

## ORIGINAL ARTICLES

## Delphi study into planning for care of children in major incidents

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### Abstract

**This paper describes a Delphi study used to identify and improve areas of concern in the planning of care for children in major incidents. The Delphi was conducted over three rounds and used a multidisciplinary panel of 22 experts. Experts were selected to include major incident, immediate care, emergency medicine, and paediatric specialists. This paper presents a series of consensus statements that represent the Delphi group's opinion on the management of children in major incidents. The statements cover all phases of major incident planning and response. Paediatric services may play a vital role in the preparation and response to a major incident involving children. This paper represents a consensus view on how best to plan and respond to major incidents involving children. An accompanying paper describes the practical implementation of this guidance.**

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### Major incidents—a definition:

*“An event that owing to the number, severity, type or location of live casualties requires special arrangements by the health services.”*<sup>31</sup>

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Table 1 Major incidents known to have involved large numbers of children

Major incident	Year	All casualties (n)	Child casualties (n)
Martinez coach crash (USA) <sup>3</sup>	1975	51	50
Mass lightning strike (USA) <sup>4</sup>	1977	47	47
Bologna bombing (Italy) <sup>5</sup>	1980	291	27
M5 coach crash (UK) <sup>6</sup>	1983	31	27
Chemical gas leak, Arizona (USA) <sup>7</sup>	1987	>67	67
Enniskillin bombing (NI) <sup>8</sup>	1987	65	6
Three rivers regatta accident (USA) <sup>9</sup>	1990	24	16
Newton train crash (UK)*	1991	26	7
Dimmocks Cote train crash (UK)*	1992	45	12
Avianca plane disaster (USA) <sup>10</sup>	1993	92	22
York coach crash (UK) <sup>11</sup>	1994	41	40
West St bus crash, Glasgow (UK) <sup>12</sup>	1994	33	33
Abbeyhill junction train crash (UK)*	1994	47	10
Oklahoma bombing (USA) <sup>13</sup>	1995	759	61
Warrington coach crash (UK)†	1996	51	50
Manchester bombing (UK) <sup>14</sup>	1996	217	30
Dunblane mass shooting (UK) <sup>15</sup>	1996	30	28

The incidents listed are those for which casualty numbers are available. Many other incidents have involved children but the exact numbers are unknown (for example, Zeebrugge ferry disaster<sup>16</sup> and the Hillsborough stadium disaster<sup>17</sup>).

\*Personal communication, Health and Safety Executive, 1996.

†Personal communication, Merseyside Ambulance Service, 1996.

NI, Northern Ireland.

If casualties in major incidents are to receive the best possible care then quality planning and preparation is essential.<sup>1</sup> The prospect of dealing with a major incident that results in large numbers of injured children is daunting. Nevertheless, such incidents do occur both in the UK and abroad (table 1). Although major incidents can arise from a variety of causes,<sup>2</sup> children may be prominent in many types of major incident (table 1).<sup>3-17</sup> Those providing paediatric services may feel that major incident planning is an area in which they have a small role to play. In fact, they can play a vital role in the preparation and response to a major incident involving children.<sup>18</sup>

Difficulties in the management of children during a major incident have been documented at all stages of the incident response. In the prehospital phase, problems have been identified in determining triage and transport priorities.<sup>9 10</sup> In the hospital reception phase, difficulties have arisen in mobilising staff experienced in managing children, and in obtaining adequate amounts of paediatric equipment.<sup>11</sup> In the surgical phase of a major incident, concern has been expressed at the standard and choice of surgical procedures performed by non-paediatric surgeons.<sup>6</sup> The common theme is not that planning for children failed, but rather that planning for children did not exist.

Major incident planning should follow an “all hazards approach”<sup>11 19</sup> that is designed to deal with all types of major incident. Certain types of incident require additional arrangements if optimal patient care is to be achieved.<sup>19</sup> Incidents resulting in chemical,<sup>20</sup> burn,<sup>21</sup> or radiation<sup>22</sup> casualties require additional arrangements, primarily because the resources to deal with these types of patients are scarce and often located in regional centres, at least in the UK. An incident resulting in only a few such casualties may result in the declaration or even decompensation<sup>23</sup> of a major incident.

