

**Developing precision medicines: Drug combinations to overcome drug resistance**  
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Synthetic Biology and Precision Medicine Centre

**2<sup>nd</sup> November, 16:00-16.20 and ICC, CSIR South Africa**



**science & innovation**

Department:  
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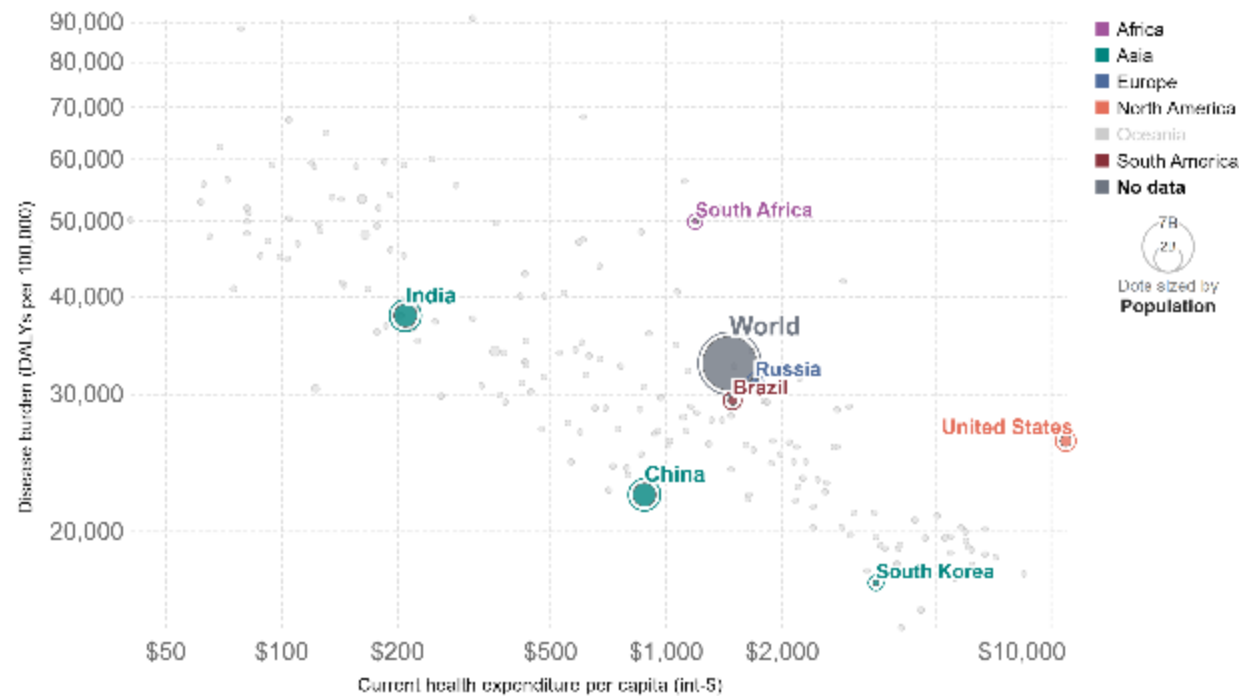


