

## Thematic review of deaths of children through fire

**Child Death Review Programme** 

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## 1 Summary

While deaths through fire are rare in Wales, the consequences of any child death are substantial. This review considered information on deaths through fire of children (0-17 years) in Wales alongside a literature review and thematic panel discussion.

Three themes emerged; personal safety, safety in the home and wider safety issues. Through discussions around these themes, opportunities for prevention of deaths of children through fire were identified. These included providing consistent and clear messages for the public; ways to share these messages and existing messages effectively; exploring existing prevention activities and initiating discussions around legislation.

## **Opportunities for prevention**

Consistent and clear messages for the public:

- the importance of **every** home having a working smoke alarm
- the importance of knowing what to do in the event of a fire 'get out, stay out, call 999'
- the importance of having an escape plan and following home safety advice
- the risks of cooking under the influence of alcohol or drugs
- the appropriate supervision of children, e.g. every child needs a sober caregiver.

Ways to share these and existing prevention messages:

These could be explored by the Child Death Review Programme (CDRP) team liaising with Welsh Government and with Health Improvement colleagues in Public Health Wales to determine effective mechanisms for sharing these messages.

Existing prevention activities:

- CDRP team to explore the possibility of adding families with children <5 years to qualify for a free home safety check
- CDRP team to explore pathways for preventative actions where there is a threat of arson.

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Legislation:

• CDRP team to initiate discussions on legislation relating to smoke alarms.

The CDRP team have started to meet with stakeholders to progress the opportunities for prevention which were identified.

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## 2 Context

The CDRP aims to identify and describe patterns and causes of child death, including any trends, and to identify opportunities to prevent child deaths in Wales. Topics are chosen based on the numbers of deaths involved, current policy needs; discussions with the CDRP Steering group and, most importantly through identification of areas where there are opportunities to reduce the risk of death in children and young people in Wales.

In 2015-16 there were over 12,000 fires reported across Wales<sup>1</sup>, resulting in 245 deaths or injuries, which resulted in hospital admission<sup>2</sup>. Where deaths or serious injuries occur the impacts are substantial, and the fires causing such injuries are often preventable. Additionally there is a known inequality inherent to fire-related injuries, with children living in the most deprived areas of Wales being over twice as likely to present to accident and emergency with burn related injuries compared with those in the least deprived areas<sup>2.</sup> Understanding and addressing these inequalities alongside reducing child deaths through fire across Wales is paramount.

The aim of the review was to identify modifiable risk factors and opportunities for preventing deaths of children through fire. This was done through reviewing the literature around the risks and interventions for reducing deaths of children through fire, considering the incidents that had occurred over a five-year period in Wales and bringing together a panel of experts to discuss the incidents and literature. This triangulation of evidence allowed for identification of modifiable factors and policy areas where there is opportunity to reduce overall risk of death through fire, influence to reduce inequalities, and better understand how to communicate with those who are most at risk.

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<sup>&</sup>lt;sup>1</sup> Fire & Rescue Service, 2016

<sup>&</sup>lt;sup>2</sup> Public Health Wales Observatory, 2016

## 3 Methodology

## 3.1 Protocol

A protocol was developed to provide specific guidance for planning and conducting the thematic review of deaths of children through fire. The protocol was informed by the CDRP thematic review procedure, produced May 2016, and set out the case definition, scope, time-line, budget and quality assurance elements of the review. Both documents are available on request from the CDRP team.

### **3.2** Data sources for triangulation of evidence

#### 3.2.1 Individual deaths

The review focused on deaths through fire. Scalds, radiation or friction burns were excluded. All causes of death as a direct consequence of fire, for example smoke inhalation, were included. While the review did not focus on fire-related deaths as a result of homicide or suicide, these were also included.

The review included all deaths through fire (meeting the definition outlined above) among children aged 0-17 years, where the death occurred between 1 January 2010 and 31 December 2014, and where the event leading to death occurred in Wales and/or where the child was normally resident in Wales at the time of the death. Nine child deaths were identified from five fire incidents.

