

A Case Study for Modelling Endoscopy Demand for Capacity Planning in South Devon and Torbay NHS Foundation Trust

Outline of the presentation

- Endoscopy services
- Case study organisation
- Analytic framework and introduction to hybrid systems modelling
- Modelling demand for the planning of endoscopy services
- Previous studies on hybrid approach
- Forecasting with DES model
- Conclusion

GI Endoscopy Services

Colonoscopy

Sigmoidoscopy

Oesophago-gastro-duodenoscopy (Upper OGD)

Scoping the Future: Report for Cancer Research UK (Brown et al., 2015)

- 44% increase in national demand 2013/4 to 2019/20
 - Approximately 25% due to demographic change
 - Approximately 50% due to changes in National BCSP
 - 10% due to changes in NICE referral guidelines
 - 7% due to public awareness campaigns
- Can this be made more specific to the local area?

Torbay and South Devon NHS Foundation Trust

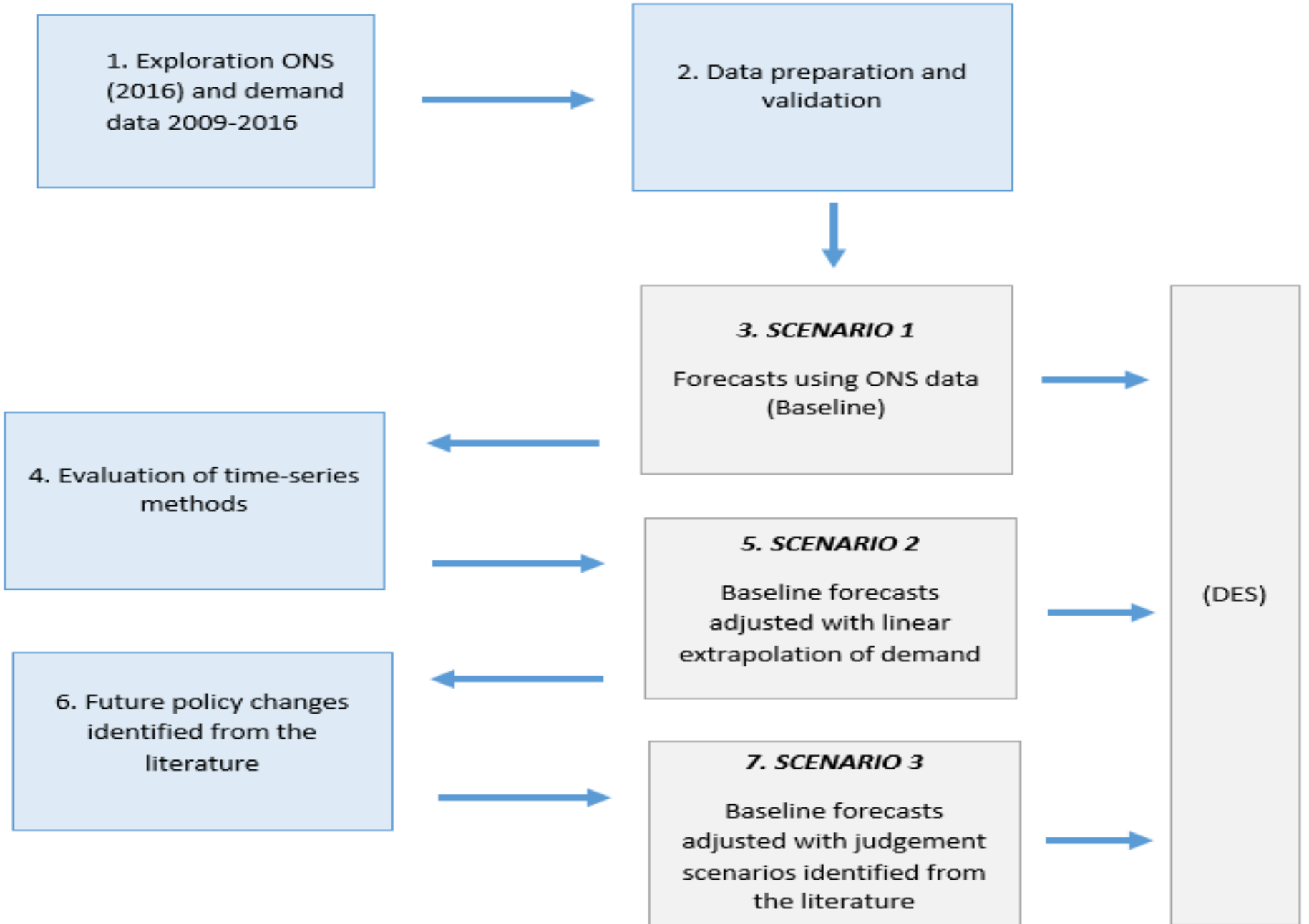
South Devon and Torbay CCG population 280,000

11% aged over 75 years; compared with 8% nationally

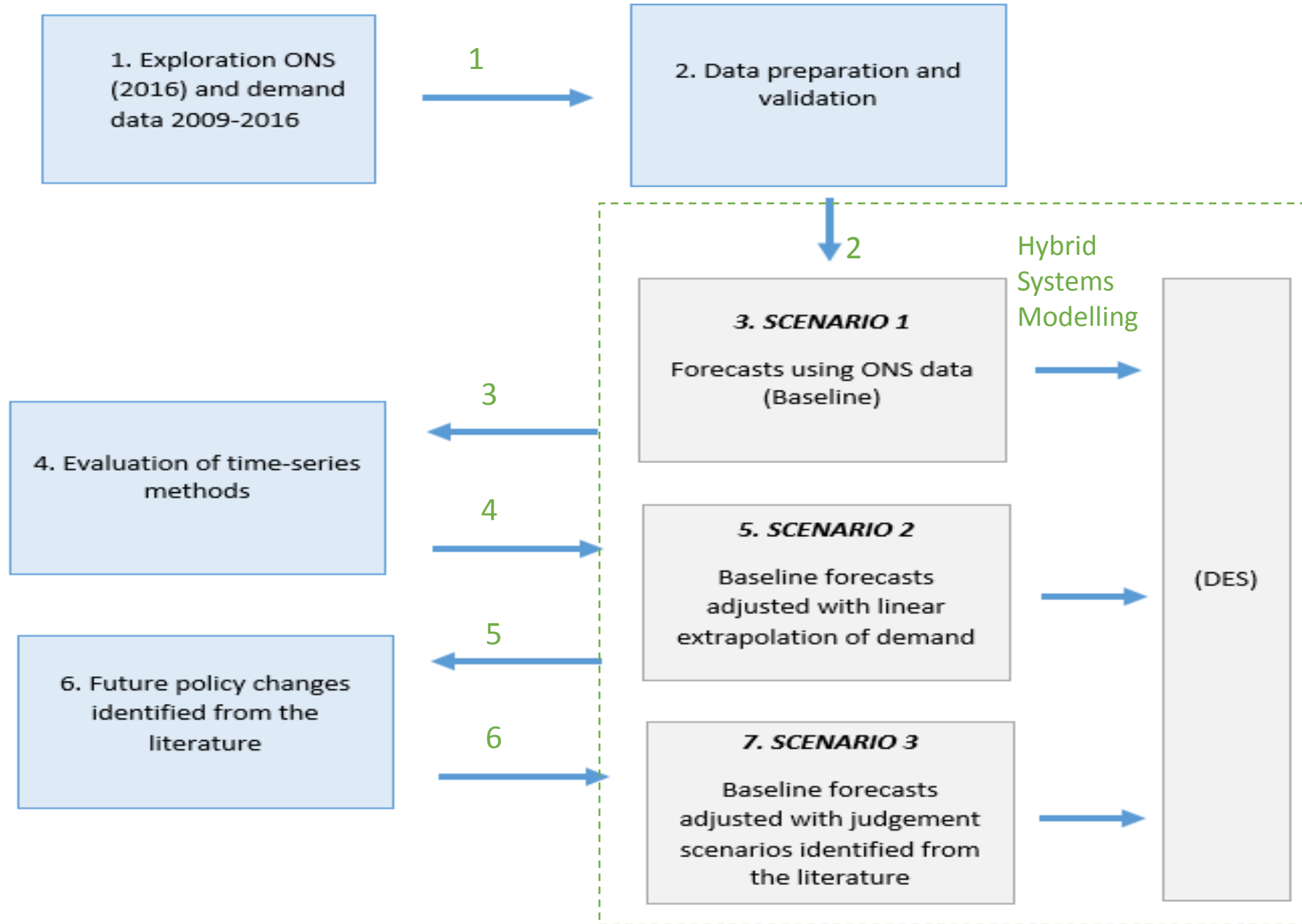
GI endoscopy services provided at Torbay Hospital, over 7000 procedures per year, increased 14% from 2012



Analytic Framework



Analytic Framework



Hybrid M&S Study/Hybrid Systems Modelling

Problem Formulation/Conceptual Modelling

Input/Output Data and Analytics

Business Intelligence

Big data and Analytics

Forecasting Techniques

Model Development (can be hybrid simulation)

Agent-based Simulation

System Dynamics

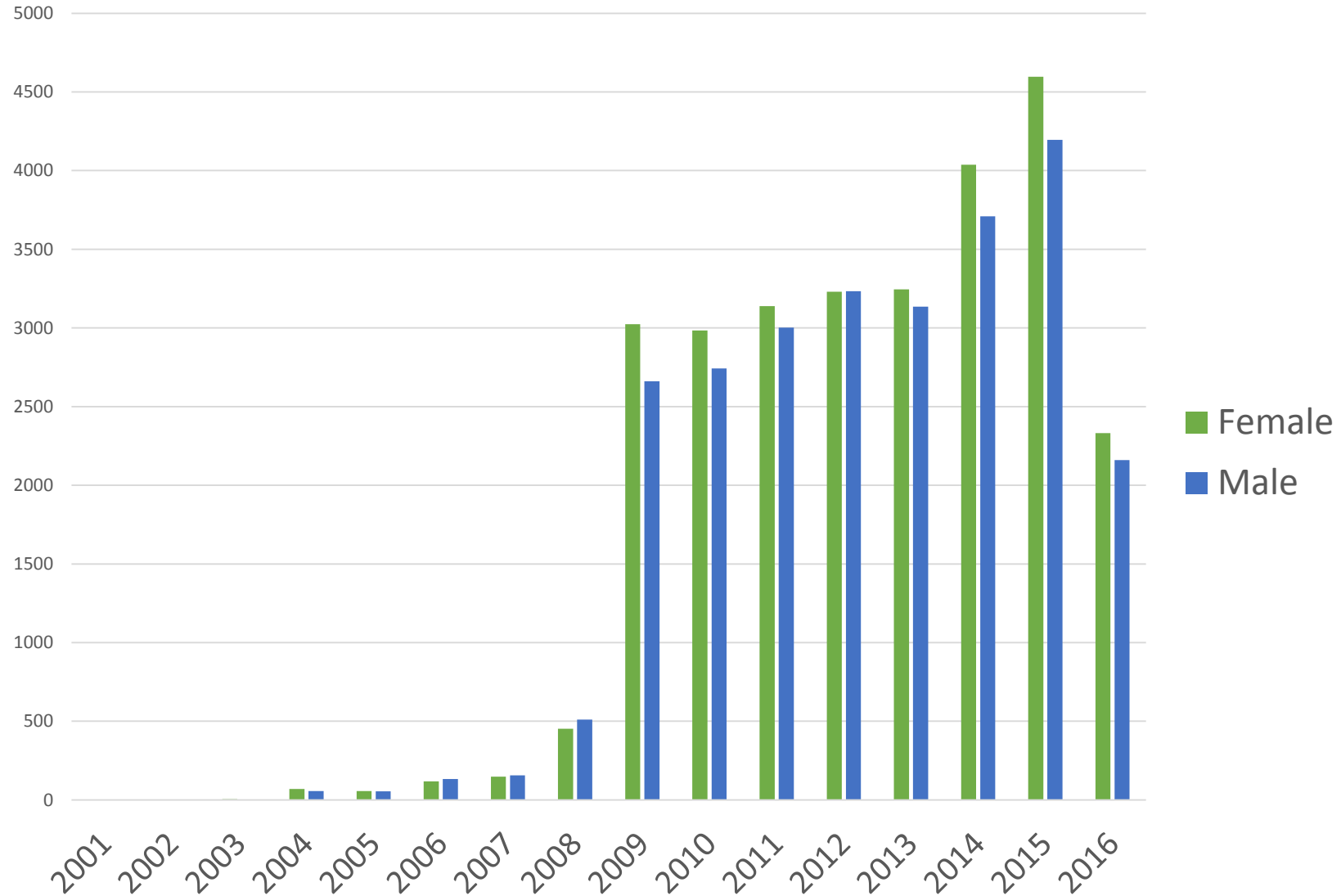
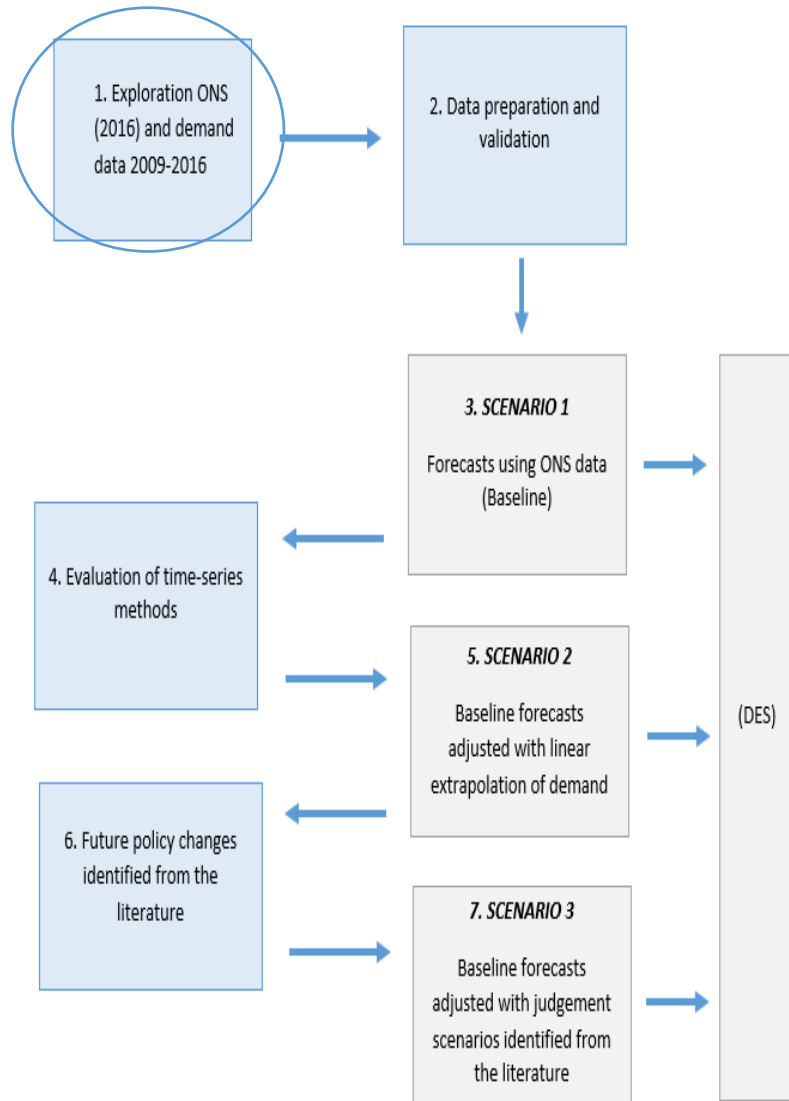
Discrete-event Simulation