# Problem Statement – Disease burden in South Africa



## Disease burden vs. health expenditure per capita, 2019

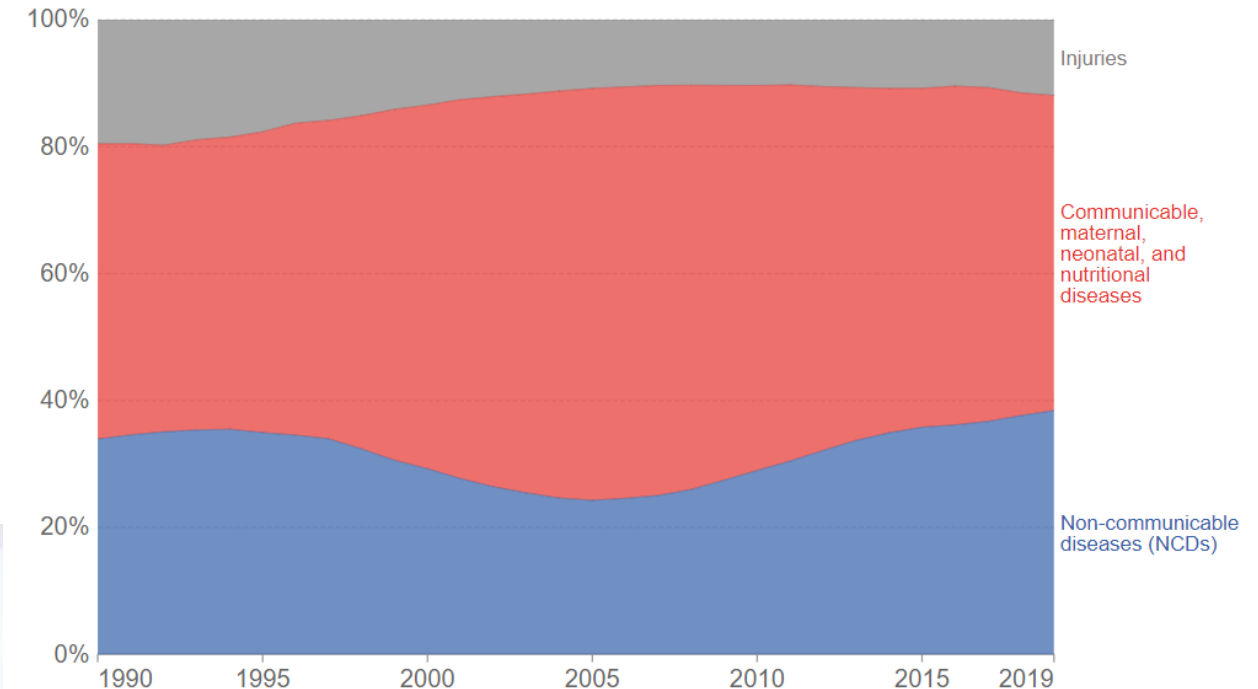
Total disease burden from all causes, measured as the number of Disability-Adjusted Life Years (DALYs) per 100,000 individuals, versus health expenditure per capita measured in current international-\$



Source: IHME, Global Burden of Disease (2019); World Health Organization (via World Bank) OurWorldInData.org/burden-of-disease • CC BY

## Total disease burden by cause, South Africa, 1990 to 2019

Total disease burden measured as Disability-Adjusted Life Years (DALYs) per year. DALYs measure the total burden of disease – both from years of life lost due to premature death and years lived with a disability. One DALY equals one lost year of healthy life.



Source: IHME, Global Burden of Disease (2019)

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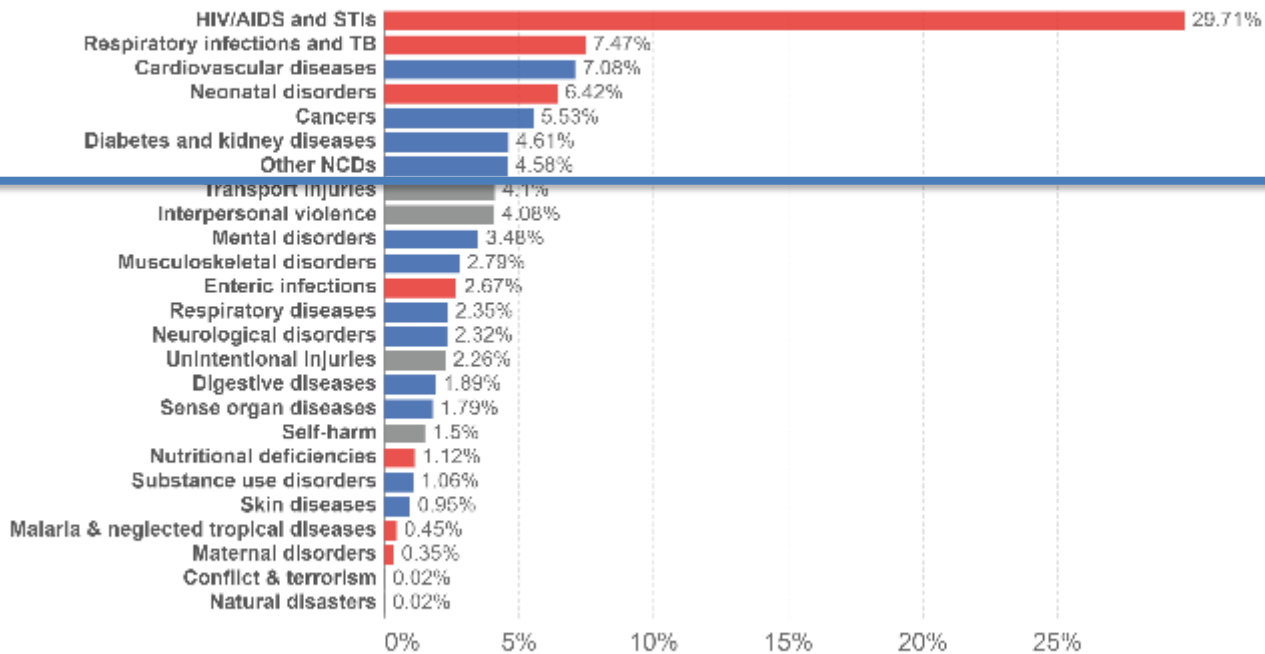
# Problem Statement: Shift-Toward non-communicable diseases



## Share of total disease burden by cause, South Africa, 2019

Total disease burden, measured in Disability-Adjusted Life Years (DALYs) by sub-category of disease or injury. DALYs measure the total burden of disease – both from years of life lost due to premature death and years lived with a disability. One DALY equals one lost year of healthy life.

