Role of medical advances in population longevity improvement. A case study on statins.

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About the speaker

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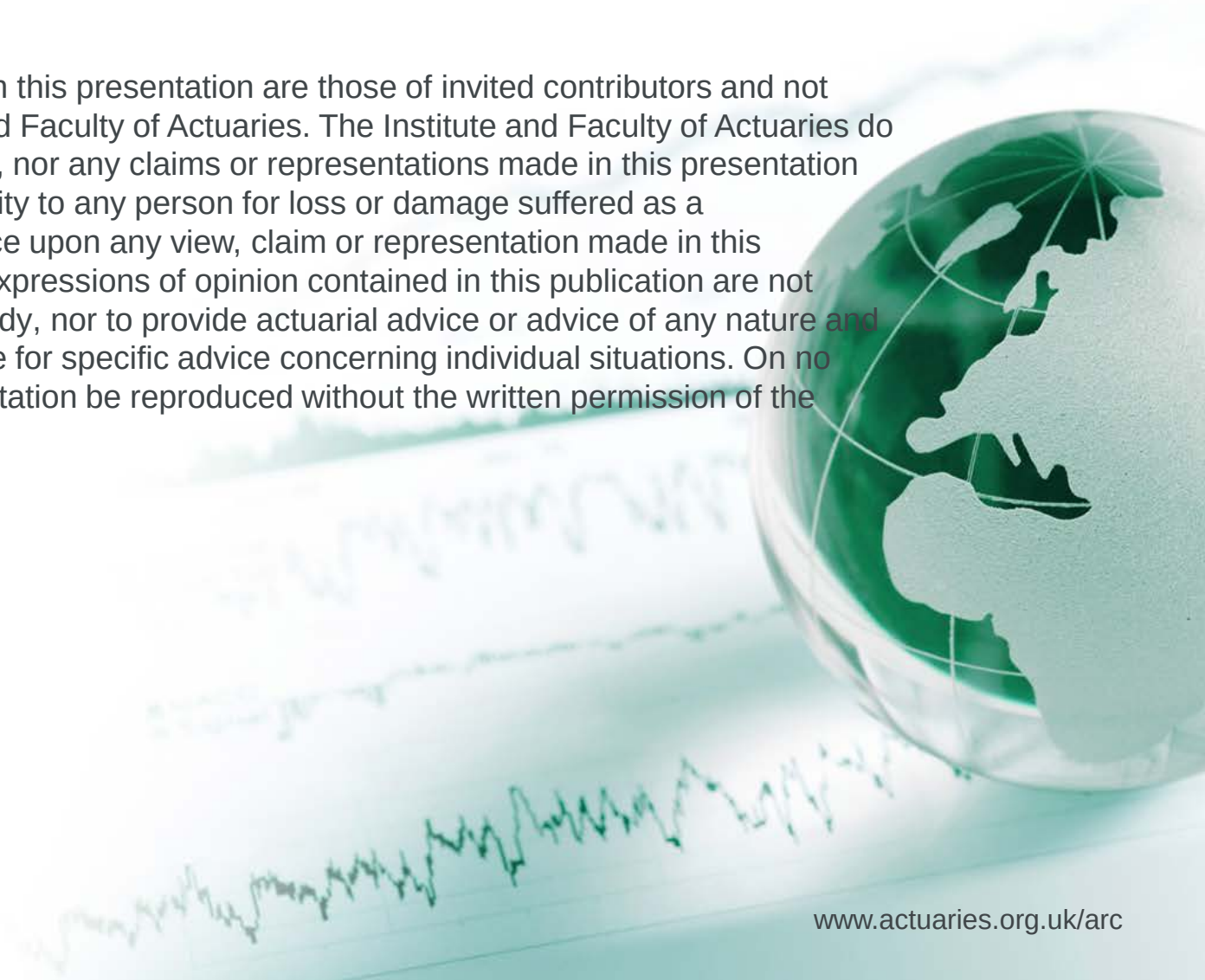


Quantifying longevity changes

- Medical advances are the major drivers in the longevity increase. But how to quantify this relationship?

- Our research uses The Health Improvement Network (THIN) primary care data, to develop statistical models of longevity.

