Decreasing fertility rates across England & Wales and its relationship with increased cases of sexually transmitted infections seen in Genito-urinary medicine clinics: A case study

Over the past two decades England & Wales have been experiencing total fertility rates (TFR) lower than the necessary value for replacement of generations. At the same time new cases of sexually transmitted infections (STI) reported by Genito-urinary medicine (GUM) clinics have been steadily increasing. This case aimed to analyse the potential relationship between decreasing fertility rates in England & Wales and the number of new cases of STI's reported by GUM clinics. Using raw data from the Annual abstract of statistics and the Department of health & social security, TFR between 1951-98 were calculated and correlated, using SPSS, with the total number of new cases of STI's. As a result a significant relationship between TFR & STI's was found. It finishes by explaining the relationship between fertility rates and STI's and looks at other, perhaps more influential factors affecting fertility rates, e.g. the introduction of the contraceptive pill, and the more recent trend in England and Wales towards later childbearing.

Europe is currently experiencing it lowest ever fertility levels and its longest ever period of fertility below replacement levels (Day 1995). By mid-1998 England & Wales TFR's less than 2.1 children per women for the best part of two decades (Table 1), well below the necessary value for replacement of generations (United Nations 1998).

It may be that low fertility rates may just be postponement of births, e.g. more women are giving birth in their early forties (Ruddock *et al* 1998), or it could be the unavoidable end stage of full demographic transition i.e. populations that have full control over their fertility have better things to do than replace themselves (Day 1995).

Whilst fertility rates within England and Wales have been decreasing, cases of STI's seen in GUM clinics have been steadily increasing. Between 1991 and 2001 reported cases of STI's in GUM clinics more than doubled in England & Wales (Figure 1) (www.statistics.gov.uk).

Age group	1960-64	1964-69	1970-74	1975-79	1980-84	1985-89	1990-94
15-19	0.040	0.049	0.045	0.030	0.030	0.031	0.033
20-24	0.175	0.165	0.130	0.180	0.095	0.094	0.088
25-29	0.183	0.164	0.135	0.125	0.127	0.125	0.120
30-34	0.105	0.090	0.067	0.650	0.075	0.084	0.087
35-39	0.049	0.040	0.025	0.020	0.024	0.030	0.033
40-44	0.015	0.010	0.007	0.005	0.005	0.005	0.006
TFR	2.84	2.59	2.05	1.77	1.78	1.85	1.84

Table 1. Age specific fertility rates, England 1960-94 (Hinde 2003)

The aim of this case study was to statistically analyse the potential relationship between decreasing fertility rates in England & Wales and the number of new cases of STI's reported by GUM clinics. Therefore the null hypothesis *Ho* predicted that there was no relationship between decreasing fertility rates in England & Wales and the increase in number of STI's seen by GUM clinics.

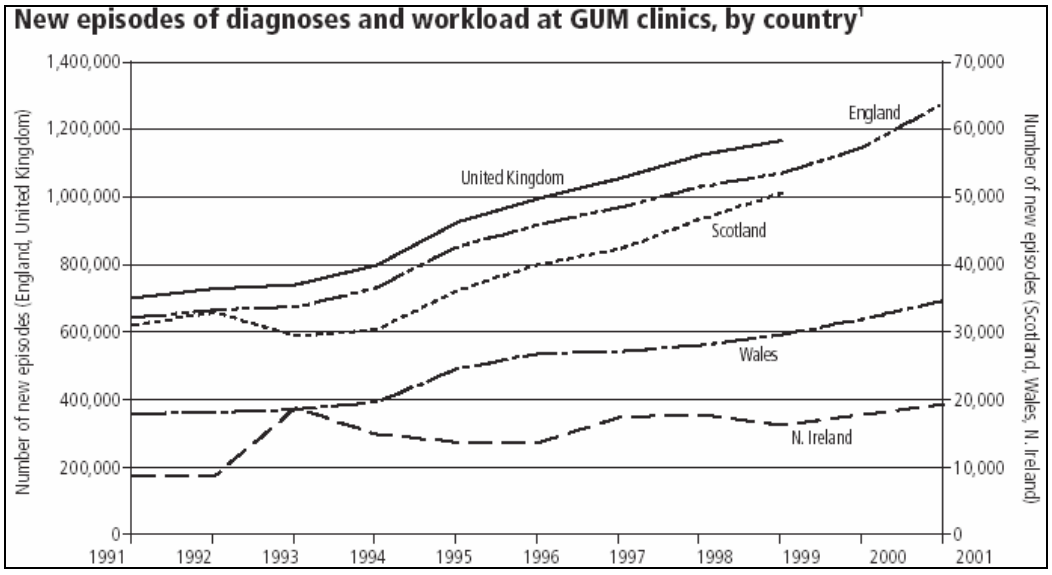

Figure 1. From www.statistics.gov.uk, (The health of children & young people, Adolescent sexual health, March 2004)