Our World in Data



Source: IHME, Global Burden of Disease (2019)

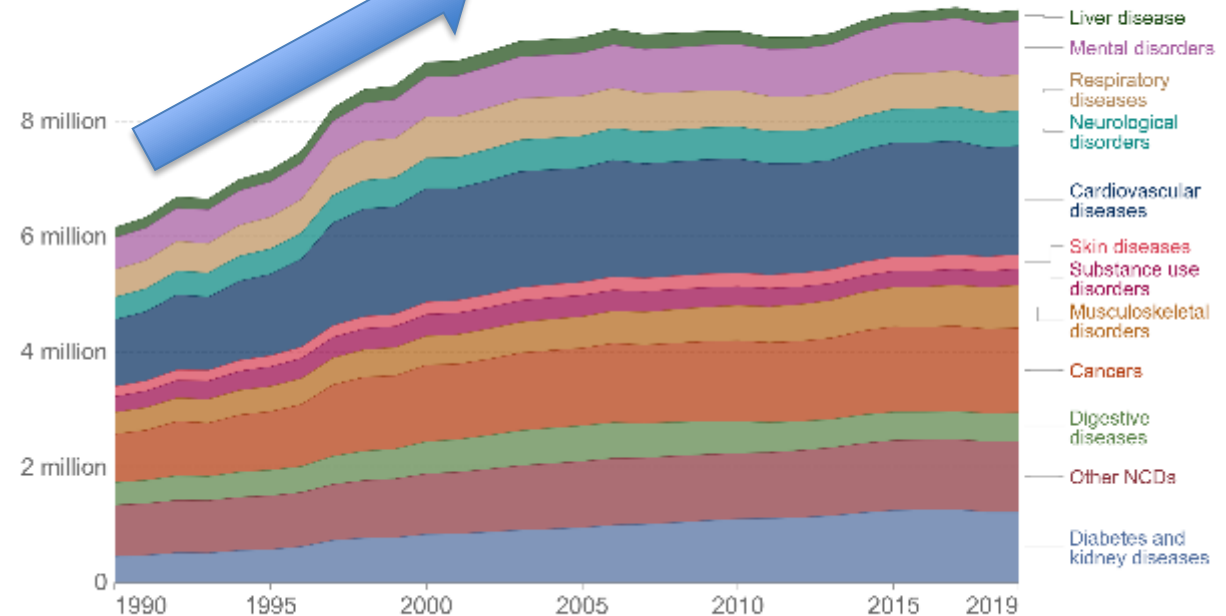
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Note: Non-communicable diseases are shown in blue; communicable, maternal, neonatal and nutritional diseases in red; injuries in grey.

## Disease burden from non-communicable diseases, South Africa, 1990 to 2019

Our World in Data

Total disease burden from non-communicable diseases (NCDs), measured in DALYs (Disability-Adjusted Life Years) per year. DALYs are used to measure total burden of disease – both from years of life lost and years lived with a disability. One DALY equals one lost year of healthy life.



Source: IHME, Global Burden of Disease (2019)

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# Problem Statement – Unmet Medical need in Cancer



Cancer	HIC number of cases 1990	LMIC number of cases 1990	HIC number of cases 2016	LMIC number of cases 2016	Fold change HIC	Fold change LMIC
Breast cancer	467198	70634	726622	190102	1.56	2.69
Tracheal, bronchus, and lung cancer	476710	72750	746752	159990	1.57	2.20
Stomach cancer	256111	98378	292833	136618	1.14	1.39
Colon and rectum cancer	477269	47737	792174	112741	1.66	2.36
Other neoplasms	96362	39052	247574	105289	2.57	2.70
Liver cancer	80650	46993	189298	91647	2.35	1.95
Prostate cancer	419216	25137	899317	74721	2.15	2.97
Pancreatic cancer	99603	18608	192036	39197	1.93	2.11
Bladder cancer	133992	14391	213500	34771	1.59	2.42
Kidney cancer	92384	9864	160805	25876	1.74	2.62
<b>Uterine cancer</b>	89318	12357	188007	25635	2.10	2.07
Malignant skin melanoma	83987	2293	211113	5763	2.51	2.51

## Cancer by numbers in South Africa



**New Cases**  
107,467



**Deaths**  
57,373

Global Burden of Disease estimates for cancer incidence (raw case number) in High SDI (HIC) and Low Middle Income (LMIC) countries in 1990 and 2016. Fold change in these is displayed in right hand columns. Considerable rises in cancer incidence in LMICs can be seen.