A number of sources of information were used to gather further information on these deaths, including death registration from the Office for National Statistics (ONS), reports submitted to the CDRP, records from services involved in reviewing deaths, information from heads of safeguarding, verdicts and reports from coroners, emergency services information and media reports.

#### 3.2.2 Literature review

The aim of the literature review was to assess published evidence for the risks of deaths through fire and the effectiveness of interventions for reducing deaths of children through fire. The literature review questions were:

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- a) What do we know about the risks and protective factors associated with fire-related deaths in children?
- b) What interventions might be effective in addressing risk factors, increasing protective factors, and preventing child deaths from fire?

The literature review followed a transparent, repeatable approach as set out in the literature review protocol, available from the Public Health Wales Observatory Evidence Service (OES).

3.2.3 Thematic panel meetings

The panel comprised of the core thematic review team, a member of the OES, the domain experts and an independent chair. The domain experts came from medical and fire safety backgrounds.

## Table 1: Panel for thematic review of deaths of children throughfire

| Name               | Professional role                        | Panel membership role              |
|--------------------|--|------------------------------------|
| Catherine Floyd    | Speciality Registrar in Public<br>Health | Independent chair                  |
| Dr Rosalind Reilly | Consultant in Public Health              | Public Health lead for Child Death |
|                    |  | Review Programme, core team        |
|                    |  | member                             |
| Bev Heatman        | Child Death Review                       | Review manager,                    |
|                    | Programme Manager                        | core team member                   |
| Dr Lorna Price     | Community Paediatrician                  | Paediatric lead for Child Death    |
|                    | Designated Doctor                        | Review Programme, core team        |
|                    | Safeguarding                             | member                             |
| Dr Jo McCarthy     | Speciality Registrar in Public           | Review lead,                       |
|                    | Health                                   | core team member                   |
| Dr Chukwudi Okolie | Evidence Service                         | Literature review lead             |
|                    | Researcher                               |                                    |
| Karen Jones        | Head of Community Safety                 | Domain expert                      |
|                    | at Mid and West Wales Fire               |                                    |
|                    | and Rescue Service                       |                                    |
| Dr Joanne Bowes    | Consultant Anaesthetist                  | Domain expert                      |
| Professor Tom      | Consultant Plastic Surgeon               | Domain expert                      |
| Potokar            | and Director of Interburns               |                                    |

Two panel meetings were held as part of the thematic review. At the first meeting demographic information on the children who had died was presented, each incident was discussed in detail and the literature review findings were shared with panel members. During the second panel

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meeting further discussions were held which led to the development of opportunities for prevention.

All panel members signed confidentiality agreements and conflict of interest declarations prior to panel meetings.

## **3.3** Formulation of opportunities for prevention

Information discussed, interpreted and agreed at panel was collated and recorded by the CDRP team. Panel members discussed potential opportunities for prevention which could be explored to reduce deaths of children through fire in Wales. Emerging themes were collated between panel meetings so that these could be presented back to the panel for further discussions. Following the second panel meeting any highlighted issues from the panel were recorded, and these led to the development of opportunities for prevention by the core team. The domain experts agreed on the final list of opportunities for prevention.

## 3.4 Reporting, engagement and progression of review findings

The thematic review of deaths of children through fire report was developed by the review lead and core team with contributions from the evidence lead.

The core team have and will continue to engage with key stakeholders including policy leads at Welsh Government and Public Health Wales colleagues to determine how the opportunities for prevention can be progressed.

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## 4 Findings

## 4.1 What did the information about individual deaths/incidents tell us?

Nine deaths through fire in Wales among 0-17 year olds between 1 January 2010 and 31 December 2014 were identified. The deaths occurred in five separate incidents; two deliberately started fires and three accidental fires. There was no location pattern to the fires, which occurred across Wales.

#### 4.1.1 Age and sex

• There was no clear age or gender pattern for the fire deaths.

