MARIE STOPES INTERNATIONAL

PROVIDING CHOICES IN REPRODUCTIVE HEALTHCARE

The MSI Impact Calculator: methodology and assumptions

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2009

Acknowledgements

The authors would like to thank the following people for their contributions: Akin Bankole, Nada Chaya, Chris Duncan, Sam Guy, Kim Longfield, Thoai Ngo, Kristen Ormston, Dhaval Patel, Francisco Pozo-Martin and Warren Stevens.

Acronyms

AGI	Alan Guttmacher Institute
CYP	Couple years of protection
DALYs	Disability adjusted life years
DHS	Demographic and Health Surveys
HIV	Human immunodeficiency virus
IMR	Infant mortality rate
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Surveys
MMR	Maternal mortality ratio
MSI	Marie Stopes International
PSI	Population Services International
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization
WWF	World Wildlife Fund

For citation purposes: Corby N, Boler T and Hovig D. *The MSI Impact Calculator: methodology and assumptions*. London: Marie Stopes International, 2009.

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Introduction

Marie Stopes International (MSI) is one of the largest and most experienced reproductive health organisations in the world. It currently works in more than 40 countries across Africa, Asia, Latin America and Europe, delivering high-quality reproductive health services and products, including family planning, safe abortion and post-abortion care; maternal and child healthcare; and treatment for sexually transmitted infections.

As a leading organisation in this field, MSI and its partners are committed to measuring the global impact of its work. It achieves this by monitoring the number of clients reached, the number of services provided or contraceptive methods supplied and the couple years of protection (CYP) subsequently delivered in each country. This monitoring enables comparison across countries and greater analysis of financial, market and client trends. In turn, it also enables MSI and its partners to respond quickly and effectively to those trends and develop strong, evidence-based operational plans.

This paper builds upon this on-going monitoring by identifying how MSI and its partners can estimate the broader impact of its health programmes. In particular, it identifies how MSI and its partners can estimate the demographic, health, economic and environmental impact of its family planning and safe abortion services (including treatment of incomplete abortions). All of the analysis relies on validated and commonly used formulas – i.e. MSI has not created its own model but rather systematically assessed and integrated existing models. In the future, it is expected that MSI will probably develop its own models and thus, these estimates should be viewed as a work in progress.

The formulas for assessing impact were applied systematically to national level data in order to create a series of simple conversion tables, which form the basis of the MSI Impact Calculator (Chapter One). MSI programmes can easily estimate their impact on a number of international indicators by following the simple rules explained in Chapter One.

For those who wish to understand the methodology underlying the MSI Impact Calculator, Chapter Two discusses the sources and methodology used and highlights the limitations of each one in turn. In doing so, this paper recognises that, whilst this broader impact analysis is far from perfect, it presents a strong, systematic basis upon which to estimate the impact of health programmes undertaken by MSI and its partners. The original data source, formulas and an interactive tool are available in Microsoft Excel upon request.

It should be noted that the MSI Impact Calculator will under-estimate the total impact of MSI programmes. This is because the starting point for most of the calculations is MSI's family planning and safe abortion services. The MSI Impact Calculator subsequently omits MSI programmes unrelated to these particular services such as human immunodeficiency virus (HIV) or safe delivery programmes.

Chapter One: Conversion tables

The following conversion tables (Tables 1-6) provide coefficients[i] with which the demographic, health, economic and environmental impact of MSI's family planning and safe abortion services can be estimated. Only countries where MSI or its partners work are included in the following tables.

Tables 1-3 provide coefficients to estimate the impact of family planning services (note this does not include safe abortion). A metric known as CYP (couple years protection) is used as a measure of family planning impact and is described in more detail on page 12. All coefficients for family planning impact are therefore provided per CYP.

Tables 4-6 provide estimates of the impact of either safe abortion services or treatment of incomplete abortions (which may arise through spontaneous or induced abortion).

In some countries, MSI will provide safe abortions and in some other countries MSI will only provide treatment of incomplete abortion. For a full description of which services MSI offers in which country, please visit: www.mariestopes.org. For the sake of simplicity, the conversion tables refer to the impact of "safe abortion" although what service is actually being assessed will depend on the country.

1.1 How to use the tables

To estimate the impact of family planning programmes, first CYP estimates need to be developed. All MSI programmes already count CYPs and use the conversion factors outlined on page 13.

Once you have the family-related CYPs or the number of safe abortions or treatment of incomplete abortions:

1) choose which indicator to analyse
2) multiply the total number of CYPs provided (for Tables 1-3) or the total number of safe abortions provided (for Table 4-6) by the corresponding coefficient.

In order to then estimate the total impact of MSI's family planning and safe abortion services, add the impact of family planning to the impact of safe abortions.

To estimate the total impact of MSI and its partners by region or globally for one particular indicator in Tables 1-6, calculate the sum of all relevant country estimates.

[i] Coefficient means a number that is used to multiply another number. In all these cases, coefficients are rounded up to six decimal places.

Table 1: Demographic and health impact of family planning services (as measured per CYP)

