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FORECASTING BRANDED AND GENERIC PHARMACEUTICAL LIFE CYCLES

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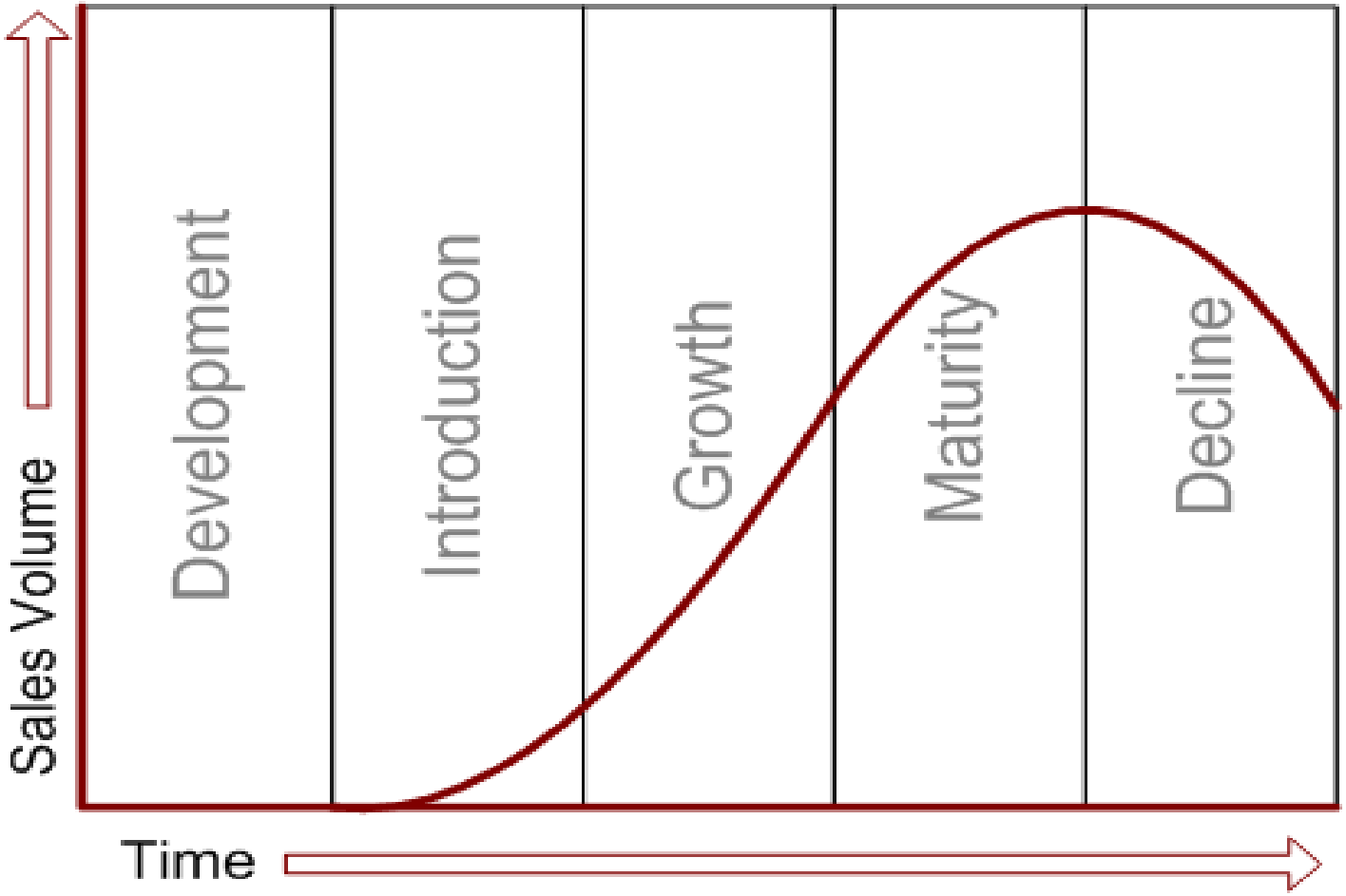
Presentation Structure