#### 4.1.2 Residence

- All of the fires occurred in a private or rented residence
- Seven children were in their own homes at the time of the fire.

#### 4.1.3 Time of day and seasonality

- Most incidents occurred during the night or early hours of the morning
- There was no seasonality pattern to the fires.

#### 4.1.4 Alert systems

- Four of the five incidents occurred in homes without a working smoke alarm
- None of the homes had any additional fire alert or safety adaptations.

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#### 4.1.5 Commonalities in accidental fires

There were three accidental fires in total, resulting in four child deaths.

- Most accidental fires started in the kitchen area
- All occurred when the victims or caregivers were sleeping
- In all incidents there was an attempt to escape.

#### 4.1.6 Commonalities in deliberately started fires

There were two deliberately started fires in total, resulting in five child deaths.

- Both fires occurred at night
- In both fires there was an attempt to escape
- In both incidents victims were upstairs and the fire was downstairs.

## 4.2 What did the literature tell us?

The literature search was split into risk factors and interventions. A copy of the full literature review is available on request from the OES.

#### 4.2.1 Risk factors

410 studies on the risk factors for fire were initially identified. Following screening and applying eligibility criteria, 16 studies were reviewed in full. There was found to be a paucity of good quality research evidence around risk factors for death through fire. All were observational studies, and eight of the 16 came from the USA. From the evidence, risk factors could be broken down into demographic, behavioural and environmental.

#### **Demographic risk factors**

- Households with a high number of residents under 15 years specifically at risk are children under five and males over six
- Worldwide, children from minority ethnic groups
- Low income households
- Residing in a rural area
- Single parent families

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- Maternal low educational attainment and young maternal age (under 20 years old)
- Physical or mental handicap or disability
- Involvement of social services with the family.

#### Behavioural risk factors

- Alcohol use by supervising adult
- Smoking
- Fire play
- Lack of fire escape plan
- Lack of supervision.

#### Environmental risk factors

- Absence of functional smoke alarm
- Absence of or no access to a telephone
- Mobile homes or homes with few/no safety features
- Loose fitting and non fire resistant clothing.

The risk factors often interact, for example socioeconomic status, type of residence and lack of household safety features may all be related issues. Risk is not limited to the child, with many of the factors mentioned also being risks for adults too, and age and sex are the top predictors of fire-related mortality.

#### 4.2.2 Effective interventions

812 studies and documents focussing on interventions to prevent or limit deaths through fire were identified. Following screening and applying eligibility criteria, 40 were reviewed in full. 17 were research studies, including one randomised controlled trial and two systematic reviews, and 23 were reports. Nine of the 17 research studies came from the USA and five from the UK, one from Australia, one from Greece and one from Canada. From the evidence, interventions could be broken down into educational, environmental and legislative.

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#### Educational interventions

- There is evidence that one-to-one education on home safety is effective at increasing the proportion of families with functional smoke alarms, fire guards, and a fire escape plan. However evidence suggests that home safety education is ineffective in increasing safe storage of matches or the possession of a fire extinguisher
- Evidence on the effectiveness of school based education in improving children's knowledge of fire and burn prevention is inconsistent.

#### **Environmental interventions**

- There is evidence to suggest that the presence of a functional smoke alarm in households is effective at reducing the incidence of firerelated deaths and injuries in children, however this does not hold true for fires started through fireplay or arson
- There is evidence to suggest that mixed-frequency beeping or voice based smoke alarms are more effective than single frequency beeping in waking selected risk groups.

#### Legislative

- There is evidence to suggest that laws requiring all homes to have smoke alarms is effective at promoting the use of smoke alarms.
- 4.2.3 Evidence from Child Death Review reports

Thirteen Child Death Review reports from programmes in other countries were considered as part of the evidence review. Recommendations from these reports were considered, and included:

- Installation and use of functional smoke alarms
- Enactment of laws requiring all existing homes to have smoke alarms installed
- Fire safety education for vulnerable families
- Emergency fire escape plans developed
- Proper supervision of young children
- Prevent access to fire-starting material
- Routine checks of electric appliances and wiring.