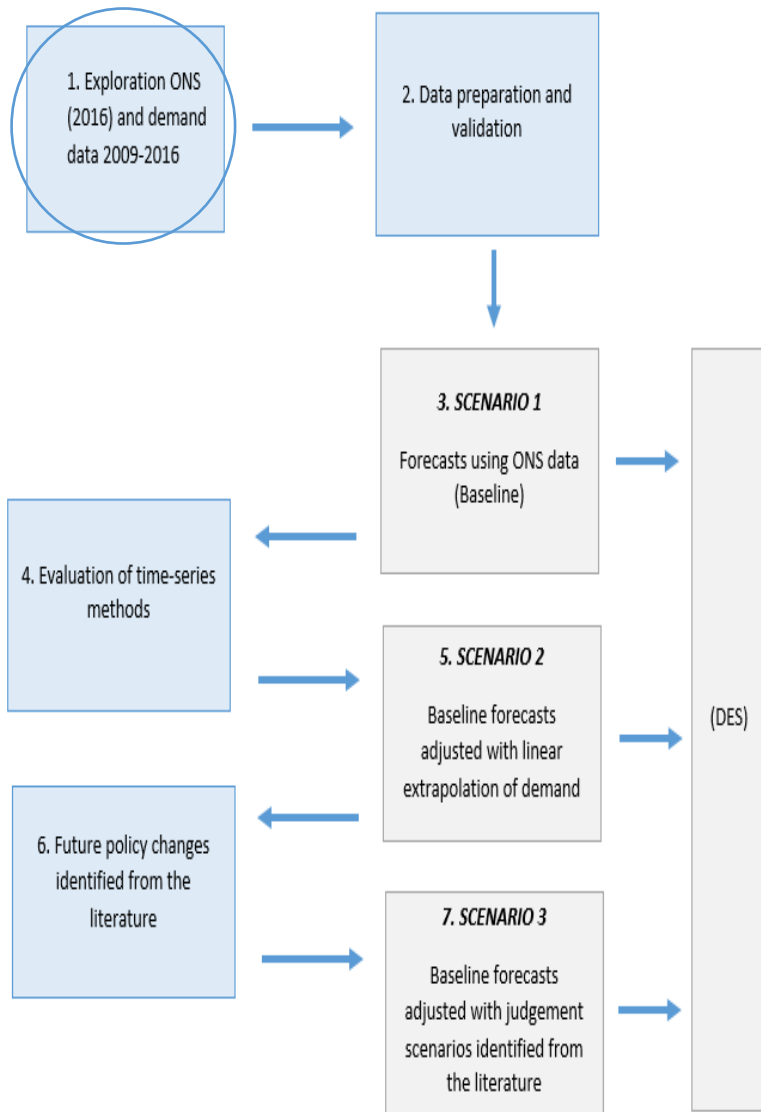
Monte-Carlo Simulation

Model Formalism

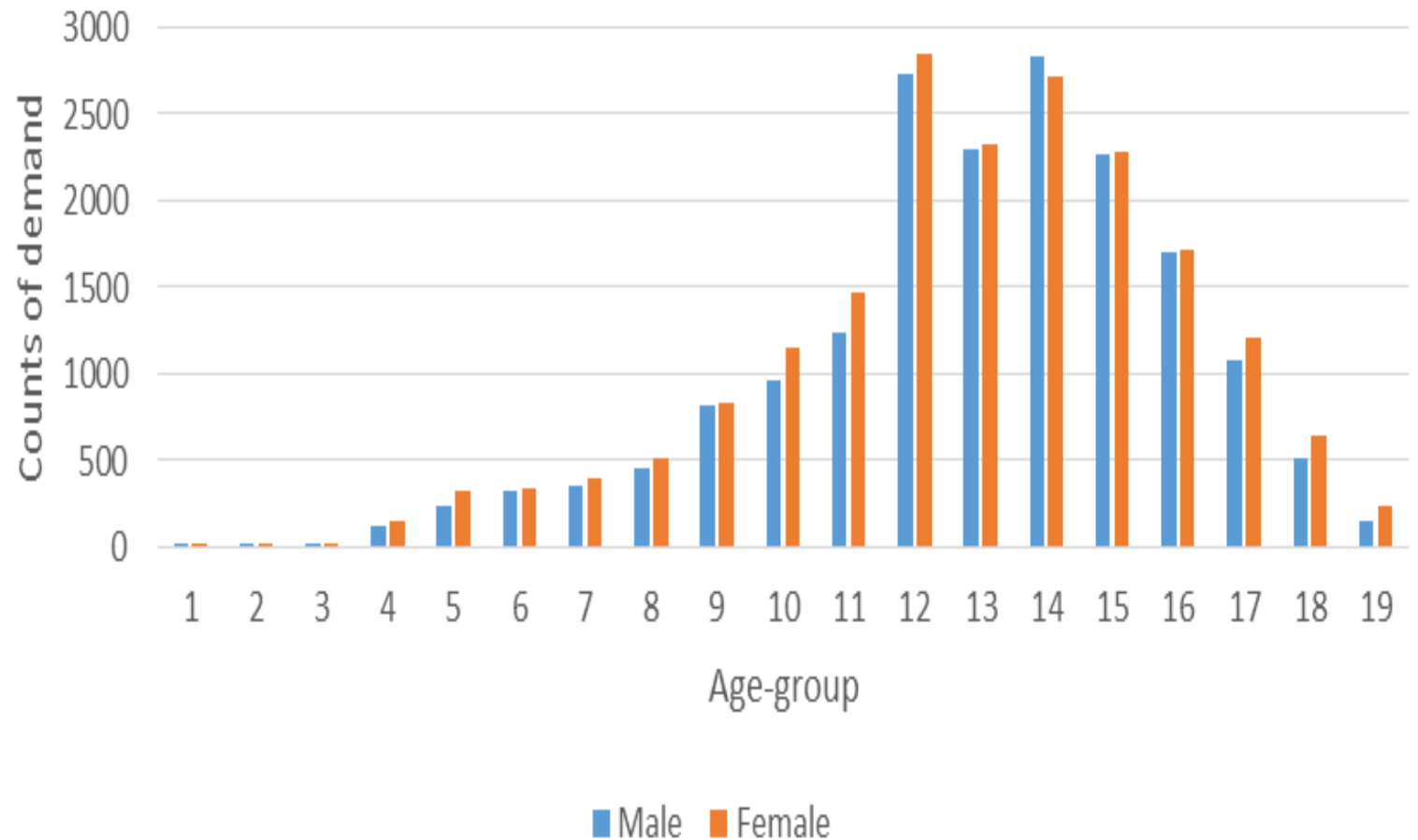
Experimentation

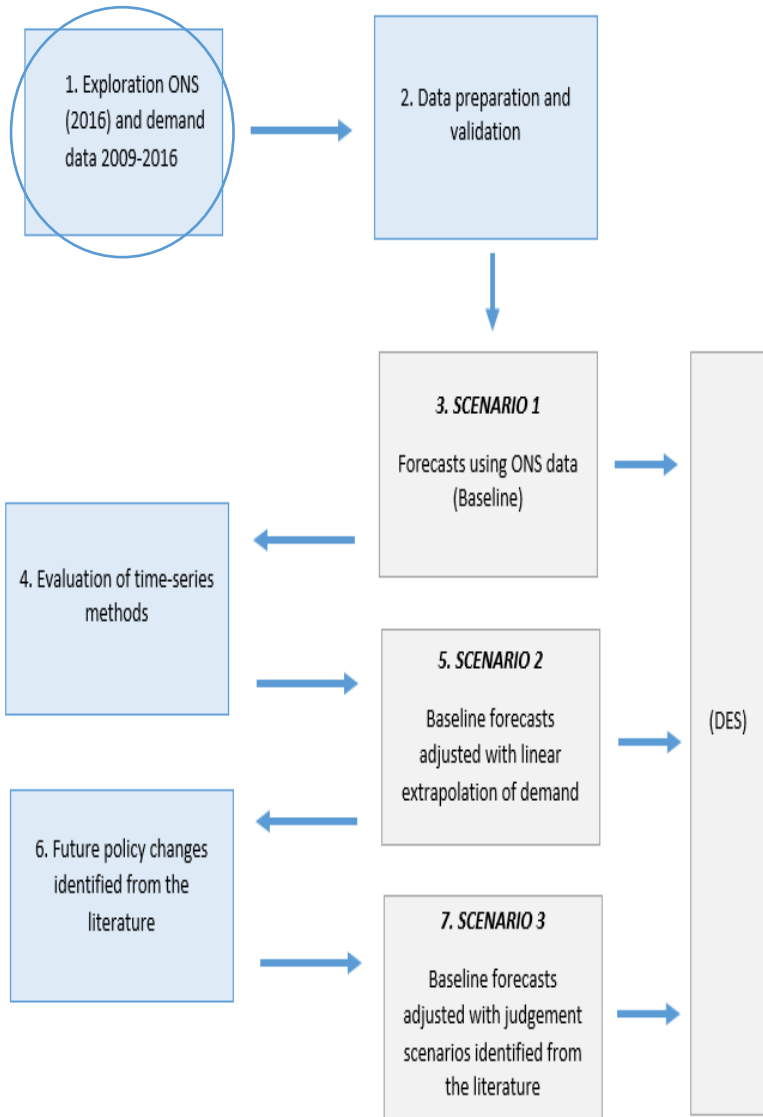
Overall demand for endoscopy services 2009-2016





