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Affordable and Collaborative BAN Portable Health Clinic

Contact :

Masahiro Kuroda
National Institute of Information and
Communications Technology, Japan

Email: marsh@nict.go.jp

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Masahiro Kuroda

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Communications Technology, Japan

marsh@nict.go.jp

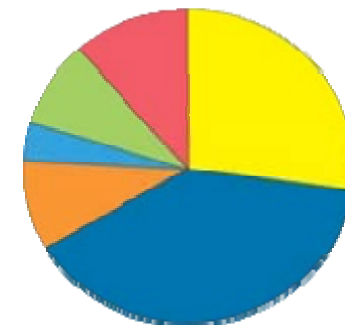
Health: Benefit to Personal & Public Health

- Nearly 80% of NCD deaths (29 million) occur in low- and middle-income countries and lead to catastrophic medical expenditures

- More than 9 million of all deaths attributed to NCDs occur before the age of 60; 90% of these "premature" deaths occurred in low- and middle-income countries

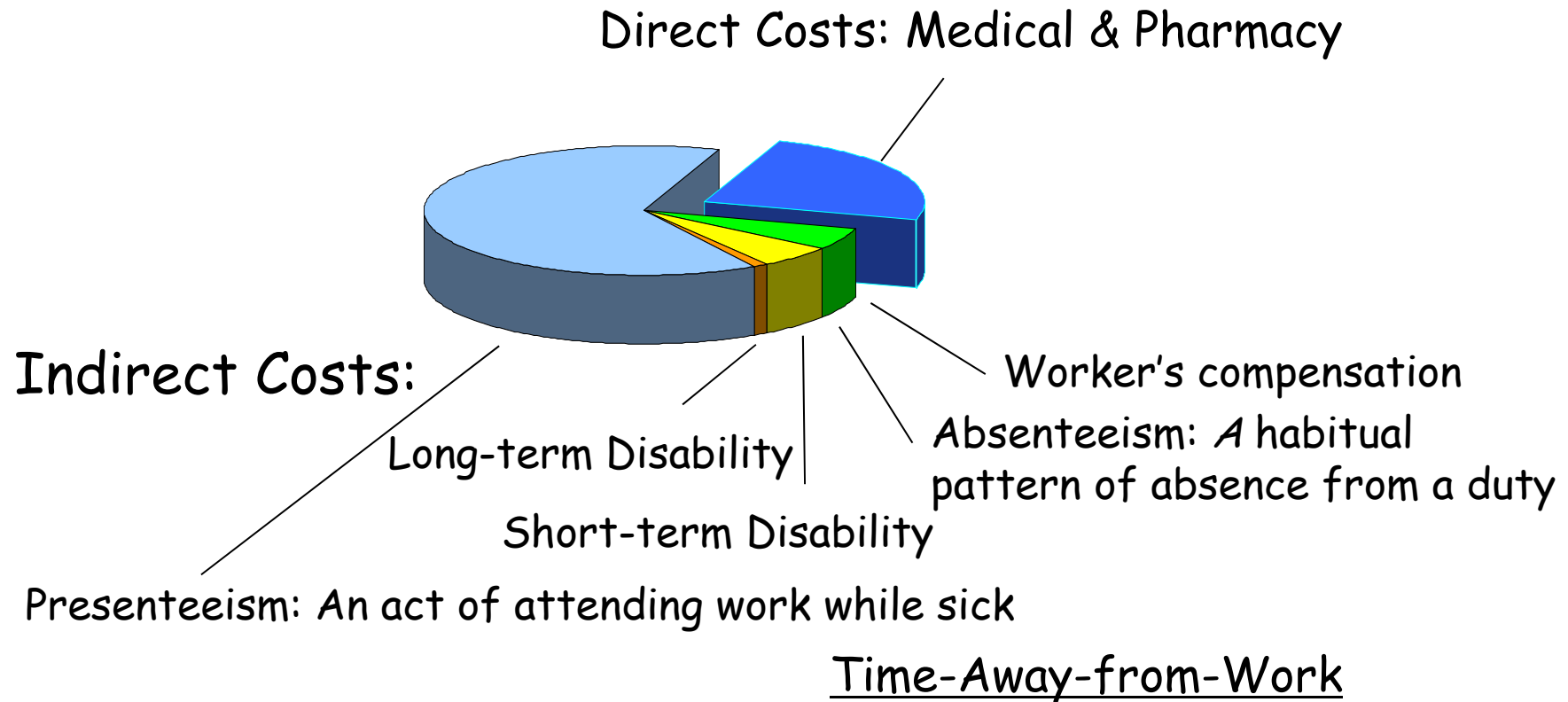
- Affordable e-health for public health keeps healthy workers and national interest

Global NCD deaths under age 70 by cause of death, 2008



NCDs: Non Communicable Diseases

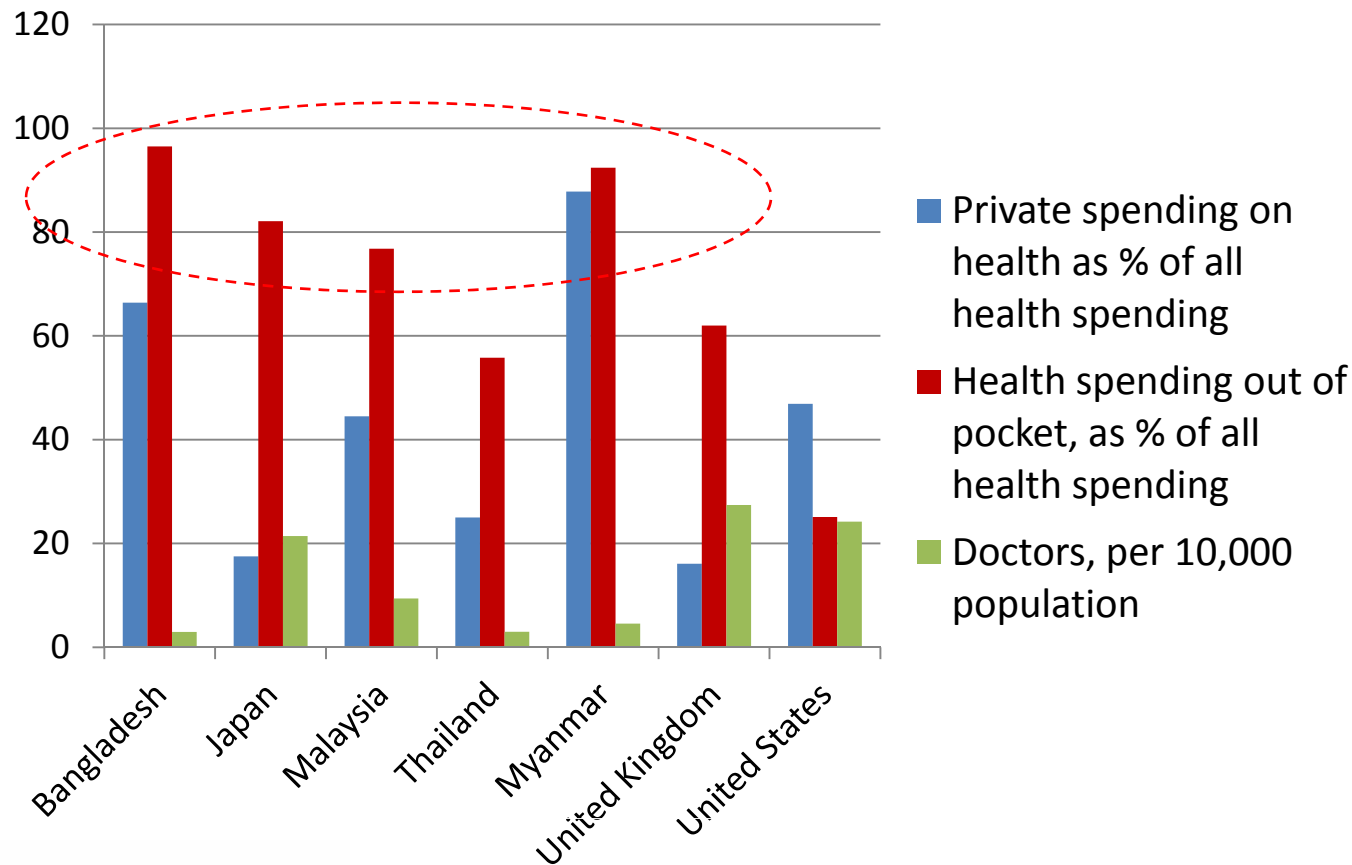
Relative Costs of Poor Health: Total Value of Health