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#### 4.2.4 Evidence from other reports

Ten additional reports were also considered. Recommendations from these reports mirrored those of the Child Death Review reports and included the additional recommendations of:

- Having a no smoking policy at home
- Use of fire-retardant material for children's bedclothes, bedding and furniture
- Installation of residential sprinklers
- Use of child-resistant lighters
- Use of thermostatically controlled freestanding electric deep fat fryers for frying chips.

#### 4.2.5 Conclusions

Evidence suggests that there is good quality evidence to support use of educational interventions to increase smoke alarm use and fire escape plans, but that education is ineffective at increasing safe match storage or possession of a fire extinguisher. Evidence overall demonstrated the effectiveness of smoke alarms in preventing injury and death through fire, unless the fire is as a result of fire play or arson.

There is limited systematic review level and randomised trial evidence available on risks and interventions to prevent death through fire. Formal research is not the only type of evidence for consideration, and Child Death Review reports and expert opinion provided valuable information for this evidence review.

#### 4.3 What themes emerged from panel discussions?

Discussion topics from the first panel meeting, where each incident was discussed and the literature review findings presented, are outlined in figure 1.

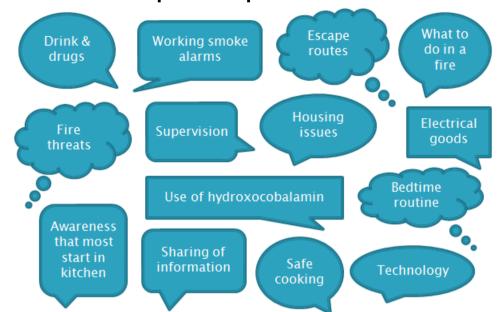


Figure 1: Discussion topics from panel one

Three themes emerged. These were

- 1) Personal safety
- 2) Safety in the home
- 3) Wider safety issues

Panel members were asked to consider the issues which were raised in the first panel meeting under these three themes and decide whether there were particular areas that they would like to specifically highlight. During the second panel meeting these were further developed and agreed as opportunities for prevention. The following chapters on personal safety, safety in the home and wider safety issues summarise panel discussions around each theme.

## 5 Personal safety

Personal safety included issues such as education on what to do in a fire, plans made by a family or individuals, alcohol and drug intake, supervision issues and other aspects which affected individual risk of death through fire.

## 5.1 What did the information about individual deaths/incidents tell us?

• There were incidents where people attempted to return to burning buildings

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- There was an incident where a family member investigated the fire before attempting to escape
- There were incidents where drugs and alcohol were involved in the deliberate setting of fires
- There were incidents where individuals were cooking under the influence of alcohol or drugs.

## 5.2 What did the literature tell us?

Risk factors for death through fire include alcohol use by the supervising adult, smoking, fire play, lack of a fire escape plan and lack of supervision. Home safety education is effective at increasing the proportion of people making home safety changes, such as deciding on an escape plan and installing a working smoke alarm. There is evidence to suggest however that safety education is ineffective in increasing safe storage of matches or possession of a fire extinguisher. Evidence around school based education to improve children's knowledge of fire and burn prevention, and their response behaviours in a fire, is inconsistent.

## 5.3 What information emerged from the panel?

5.3.1 Knowledge of what to do in a fire

It was acknowledged by the panel that in many instances people do not know how to respond in a fire, and that when panicked actions are often not those which the fire service would recommend. The need for a consistent, simple and easy to remember message around actions during a fire was highlighted. The Fire and Rescue Service have a message they currently use, 'get out, stay out and call 999' and the panel recognised it as important to raise awareness around this and to keep the message the same to avoid confusion.

