European traceability of victims during Mass Casualty Incidents

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Conflict of interest

Expert (no personal fees) for the 3 years Research Project “TRIAGE” (Grant from the French National Research Agency)

Thanks to Dr Nicolas Poirot and Dr Maud Michaloux for help on bibliography and slides
Background
During a disaster drill at Detroit-Wayne County Metropolitan Airport in September 1978, an attempt was made to evaluate the effectiveness of triage by tracing the routes of “victims” using a system of tracking cards. The cards were placed with the victims during make-up and collected at the receiving treatment facility. The system, despite several problems encountered in its use, provided an accurate method for evaluating the manner in which “victims” were handled during the “rescue” effort. DeMars ML, Buss RM, Cleland LC: Victim-tracking cards in a community disaster drill. Ann Emerg Med 9:207-209, April 1980.
Evaluation of the effectiveness of Triage by tracing the routes of the victims

- Community aspects of disaster planning
  - Involvement of many agencies to provide care to the victims
  - Plans encompassing multiples organizations and agencies

- Key role of initial on scene triage
  - Great number of victims of various severities
  - Many receiving hospitals of various sizes and capabilities

- Goal: transfer of patients to the appropriate hospitals
  - Reducing undertriage and overtriage
  - Avoiding secondary transfers and preventable deaths

DeMars ML, Ann Emerg Med 1980
Implementation of victim transportation information = Tracking / Traceability cards

Would some other informations be useful?

Only 4 informations!

DeMars ML, Ann Emerg Med 1980
Difficulties to complete, use and/or collect the tracking cards during a MCI drill!

### Table
**OUTCOME OF VICTIM-TRACKING CARDS**

<table>
<thead>
<tr>
<th>No. Cards</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cards placed</td>
<td>206</td>
</tr>
<tr>
<td>Cards returned</td>
<td>178</td>
</tr>
<tr>
<td>Cards missing</td>
<td>28</td>
</tr>
<tr>
<td>Lost by “victims”</td>
<td>3</td>
</tr>
<tr>
<td>Cards from “dead-at-the-scene”</td>
<td>25</td>
</tr>
<tr>
<td>Cards usable to assess triage</td>
<td>124</td>
</tr>
<tr>
<td>Eliminations</td>
<td>54</td>
</tr>
<tr>
<td>Triage tag lost from “victim”</td>
<td>4</td>
</tr>
<tr>
<td>Triage category not on tracking card</td>
<td>50</td>
</tr>
<tr>
<td>Cards usable to assess destination</td>
<td>140</td>
</tr>
<tr>
<td>Eliminations</td>
<td>38</td>
</tr>
<tr>
<td>Military personnel</td>
<td>9</td>
</tr>
<tr>
<td>Destination not on tracking card</td>
<td>29</td>
</tr>
</tbody>
</table>

No return of cards for 25 dead patients!

Incomplete informations

50 triage categorizations

38 destinations

Effective triage and allocation of victims to the appropriate hospitals are most of the time pretty well performed from the scene of the MCI. However, the precise number of victims, their conditions, the status of their transport and their hospital destinations are often unknown.
Lessons from World Trade Center Attacks

One of many examples of communication failure with regard to response from different agencies:

Communication problems were a greater hindrance to an effective response concerning triage, patient movement and hospital preparation, than all other factors combined.
12500 adults and 5000 children were registered as missing. The US Senate Homeland Security and Governmental Affairs Committee Report concluded that «responders’ efforts during the crisis were hampered by the lack of data interoperability».
Lessons from fire in a pub in Volendam on New Year’s night 2000/2001 (Netherlands)

14 people deceased and 245 people injured in the fire. It took several hours to get an overview of the number of victims and the severity of their injuries. The registration of patients at the disaster site and in the 19 receiving hospitals was a major problem.
Closed VS Open Mass Casualty Incident

Closed MCI:
- a single event in a specific location, with a limited and known number of victims: airplane crash ...