- The advantage of using individual-level medical data is that it is possible to model both the uptake of medical treatment and the effect of that treatment on longevity conditional on the individual sociodemographic and health factors instead of the aggregated profile.

Recent changes in mortality improvements

"From 1968-2010, 70% of all mortality improvements can be attributed to the fall in deaths from circulatory diseases.

…

The period 2011-16 saw much lower mortality improvements in circulatory diseases."

Jon Palin *on behalf of the CMI Mortality Projections Committee,*
Mortality improvements in decline *The Actuary, 2017/08*

Drivers of these changes

- But what were the drivers of this rapid improvement and the consequent decline in longevity improvement rates?

- We show that these developments in longevity are mainly due to statins, cholesterol lowering drugs prescribed to prevent cardiovascular disease (CVD).

Data

- The Health Improvement Network (THIN) data
  - Medical records from primary care
  - Representative of the UK when adjusted for deprivation
- All patients born before 1960 and followed to 01.01.2017, this includes 3.5 million patients
- Added various social economic status variables such as Townsend score, IMD and Mosaic

New Guidelines on Primary prevention of CVD

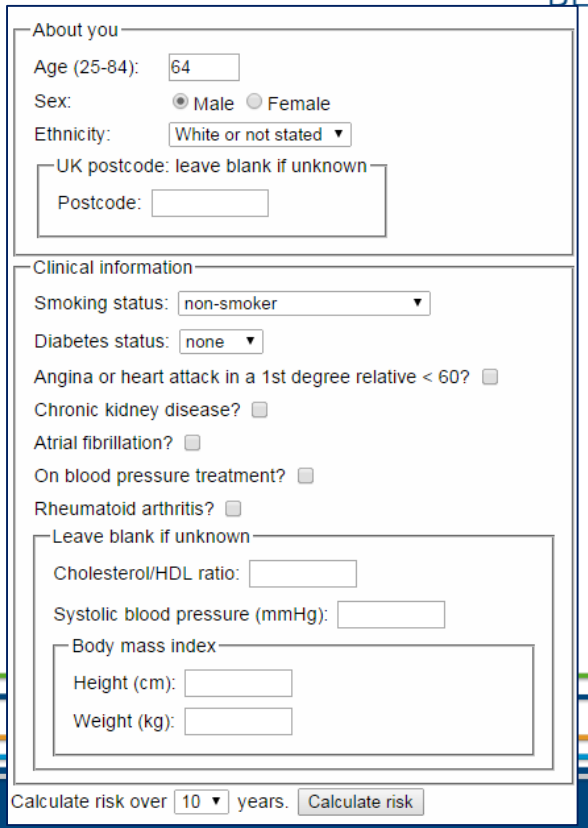
Primary prevention: no previous history of CVD

- Example: lipid-lowering therapy - statins

National Institute of Health and Clinical Excellence (NICE):

- *Offer atorvastatin 20 mg for the primary prevention of CVD to people who have a 10% or greater 10-year risk of developing CVD.*
- *Estimate the level of risk using the QRISK2 assessment tool*
- www.nice.org.uk/guidance/cg181/
- www.qrisk.org/2016/

Up to 17 million UK residents eligible for statins



Design and Data Selection

- Population-based retrospective cohort study
- Restrictions data:
  - Medical records from 1987 to 2011 of people born between 1920 and 1940
- Target ages:
  - 60, 65, 70, and 75 [between 115,000-250,000 patients, 52-58% women]

- Exclusion:
  - Patients with a history of cardiovascular disease

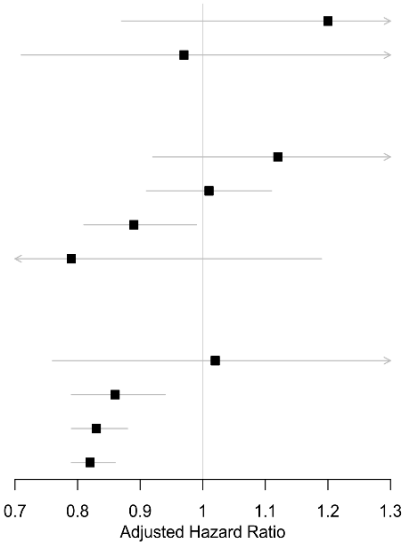
Gitsels L.A., Kulinskaya E., Steel N. (2016) Survival Benefits of Statins for Primary Prevention: A Cohort Study. PLoS ONE **11**(11): e0166847. doi:10.1371/journal.pone.0166847

