



Healthcare Audit Data Analytics

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Agenda

01

Healthcare Audit

How to conduct The Healthcare Audit

02

Setting up Data Collection

How to collect raw data for analytics

03

Statistical Method and Data Analytics Application

The example of frequently used Statistical Method and Data Analytics Application

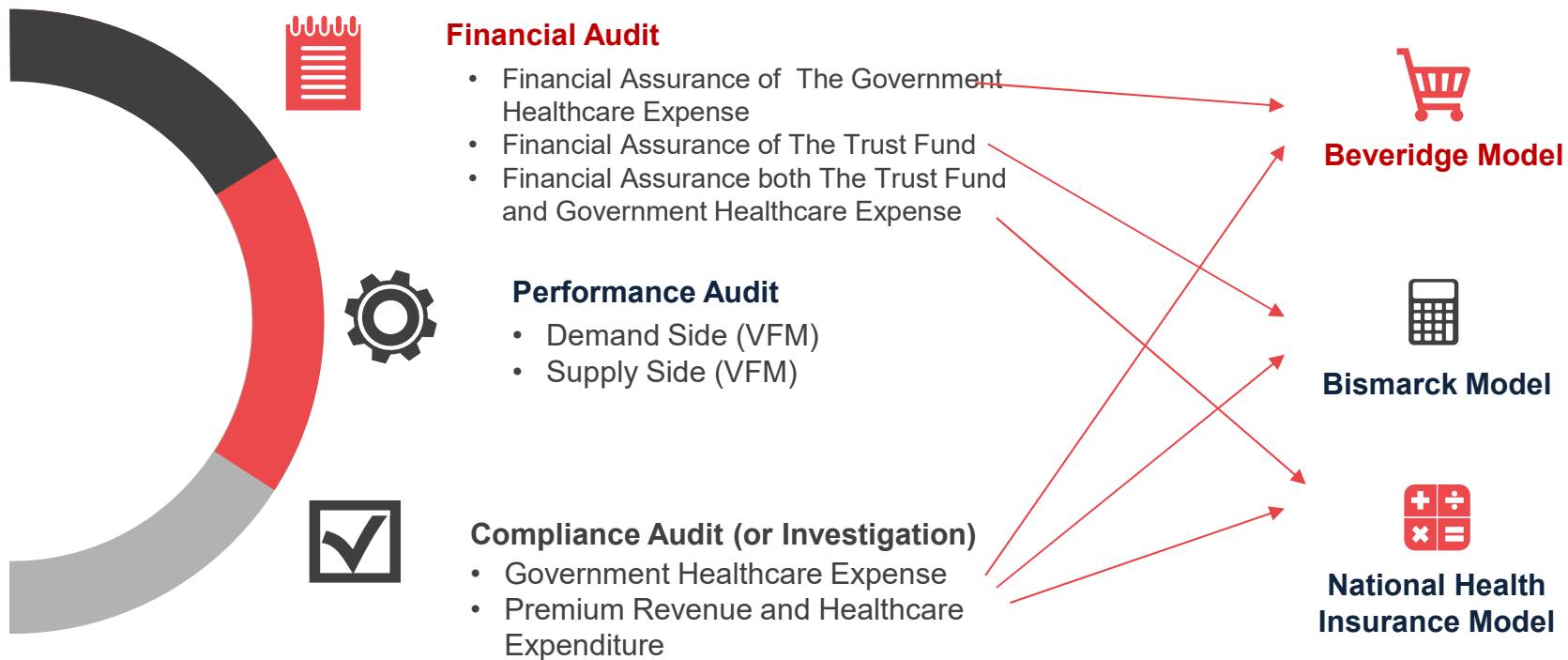
04

Implementation of Data Analytics Example

The example of the Implementation of Data Analytics in Healthcare Audit.

Healthcare Audit

Do all of the three primary types applicable in Healthcare Audits?



Strategy of Healthcare

How Does Healthcare Works?