Open MCI:
- a single or multiple event in one or several places, with an initially unknown number of victims: bomb, terrorist attacks ...

152 passengers, 9 crew members

??? victims
February 2009 Airplane Crash at Amsterdam Schiphol Airport: An Overview of Injuries and Patient Distribution

Ingri L.E. Postma (a1), Jasper Winkelhagen (a2), Frank W. Bloemers (a3), Martin J. Heetveld (a4), Taco S. Bijlsma (a5) and J. Carel Goslings (a1)

Abstract

OBJECTIVE: The objective of this study was to describe the injuries and distribution of casualties resulting from the crash of Turkish Airlines flight TK 1951 near Schiphol Airport in the Netherlands on 25 of February 2009.

METHODS: This was a retrospective, descriptive study. Based on a review of the hospital records for all casualties of the airplane crash, triage at the scene, time to emergency department, Abbreviated Injury Scale (AIS) and Injury Severity Score (ISS), mortality, length of hospital stay and surgical procedures were abstracted.

RESULTS: Of the 135 passengers, nine died on-scene. A total of 126 survivors were examined in 15 hospitals; data for all survivors were available for the study. Median time between crash and arrival at an emergency department was 3.5 hours (range 1.25-5.5 hours). Six passengers were uninjured and 66 were admitted to hospital. A total of 305 injuries were recorded. The majority were head and facial injuries (92), spinal injuries (35), and fractures of extremities (38). Eighteen percent of the patients had a spinal injury. The mean ISS was 6.3 (range = 1-57). The ISS score was >15 for 13 patients. Surgical procedures (80) were necessary in 23 patients. There was no in-hospital mortality.

CONCLUSIONS: Although the accident was in an urban area, there was a significant delay between the time of the accident and the arrival of the casualties at hospital emergency departments. The Turkish Airlines crash provides extensive information for research into mass-casualty or disaster management, triage, plane crash injuries, and survivability. The "Medical Research Turkish Airlines Crash" (MOTAC) study group currently is investigating several of these issues.
4 days to locate 136 victims because of insufficient patient registration, both pre-hospital and in-hospital!
What are the major pitfalls for traceability of victims during Mass Casualty Incidents?
Triage ≠ Traceability ≠ Identification

• **Triage** = affectation for each victim of a priority rank for treatment and transport to the hospital
  -> medical file and tag to each victim

• **Traceability** = follow up of each patient from the site until hospital
  -> affectation of an identification code
  -> data base shared by all services

• **Identification** = name, surname, age and address of the patient
  -> but many unconscious or dead victims without ID card
The major pitfalls for traceability

- **Involvement of multiple organizations and agencies**
  - Pre-hospital and in-hospital own systems

- **Victims spontaneously coming to the hospitals**
  - Not registered before hospital admission

- **Loss of communication**
  - Vocal informations and data transfer

- **Multisite MCI**
  - Coordination between the different sites systems

- **Damage control strategy**
  - Minimum time on scene before hospital transfer

- **System not daily used**
  - Difficulties for personnel not accustomed to the system
Multiple organizations / agencies involved

**Prehospital Field**
- Different paper and computer listings from different organizations and providers
- Difficulties to count and track patients without identity and registration number

**Hospitals and authorities**
- Own registration files not compatible between themselves and with the pre-hospital system
  - *impossibility to integrate SINUS numeric characters in APHP admission computers*
  - *hospital staff not used to pre-hospital wrists and tags and some were trashed on hospital admission*
Spontaneous arrival of casualties to the nearest hospitals close to the MCI

- Including absolute emergencies
- Walking casualties or transported by bystanders
- Stretcher evacuations by ER staff
354 victims hospitalized
  - 302 in public hospitals
  - 52 in military hospitals

20% in 2 nearby hospitals
= patients without any triage and traceability

Loss of communications

- **Physical destruction**
  - AZF factory explosion
    (Toulouse, 2001)