- Previous Research – Product Lifecycle
- Pharmaceutical Market
- Research Project – Aims
- Research Project - The Data
- Preliminary Results
- Graph Categories
- Next Steps

Previous Research – Product Life Cycle



Pharmaceutical Market

- Moss (2008) states that research has focused on consumer products and brands disregarding other products and brands such as pharmaceuticals.
- Highly competitive non assembled global industry
- In 2007 the top 10 pharmaceutical companies had a combined sales of just under £150 billion and commanded 45% market share
- 2 of these were UK companies – AstraZeneca and GlaxoSmithKline

Pharmaceutical Market continued

- In 2008 £4 billion was spent on R&D however this was expected to decrease due to the financial climate
- Patent Expiration – Major Problem
- UK patents last for 20 years from application
- 5 year extension can be applied for
- Generics enter the market
- NHS and other health/government organisations always looking at ways to curb the rising cost of healthcare

Pharmaceutical Market continued

- **A branded drug** is one made by a specific pharmaceutical company and is therefore given a name. The generic is the key compound that makes up the drug. In some cases the company can market both the branded and generic to appeal to a wider audience. An example is Sertraline.

- Brand name – Lustral by Pfizer
- Generic name – Sertraline.

Research project - aims

- Aims

1. To classify the patterns that are exhibited during the product lifecycle of pharmaceutical drugs

2. Model these patterns

3. Forecast the patterns over time

Research Project – The Data

- JIGSAW database
- Established in 1985 by ISIS research for the purposes of academic research
- Data from 1987 -2008
- 2.57 million script records
- Self Report Questionnaires from GP's
- Data is specifically relating to what drugs are prescribed