Using raw population data selected from the annual abstract of statistics, standard birth and fertility rates were calculated between 1951 and 1998 and compared with the number of cases of STI's reported in England between 1959 and 1993.

The raw data used is as follows;

- Number of females in population, age specific, England & Wales 1951-1998 (Annual abstract of statistics)
- Birth rate per 1000 women, age specific, England & Wales 1956-1998 (Annual abstract of statistics)

- Estimated mid year population, England & Wales 1951-1998 (Annual abstract of statistics)
- Total number of STI's seen at Genito-urinary medicine clinics, England 1949-1993 (Department of health & social security)

Year	STI's (Thousands)
1993	661.3
1992	656.9
1991	634.4
1990	579.2
1989	582.8
1988	560.2
1987	620.3
1986	647.4
1985	605.3
1984	569.9
1983	547.4
1982	517.7
1981	479.9
1980	459.0
1979	417.8
1978	410.7
1977	397.7
1976	380.6
1975	363.6
1974	350.6
1973	346.8
1972	316.8
1971	299.9
1970	246.7
1969	221.5
1968	190.4
1959	112.7
1949	110.9

Table 2. Total number of STI's seen by GUM clinics, England & Wales 1949-1993 (Dept. of health & social security) & (NSO)

Number of females in standard population (Thousands)	Age group						
Year	15-19	20-24	25-29	30-34	35-39	40-44	Total
1998	1545	1517	1902	2079	1953	1725	10721
1997	1529	1563	1942	2088	1904	1694	10719
1996	1503	1634	1976	2079	1854	1672	10717
1995	1473	1711	2001	2054	1802	1666	10707
1994	1454	1773	2039	2011	1759	1682	10718
1993	1459	1841	2063	1958	1723	1704	10748
1992	1510	1896	2083	1910	1695	1755	10849
1991	1718	1927	2024	1797	1612	1800	10878
1990	1666	1972	2060	1799	1667	1836	10999
1989	1734	2020	2016	1747	1683	1813	11012
1988	1806	2049	1963	1711	1709	1779	11016
1987	1864	2068	1910	1679	1759	1705	10985
1986	1907	2072	1847	1658	1849	1570	10903
1985	1932	2052	1782	1651	1842	1505	10764
1984	1973	2005	1728	1667	1817	1462	10652
1983	2007	1948	1693	1693	1784	1421	10546
1982	2121	1943	1708	1765	1735	1417	10689
1981	2016	1830	1649	1835	1584	1385	10299
1980	1965	1765	1645	1823	1499	1397	10094
1979	1922	1972	1672	1796	1461	1387	10210
1978	1874	1692	1700	1771	1420	1369	9826
1977	1863	1680	1753	1730	1470	1361	9857
1976	1810	1662	1852	1599	1401	1365	9689
1975	1762	1661	1850	1533	1419	1378	9603
1974	1720	1685	1832	1491	1407	1401	9536
1973	1688	1710	1811	1449	1837	1428	9923
1972	1664	1763	1746	1421	1378	1446	9418
1971	1621	1850	1601	1411	1378	1464	9325
1970	1629	1885	1575	1450	1411	1468	9418
1969	1652	1869	1533	1443	1425	1492	9414
1968	1682	1839	1501	1426	1443	1522	9413
1967	1741	1763	1478	1416	1455	1558	9411
1966	1825	1639	1473	1416	1473	1598	9424
1965	1822	1582	1479	1425	1487	1661	9456
1964	1813	1537	1462	1433	1507	1706	9458
1963	1792	1501	1440	1457	1536	1667	9393
1962	1728	1470	1419	1472	1570	1606	9265
1961	1577	1438	1400	1478	1621	1554	9068
1960	1509	1450	1414	1497	1680	1499	9049
1959	1457	1429	1426	1515	1752	1443	9022
1958	1412	1402	1449	1541	1681	1531	9016
1957	1389	1386	1465	1573	1615	1612	9040
1956	1389	1389	1479	1621	1561	1655	9094
1955	1399	1405	1497	1679	1503	1685	9168
1954	1399	1421	1520	1756	1451	1689	9236
1953	1381	1446	1553	1692	1548	1689	9309
1952	1368	1470	1590	1630	1632	1697	9387
1951	1369	1500	1654	1565	1691	1707	9486