Gitsels, L. A., Kulinskaya, E., & Steel, N. (2017). Survival prospects after acute myocardial infarction in the UK: A matched cohort study 1987-2011. *BMJ Open*, *7*(1). http://doi.org/10.1136/bmjopen-2016-013570

QRISK groups by age over time

Hazard ratios of mortality with statins

QRISK2 at baseline	Statins Deaths (%per annum)	No LLT Deaths (%per annum)	Adjusted HR (95%CI)
<10%			
Age 60	43 (0.59)	5,027 (0.68)	1.20 (0.87–1.67)
Age 65	41 (0.59)	2,899 (0.71)	0.97 (0.71–1.34)
10–19%			
Age 60	124 (1.19)	8,921 (1.42)	1.12 (0.92–1.36)
Age 65	470 (0.94)	17,187 (1.52)	1.01 (0.91–1.11)
Age 70	486 (0.94)	14,639 (1.67)	0.89 (0.81–0.99)
Age 75	30 (1.35)	1,618 (1.76)	0.79 (0.52–1.19)
>=20%			
Age 60	52 (1.99)	1,012 (2.50)	1.02 (0.76–1.36)
Age 65	663 (1.79)	7,348 (2.89)	0.86 (0.79–0.94)
Age 70	2,142 (1.93)	23,070 (3.16)	0.83 (0.79–0.88)
Age 75	3,094 (2.53)	32,279 (3.61)	0.82 (0.79–0.86)

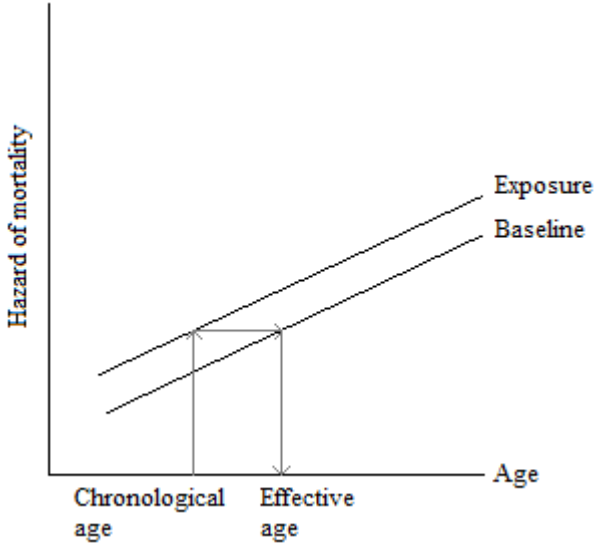


Cox regression with frailty on GP practice. HRs adjusted for sex, year of birth, deprivation, diabetes, high cholesterol, blood pressure regulating drugs, body mass index, smoking status

What does this mean for longevity

- Using Gompertz law, the increase in annual hazard of mortality associated with ageing one year is approximately constant between ages 30 and 95
- For England and Wales in 2010-2012, the increase in the hazard between those ages was approximately 1.1.
- A HR can be translated to the numbers of years gained in effective age as log HR/ log (1.1)≈ 10*log(HR).

