# *Neglected* topics in biomedical engineering and the undeniable role of telemedicine today

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- Bioengineering in civil protection and catastrophe help
  - types of emergency situations
  - forecasting catastrophes
  - coordinating and estimation of needs
    - water, food, pharmaceuticals, people, tools, caring
  - logistics and packaging and transport
  - management of the rescue
  - emergency technologies
    - search for people buried under ruins or rubble
    - search for people in the sea, snow, etc.
  - caring for survivors
  - evacuating people from damaged/risky zones
  - planning of encampment
  - copying with infectious diseases
  - logistics and communications in catastrophe areas

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- <u>Types of emergency situations</u>
  - Natural disasters
    - Floods, hurricanes, earthquakes, volcanos
      - Immediate impact on human health
      - Secondary impacts
        - Landslides from floods
        - Fires from earthquakes
        - Flooding from tsunamis
        - Ferries sunk by typhoons
  - Environmental emergencies
    - Technological, industrial accidents
    - Hazardous materials
  - Complex emergencies
    - Break-down of authorities
    - Attacks on strategic installations
    - Conflicts, wars
  - Pandemic emergencies
    - Contagious disease
      - Disrupting services and businesses

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- Disaster prevention (avoid risks)
  - Not all disasters can be prevented (earthquakes, etc.)
  - BUT risk can be mitigated
- Disaster preparedness (pre-disaster activities)
  - Minimize loss of life and damage
    - Remove people and property from a threatened location
    - Facilitating timely and effective rescue, relief
- Disaster relief
  - Reduce de impact
    - Rescue, relocation, providing food and water
    - Preventing disease and disability
    - Repairing vital services (telecommunications, transport)
    - Providing temporary shelters and emergency health care
- Disaster recovery
  - People still vulnerable after emergency care
  - Rebuilding infrastructures, development

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## Slide 1

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- Quantifying needs
  - Water
  - Electricity
  - Tools
  - Gasoline
  - Communication
  - Waste disposal
  - Food
  - Pharmaceuticals
  - People
  - Security
- Local health facilities are weakened
  - Understaffed and overworked in the aftermath of a disaster
  - High demand for personnel and materials
  - Physicians must turn to provide critical care they normally don't give
    - Need for medical equipment and devices very easy to use with very little training

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## Slide 2

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- Quantifying needs
  - Money
    - Donors allocate money on specific cases and types
      - Publicity
    - Funding starts only after a disaster has occurred
    - Preparedness activities not well funded
    - Difficult to use resources efficiently
      - The "ambulances to nowhere" situation

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- Planning of encampment
  - Look for a safe place (depending on the type of disaster)
  - Define clean and dirty zones
  - Dirty zone downhill (wastes and sewage here)
  - Clean zone uphill (storage of food, water and supplies here)
  - Define communication areas (road)
  - Define logistic zones (kitchen, food storage, no people here)
  - Define security plan

- Copying with infectious diseases
  - Care for clean water supply
  - Care for toilettes and sewage
  - Vaccination
  - Continuous health monitoring
    - Respiratory diseases
    - Digestive diseases

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- Role of biomedical engineering and telemedicine
  - Resource limited settings
    - The meaning of Jugaad (an Indian Hindi-Urdu term)
      - The art of getting by
      - L'art de la débrouille
      - L'arte di arrangiarsi
    - Affordable health-care
    - Affordable telemedicine services
    - KISS approach
      - Keep It Stupidly Simple
    - Affordability
      - Not just low cost
      - Low effort
      - Low education
      - Low expertise
      - Low resources
      - Low maintenance
      - Rugged



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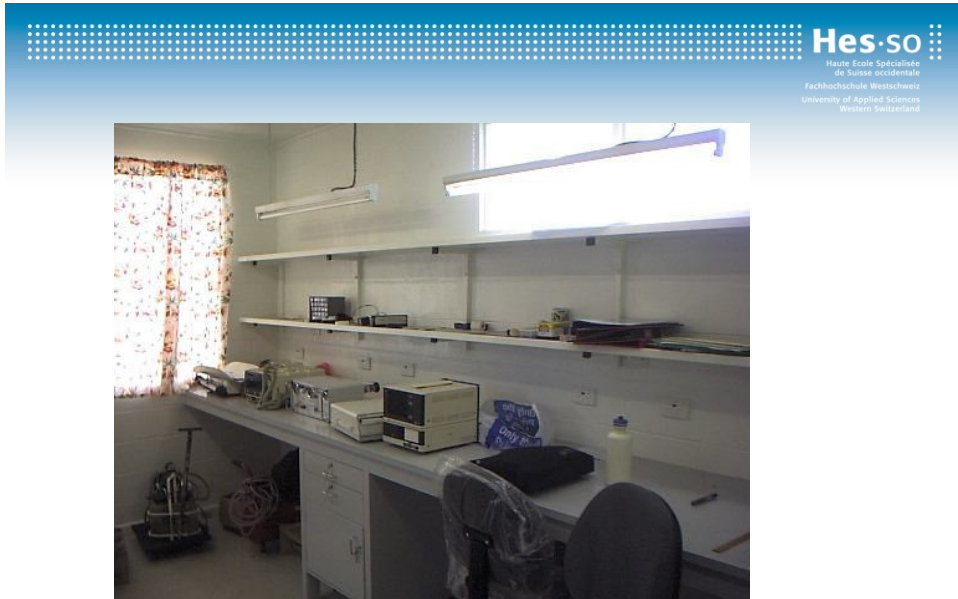IMIT 2014 International Medical Informatics and Telemedicine Conference, Geneva, 13-15 April 2014