Table 3. Age specific female population, England & Wales 1951-98 (Annual abstract of statistics)

England & Wales population (Mid year estimates)	
Year	Total (Thousands)
1998	52428
1997	52211
1996	52010
1995	51820
1994	51621
1993	51439
1992	51277
1991	51100
1990	50869
1989	50678
1988	50487
1987	50321
1986	50162
1985	49990
1984	49810
1983	49681
1982	49613
1981	49634
1980	49603
1979	49508
1978	49443
1977	49440
1976	49459
1975	49470
1974	49468
1973	49459
1972	49327
1971	49152
1970	48891
1969	48738
1968	48511
1967	48272
1966	47967
1965	47671
1964	47324
1963	46973
1962	46709
1961	46205
1960	45775
1959	45386
1958	45109
1957	44907
1956	44667
1955	44441
1954	44274
1953	44109
1952	43955
1951	43815

Table 4. Estimated mid year population, England & Wales 1951-98 (Annual abstract of statistics)

Birth rate per 1000 women	Age Group						
Year	15-19	20-24	25-29	30-34	35-39	40-44	Total
1998	30.9	75.5	112.2	89.9	39.8	7.5	355.8
1997	30.2	76.6	104.8	88.8	38.9	7.3	346.6
1996	29.8	77.5	106.9	88.6	37.2	6.9	346.9
1995	28.5	76.8	108.6	87.3	36.2	6.5	343.9
1994	29.0	79.4	112.1	88.7	35.8	6.1	351.1
1993	31.0	82.7	114.1	87.0	34.1	5.9	354.8
1992	31.7	86.2	117.3	87.2	33.4	5.5	361.3
1991	33.0	89.3	119.4	86.7	32.1	5.1	365.6
1990	33.3	91.4	122.6	86.9	31.1	5.0	370.3
1989	32.0	91.7	120.4	83.2	29.4	4.9	361.6
1988	32.5	94.6	124.0	82.4	27.9	4.8	366.2
1987	30.9	93.4	125.0	81.3	26.5	4.8	361.9
1986	30.1	92.7	124.0	78.1	24.6	4.5	354.0
1985	29.5	94.5	127.6	76.4	24.1	4.6	356.7
1984	27.6	95.5	126.2	73.6	23.6	4.5	351.0
1983	26.9	98.5	126.4	71.5	23.1	4.4	350.8
1982	27.4	101.6	126.4	69.1	22.8	4.2	351.5
1981	28.1	105.3	129.1	68.6	21.7	4.4	357.2
1980	30.4	112.7	133.6	70.5	22.3	4.3	373.8
1979	30.3	111.3	131.2	69.0	21.3	4.3	367.4
1978	29.4	106.9	122.6	63.1	19.5	4.2	345.7
1977	29.4	103.7	117.5	58.6	18.2	4.1	331.5
1976	32.2	109.3	118.7	57.2	18.6	4.4	340.4
1975	36.5	114.7	123.2	58.5	20.0	4.8	357.8
1974	40.4	123.4	129.8	60.3	21.6	5.4	380.9
1973	43.9	131.0	135.5	63.6	24.6	6.1	404.6
1972	48.1	141.8	142.8	70.0	28.9	7.2	438.9
1971	51.0	154.4	154.5	77.7	32.8	8.1	478.5
1970	49.9	156.1	154.7	80.1	34.7	8.6	484.2
1969	49.9	157.4	158.4	84.9	37.3	9.5	497.3
1968	49.3	163.3	163.3	89.2	40.3	10.4	515.8
1967	49.1	167.0	167.4	93.1	43.2	11.3	531.0
1966	47.9	176.6	174.6	97.3	45.3	11.7	553.4
1965	45.4	179.6	180.8	102.6	48.1	12.6	569.1
1964	42.3	179.5	185.1	107.1	50.0	13.1	577.0
1963	40.0	178.2	182.8	105.4	48.5	13.4	568.3
1962	39.0	177.4	180.6	104.6	48.6	14.1	564.2
1961	37.3	172.3	176.8	103.1	48.1	14.1	551.7
1960	34.2	165.5	171.8	100.5	46.2	13.8	532.0
1959	31.6	160.2	163.8	94.7	44.1	12.3	506.7
1958	31.0	158.3	161.4	93.6	45.8	12.0	502.1
1957	29.7	152.6	157.3	91.4	46.5	12.2	489.7
1956	27.3	146.7	150.6	88.2	45.5	12.4	470.6
1955	23.5	137.1	141.7	84.3	44.2	12.4	443.1
1954	22.7	136.2	139.1	84.9	44.3	12.9	440.2
1953	22.0	134.6	139.5	89.0	44.2	13.0	442.4
1952	21.06	128.6	135.6	88.91	44.29	13.07	431.6
1951	21.03	126.2	134.2	89.04	45.74	13.36	429.6