## South Africa: 78% increase in cancer by 2030 LANCET

A recent study published by medical journal Lancet predicts that South Africa could see an increase of 78% in the number of cancer cases by 2030.

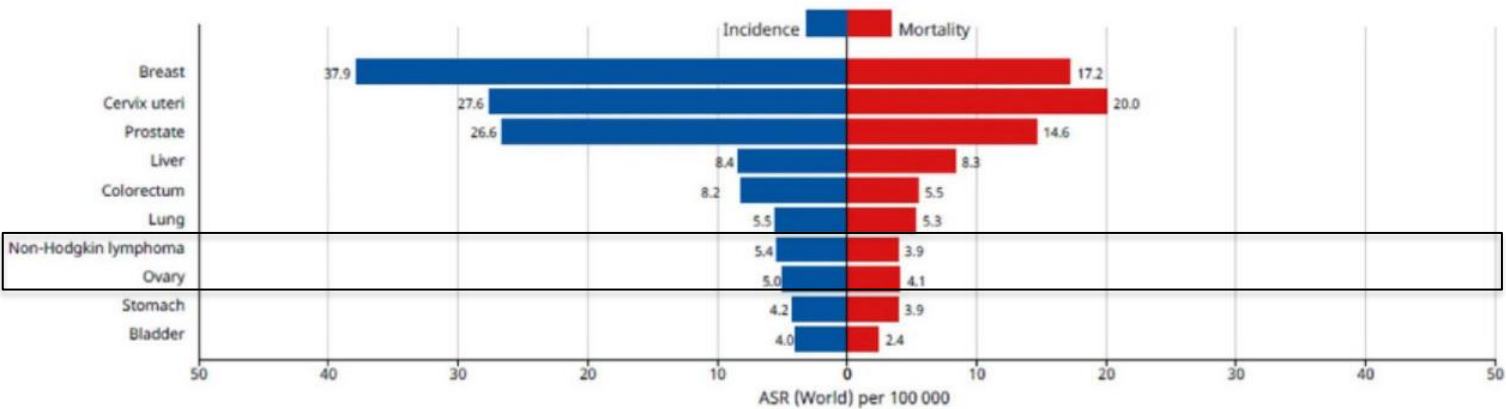


# Problem Statement – Unmet Medical need in Cancer



B