Overall endoscopy demand per age group, all procedures 2009-2016

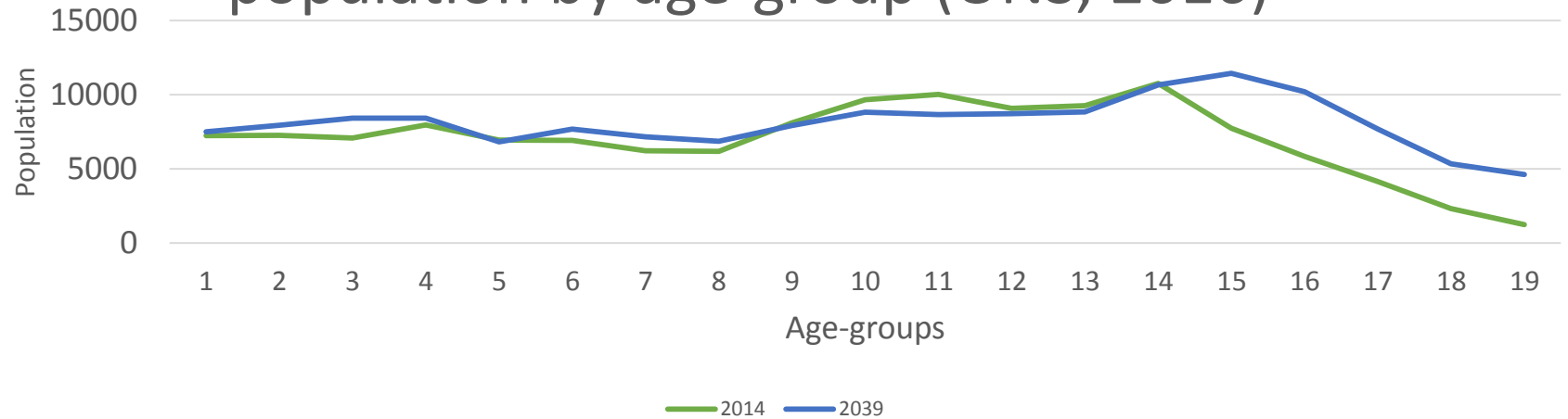


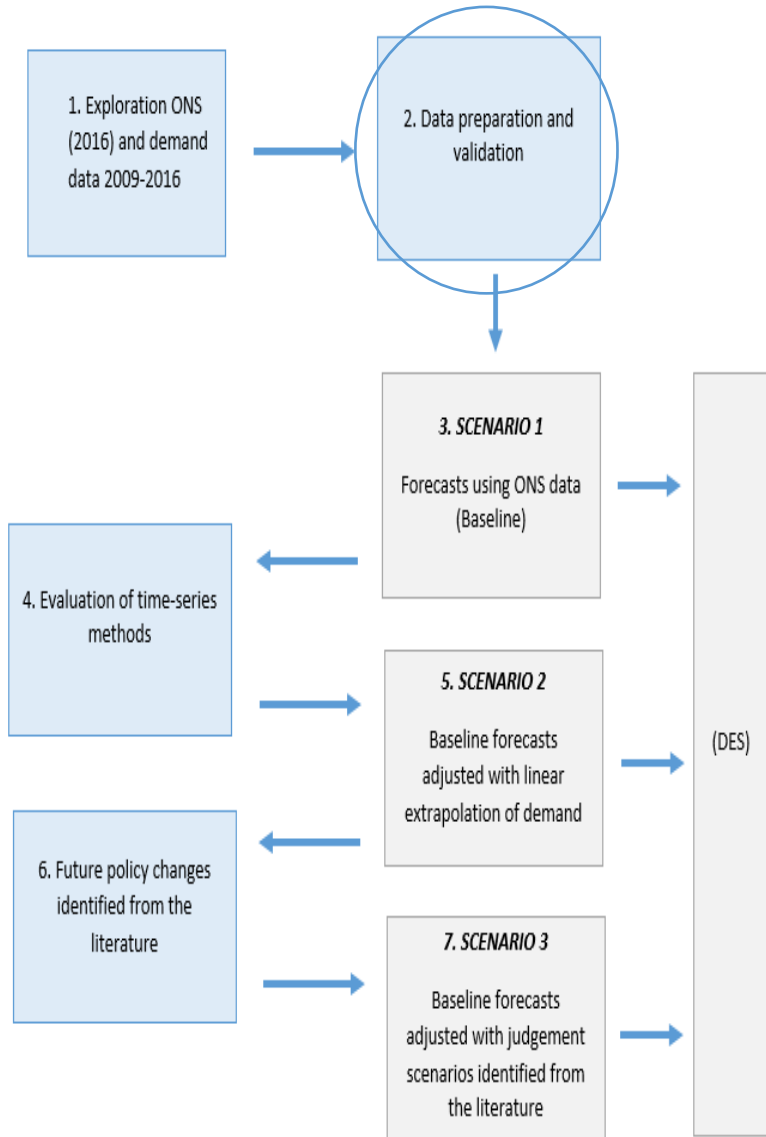


2014 and 2039 change in female population by age-group (ONS, 2016)

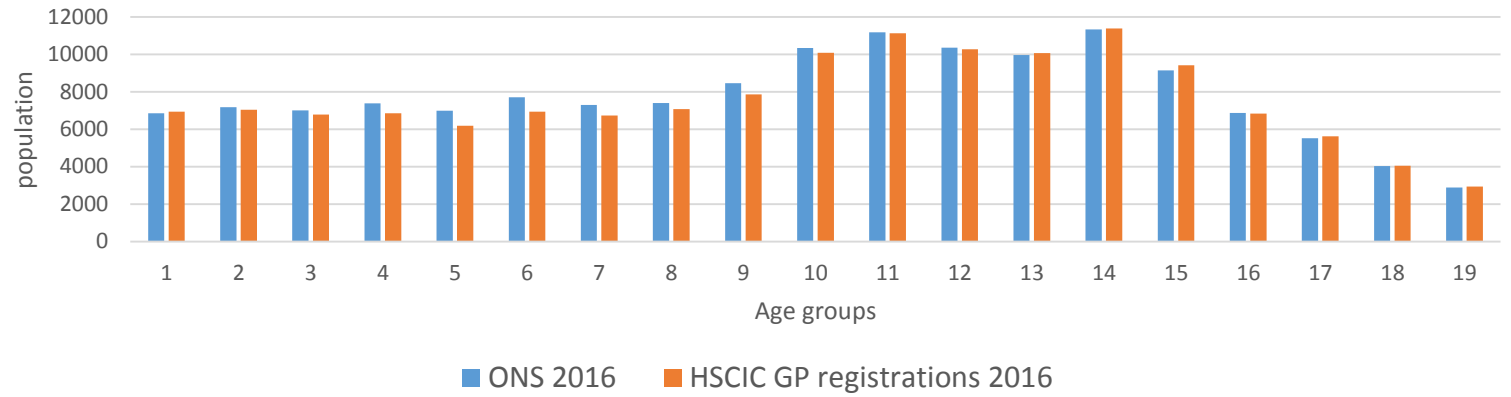


2014 and 2039 change in male population by age-group (ONS, 2016)

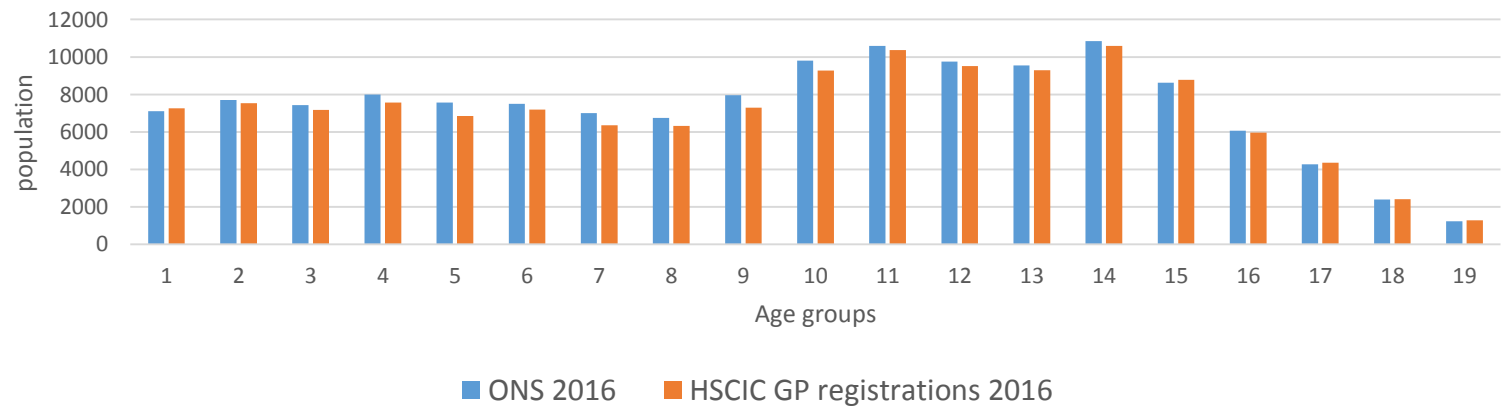


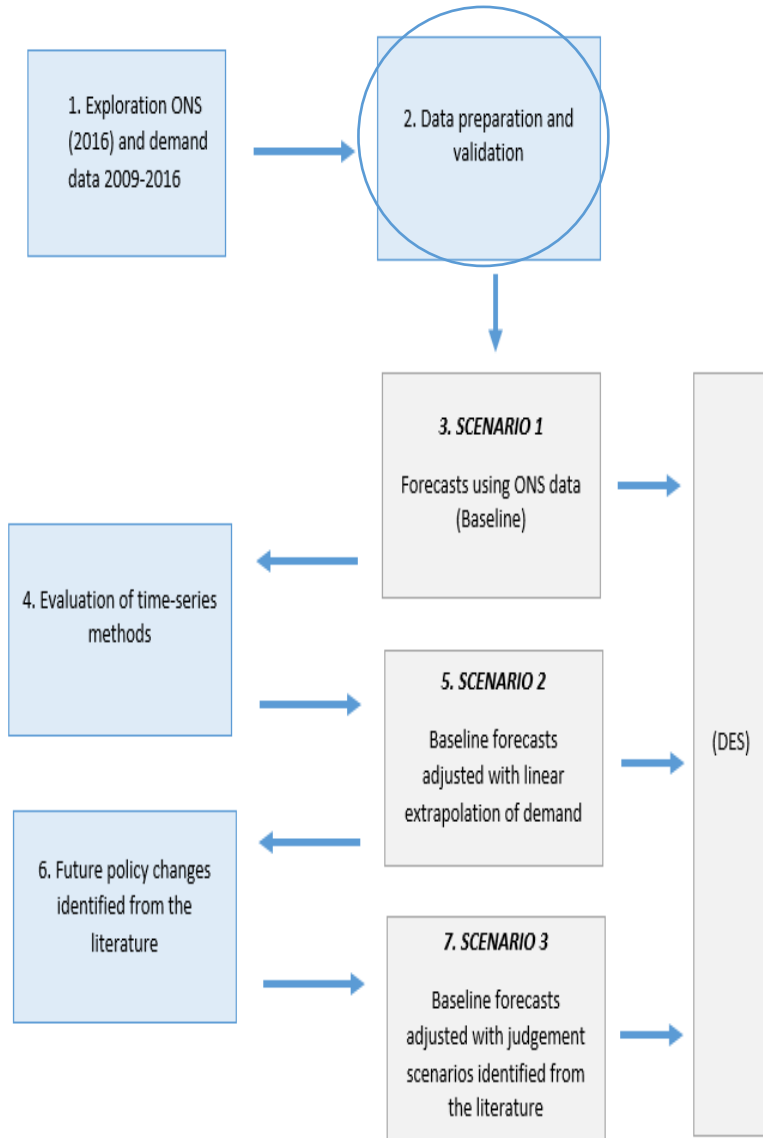


Female 2016 ONS projection vs GP Registration numbers South Devon and Torbay CCG (ONS, 2016; HSCIC, 2016)