Table 5. Birth rate per 1000 women, England & Wales 1951-98 (Annual abstract of statistics)

Standardised birth rate and total fertility rate were calculated using the following equations;

Standardised birth rate
(per 1000 population)

$$\frac{\text{Total expected births in standard population}}{\text{England \& Wales mid Year population}} \times 1000$$

Figure 2.

Total fertility rate
(per women)

$$\frac{\text{Total age specific birth rate} \times 5}{1000}$$

Figure 3.

Total fertility rates (Table 7) indicate the number of children that would be born per women passing through the child bearing ages assuming none of the women die during the period. In this study TFR's were correlated with STI's in order to accept or reject the null hypothesis.

Age specific fertility rates (Table 7), were also calculated using the same method as for total fertility rate (Figure 3), but for specific age ranges. ASFR's are useful for comparing the reproductive behaviour of women at different ages (www.statistics.gov.uk).

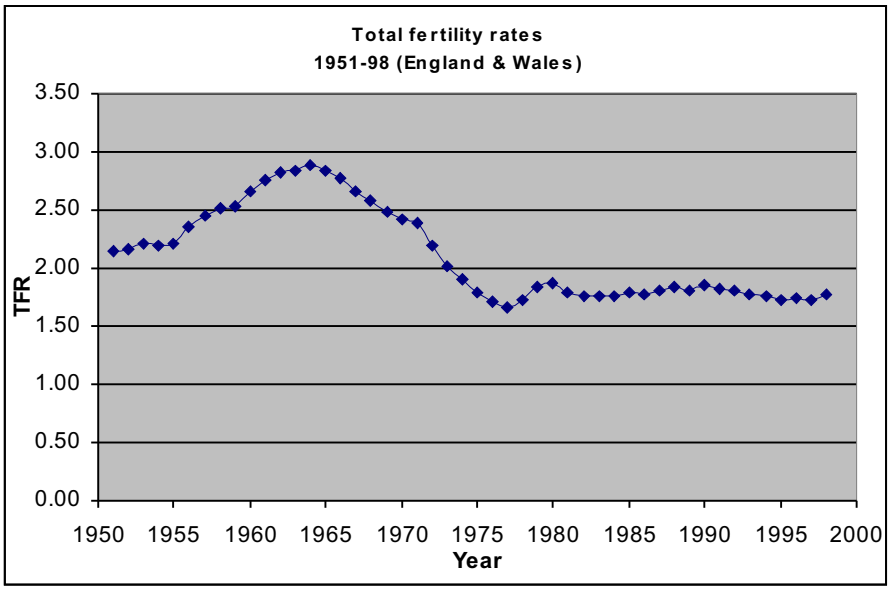

Figure 4. Total fertility rates, England &Wales, 1951-98

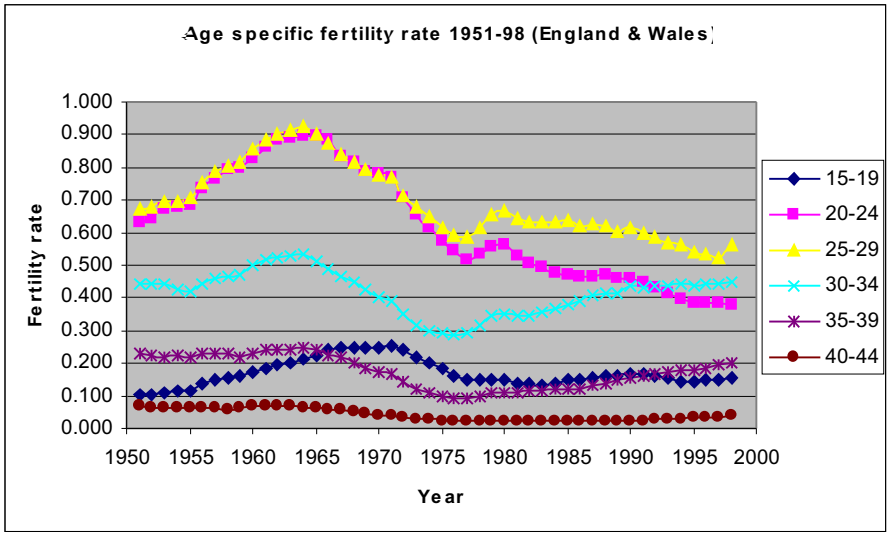

Figure 5. Age specific fertility rates, England & Wales, 1951-98

Year	Standardised birth rate (per 1000 population)
1998	12.5
1997	12.3
1996	12.4
1995	12.5
1994	12.8
1993	13.1
1992	13.4
1991	13.4
1990	13.9
1989	13.6
1988	13.7
1987	13.5
1986	13.2
1985	13.1
1984	12.8
1983	12.6
1982	12.9
1981	12.7
1980	13.0
1979	13.3
1978	11.9
1977	11.5
1976	11.8
1975	12.3
1974	13.0
1973	13.9
1972	14.8
1971	15.9
1970	16.3
1969	16.6
1968	17.1
1967	17.4
1966	17.9
1965	18.3
1964	18.5
1963	18.2
1962	17.9
1961	17.5
1960	17.1
1959	16.5
1958	16.4
1957	16.1
1956	15.6
1955	15.0
1954	15.2
1953	15.5
1952	15.3
1951	15.5

Table 6. Standard birth rate Per 1000 population, 1951 -98, England & Wales

Year	15-19	20-24	25-29	30-34	35-39	40-44	Total fertility Rate
1998	0.155	0.378	0.561	0.450	0.199	0.038	1.78
1997	0.151	0.383	0.524	0.444	0.195	0.037	1.73
1996	0.149	0.388	0.535	0.443	0.186	0.035	1.73
