

Artificial Intelligence for Healthcare Service Improvement



Analytics, Data Platform, Software Engineering

Briliantoro
President Director



BACKGROUNDS

We are a group of data explorer from Jakarta, offering data analysis products and solutions, data architecture, system design and development services to a diverse group of clients.

Since 2016, our firm has a collective expertise in commercial, corporate, digital, and government projects - each with a philosophy of innovative solution woven into them.

Our vision is to help our customers achieve data-driven enterprise by utilizing their data, external data, (big) data platform, analytics, and automation. Get the otherwise-obscure insights and operation-grade analytics with our solutions and products.



Project Portfolio

Direct



With Business Partner*



With Business Partner*



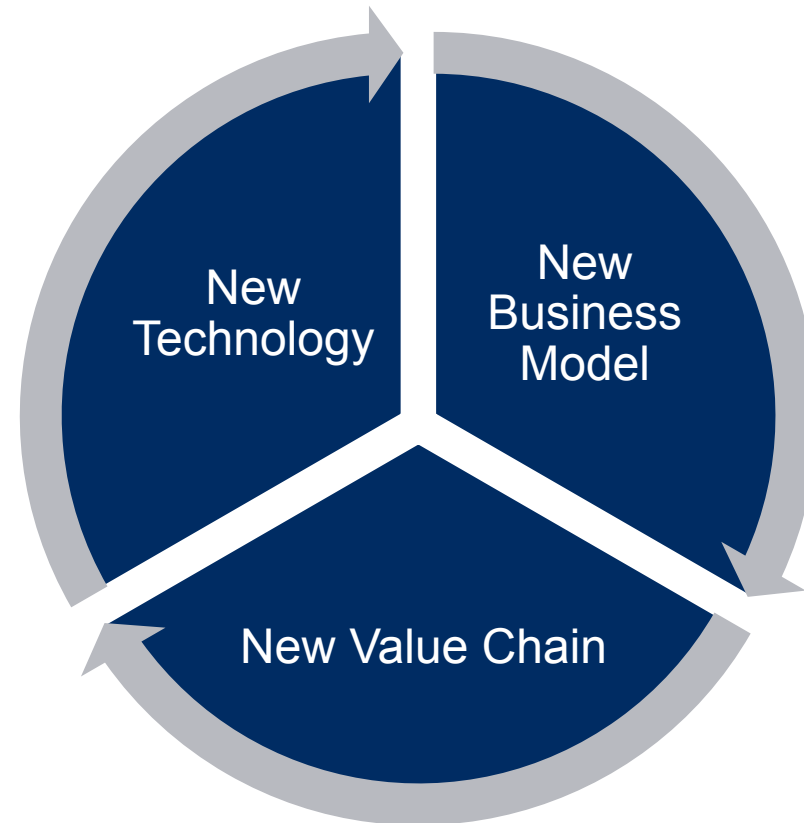
*XQ was subcontracted and/or partnered to do the project implementation with the business partner



Brief of Artificial Intelligence and Data Analytics

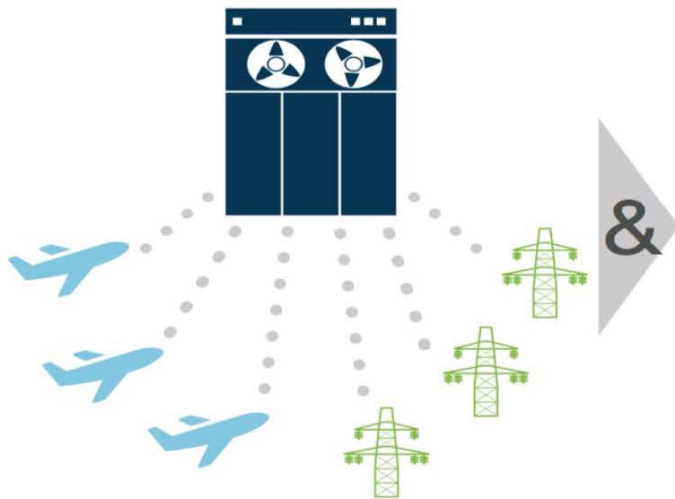
millennia behavior is *disruptive behavior*

... millennia's *innovate* and found *new ways* of doing things



Data Interaction Model

Before 2005



Closed and centralized
IoT networks

Today



Open access IoT networks,
centralized cloud

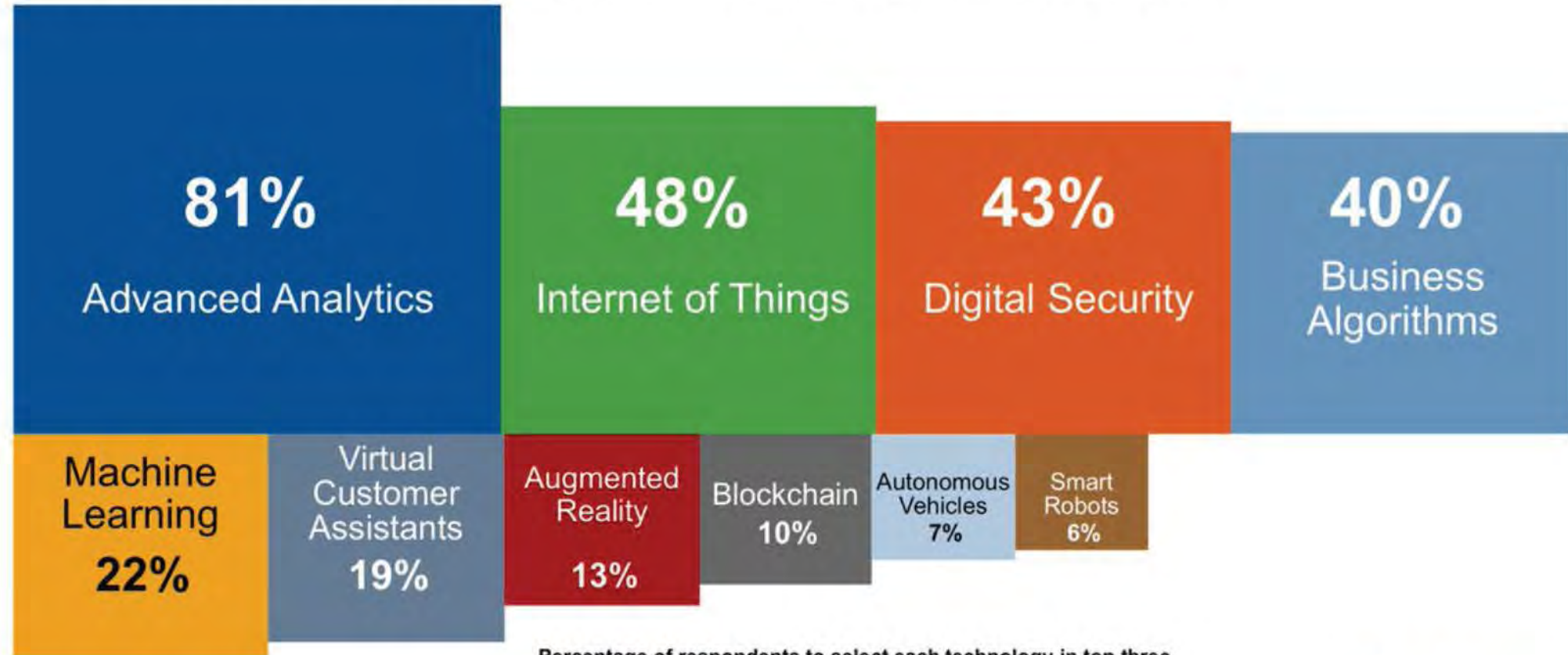
2025 and beyond



Open access IoT networks,
distributed cloud

Key Technologies Will Deliver Change

Q. In your opinion, which three of these technologies have the most potential to change your organization over the next five years?