	Indicators and related coefficients						
COUNTRY	1a No. of pregnancies averted	1b No. of births averted	1c No. of infant mortalities averted	1d No. of under-five mortalities averted	1e No. of maternal mortalities averted	1f No. of abortions averted	1g number of unsafe abortions averted
Afghanistan	0.571429	0.375115	0.061894	0.096405	0.006752	0.164516	0.109677
Albania	0.571429	0.328364	0.004400	0.004985	0.000302	0.234058	0.043116
Australia	0.571429	0.340725	0.001567	0.001942	0.000014	0.215672	-
Austria	0.571429	0.378862	0.001364	0.001629	0.000015	0.158943	-
Bangladesh	0.571429	0.375115	0.017638	0.022694	0.002138	0.164516	0.109677
Bolivia	0.571429	0.328364	0.015630	0.018848	0.000952	0.234058	0.234058
Burkina Faso	0.571429	0.415539	0.043258	0.079243	0.002909	0.104386	0.104386
Cambodia	0.571429	0.308374	0.021645	0.028031	0.001665	0.263793	0.158276
China	0.571429	0.292715	0.005529	0.006410	0.000132	0.287086	-
East Timor	0.571429	0.308374	0.023828	0.029851	0.001172	0.263793	0.158276
Ethiopia	0.571429	0.390476	0.029364	0.046310	0.002811	0.141667	0.141667
Fiji	0.571429	0.382670	0.005970	0.006834	0.000804	0.153279	0.027869
Ghana	0.571429	0.415539	0.030417	0.047870	0.002327	0.104386	0.104386
India	0.571429	0.375115	0.020406	0.027035	0.001688	0.164516	0.109677
Ireland	0.571429	0.433766	0.001605	0.001822	0.000004	0.077273	-
Kenya	0.571429	0.390476	0.031160	0.047326	0.002187	0.141667	0.141667
Madagascar	0.571429	0.390476	0.027333	0.043655	0.001991	0.141667	0.141667
Malawi	0.571429	0.390476	0.027552	0.043148	0.004295	0.141667	0.141667
Mali	0.571429	0.415539	0.048535	0.081279	0.004031	0.104386	0.104386
Mexico	0.571429	0.367800	0.010593	0.012770	0.000221	0.175397	0.175397
Mongolia	0.571429	0.292715	0.010309	0.012675	0.000135	0.287086	-
Myanmar	0.571429	0.308374	0.022758	0.031763	0.001172	0.263793	0.158276
Namibia	0.571429	0.375115	0.017679	0.025358	0.000788	0.164516	0.123387
Nepal	0.571429	0.375115	0.016167	0.020519	0.003113	0.164516	0.109677
Nigeria	0.571429	0.415539	0.040390	0.078454	0.004571	0.104386	0.104386
Pakistan	0.571429	0.375115	0.027421	0.033910	0.001200	0.164516	0.109677
Papua New Guinea	0.571429	0.382670	0.019118	0.024912	0.001799	0.153279	0.027869
Philippines	0.571429	0.308374	0.007028	0.008696	0.000709	0.263793	0.158276
Romania	0.571429	0.193031	0.002432	0.002876	0.000046	0.435366	0.053902
Sierra Leone	0.571429	0.415539	0.064409	0.108788	0.008726	0.104386	0.104386
South Africa	0.571429	0.375115	0.017274	0.022132	0.001500	0.164516	0.123387
Sri Lanka	0.571429	0.375115	0.006189	0.007690	0.000218	0.164516	0.109677
Tanzania	0.571429	0.390476	0.028673	0.045178	0.003710	0.141667	0.141667
Uganda	0.571429	0.390476	0.031902	0.050918	0.002148	0.141667	0.141667
United Kingdom	0.571429	0.357254	0.001751	0.002072	0.000029	0.191085	-
Vietnam	0.571429	0.343931	0.004447	0.005159	0.000516	0.210902	0.172556
Yemen	0.571429	0.382670	0.020898	0.027705	0.001645	0.153279	0.048770
Zambia	0.571429	0.390476	0.040317	0.066303	0.003241	0.141667	0.141667
Zimbabwe	0.571429	0.390476	0.023015	0.035143	0.003436	0.141667	0.141667

Data not available (-).
All figures are rounded to six decimal points.
These figures were derived using the rules for data selection (see section 2.1) and includes data from: Multiple Indicator Cluster Surveys (MICS), Alan Guttmacher Institute (AGI).; Sedgh G, et al (2007).; World Health Organization, (2007); WHO; and peer-reviewed studies including: Everett 1997 and Warburton and Fraser (1964). More details are available upon request in the form of the original Microsoft Excel workbook.

Table 2: Overall health impact of family planning services as measured per CYP

COUNTRY	Disability-adjusted life years (DALYs) averted
Afghanistan	0.143114
Albania	-
Australia	-
Austria	-
Bangladesh	0.143114
Bolivia	0.039591
Burkina Faso	0.246616
Cambodia	0.058877
China	0.058877
East Timor	-
Ethiopia	0.246616
Fiji	-
Ghana	0.246616
India	0.143114
Ireland	-
Kenya	0.246616
Madagascar	0.246616
Malawi	0.246616
Mali	0.246616
Mexico	0.039591
Mongolia	0.058877
Myanmar	0.058877
Namibia	0.058877
Nepal	0.143114
Nigeria	0.246616
Pakistan	0.143114
Papua New Guinea	-
Philippines	-
Romania	0.053097
Sierra Leone	-
South Africa	0.246616
Sri Lanka	0.143114
Tanzania	0.246616
Uganda	0.246616
United Kingdom	-
Vietnam	0.058877
Yemen	-
Zambia	0.246616
Zimbabwe	0.246616

Data not available (-).
All figures are rounded to six decimal points.
These figures were derived using the rules for data selection (see section 2.1) and are based on data and formulas from unpublished calculations by Population Services International (PSI). More details are available upon request in the form of the original Microsoft Excel workbook.