1995	0.143	0.384	0.543	0.437	0.181	0.033	1.72
1994	0.145	0.397	0.561	0.444	0.179	0.031	1.76
1993	0.155	0.414	0.571	0.435	0.171	0.030	1.77
1992	0.159	0.431	0.587	0.436	0.167	0.028	1.81
1991	0.165	0.447	0.597	0.434	0.161	0.026	1.83
1990	0.167	0.457	0.613	0.435	0.156	0.025	1.85
1989	0.160	0.459	0.602	0.416	0.147	0.025	1.81
1988	0.163	0.473	0.620	0.412	0.140	0.024	1.83
1987	0.155	0.467	0.625	0.407	0.133	0.024	1.81
1986	0.151	0.464	0.620	0.391	0.123	0.023	1.77
1985	0.148	0.473	0.638	0.382	0.121	0.023	1.78
1984	0.138	0.478	0.631	0.368	0.118	0.023	1.76
1983	0.135	0.493	0.632	0.358	0.116	0.022	1.75
1982	0.137	0.508	0.632	0.346	0.114	0.021	1.76
1981	0.141	0.527	0.646	0.343	0.109	0.022	1.79
1980	0.152	0.564	0.668	0.353	0.112	0.022	1.87
1979	0.152	0.557	0.656	0.345	0.107	0.022	1.84
1978	0.147	0.535	0.613	0.316	0.098	0.021	1.73
1977	0.147	0.519	0.588	0.293	0.091	0.021	1.66
1976	0.161	0.547	0.594	0.286	0.093	0.022	1.70
1975	0.182	0.574	0.616	0.293	0.100	0.024	1.79
1974	0.202	0.617	0.649	0.302	0.108	0.027	1.90
1973	0.220	0.655	0.677	0.318	0.123	0.030	2.02
1972	0.241	0.709	0.714	0.350	0.145	0.036	2.19
1971	0.255	0.772	0.772	0.389	0.164	0.041	2.39
1970	0.250	0.781	0.773	0.401	0.173	0.043	2.42
1969	0.249	0.787	0.792	0.425	0.187	0.048	2.49
1968	0.246	0.816	0.817	0.446	0.201	0.052	2.58
1967	0.245	0.835	0.837	0.465	0.216	0.056	2.65
1966	0.240	0.883	0.873	0.487	0.227	0.058	2.77
1965	0.227	0.898	0.904	0.513	0.241	0.063	2.85
1964	0.212	0.898	0.925	0.535	0.250	0.065	2.89
1963	0.200	0.891	0.914	0.527	0.242	0.067	2.84
1962	0.195	0.887	0.903	0.523	0.243	0.070	2.82
1961	0.186	0.862	0.884	0.516	0.241	0.070	2.76
1960	0.171	0.827	0.859	0.503	0.231	0.069	2.66
1959	0.158	0.801	0.819	0.474	0.221	0.061	2.53
1958	0.155	0.792	0.807	0.468	0.229	0.060	2.51
1957	0.148	0.763	0.786	0.457	0.233	0.061	2.45
1956	0.137	0.733	0.753	0.441	0.227	0.062	2.35
1955	0.118	0.685	0.709	0.422	0.221	0.062	2.22
1954	0.113	0.681	0.696	0.425	0.222	0.065	2.20
1953	0.110	0.673	0.698	0.445	0.221	0.065	2.21
1952	0.105	0.643	0.678	0.445	0.221	0.065	2.16
1951	0.105	0.631	0.671	0.445	0.229	0.067	2.15

