Pre-hospital coronary care and coronary fatality in the Belfast and Glasgow MONICA populations

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Background
The aim of this study was to describe and compare coronary event case fatality and care pathways in two defined populations with access to different models of pre-hospital care provision.

Methods

Results
Case fatality at 28 days following an acute coronary event was 6.5% greater in the Glasgow MONICA Project (GMP) population (46.7%) than in the Belfast MONICA Project (BMP) population (40.2%). Pre-hospital case fatality was 33.9% in the GMP population and 28.3% in the BMP population. These differences could not be fully explained by mobile coronary care unit (MCCU) responses in the BMP area. Initial care was provided in hospital for 28.3% of the BMP events and only 7.7% of the GMP events. Additional data collected by the Belfast and Glasgow MONICA investigators support a large difference between the median delay to main medical care in the BMP events (120 min) and the median delay to ward admission in the GMP area (220 min) at this time.

Conclusions
Our findings suggest that the delay between coronary event onset and access to specialist coronary care was the most likely critical difference, irrespective of hospital-based MCCU provision in the BMP area. An established ‘culture of early intervention’ in Belfast may have been an important factor. As a large proportion of coronary event fatalities continue to occur outside hospital, there is a need to strengthen the evidence base underpinning the provision of appropriate skilled care and treatment at the earliest possible opportunity.

Keywords
MONICA, coronary event register, mortality, coronary heart disease, myocardial infarction, pre-hospital care

It is estimated that of the 275 000 people in the United Kingdom who suffer an acute myocardial infarction each year, there are ~120 000 deaths. The majority of these fatal coronary events occur in the community before admission to hospital. This highlights the limited potential for further substantial reductions in coronary heart disease mortality by advances in hospital-based treatment alone. However, existing models for pre-hospital care have been largely dependent on both local circumstances and consensus.

Hospital-based mobile coronary care units (MCCUs), manned by coronary care unit medical and nursing staff, were established in Northern Ireland in the late 1960s and early 1970s following the landmark publications of Pantridge and Geddes. This is in contrast to many other regions within the United Kingdom, where ambulance services or general practitioner (GP)-based programmes deliver initial care outside hospital. Evaluation of alternative models for pre-hospital care
poses complex problems. A randomized controlled trial may be ethically and pragmatically difficult where services are well established, but drawing valid conclusions from indirect comparisons of different models is challenging. Populations and settings may vary in terms of underlying risk factor distributions and coronary event incidence, and in terms of local factors such as road networks, population density and the provision of other health services.

The World Health Organization MONItoring of Trends and Determinants in Cardiovascular Disease Project (MONICA) was established in the early 1980s. Coronary event registers were maintained in both Glasgow and Belfast. At that time, there were two dedicated MCCU vehicles operational in the Belfast MONICA Project (BMP) area, but there were no similar response teams in the Glasgow MONICA Project (GMP) area. The inferred benefits of a medically manned mobile service include a reduction in delay to clinical assessment and a range of interventions which might include, as indicated, opiate pain relief, management of complex cardiac arrhythmias, management of heart failure and thrombolysis. Between 1988 and 1990, all Glasgow emergency ambulances were equipped with semi-automatic defibrillators and crews trained in their use. In addition from 1990, Glasgow paramedics were permitted to perform intravenous cannulation and tracheal intubation but did not administer specific cardiovascular drugs or opiate analgesia. The BMP and GMP populations are largely comparable in terms of their high coronary event incidence, the socio-economic environment and in some important candidate genes for cardiovascular risk. The regional Research and Development Office of the Department of Health and Personal Social Services and Public Safety, Northern Ireland (DHSSPSNI) commissioned a secondary analysis of data from the BMP and GMP coronary event registers, with the aim of determining whether access to a hospital-based medically manned MCCU service had any demonstrable effect on population-level coronary event case fatality.

Methods
Study populations and settings
WHO MONICA study populations were defined as all persons aged 25–64 who had been residing for at least 6 months in areas delineated by clear geopolitical boundaries. As described elsewhere, the BMP study population comprised residents of the city of Belfast and the Castlereagh, North Down, and Ards district council areas. The BMP study population comprised residents of the city of Glasgow north of the river Clyde. The BMP area was geographically larger, and incorporated both rural and urban locations. The populations in both areas were served by five acute hospitals. There were two hospital-based MCCUs operating within the BMP area.