- **Saturation**
  - ANTARES network on Paris Attacks on 13/11/2015
  - Phone network on Brussels attacks on 22/03/2016

- **Security inactivation**
  - Process decided by authorities
    - to stop communication between terrorist groups
    - to prevent bomb explosion triggered by a cellular phone
Mass casualties and multisite terrorist attacks

- **Madrid 2004**
  - 191 dead, 1858 wounded

- **London 2005**
  - 52 dead, 700 wounded

- **Mumbaï 2008**
  - 188 dead, 312 wounded

- **New York 2001**
  - 2973 dead
  - 6291 wounded

And also:
Israël, Egypt, Nigeria, Tunisia …
Paris attacks on Nov 13th, 2015

- 6 different attack sites
- 17 hospital receiving casualties

\[= 102 \text{ possible routes!}\]
Prehospital care has changed since Mumbaï attacks

1) Attacks are simultaneous and multisite
   - Railway station, luxury hotels, restaurants, and even hospital, police station …

2) A high number of victims
   - Several decades to hundreds

3) Assault riffles are commonly used
   - Not only bombs and kamikaze explosions
   -> major penetrating injuries
   => prehospital damage control is mandatory

4) Combats are going on for several hours / days in the city
   - Prehospital care must be performed “under fire” as in battlefield
Prehospital « Damage Control » strategy

Hypothermia

Acidosis  ➔  Coagulopathy

External methods of hemostasis

Prevention of hypothermia

Low volume resuscitation,

Vasopressor ?

Specific transfusion strategy

Tranexamic acid

DC surgery:
• Control hemorrhage
• Control contamination
• Judicious use of abdominal packing

DC surgery:
• Consider early reoperation if bleeding
• Reoperation once physiology restored
• Perform definitive surgery
• Possible abdominal closure or staged closure

Stabilization
Transfusion strategy
High FFP: RBC ratio

Optimization of ventilation
Monitoring of intra-abdominal pressure

Damage control resuscitation = continuum of care

temperature
pH
coagulopathy

Tourtier JP, Ann Fr Anesth Reanim 2013
Front medical chain adapted for Damage Control

- MCI
- Rescuer Triage
- Medical Triage
  - Advanced Medical Post
  - Relative emergencies
  - Absolutes emergencies
Front medical chain adapted for Damage Control

MCI

Rescuer Triage

Relative emergencies

Medical Triage

Absolutes emergencies

Advanced Medical Post

Extreme emergencies

Operating room

Traceability may be time-consuming whereas priority is rapid transfer from the scene to the operating room
The major problem with triage tags appears to arise from the fact that they are a departure from normal procedures. This is against one of the fundamental principles of the medical management of large incidents, the so-called ‘doctrine of daily routine.’ \(^3\)\(^{,15–18}\) In the stress of a large incident people will tend to follow their usual pattern of behaviour, even where disaster plans dictate otherwise. Having to remember the details of application of an unfamiliar system appears to detract from patient care and further confuse an already chaotic situation. Vayer et al. argue that either triage tags should be used regularly in routine operations to maintain familiarity, or another system should be adopted.\(^3\)
Specifications of an ideal traceability system for Mass Casualty Incidents
Global specifications for a traceability system

- Early, unique identification, registration and following of victims during a disaster or MCI.
- Real-time information about the victims (quantity, seriousness of injury), their whereabouts and destination.
- Early management information to the chain of command.
- A stable data communication platform.
- Interoperability and availability to relevant authorities and participants in the response.
- A secure network whatever the location and the MCI.

Marres GM, Prehosp Disaster Med 2013
Identification / registration of the victims

**Prerequisites**

- Simple, low-cost and reliable
- Not removable by the patient himself
- Not interchangeable between children
- Predefined unique identification number
- Bar code for easy registration in the database
- Only one system for all the providers on a MCI scene
Identification / registration of the victims

**Options**

- Resistant to decontamination for CBRN MCI
- Coloured or associated to triage tag for easy visualization of the categorization of each patient
- Wireless such as radiofrequency identification device (RFID)
Identification / registration of the victims

- An example of a wrong naming convention for unidentified patients during Boston Marathon bombings.