#GartnerSYM

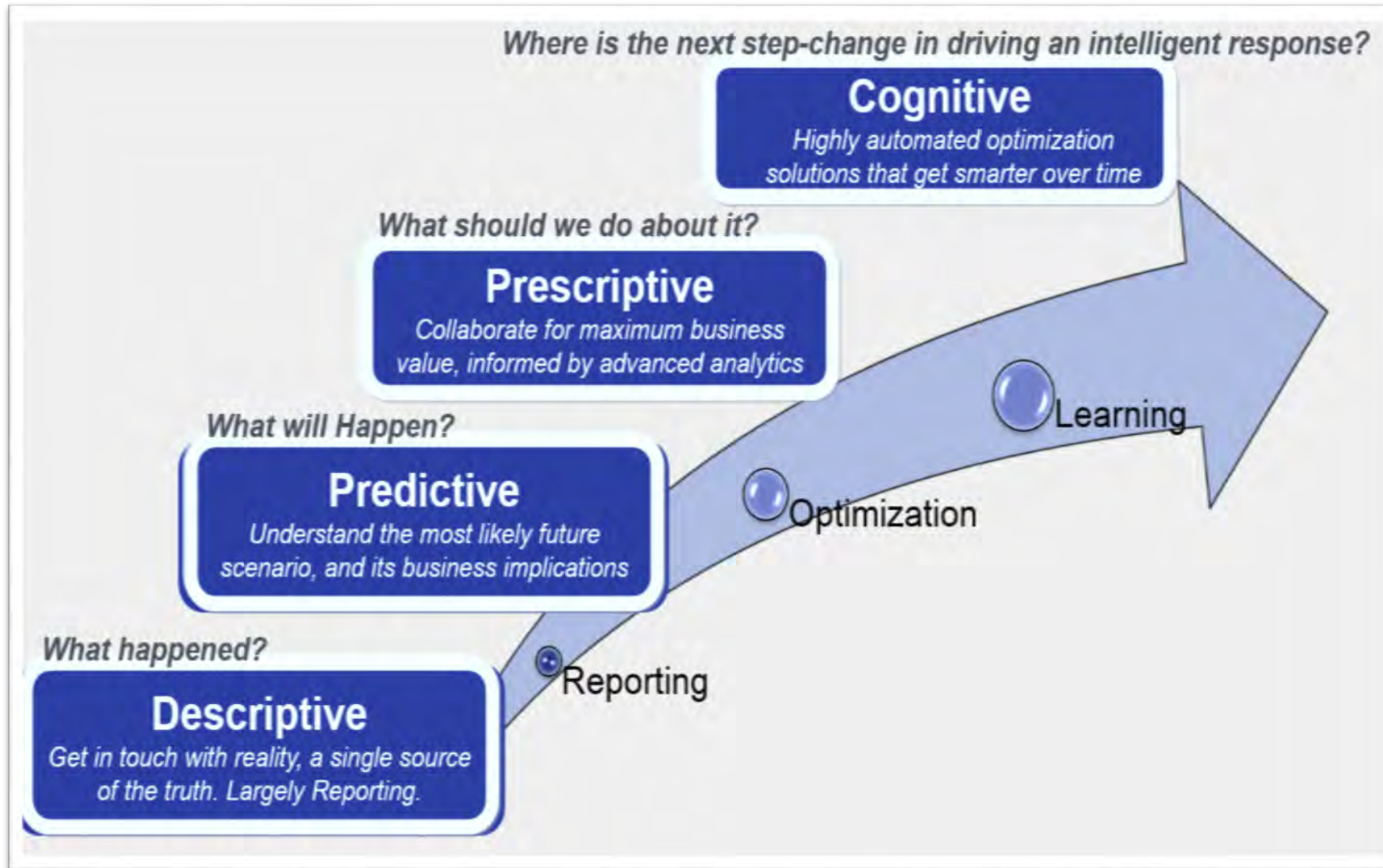
24 CONFIDENTIAL AND PROPRIETARY | ©2016 Gartner, Inc. and/or its affiliates. All rights reserved. Gartner and ITape are registered trademarks of Gartner, Inc. or its affiliates.

Gartner

Why Analytics??

- Unstable global economies compel organizations to operate under unprecedented regulatory and competitive environments.
- Several markets have matured to an extent that they benefit from faster time to market (TTM) and shorter decision cycles.
- Companies must take rapid decisions based on insightful and accurate data to stay on top of their game.
- Organizations are therefore including analytics as an integral component of their business plans to help make meticulous assessments of business environments and predict future trends.











Journey of Analytics



Enterprise Information Flow



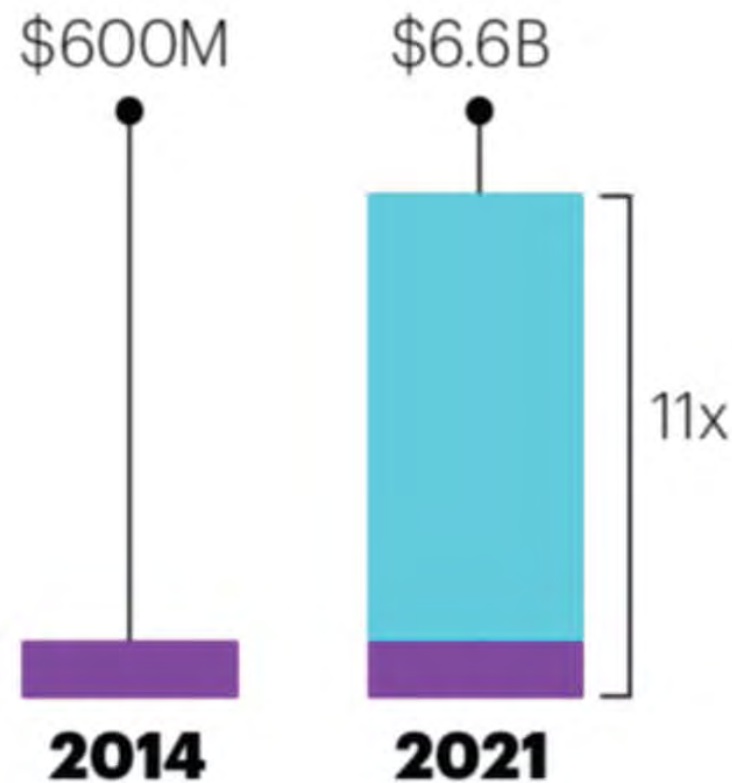
10 AI Applications That Could Change Health Care

APPLICATION	POTENTIAL ANNUAL VALUE BY 2026	KEY DRIVERS FOR ADOPTION
Robot-assisted surgery	 \$40B	Technological advances in robotic solutions for more types of surgery
Virtual nursing assistants	 20	Increasing pressure caused by medical labor shortage
Administrative workflow	 18	Easier integration with existing technology infrastructure
Fraud detection	 17	Need to address increasingly complex service and payment fraud attempts
Dosage error reduction	 16	Prevalence of medical errors, which leads to tangible penalties
Connected machines	 14	Proliferation of connected machines/devices
Clinical trial participation	 13	Patent cliff; plethora of data; outcomes-driven approach
Preliminary diagnosis	 5	Interoperability/data architecture to enhance accuracy
Automated image diagnosis	 3	Storage capacity; greater trust in AI technology
Cybersecurity	 2	Increase in breaches; pressure to protect health data