Table 3: Economic and environmental impact of family planning services as measured per CYP

	Indicators and related coefficients		
COUNTRY	3a Total cost savings (GBP)	3b Ecological footprint prevented (global hectares per person)	3c Carbon footprint prevented (global hectares per person)
Afghanistan	106.827743	0.187558	-
Albania	20.000020	0.722402	0.364484
Australia	23.935443	2.657655	0.674635
Austria	13.581528	1.894309	1.163106
Bangladesh	41.269218	0.225069	0.048765
Bolivia	69.657228	0.689565	0.124778
Burkina Faso	71.199423	0.831078	0.029088
Cambodia	111.902212	0.277537	0.043172
China	44.711728	0.614702	0.330768
East Timor	114.953112	-	-
Ethiopia	60.412487	0.546667	0.023429
Fiji	40.847974	-	-
Ghana	54.746332	0.623308	0.124662
India	42.695519	0.337604	0.123788
Ireland	6.602877	2.732727	1.748078
Kenya	57.656905	0.429524	0.046857
Madagascar	52.596931	0.429524	0.015619
Malawi	69.305365	0.195238	0.027333
Mali	84.284417	0.664862	0.033243
Mexico	38.457274	1.250522	0.706177
Mongolia	61.157078	1.024503	0.357113
Myanmar	111.277566	0.339212	0.018502
Namibia	36.702888	1.387926	0.240074
Nepal	43.176961	0.300092	0.011253
Nigeria	80.359640	0.540201	0.049865
Pakistan	48.673509	0.300092	0.112535
Papua New Guinea	94.982265	0.650539	-
Philippines	53.075524	0.277537	0.021586
Romania	37.201577	0.559791	0.218125
Sierra Leone	133.102249	0.332431	-
South Africa	41.419504	0.787742	0.386369
Sri Lanka	21.677897	0.375115	0.138793
Tanzania	66.183021	0.429524	0.035143
Uganda	58.087186	0.546667	0.011714
United Kingdom	16.328045	1.893444	1.253960
Vietnam	37.947820	0.447111	0.158208
Yemen	64.062989	0.344403	0.137761
Zambia	73.969397	0.312381	0.054667
Zimbabwe	58.811350	0.429524	0.082000

Data not available (-).
These figures were derived using the rules for data selection (see section 2.1) and includes data and formulas from: Levine et al. (2006); Vlassof (2006) and World Wildlife Fund (2008)_More details are available upon request in the form of the original Microsoft Excel workbook.

Table 4: Demographic and health impact of a safe abortion or a treatment of an incomplete abortion

	Indicators and related coefficients				
COUNTRY	4a No. of births averted	4b No. of infant mortalities averted	4c No. of under-five mortalitites averted	4d No. of maternal mortalities averted	4e No. of unsafe abortions averted
Afghanistan	0.85	0.140250	0.218450	0.015300	0.666667
Albania	0.85	0.011390	0.012903	0.000782	0.184211
Australia	0.85	0.003910	0.004845	0.000034	-
Austria	0.85	0.003060	0.003655	0.000034	-
Bangladesh	0.85	0.039967	0.051425	0.004845	0.666667
Bolivia	0.85	0.040460	0.048790	0.002465	1
Burkina Faso	0.85	0.088485	0.162095	0.005950	1
Cambodia	0.85	0.059662	0.077265	0.004590	0.60
China	0.85	0.016057	0.018615	0.000383	-
East Timor	0.85	0.065680	0.082280	0.003230	0.60
Ethiopia	0.85	0.063920	0.100810	0.006120	1
Fiji	0.85	0.013260	0.015181	0.001785	0.181818
Ghana	0.85	0.062220	0.097920	0.004760	1
India	0.85	0.046240	0.061260	0.003825	0.666667
Ireland	0.85	0.003145	0.003570	0.000009	-
Kenya	0.85	0.067830	0.103020	0.004760	1
Madagascar	0.85	0.059500	0.095030	0.004335	1
Malawi	0.85	0.059976	0.093925	0.009350	1
Mali	0.85	0.099280	0.166260	0.008245	1
Mexico	0.85	0.024480	0.029512	0.000510	1
Mongolia	0.85	0.029937	0.036805	0.000391	-
Myanmar	0.85	0.062730	0.087550	0.003230	0.60
Namibia	0.85	0.040061	0.057460	0.001785	0.75
Nepal	0.85	0.036635	0.046495	0.007055	0.666667
Nigeria	0.85	0.082620	0.160480	0.009350	1
Pakistan	0.85	0.062135	0.076840	0.002720	0.666667
Papua New Guinea	0.85	0.042466	0.055335	0.003995	0.181818
Philippines	0.85	0.019372	0.023970	0.001955	0.60
Romania	0.85	0.010710	0.012665	0.000204	0.123810
Sierra Leone	0.85	0.131750	0.222530	0.017850	1
South Africa	0.85	0.039143	0.050150	0.003400	0.75
Sri Lanka	0.85	0.014025	0.017425	0.000493	0.666667
Tanzania	0.85	0.062416	0.098345	0.008075	1
Uganda	0.85	0.069445	0.110840	0.004675	1
United Kingdom	0.85	0.004165	0.004930	0.000068	-
Vietnam	0.85	0.010991	0.012750	0.001275	0.818182
Yemen	0.85	0.046419	0.061540	0.003655	0.318182
Zambia	0.85	0.087763	0.144330	0.007055	1
Zimbabwe	0.85	0.050099	0.076500	0.007480	1

Data not available (-).
All figures are rounded to six decimal points.
These figures were derived using the rules for data selection (see section 2.1) and includes data from: MICS, AGI (1991); Sedgh et al. (2007); WHO (2007); WHO ;and peer-reviewed studies including: Everett (1997); and Warburton (1964). More details are available upon request in the form of the original Microsoft Excel workbook.

Table 5: Overall health impact of a safe abortion or a treatment of an incomplete abortion

COUNTRY	Disability-adjusted life years (DALYs) averted
Afghanistan	0.286227
Albania	-
Australia	-
Austria	-
Bangladesh	0.286227
Bolivia	0.079181
Burkina Faso	0.493233
Cambodia	0.117754
China	0.117754
East Timor	-
Ethiopia	0.493233
Fiji	-
Ghana	0.493233
India	0.286227
Ireland	-
Kenya	0.493233
Madagascar	0.493233
Malawi	0.493233
Mali	0.493233
Mexico	0.079181
Mongolia	0.117754
Myanmar	0.117754
Namibia	0.117754
Nepal	0.286227
Nigeria	0.493233
Pakistan	0.286227
Papua New Guinea	-
Philippines	-
Romania	0.106195
Sierra Leone	-
South Africa	0.493233
Sri Lanka	0.286227
Tanzania	0.493233
Uganda	0.493233
United Kingdom	-
Vietnam	0.117754
Yemen	-
Zambia	0.493233
Zimbabwe	0.493233

Data not available (-).
All figures are rounded to six decimal points.
These figures were derived using the rules for data selection (see section 2.1) and are based on data and formulas from unpublished calculations by PSI. More details are available upon request in the form of the original Microsoft Excel workbook.

