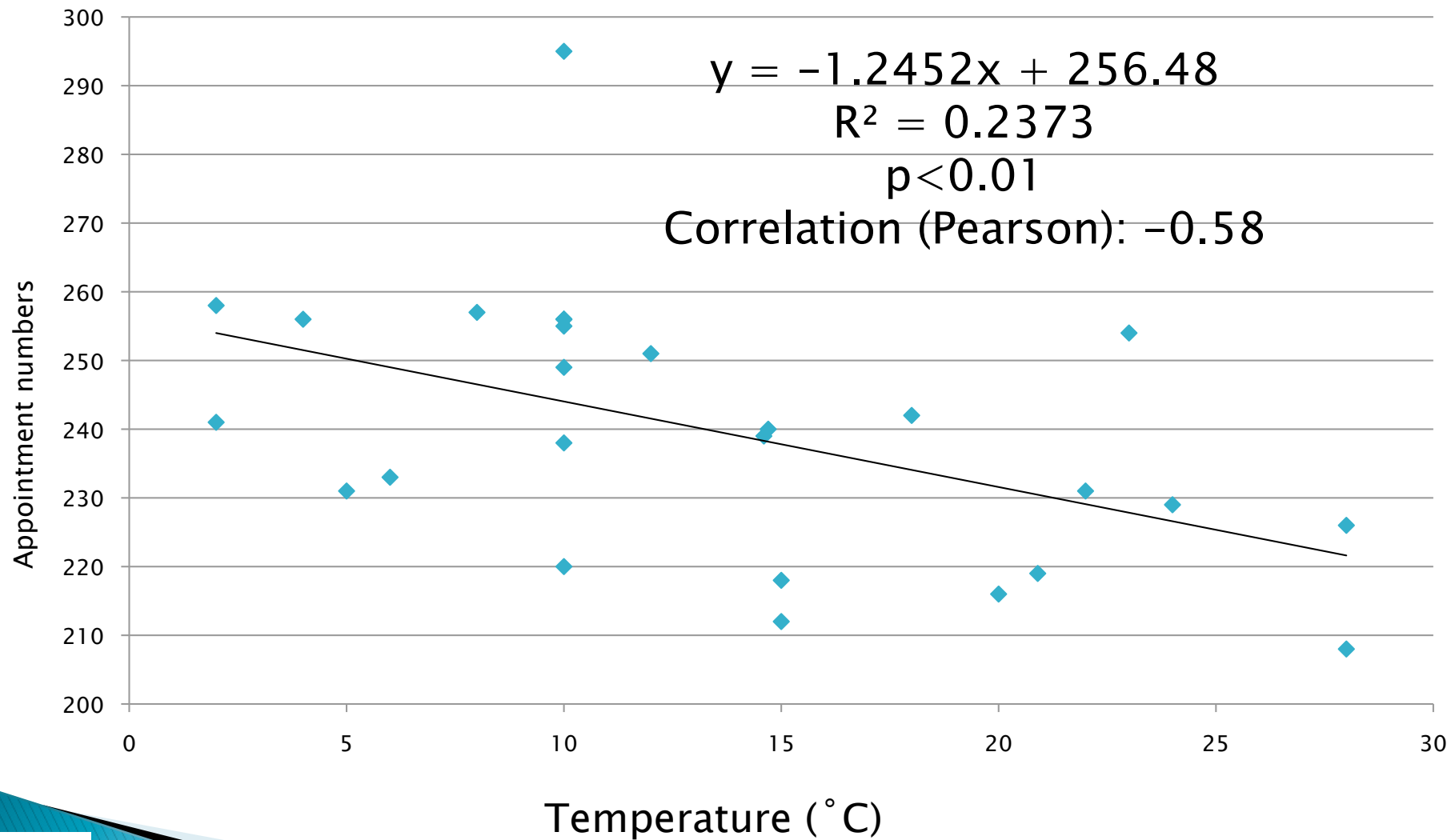
# Solar Energy



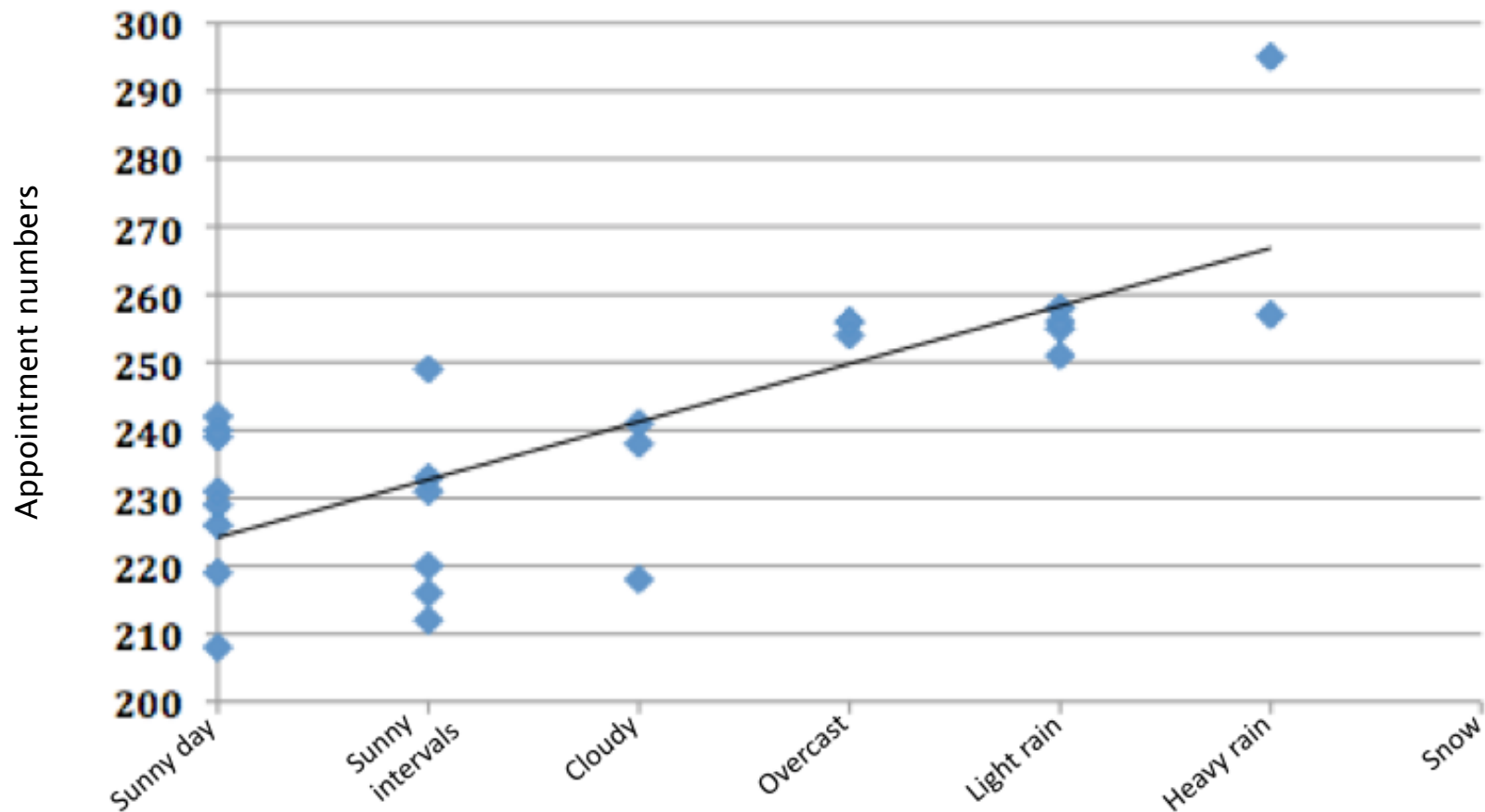
# Solar Energy



# Temperature