The AI health market is seeing explosive growth

HEALTH AI MARKET SIZE 2014-2021

Acquisitions of AI startups are rapidly increasing while the health AI market is set to register an explosive CAGR of 40% through 2021



Source: Accenture analysis

Technology Implementation

Lack of End-User Adoption is the #1 Reason for Failed Implementations

*"Without effective user adoption, end users are experiencing productivity losses averaging **17%**. It's like giving everyone Friday off."*

Source: Neochange/ Oracle UPK. 4th annual IT Adoption Insight Report

*"2 out of 3 IT projects **FAIL** due in large part to user adoption issues."*

Source: IDC Analyst Connection



79%
of why IT
projects fail
is due to
**HUMAN
RELATED
FACTORS**
we can control

Source: 2014 IT Resource Management Survey

Artificial Intelligence Use case



Anomaly Detection

Anomaly detection is the act of identifying an event or item that doesn't conform to others in an expected pattern. Your bank may call you now and then to ask about a specific charge on your credit card because it was unlike most of your purchases. Therefore, it was flagged so customer service would call (or text) you to ask if you made the purchase or if perhaps it was a fraudulent transaction. In healthcare, medical issues or textual errors can be identified and flagged. It has been able to improve image analysis efficiency by flagging specific anomalies in an image so that a radiologist can take a closer look. This gives radiologists more time to focus on reviewing those anomalies, saving time and improving patient care. Another way in which anomaly detection is used is to monitor and detect abnormal activities to mitigate insurance fraud and data breaches, like the credit card example above.

Robotic Surgery

In 2017, the Smart Tissue Autonomous Robot (STAR) demonstrated it was more precise than expert surgeons and damaged less of the surrounding flesh. AI is also improving surgery outcomes by analyzing pre-op data and helping surgeons during the procedure by providing new surgical techniques, resulting in fewer complications and shorter patient hospital stays.

Dosage Accuracy

Determining medication dosing relies on guidelines along with educated guesswork, according to HBR. Dosing errors account for up 37% of all preventable medical errors, which can be reduced significantly by combining those guidelines with improved data and analysis. As AI is increasingly used for this, incorrect dosing – and its devastating effects – could be a thing of the past.

Virtual Assistance

Virtual nursing assistants can potentially reduce unnecessary hospital visits and lessen the burden on medical professionals. AI-powered virtual nurses are being used by healthcare organizations to ask patients questions about their health, assess symptoms and give them care suggestions, giving healthcare professionals more time to focus on critical care.

Back Office efficiency

Healthcare costs are through the roof, so AI is being increasingly applied to correct and improve inefficiencies in the backoffice such as improving workflows and eliminating time-consuming tasks such as writing chart notes and ordering tests and prescriptions. Automating administrative tasks frees up care providers to prioritize urgent matters and saves time on routine tasks.

Identifying Disease Cell

Teaching a computer to better recognize what something looks like is what the industry calls deep learning. It is used for such technologies as speech recognition and it gets more accurate the more the system is used. The same process is used to identify cancer cells. Surgeons rely on biopsies to decide what tissue to remove, so accurate biopsy identification and analysis is crucial. By feeding thousands of images of cancer cells as well as examples the computer was prone to make a mistake on, an AI and machine learning-powered computer continually improves in accuracy. With improvements in scanning, storage, performance and algorithms, cell identification is going to be a capability to watch in the years to come.

Helping Avoid Illness

One of the most exciting ways AI is being used is in conjunction with the Internet of Medical Things (IoMT) in consumer health applications. These apps help people get and stay healthy so they don't need to see a doctor as often by encouraging healthy behavior by tracking steps and exercise time, reminding people to drink more water, and counting calories, sodium and sugar for better diet practices. These apps are also useful for doctors so they can understand the day-to-day behaviors of their patients.

Our Helathcare Use case



How AI can help??

Patient inflow Scheduling
Disease Prediction
Resource Planning
Cash Flow Prediction
Automatic Report Generator