Few UK hospitals are staffed or equipped to deal with more than a few seriously injured children, with well documented shortages of paediatric surgical<sup>24</sup> and intensive care unit beds.<sup>25</sup> Specialist services for children are geographically scattered and some are confined to specialist hospitals not always co-located with emergency departments.<sup>26</sup> This distribution

Table 2 Example of Delphi statement in round 3

(13) The regional emergency planning officers (REPO) should ensure that provision is made for the care of children in major incidents	1	2	3	4	5	6	7	8	9
Likert scale*									
Results from round 2 (your previous answer in bold)	0	0	0	<b>1</b>	0	5	8	2	7

\*A Likert scale is a simple numerical scale that allows a subjective view (that is, level of agreement in this study) to be converted into a numerical value. Conversion to a numerical value allows the results to be analysed statistically.

might make it difficult to provide specialist care during a major incident.

The need for paediatric major incident planning is recognised in many countries,<sup>27-29</sup> but few centres in the UK recognise it as a priority.<sup>30</sup> Recent analysis of hospital major incident plans has shown that fewer than one third of hospitals plan for the care of children in major incidents,<sup>19</sup> and that prehospital teams rarely contain staff trained in paediatrics.<sup>31</sup>

We conducted a three part Delphi study with the aim of identifying and improving areas of concern in planning for major incidents involving children.

### Methods

A three round Delphi was conducted between February 1996 and October 1996 using a panel of 22 experts from specialties involved in the management of children in major incidents (appendix 1).

Expertise was ascribed using two criteria: first, evidence of research activity in major incidents or paediatric/prehospital emergency care; second, if individuals held positions of authority and influence within the sphere of major incident planning.<sup>32</sup> This was to ensure that decisions were made by persons in senior posts, so that subsequent implementation and

recommendations would be eased.<sup>32</sup> There was considerable overlap between these two groups. A list of the members of the Delphi group is given at the end of the paper. Twenty eight individuals were approached, of whom 22 agreed to participate and completed the second round; 18 individuals completed all rounds.

The first round of the Delphi asked group members to consider broadly the problems of dealing with children in major incidents. Their replies were collated into a series of statements that were checked for clarity by an independent person.

Round 2 comprised 161 statements. Group members were required to express their level of agreement with each statement using a Likert scale.<sup>33</sup>

The third and final round of the Delphi presented the same statements together with a summary of the rest of the group's findings (table 2).

In the third round group members could change their opinions after considering the opinions of the rest of the group.

Consensus was defined as: (1) all members of the group agreeing with the statement; (2) all but one member of the group agreeing with the statement; or (3) two members scoring 4 with the rest of the group in agreement (for a positive statement). Statements that achieved consensus in the second round were not reiterated in round 3.

Eight of 161 (5%) statements in round 2 were left unanswered by more than half of the group because of ambiguous terminology. These statements were rewritten and submitted without feedback in round 3. Fourteen additional statements were constructed for

Table 3 Statements reaching consensus on major incident preparation

Preparation
(1) It is important to consider the special needs of children involved in a major incident
(2) Paediatric services will be relatively more stressed by an incident involving children than adult services in a similar size or type of incident
(3) Planning for children should be coordinated at a regional level
(4) Planning may be aided by estimating the capacity of local hospitals to receive minor and seriously injured paediatric casualties
(5) A mechanism for disseminating information on major incidents is required
(6) Where possible, children should be cared for in paediatric facilities
(7) Planning should be coordinated by a clinician experienced in the management of trauma in children
(8) Plans for children should be an integral part of all plans
Equipment
(1) The provision of paediatric equipment is an important part of emergency planning
(2) Approximately 10-15% of major incident equipment should be suitable for use in children
(3) Equipment should be available and appropriate for use in children
(4) Equipment checklists may aid emergency planners in preparing for the prehospital and hospital response
(5) Equipment supply to hospitals from suppliers is increasingly on a "just in time" basis, this may result in difficulties in obtaining equipment re-supply in major incidents
(6) Some areas designate a single adult department as the main receiving hospital for major incidents, such hospitals must be adequately equipped to deal with children in these circumstances
Training
(1) Individual preparation for major incidents should include training in the management of injured children and adults
(2) Staff likely to be part of mobile medical teams should be encouraged to train in adult and child resuscitation and major incident management
(3) Individuals required to take on key roles in a major incident response should receive training in major incident management
(4) Major incident planners should use exercises to test the management of paediatric casualties in their area
(5) When testing major incident plans, children should be played by children aged 7-14. Adequate provision must be made for their care and safety
(6) For training to be effective, key personnel must be made aware of their major incident roles