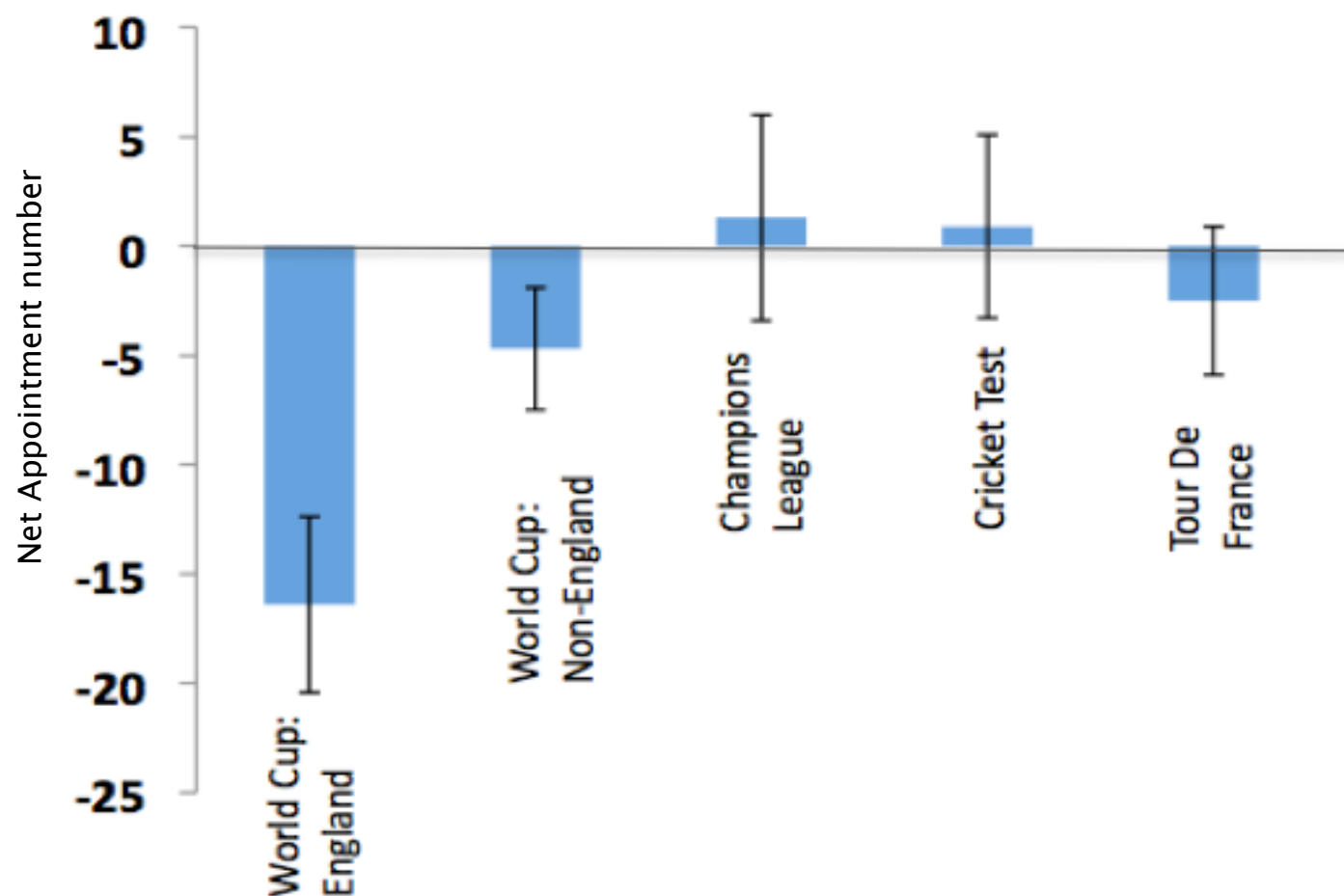


# Weather Category

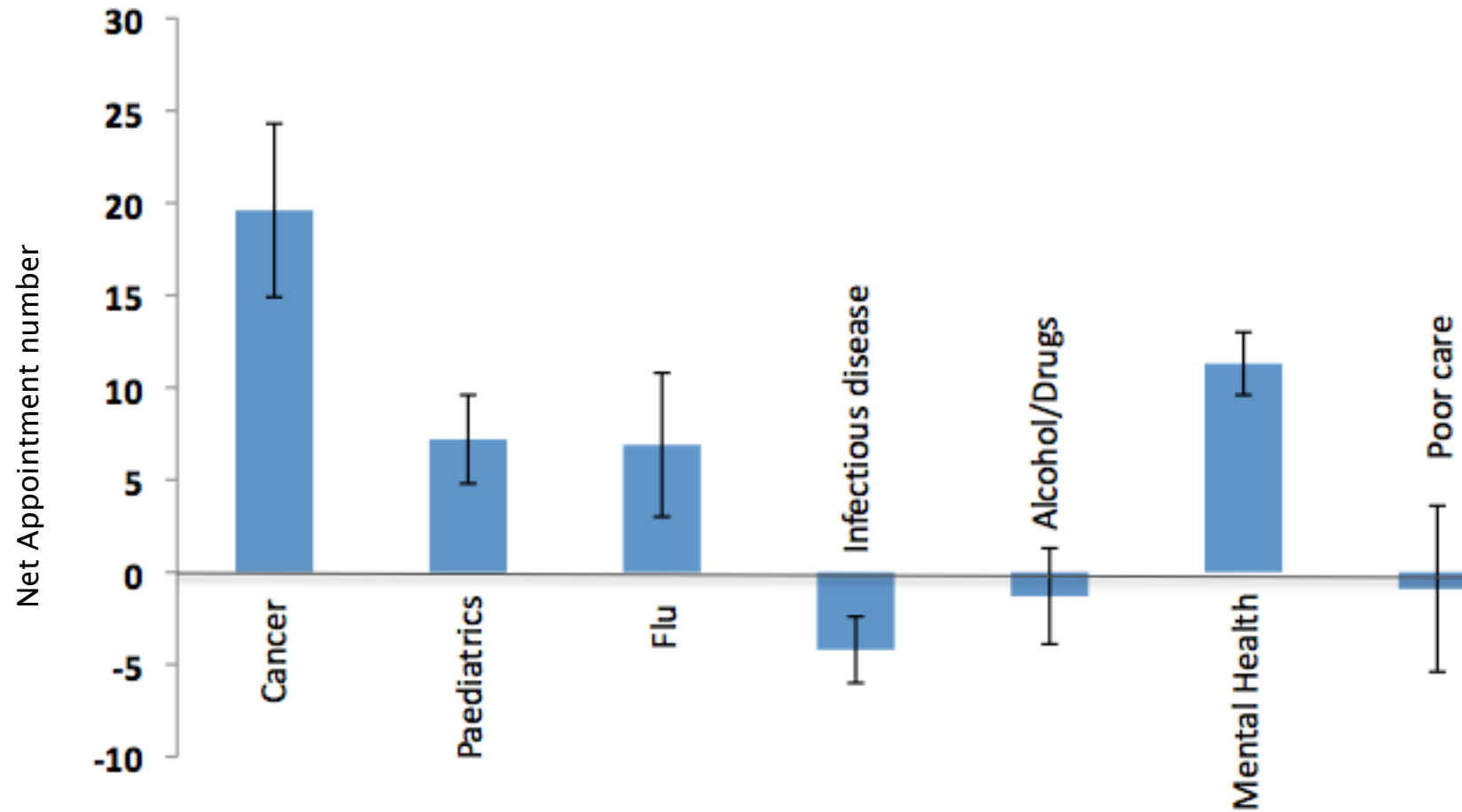


Precipitation demonstrated no statistically significant relationship with demand

# Sporting events



# Health Media



# Post-PLT / Bank Holiday

- ▶ PLT: +16.4
- ▶ Bank Holiday:  $+26.6 \pm 6.7$
- ▶ The opposite effect was found during the Christmas bank holidays:  $-23.5 \pm 6.9$
- ▶ Largest effect seen post new years