Sources of information, case finding, and data collection
Multiple sources of notification were used to identify coronary events, including hospital records, Registrar general death certificates, and Procurator Fiscal/Coroner reports. There were some differences in data collection methods between BMP and GMP. In BMP, a proportion of non-fatal coronary event finding was prospective, with identification and follow-up of suspect cases during hospitalization (hot pursuit). Detailed MCCU records were available to the Belfast investigators. In fatal coronary events, the Glasgow investigators were not permitted to interview witnesses or next-of-kin. The only source of information available to the Glasgow investigators for a coronary death outside hospital was the police record.

Acute coronary event definition
MONICA investigators applied diagnostic criteria for myocardial infarction on the basis of symptoms, electrocardiographic evidence, cardiac enzyme results, and necropsy reports. Events occurring >28 days after a previous non-fatal episode were considered as new events. As a pragmatic approach, reflecting routinely reported mortality trends, WHO MONICA criteria (definition 1) was applied. Under this definition, ‘acute coronary events’ include death certified fatal events with a survival period <28 days but without adequate supporting data. As the figures represent all known cases in the defined populations, confidence intervals (CIs) have not been presented. WHO MONICA derivations for case fatality have been outlined elsewhere.

MONICA dataset archive
The MONICA dataset archive contains ‘core’ data item files that were centrally collated and quality assured. During the 6 year period 1988–1993, enriched datasets were collected in both the BMP and GMP registers, which included details of pre-hospital care, resuscitation attempts, and medical interventions. As retrospective checks showed the Glasgow data in the MONICA dataset archive, and used in collaborative analyses, to be incomplete for part of 1991, we assessed the robustness of our conclusions by repeating analyses with and without data for 1991. Although our conclusions would be unaltered, we report the analyses omitting 1991 data in this article.

BMP and GMP datasets
Independently, the BMP and GMP investigators collected additional information on socio-demographic variables and time point/interval data pertaining to the care pathway.

Analysis
The data were analysed using the statistical package SPSS for Windows (version 11.0). Comparisons between proportions of categorical data were tested, where appropriate, using the $\chi^2$ test for contingency tables. The ‘core’ data items in the WHO MONICA archive permitted adjustment for a limited number of potential confounders using multiple logistic regression.

Results
Over these 5 years, 3797 acute coronary events were recorded in the GMP register and 3294 events were recorded in the BMP register. As shown in Table 1, case fatality at 28 days following an acute coronary event was greater in the GMP population (46.7%) than in the BMP population (40.2%). This pattern was a consistent finding for each registration year, with the exception of 1992. The case fatality difference between the cities was 7.5% for men and 3.5% for women and the difference was...
The observed difference in pre-hospital case fatality shown in Table 2 (33.9% vs 28.3%), suggests that 85% of the notional 214 ‘lives saved’ in Belfast occurred outside hospital.

### Care pathways

Figures 1 and 2 illustrate the BMP and GMP care pathways (initial and main care) and survival outcomes for registered acute coronary events. A doctor was not in attendance before fatal collapse in 25.7% of the events in the BMP area and 23.1% of the events in the GMP area. The 28 day case fatality for those events where the person survived to hospital coronary or intensive care unit admission was 12.1% in the BMP population and 14.0% in the GMP population.

### Initial care

There was insufficient data to classify ‘initial care’ for 0.4% of the BMP events and for 9.1% of the GMP events. Emergency or medical services were not in attendance to administer care in 12.7% of the BMP events and 14.6% of the GMP events. The initial point of access to skilled care was a hospital for 33.3% of the BMP events and 10.3% of the GMP events. These figures include 4.9% of the BMP events and 2.5% of the GMP events that occurred in hospital inpatients. In the remaining 28.3% of the BMP events and 7.7% of the GMP events where initial care was administered in hospital, it is likely that patients were admitted to the accident and emergency department.