A similar difficulty occurred in some hospital in Paris during Paris attacks on Nov 13th, 2015. XX01, XX02, XY01 ...

Medical file / report

Not strictly included in the traceability process

Mandatory informations

- Identification code
- Age, sex
- Vital parameters
- Main injuries
- Treatment
- Categorization
- Decision or hospital destination

Optional informations

- Identity, address, nationality
- Site (code) if multisite MCI
Medical file / report

- Attached to the patient
- Resistant to decontamination for CBRN MCI
- Easily readable and implementable by any care provider on the MCI site
  [ Unreadable for non medical providers (police ...) ]
Real-time counting of all the victims

- Paper and manual counting belong to the past!
- Scanning barcodes is more efficient, but need devices
- WIFI is the best solution, but need special devices and is not 100% reliable...
An early and precise count of the victims and their severity is requested by the authorities for communication with families and relatives who are looking for somebody missing. For communication with the media, a precise number of victims and their categorization is necessary. Human and material resources involved for care and rescue.

High risk of fuzzy and changeable information on the count and severity of the victims:

- Synonymous for families and media of fuzzy and confusion during care and rescue of the victims.
Local communication system

Usable whatever the location and type and MCI

Local network
- Autonomous = working off-line / central server
- Regular implementation as soon as connected to the server
- Local wireless network
  - Need dedicated hotspots
  - Subject to dysfunctions and interferences

Direct implementation from the MCI scene
- Manual through barcodes and computers
- With wireless PDA
On-line transmission to a central server

- On-line implementation of list of patients
-Readable with specific permissions by authorities, EMS, hospital ...

- Secured transmission by multiple and redundant pathways
  - GPRS, 3G, 4G, TETRA, satellite...
  - Internet web sites
  - Internet communications ...

- Degraded solutions have to be anticipated
  - Lists of patients printed on paper and sent by fax
  - Picture of the lists sent by phone messages
  - USB key brought by a courier ...
Direct connection with in-hospital network

- One unique identification code available for both pre-hospital and in-hospital registry
- Direct implementation of in-hospital files with pre-hospital informations
- Enable real time adaptation of hospital capacity to the pre-hospital situation
- Enable information to health authorities
Unidentified patients

- Difficulties for unconscious or dead patients without ID card at the time of pre-hospital care

- Photographies after hospital admission +++
  - Face and global appearance
  - Particular sign enabling recognition by families and relatives = anatomic specificity, scar, tattoo, jewelry ...
Some exemples of Traceability systems
Numerical Standardized Information System “SINUS”

System for an interservices crisis management

First Aid Providers
- Quantification
- Coordination

Authorities
- Listing
- Information
- Investigations
- Coordination

Health
- Follow-up
- Coordination

SAMU de Paris
Numerical Standardized Information System “SINUS”

- Local implementation of the list of victims
  - Pre-hospital registration of victims
  - Pre-numbered wristbands with stickers for paper medical files
  - Barcodes entered into a local computer
  - Transmission to a central server as soon as possible
    -> internet connection or manual transport of an USB key
Numerical Standardized Information System “SINUS”

- Enable an on-line assessment of the count and severity of the victims
- Immediately available on the site of the MCI
- Simultaneous transmission to all involved services
- Exact final assessment as soon as the end of the MCI
Numerical Standardized Information System “SINUS”

- Deployed in Paris and peripheral area since 2009
  - Progressively implemented in many areas in France
- All fire department, EMS and police teams are equipped with pre-numbered wristbands
  - Only fire department or police may initiate a new session
  - No medical informations are shared between services
- Systematically used for ≥ 5 victims on a “MCI”
  - Fire, road accident, collective intoxication, fight …