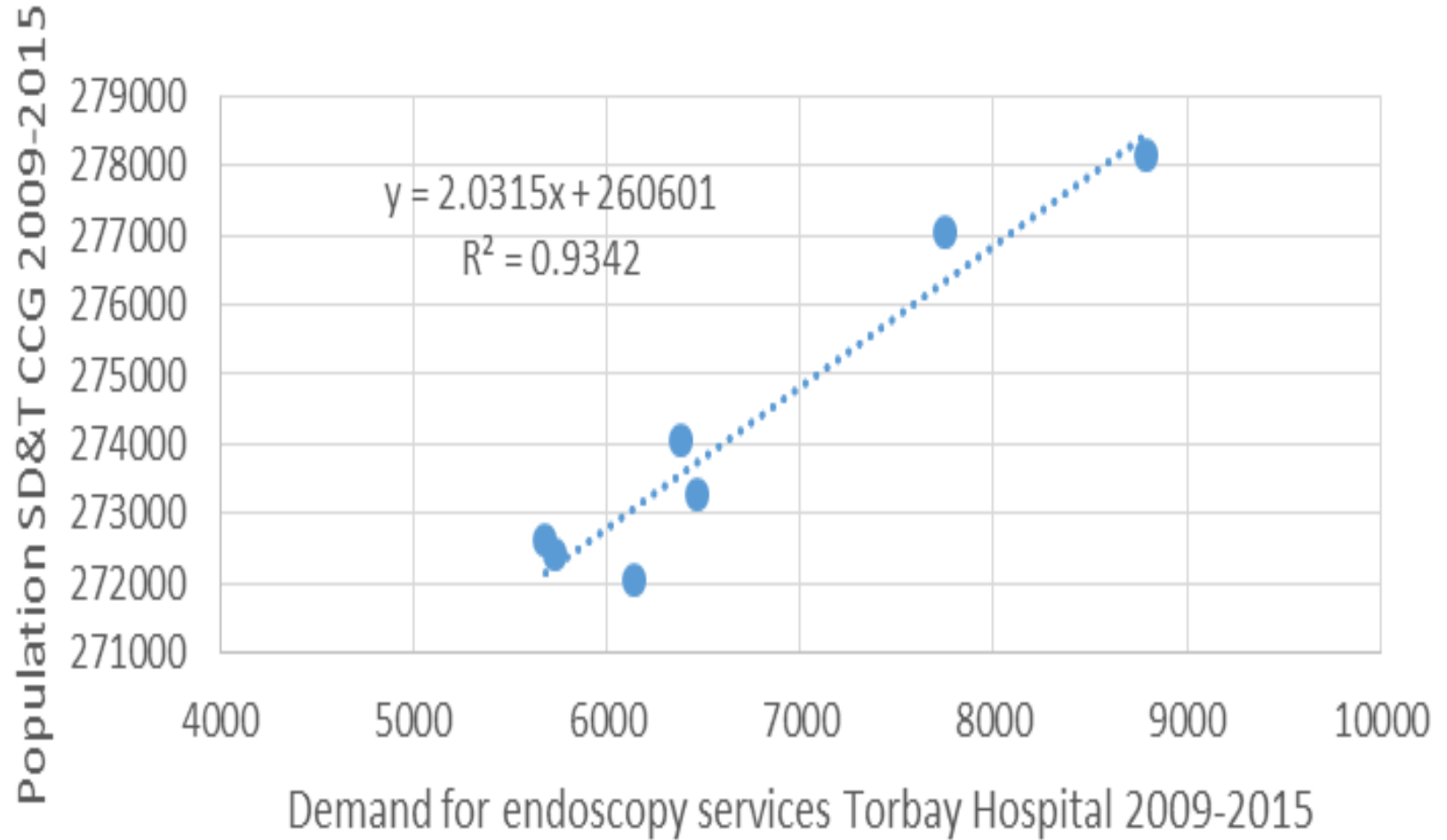


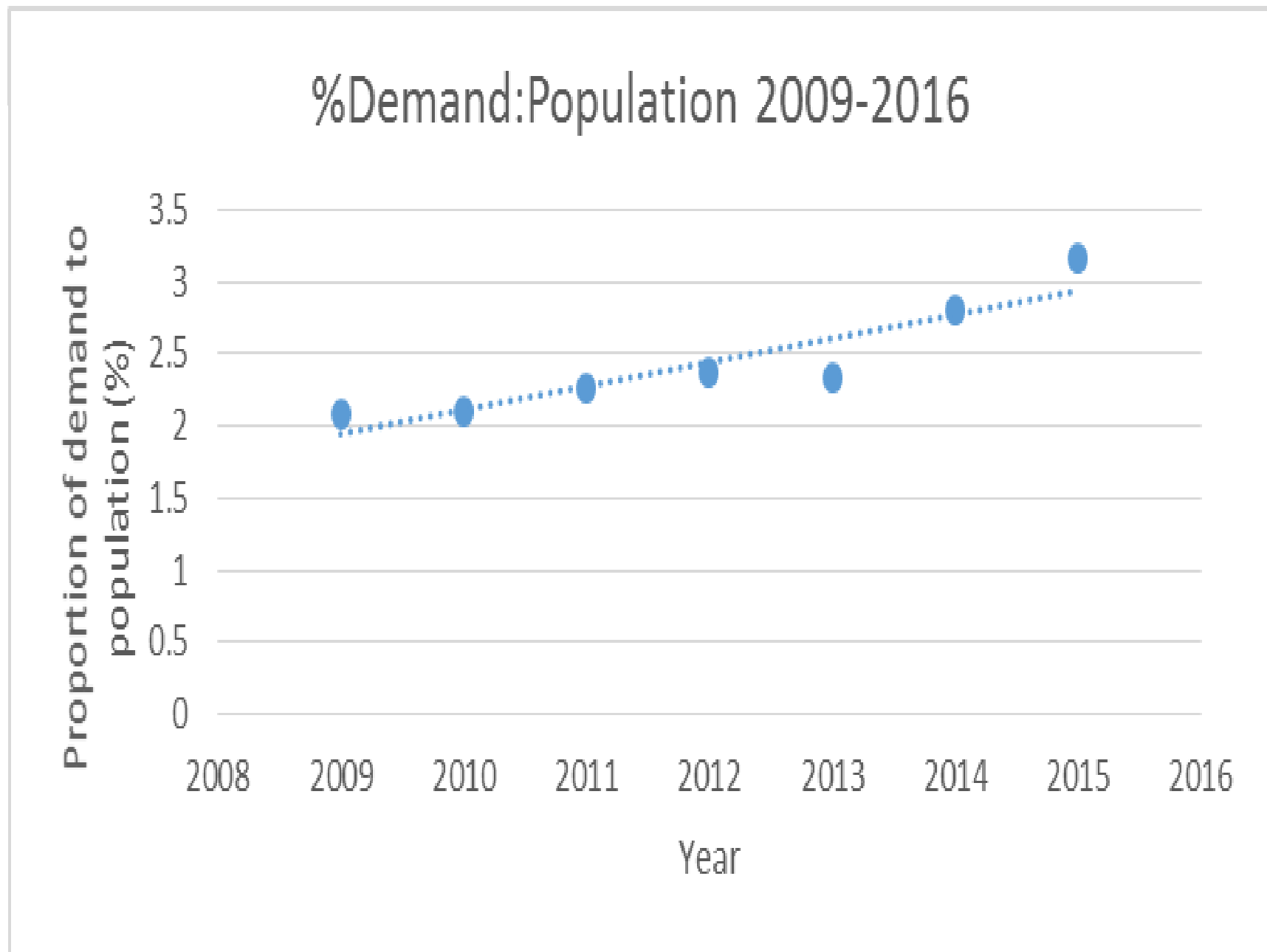
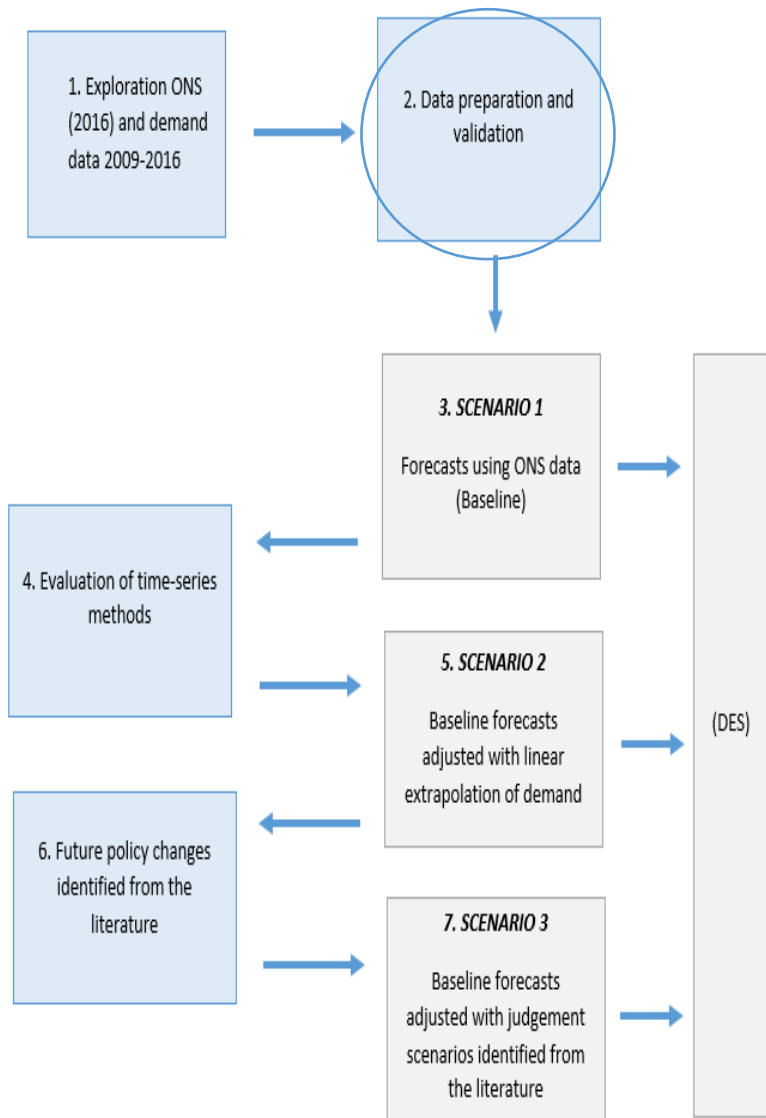
Male 2016 ONS projection vs GP Registration numbers South Devon and Torbay CCG (ONS, 2016; HSCIC, 2016)