The MONICA category for initial care by a ‘mobile team’ includes specially trained paramedics or a medical team
Figure 1  BMP acute coronary event care pathway 1988, 1989, 1990, 1992, and 1993

Figure 2  GMP acute coronary event care pathway 1988, 1989, 1990, 1992, and 1993
deployed to give cardiopulmonary resuscitation, if needed. A hospital-based MCCU was in attendance at 30.4% of the coronary events registered in the BMP, whereas Glasgow paramedics attended only 3.9% of the registered coronary events. Case fatality at 28 days in those BMP events with pre-hospital MCCU care was 44.7%. As shown in Table 3, an MCCU was in attendance for a larger proportion of the BMP events in men than in women. Attendance by an MCCU was more likely if the patient had a previous history of myocardial infarction or ischaemic heart disease.

**Care pathway delay intervals**

The defined onset of a coronary event may be imprecise due to variation in presenting symptoms and reliance on patient or witness recall. The delay from onset to ‘medical presence’ was estimated by the MONICA investigators, using circumstantial evidence if necessary. The MONICA definition of ‘medical presence’ includes specially trained and equipped paramedics able to treat cardiac arrest. As outlined in Table 4, there was insufficient data available for coding delay to medical presence in 5.6% of the BMP events, in comparison with 0.7% of the BMP events. Furthermore, 16.9% of events in the GMP register were coded ‘delay to medical presence unknown but probably less than 24 hours’. Medical presence within 2 h of the onset of symptoms was recorded for 48.3% of the BMP events and 28.3% of the GMP events.

Additional accurate BMP and GMP time point/interval data for the 6 year period from 1988 to 1993 were used to estimate the cumulative delay to specialist coronary care in each population, as illustrated in Figure 3. The median delay to main medical care for the BMP events, in the form of an MCCU attendance or admission to a hospital unit, was estimated to be

### Table 3 BMP acute coronary event initial care 1988, 1989, 1990, 1992, and 1993

<table>
<thead>
<tr>
<th>Factor (%)</th>
<th>BMP: initial care</th>
<th>Bystander/GP</th>
<th>MCCU</th>
<th>Routine ambulance</th>
<th>Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>438</td>
<td>17.8%</td>
<td>522</td>
<td>21.2%</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>198</td>
<td>23.7%</td>
<td>151</td>
<td>18.1%</td>
</tr>
<tr>
<td><strong>Age group (onset)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25–34 years</td>
<td>1</td>
<td>6</td>
<td>17.6%</td>
<td>4</td>
<td>11.8%</td>
</tr>
<tr>
<td>35–44 years</td>
<td>0.0%</td>
<td>36</td>
<td>14.8%</td>
<td>57</td>
<td>23.5%</td>
</tr>
<tr>
<td>45–54 years</td>
<td>2</td>
<td>168</td>
<td>18.3%</td>
<td>201</td>
<td>21.9%</td>
</tr>
<tr>
<td>55–64 years</td>
<td>9</td>
<td>426</td>
<td>20.3%</td>
<td>411</td>
<td>19.6%</td>
</tr>
<tr>
<td><strong>Previous myocardial infarction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>4</td>
<td>160</td>
<td>17.0%</td>
<td>278</td>
<td>29.5%</td>
</tr>
<tr>
<td>No</td>
<td>8</td>
<td>472</td>
<td>20.3%</td>
<td>394</td>
<td>16.9%</td>
</tr>
<tr>
<td>Insufficient data</td>
<td>0.0%</td>
<td>4</td>
<td>16.0%</td>
<td>1</td>
<td>4.0%</td>
</tr>
<tr>
<td><strong>Chronic ischaemic heart disease</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>4</td>
<td>239</td>
<td>16.5%</td>
<td>388</td>
<td>26.7%</td>
</tr>
<tr>
<td>No</td>
<td>8</td>
<td>392</td>
<td>21.5%</td>
<td>283</td>
<td>15.3%</td>
</tr>
<tr>
<td>Insufficient data</td>
<td>0.0%</td>
<td>5</td>
<td>22.7%</td>
<td>2</td>
<td>9.1%</td>
</tr>
</tbody>
</table>