Table 6: Economic and environmental impact of a safe abortion or a treatment of an incomplete abortion

COUNTRY	Indicators and related coefficients 6a Total cost savings (GBP)	6b Ecological footprint prevented (global hectares per person)	6c Carbon footprint prevented (global hectares per person)
Afghanistan	267.180095	0.425	-
Albania	15.740605	1.870	0.944
Australia	13.737003	6.630	1.683
Austria	-	4.250	2.610
Bangladesh	118.626409	0.510	0.111
Bolivia	216.142934	1.785	0.323
Burkina Faso	213.257412	1.700	0.060
Cambodia	297.584126	0.765	0.119
China	58.601092	1.785	0.961
East Timor	305.993595	-	-
Ethiopia	190.968652	1.190	0.051
Fiji	77.176516	-	-
Ghana	179.602010	1.275	0.255
India	121.858366	0.765	0.281
Ireland	0.000000	5.355	3.426
Kenya	184.970219	0.935	0.102
Madagascar	173.955520	0.935	0.034
Malawi	210.326929	0.425	0.060
Mali	240.023249	1.360	0.068
Mexico	142.935324	2.890	1.632
Mongolia	106.355857	2.975	1.037
Myanmar	295.862357	0.935	0.051
Namibia	115.598027	3.145	0.544
Nepal	122.949299	0.680	0.026
Nigeria	231.994973	1.105	0.102
Pakistan	135.404315	0.680	0.255
Papua New Guinea	197.421565	1.445	-
Philippines	135.434845	0.765	0.060
Romania	10.579400	2.465	0.961
Sierra Leone	339.881920	0.680	-
South Africa	126.285738	1.785	0.876
Sri Lanka	74.233055	0.850	0.315
Tanzania	203.530119	0.935	0.077
Uganda	185.906868	1.190	0.026
United Kingdom	-	4.505	2.984
Vietnam	119.159487	1.105	0.391
Yemen	140.382986	0.765	0.306
Zambia	220.479730	0.680	0.119
Zimbabwe	187.483249	0.935	0.179

Data not available (-).
These figures were derived using the rules for data selection (see section 2.1) and includes data and formulas from: Levine (2006); Vlassof (2006) and the WWF (2008*)*. More details are available upon request in the form of the original Microsoft Excel workbook.

Chapter Two: Methodology

This section discusses in more detail the sources and methodology used to derive the coefficients provided in Tables 1-6. The discussion below describes the rules for data selection, provides an analysis of the data used to derive the coefficients for each indicator, the data's limitations and how the data could be improved.

2.1. Rules for data selection

The accuracy of the coefficients provided in Tables 1-6 are only as accurate as the original data or formulas used. Given this, any primary data used are the most recent nationally representative data from Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Survey (MICS) or other surveys, UN reports or databases, reports by an international organisation or peer reviewed studies.

DHS surveys are nationally representative household surveys that provide data in the areas of population, health and nutrition. Standard DHS surveys have a sample size between 5,000 and 30,000 households and are typically conducted every five years. Interim DHS surveys are conducted between standard surveys and have shorter questionnaires. Although nationally representative, they have smaller sample sizes (up to 3,000 households).[ii] Similarly, the MICS programme is a nationally representative survey developed by UNICEF to monitor key indicators such as nutrition, maternal mortality and contraception. This programme has been conducted every five years since 1995 and is now the largest source of statistical information on children. Furthermore, it is designed to complement DHS surveys (and other household surveys) to aid comparison of data.

The formulas used to derive these coefficients are recognised as the best and are widely used by partner organisations such as WHO, UNICEF and the Alan Guttmacher Institute (AGI). In many cases they are also the only formulas available. Where different formulas existed, those used by UN agencies or those that had gained broad support were selected.

2.2. Estimating the impact of family planning

The data used to derive the coefficients in Tables 1-6 is discussed in more detail below. First though, it is important to identify MSI's CYP measurement and the associated limitations.

2.2.1. Using CYP to measure family planning performance

CYP is a commonly used measurement of family planning performance.[1] It is calculated by multiplying the number of each contraceptive method given to clients by a corresponding conversion factor. This yields an estimate of the duration of contraceptive protection provided.[1] One full CYP is the equivalent of one year of protection from unintended pregnancy for one couple.

[ii] See http://www.measuredhs.com/aboutsurveys/dhs/start.cfm for more information.

The conversion factor differs for each method of contraception. For example, the conversion factors used by MSI equate 100 male condoms paid for by the client and 500 free male condoms to one CYP (see Table 7). These differences are because the factors reflect how many estimated units of that method are typically needed to provide one year of contraceptive protection per couple. They also reflect estimated effectiveness, wastage and frequency of sexual intercourse.[2]