Age-standardized incidence and mortality rates, top ten cancers



**ABOUT 5-10%**

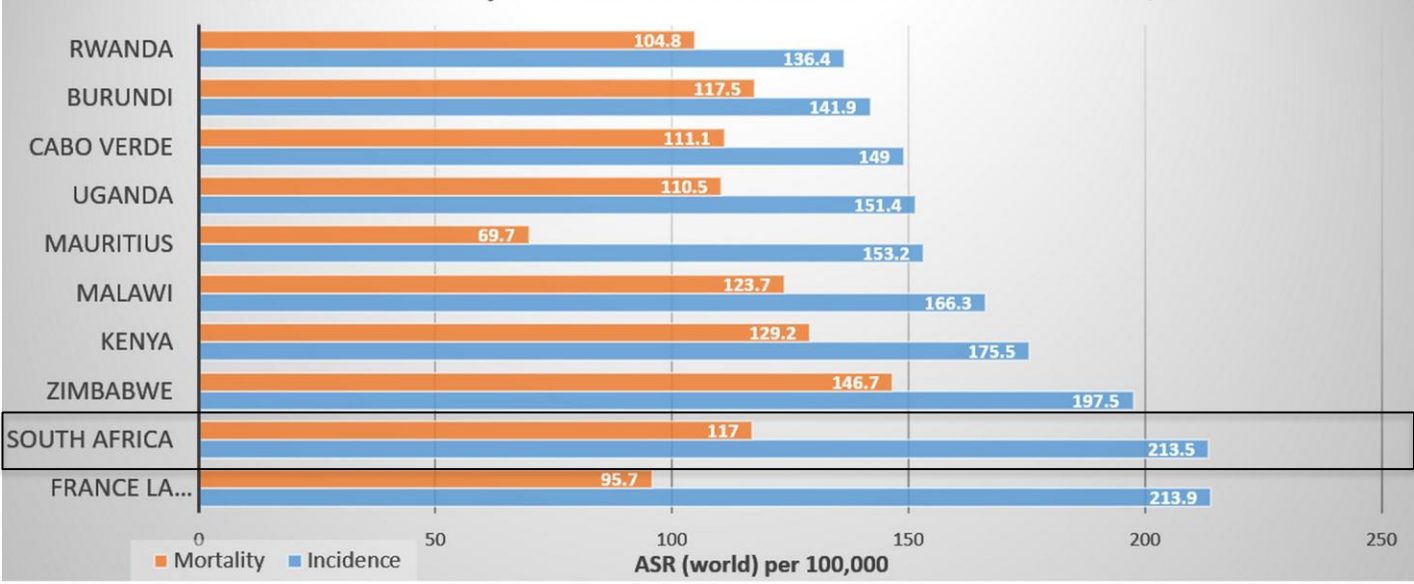


of all cancers are inherited, however **EVERY WOMAN** is at risk for developing gynaecological cancers and **EVERY WOMAN** should know the symptoms

Blood Cancer;

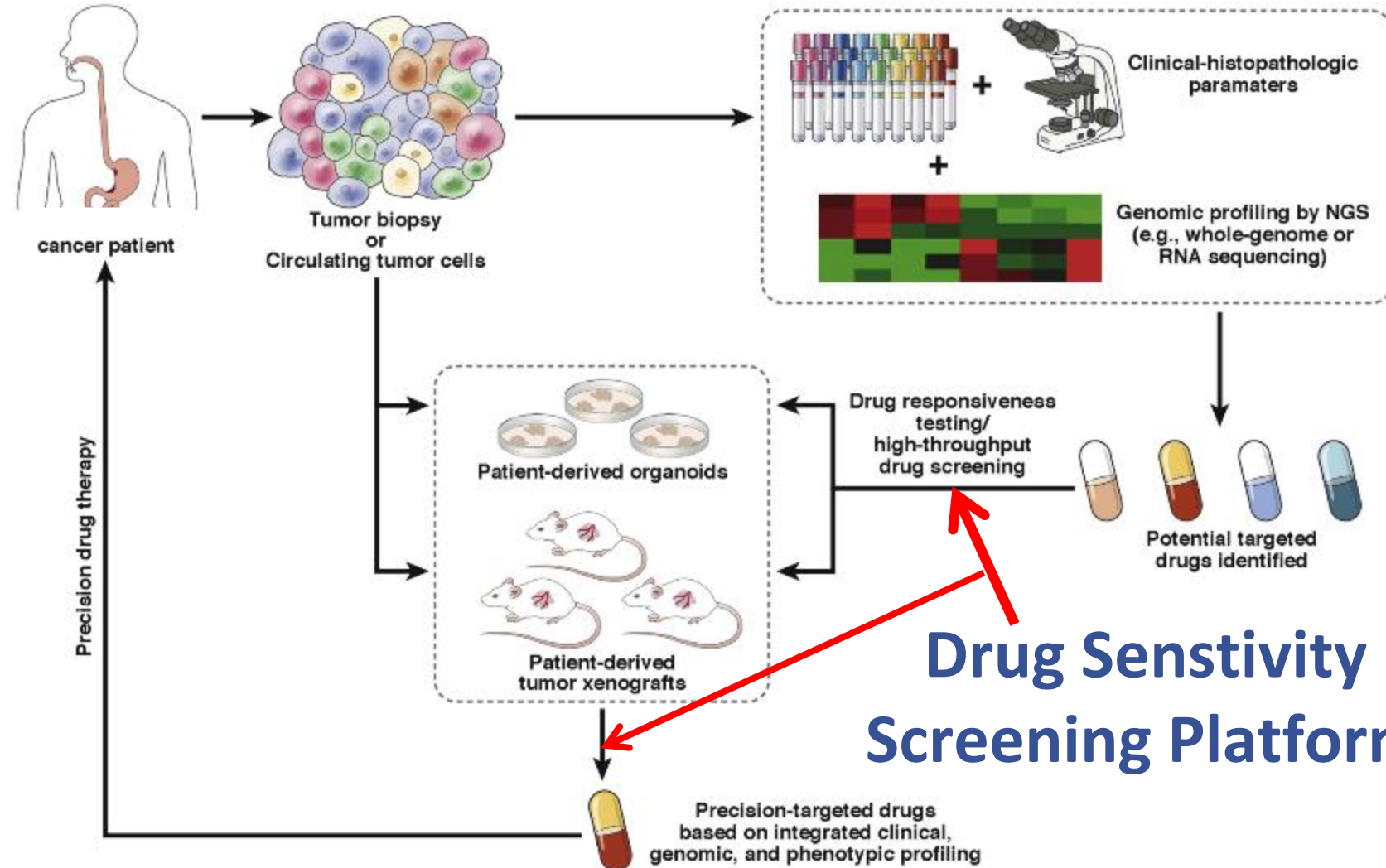
Ovarian Cancer;