# Over-capacity effect

Day 1: Fully booked

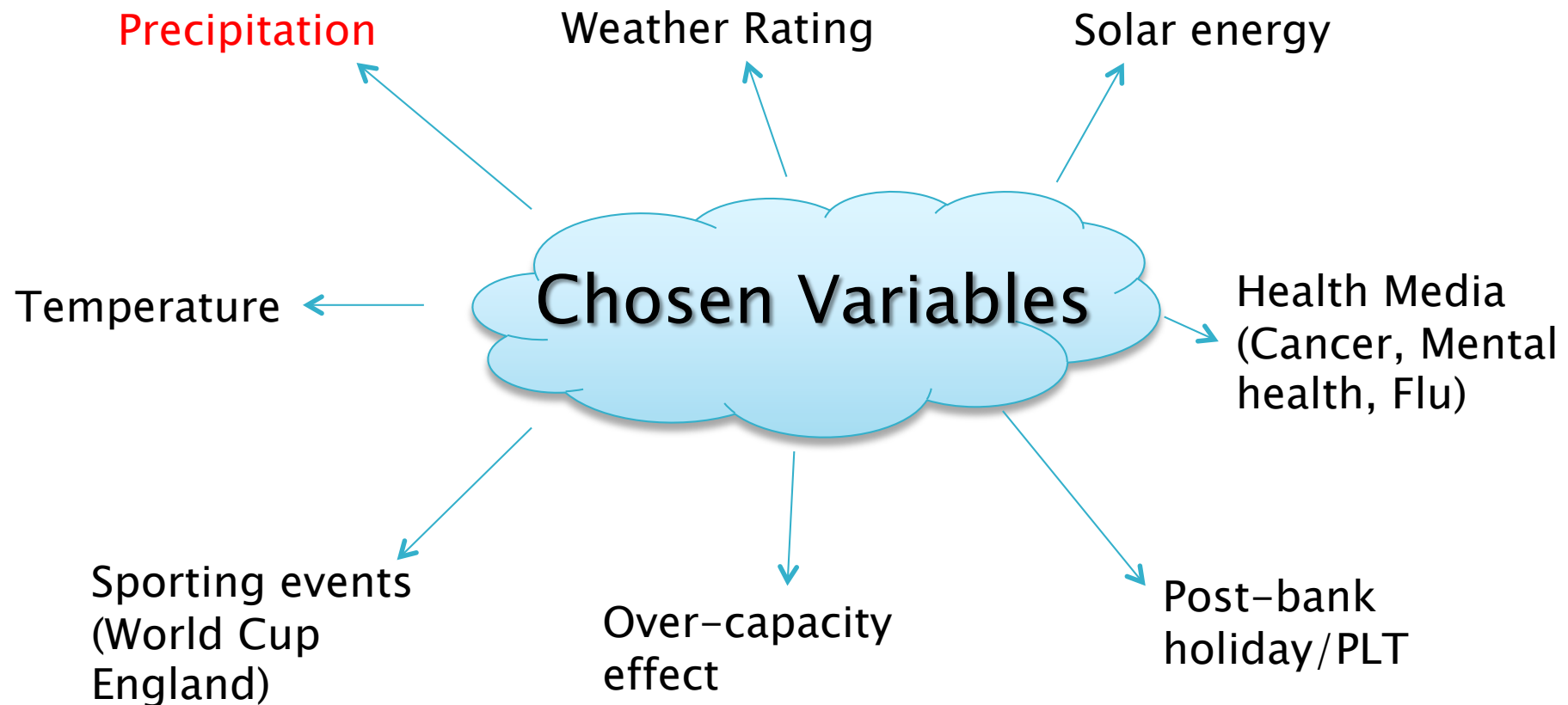
Day 2: +33.1 \*

Day 3: +9.4 \*

Day 4: +3.4



# Predictive Model: KYLIE



► Step 1: Linear regression

$$y = -2.0674x + 260.15 \text{ (Trendline)}$$

$$\text{App. no.} = (-2.0674 \times \text{Solar energy}) + 260.15$$



## ► Step 2: Multi-level regression analysis

Looks at all the 'independent variables'

Bases power on  $R^2$  and p value

Degree of accuracy in weather predictions

Produces predicted result

App. No. =  $264.171678 + (-2.506658 \times \text{Solar energy}) + (0.76855488 \times \text{Temperature}) + (-0.0846631 \times \text{Weather rating})$