Preventive Action

Prevent diseases to be more severe and costly to recover



Primary Care

Deal with non-specialistic diseases, usually, primary care paid with the capitation fund



Diagnostic Related Group (DRG)

Standardized Cost of Healthcare Claim based on International Code of Diseases and Clinical Modification



Cost and Quality Control

A Mechanism to ensure Cost and Quality of Healthcare



Notable Fraud

- Upcoding
- Readmission
- Bloody Discharge



Notable Inefficiency and Ineffectivity

- DRG standardized Cost is too expensive and consider too much health resources
- DRG is too slow to respond technological changes
- Uneven Health Resources and Facility Condition

Data Collection

Bismarck vs Beveridge



Bismarck

Quality Control

- Social Media Analytics
- Referrals Data
- Patient status



Health Resources and Facilities

- Credential/Recertifying Data
- MoH Data



Expenditure (Cost Control)

- Claim and Grouping Data
- Performance Capitation Monitoring Data
- Referral Data
- Government Related Program



Beveridge

Quality Control

- Social Media Analytics
- Referrals Data
- Patient status



Health Resources and Facilities

- MoH Data
- Other Government Agency Data



Expenditure (Cost Control)

- Claim and Grouping Data
- Performance Capitation Monitoring Data
- Referral Data.



Statistical Method

and Data Analytics Application



What will you deal with your collected Data?

Large Population
Homogenous
Normal Distribution

Small Population
Homogenous
Normal Distribution

Large Population
Heterogenous
Abnormal Distribution

Small Population
Heterogenous
Abnormal Distribution

Statistical Method

and Data Analytics Application



Cluster Analysis

To deal with Large Population, Heterogenous, and Abnormal Distribution



Desriptive Statistic

Mean, Modus, and Median



Statistical Inference

Corellation and Regression.



Estimating Population

Mark and Capture Regression



Other

- Data Envelopment Analysis
- Moving Average Convergence and Divergence

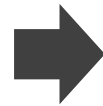
Data Analytics Application

Most Frequent Used Application



Collected Data

- SQL
- Webscrapping



Data Analytics Application

- ▶ Excel
- ▶ SPSS
- ▶ R (Studio)
- ▶ Phyton
- ▶ Others



Result

- ▶ Report
- ▶ Html/XML (if processed further with serverside Apps/ASP, PHP, etc)



Example

Example of Data Analytics
Implementation in Healthcare Audit

Saving US\$49.237.020/Year

Healthcare Performance Audit

Preliminary Condition and Issues



National Health Insurance Model

Funded by Premium Health Insurance

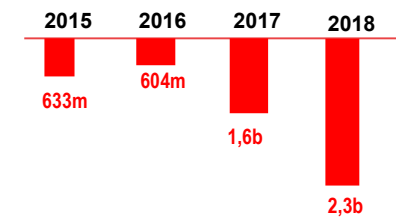
Primary Health Care

- Non-Specialistic Diseases
- Diseases Control and Prevention
- Health Promotion
- Chronic Diseases Health Services
- Government Project (Antenatal Care)
- Funded by Capitation and Government Health Investment (Medical Equipment and Supplies Support, Health Worker Support, and Transfer Fund)

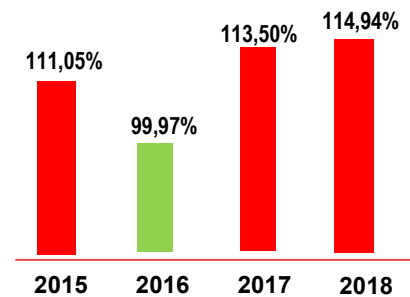
Hospital Health Care

- Specialistic Diseases and Emergencies
- Funded by Health Service Claim and Government Health Investment ((Medical Equipment and Supplies Support, Health Worker Support, and Transfer Fund)

Net Equity



Claim Ratio



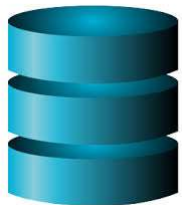
Data Analytics

Healthcare Expenditure



Tools Used

Descriptive Analysis

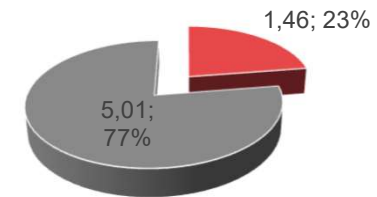


Criterion :

- Catastrophic illness (ICD)
- Highest single claim cost



Claim Expenditure Distribution



■ Catastrophic ■ Non Catastrophic



Criterion :

- Most Frequent Outpatient Care
- Most Frequent Inpatient Healthcare



Outpatient :

1. Chronic Diseases (Misc)
2. Dialysis

Inpatient :