Preliminary Diagnosis
Pretreatment



Health Monitoring
Health Maintenance

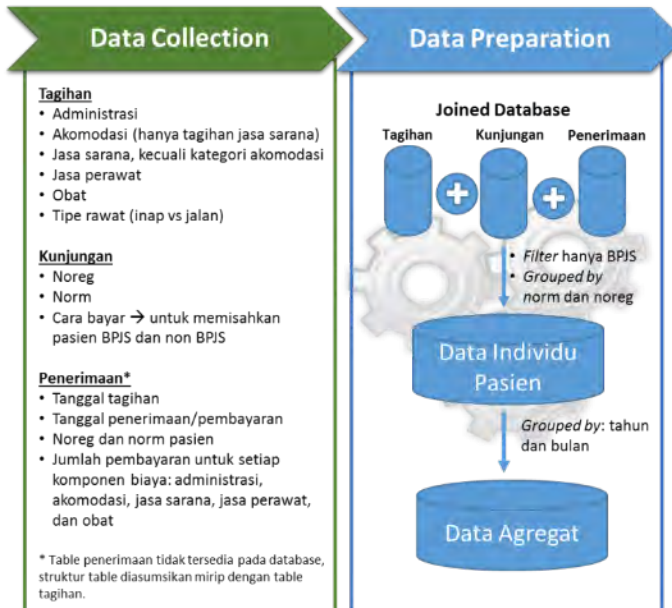
Claim Prediction
Cash flow Prediction



Disease Warning System
Disease Map

Health Campaign
Medical Infrastructure Planning

Case 1 – Cash Flow Prediction

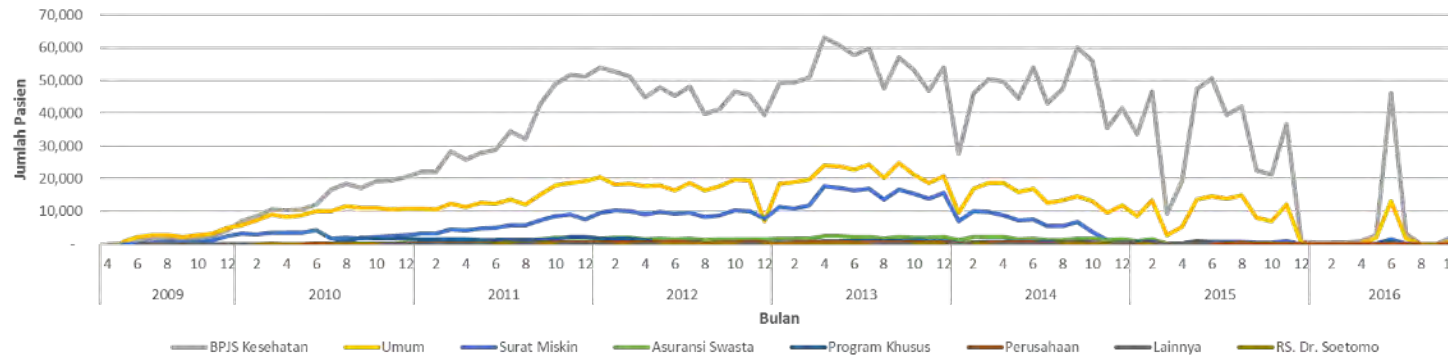


tahun	bulan	tipe_rawat	cara_bayar	total pasien	obat	administrasi	jasa sarana	jasa perawat	akomodasi
2009	4	rawat jalan	BPJS Kesehatan	1	NULL	NULL	1,638,450	1,092,300	NULL
2009	4	rawat inap	BPJS Kesehatan	1	NULL	15,000	587,942	368,628	260,000
2009	5	rawat jalan	BPJS Kesehatan	230	NULL	-	33,329,712	22,219,808	NULL
2009	5	rawat inap	BPJS Kesehatan	1	NULL	-	-	-	NULL
2009	6	rawat jalan	BPJS Kesehatan	921	NULL	-	122,527,710	81,550,606	NULL
2009	7	rawat jalan	BPJS Kesehatan	1,880	NULL	-	281,243,995	185,149,197	NULL
2009	7	rawat inap	BPJS Kesehatan	7	NULL	-	1,638,000	1,988,000	3,622,000
2009	8	rawat jalan	BPJS Kesehatan	1,744	NULL	-	272,305,015	177,528,552	NULL
2009	8	rawat inap	BPJS Kesehatan	92	NULL	602,000	17,609,023	45,711,472	79,663,000
2009	9	rawat jalan	BPJS Kesehatan	1,372	NULL	-	217,639,694	145,058,838	NULL
2009	9	rawat inap	BPJS Kesehatan	185	NULL	1,257,000	94,824,089	93,666,922	96,390,000
2009	10	rawat jalan	BPJS Kesehatan	1,480	NULL	-	234,538,836	152,847,618	NULL
2009	10	rawat inap	BPJS Kesehatan	420	NULL	2,539,000	147,690,889	139,628,211	169,957,500
2009	11	rawat inap	BPJS Kesehatan	872	NULL	5,652,010	295,467,852	299,569,466	219,585,500
2009	11	rawat jalan	BPJS Kesehatan	1,546	NULL	-	221,202,235	144,569,016	NULL
2009	12	rawat inap	BPJS Kesehatan	1,314	NULL	9,645,105	763,254,247	711,922,236	391,742,000
2009	12	rawat jalan	BPJS Kesehatan	3,088	NULL	-	339,532,965	218,521,362	NULL
2010	1	rawat inap	BPJS Kesehatan	1,618	NULL	12,368,040	1,272,223,953	990,530,875	391,086,000

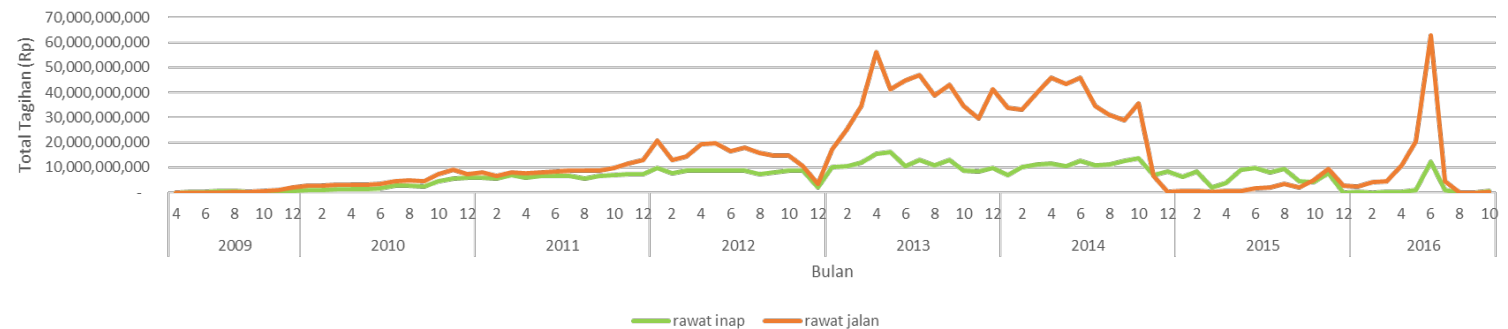
We map the data from RS Dr. Soetomo to identify the pattern and behaviour of payment in each point over time.