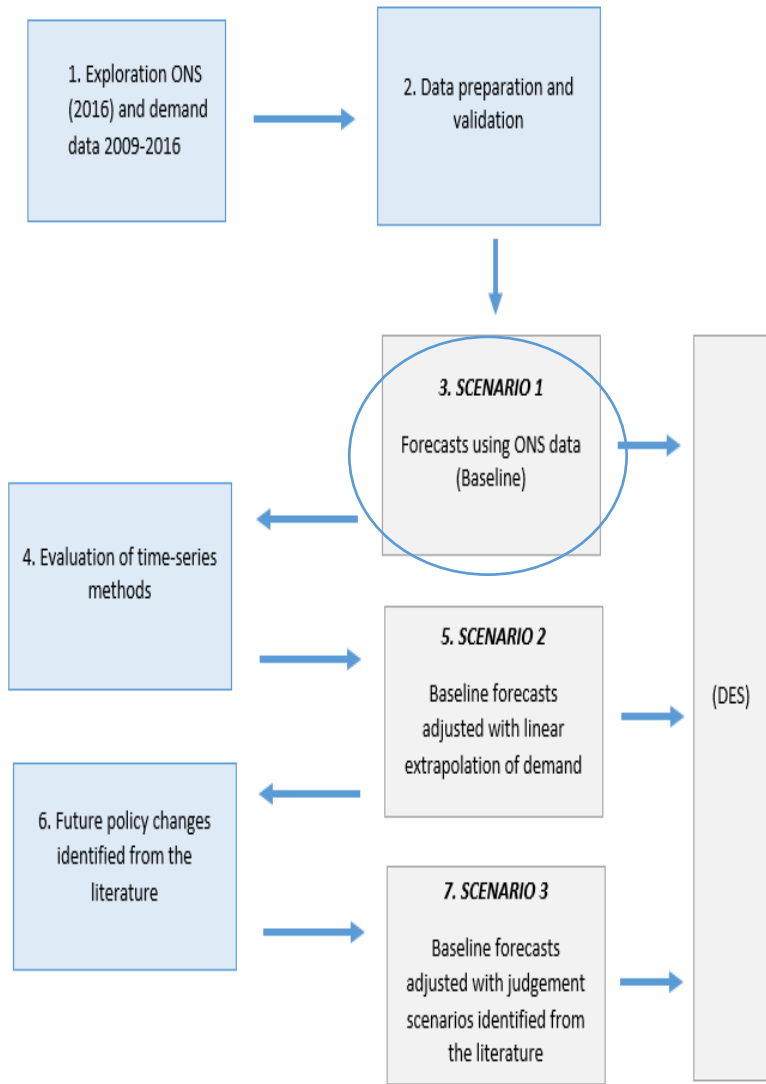




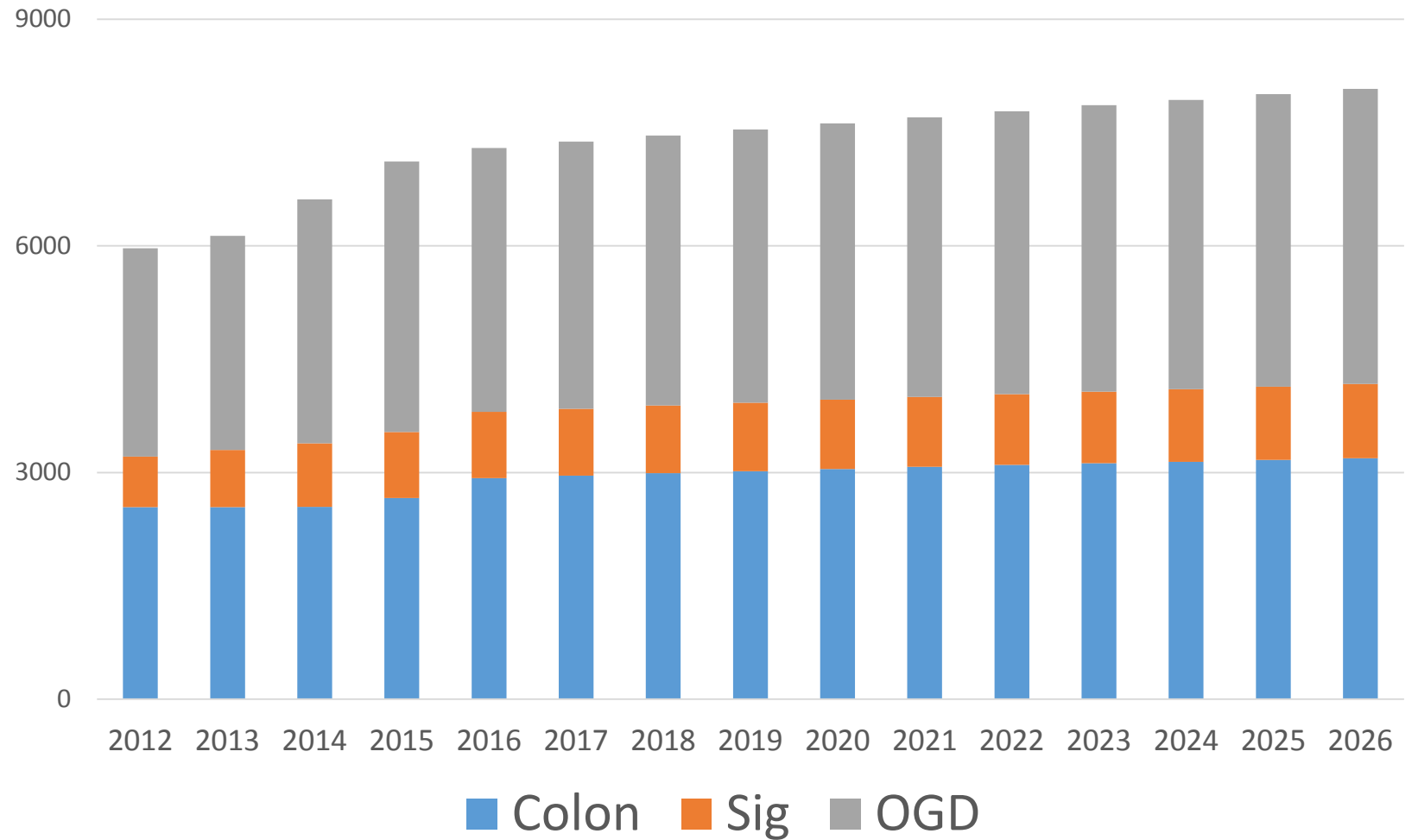
Population growth and endoscopy demand 2009-2016 (ONS, 2013;2014;2016)



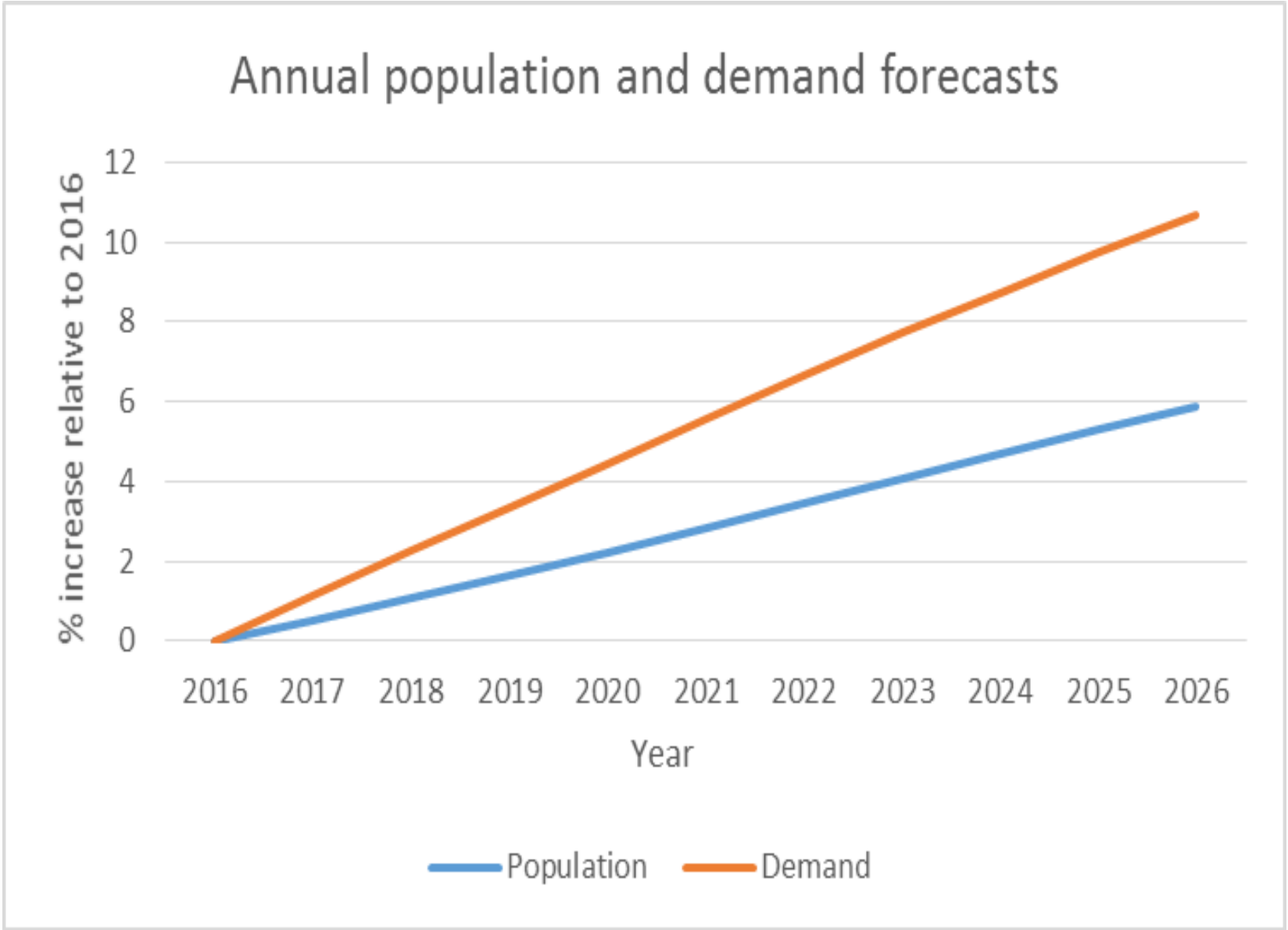
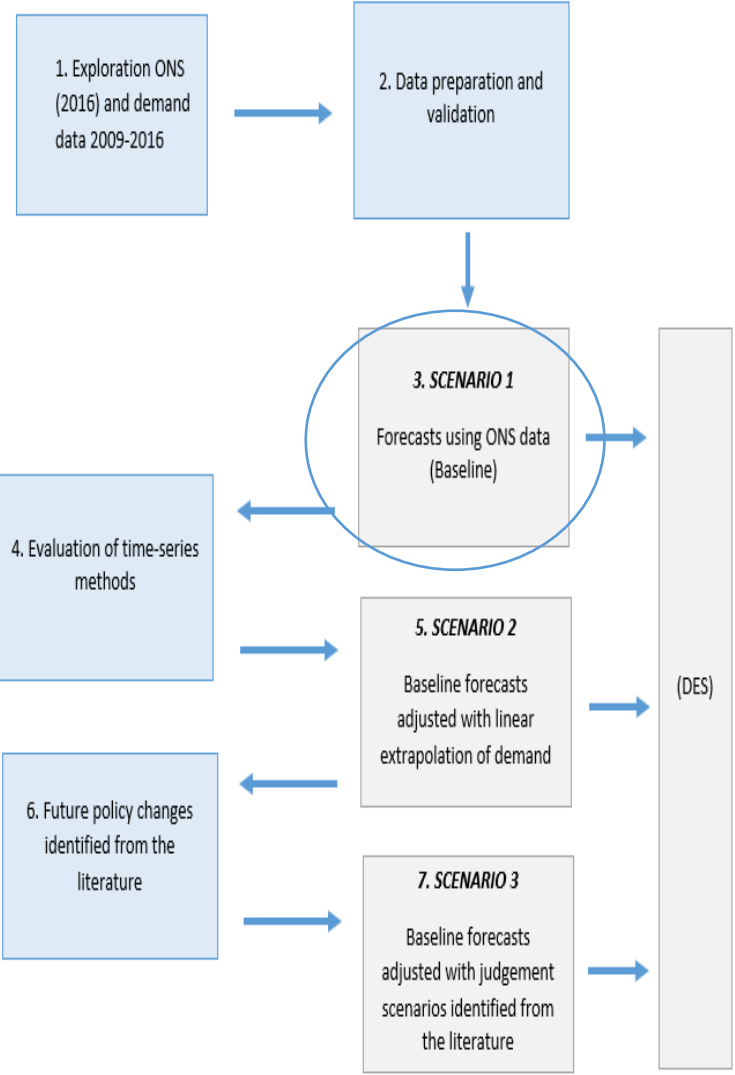




Total endoscopy demand forecast Scenario 1



South Devon and Torbay CCG population projection and Torbay Hospital endoscopy demand forecasts



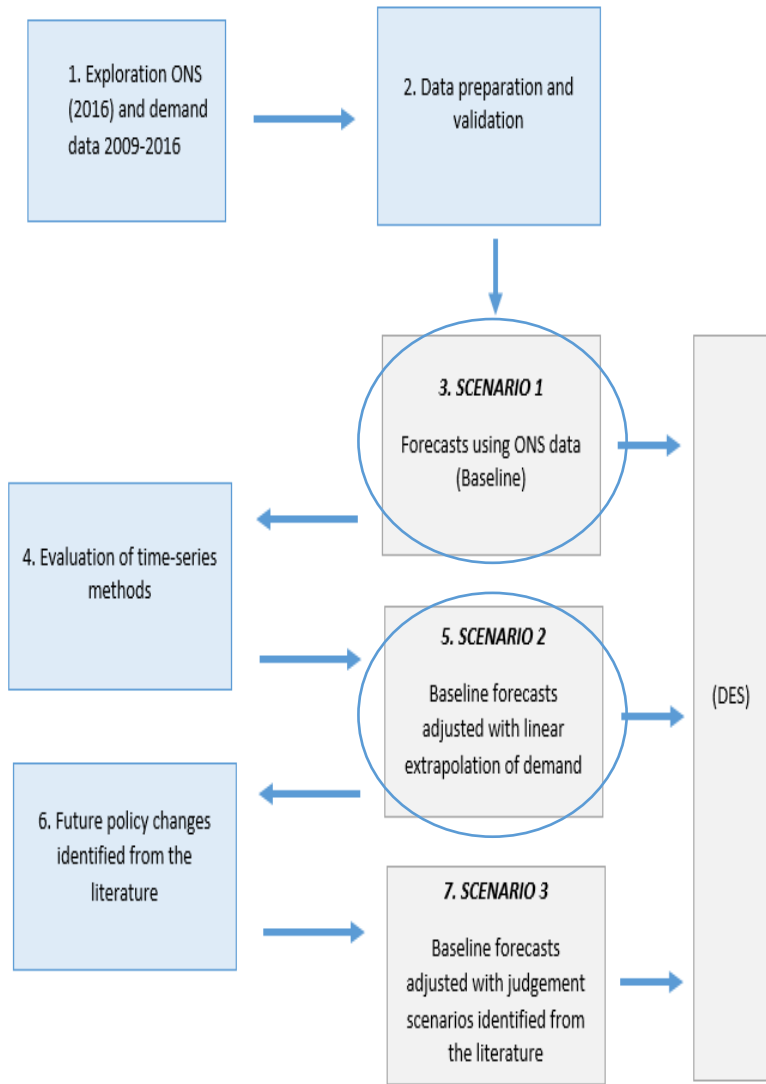
Studies using official population projections for health forecasting

