



Patient distribution in a mass casualty event of an airplane crash



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ABSTRACT

Introduction: Difficulties have been reported in the patient distribution during Mass Casualty Incidents. In this study we analysed the regional patient distribution protocol (PDP) and the actual patient distribution after the 2009 Turkish Airlines crash near Amsterdam.

Methods: Analysis of the patient distribution of 126 surviving casualties of the crash by collecting data on medical treatment capacity, number of patients received per hospital, triage classification, Injury Severity Score (ISS), secondary transfers, distance from the crash site, and the critical mortality rate.

Results: The PDP holds ambiguous definitions of medical treatment capacity and was not followed. There were 14 receiving hospitals (distance from crash: 5.8–53.5 km); four hospitals received 133–213% of their treatment capacity, and 5 hospitals received 1 patient. Three hospitals within 20 km of the crash did not receive any casualties. Level I trauma centres received 89% of the ‘critical’ casualties and 92% of the casualties with ISS ≥ 16 . Only 3 casualties were secondarily transferred, and no casualties died in, or on the way to hospital (critical mortality rate = 0%).

Conclusion: Patient distribution worked out well after the crash as secondary transfers were low and critical mortality rate was zero. However, the regional PDP was not followed in this MCI and casualties were unevenly distributed among hospitals. The PDP is indistinctive, and should be updated in cooperation between Emergency Services, surrounding hospitals, and Schiphol International Airport as a high risk area.

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Introduction

On February the 25th 2009 flight TK1951 from Turkish Airlines crashed nearby Schiphol Airport Amsterdam, the Netherlands. One hundred and thirty five occupants were aboard, 126 survived the crash. In dealing with a large amount of casualties with a high energy trauma mechanism, management of patient distribution was a challenge.

Abbreviations: ESC, Emergency Services Centre; ISS, Injury Severity Score; MCI, Mass Casualty Incident(s); PDP, Patient Distribution Plan(s).

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Preparation for disasters and Mass Casualty Incidents (MCIs) is a difficult but important task. Numerous casualties must be triaged, transported and treated at the appropriate hospital without overwhelming any of the hospitals. Disaster protocols are developed to offer guidance in executing these tasks. The literature reports different kinds of problems in patient distribution during MCIs, and more important, the same errors seem to be repeated in following disasters or MCIs.^{1–6} To prepare for MCIs it is important to evaluate and report the outcomes of previous MCIs. In this study we evaluated the patient distribution after the MCI of the Turkish Airlines crash on February 25th 2009, near Amsterdam.

This paper describes the analysis of the following research questions:

1. How is medical response to Mass Casualty Incidents (MCIs) and patient distribution organised in the Netherlands, with special attention to high risk areas such as Schiphol International Airport?
2. How was the patient distribution executed in this MCI and was it carried out according to the regional patient distribution protocol (PDP)?

Methods

We collected the national and regional MCI plans and protocols that were applicable to the airplane crash, in order to analyse the general MCI response plans and specifically the regional patient distribution protocol (PDP).^{7–11} Since the crash some protocols have already been in revision. In this analysis we studied the situation as it was at the time of the crash.

For the second question we analysed the events on the day of the crash, by studying evaluation reports of the Dutch Safety Board and the evaluation report of the Public Order and Safety Inspectorate in cooperation with the Health Inspectorate.^{12–14} We analysed the medical charts of ambulances and hospitals of all casualties of the crash. We specifically looked at the number of casualties the hospitals received, whether these hospitals had activated their hospital disaster plan and the distance from the crash site to the receiving hospital. The latter was calculated with the route planner of the Royal Dutch Touring Club (Dutch acronym ANWB).¹⁵

Additionally we collected the triage classification (P1, P2, P3) of the casualties and their Injury Severity Score (ISS).^{16–18} To evaluate the patient distribution outcome, we looked at the secondary transfers and critical mortality rate.^{1–2} The critical mortality rate expresses the quality of triage and patient distribution as a ratio between critically injured casualties and in-hospital (or on-transport) mortality. This is based on the fact that critically injured casualties benefit the most of rapid transport to an appropriate facility. We compared the data of the patient distribution after the crash to the regional PDP.