Table 4 Statements reaching consensus on major incident management

(1) In the prehospital phase of a major incident children should follow the same routes and be treated in the same areas as adults
(2) Problems may arise when parents/relatives are present at the scene. The decision as to whether or not to allow parents to remain with children at the scene is dependent on local circumstances. This decision should be made by the senior medical and ambulance officers at the scene
(3) Difficulties may arise in the command of the scene when both children and adults are involved in a major incident

Table 5 Statements reaching consensus on major incident support

**Triage**

- (1) The use of many adult methods of triage will over triage children
- (2) A modification to adult scoring systems is preferable to an entirely different score
- (3) There are only a few parameters suitable for use in the major incident triage of children
- (4) Over triage of children may compromise the care given to adult patients by directing slightly injured children to high priority care areas
- (5) In incidents involving small numbers of children, the relative over triage of children by many adult trauma scores is beneficial
- (6) When a large number of children need to be triaged the Eichelberger modification to the triage revised trauma score<sup>34</sup> appears to be the best method available at present<sup>35</sup>
- (7) There is a necessity for a common triage methodology to be used between all prehospital care services

**Treatment**

- (1) Children should be assessed and resuscitated by teams with the skills and experience necessary for the treatment of trauma in children
- (2) Surgery in children should be performed by surgeons familiar with the management of trauma in children
- (3) Appropriately stocked resuscitation areas for children should be available for children although there is no need for these areas to be entirely separate from adult resuscitation areas

**Transport**

- (1) Where well equipped paediatric emergency departments exist with full back up facilities it maybe advisable to transport injured children directly to these facilities as long as prehospital transport times would not be unduly prolonged
- (2) Paediatric major incidents are likely to result in the need for secondary transfers from receiving hospitals to tertiary facilities
- (3) Transfers should be conducted by staff proficient in the care of ill or injured children

Table 6 Statements reaching consensus on specialist paediatric services

- (1) Paediatric hospitals and tertiary services represent a potentially valuable resource in a paediatric major incident
- (2) Paediatric departments may be able to assist receiving hospitals in the initial phase of a response by supplying paediatric anaesthetic experience, paediatricians, and paediatric nursing advisors to form paediatric resuscitation teams
- (3) In the hours after a major incident there is a role for a paediatric assessment team (PAT) comprising staff with intensive care, surgical, and nursing experience. This team can advise on specific management and conduct secondary triage for transfer to tertiary paediatric facilities
- (4) The type of support that will be required after a paediatric major incident will vary with local circumstances and individual hospitals. Planners should consider these issues and, if necessary, make arrangements for support from paediatric hospitals or tertiary services

Table 7 Statements reaching consensus on major incident recovery and support

- (1) Support to children and their relatives should start soon after a major incident response. Initially, this will be achieved through hospital staff
- (2) Outside agencies and mental health services should be capable of providing continuing support and help to victims. This process should begin in hospital
- (3) Staff may become victims of emotional disturbance after a major incident. Provision should be made for the support of staff
- (4) A crèche is a useful adjunct to a major incident response and may provide facilities for the children of both staff and victims

round 3. These statements were prompted by group members identifying new areas of concern when reading round 2.

**STATISTICAL ANALYSIS**

Data were analysed using SPSS for Windows version statistical package to calculate mean scores and range.

**Results**

We present our results as a series of consensus statements. These are summaries of the main points of consensus from rounds 2 and 3 of the Delphi study. These summaries are based on the original set of over 200 statements, which are available elsewhere (Carley SD, MPhil Thesis, Manchester University, 1997).

Tables 3–7 show the results for the three phases of major incident response,<sup>19</sup> that is: preparation (table 3), management (table 4), and support (tables 5, 6, and 7).

**Discussion**

Conducting research into major incidents is difficult because the events are unpredictable.

**Key messages**

- Children may be involved in all types of major incidents
- Few UK hospitals plan for the needs of children involved in a major incident
- Major incident planners must ensure that all acute hospitals have plans to manage a major incident involving children

Clinical experimentation is impossible so, traditionally, practice has been based upon a small number of case reports and expert opinion. The opinions of single authors are highly susceptible to bias. This is particularly so with regard to major incident planning because we believe a multidisciplinary approach is necessary. Committees and expert working groups are also susceptible to bias through confounding by interpersonal relationships.<sup>36</sup> We used the Delphi method in an attempt to reduce bias.<sup>37</sup>

The process produced a series of statements on which a panel of experts has achieved consensus. These cover prehospital and hospital phases of planning and response to a major incident involving children. It became clear that the difficulties of managing children should be considered when planning for major incidents, so that both clinical expertise and equipment resources will be available. This may require cooperative planning arrangements between hospitals.<sup>2</sup> Such arrangements must be made in advance of a major incident because they are difficult to coordinate successfully when an incident is in progress.