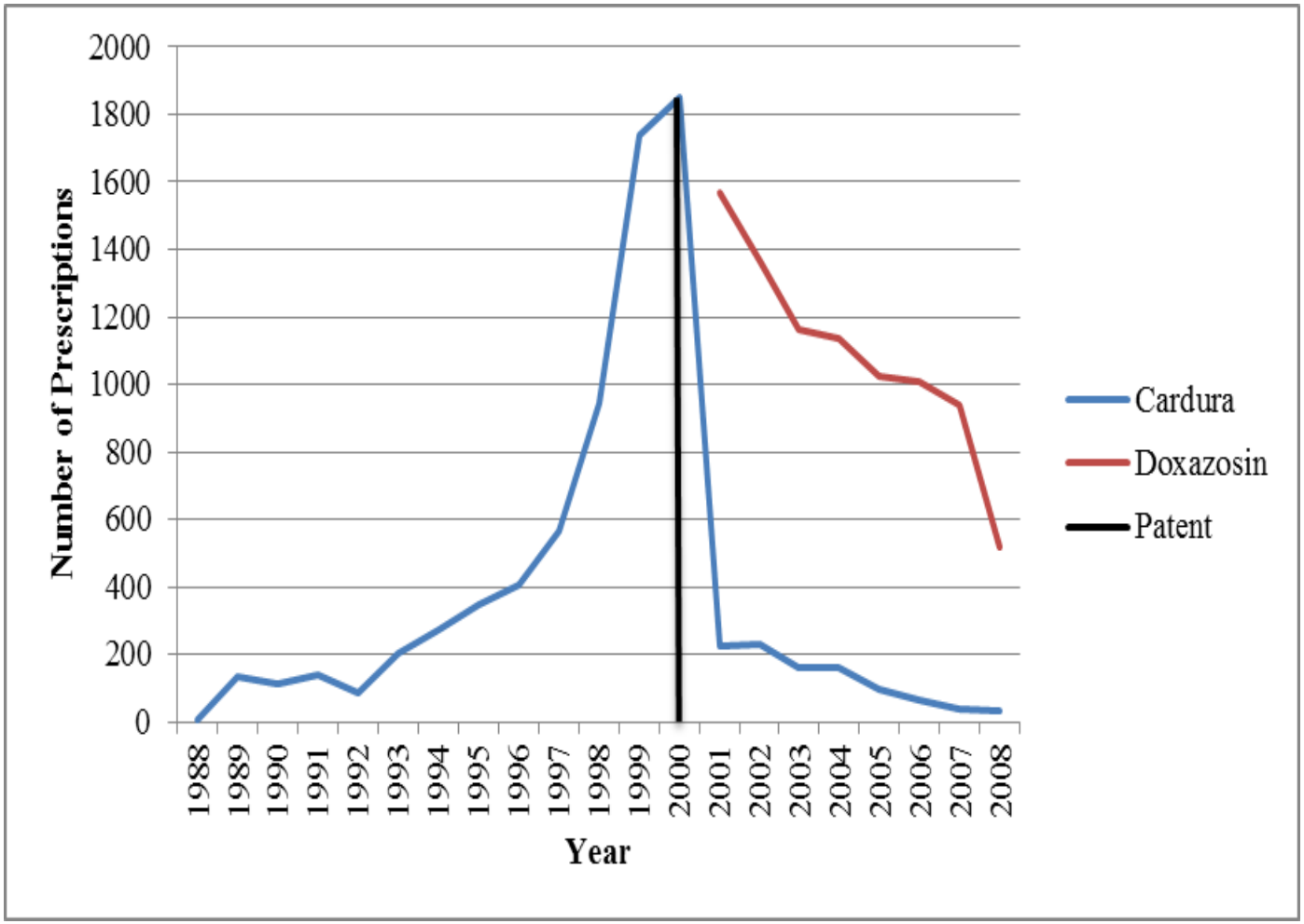
Pharmaceutical Life Cycle types

- Based on the current research there are three types of pharmaceutical life cycle including both a branded and a generic strand.
- Branded then Generic
- High Branded Low Generic
- High Generic Low Branded
- The major group that this paper focuses on is the Branded then Generic category

Branded Then Generic

Branded Drug	Generic Drug	Therapeutic Class	CAS Number	Patent Number	Patentee	Year of Patent Granted	Year of Patent Expiration	Supplementary Protection Certificate (SPC)	Total Number of Prescriptions (Rx) between 1987 and 2008
Lustral	Sertraline	Anti-depressant	79617-96-2	EP 30081	Pfizer	1981	2000	2005	13201
Mobic	Meloxicam	Analgesic/Anti-inflammatory	71125-38-7	EP0002482	Boehringer Ingelheim	1979	1998	2003	13276
Naprosyn	Naproxen	Anti-inflammatory	22204-53-1	GB 1291386	Syntex	1972	1988	NA	65817
Tagamet	Cimetidine	Acid reflux	51481-61-9	GB1338169	SmithKline & French	1971	1992	NA	41033
Tenormin	Atenolol	Hypertension	29122-68-7	GB 1285038	ICI	1972	1990	NA	54297
Tritace	Ramipril	Hypertension	87333-19-5	EP79022	Hoechst AG	1983	2002	2004	27898
Zantac	Ranitidine	Peptic Ulcer Disease	66357-35-5	GB 1565966	Allen & Hanburys	1980	1997	NA	46673

Branded then Generic



Models used in the current research

- Initial research focused on using the following models:
- Naïve Model
- Moving Average Model
- Single Exponential Smoothing (SES)
- Repeat Purchase Diffusion Model (RPDM)
- Bass Diffusion Model

Results – Branded then Generic

Forecasting Bias, Accuracy and Variance (ME, RAE, MSE) of Branded Drugs

	Naïve Methods		Exponential Smoothing	Diffusion Models	
	Naive	Moving Average	SES	Bass	RPDM
ME	-90.13	-178.84	-127.7	-530.24	-440.69
RAE	1	1.84	1.44	5.07	4.92
MSE	188674.9	386082.2	274580.69	1192661	1105040

Forecasting Bias, Accuracy and Variance (ME, RAE, MSE) of Generic Drugs

	Naïve Methods		Exponential Smoothing	Diffusion Models	
	Naive	Moving Average	SES	Bass	RPDM
ME	-178.32	-281.39	-261.07	-702.8	-659.96
RAE	1	1.93	1.26	3.56	3.61
MSE	97114.84	382981.9	223314.99	942576.8	928290.7