Table 7: CYP conversion rates used by MSI for family planning services

Procedure/method	Factor	Number of CYPs
Tubal Ligation	12.5	1 Marie Stopes Ligation = 12.5 CYPs
Vasectomy	12.5	1 Marie Stopes Vasectomy = 12.5 CYPs
IUCD (Gynefix & other) – insertion	5.5	1 IUCD insertion = 5.5 CYPs
Diaphragm insertion	1	1 diaphragm insertion = 1 CYP
Injectables – 1 month	0.83	12 monthly injectables provided = 1 CYP
Injectables – 2 month	0.166	6 two-month injectables provided = 1 CYP
Injectables – 3 month	0.25	4 three-month injectables provided = 1 CYP
3-year implant insertion	3.5	1 three-year implant insertion = 3.5 CYPs
5-year implant insertion	3.5	1 five-year implant insertion = 3.5 CYPs
Pills (client pays)	0.0714	14 cycles of the pill sold = 1 CYP
Pills (free supply)	0.0142	70 cycles of the pill provided free = 1 CYP
Male condom (client pays)	0.01	100 pieces of male condoms sold = 1 CYP
Male condom (free supply)	0.002	500 pieces of male condoms provided free = 1 CYP
Female condom (client pays)	0.05	20 pieces of female condoms sold = 1 CYP
Female condom (free supply)	0.01	100 pieces of female condoms provided free = 1 CYP
Foam tablets (client pays)	0	Foam tablets sold = 0 CYPs
Foam tables (free supply)	0	Foam tablets provided free = 0 CYPs
Emergency contraception (client pays)	0.11	9 packs of emergency contraception sold = 1 CYP
Emergency contraception (free supply)	0.022	45 packs of emergency contraception provided free = 1 CYP

These conversion factors offer only a limited indication of family planning performance for a number of reasons. For example, these conversion factors do not reflect regional or national estimates of wastage for condoms or frequency of sexual intercourse. Furthermore, they do not account for method substitution (Levine et al 2006).[3] A particular distribution programme may simply cause people to replace one contraceptive method or supplier for another and not necessarily increase the overall use of contraception. In addition, these factors do not reflect the cost-effectiveness of different programmes.[3] They also ignore whether a particular programme is reaching high-risk or marginalised groups.[4]

2.2.2. Number of pregnancies averted

Indicator 1a (see Table 1) enables MSI and its partners to estimate the number of pregnancies they avert per CYP they provide. This presents a basic but crucial means with which MSI and its partners can estimate the impact of its family planning services.

Formula

The number of pregnancies averted per CYP was simply derived from a ratio developed by AGI in 1996; that seven CYPs will avert four unintended pregnancies. The number of pregnancies averted per CYP was calculated using this ratio as follows:

$$\text{Number of pregnancies averted per CYP (1a)} = \frac{4}{7}$$

Data source

The AGI ratio presented the best and only estimate of the relationship between CYPs and pregnancies averted. Furthermore, this AGI ratio has received broad international support since its development and is commonly used to measure family planning performance.[5]

However, it has some significant limitations. For example, the AGI ratio assumes that the likelihood that a woman will become pregnant in the absence of contraception is similar across the world and across age cohorts. However, this is almost certainly not the case. National and regional differences in infertility exist, as do variations in the underlying patterns of sexual behaviour that will increase or decrease the probability of pregnancy for many women.[6] As a result, the probability of pregnancy will differ between regions, countries and individuals. In turn, this means that each CYP provided by MSI and its partners will not uniformly avert 0.57 pregnancies. These limitations also apply to indicators 1b to 1g, 3b and 3c. The estimate could therefore be improved by developing ratios that are specific to country and region.

2.2.3. Number of births averted

Indicator 1b (see Table 1) enables MSI and its partners to estimate the number of births they avert per CYP they provide. It provides an important indication of the impact of MSI and its partners on population growth, a key concern of a number of national governments and international agencies.

Formula

The number of births averted per CYP was derived using the data sources identified below and the AGI ratio discussed in section 2.2.2., as follows:

Number of births averted per CYP (1b) = 1a X probability pregnancy ends in live birth

The probability that a pregnancy ends in birth is assumed to equate to the probability that the birth will not end in either a miscarriage or an abortion. This assumption matches that made by UNFPA, that all pregnancies result in one of three outcomes: live birth, miscarriage or abortion.[7] Given this, the formula can therefore be rewritten (where χ is the probability of miscarriage and γ is the probability of abortion) as:

Number of births averted per CYP (1b) = 1a x (1- χ - γ)

Data source

The coefficients for indicator 1b were derived using estimates on the rates of miscarriage based on two seminal peer-reviewed studies[8, 9] and the abortion ratios from WHO's *Unsafe abortion: Global and regional estimates of the incidence of unsafe abortion and associated mortality in 2003*, 5th ed. 2007[10] and Sedgh et al. Legal Abortion Worldwide: Incidence and recent trends. *International Family Planning Perspectives* 2007;33(3):106–116;[11] each represented the best source of information under the rules for data selection.

Several peer-reviewed studies quote a 15 per cent probability that pregnancy will end in a miscarriage. The studies referenced here reached this conclusion using hospital records and personal interviews of family history respectively. The abortion ratios (defined as the annual number of abortions per 100 live births[iii]) were derived by combining WHO estimates of illegal abortions, the number of abortions in countries with complete official statistics and adjusted counts of legal abortion in countries where statistics are incomplete or nonexistent. These adjustments were based on experts' judgement of the likely underreporting and on abortion rates in countries with a similar profile of service provision and similar legal and social conditions.

There are several limitations with the data and ratios used. First, the assumption that all pregnancies result in one of three outcomes – live birth, miscarriage or abortion – omits still births. As a result, it may overestimate the number of births averted per CYP. Second, the probability of miscarriage has been shown to increase significantly with age.[12,13] As a result, the number of births averted per CYP may vary according to the age of the client. Furthermore, the probability of miscarriage may differ significantly in some settings from the 15 per cent assumed here.[14] The methodology employed in the Warburton study is also subject to the recall and honesty of participants. However, given that many other studies support its finding that 15 per cent of pregnancies end in miscarriage, this limitation with the study is less significant. Furthermore, the available data may significantly underestimate the rate of abortion given that many women continue to seek illegal abortion and others may not report having an abortion at all, given the sensitive nature of this information.[10, 15]

Finally, all of the abortion ratios except those for Australia, Ireland, UK and Vietnam are sub-regional averages. Subsequently, national rates may differ significantly. These limitations also apply to indicators 1c to 1g, 3a to 3c, 4a to 4d and 6a to 6c.