Table 7. Age specific fertility rates & Total fertility rate, 1951-98, England & Wales

Total fertility rates found in the literature confirm the calculated TFR's in this study. A small rise after the War, associated with demobilisation is then followed by a more sustained increase between 1958 & 1971, reaching a maximum of 2.89 in 1964. TFR then dramatically declines from 1971 to a record low of 1.66 in 1977. A slight increase occurred and from about 1980 TFR has remained relatively consistent at around 1.8 (Hine 2003).

Unfortunately data for the total number of STI's reported by GUM clinics in England & Wales were not available and for the purpose of this study data for England were assumed as representative of both England & Wales.

Data for the total number of STI's reported by GUM clinics between 1951 -98 in England is incomplete, however statistics for 1949 and 1959 were available and a line of best fit was fitted to the graph (Figure 6).

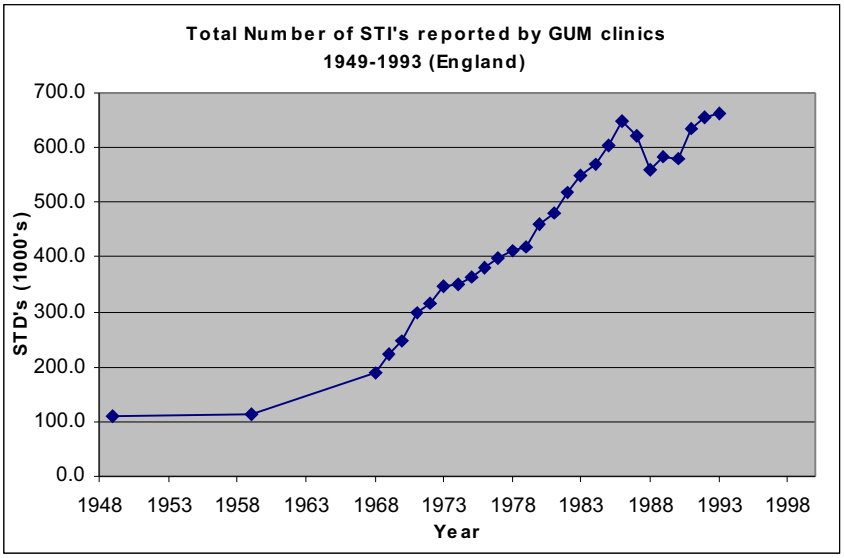

Figure 6. Number of STI's reported by GUM clinics, England, 1949 -1993

Between 1949 and 1993 new cases of STI's reported by GUM clinics in England increased by approximately 650%, from 110,900 in 1949 to 661,300 in 1993. In 2001 this figure stood at around 1,300,000 (Figure 1), a further increase of 200% since the beginning of 1990.

Cases of Gonorrhoea and Chlamydia steadily increased between 1949 and 1986, which is significant as both, if untreated, are associated with pelvic inflammatory disease and tubal factor infertility (PHLS *et al* 2002).

Cases of Gonorrhoea increased from 23,123 in 1949 to its peak of 58,734 in 1977, an increase of 254%. After 1977 we see a gradual decline in cases of Gonorrhoea (Figure 7).