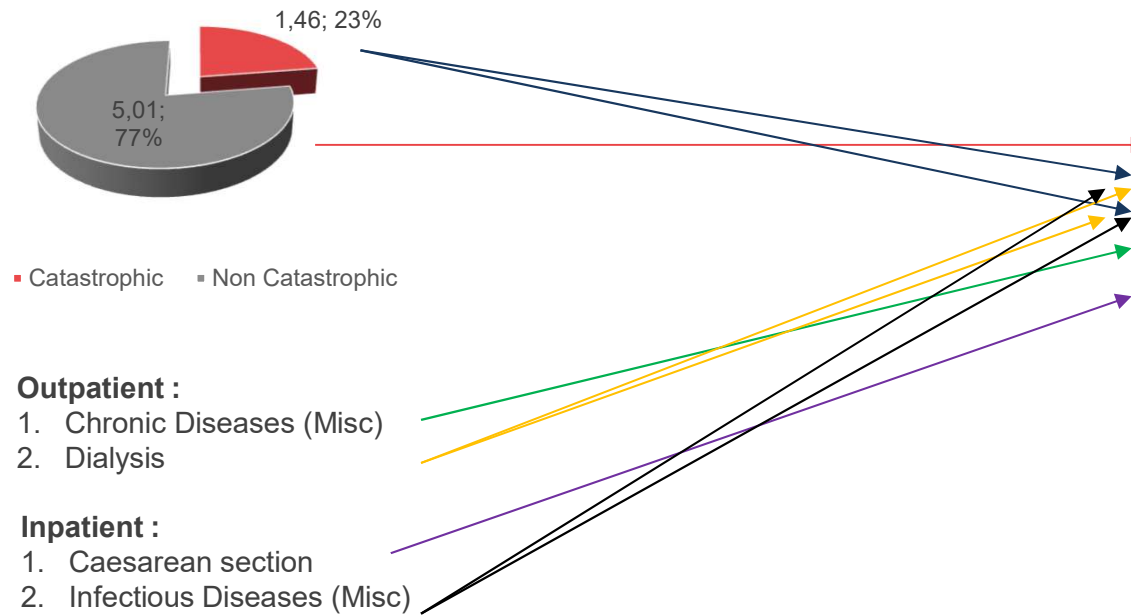
1. Caesarean section
2. Infectious Diseases (Misc)

Treating the Result

In PHC Perspective



Claim Expenditure Distribution



Primary Health Care

- Non-Specialistic Diseases
- Diseases Control and Prevention
- Health Promotion
- Chronic Diseases Health Services
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Measuring PHC Efficiency

Technical Efficiency



Collected Data

- SQL

```
library(rDEA)
deapHF <- read.csv("kasus7.csv", sep=";")
Y = deapHF[c('Patient', 'Prevention', 'Refferalscore')]
X = deapHF[c('Workforce', 'Equopment', 'Supplies')]
firms = 1:20
di_naive = dea(XREF=X, YREF=Y, X=X[firms,], Y=Y[firms,], model="input",
RTS="variable")
TE <- di_naive$thetaOpt
HFs <- deapHF$HF
plotHFs <- data.frame(HFs, TE)
rownames(plotHFs) <- plotHFs[,1]
plotHFs[,1] <- NULL
plot(plotHFs$TE)
text(plotHFs$TE, row.names(plotHFs), cex=0.6, pos=4, col='green')
plotHFs
```

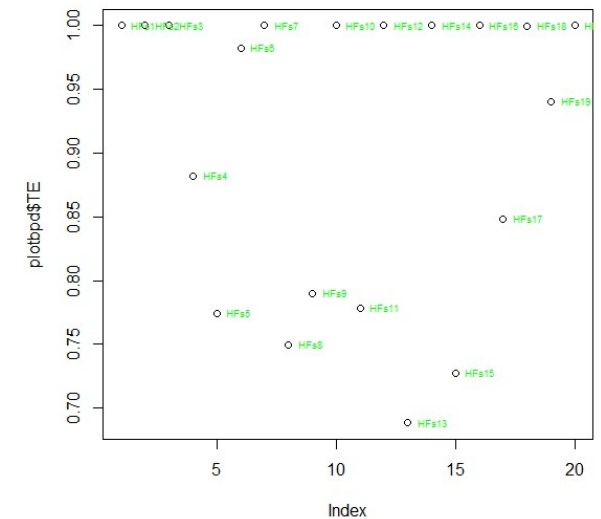
Data Analytics Algorithm

Data Envelopment Analysis

	TE
HFs1	1.0000000
HFs2	1.0000000
HFs3	1.0000000
HFs4	0.8817593
HFs5	0.7745699
HFs6	0.9823582
HFs7	1.0000000
HFs8	0.7494998
HFs9	0.7897492
HFs10	1.0000000
HFs11	0.7785213
HFs12	1.0000000
HFs13	0.6883420
HFs14	1.0000000
HFs15	0.7272210
HFs16	1.0000000
HFs17	0.8484182
HFs18	0.9998001
HFs19	0.9403520
HFs20	1.0000000