Given these limitations, the coefficients would be more accurate if the supporting ratios were improved and updated. In particular, national level estimates of abortions and miscarriages, as well as an updated abortion ratio, would provide a more valid estimation.

2.2.4. Number of infant mortalities averted

Indicator 1c (see Table 1) enables MSI and its partners to estimate the number of infant mortalities they avert per CYP they provide. Infant mortality is a key measurement used to monitor progress made towards achieving Millennium Development Goal (MDG) 4 – which aims to reduce child mortality by two-thirds by 2015. As a result, indicator 1c enables MSI and its partners to estimate their contribution towards the MDGs, as well as wider health impacts.

Formula

The number of infant mortalities averted per CYP was derived using the infant mortality rate (IMR) identified below and indicator 1b, as follows:

$$\text{Number of infant mortalities averted per CYP (1c)} = \left(\frac{IMR}{1000}\right) \text{ X 1b}$$

[iii] Abortion ratios are often given per 100 live births and/or per 100 pregnancies. However, abortion ratios are commonly derived using live births as a proxy for pregnancies due to available data.

The IMR is defined as the number of children who die before one year of age per 1000 live births. The coefficients for births averted per CYP (1b) available in Table 1 are rounded to six decimal points. Using these coefficients to calculate 1c may lead to some inaccuracies. As a result, the coefficients given for 1c in Table 1 are derived using unrounded figures. This also applies to all coefficients that are derived using indicator 1b.

Data source

The coefficients for indicator 1c were derived using the 2007 data available from MICS.[iv] This nationally representative survey presented the best source of data under the rules for data selection and the largest source of statistical information on children.

By incorporating 1b into the above formula, the coefficients for indicator 1c are affected by the same limitations as described in section 2.2.3. More specifically, the IMR estimates would be more accurate if they were based upon vital registration systems instead of household surveys. This also applies to indicator 1d.

2.2.5. Number of under-five mortalities averted

Indicator 1d (see Table 1) enables MSI and its partners to estimate the number of mortalities of children aged five years and under that are averted per CYP they provide. Like infant mortality, the under-five mortality rate is a key measurement used to monitor progress made towards MDG 4. As a result, indicator 1d also provides important estimates of the contribution of MSI and its partners towards the MDGs and their positive impact on health outcomes.

Formula

The number of under-five mortalities averted per CYP was derived using the under-five mortality rate identified below and indicator 1b, as follows (where ρ represents the under-five mortality rate):

$$\text{Number of under-five mortalities averted per CYP (1d)} = \left(\frac{\rho}{1000}\right) \text{X 1b}$$

The under-five mortality rate is defined as the number of children who die before five years of age per 1000 live births.

Data source

The coefficients for indicator 1d were also derived using the latest data available from MICS.[v] This nationally representative survey presented the best source of data under the rules for data selection and the largest source of statistical information on children. As a result, the coefficients for indicator 1d are affected by the same limitations as those identified for indicator 1c (see section 2.2.4).

[iv] Available online at http://www.childmortality.org/. Accessed December 2008. See section 2.1. for more details on MICS.
[v] Ibid.

2.2.6. Number of maternal mortalities averted

Indicator 1e (see Table 1) enables MSI and its partners to estimate the number of maternal mortalities averted per CYP they provide. This indicator provides an important means for MSI or its partners to estimate its contribution to MDG 5, which focuses on improving maternal health.

Formula

The number of maternal mortalities averted per CYP was derived using the maternal mortality ratio (MMR) identified below and indicator 1b, as follows:

$$\text{Number of maternal mortalities averted per CYP (1e)} = \left(\frac{MMR}{100{,}000}\right) \text{X 1b}$$

The MMR is defined as the number of maternal deaths per 100,000 live births. It includes all women who die whilst pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.[10]

Data source

The coefficients for indicator 1e were derived using estimates from the WHO, UNICEF, UNFPA and World Bank report *Maternal mortality in 2005*.[16] The estimates provided in this report are nationally representative and taken from a variety of sources, including civil registration, national census and other national studies. It represents the best data under the rules for data selection. It is also the latest available data, since it has been published again in 2008 in UNICEF's *Progress for children: A report card on maternal mortality*.[17]

The limitations with the estimates are the same as those discussed in relation to indicators 1a to 1d. More specifically, though, an updated maternal mortality ratio would improve the accuracy of the estimated maternal mortalities averted per CYP.

2.2.7. Number of abortions averted

Indicator 1f (see Table 1) enables MSI and its partners to estimate the number of abortions they avert per CYP they provide. Globally, approximately one in five pregnancies ends in abortion.[15] One of MSI's aims is to improve access to contraception so that fewer women will have an unplanned pregnancy and consequently, fewer women will need to have an abortion. This indicator subsequently provides an important means by which MSI or its partners can estimate the positive impact their family planning services are having in reducing the number of abortions needed.

Formula

The number of abortions averted per CYP was derived using the data sources discussed below, as follows (where μ is the total abortion ratio and Ω is the probability that pregnancy will not end in miscarriage):

$$\text{Number of abortions averted per CYP (1f)} = \left(\frac{\mu}{100+\mu}\right) \text{X } \Omega$$

The abortion ratio is defined as the annual number of abortions per 100 live births.

Data source

The coefficients for indicator 1f were derived using total abortion ratios from WHO's *Unsafe abortion: Global and regional estimates of the incidence of unsafe abortion and associated mortality in 2003*[10] and Sedgh et al's Legal Abortion Worldwide: Incidence and recent trends in *International Family Planning Perspectives*.[11]

These reports represented the best and most recent data available. The method by which the report estimated the abortion rates has already been discussed in relation to indicator 1b. The limitations with the data and how the estimates could be improved were also discussed above (see section 2.2.3).