### Table 4 MONICA archive dataset—delay to medical presence 1988, 1989, 1990, 1992, and 1993

<table>
<thead>
<tr>
<th>Delay to medical presence</th>
<th>BMP 3294 coronary events</th>
<th>GMP 3797 coronary events</th>
<th>Survival difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–5 min</td>
<td>Alive at 28 days</td>
<td>Fatal at 28 days</td>
<td>Alive at 28 days</td>
</tr>
<tr>
<td></td>
<td>54 (24.9%)</td>
<td>163 (75.1%)</td>
<td>15 (13.9%)</td>
</tr>
<tr>
<td>6–59 min</td>
<td>411 (49.8%)</td>
<td>415 (50.2%)</td>
<td>195 (37.2%)</td>
</tr>
<tr>
<td>1 to &lt;2 h</td>
<td>491 (89.8%)</td>
<td>56 (10.2%)</td>
<td>370 (83.9%)</td>
</tr>
<tr>
<td>2 to &lt;4 h</td>
<td>389 (88.4%)</td>
<td>51 (11.6%)</td>
<td>336 (87.3%)</td>
</tr>
<tr>
<td>4 to &lt;24 h</td>
<td>446 (88.5%)</td>
<td>58 (11.5%)</td>
<td>420 (83.7%)</td>
</tr>
<tr>
<td>&gt;24 h or longer</td>
<td>127 (72.6%)</td>
<td>48 (27.4%)</td>
<td>252 (69.4%)</td>
</tr>
<tr>
<td>Unknown, probably &lt;24 h</td>
<td>45 (31.0%)</td>
<td>100 (69.0%)</td>
<td>354 (55.3%)</td>
</tr>
<tr>
<td>Not relevant, no medical presence</td>
<td>– –</td>
<td>– –</td>
<td>– –</td>
</tr>
<tr>
<td>Insufficient data</td>
<td>6 (27.3%)</td>
<td>16 (72.7%)</td>
<td>82 (38.7%)</td>
</tr>
</tbody>
</table>

* Time between onset of symptoms and medical presence (includes specially trained and equipped paramedics able to treat cardiac arrest).
The estimate for the median delay to ward admission in the GMP events, used as a proxy for access to coronary care, was over 1.5 h longer. The estimate for the median delay to MCCU care in the BMP area was 75 min.

Cardiac arrest and resuscitation

As shown in Figure 4, an ‘apparent cardiac arrest’ occurred outside hospital in 29.0% of the BMP events and 34.7% of the GMP events. There were 28 (2.9%) survivors following cardiac arrest and resuscitation attempts from 1988 to 1993.
arrests outside hospital in the BMP area and 9 (0.7%) survivors following cardiac arrests outside hospital in the GMP area. This reflects both a larger proportion of survivors at 28 days following successful resuscitation outside hospital (7.4% vs 1.0%), and following successful resuscitation on arrival in hospital (4.0% vs 1.6%). There were 25 survivors following a cardiac arrest event outside hospital attended by an MCCU in the BMP area.

Factors associated with survival status

Univariate analysis of pooled events from both registers demonstrated that the proportion of survivors at 28 days following a coronary event was significantly larger in the BMP population ($P < 0.001$), younger age groups ($P < 0.001$), persons with no previous history of myocardial infarction ($P < 0.001$) or ischaemic heart disease ($P < 0.001$), and in those persons not attended by a ‘mobile team’ ($P < 0.001$). Multivariate analysis was performed using the binary outcome ‘survival at 28 days’ as the dependent variable. A fatal coronary event was found more likely to occur in the GMP population vs the BMP population, with an adjusted odds ratio (OR) of 1.61 (95% CI 1.38–1.89). When delay to medical presence was added to the regression model as an explanatory categorical variable, pre-hospital care by a ‘mobile team’ (adjusted OR 1.02 (95% CI 0.85–1.23)) was no longer significantly associated with a higher risk of death within 28 days of coronary event onset. In comparison with patients attended by skilled personnel within 1 h were found to be at increased risk of a fatal outcome within 28 days.

Discussion

The practice of cardiology, coronary care nursing specialization, and the role of the ambulance service have all changed substantially in the last two decades. Considering the evidence to support domiciliary thrombolysis by GPs, legislative changes to extend the range of parenteral medicines which can be administered by paramedics and the increasing difficulty in providing junior medical staff cover for hospital-led MCCUs, one may reasonably question whether a hospital-based MCCU service offers definitive health gain in routine practice. The present analysis was commissioned by the regional R&D Office to help answer this question.