Edington, Burton. *A Practical Approach to Occupational and Environmental Medicine* (McCunney). 140-152. 2003

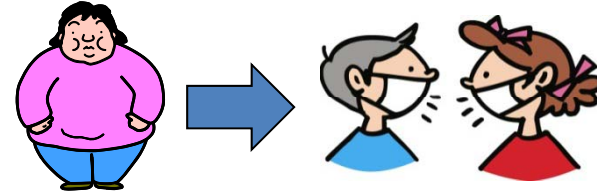
Health Spending Out of Pocket

Out of pocket expenditure is any direct outlay by households to health practitioners and suppliers of pharmaceuticals, therapeutic appliances, and other goods and services. <http://data.worldbank.org/indicator/SH.XPD.OOPC.ZS>)



Affordable Public Health keeps National Interest

- Epidemic of Obesity Communicable ?
 - Yes and No

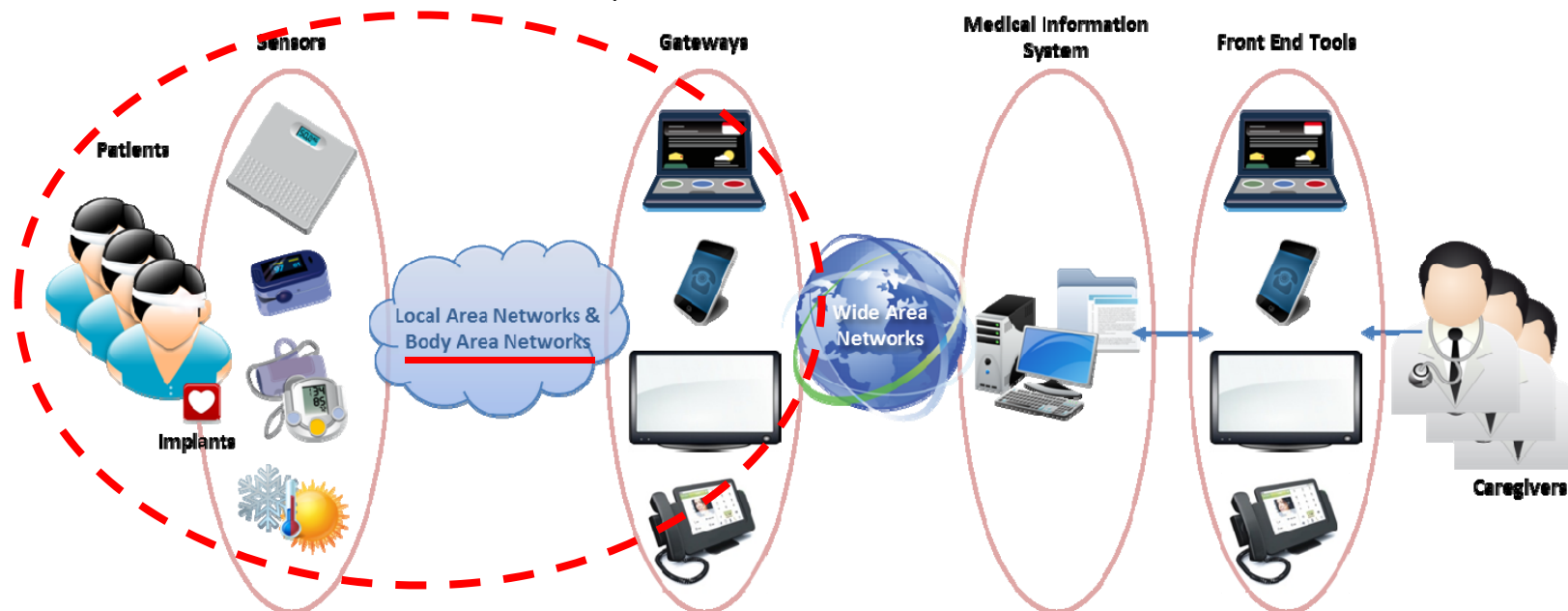


- Alcohol abuse cost the U.S. health care system \$85.8 billion in 1988. The tab for cigarette smoking totals over \$65 billion annually. Costs related to obesity now surpass \$27 billion per year.
- The American Medical Association recently revealed that at least 25 cents of every health care dollar is spent on the treatment of diseases or disabilities that result from potentially changeable behaviors.

<http://www.scu.edu/ethics/publications/iie/v6n1/voluntary.html>

BAN in BAN Portable Health Clinic

- Body Area Network (BAN) offers a wired communication or short range radio communication capability for sensors to exchange data with a gateway around a person's body (From ITU-T Focus Group on M2M service layer: *M2M enabled ecosystems: e-health*)
- BAN is not limited to the space around a person, but depends on the distance reachable by cables and radios



"Overview of key functional components in the e-health ecosystem for Remote patient monitoring/assisted living" from ITU-T M2M FG report

BAN and Medical BAN Technologies



BAN



Medical BAN

IEEE802.15.6

IEEE802.15.4j(US only)

IEEE802.15.4n(China only)

- **Medical frequency band** for quality of service
- **Low-power** consumption in modulations
- **Strict security** enforcement
- Top-priority data transfer for **emergency data**
- Ensure **secure SAR** (Specific Absorption Ratio) level



Affordable Checkup and Telemedicine

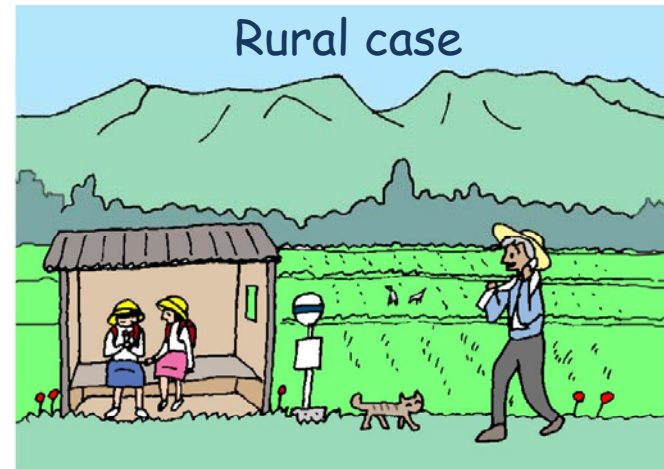
- BAN Portable Health Clinic (BAN-PHC): Health check-up and telemedicine on sites, such as factories in urban areas and villages in rural areas
- Continuous use in areas where power supply is unstable , easy-to-use interfaces to users, such as paramedics, easy network maintenance and ease of carrying



An international joint-research project "portable health clinic": Kyushu university hospital, Graduate school of IS and EE, and Grameen Communications. NICT cooperation: Provide low-power & secure BAN standard technologies both for medical/healthcare devices and for the coordinator based on Android