Incidence and mortality rates in selected countries in Sub-Saharan Africa, 2018





# Solution- A Precision Medicine approach by drug repurposing platform

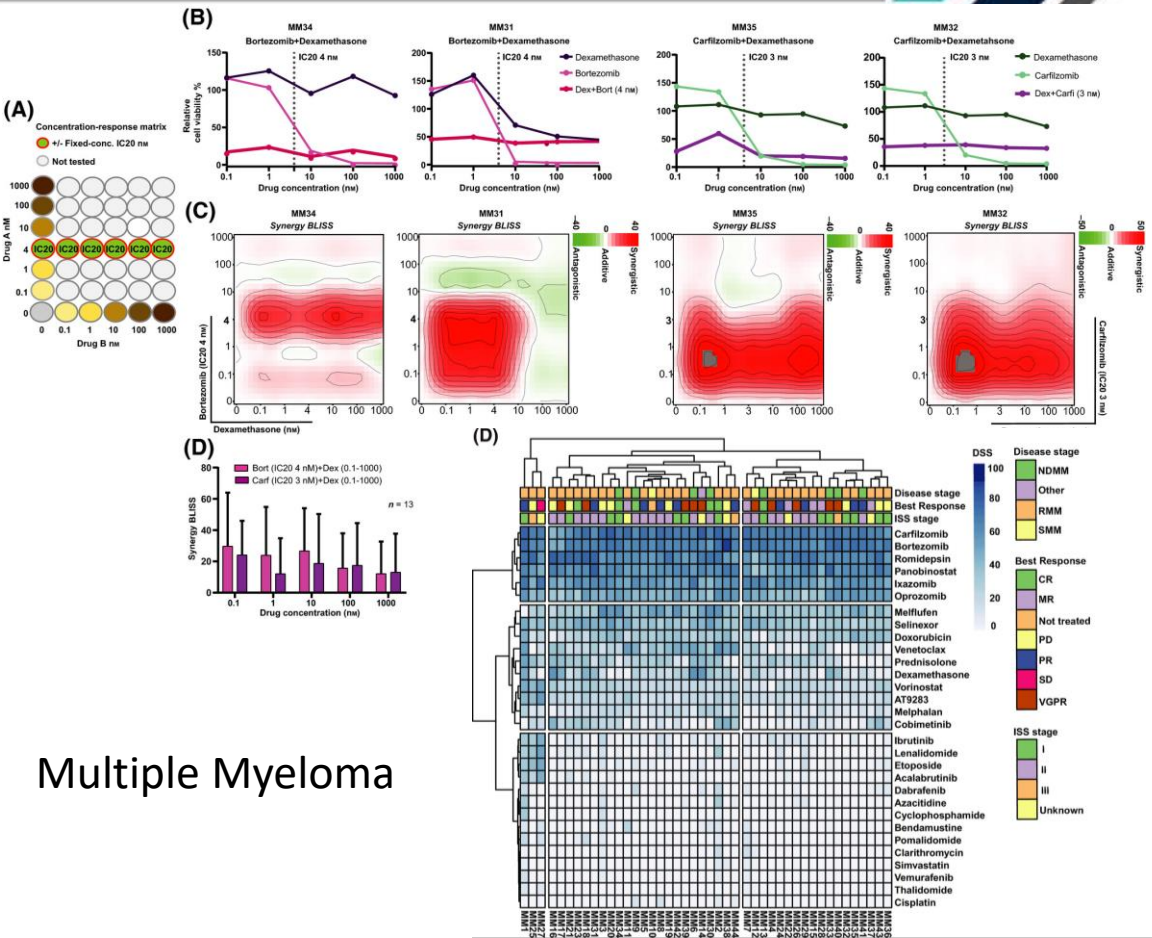
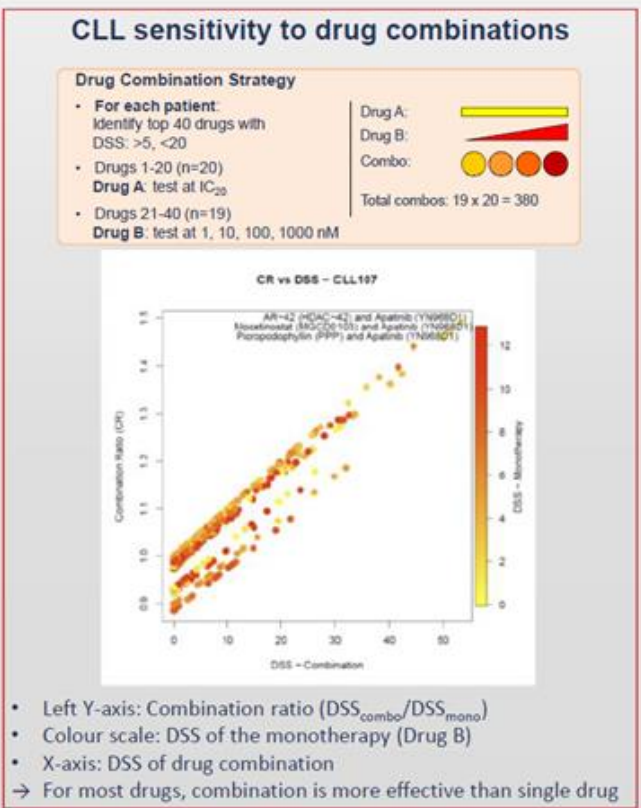
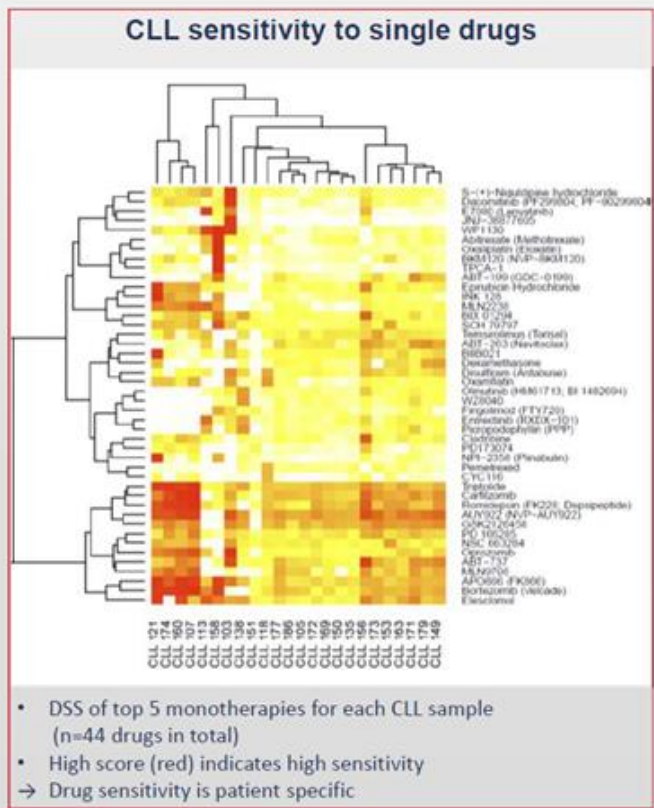