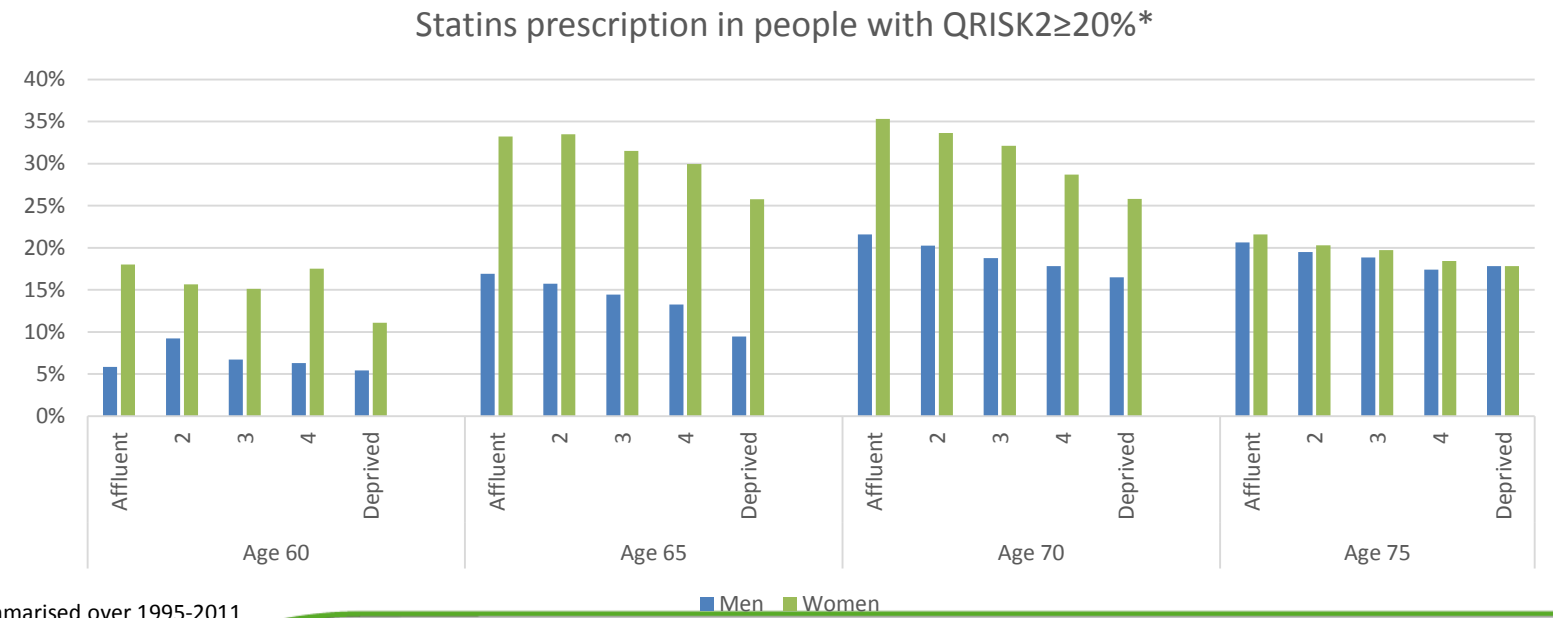
[Brenner, 1993; Spiegelhalter, 2016]



Translating to population life expectancy

- Take a period life table
- Calculate effective age changes due to a health intervention in relevant subpopulations [risk group, age, sex and deprivation status]
- The longevity improvement associated with statin prescription translates to a decrease in effective age of up to two years
- Take into account uptake rates in these subgroups
- Population LE is the weighted average of the LE in these subgroups

Prevalence of statins prescription for primary prevention of cardiovascular disease by deprivation quintiles (Townsend)