Real Technologies for BAN-PHC

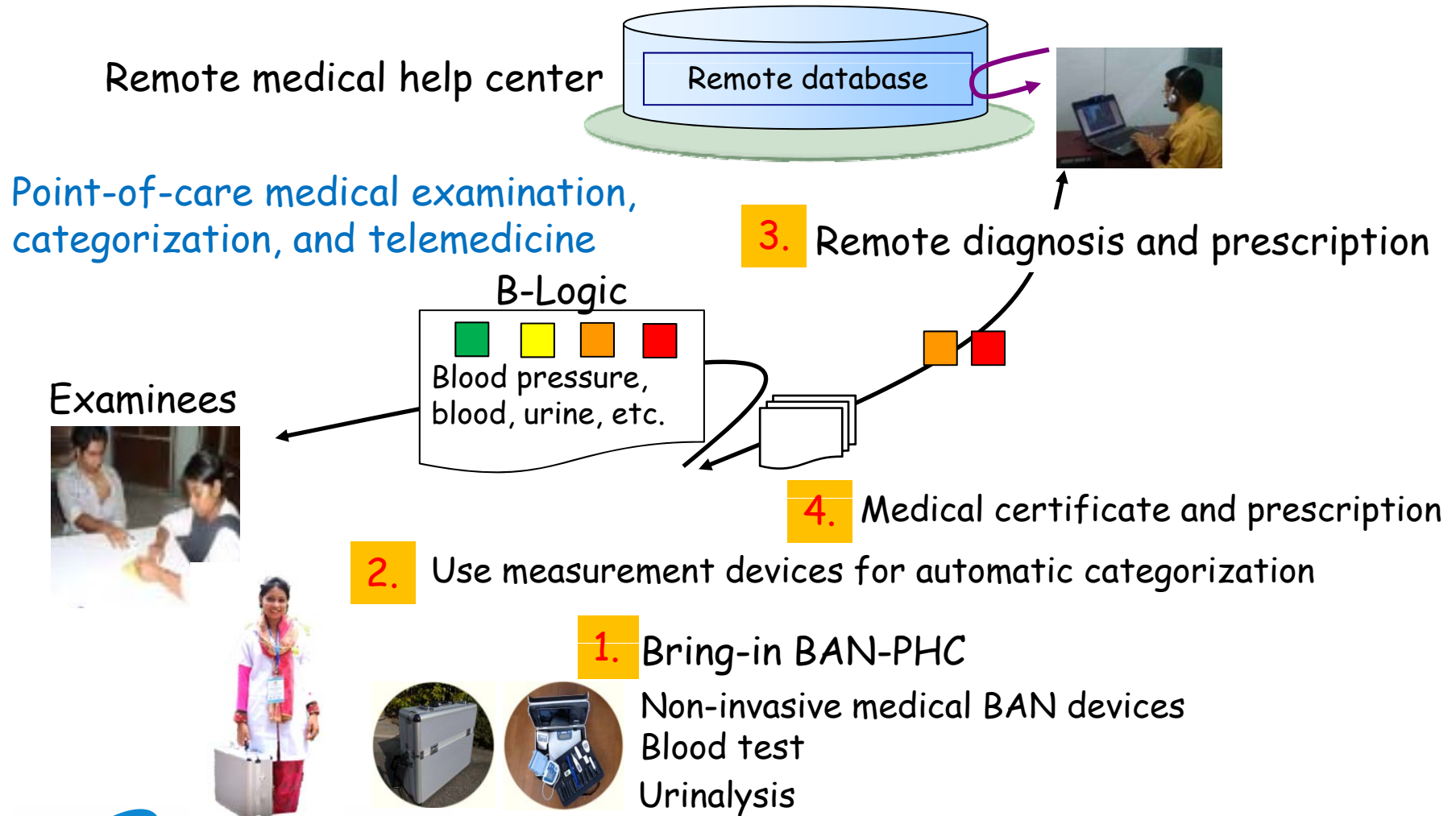
- Under unstable power supply and batteries may not be charged
- Data transfer via cell phone may not be available
- Limited space/location in setting up the clinic
- User-friendly interface for examiners