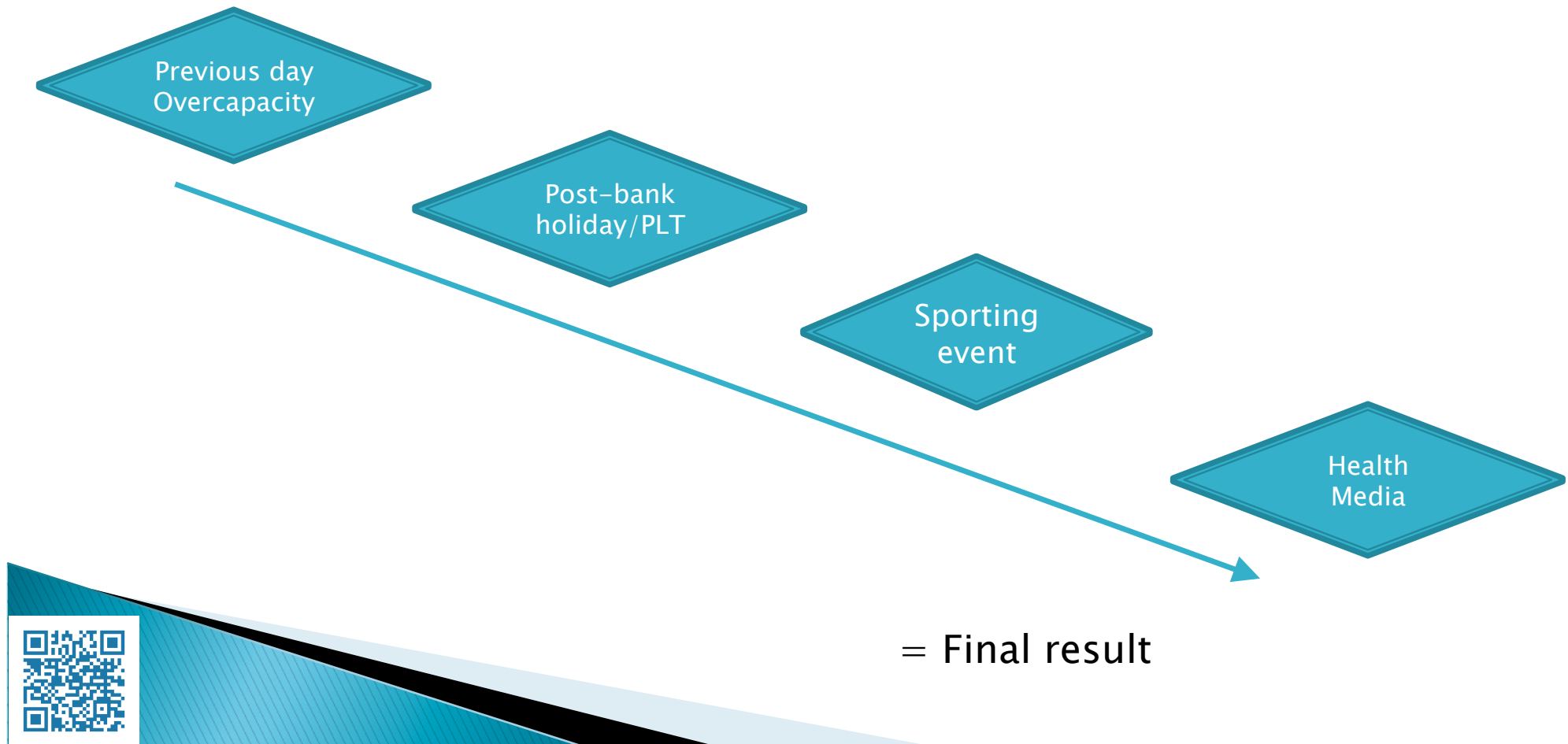
The 'Kylie equation'



► Step 3

Add in the Adjuncts where applicable

## KYLIE algorithm



# Model fitness tests

|            |     |     |
|------------|-----|-----|
| 08/01/2018 | 258 | 258 |
| 15/01/2018 | 256 | 257 |
| 22/01/2018 | 257 | 262 |
| 29/01/2018 | 238 | 246 |
| 05/02/2018 | 295 | 265 |
| 12/02/2018 | 256 | 253 |
| 19/02/2018 | 255 | 253 |
| 26/02/2018 | 233 | 241 |
| 05/03/2018 | 256 | 247 |
| 12/03/2018 | 249 | 248 |
| 19/03/2018 | 242 | 245 |
| 26/03/2018 | 241 | 244 |
| 09/04/2018 | 251 | 246 |