**Cancer Precision  
Medicine- Blood  
and Ovarian  
cancer**

**Drug Sensitivity  
Screening Platform**



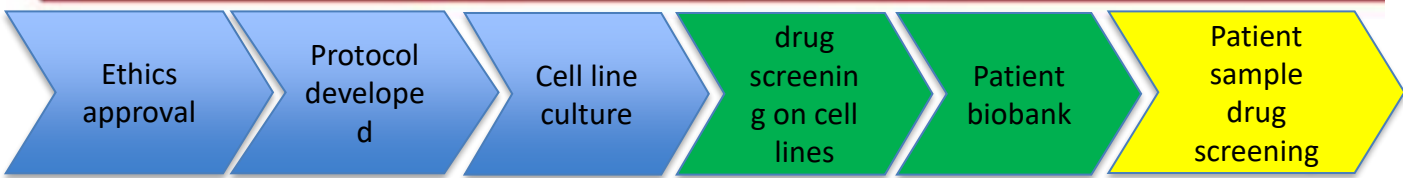
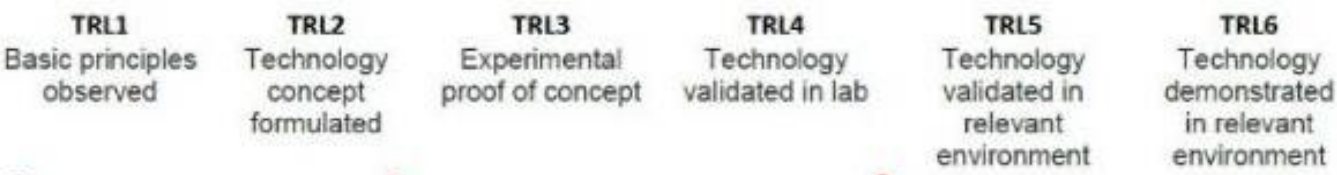
# Solution: Cancer Precision Medicine- Chronic Lymphocytic Leukemia (CLL) and Multiple Myeloma (MM)