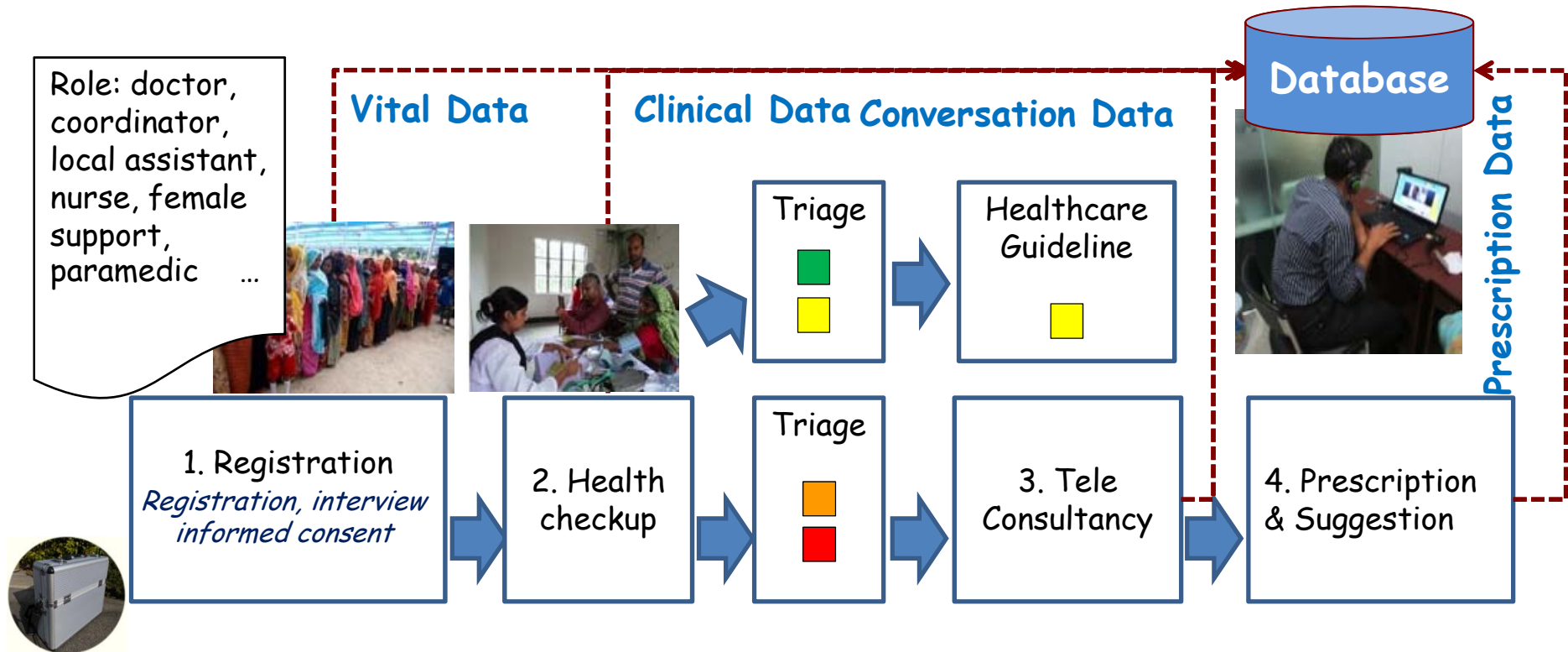
Mass Medical Exam. case



BAN-PHC System







BAN-PHC Workflow



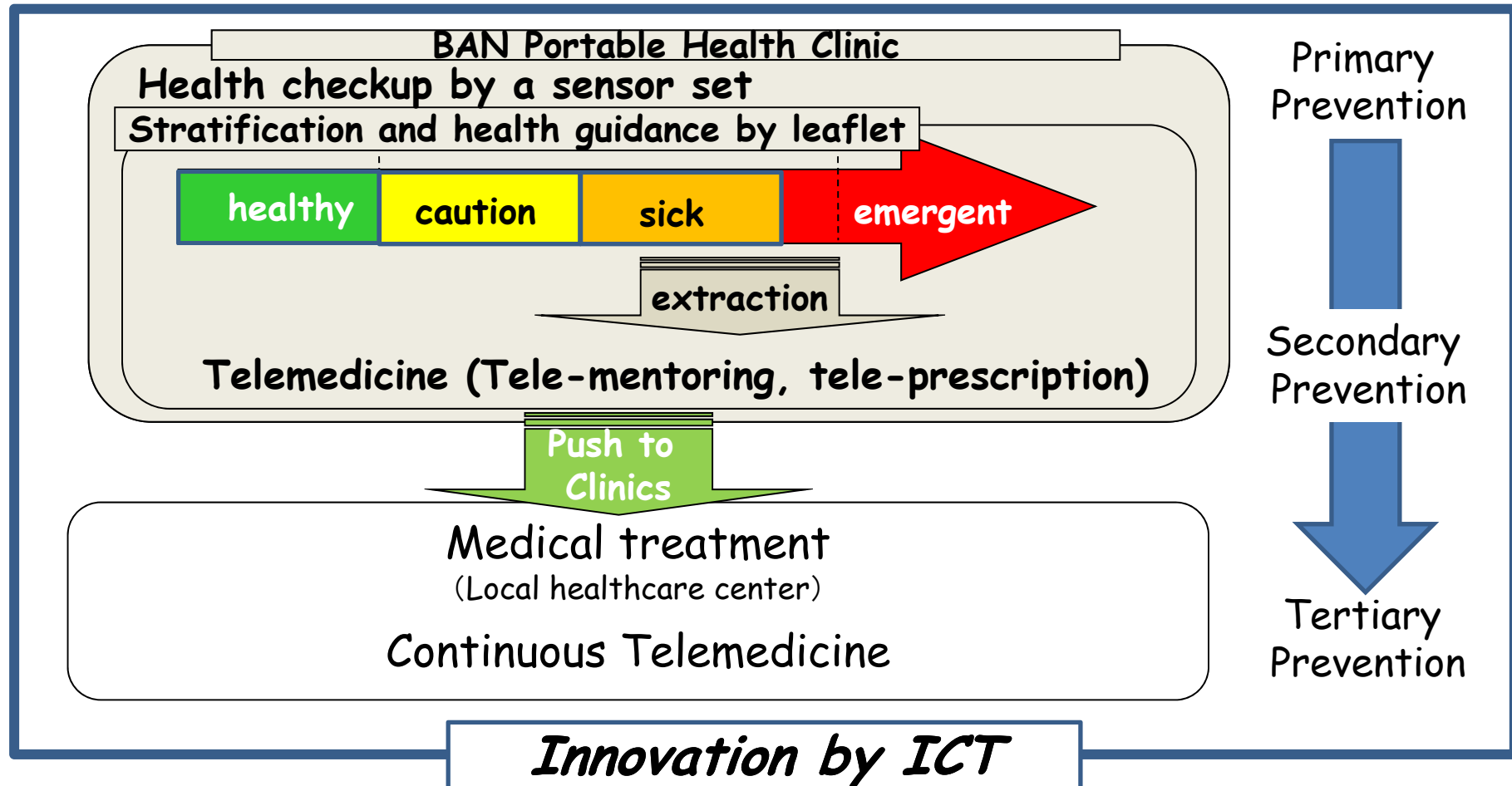
B-Logic: Automatic Categorization

	Green	Yellow	Orange	Red
Blood Pressure (mmHg)	< 140 mmHg	$140 \leq < 160$ mmHg	$160 \leq < 180$	$180 \leq$
	< 90 mmHg	$90 \leq < 100$ mmHg	$100 \leq < 110$	$110 \leq$
Blood Sugar	< 100mg/dl	$100 \leq < 126$ mg/dl	$126 \leq < 200$ mg/dl	≥ 200 mg/dl
Postprandial Blood Sugar	< 140mg/dl	$140 \leq < 200$ mg/dl	$200 \leq < 300$ mg/dl	≥ 300 mg/dl
Urine test				
...				
SpO2	$\geq 96\%$	$93 \leq < 96\%$	$90 \leq < 93\%$	$< 90\%$

-  Red: Emergent - **Telemedicine** + Encouragement to visit clinic
-  Orange: Affected - **Telemedicine**
-  Yellow: Caution - **Provide a leaflet** about health care in Bengal
-  Green: Normal

Designed by Naoki Nakashima, M.D., Kyushu University Hospital and
Kunihisa Kobayashi, M.D., Fukuoka University Chikushi Hospital

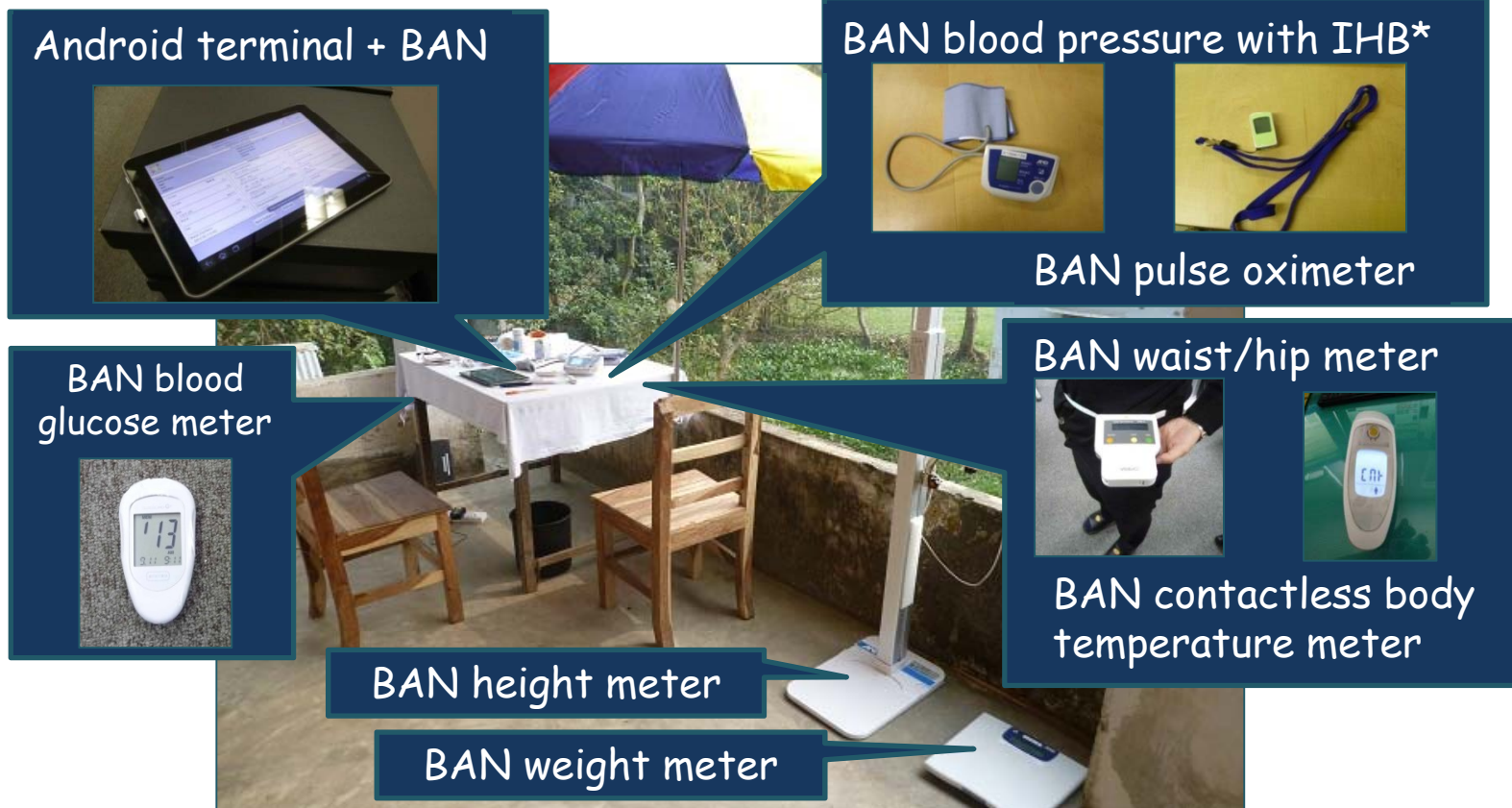
Population Management of Chronic Diseases