2.2.8. Number of unsafe abortions averted

Indicator 1g (see Table 1) enables MSI and its partners to estimate the number of unsafe abortions averted per CYP they provide. Unsafe abortion is one of the leading causes of maternal mortality and morbidity worldwide.[18] As a result, this indicator enables MSI and its partner to estimate one aspect of its contribution towards MDG 5 (improving maternal health).

Formula

The number of unsafe abortions averted per CYP was derived using the data source identified below, as follows (where β is the unsafe abortion ratio, μ is the total abortion ratio and Ω is the probability pregnancy will not end in miscarriage):

$$\text{Number of unsafe abortions averted per CYP (1g)} = \left(\frac{\beta}{100+\mu}\right) \text{X } \Omega$$

An unsafe abortion is defined as an abortion carried out unofficially for reasons not accepted in the laws of a country. Abortions outside the legal framework are frequently performed by unqualified and unskilled providers, or are self-induced. As a result, they may be incorrectly carried out or performed in unhygienic conditions, placing the woman at risk of often severe complications. Furthermore, they often lack immediately available medical support. The woman may also hesitate to seek care if complications occur.[10]

Data source

The coefficients for indicator 1g were derived using data from WHO's *Unsafe abortion: Global and regional estimates of the incidence of unsafe abortion and associated mortality in 2003*[10] and Sedgh et al's Legal Abortion Worldwide: Incidence and recent trends in *International Family Planning Perspectives*.[11]

The method by which the report estimated unsafe abortion has already been discussed in relation to indicator 1b. The limitations with the data and how the estimates could be improved were also discussed above (see section 2.2.3).

2.2.9. DALYs averted

The figures in Table 2 allow MSI and its partners to estimate the number of disability adjusted life years (DALYs) averted per CYP they provide. DALYs are defined as the sum of years lost due to premature mortality and the years of productive life lost due to disability. DALYs were developed in 1990 by the WHO and the Harvard School of Public Health as a single measure to quantify and compare the burden of diseases, injuries and risk factors. They have since been refined and now represent an internationally agreed measure of health interventions. As a result, these figures provide an important means by which MSI and its partners can compare its broader health impact to other organisations.

Formula

The number of DALYs averted per CYP was derived using the data source identified below, as follows (where κ is the PSI DALY coefficient and ν is the PSI CYP conversion factor):

$$\text{DALYs averted per CYP} = \frac{\kappa}{\nu}$$

Data source

The figures in Table 2 were derived using the PSI's DALY Translation Model (DTM)- an unpublished model developed by PSI to estimate the health benefits accrued from family planning services. The calculator derived country-specific figures for Disability Adjusted Life years (DALY) averted from family planning interventions by estimating the disease burden caused by pregnancy and child birth to women and the incremental impact on child mortality due to inadequate birth spacing using the incidence of maternal conditions, maternal mortality rates and the net variance in infant and child mortality that can be attributed to birth interval originally developed by Rutstein (2005). These estimates of disease burden were translated into a total figure measured in DALY using the methodology from the recent joint World Bank / World Health Organization study, the Disease Control Priorities Project (DCPP) published in 2006.

The coefficients in Table 2 are affected by some key limitations. First, the PSI model is based upon different CYP conversion factors to those used by MSI. The model uses the same conversion factors used by USAID. Second, the estimates of maternal mortality and under-five mortality averted differ significantly from those made for indicators 1d and 1e. As a result, the actual number of DALY averted by MSI and its partners may differ from estimates generated using the coefficients in Table 2.

2.2.10. Economic cost-saving per CYP

Indicator 3a (see Table 3) enables MSI and its partners to estimate the costs it saves individual households and national budgets as a result of the abortions and infant and maternal deaths they avert. As a result, this indicator provides an important means by which MSI and its partners can estimate the financial impact of their programmes.

Formula

The economic cost-saving per CYP was derived using the data identified below and indicators 1c, 1e and 1f, as follows (where α is the costs saved per infant mortality, η is the costs saved per maternal mortality and ν is the cost of post-abortion care):

$$\text{Total cost savings per CYP (3a)} = (\alpha \times 1c) + (\eta \times 1e) + (\nu \times 1f)$$

Data source

The estimated savings per infant and maternal death averted were based on estimates from Levine et al in *Contraception* in 2006.[3] The authors derived these estimates using an AGI model.[vi]

The estimated savings in post-abortion care was taken from Vlassof et al's *Economic impact of unsafe abortion-related morbidity and mortality: Evidence and estimation challenges*.[20] This 2008 report derived its estimated savings from an extensive literature review of available costing studies. The particular method used to derive these savings assumed that most studies underestimated the true cost of treatment by omitting overhead and capital costs. The report subsequently inflated the findings of available costing studies by a set factor to take into account these additional costs.

There are a number of limitations to the coefficients in Table 3, however. The savings per infant and maternal mortality averted and the cost of post-abortion care will actually differ significantly between countries. Furthermore, the methodology used to estimate the cost of post-abortion care did not include some essential treatment, including treatment for poisoning, renal failure, psychosis and infertility.[20] Nor did it take into account the different cost of post-abortion care for safe and unsafe abortion. As a result, the financial savings that stem from the abortions and infant and maternal deaths averted by MSI and its partners will differ significantly in each country from the coefficients provided for indicator 3a. Also, the total economic costs saved by MSI will exceed those generated by the coefficients provided for indicator 3a given that the coefficients provided do not take into account educational costs or the general cost of upbringing for children, for example.

2.2.11. Environmental impact per CYP

Indicators 3b and 3c (see Table 3) enable MSI and its partners to estimate the ecological and carbon footprint prevented per birth averted. Ecological footprint is defined as the sum of all the cropland, grazing land, forest and fishing grounds required to produce the food, fibre and timber each person consumes, to absorb the wastes emitted when each person uses energy and to provide space for infrastructure. Carbon footprint is defined as the biocapacity needed to absorb CO_2 emissions from fossil-fuel use and land disturbance other than the portion absorbed by the oceans. As a result, these indicators provide an important means by which MSI and its partners can estimate the environmental savings made by their programmes.