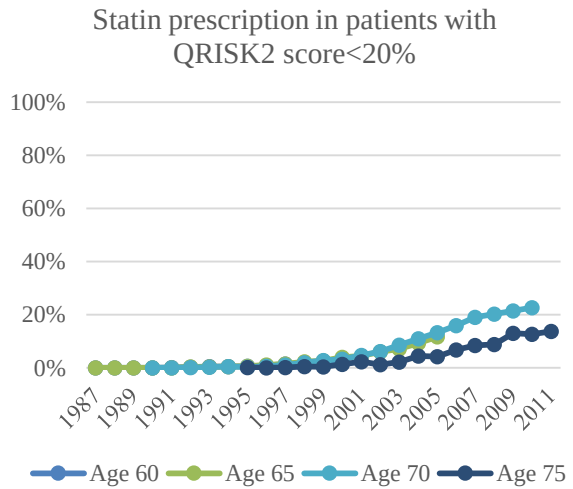


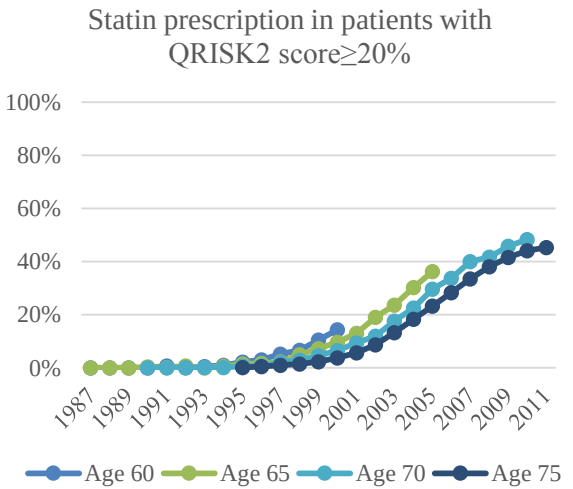
*summarised over 1995-2011

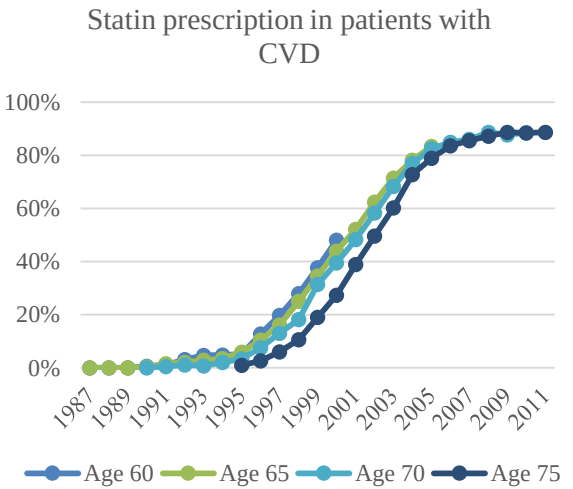
Impact of Recent changes in Guidelines:
the increase in overall life expectancy(yrs) if all eligible people were prescribed statins

	Age 70			Age 75	
Townsend deprivation quintile	Women	Men		Women	Men
1st (least)	0.74-0.76	0.82-0.84		1.08-1.09	0.86-0.88
2nd	0.75-0.76	0.82-0.85		1.04-1.06	0.76-0.78
3rd	0.74-0.76	0.81-0.84		0.92-0.94	0.78-0.80
4th	0.70-0.72	0.77-0.80		0.89-0.90	0.80-0.82
5th (most)	0.62-0.65	0.80-0.83		0.75-0.76	0.63-0.65
Total	0.73-0.75	0.81-0.84		0.98-0.99	0.79-0.81

Statins prescription rate by age-risk group







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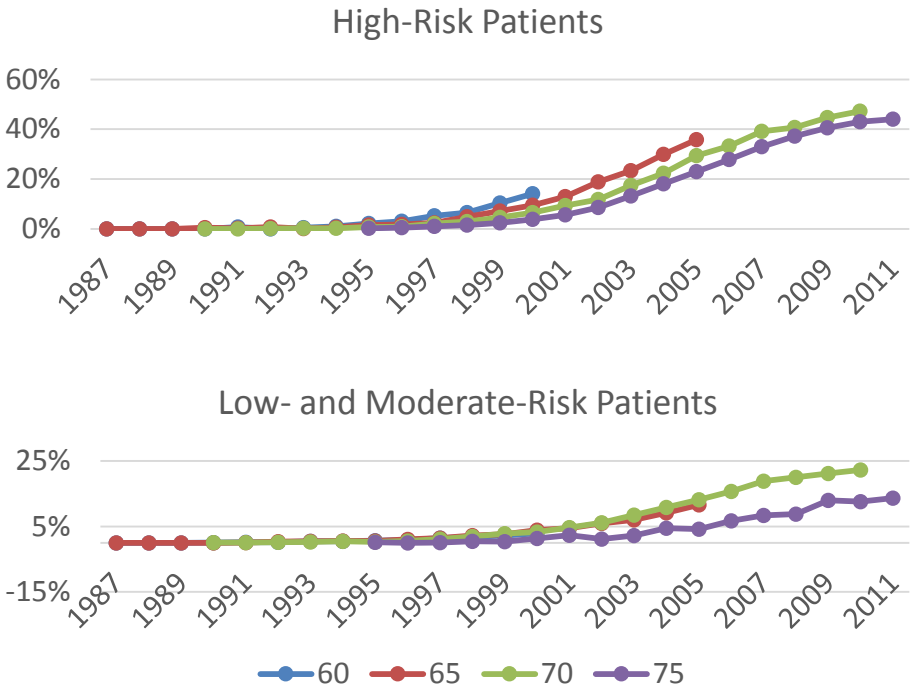