Case 1 – Cash Flow Prediction

Tren Pasien Berdasarkan Cara Pembayaran

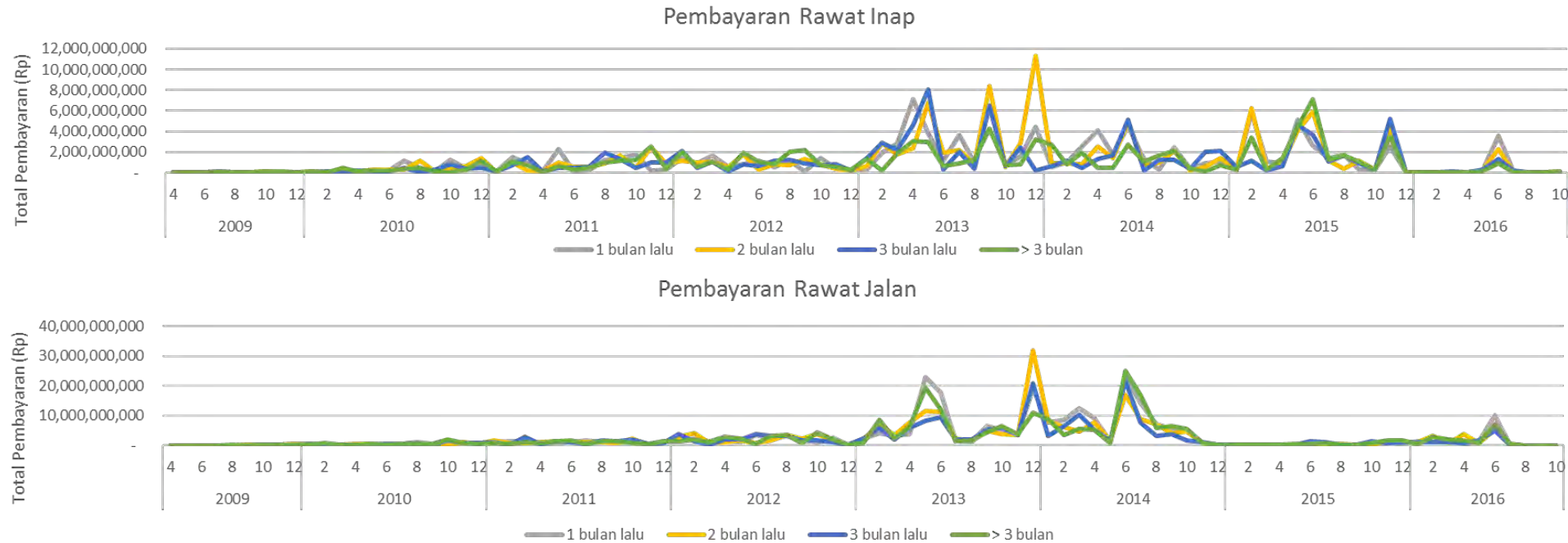


Tagihan Pasien BPJS



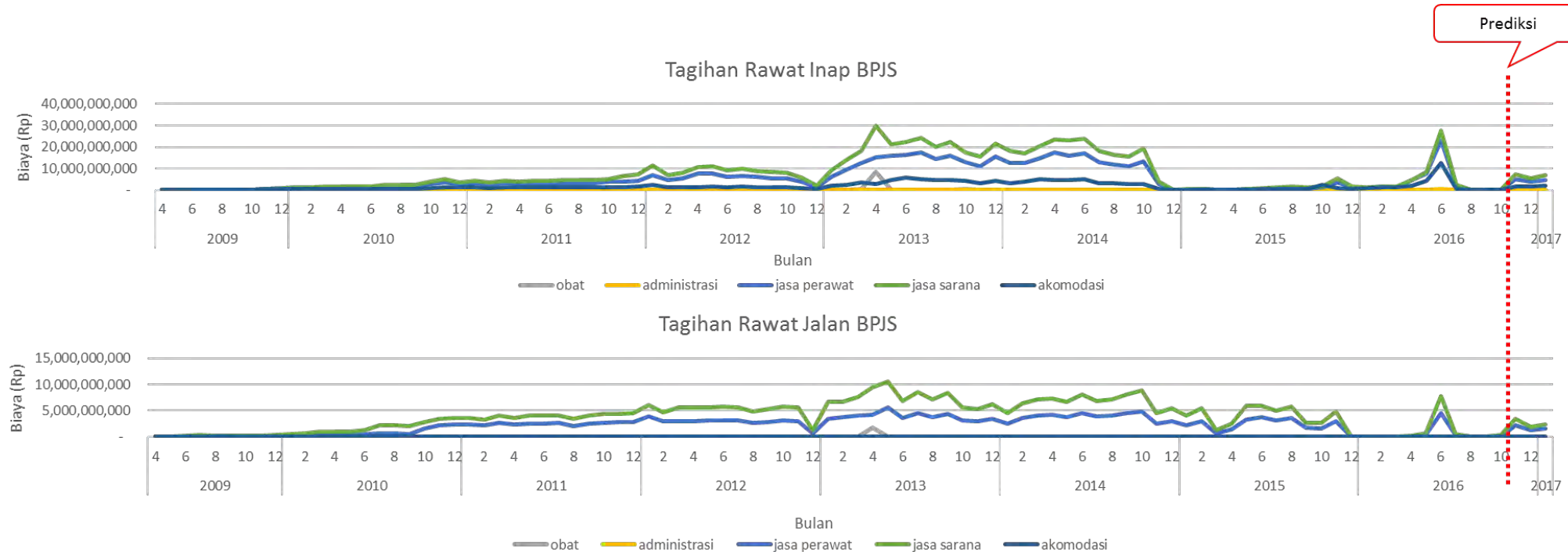
By doing so, we could start to better predict the disbursement for each installation point.

Case 1 – Cash Flow Prediction



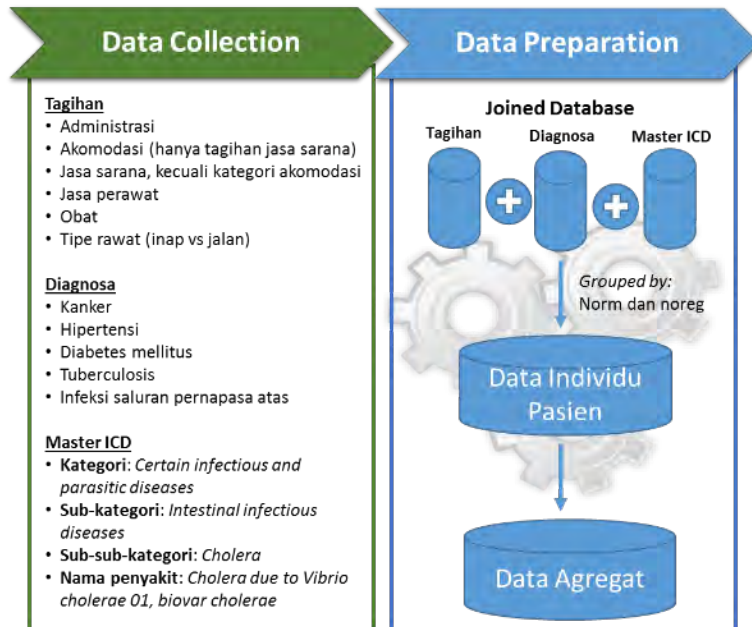
In Addition, this use case can then be adjusted to monitor the spikes in the trends and identify anomalies (for possibility of frauds).

Case 1 – Cash Flow Prediction



With time-series and regression analysis, we could (with certain degree of confidentiality) predict the future cash flow (with corresponding components).

Case 2- Disease Mapping: Warning System



The screenshot displays the ICD-10 Version:2010 website. The left sidebar shows the hierarchy: ICD-10 Version:2010 > I Certain infectious and parasitic diseases > II Neoplasms > C00-C97 Malignant neoplasms. The main content area shows the **Chapter II Neoplasms (C00-D48)** section, which contains the following blocks:

- C00-C97 Malignant neoplasms
- C00-C75 Malignant neoplasms, stated or presumed to be primary, of specified sites, except of lymphoid, haematopoietic and related tissue
- C00-C14 Malignant neoplasms of lip, oral cavity and pharynx
- C15-C26 Malignant neoplasms of digestive organs
- C30-C39 Malignant neoplasms of respiratory and intrathoracic organs
- C40-C41 Malignant neoplasms of bone and articular cartilage
- C43-C44 Melanoma and other malignant neoplasms of skin
- C45-C49 Malignant neoplasms of mesothelial and soft tissue
- C50-C50 Malignant neoplasm of breast
- C51-C58 Malignant neoplasms of female genital organs
- C60-C63 Malignant neoplasms of male genital organs
- C64-C68 Malignant neoplasms of urinary tract
- C69-C72 Malignant neoplasms of eye, brain and other parts of central nervous system
- C73-C75 Malignant neoplasms of thyroid and other endocrine glands
- C76-C80 Malignant neoplasms of ill-defined, secondary and unspecified sites
- C81-C96 Malignant neoplasms, stated or presumed to be primary, of lymphoid, haematopoietic and related tissue
- C97-C97 Malignant neoplasms of independent (primary) multiple sites
- D00-D09 In situ neoplasms
- D10-D36 Benign neoplasms
- D37-D48 Neoplasms of uncertain or unknown behaviour

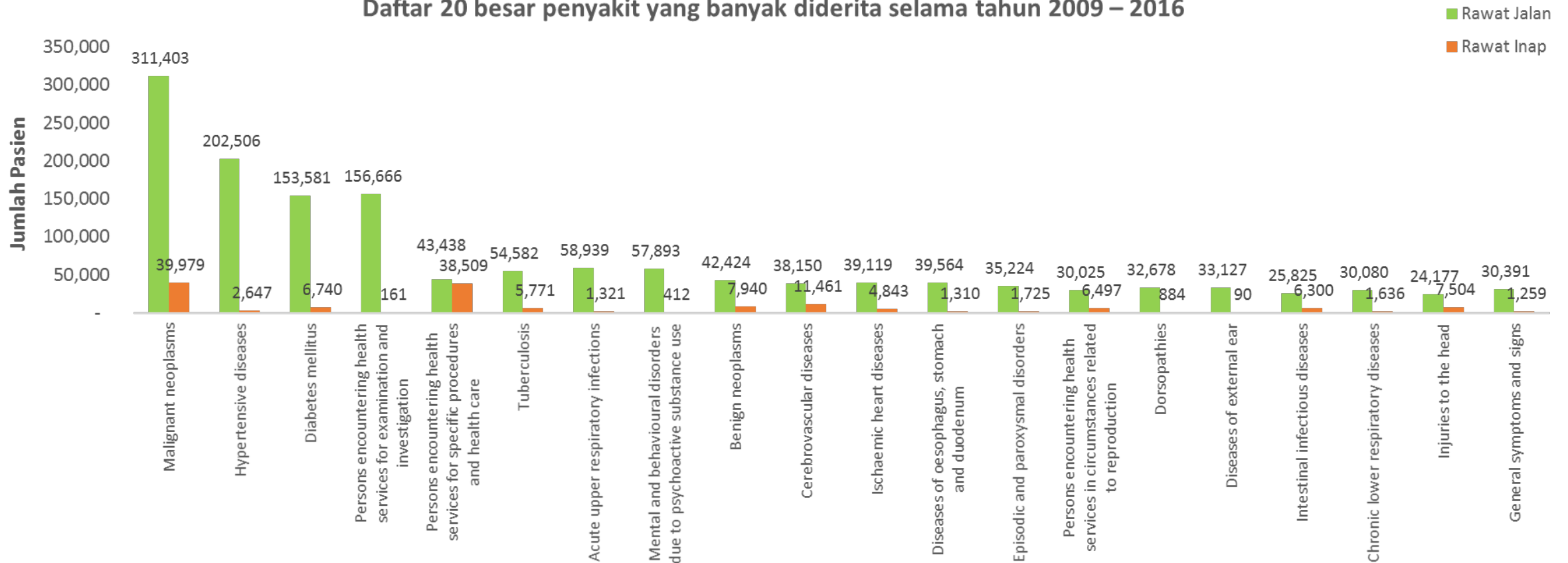
Notes:

1. Primary, ill-defined, secondary and unspecified sites of malignant neoplasm

Combining both Insurance and Hospital data, we'll have a very rich integrated dataset for disease, diagnosis, treatment, and other supporting variables ready for time-series, trend, and other analysis

Case 2- Disease Mapping: Warning System

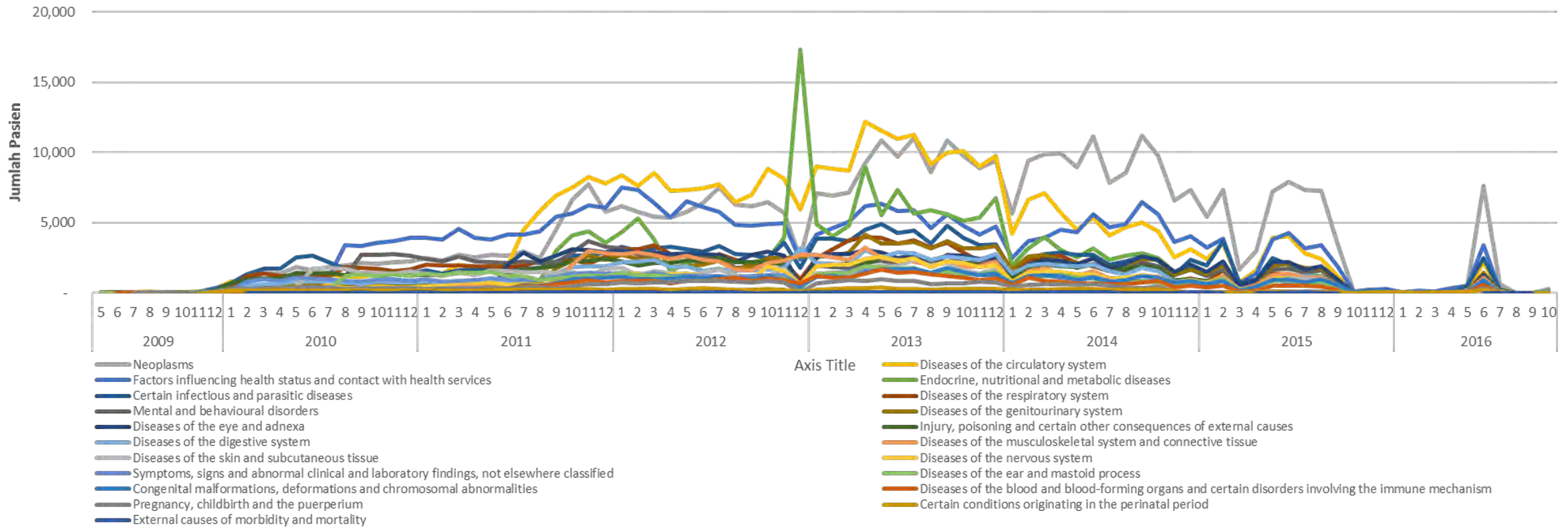
Daftar 20 besar penyakit yang banyak diderita selama tahun 2009 – 2016



We could see in both helicopter and granular level of the health condition of Indonesia. This can be beneficial for policy-making insight as well as preventive and corrective campaigns.

Case 2- Disease Mapping: Warning System

Kejadian Penyakit Berdasarkan Kategori dan Waktu



As the by-product of this analysis, the insurance, hospital, and pharma companies can benefit with this insights. From planning the infrastructure, catching emerging needs of treatment, and identifying working/non-working medicing/treatment across the country.

Case 2- Disease Mapping: Warning System

DISEASE MAPPING

Provinsi All

TIME PERIODE

Tahun 2016

Bulan All

DISEASE TYPE

Category Diseases of the respiratory system

Subcat All



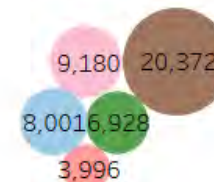
TOP 5 CITIES BY DISEASE & TOP DISEASE BY CATEGORY

TOP 5 CITY BY DISEASE



Kodya
■ Surabaya Kota
■ Sidoarjo
■ Gresik
■ Bangkalan
■ Lamongan

TOP 5 DISEASE CATEGORY

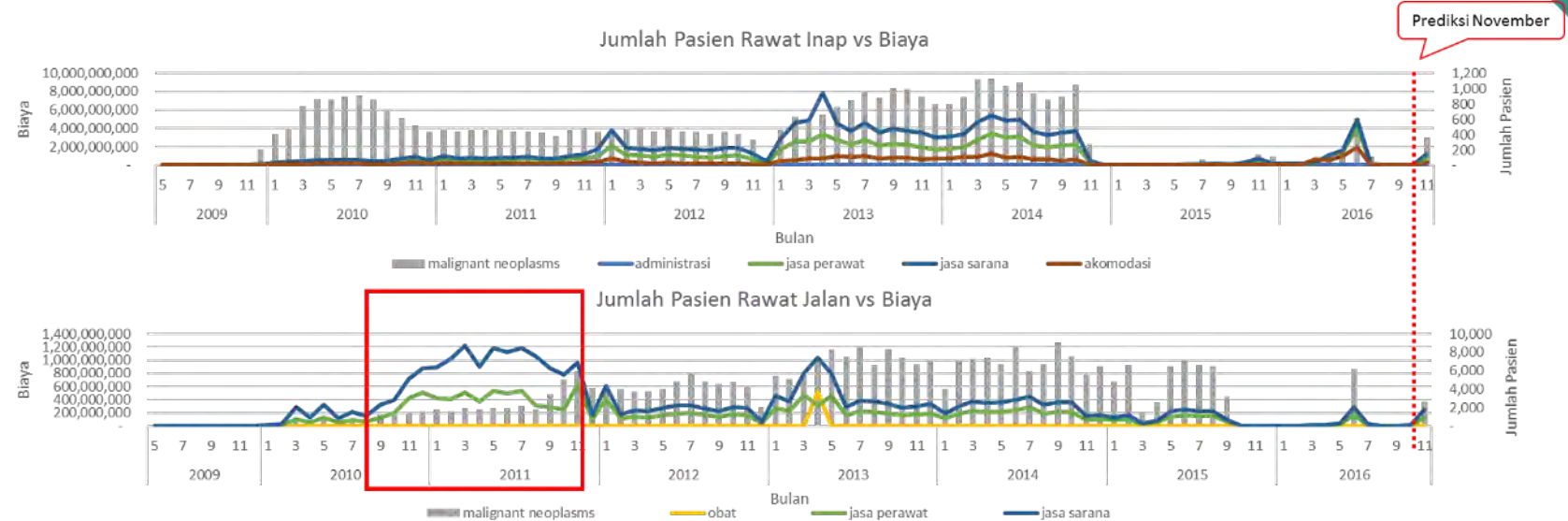


Kategori Name

■ Certain infectious and parasitic di..
■ Diseases of the circulatory system
■ Diseases of the respiratory system
■ Factors influencing health status ..
■ Neoplasms