=> All staffs are accustomed to use the SINUS system +++

=> Easily implemented during Paris and Nice attacks
Triage of victims through injury cards with barcodes
- Data online registration into Personal Data Assistant
- Wireless network with routers on ambulances
- Connection GPRS or TETRA to the central database
- Tested during a drill
Online Victim Tracking and Tracing System (ViTTS) for Major Incident Casualties

Geertruid M.H. Marres, MD; Luc Taal, MD, PhD; Michael Bemelman, MD; Jos Bouman, B-ICT; Luke P.H. Leenen, MD, PhD, FACS

Positive points

- No system failure.
- All patients were entered in the system at the prehospital MCI scene.
- The deployed local network with hotspots, mobile routers and GPRS connection to the central database worked well.
- An overview of patients at the MCI scene and their triage categories was available in real time at the receiving hospital, before the first patients arrived.
- Data were updated reliably and in a timely fashion.
Negative points

On patient admission to the hospital, not all ViTTS files were linked to patients’ in-hospital files.

From the injury cards, only the barcode and the color (triage) codes were used consistently during the exercise.

Due to unfamiliarity with the PDAs, some medical staff encountered problems using them.

In this exercise, additional medical parameter options beyond primary triage (e.g. RTS) of the PDA system were not often used.
Major Incident Hospital constructed in 1991 under the University Medical Centre Utrecht

Dedicated to provide emergency care for multiple casualties under exceptional circumstances

Test of a Patient Barcode Registration System

Only for in-hospital tracking and tracing

Patients wristbands with barcode

Real time monitoring of department capacity for the command team
ORIGINAL RESEARCH
Continuous Development of a Major Incident In-Hospital Victim Tracking and Tracing System, Withstanding the Challenges of Time  
(Disaster Med Public Health Preparedness. 2016;page 1 of 7)

J.J. Mark Haverkort, MD; Jos H. Bouman, BSc; Jelte D.D. Wind; Luke P.H. Leenen, MD, PhD, FACS

Capacity Overview Screen After 118 Patients Have Been Admitted.

Het Calamiteitenhospitaal
Continuous Development of a Major Incident In-Hospital Victim Tracking and Tracing System, Withstanding the Challenges of Time

J.J. Mark Haverkort, MD; Jos H. Bouman, BSc; Jelte D.D. Wind; Luke P.H. Leenen, MD, PhD, FACS

Overview of the Flow of Red Priority-One Patients From First Registration in the Ambulance Receiving Area Until Their Definitive Station.

Note. The y-axis shows each patient’s barcode number.
Conclusions

The key to successful systems for high patient surge situations, such as disasters and major incidents, is simplicity. The choice was made to use barcodes instead of more modern solutions such as radiofrequency identification (RFID) to reduce the risk of system failure during disaster scenarios. Ideally, a victim tracking and tracing system should cover both the pre-hospital setting and the in-hospital patient surge. The next step in the development of the 2014 PBRS will be introducing it into regular emergency care. +++
Failure to implement rapidly a communication response system may result in the public overwhelming hospitals.

National system “ADAM” for supplying information on the in-hospital location and identification of casualties:

- Online interface with hospitals’ patient registration systems.
- Information centres have access to information on which hospital has admitted identified and unidentified casualties.
- Unidentified casualties are photographed at the entrance to the hospital and the picture is stored in ADAM +++.
### Patient’s general details:

<table>
<thead>
<tr>
<th>ID number*</th>
<th>Date</th>
<th>Hour</th>
</tr>
</thead>
</table>

### Identified patients:

<table>
<thead>
<tr>
<th>First name</th>
<th>Surname</th>
<th>Father’s name</th>
<th>Social security (or passport) number</th>
<th>Military personal number</th>
<th>Gender</th>
<th>Date of birth</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Address</th>
<th>Phone number</th>
<th>Cellular number</th>
</tr>
</thead>
</table>