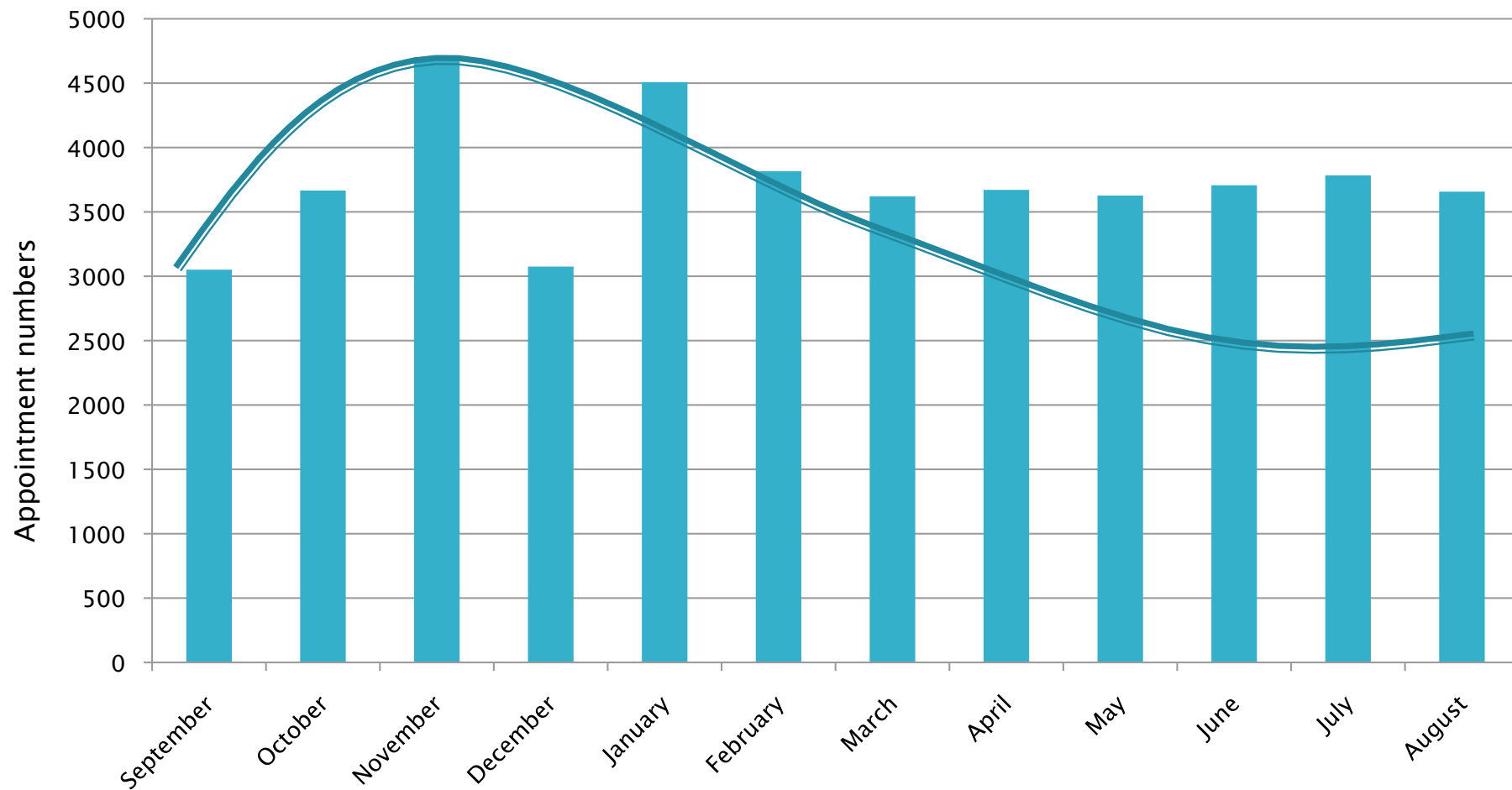
+/- 8.81 patients/day



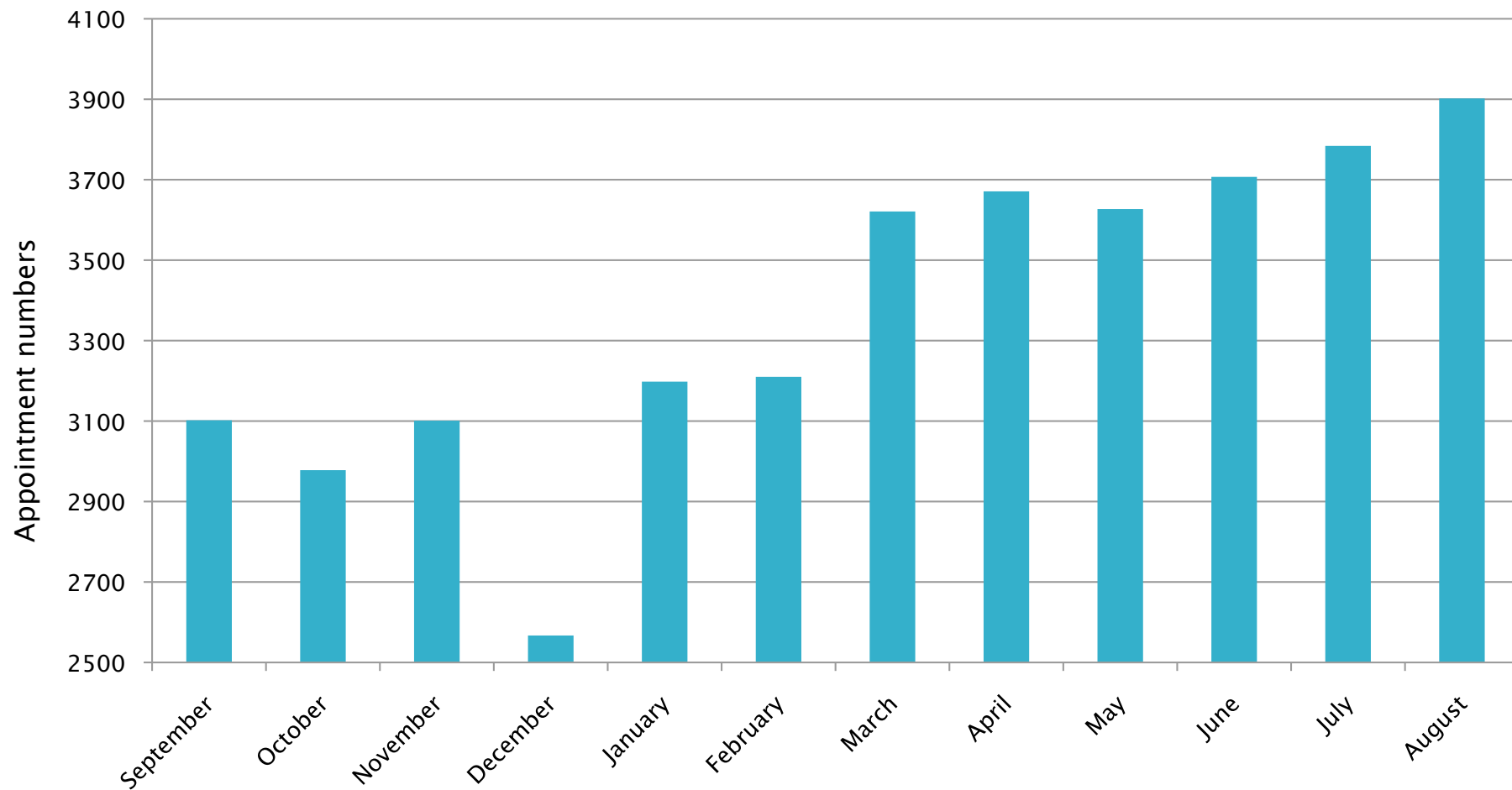
# Hidden phenomenon...



# Actual Demand



# Weather Adjusted



# The 'Rick Astley' effect

- ▶ Over **TIME** during the implementation of a new appointment system patient demand increases
- ▶ Linear relationship starting 3 months after start date
- ▶ No current sign of plateau



# Reasons?

- ▶ Patients understanding of the system improves over time
- ▶ Improved access leads to increase patient dependence
- ▶ Increase in the number of patients with multiple appointments on the same day
- ▶ Abuse of the system



# Conclusions

- ▶ Weather significantly and reliably impacts patient demand in primary care
- ▶ Specific sporting events in addition to health media also increase patient demand
- ▶ There has been a linear increase in patient demand over the last 12 months 'Rick Astley effect'
- ▶ Predictive tool KYLIE is currently accurate to about  $\pm 7.2$  once the Rick Astley equation incorporated



# Future...

- ▶ Create adaptive software
- ▶ After 2–4 years of data predictive tool can be marketed
- ▶ Form part of a training package we will deliver to prospective surgeries looking to adopt GP direct system
- ▶ Application in ongoing research to better understand patient demand in primary care



# Thank you

► Any questions?