Population coronary event registers

A secondary analysis of existing coronary event registers has acknowledged limitations in this context, and can only provide an indirect evaluation of the contribution that a hospital-based mobile coronary care service may have made to the case fatality differences between Belfast and Glasgow. Advantages of using these data include the fact that the BMP and GMP study populations are known to be largely comparable in terms of coronary heart disease risk factor distribution and incidence of myocardial infarction. Registered coronary events were defined using the MONICA diagnostic algorithm, and recorded data items were centrally collated and quality assured. The BMP and GMP registers are known to be representative of other routinely available mortality statistics. Data collection quality was high and consistent.21 The use of population registers also avoids survival bias that would be associated with a focus only on cases admitted to hospital. Nevertheless we acknowledge that any observed differences in 28 day case fatality between the BMP and GMP areas may be attributed to other unmeasured local factors, which are independent of access to an MCCU service.

It is possible that the lower case fatality in the BMP population may have resulted from better ascertainment of non-fatal coronary events, or the converse in the GMP population. However, it is considered unlikely that a systematic bias in coding or different interpretation of diagnostic criteria is a main determinant of the case fatality difference between the two populations. We do acknowledge, however, that some data items such as delay to medical presence are more complete in the BMP register. This probably reflects access to MCCU records, and attempts to verify onset times with relatives or witnesses which was not permitted in Glasgow.

The quality of initial and subsequent medical care in the two cities was broadly comparable at the population level, however, important individual-level variables such as the severity of myocardial infarction, other pre-existing morbidity, or the quality of individual care are unknown. Drawing a firm conclusion on possible case-mix differences between Belfast and Glasgow is difficult, as registered events with complete case-mix data, such as serial cardiac enzymes results, are likely to over-represent ‘survivors’. For those coronary events managed in hospital, case fatality and the distribution of serial cardiac enzyme levels (an indirect indication of the extent of myocardial damage) are again broadly comparable between the populations (data not shown). This does not suggest that a larger proportion of cases at the milder end of the disease spectrum were admitted to hospital and investigated in the BMP area.

The division of patients at the greatest risk of death between various forms of pre-hospital care is unknown, and highly unlikely to be random. Indeed non-random ‘confounding-by-intention’ (the tendency to summon different types of assistance for different types of cases) is to be expected. Consequently, we were not surprised that the data support a higher risk of death associated with MCCU attendance. The survival outcome at 28 days is extremely dependent on what happens within the first few minutes and hours of the onset of myocardial infarction. Clearly the impact of mobile coronary care can only be demonstrated for those who survive until it arrives and so a better method of analysis should account for censoring by competing risks. Although more interest is being shown in techniques such as G-estimation and Marginal Structural Models, we considered the data on key delay intervals too imprecise to merit their application here.33-25

Factors in the care pathway associated with case fatality

While tentatively concluding that the 6.5% difference in the case fatality at 28 days is not mainly due to the provision of pre-hospital MCCU care in the BMP area (and its absence in the GMP area), the following findings need to be taken into account.

First in considering the care pathways, it appears that initial medical care was provided in hospital for 28.3% of the BMP events and only 7.7% of the GMP events. This important difference may reflect local accessibility of hospital accident and emergency departments, or possibly better recognition of or response to symptoms, arising from an established ‘culture’ (involving patients, GPs, and hospital staff) of early intervention in Belfast. We should also bear in mind that overall, across the 38...
MONICA populations, both Belfast and Glasgow had lower than average case fatality (ranking 10th and 14th, respectively in the last 3 years of registration). There were several MONICA populations such as Switzerland-Ticino and Canada-Halifax with relatively low case fatality, which do not have a rapid response pre-hospital coronary care service. The United Kingdom Heart Attack Study (UKHAS) investigators have reported on a paramedic-based model for pre-hospital coronary care over a 2 year period ending in December 1995. If we consider coronary events in persons 64 years old and under, then the pre-hospital case fatality in the health districts of Brighton, York, and South Glamorgan (28.7%) was similar to our findings for the BMP area (28.3%). The hospital case fatality (6.7%) is less than our findings for the BMP area (11.9%). It should be noted, however, that the diagnostic criteria applied by the UKHAS investigators differed from that used in the MONICA project.