How much statins have already contributed to the increase in current LE?

The LE of 1987, when statins were introduced to the healthcare market, was compared to the LE of 2010 as it is and as if there was no statin prescription.

The increase in LE from 1987 to 2010 in women was 2.7 and 2.2 years at ages 70 and 75, and in men 3.7 and 2.8 years at ages 70 and 75.

Statins contributed to 74% (60-89%) of this increase in LE at age 70 and to 57% (45-71%) of this increase at age 75.

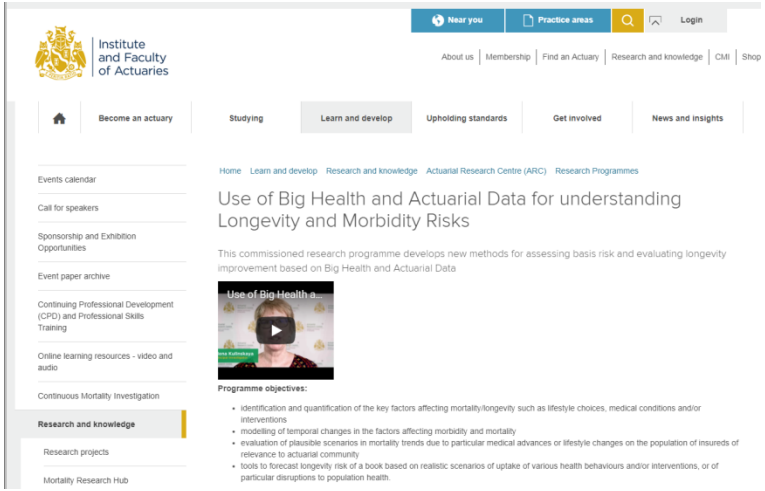
Conclusions

- Longevity improvement due to statins is already in part incorporated in the national LE due to the 90% prescription rate in CVD survivors.

- Our results agree amazingly well with the conclusions by the CMI. However, the national LE would further increase by up to one year if all eligible people under the current guidelines would be prescribed statins.

- Methodology is easily applied to future health interventions such as newly recommended by the American Heart Association (2017) intensive blood pressure control.

Find out more



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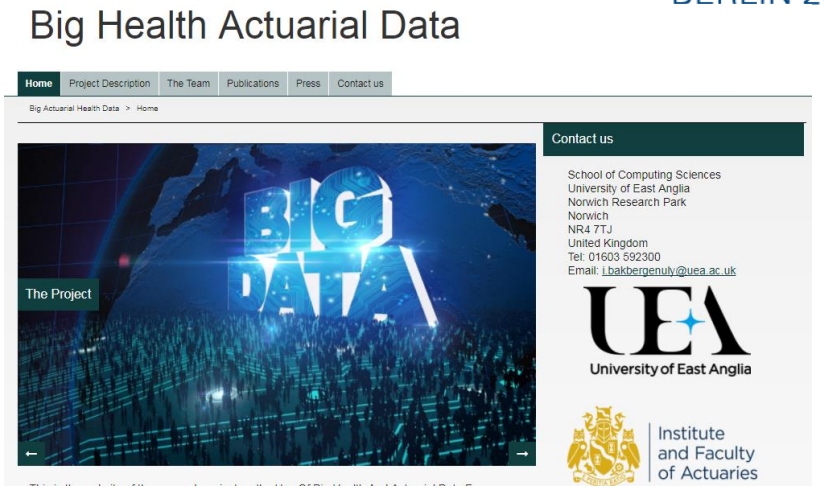

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Thank you very much for your attention!

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