#### 5.3.2 Drugs and alcohol

Use of drugs and alcohol featured in both the literature and the incidents which were reviewed, particularly around the ability of intoxicated parties to supervise cooking or children. Additionally the effect alcohol may have played in the deliberately started fires was explored and discussed. It was felt that the strongest safety message around prevention of death through fire in relation to drug and alcohol use was around cooking, and the importance of not cooking under the influence of drugs or alcohol.

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#### 5.3.3 Supervision

The importance of adequate supervision for young children was discussed. While lack of supervision was not directly the cause of any of the firerelated deaths reviewed, the need for adequate supervision and for every child to have a sober caregiver to prevent injuries was agreed.

#### 5.4 Panel suggestions: Personal safety

- The panel recognised the importance of public awareness around what to do in a fire, and the need for one consistent message: 'get out, stay out, call 999'
- The panel suggested that one recognised leaflet is used consistently throughout Wales for sharing information about fire safety, and that this information is updated to include information around not cooking under the influence of drugs or alcohol.

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## 6 Safety in the home

# 6.1 What did the information about individual deaths/incidents tell us?

- In most incidents there was not a smoke alarm in the home
- In all incidents there were no additional fire safety features, such as sprinkler systems or fire doors, in the homes
- In all of the incidents of accidentally started fires the fire started in the kitchen
- In all incidents there were issues around escape from the building.

### 6.2 What did the literature tell us?

Absence of a functional smoke alarm is identified as an environmental risk factor for deaths through fire. Additionally there is evidence that the presence of a smoke alarm is effective in reducing the incidence of firerelated deaths and injuries in children, although this evidence does not include intentionally started fires. There is evidence around which types of smoke alarms are most effective, with voice alarms and mixed frequency beeping being more effective than high frequency beeping in waking heavy sleepers, intoxicated adults, children and those with hearing impairments.

There is evidence that enacting laws which require existing homes to have smoke alarms is effective at promoting use of the alarms.

### 6.3 What information emerged from panel?

6.3.1 Smoke alarms and additional home safety mechanisms

Panel discussions focussed around what the most important safety features of homes were in the context of fire risk. As with evidence from the literature and the incidents presented, the importance of a working smoke alarm was highlighted as the single most important message around fire safety. The current and future need for smoke alarms to become mandatory, backed by legislation, for all rented properties was agreed by all panel members. Discussions around whether the panel should advocate for a specific type of alarm, such as those where there is best evidence for waking heavy sleepers and intoxicated individuals took place. It was decided that this would not be appropriate, as the most

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important message was to have a working alarm and there is good evidence around the efficacy of standard smoke alarms.

Additional home safety features, such as sprinkler systems and fire doors, were also discussed. Evidence around sprinkler systems exists, and new homes are required to have a system installed, however there was not information on whether these systems would have affected the outcomes in the incidents reviewed, or a focus on these in the literature. It was felt that for these reasons, and to ensure that the main message around smoke alarms was not diluted, additional home fire safety features would not be a focus.

#### 6.3.2 Electrical appliances

Electrical appliances and registration of these, so that they could be easily recalled if manufacturers identified a fault, were discussed extensively. However without concrete evidence to inform an opportunity for prevention, it was not felt that advocating for everyone to register their appliances was a point that the panel could progress.

6.3.3 Location of fire and escape routes

The kitchen was highlighted as an area of high fire risk. Linked to discussions around this was having an escape route which avoided the kitchen area as well as a backup escape route for if stairs were blocked. The need to ensure keys were not left in the kitchen was highlighted, and a safe bedtime routine including closing the kitchen door was discussed as an important element of home fire safety to promote.

6.3.4 Layout of house

The issue of clutter was raised, and the importance of keeping exits clear, however it was not felt that there was enough evidence or information to highlight this area. The number of incidents occurring in terraced housing, and the effect this may have on escape routes, was also discussed. While there appeared to be links between housing with limited exits and fire risk, from the incidents reviewed the layout of a home is not something that is easily modifiable. It was therefore decided that housing layout was not suitable as an opportunity for prevention.