Chlamydia likewise steadily increased from 21,492 in 1959 to its peak in 1986 of 157,792, an increase of 734%. Similar to Gonorrhoea, cases of Chlamydia declined between 1986 and 1993 (Figure 8).

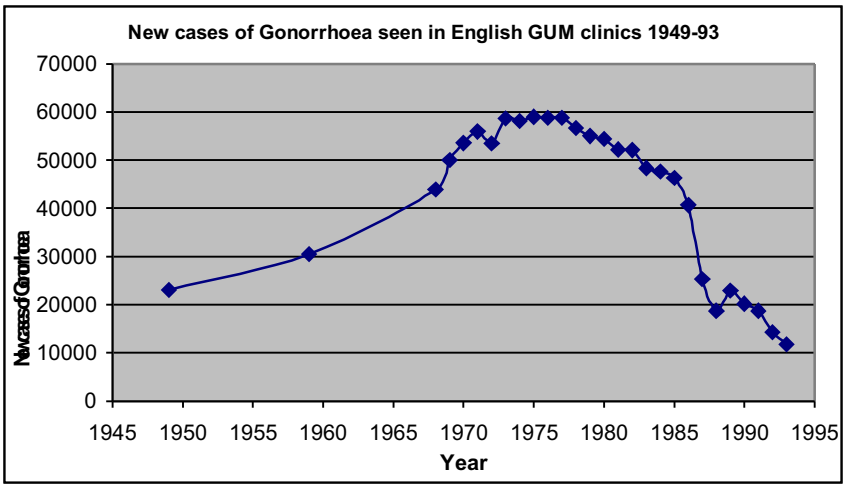

Figure 7. New cases of Gonorrhoea seen in English GUM clinics 1949-93

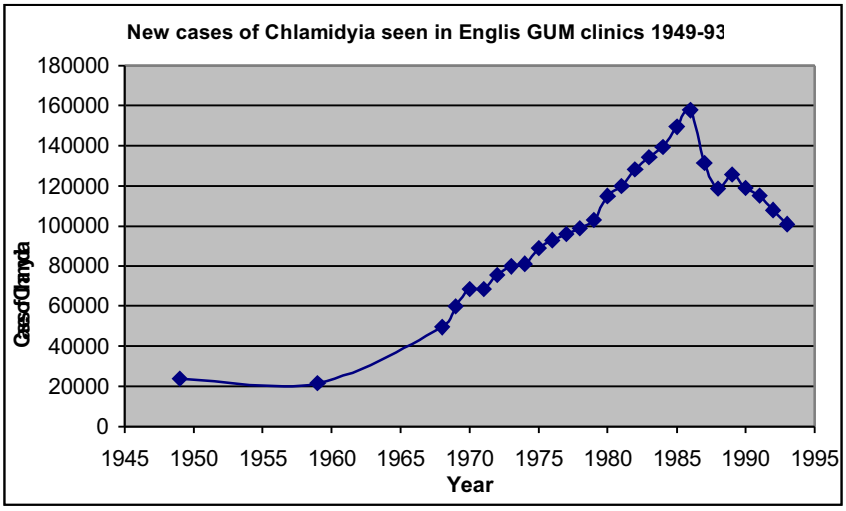

Figure 8. New cases of Chlamydia seen in English GUM clinics 1949-93

At the same time as new cases of Gonorrhoea reaching its highest ever value TFR reached an all time low of 1.66 in 1977. After 1977 we see a slight increase to 1.87 in 1980 and then plateaus off over the next 13 years. It could be suggested that the lowest ever fertility rates in England and Wales has a direct relationship with the highest number of new cases of Gonorrhoea and the relatively more consistent TFR of 1.8 between 1980 and 1993 coincides with the decline in the number of new cases of Gonorrhoea and Chlamydia reported by GUM clinics.

To reinforce the aims of the study the null hypothesis *Ho* predicts no relationship between decreasing fertility rates in England & Wales and the increase in number of STI's seen by GUM clinics.

In order to accept or reject the null hypothesis, total cases of STI's & TFR's were entered into SPSS and correlated. As all the data met parametric tests and is of an interval level of measurement a 2-tailed Pearson's correlation was used. The data

set for new cases of STI's are incomplete so only 1993-68, 1959, & 1949 figures were correlated with TFR. The 1949 value for cases of STI's seen in GUM clinics were assumed as the 1951 value as very little increase is seen between 1949 and 1959.