Using a static rate of historical demand

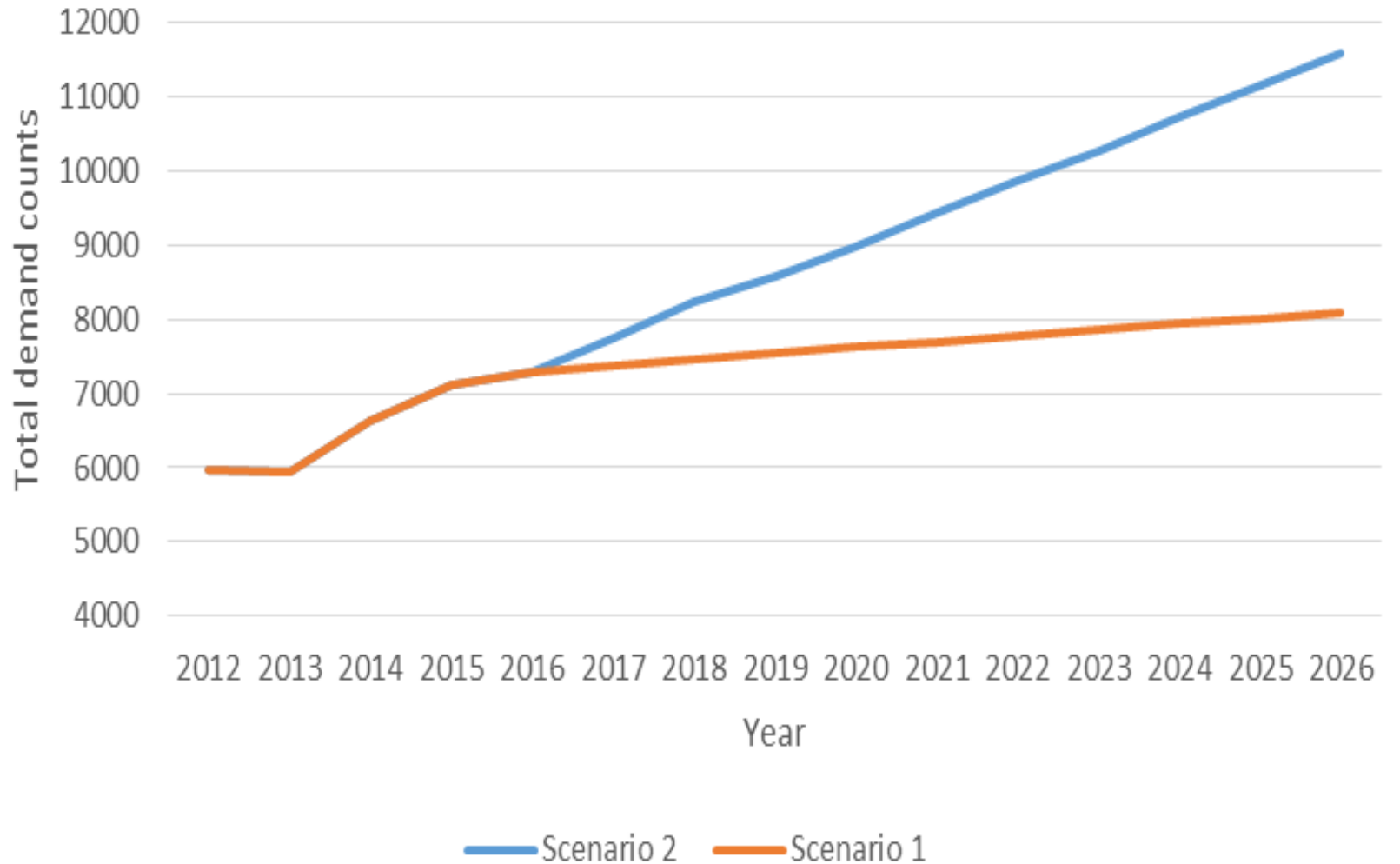
- Etzioni et al., 2003; 2009
- Strunk et al., 2006
- Culliford et al., 2015
- Elbattah & Molloy, 2016

Integrating historical patterns of demand

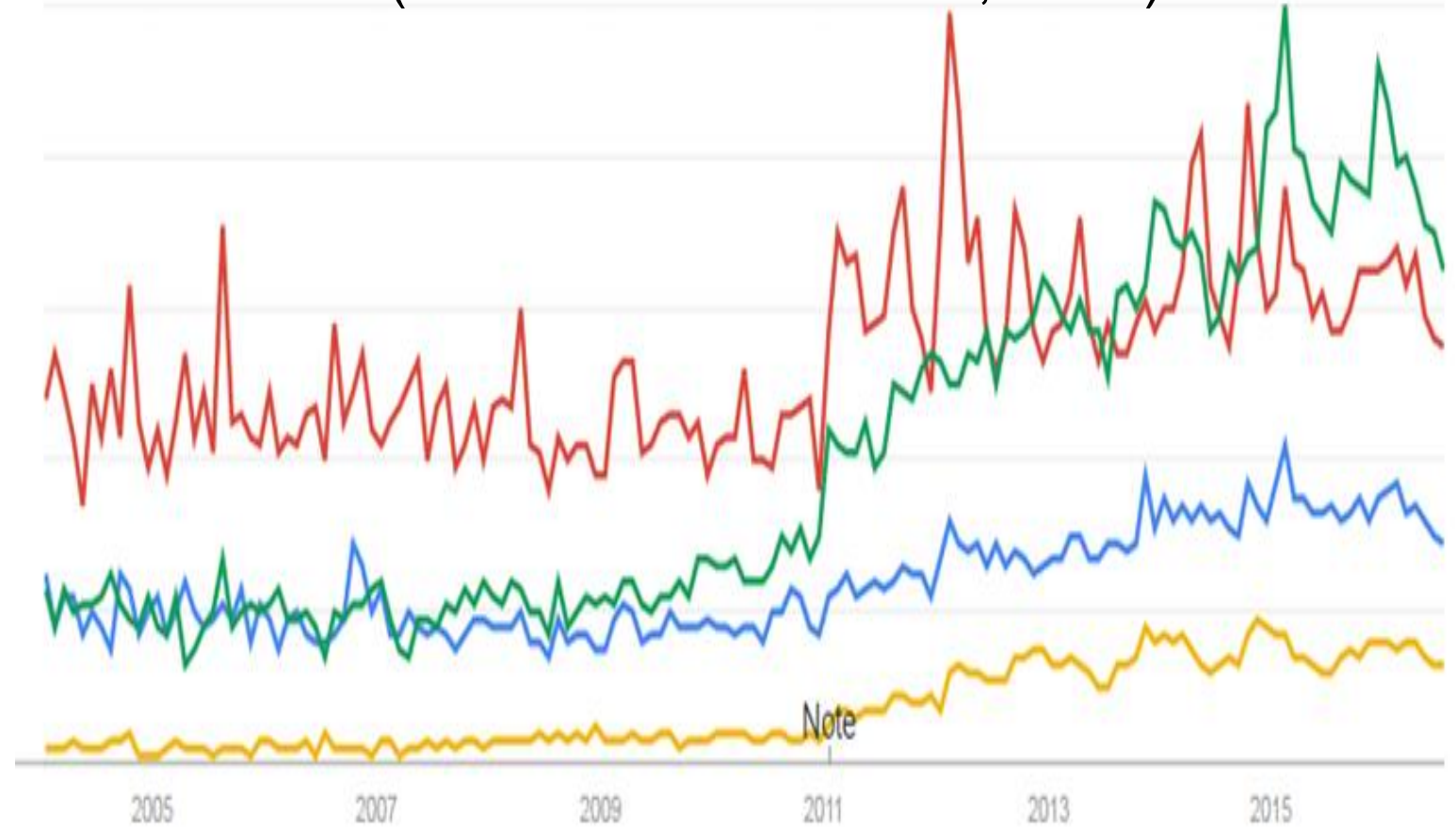
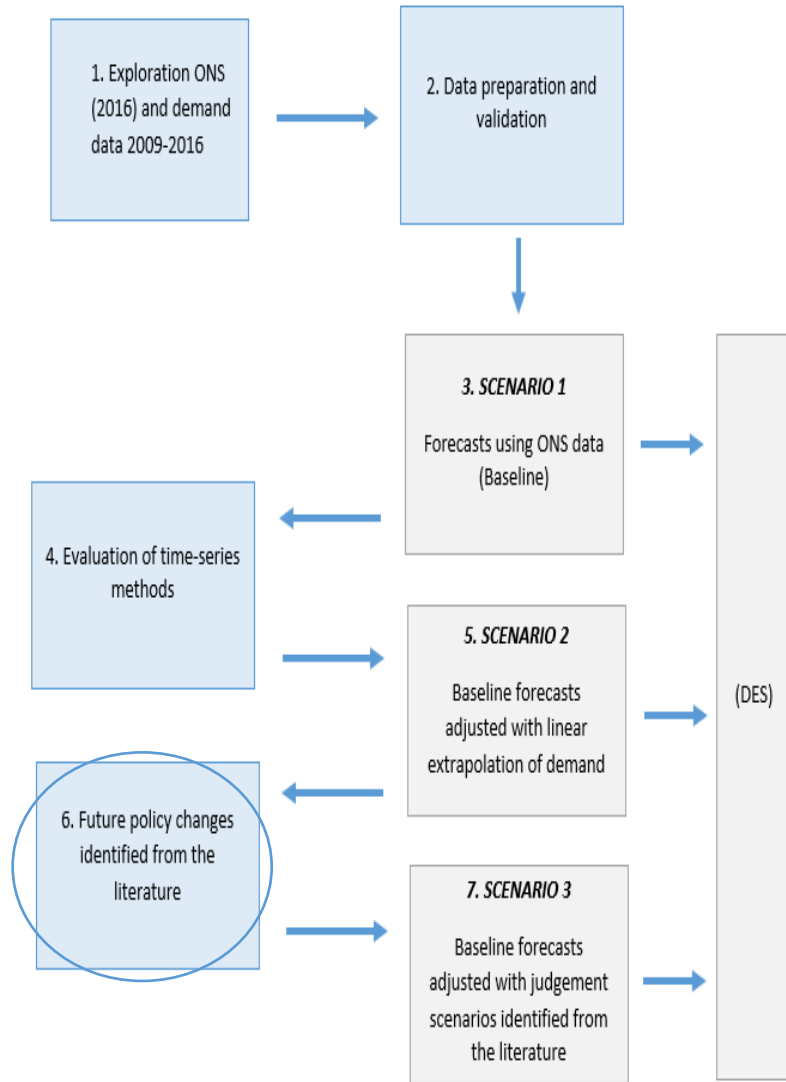
- Lowthian et al., 2011
- Culliford et al., 2015
- Mielczarek, 2013
- Demir et al., 2016



All procedure forecasts for Scenarios 1 and 2 (absolute counts)



'Be Clear on Cancer' public awareness campaigns for bowel cancer and gastro-oesophageal cancer 2011-2013/2015 (Cancer Research UK, 2016)



Google trends search terms (3/07/2016):