Case 3 - Disease Mapping: Predict the Future

year	month	tipe rawa	apter_r	apter_r	bigclass_cod	gclass_r	total pasien
2009	5	rawat jalan	C00-D48	Neoplasm	C00-C97	Malignant	8
2009	5	rawat jalan	E00-E90	Endocrine	E40-E46	Malnutriti	1
2009	5	rawat jalan	G00-G99	Diseases o	G90-G99	Other diso	1
2009	5	rawat jalan	H00-H59	Diseases o	H10-H13	Disorders	2
2009	5	rawat jalan	J00-J99	Diseases o	J00-J06	Acute uppe	2
2009	5	rawat jalan	K00-K93	Diseases o	K20-K31	Diseases o	2
2009	5	rawat jalan	L00-L99	Diseases o	L50-L54	Urticaria a	2
2009	5	rawat inap	N00-N99	Diseases o	N40-N51	Diseases o	1
2009	5	rawat inap	N00-N99	Diseases o	N17-N19	Renal failu	1
2009	5	rawat jalan	R00-R99	Symptoms	R10-R19	Symptoms	1
2009	5	rawat jalan	J00-J99	Diseases o	J40-J47	Chronic lo	3
2009	5	rawat jalan	J00-J99	Diseases o	J30-J39	Other dise	3
2009	5	rawat jalan	I00-I99	Diseases o	I20-I25	Ischaemic	3
2009	5	rawat jalan	I00-I99	Diseases o	I10-I15	Hypertens	6
2009	5	rawat jalan	H60-H95	Diseases o	H80-H83	Diseases o	3
2009	5	rawat jalan	E00-E90	Endocrine	E10-E14	Diabetes r	10
2009	5	rawat jalan	C00-D48	Neoplasm	D10-D36	Benign nec	1
2009	5	rawat jalan	A00-B99	Certain inf	A20-A28	Certain zo	1
2009	5	rawat jalan	A00-B99	Certain inf	A00-A09	Intestinal i	1
2009	5	rawat jalan	A00-B99	Certain inf	A15-A19	Tuberculo	3
2009	5	rawat jalan	F00-F99	Mental an	F20-F29	Schizophre	1
2009	5	rawat jalan	H60-H95	Diseases o	H65-H75	Diseases o	1
2009	5	rawat jalan	K00-K93	Diseases o	K35-K38	Diseases o	1



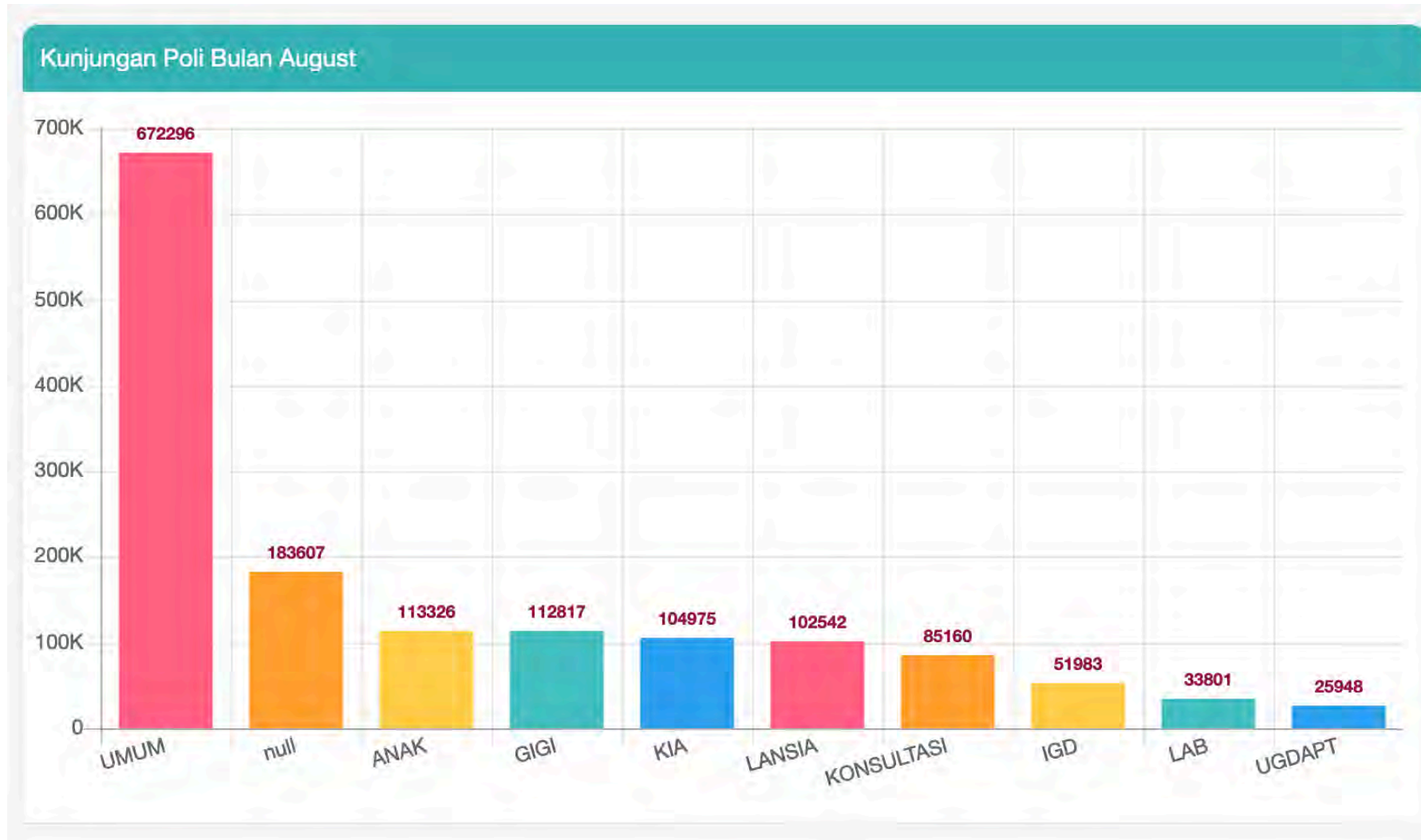
Going further, with very detailed data set, we can start to predict the future based on historical patterns and correlating variables. Moreover, we could also analyse the impact it may creates on the insurance claims both on BPJS and Insurance alike – for each individual disease.

Top 10 Disease

Diagnosa Kasus Terbanyak Bulan August

#	Kode	Nama	Jumlah
1	I10	Hipertensi primer/essensial	116579
2	J06.9	Infeksi saluran pernapasan atas (ISPA), tidak spesifik	105841
3	J00	Nasofaringitis akut	78011
4	K30	Dispepsia	50435
5	M79.1	Myalgia	39654
6	J06	Acute upper respiratory infections of multiple and unspecifi	36984
7	A09	Diarrhoea and gastroenteritis of presumed infectious origin	31527
8	Z00.0	Pemeriksaan Medis Umum	29264
9	K04.1	Necrosis of pulp	23548
10	Z00	General examination and investigation of persons without com	23150