Results

The Netherlands (16.7 million inhabitants, 41,526 square km) is divided in 25 Safety Regions. The safety regions have their own Emergency Services Centre (ESC), with in total 215 ambulance stations for in almost 700 ambulances.¹⁹ Each safety Region is responsible for their regional disaster protocol, which should be in accordance with the national disaster protocols. Different high risk areas, involving different kinds of risks (e.g. North Sea Channel, chemical industry areas), all have their own protocols. Some involve several safety regions for one overlapping high risk area. When an incident involves an airplane crash at Schiphol Airport Amsterdam the Aircraft Accident Schiphol (Dutch acronym VOS) protocol is used. The medical response of this system is presented in Table 1. Each safety region has its own Emergency Services Centre (ESC), receiving calls for emergency assistance and coordinating the dispatches of these emergency responders (police, fire department, and ambulance services).

In the Netherlands hospitals are equipped according to Level I, II or III standards. Level I hospitals have full trauma care facilities. When a Mass Casualty Incident (MCI) occurs, a number of hospitals can be put on alert by the Emergency Services Centre (ESC) (Table 1) or can be requested to activate their hospital disaster plan (Dutch acronym: ZiROP). When the hospital disaster plan is

activated extra capacity is created to receive and treat casualties. The Netherlands also has a Major Incident Hospital situated at the Military Hospital in Utrecht, with a liaison with the University Medical Centre Utrecht. Within 30 min they are ready to receive 100 patients. If needed, in 1 h this facility is able to upscale to 250–300 patients.²⁰

In case of a Mass Casualty Incident (MCI), casualties are triaged at the scene following the critical/immediate (P1), serious/urgent (P2), minor/delayed (P3) triage classification according to the Triage Sieve and Sort system used by the MIMMS (Major Incident Medical Management and Support).¹⁶ Then the casualties are transported to hospital according to urgency. The distribution of the casualties among different hospitals is executed according to the regional patient distribution protocol (PDP) of the safety region involved.

Since 2008 Schiphol Airport falls under the responsibility of safety region Kennemerland. Geographically though, Schiphol lies on the border of 2 safety regions. The regional PDP was last updated in 2008. When the number of casualties is high and exceeds the coordinating capacity of ambulance personnel and centralists, a special patient distribution coordinator is sent to the scene.^{9,11,21}

In the existing patient distribution protocol (PDP), the general medical treatment capacity per hospital is defined as one critically or seriously injured patient (P1 or P2) per emergency team per hospital in the first hour. In the second hour an extra 2 P1 or P2 patients can be received per emergency team in Level I or II trauma centres. The PDP does not describe the number of emergency teams per hospital.⁹

The PDP mentions that, according to government requirements, in case of a Mass Casualty Incident (MCI), hospitals should be able to clear 3% of their total bed capacity. However, the PDP also states that in daily practice hospitals only agreed upon clearing only 1%, because 3% appeared to be not reasonably possible. We consider this 3% medical treatment capacity as the maximum number of casualties able to be presented at the emergency department. In the regional PDP of safety region Kennemerland, there is information about 30 hospitals with a (presumed) total bed capacity of 14,398 beds. These total bed capacity numbers, however, are actually outdated because of the mergers of several hospitals and the increase in outpatient treatments. In the PDP medical treatment capacity numbers are mentioned based on 1% and on 3% of total bed capacity. The receiving hospitals and their medical treatment capacity are in Table 2.

The distribution of casualties is further decided upon by the triage classification of the casualties and the proximity of the hospitals. The PDP has the rationale that, in MCIs in the primary distribution phase, no consideration is given to injury type or severity (e.g. burn injuries). Only in the secondary, definitive, distribution phase some patients may be transferred to specialised centres if necessary.

After the Turkish Airlines Crash the first reports of the accident came into the Emergency Services Centre (ESC) one minute after the crash at 10:27 a.m.^{12,14} Eighty two ambulances from different

Table 1
Airplane accident Schiphol (AAS).

Scale	Type of incident	Medical response
AAS 1	Pan-pan call	2 Ambulances 1 Medical Officer
AAS 2–4	Mayday call	5–14 Ambulances; 1 Medical combination team ^a ; 1–2 Medical officers; 1–6 Hospitals
AAS 5	Crash < 50 occupants	25 Ambulances; 1 Medical combination team ^a ; 2 Medical officers; 7–13 Hospitals
AAS 6	Crash 50–250 occupants	64 Ambulances; 5 Medical combination teams ^a ; 4 Medical officers; 7–13 Hospitals
AAS 7	Crash > 250 occupants	126 Ambulances; 10 Medical Combination teams ^a ; 7 Medical officers; 13–22 Hospitals

^a Medical Combination Team: 1 trauma team (doctor + nurse), 2 ambulance teams, 1 Rapid Response Team for Medical Assistance, (Dutch acronym, SIGMA team).

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