Many of the consensus statements extrapolate on the principles relevant to adult major incident planning<sup>19</sup> (for example, the provision of suitable equipment). However, the provision of specialist services proved a particular consideration. Tertiary services (in particular intensive care and surgery) may be at a premium during a major incident. It would be impractical to transfer all children to specialist centres for assessment and treatment because this would merely result in transferring a major incident from one hospital to another. Clearly, a form of triage is required to identify those children most likely to benefit from tertiary services. The use of a paediatric assessment team (PAT) has been proposed as a solution to this problem. This concept is not new, having been proposed for chemical, burns, and radiation incidents.<sup>19</sup> These specialist PATs only form during the response to a major incident. However, they are similar to paediatric intensive care retrieval teams, consisting of senior, skilled staff experienced in travelling to and working in other hospitals. It is quite likely that the services of an intensive care retrieval team would be required in a major incident involving children, and we suggest that this role be formalised with the addition of a paediatric surgical opinion. Membership will depend upon local resources but should be made explicit in local and regional major incident plans.

So far as we know, this is the first time that a systematic approach to expert opinion has been

taken in this field of research. However, our findings must be interpreted with some caution for the following reasons.

First, the definition of expertise is subjective and relies upon the leading researcher and advisors knowing who are the potential experts in the field. We attempted to seek representation from all specialities with an interest in major incident planning for children, based upon our own knowledge, and recognise this as a source of bias. Second, the Delphi method only explores those areas of concern raised by members of the group, so important areas of planning might have been overlooked. Third, although the group appears to have achieved consensus on many statements this does not necessarily mean agreement. Delphi group members who are tired or bored with the process might shift towards consensus to stop the process.

This Delphi study did not produce a succinct set of guidelines for use by emergency planners. Our accompanying paper illustrates how the principles outlined in this paper can be translated into practice.

### Appendix 1: The Delphi process

Delphi is a structured process that uses a panel of experts to investigate a complex or imprecise issue using a series of structured statements. It was originally designed for use by futurologists at the RAND Corporation during the 1960s. It has since been used in many other areas, most recently in the health care sciences. The process occurs in three stages:

Stage 1. A panel of experts formulate a series of ideas pertaining to the subject in question. This is done individually and anonymously

Stage 2. The statements from stage 1 are collated and sent to all members of the expert group. They indicate their level of agreement with each statement using a Likert scale (table 2)

Stage 3. Each statement is fed back to the panel with their own and the rest of the panel's previous opinions. All feedback is anonymous. Numerous iterations may be necessary

#### SPECIALTIES REPRESENTED IN THE DELPHI GROUP

Hospital paediatrics  
Paediatric emergency medicine  
The Ambulance Service  
The Department of Health (emergency planning)  
Immediate (prehospital) care doctors and nurses  
Paediatric anaesthetics  
Emergency nursing  
Disaster planning  
Accident and emergency

#### Delphi group members

David Larkin (Ambulance Service Association), Alan Parker (Ambulance Service Association), Andrew Marsden (Scottish Ambulance Service), Chris Carney (Staffordshire Ambulance Service), Duncan MacPherson (Department of Health), David Ward (Regional Emergency Planning Advisor, North West region), Gordon Tunley (Regional Emergency Planning Advisor, Oxford), Mike Williams (Accident and emergency (A&E)), Jim Wardrope (A&E), Tom Beattie (Paediatric A&E, Edinburgh), Ian Swann (A&E, Glasgow), Anthony Redmond (Disaster Medicine, Stoke), Roger Snook (Immediate Care, Bath), Tim Hodgetts (Immediate Care/Disaster Medicine, Surrey), Barbara Phillips (Paediatric A&E, Liverpool), Lynn Williams (Paediatric A&E, Nottingham), John Leigh (Anaesthetics, Bristol),

Fiona Jewkes (Paediatrics, Cardiff), John Scott (BASICS/Immediate Care, Cambridge), Matthew Cooke (A&E/Immediate Care, Birmingham), Simon Davies (Nursing/Immediate Care, Staffordshire), Tracy Matthews (Nursing/A&E, Manchester).

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