From Dr. Naoki Nakashima, Kyusyu University Hospital

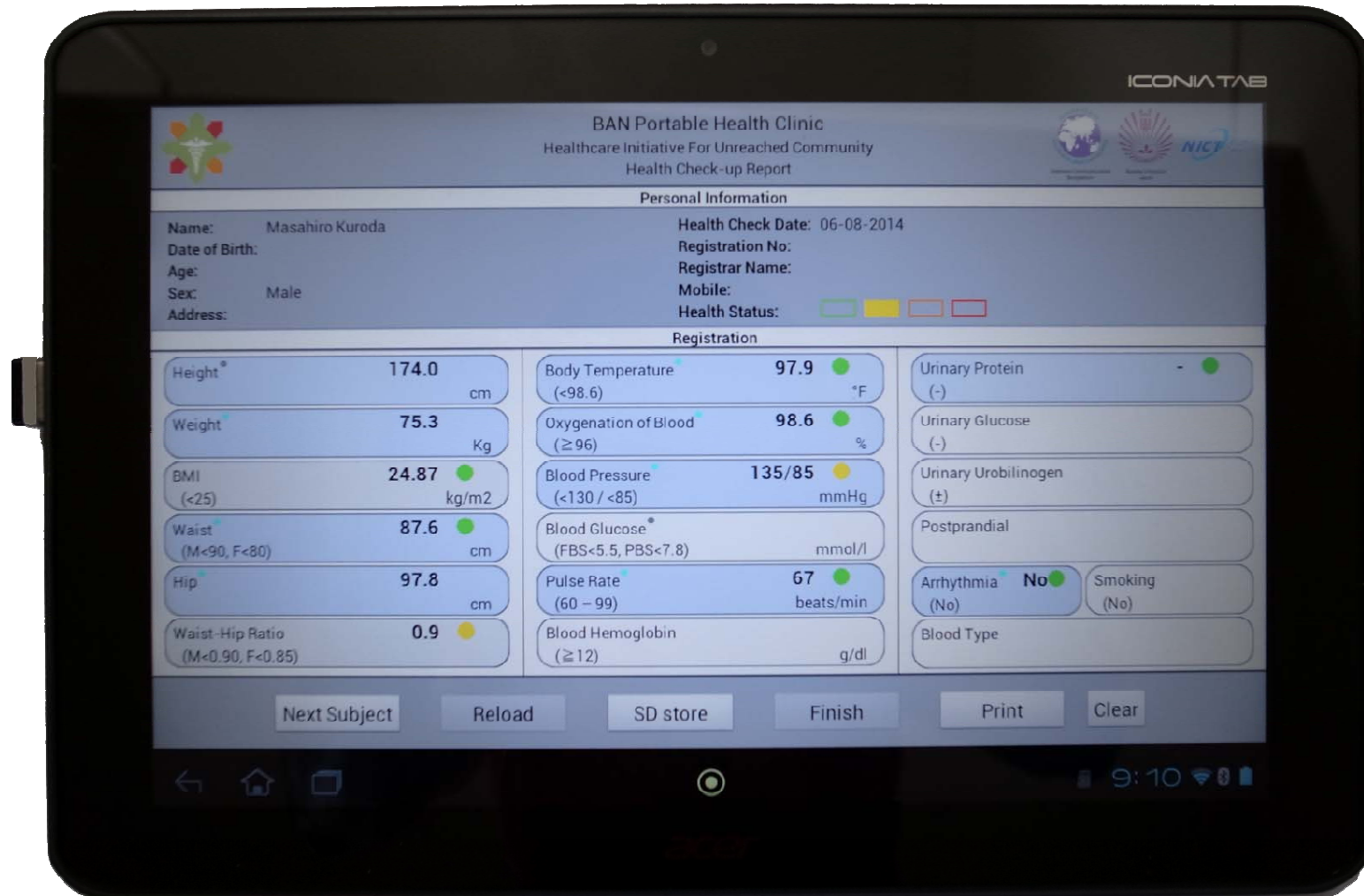
BAN-PHC Devices on Site

- Support International BAN Standards
- Plug-in any sensors following the open standards

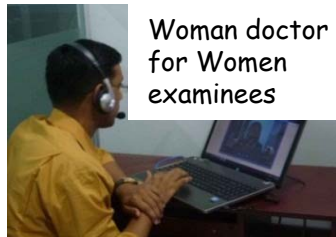


*IHB: Irregular Heat Beat

Android Tablet Screen in BAN-PHC



Medical Checkup and Remote Diagnosis in Rural Area, Bangladesh



Woman doctor for Women examinees

Doctor's remote exam.