Second, successful pre-hospital resuscitation by an MCCU does not explain the observed differences in case fatality between the BMP and GMP. At most, this could account for 1 in 10 of the ‘additional survivors’. Interestingly, in an analysis of the impact of equipping routine ambulances with defibrillators in Glasgow (before and after 1989), there was an increase in the number of resuscitation attempts but crews attended less than half of all cases and the critical issue, unsurprisingly, was the response delay. It is not possible to determine whether medical interventions recorded for the BMP events were administered by the mobile team outside hospital. Overall, thrombolysis was administered in only 35% of the BMP coronary events and 25% of the GMP coronary events. It appears unlikely that access to pre-hospital thrombolysis can explain the observed difference in case fatality. In those BMP events where the person survived to hospital admission, the hospital case fatality was 11.1% for those attended by an MCCU and 12.2% for those not attended by an MCCU. This does not suggest a large survival benefit associated with pre-hospital MCCU care before transport to hospital.

Third, the observed sex-specific and age-specific differentials in 28 day case fatality between the two cities is not readily explained by the proportion of events in each sub-group attended by an MCCU. There were no significant variations in the BMP case fatality by district of residence (data not shown). However, a mobile unit response was more likely for Belfast City Council or Castlereagh District Council residents, where the two MCCU hospital base units are located.

Finally, despite the acknowledged missing data, and the limitations and imprecision of available time point/interval data, it is likely that delay from onset to ward admission in the GMP area is of fundamental importance to this comparison of 28 day case fatality. It is known from other sources that during the MONICA registration period, the ambulance service in Glasgow had difficulties achieving response time targets. Delay to specialist clinical assessment and intervention, in other words ‘coronary care’, is likely to be the critical difference between the BMP and GMP populations. The overall reduction in this BMP delay interval cannot be fully explained by the provision of MCCU care. The UKHAS investigators reported a median delay to coming under paramedic care of 108 min, and 138 min for arrival at hospital. The median delay from onset to MCCU attendance, estimated from the BMP register, was 75 min over the 6 year period 1988–1993. This might again reflect an established ‘culture of early intervention’ in Belfast.

Future evaluation of models for pre-hospital coronary event care

There are clearly other outcome indicators of relevance to the assessment of pre-hospital models for coronary event care such as, for example, complication rates or the degree of cardiac function impairment on discharge. Process measures, such as delay to reperfusion, are also of fundamental importance for performance monitoring. Ultimately, the cost-effectiveness of proposed pre-hospital models must be considered. Arguably, it is not acceptable to deny experienced medical or nursing cover to hospital inpatients for the duration of an MCCU response. With such issues in mind, any future evaluation of hospital-based MCCU should consider a much broader context and take account of the opportunity costs on the ambulance service as a whole (and its overall response times), the level of care provided to hospital inpatients during an MCCU response, the overall population mortality from coronary heart disease and, arguably, mortality from other conditions requiring an emergency ambulance. The paper in the early 1980s by Mathewson et al. which compared case fatality in two rural districts in Northern Ireland (Ballymena, which had an MCCU, and Omagh, which did not) did not consider this broader canvas and since its publication, there have been significant developments in the training and number of paramedic ambulance crews and in the use of automated defibrillators by GPs. It would have been of interest to determine whether there was any impact on coronary event case fatality following the introduction of a mobile coronary care service in the Omagh area. Such data have never been published.

Conclusions

Our conclusions from this observational study must be interpreted with caution. However, we were able to describe the care pathway and outcomes for a large number of coronary events in two well-defined and comparable populations. While the Coronary Heart Disease National Service Framework scarcely considered the appropriateness of different models of out-of-hospital care, there is a need for evidence-based strategies to ensure the provision of skilled care and appropriate treatment at the earliest possible opportunity in an acute coronary event. In practice, the strategic and operational model of choice for pre-hospital coronary care will almost certainly depend on local factors.

Acknowledgements

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KEY MESSAGES

• The majority of fatal coronary events occur in the community before admission to hospital.
• Existing models for pre-hospital care have been largely dependent on both local circumstances and consensus.
• Models for pre-hospital care should ensure the provision of skilled care and appropriate treatment, including resuscitation, at the earliest possible opportunity in the coronary event care pathway.
• In addition, evidence-based local strategies are needed to reduce the overall delay between event onset and access to ‘expert clinical assessment and intervention’.

References