[vi] See http://www.guttmacher.org/pubs/fund_impact.html for more information.

Formula

The ecological and carbon footprint prevented per CYP was derived using the data identified below and indicator 1b, as follows:

Ecological footprint prevented per CYP (3b) = Ecological footprint per person x 1b

Carbon footprint prevented per CYP (3c) = Carbon footprint per person x 1b

Data source

The ecological and carbon footprint per person was taken from WWF's *Living Planet Report 2008*.[21] This represented the best source of information under the rules for data selection. The report calculated ecological footprint by dividing the average amount of material consumed by each person (tonnes per year) by the yield of the specific land or sea area (annual tonnes per hectare) from which it was harvested or where its waste material was absorbed. The numbers of hectares that result from this calculation was then converted to global hectares using yield and equivalence factors.[vii] The carbon footprint was calculated by dividing the direct carbon dioxide emissions from fossil fuel consumption as well as indirect emissions for products manufactured abroad for each country by its population.

The coefficients in Table 3 are affected by key limitations. In particular, the methodology used to estimate ecological footprint per person in each country is not yet standardised. As a result, the estimates generated using the coefficients in Table 3 for indicator 3b are not directly comparable. Given this, the methodology used to estimate ecological footprint should be standardised to enable direct comparison between countries.

2.3 MSI's impact per safe abortion and treatment of incomplete abortions

The indicators in Tables 4-6 enable MSI and its partners to estimate the broader impact of its safe abortion services or services to treat incomplete abortions. In many countries, a large proportion of abortions are unsafe and can lead to serious health complications including death. In as many countries as possible, MSI therefore provides treatment of incomplete abortions as part of a comprehensive post-abortion care package. In addition, MSI provides safe abortions in countries according to the national laws.

These abortion-related services have multiple positive impacts, such as a reduction in maternal mortality, infant mortality and various other economic and health-related outcomes. This section therefore provides the methodology underpinning MSI's impact calculations for abortion-related services.

Many of these calculations are similar to the ones described in detail under section 2.2 and also rely on the same sources of data. The relationship between all these services and impacts is depicted in a flow diagram (see Appendix). The methodology section below therefore summarises the formulas for abortion-related services, referring to the detail above.

[vii] See http://www.footprintnetwork.org/en/index.php/GFN/

Formulas

The number of births averted per safe abortion was derived as follows (where χ is the probability of miscarriage):

$$\text{Number of births averted per safe abortion (4a)} = 1 - \chi$$

The number of infant mortalities averted per safe abortion was derived using the IMR and indicator 4a, as follows:

$$\text{Number of infant mortalities averted per safe abortion (4b)} = \left(\frac{IMR}{1000}\right) \text{ X 4a}$$

The number of under-five mortalities averted per safe abortion was derived using the under-five mortality rate and indicator 4a, as follows (where ρ represents the under-five mortality rate):

$$\text{Number of under-five mortalities averted per safe abortion (4c)} = \left(\frac{\rho}{1000}\right) \text{ X 4a}$$

The number of maternal mortalities averted per safe abortion was derived using the MMR and indicator 4a, as follows:

$$\text{Number of maternal mortalities averted per safe abortion (4d)} = \left(\frac{MMR}{100{,}000}\right) \text{ X 4a}$$

The number of unsafe abortions averted per safe abortion was derived using the abortion ratio (β) and the unsafe abortion ratio (Ω), as follows:

$$\text{Number of unsafe abortions averted per safe abortion (4e)} = \frac{\Omega}{\beta}$$

In order to calculate the number of DALYs averted per safe abortion, it was necessary to use the CYP conversion factor for abortions (see page 13) because the PSI DALY calculator does not have a direct formula for abortions. The number of DALYs averted per safe abortion was subsequently derived as follows (where κ is the PSI DALY coefficient and ν is the PSI CYP conversion factor):

$$\text{DALYS averted per safe abortion} = \frac{\kappa}{\nu} \text{ X 2}$$

The economic cost-saving per safe abortion was derived using indicators 4b, 4d and 4e, as follows (where α is the costs saved per infant mortality, η is the costs saved per maternal mortality and ν is the cost of post-abortion care):

$$\text{Total cost-savings per safe abortion (6a)} = (\alpha \text{ x 4b}) + (\eta \text{ x 4d}) + (\nu \text{ x 4e})$$

The ecological and carbon footprint prevented per safe abortion was derived using indicator 4a, as follows:

Ecological footprint prevented per safe abortion (6b) = Ecological footprint per person x 4a

Carbon footprint prevented per safe abortion (6c) = Carbon footprint per person x 4a

Data source

The coefficients for each indicator in Tables 4-6 were derived using identical sources of data to those used for each parallel indicator in Tables 1-3. For example, the carbon footprint prevented per safe abortion (indicator 6c) used the same estimates of carbon footprint per person in WWF's *Living Planet Report 2008*[21] as used indicator 3c. Ddetails of the data used, how it was collected, the associated limitations and how the data could be improved has already been discussed throughout this paper.

Conclusion

By using the coefficients provided in Tables 1-6 as described in this paper, MSI and its partners can estimate the demographic, health, economic and environmental impact of their family planning and abortion services. These coefficients are not perfect, however. They are affected by a number of limitations that stem from the data used to derive them, limitations that MSI and other organisations should work to resolve. However, these coefficients offer a strong, systematic basis upon which to estimate the substantial impact of family planning and abortion services undertaken by MSI and its partners. They also provide an invaluable indication of what can be achieved by effective sexual and reproductive health services and in turn emphasise the importance of comprehensive sexual and reproductive health care to the development agenda.

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