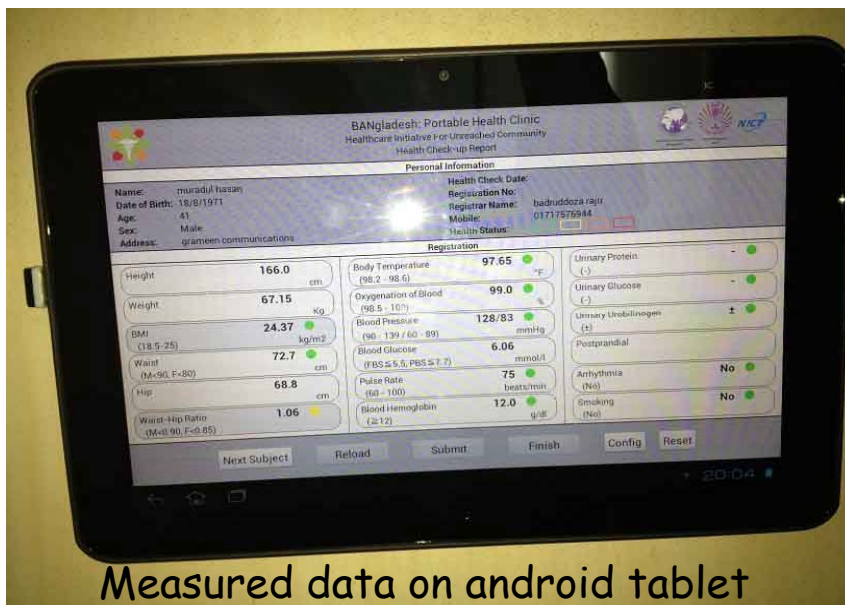
Remote examinee



Wait for remote



Physical examination scene

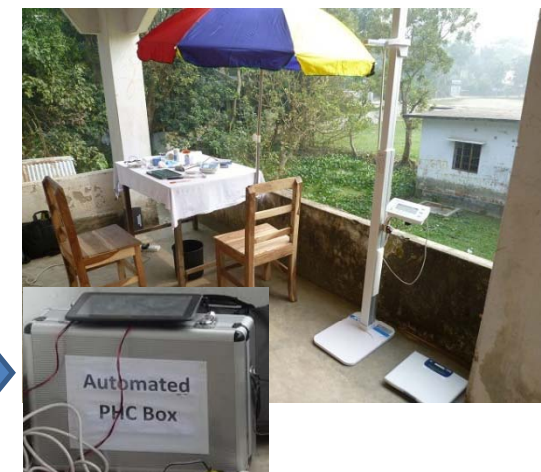


Measured data on android tablet

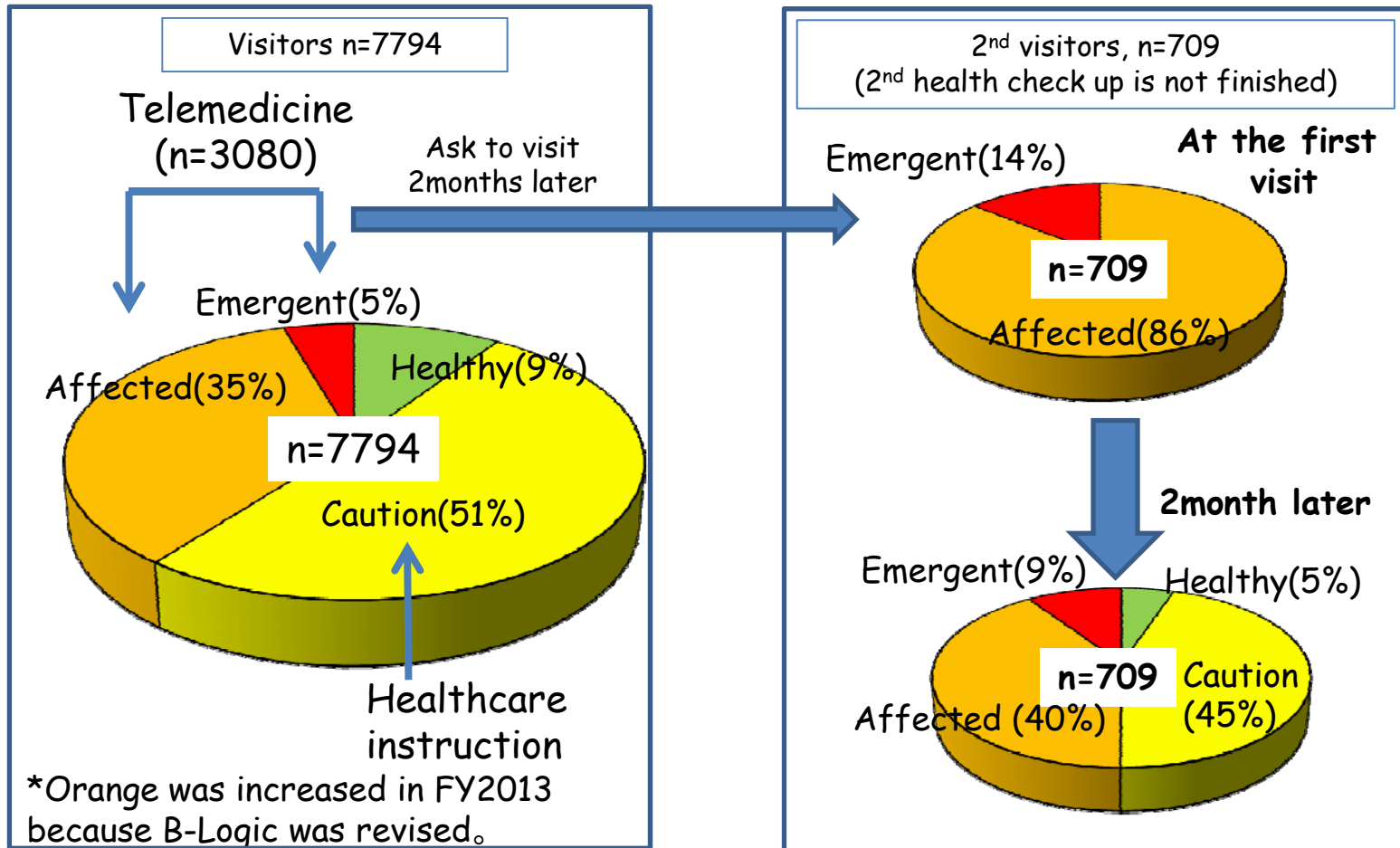
Start



Reg. , Interview Informed consent



Results of Telemedicine in FY2013



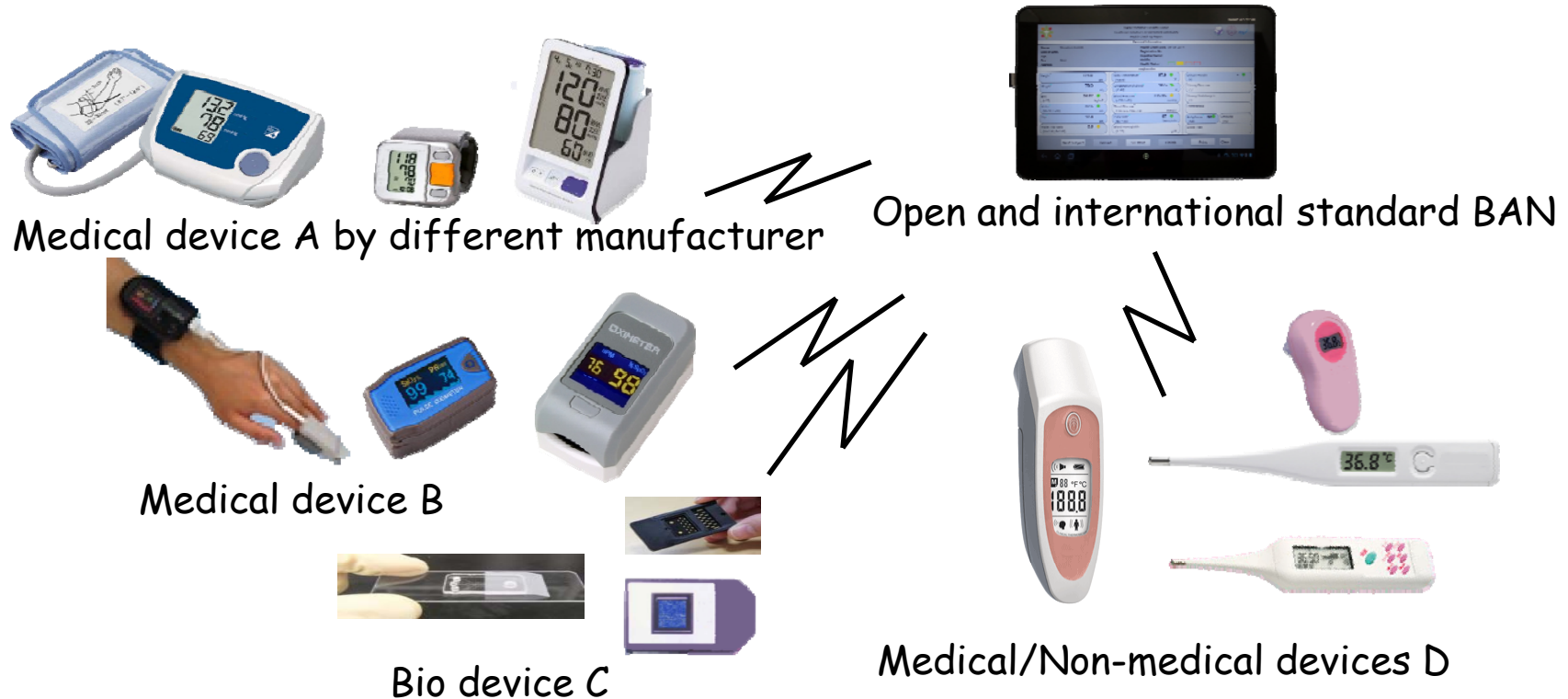
Progress report in FY2013

※We have to think "regression to the mean"