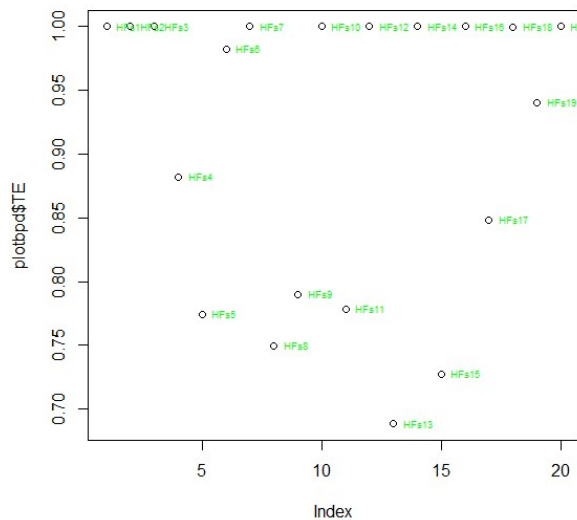
Result

- Resultset for Further Report or View



Substantive Test

Following the Analytics Result



Substantive Result:

- Financially strong local government also invest their fund into PHC (Large Input – Relatively Constant Output)
- Less financial penalty for PHC Performance related to:
 - a. referring non-specialistics diseases
 - b. Ineffective diseases prevention and control
 - c. Ineffective Health Promotion
 - d. Ineffective Chronic Diseases Health Service
- Uneven Health Medical Equipment, Supplies, and Worker

Audit Recommendation

Following the Audit Findings



Substantive Result:

- Financially strong local government also invest their fund into PHC (Large Input – Relatively Constant Output)
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- Uneven Health Medical Equipment, Supplies, and Worker

Recommendation:

- Central Government Budget Alignment or improve the PHC outputs
- Improvement of the Capitation Payment Policy to consider:
 - a. non-specialistics diseases referral rate
 - b. Diseases prevention and control and Health Promotion contact rate
 - c. Chronic Diseases Health Service ratio
- Policy, planning, and budget improvement for PHC investment

Monitoring Audit Recommendation

Measuring Impact



Collected Data

- SQL
- Webscrapping

Data Analytics Algorithm

Moving Average
Convvergence/Divergence

Result

- ▶ Trend Changes

MACD

```
library(quantmod)
macdtl <- read.csv("kasus6.csv", sep=";")
macdtl$Tanggal<-strptime(macdtl$Tanggal, form
at="%Y-%m-%d")
dataxts<-xts(macdtl$Kapitasi, order.by=macdtl$T
anggal)
chartSeries(dataxts)
addMACD(fast=4,slow=8,signal=2,type="EMA")
```



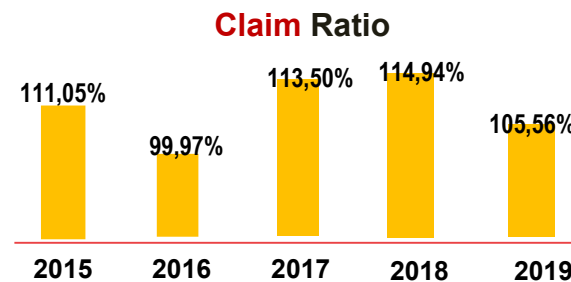
Monitoring Audit Recommendation

Measuring Impact



Recommendation:

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- Policy, planning, and budget improvement for PHC investment



Saving Health Expenditure
US\$49.237.020/Year

A close-up photograph of a person's hands typing on a laptop keyboard. The background is softly blurred, showing a patterned surface. A semi-transparent white circle is centered over the keyboard, containing the text 'Thank you' in a large, bold, black font, and 'For your Attention' in a smaller, regular black font below it. To the right of the circle, there are three red circles of varying sizes, with the largest one being the most prominent.

Thank you
For your Attention