Stomach Cancer Bowel Cancer Blood in Poo Heartburn

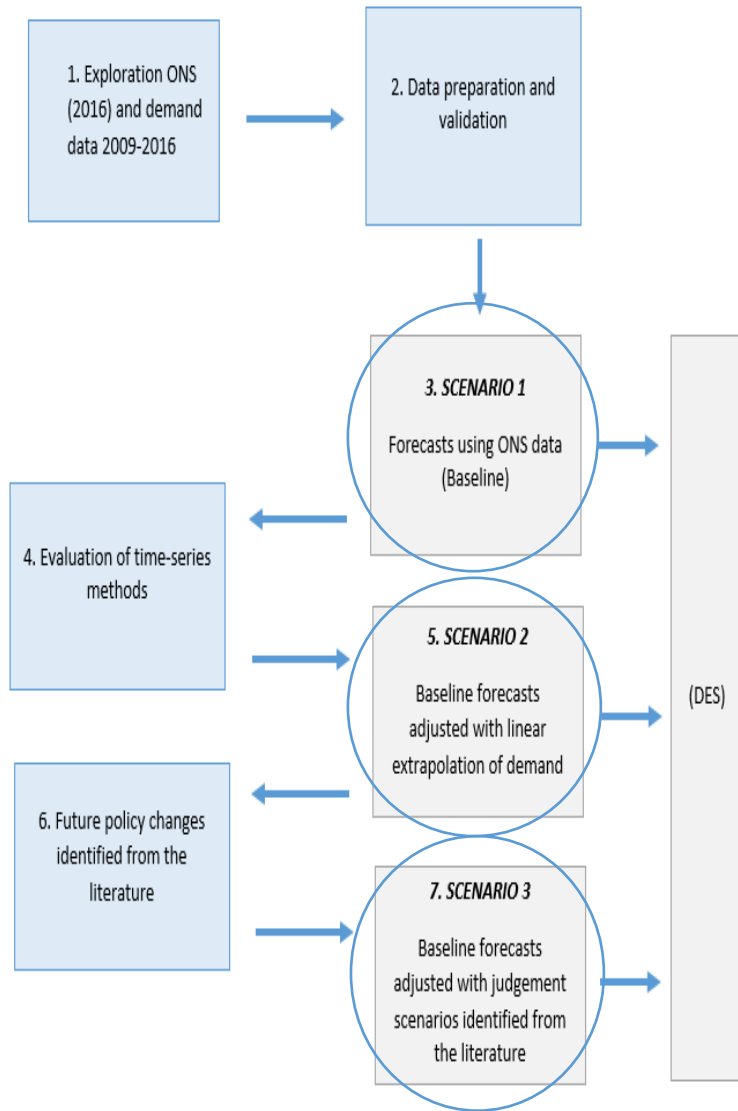
FUTURE POLICY CHANGES

3.1% increase in demand from baseline due to further public awareness campaigns

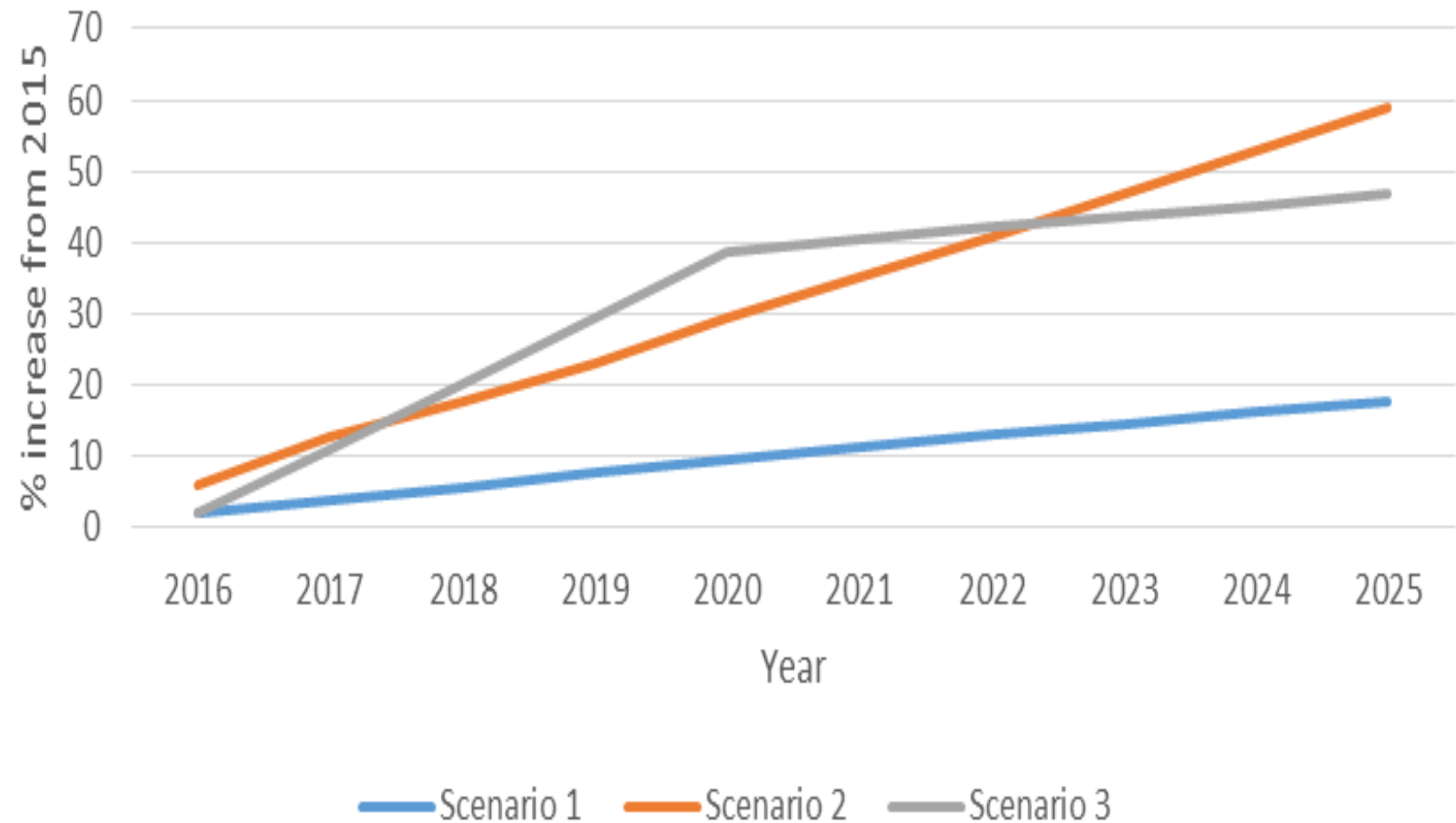
- Calculated by Brown et al. (2015) at the national level
- Independent Cancer Taskforce (2015) recommended further public awareness campaigns
- NAEDI (CRUK, 2016): 'Be Clear on Cancer' campaign; increase GP access to investigation

26% increase in demand from 2020 due to new 28d-diagnostic metric

- Independent Cancer Taskforce (2015) recommended that by 2020, 95% of patients referred for testing by a GP are definitively diagnosed with cancer, or cancer is excluded, and the result communicated to the patient, within four weeks.
- In September 2015, the Government responded to this recommendation pledging that from 2020, people with suspected cancer will be diagnosed within 28 days of being referred by a GP (HoC, 2016).

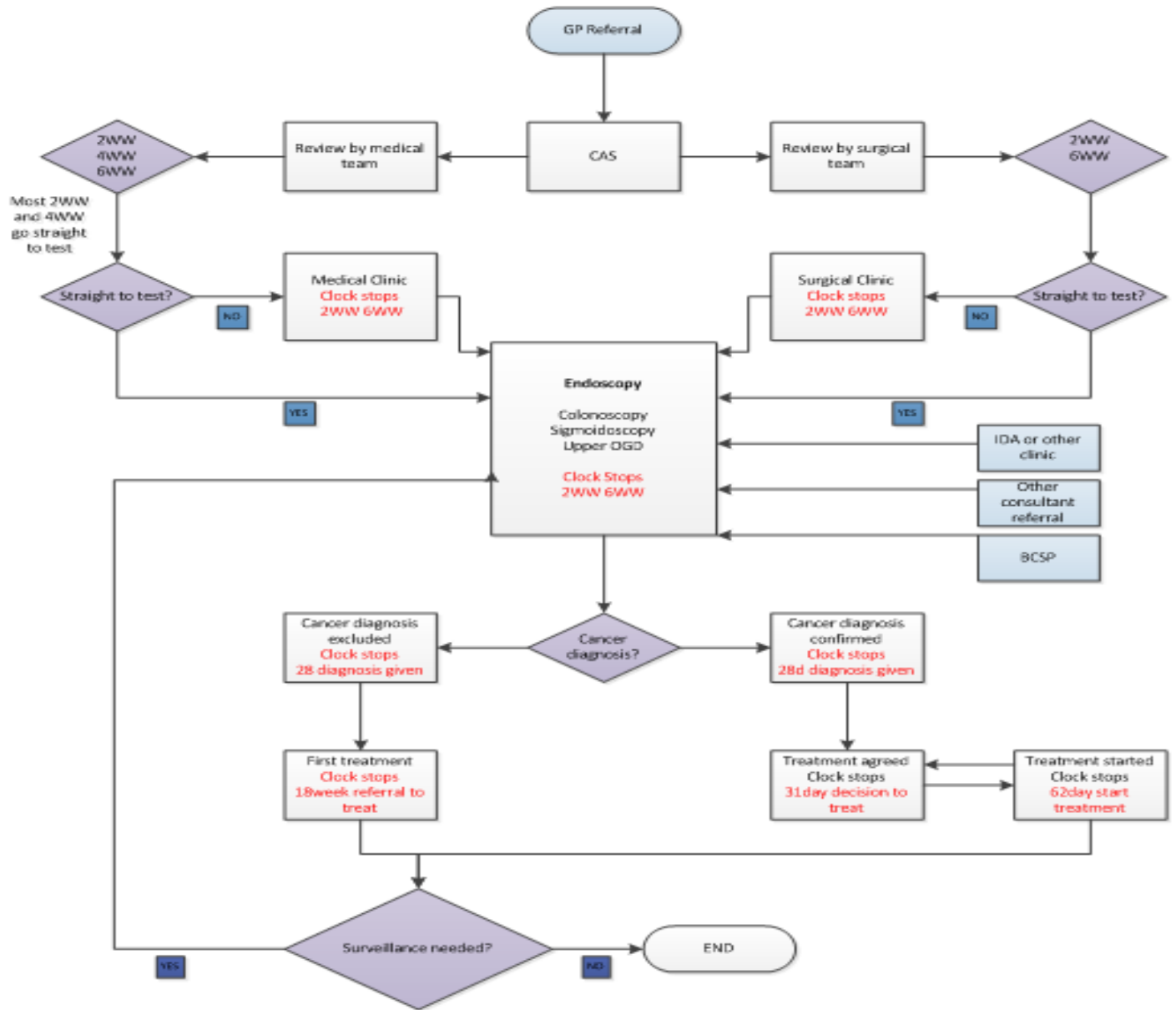
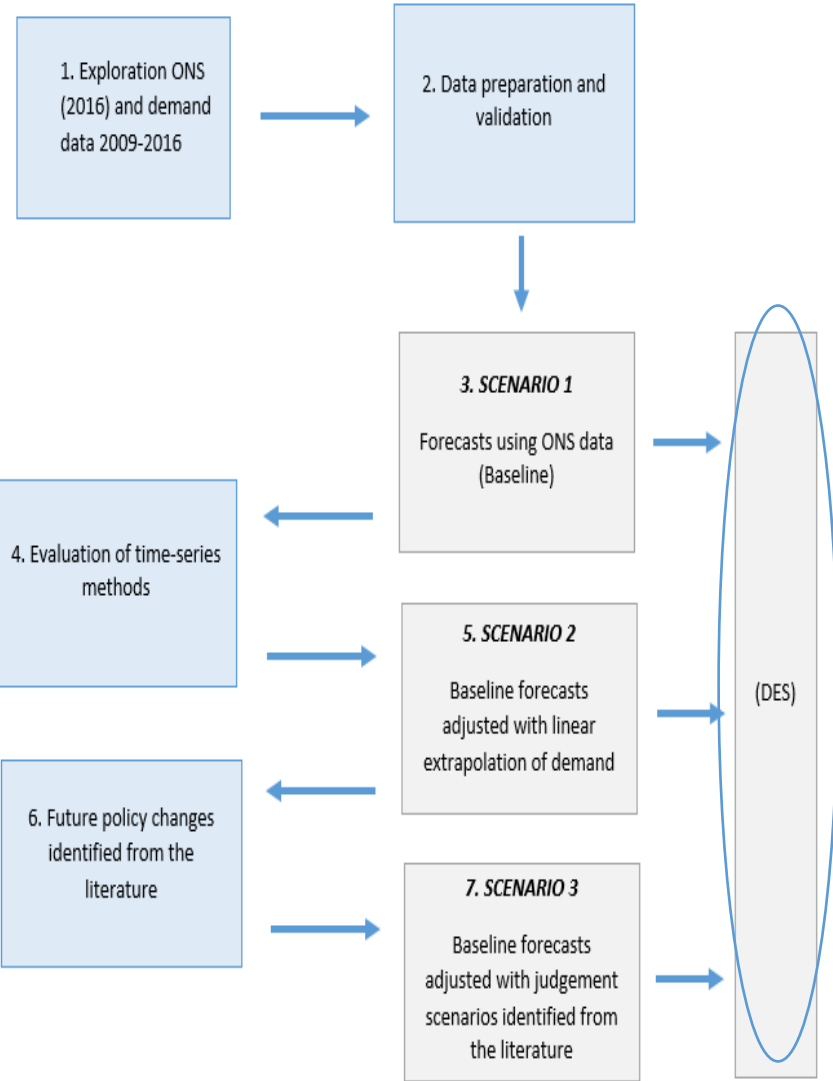