Year	TFR	STI's (1000's)
1993	1.77	661.3
1992	1.81	656.9
1991	1.83	634.4
1990	1.85	579.2
1989	1.81	582.8
1988	1.83	560.2
1987	1.81	620.3
1986	1.77	647.4
1985	1.78	605.3
1984	1.76	569.9
1983	1.75	547.4
1982	1.76	517.7
1981	1.79	479.9
1980	1.87	459.0

Year	TFR	STI's (1000's)
1979	1.84	417.8
1978	1.73	410.7
1977	1.66	397.7
1976	1.7	380.6
1975	1.79	363.6
1974	1.9	350.6
1973	2.02	346.8
1972	2.19	316.8
1971	2.39	299.9
1970	2.42	246.7
1969	2.49	221.5
1968	2.58	190.4
1959	2.58	112.7
1951	2.15	110.9

Table 8. SPSS Pearson's correlation data.

Pearson's correlation coefficient (r) gives a value of 0.732. With n=26, Pearson product moment correction values give a significance (p) at the 0.01 level, which confirms that given by SPSS.

Therefore the null hypothesis is rejected and it can be suggested that decreasing fertility rates can be associated with increasing cases of STI's.

Increased sexual risk behaviour accounts for much of the rise in STI diagnosis however delays of up to a week for urgent and as much as four weeks for non urgent appointments increases duration of infectiousness which in turn increases STI incidence. Other reasons for the increases in cases of STI's include increased acceptability of GUM services, increased awareness both professionally and public, and improved diagnostic testing (PHLS *et al* 2002).

It is also important to consider that cases of STI's in the population is underestimated as diagnoses made in non GUM clinics go un-reported in this type of data set and infections such as gonorrhoea & genital chlamydial infection are often asymptomatic and subsequently go un-diagnosed (PHLS *et al* 2002)

Regardless of the fact that STI's are underestimated they still only occur in a small fraction of the population and therefore it is important to consider other factors that lead to decreasing total fertility rates in England & Wales.

More recently the most dramatic change in fertility rates in England and Wales has been a shift towards later childbearing (Ruddock *et al* 1998). Figure 4 shows that

since 1980 fertility rates in the age group of 30-34 & 35-39 have been increasing from 0.353 & 0.112 respectively in 1980 to 0.450 & 0.199 respectively in 1998. This coincides with decreasing fertility rates between the ages of 20-24 & 25-29. Fertility rates of this age group were 0.564 & 0.668 respectively in 1980, and 0.378 & 0.561 respectively in 1998. In terms of fertility rates the result of later childbearing meant that the TFR of these two age groups (20-24 & 25-29) & (30-34 & 35-39) equalled 1.7 and 1.6 in 1980 and 1998 respectively.

This agrees with Hines statement that in the last two decades women have been postponing parenthood in place of entering higher education and paid employment (Hine 2003).

Widespread adoption of contraception is seen as the principal cause of fertility decline (Black 1999).

The contraceptive pill was introduced to the UK in the early 1960's and by 2002/03 was used by 26% of women aged between 16 and 49, remaining the most common method of contraception used (www.statistics.gov.uk).

One obvious result that highlights the importance of the contraceptive pill to fertility rates was the pill scare of 1977. The Royal College of General Practitioner's and University of Oxford/FPA published studies which concluded that use of oral contraception increased the risk of death from cardiovascular disease and as a result sales plummeted. In 1978 fertility rates began to rise and continued to do so until 1980 from 1.66 to 1.87 respectively (Bone 1982).

Therefore it can be suggested that the contraceptive pill and the postponement of parenthood has had a much bigger effect on fertility rates than that of STI's.

In fact one article suggests that women who do use contraception are usually more sexually active and have more sexual partners thus are at a higher risk of STI's (Chandran 1993).

Therefore the contraceptive pill can be seen as a double edged sword in that it has the affect of decreasing fertility rates whilst at the same time increasing cases of STI's.

In conclusion, the case study revealed that fertility rates in England & Wales have been declining since 1964 and as a result have been lower than the necessary level for replacement of generations since 1974. The study found that there is a significant relationship between the number of new cases of STI's, $p = 0.01$, and TFR's. This can be explained for example by the increase of cases of Gonorrhoea and Chlamydia which if untreated lead to pelvic inflammatory disease and tubal factor infertility.

However the importance of STI's in the decline of fertility in England & Wales is somewhat insignificant compared to that of the contraceptive pill or the recent trend of parenthood postponement.

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Appendix