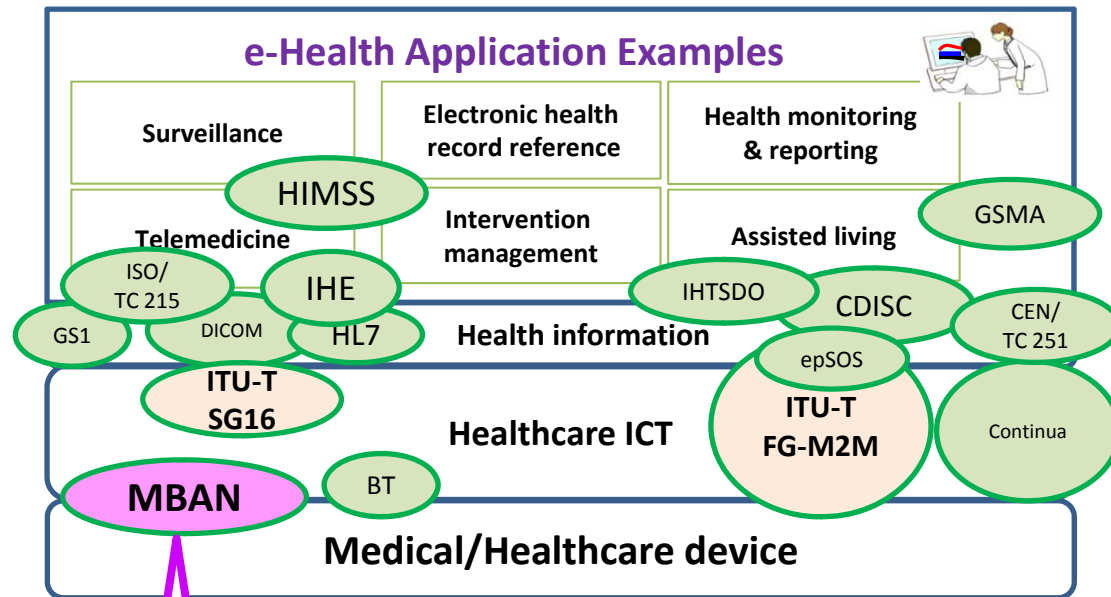
From Dr. Naoki Nakashima, Kyusyu University Hospital

Collaborative BAN-PHC

- Any device following open standard interfaces and formats can be a medical/measurement device in BAN-PHC
- Cost effective device gets the position in BAN-PHC



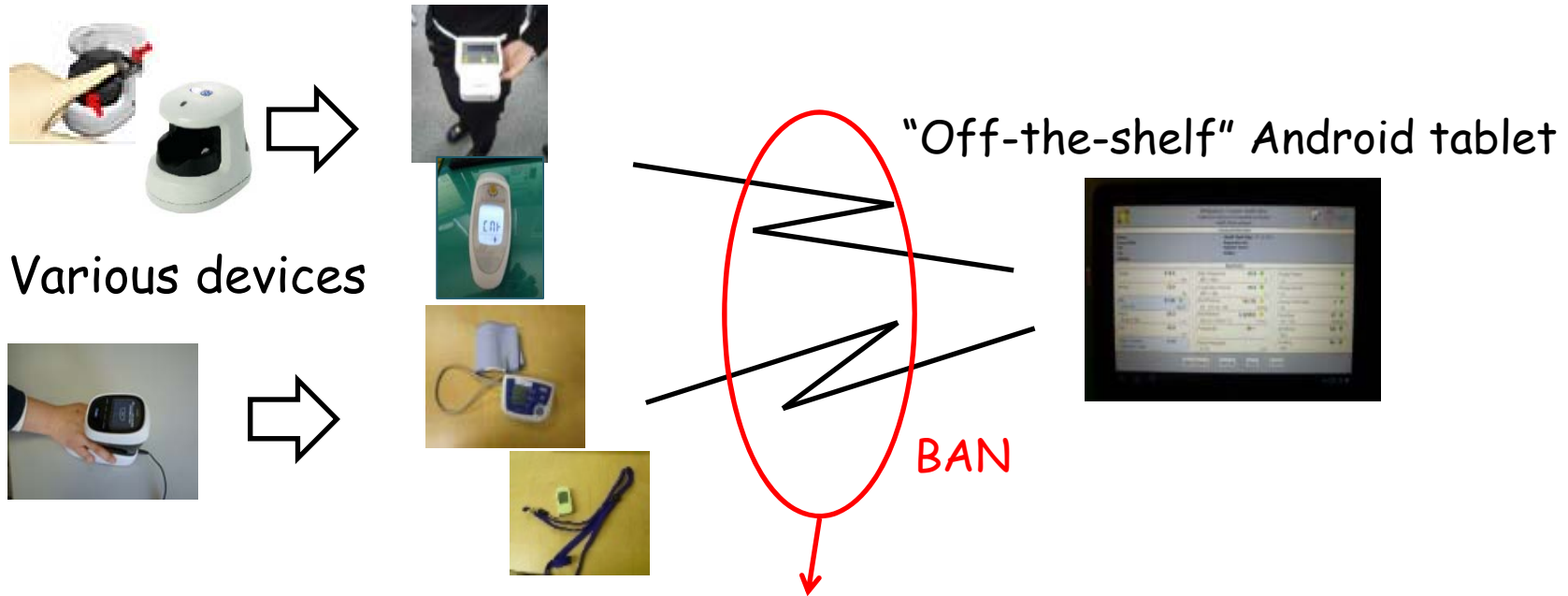
Standards around E-Health and Medical BAN



MBAN (Medical Body Area Network) international standards are essential for qualified eHealth.

- | | |
|---|--|
| <ul style="list-style-type: none"> ● Medical frequency band for quality of service ● Low-power consumption in modulations ● Strict security enforcement ● Top-priority data transfer for emergency data ● Ensure secure SAR (Specific Absorption Ratio) level | <ul style="list-style-type: none"> ● IEEE802.15.6 Narrow Band [US,JP,EU, 400MHz, 800MHz, 900MHz, 2.36GHz, 2.4GHz] ● IEEE802.15.4j [US, 2.36GHz] ● IEEE802.15.4n [CN, 200MHz, 400MHz, 600MHz] Coming up soon |
|---|--|

Example: Japan and China worked on common Medical BAN standards



International standards but depends on radio regulations in each country

(1) IEEE802.15.6 (US, EU, Japan, China)