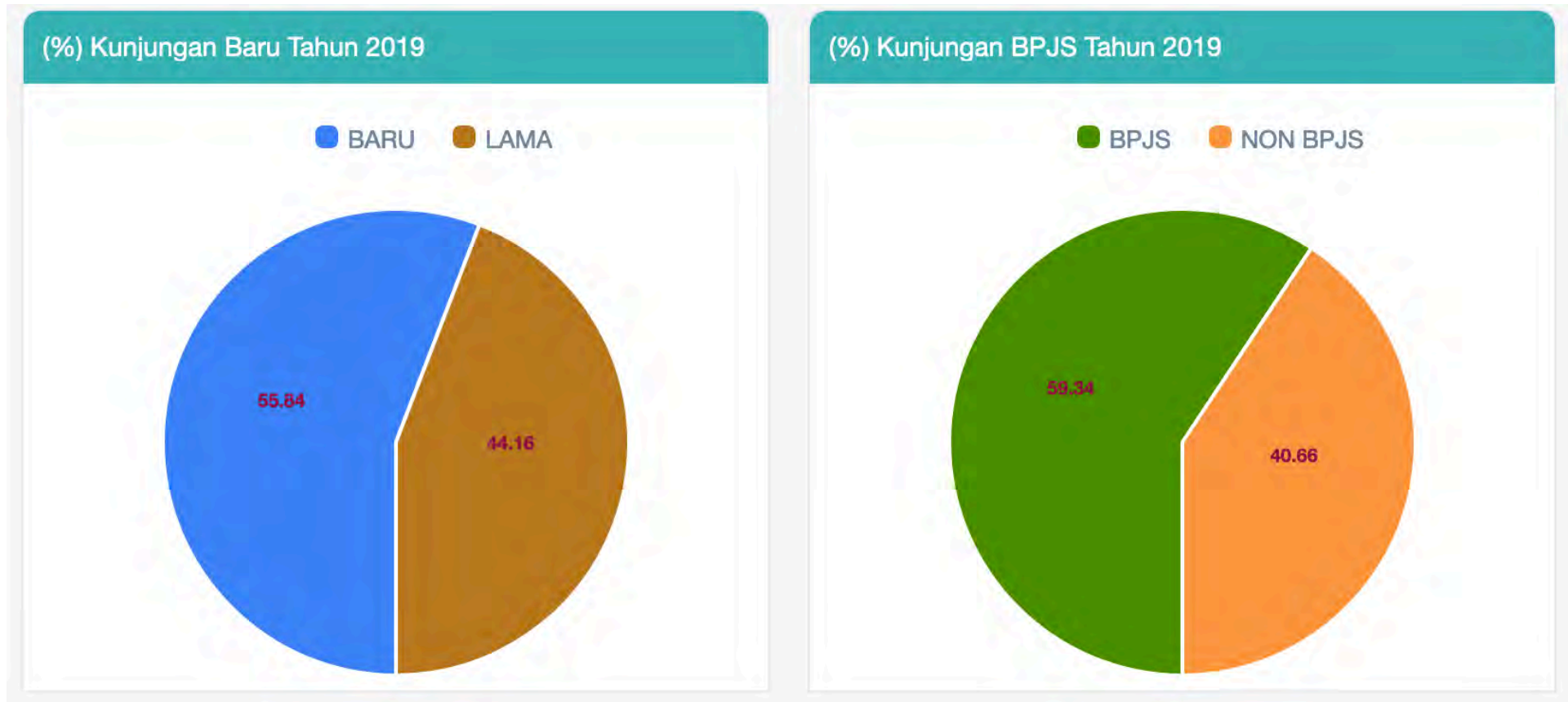
Clinic Visit



Number of Patient Visit



Type of Patient



Automatic Report Generator

+/- 90 Create Report
Data App



Laporan --> Laporan Program

[Tahun]
Tahun: 2016 Program: KIA

[Laporan]
Form: 1 2 3 4 5 6 7 8 9 10 11 12

[Puskesmas]

Kode	Nama Puskesmas
P0172100001	KEC. MATR
P0172100002	KEL. KAYU
P0172100003	KEL. UTAN
P0172100004	KEL. PISAI
P0172100005	KEL. UTAN
P0172100006	KEL. DAL I
P0172100007	KEL. UTAN
P0172100008	KEL. KEBON

CHECK ALL PUSKESMAS

Laporan --> Laporan Program

[Tahun]
Tahun: 2016 Program: Surveilans

[Laporan]
Form: 1 2 3 4 5 6 7 8 9 10 11 12

[Puskesmas]

Kode	Nama Puskesmas	Last Update
P0172100001	KEC. MATRAMAN	-
P0172100002	KEL. KAYU MANGS	-
P0172100003	KEL. UTAN KAYU UTARA	-
P0172100004	KEL. PISANGAN BARU	-
P0172100005	KEL. UTAN KAYU SEL. I	-
P0172100006	KEL. PAL MERJEM	-
P0172100007	KEL. UTAN KAYU SEL. II	-
P0172100008	KEL. KEBON MANGOTS	-

CHECK ALL PUSKESMAS

Laporan --> Laporan Program

[Tahun]
Tahun: 2015 Program: Gizi

[Laporan]
Form: 1 2 3 4 5 6 7 8 9 10 11 12

F1 - Penimbangan Balita Per Posyandu
F2 - Penimbangan B...
F3 - Penimbangan B...
Daftar Bumil KEK
F5 - Balita Gizi Buru
F7 - Kapsul Vitamin
Garam Beryodium
Vitamin A ibu Nifas

[Keterangan]
Form belum ada d...
Form ada datanya
Form sudah divalidasi
Form diupload dil...

Laporan --> Laporan Program

[Tahun]
Tahun: 2016 Program: Promkes

[Laporan]
Form: 1 2 3 4 5 6 7 8 9 10 11 12

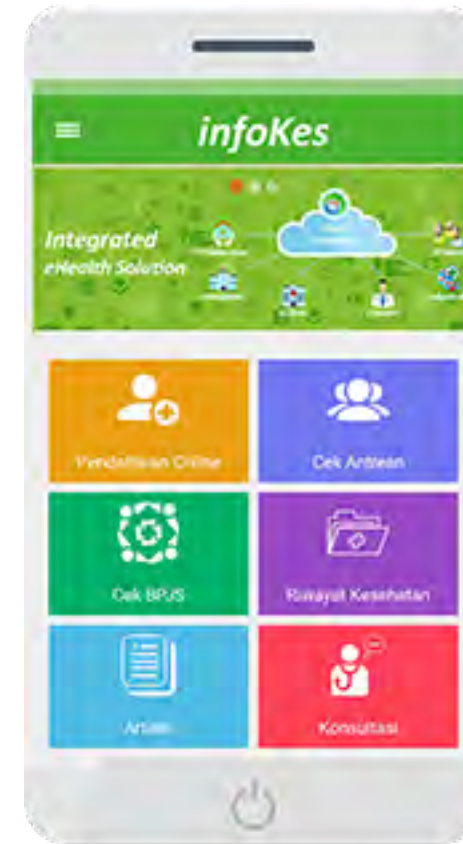
[Puskesmas]

Kode	Nama Puskesmas	Last Update
P0172100001	KEC. MATRAMAN	-
P0172100002	KEL. KAYU MANGS	-
P0172100003	KEL. UTAN KAYU UTARA	-
P0172100004	KEL. PISANGAN BARU	-
P0172100005	KEL. UTAN KAYU SEL. I	-
P0172100006	KEL. PAL MERJEM	-
P0172100007	KEL. UTAN KAYU SEL. II	-
P0172100008	KEL. KEBON MANGOTS	-

CHECK ALL PUSKESMAS

[Keterangan]
Form belum ada datanya
Form ada datanya
Form sudah divalidasi
Form diupload diluar waktu yang telah ditetapkan

Preliminary Diagnosis / Pretreatment



THANK YOU



© 2018 XQUISITE INFORMATICS. All rights reserved.

The information herein is for informational purposes only and represents the current view of XQUISITE INFORMATICS as of the date of this submission.