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- Role of biomedical engineering and telemedicine
  - Resource limited settings
    - Medical devices must be "military"
      - Rugged
      - Low power
      - Simple to operate
      - Simple to repair
      - Fool-proof
    - Repairing problems
      - Need of spare parts
      - Need of tools
      - Need of documentation
      - Need of competence
      - Need of training

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- Repairing a patient monitor in Samoa islands

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- Nurses learning how to change oil in a suction pump in Papua New Guinea

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- Biomedical engineering workshop at ANGAU Hospital, Lae, New Guinea

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- Biomedical engineering workbenches at ANGAU Hospital, Lae, New Guinea
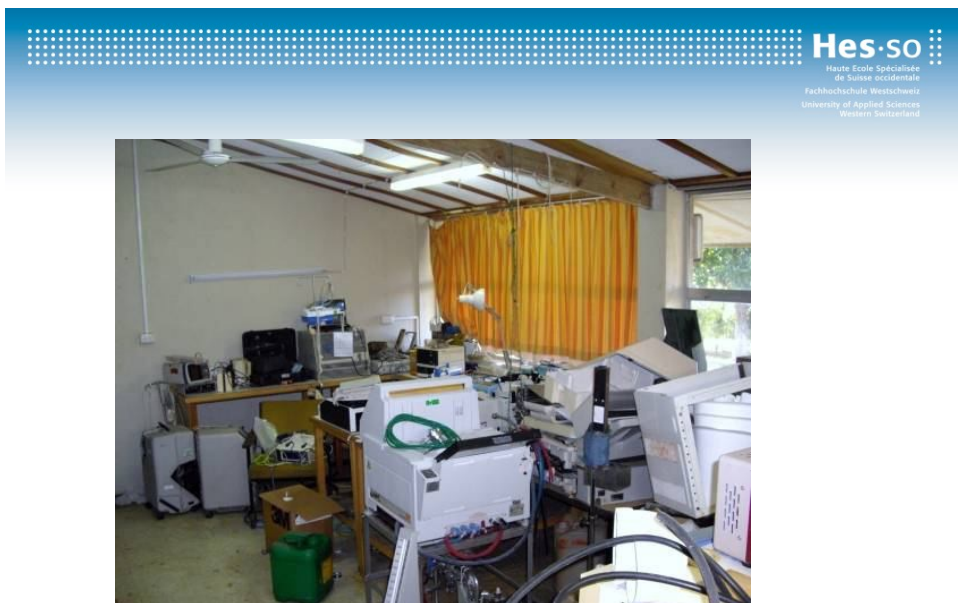
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- Biomedical engineering workshop in Vanuatu

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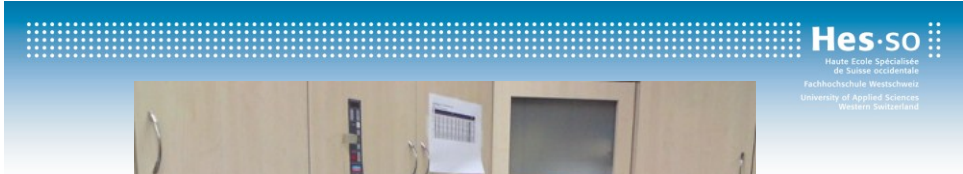
- Biomedical engineering workshop in Kuala Lumpur, Malaysia