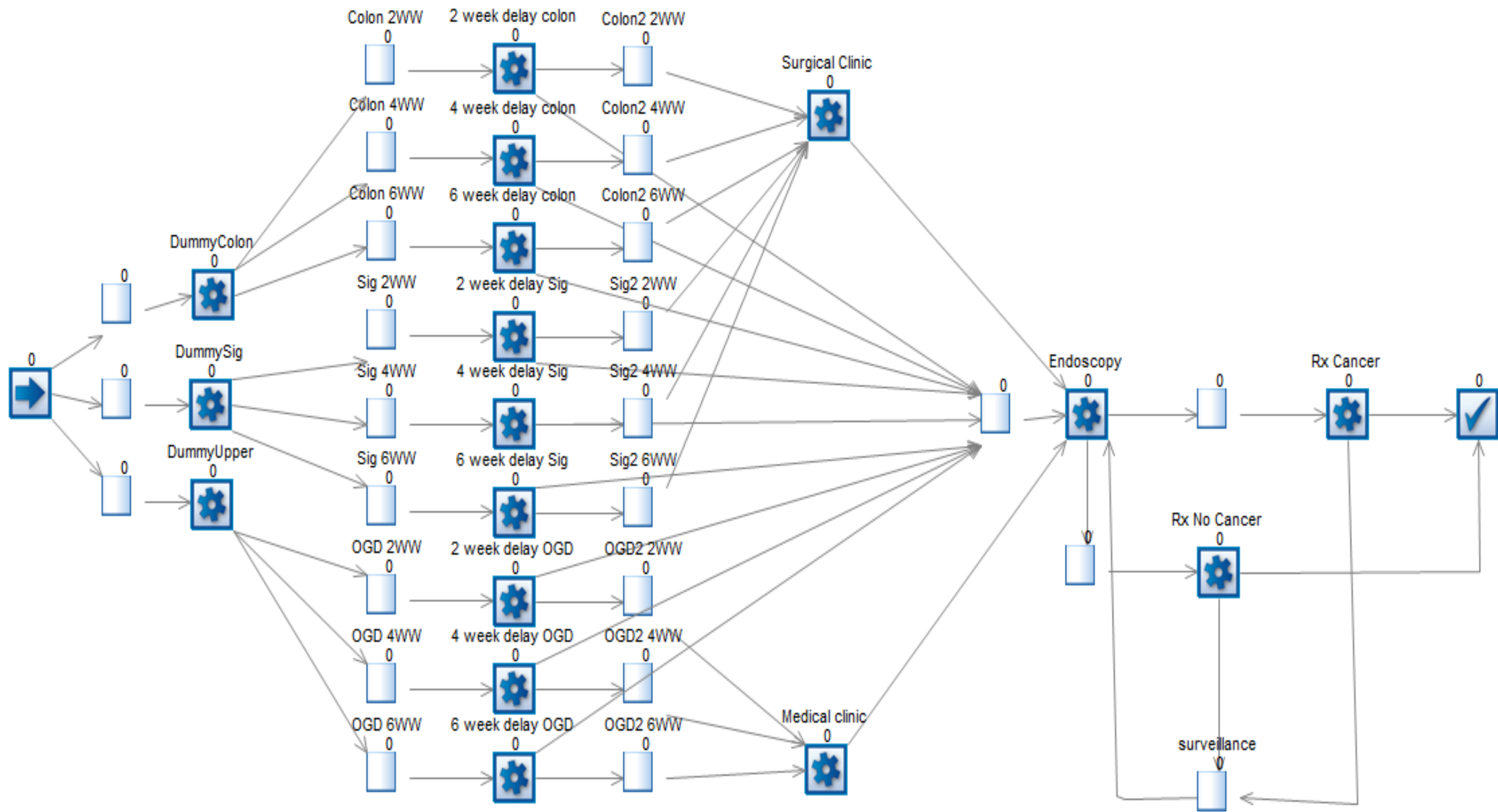
Three forecasts using population projections for overall endoscopy demand 2016-2026



Studies integrating forecasting with simulation modelling

- Demir, Gunal & Southern, 2016
- Mielczarek & Uzialki-Mydlikowska, 2012
- Mielczarek, 2013





Three forecasting scenarios for capacity planning in endoscopy

- **Scenario 1** 18% increase over ten years
- **Scenario 2** 59% increase over ten years
- **Scenario 3** 47% increase over ten years

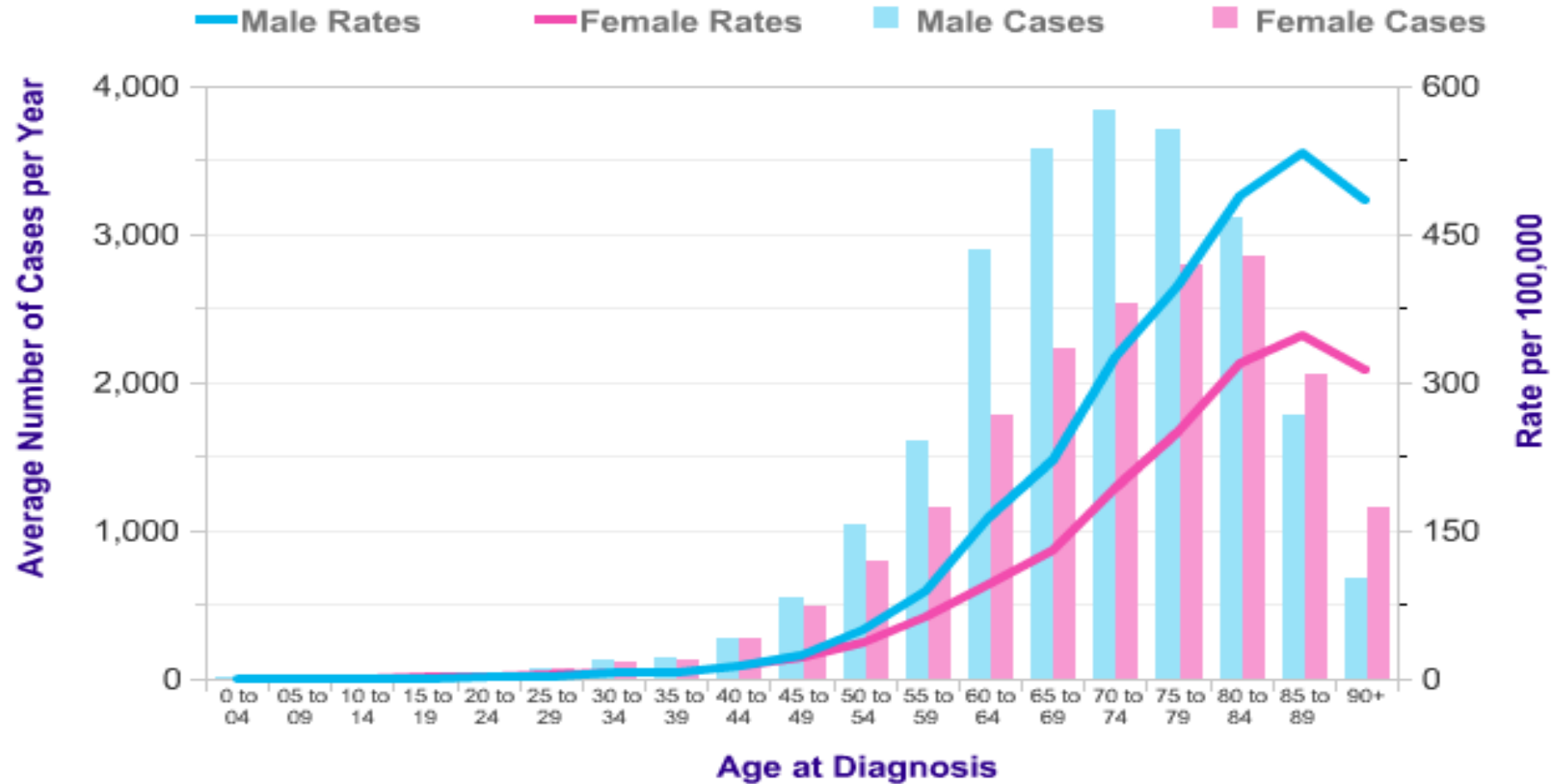
Accounts for 80% of scenario 2:

- 3.1% increase in demand in 2020 as a result of public awareness campaigns (Brown et al. 2015)
- 26% increase in demand in 2020 as a result of proposed 28-day diagnostic metric (DoH, 2015)

References

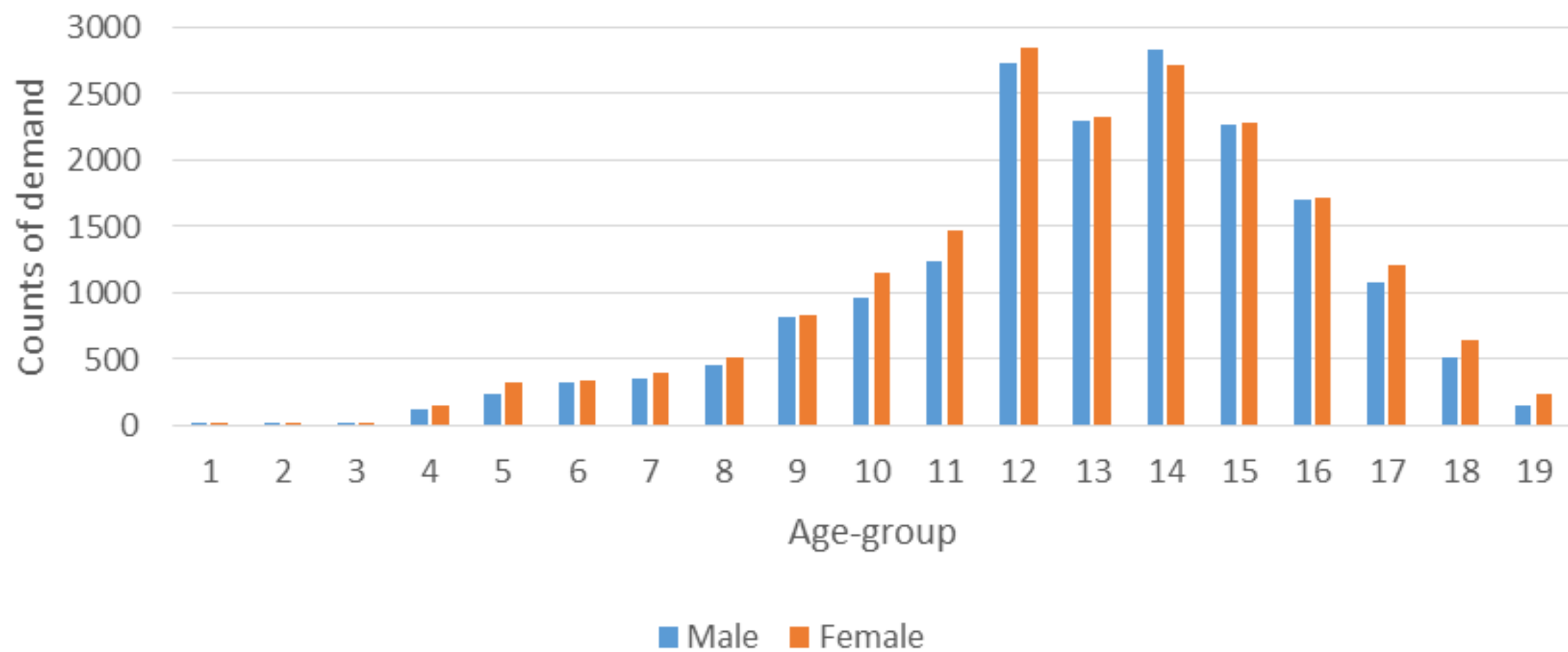
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Bowel, stomach and oesophageal cancer incidence are strongly related to age



Bowel Cancer: Average Number of New Cases per Year and Age-Specific Incidence Rates, UK, 2011-2013
Cancer Research UK

Overall endoscopy demand per age group, all procedures 2009-2016



A variety of
exogenous
variables have
been used in
long-term
health forecasting

- Current or historical data
- Demographic change
- Theories of morbidity
- Disease prevalence
- Modifiable risk factors
- Socioeconomic variables
- Policy
- ...