### Unidentified patients:

<table>
<thead>
<tr>
<th>Hair colour</th>
<th>Eye colour</th>
<th>Body build</th>
<th>Special/unique signs</th>
<th>Age group</th>
</tr>
</thead>
</table>

### Details of injury:

<table>
<thead>
<tr>
<th>Severity of Injury</th>
<th>Temporary destination</th>
<th>Hospitalisation ward</th>
</tr>
</thead>
</table>

### Reporting:

<table>
<thead>
<tr>
<th>Notification to family (yes/no)</th>
<th>Comments</th>
<th>Discharge/transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Discharged</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transferred</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Admitting facility</td>
</tr>
</tbody>
</table>
A national system for disseminating information on victims during mass casualty incidents

Disasters · December 2009

Bruria Adini, Kobi Peleg, Robert Cohen and Danny Laor

Figure 2 Structure of ADAM computerised system

Hospital information centres

NMFI

ADAM

City council information centres

Ministry of health

Police forces

Note: the NMFI only receives information from ADAM; it does not provide data to ADAM.
Wireless Internet Information System for Medical Response in Disasters (WIISARD)

- Advanced networking technology
- Electronic triage tags that report victims’ position and record medical information
- Wireless pulse-oximeters that monitor patient vital signs
- Wireless electronic medical record (EMR) for disaster care
- WiFi handheld devices with barcode scanners (front-line)
- Computer tablets with role-tailored software (managers)
Intelligent Triage Tags

- An electronic device to coordinate patient field care.
- ITTs combine the basic functionality of a paper triage tag
  - Communications device = RFID tag
  - usable in chemical-biological and radiation-threat environments
    where spacesuit-like protective gear prevents responders from
    using personal digital assistants or other computer devices
  - water resistant to survive decontamination
  - 2-button interface with menu driven configuration
  - bright flashing LED when the victim’s triage status is changed
Design and evaluation of a wireless electronic health records system for field care in mass casualty settings

L A Lenert, D Kirsh, W G Griswold, C Buono, J Lyon, R Rao, T C Chan

Randomized trial exercise on 100 simulated victims:
- 50 in a paper-based pathway VS 50 with WIISARD process
Design and evaluation of a wireless electronic health records system for field care in mass casualty settings

L A Lenert, D Kirsh, W G Griswold, C Buono, J Lyon, R Rao, T C Chan


**Length & Frequency of Mid-tier Device Disconnect Intervals**

- **n = 33**
- Disconnect Intervals surveyed across five mid-tier devices: {Transport, Treatment, Triage, Medcom, Staging}
- Parameters of data survey as follows:
  - Drill Activity Begin: 09:45:00
  - Drill Activity End: 13:15:00
  - Excluded Inactivity Period: 10:52:00 - 12:04:00
- Total Time Surveyed: ~ 02:18:00
# Design and evaluation of a wireless electronic health records system for field care in mass casualty settings