Results – Branded then Generic

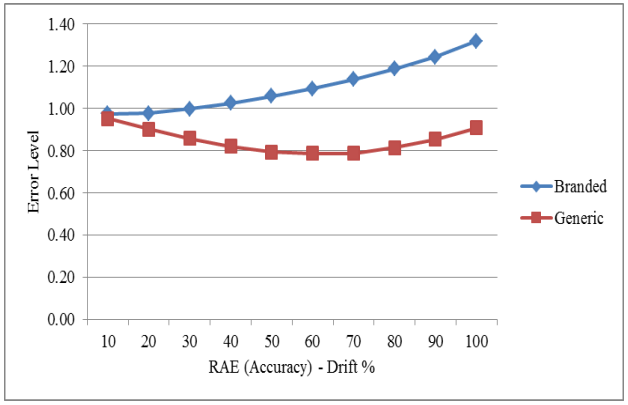
Naïve + Drift Errors of Branded Drugs for the BTG Category

	Benchmark	Drift									
	Naive	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
ME	-90.13	-81.42	-72.73	-63.99	-55.28	-46.56	-37.78	-29.13	-20.42	-11.71	-2.99
RAE	1.00	0.98	0.98	1.01	1.04	1.07	1.10	1.14	1.19	1.25	1.34
MSE	188674.93	181978.42	179087.22	180001.33	184720.76	193245.50	205576.84	221710.91	241651.59	265397.58	292948.87

Naïve + Drift Errors of Generic Drugs for the BTG Category

	Benchmark	Drift									
	Naive	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
ME	-178.32	-163.33	-148.34	-133.35	-118.36	-103.37	-88.38	-73.39	-58.40	-43.41	-28.42
RAE	1.00	0.93	0.87	0.80	0.74	0.70	0.68	0.67	0.69	0.73	0.79
MSE	97114.84	87054.64	78756.63	72220.82	67447.19	64435.75	23019.66	63699.45	65974.58	70011.91	75811.42

Level of Drift Compared with RAE for Branded and Generic Pharmaceutical Life Cycles



Extra Models

- A number of other models were then applied
- Holt Winters Exponential Smoothing
- ARIMA
- Robust Regression
- Regression over t-1

Results – Branded then Generic

Forecasting Bias, Accuracy and Variance (ME, RAE, MSE) of Branded Drugs

	Naïve Methods		Exponential Smoothing	ARIMA	Regression Models		
	Naive	Naïve + 20% Drift	HOLT	ARIMA	Regression over t	Regression over t-1	Robust Regression
ME	-90.13	-72.73	-65.71	-35.44	42.81	15.56	-32.38
RAE	1	0.98	1.41	0.97	2.53	2.51	1.01
MSE	188674.9	179087.2	205963.3	54479.69	418275.29	399378.49	60658.01

Forecasting Bias, Accuracy and Variance (ME, RAE, MSE) of Generic Drugs

	Naïve Methods		Exponential Smoothing	ARIMA	Regression Models		
	Naive	Naïve + 70% Drift	HOLT	ARIMA	Regression over t	Regression over t-1	Robust Regression
ME	-178.32	-73.39	-76.72	-199.5	-132.49	-144.87	-183.03
RAE	1	0.67	0.81	1.58	1.91	1.87	1.49
MSE	97114.84	63699,45	70617.16	202183.5	252106.86	240559.86	178817.42

Conclusions

- GP's within the UK have a tendency to prescribe branded and generic drugs differently
- Simpler models forecast pharmaceutical life cycles with a greater level of accuracy than more complex ones.
- Most accurate of the current research
  - ARIMA for branded drugs
  - Naïve + drift for generic drugs
- Aaker and Jacobson (1987) found that when modelling market share using the naive market share model, its predictive power was relatively high.
- Brodie & de Kluyver (1987) found that a number of econometric market share models perform no better than a 'naive' model.'

Conclusions

- This research provides a basis for the NHS in employing any cost saving techniques when looking at how different pharmaceuticals are prescribed, and forecasting how they may be prescribed in the future

- As for pharmaceutical companies this research will allow them to discover, when it is best in the life cycle of the branded pharmaceutical to introduce strategies to prolong its life cycle and slow down the number of generic prescriptions written

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Thank you

Any Questions?