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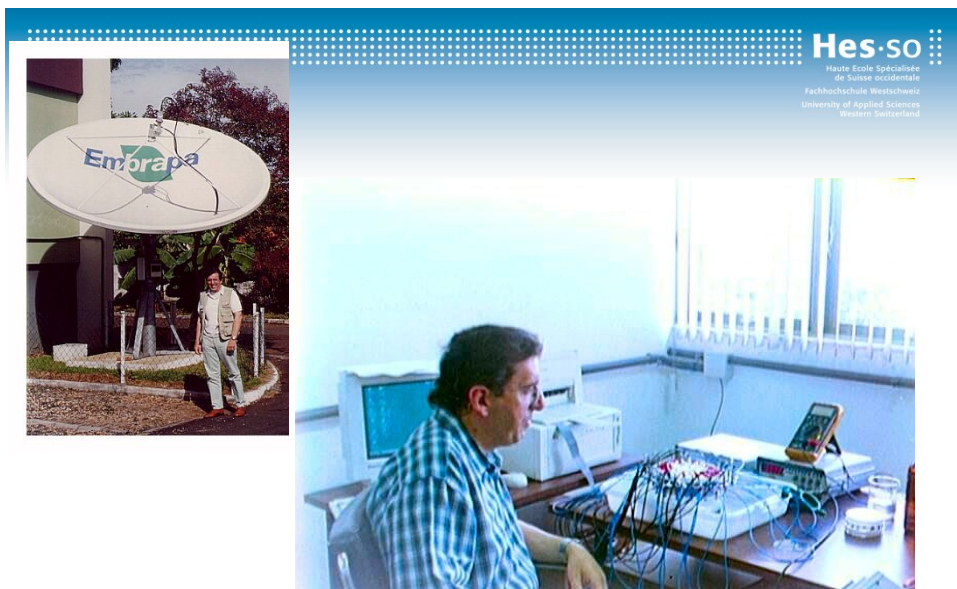- Testing a Marquette patient monitor in the Bekaa Valley, Liban

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- The new sterilizer just arrived in Gaza strip hospital

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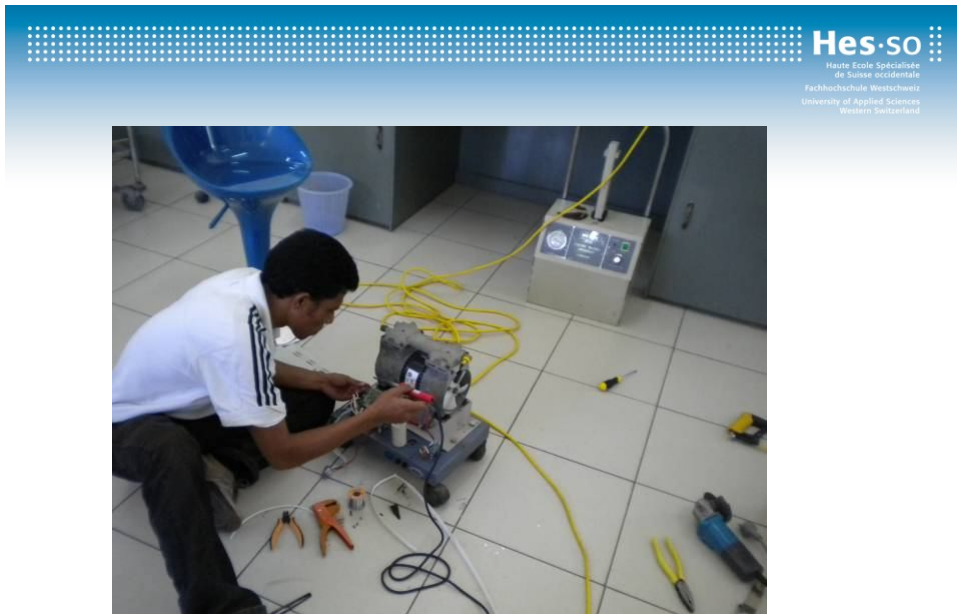
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- An impedance tomography system developed at University of São Paulo, in São Carlos, Brazil

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- A suction pump being maintained in Timor-Leste

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- A wheelchair in Krishnankoil, Tamil Nadu, South India

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- A baby under 200 W bulb to provide warmth in Madhya Pradesh hospital, India (some 20 years ago)

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- The Neonatal Intensive Care Unit (NICU) at West Bengal hospital, India (today)

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- A donated medical lamp unused in Managua hospital, Nicaragua (today)

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- A delivery room in a tribal region of Jharkhand, India (today)

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- A lot of medical equipment destroyed by the tsunami in Onagawa hospital, Miyagi Prefecture, Japan (today)

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- Longyearbyen, Svalbard Island at Spitsbergen, Norwegian sector

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- Barentsburg, Svalbard Island at Spitsbergen, Russian sector

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Thanks for your attention

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