L A Lenert,¹ D Kirsh,² W G Griswold,³ C Buono,⁴ J Lyon,⁵ R Rao,⁶ T C Chan⁴

## Table 1 Features of existing IT systems for field care and mass-casualty tracking

<table>
<thead>
<tr>
<th>System</th>
<th>Scope</th>
<th>Network</th>
<th>Patient-tracking device</th>
<th>Sensors</th>
<th>Other devices</th>
<th>Transaction model</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTEMIS</td>
<td>Mass casualty tracking and field care</td>
<td>WiFi</td>
<td>Handheld computer</td>
<td>ECG, pulse oximeter</td>
<td></td>
<td>Client push</td>
</tr>
<tr>
<td>Army BMIST-J and MC-4</td>
<td>Field care</td>
<td>Smart tag or desktop sync</td>
<td>Smart dog tag</td>
<td>None</td>
<td>Handheld computer</td>
<td>Synchronization</td>
</tr>
<tr>
<td>Navy Tacmed-cs and Theater Medical</td>
<td>Field care</td>
<td>RFID tag or desktop sync</td>
<td>Passive RFID tag wrist band</td>
<td>None</td>
<td>Handheld computer</td>
<td>Synchronization and client push</td>
</tr>
<tr>
<td>Raytheon</td>
<td>Mass casualty tracking</td>
<td>Cellular or WiFi</td>
<td>Paper triage tags with barcode</td>
<td>None</td>
<td>Cell phone or handheld computer</td>
<td>Client push</td>
</tr>
<tr>
<td>mTriage</td>
<td>Mass casualty tracking</td>
<td>SMS cellular</td>
<td>Passive RFID tag</td>
<td>None</td>
<td>Cell phone with RFID reader/reader</td>
<td>Client push</td>
</tr>
<tr>
<td>EMsystems</td>
<td>Mass casualty tracking</td>
<td>WiFi to cellular or satellite</td>
<td>Paper triage tags with barcode</td>
<td>None</td>
<td>Handheld computer</td>
<td>Client push</td>
</tr>
<tr>
<td>TACIT</td>
<td>Mass casualty tracking</td>
<td>WiFi with cellular or satellite</td>
<td>None</td>
<td>None</td>
<td>Handheld computer</td>
<td>Client push</td>
</tr>
<tr>
<td>iRevive</td>
<td>Field care</td>
<td>Zigbee to WiFi to cellular or satellite</td>
<td>Mote RFID device</td>
<td>Pulse oximeter, blood pressure, and ECG</td>
<td>Handheld computer</td>
<td>Client push</td>
</tr>
<tr>
<td>AID-N</td>
<td>Field care and mass casualty tracking</td>
<td>Zigbee to WiFi to cellular or satellite</td>
<td>Mote RFID device</td>
<td>Pulse oximeter, blood pressure, and ECG</td>
<td>Handheld computer</td>
<td>Client push</td>
</tr>
<tr>
<td>WIISARD</td>
<td>Field care and mass casualty tracking</td>
<td>WiFi to WiFi mesh network to cellular or satellite</td>
<td>WiFi RFID devices and paper triage tags with barcode</td>
<td>Pulse oximeter</td>
<td>Handheld computer, tablet computer</td>
<td>Publish and subscribe with synchronization</td>
</tr>
</tbody>
</table>
Traceability, Identification, Recognition and Management of Mass-Casualty Victims: “TRIAGE”

- System using RFID tag and electronic devices
  - dematerialized record
  - multiple informations
  - categorization
  - tracking of patients
  - cartography of patients
  - cartography of care providers and resources
“TRIAGE”

- **RFID tags**
  - for victims
  - for care providers

- **Electronic device**
  - for care providers
  - experiments with dedicated PDA
  - future: permanent application on personal smartphone ???

- **On-line geolocalization**
  - for victims
  - for care providers
Data acquisition and update

- Identification
- Medical data
- Biometric data
  - fingerprints
  - face
- visual and speech acquisition
Categorization
- Online down- / upgradable

Other mandatory informations
- Vital parameters
- Injuries
- Organization of hospital transfert
Wireless communication

Transmission of selected information to all involved services
- medical data only to care providers and physicians
- fingerprints and face identification only to police
Facilitate adaptation of the prehospital response

- Geolocalization and traceability of victims
- Geolocalization of the different providers

=> on-line ratios of providers / victims for each site
“TRIAGE”

Exact final assessment of the number of victims as soon as the end of the mass casualty incident

-> major end of point for authorities -> medias
Conclusion

- Considerations for the future development of victim tracking and tracing systems should be:
  - Simplicity is key in the design of disaster medicine systems.
  - Patient track-and-trace systems need ongoing development.
  - Links between the track-and-trace system and the hospital information system should be a high priority.
  - Track-and-trace systems should not rely on external systems during disaster situations.
  - Generic, easily replaceable hardware should be used.
  - The system must be used daily to be used on a MCI.