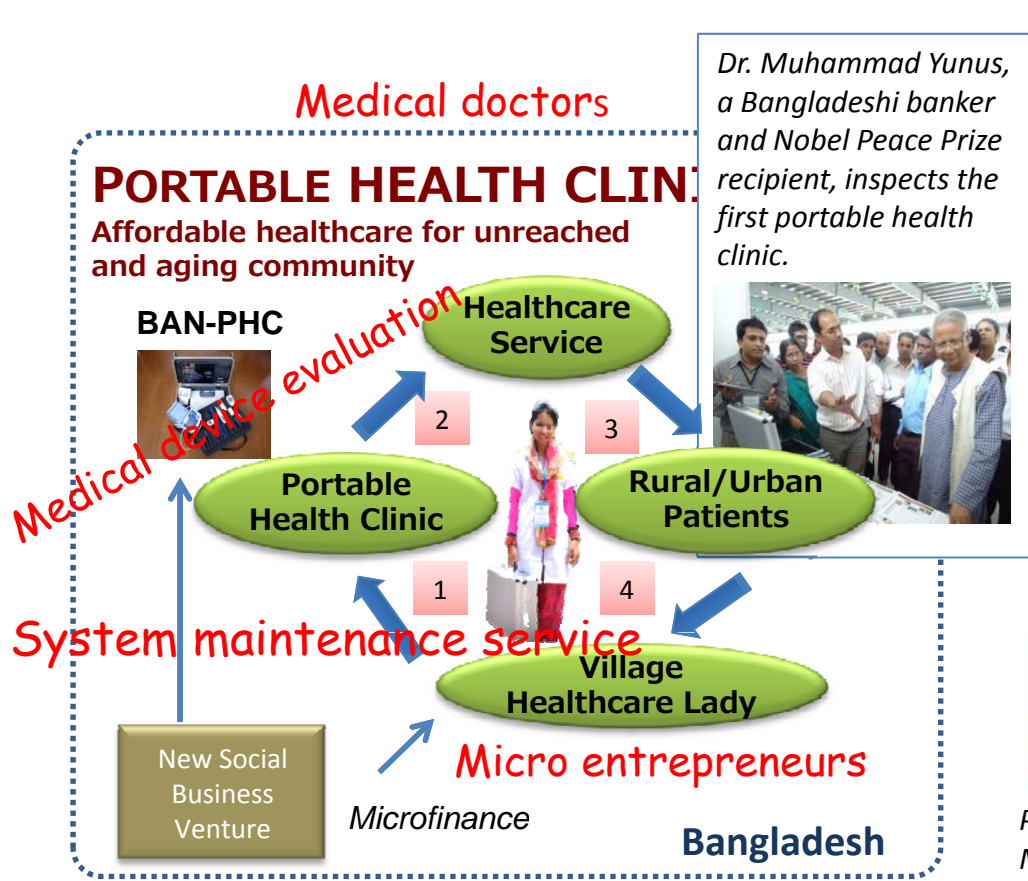
(2) IEEE802.15.4j (US)

(3) IEEE802.15.4n (China)



Japan, China and US worked together on common BAN standards between IEEE802.15.6 and IEEE802.15.4n

Ready for Affordable BAN-PHC business model



Epidemiologic study using Big data

Researchers

Global Social Business Summit 2013
7-9 Nov. in Malaysia
<http://www.gsbs2013.com/home.html>



Prime Minister of Malaysia



PHC supported by 最先端研究開発支援プログラム「超巨大データベース時代に向けた最高速データベースエンジンの開発と当該エンジンを核とする戦略的社会サービスの実証・評価」

BAN-PHC Demonstration

Android terminal + BAN



BAN blood pressure with IHB*



BAN pulse oximeter

BAN blood glucose meter



BAN waist/hip meter



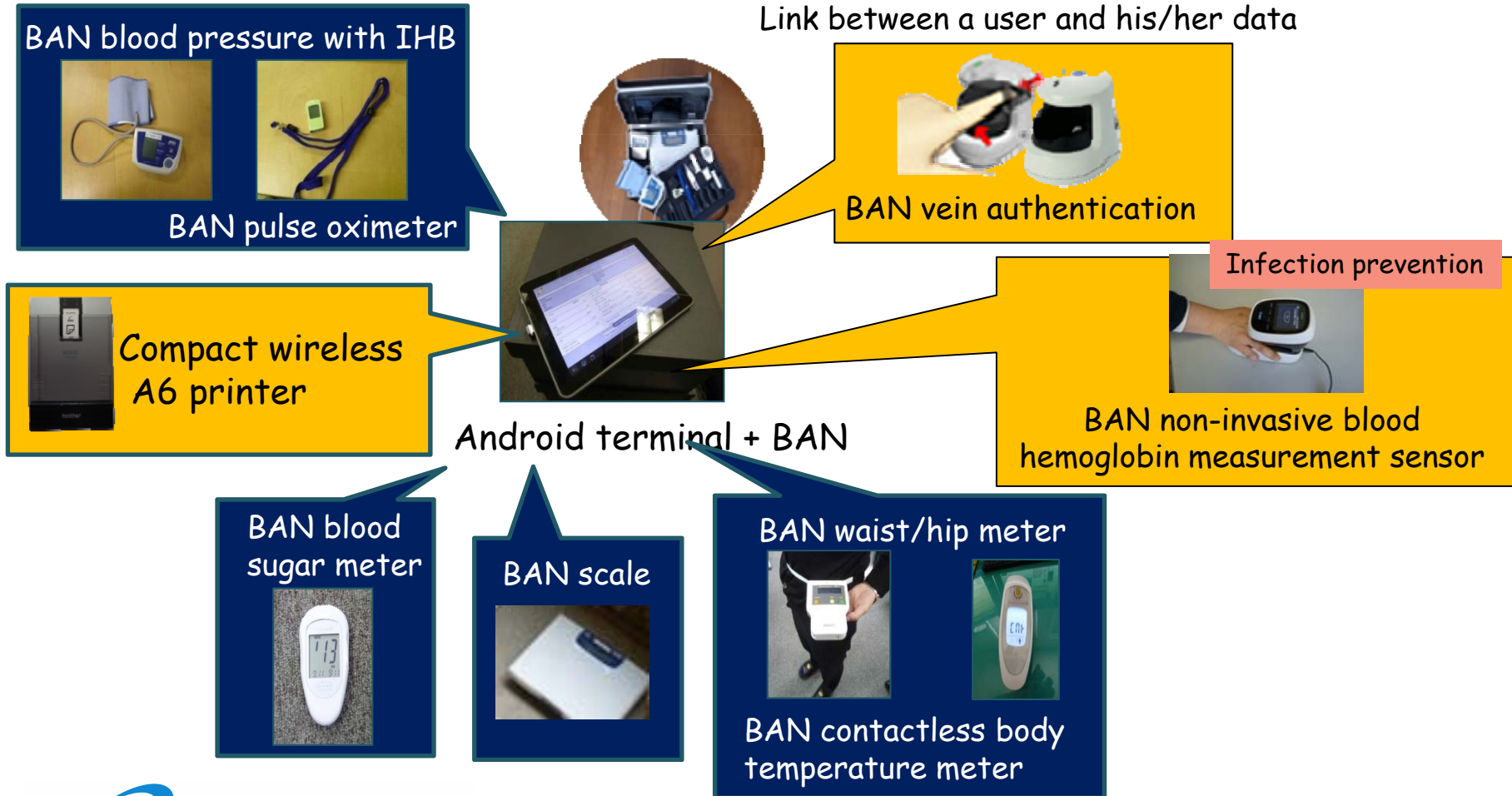
BAN contactless body temperature meter

BAN compact weight meter



Evolving BAN-PHC

Health checkup and telemedicine

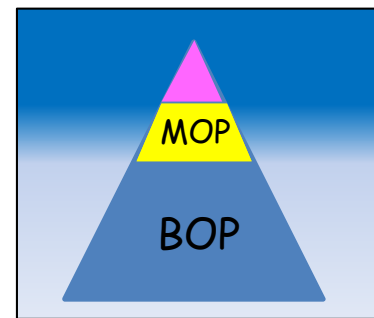


Conclusion

- Start to provide affordable health checks and telemedicine in a suitable case for primary health care to BOP/MOP*
- Ready to provide interfaces to integrate devices for BAN-PHC
- Trigger reverse innovation for affordable and collaborative BAN-PHC business model using open and international standards



To reverse innovation



*BOP: Base of the Pyramid

*MOP: Middle of the Pyramid