Multiple Myeloma



# CSIR Cancer Precision Medicine Platform



- Completed
- In progress
- To do

## Drug screening of blood and ovarian South African patient samples

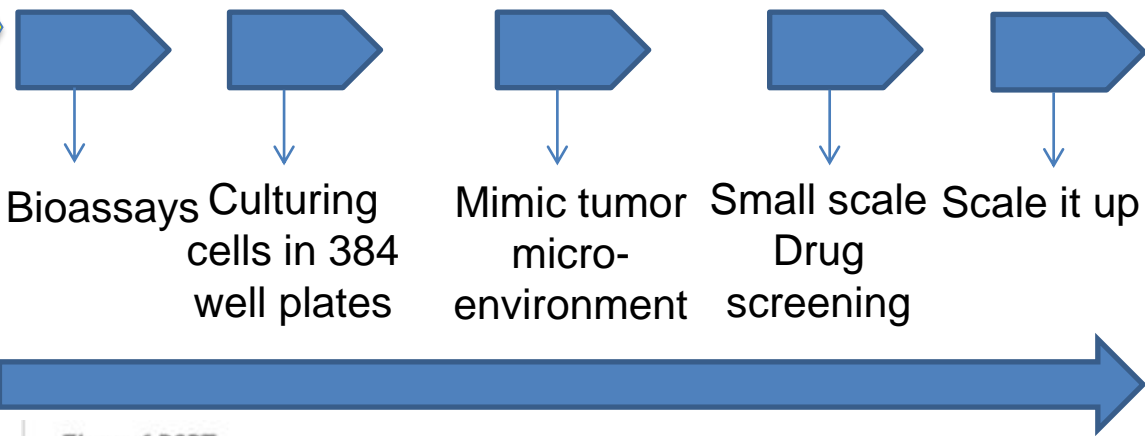
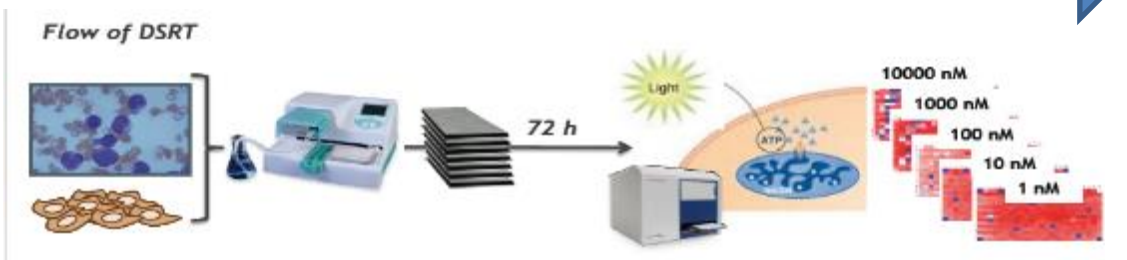
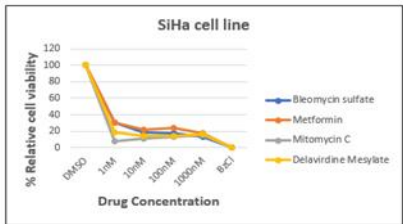
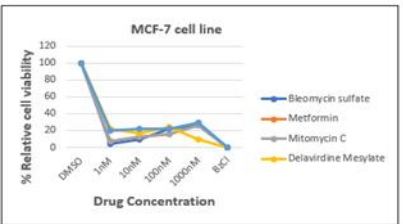


Plate lay out and the drug concentration metrics on 96 well plate

	1	2	3	4	5	6	7	8	9	10	11	12
A	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank
B	Blank	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	Blank
C	Blank	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	Blank
D	Blank	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	Blank
E	Blank	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	Blank
F	Blank	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	Blank
G	Blank	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	100nM	Blank
H	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank







**THANK YOU**

*It is far more important to know what person the disease has than what disease the person has. Hippocrates of Cos (c. 460 BC – c. 370 BC)*