### 6.4 Panel suggestions: Safety in the home

• Based on the triangulation of evidence, the panel felt that there should be a working smoke alarm in every home and acknowledged

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the difficulties surrounding this. Given that the review is focussed on children the panel suggest that an opportunity is explored to expand the 'vulnerable group' list eligible for free home safety checks by the Fire and Rescue Service to include pregnant women and families with children under the age of five years. This would open up the service of a free home safety check and provide opportunities for education about home safety and the provision of free smoke alarms

- The panel recognised legislation as an important tool for ensuring smoke alarms are fitted in rented accommodation
- The panel recognised the importance of following home fire safety advice, such as ensuring electrical appliance safety, having a safe bedtime routine and leaving keys where they can be easily accessed if needed. The panel welcomed the inclusion of these points on the national safety guidance leaflet and advocated that these be specifically mentioned in additional materials (such as in Bump, Baby and Beyond).

## 7 Wider Safety Issues

# 7.1 What did the information about individual deaths/incidents tell us?

• In both deliberately started fires there were previous threats of arson.

## 7.2 What did the literature tell us?

#### 7.2.1 Risk factors

Wider safety issues emerged during panel meetings, and the literature search had not specifically focussed on the background issues of those committing arson or on the time taken to arrive at hospital following a fire. Evidence did demonstrate that involvement with social services and alcohol use were risk factors for deaths of children through fire, although this evidence is based on risk factors of the family affected and not the perpetrator.

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#### 7.2.2 Interventions

In response to discussions in panel one, an additional evidence review focussing on use of hydroxocobalamin for smoke inhalation was undertaken by the evidence service between panels. Hydroxocobalamin is vitamin B12 which has been used to treat cyanide poisoning. Evidence of the effectiveness of hydroxocobalamin for cyanide poisoning following smoke inhalation was found to be limited.

## 7.3 What information emerged from panel?

#### 7.3.1 Referral pathways for arson

While discussing the homicide incidents, a clear message around the need for a referral pathway to arson reduction services emerged. The need for any pathway to be known about by health professionals including drug and alcohol services was also raised, and the panel acknowledged that it would be necessary to do some background research on whether such a referral pathway currently exists.

#### 7.3.2 Hydroxocobalamin

Hydroxocobalamin, or vitamin B12, has been recognised as an antidote to cyanide poisoning. Following exposure to smoke, cyanide levels in the blood can be raised, and there is some evidence to suggest hydroxocobalamin may reduce the risk of death following smoke inhalation. Hydroxocobalamin was not something that came up during the initial evidence searches, but its use was raised as an important consideration by a healthcare professional on the panel and a follow up evidence review conducted as a result. Although this is not a population level intervention, the panel agreed that this is an important area for future research nationally and expressed a hope that national bodies who make decisions on use of this medication do so with a sound evidence base.

#### 7.3.3 Wider injury prevention agenda

While discussions focussed specifically on fire-related deaths and interventions to reduce these, the wider injury prevention agenda was also highlighted. Many of the routes for sharing fire safety advice, such as through government produced leaflets, national safety campaigns and health professionals, mean that advice is given alongside general injury

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prevention information. Panel view was that there is a need to raise the profile of injury prevention, particularly child injury prevention and safety.

### 7.4 Panel suggestions: Wider safety issues

- The panel recognises the importance of a clear referral pathway where there is a threat of arson, and increasing awareness among the public and health professionals around the provision of support the Fire and Rescue Service are able to provide when arson threats are made
- The panel recognises the continued need for research around new fire safety technologies, including around the use of hydroxocobalamin
- The panel recognises that fire safety is one element of a wider child injury prevention agenda, and that efforts to publicise prevention of deaths through fire should also take into account this wider agenda.

## 8 **Opportunities for prevention**

The themes that emerged from panel discussions were considered by the CDRP team and a list of opportunities for prevention of deaths of children through fire produced. These are:

Consistent and clear messages for the public:

- the importance of **every** home having a working smoke alarm
- the importance of knowing what to do in the event of a fire 'get out, stay out, call 999'
- the importance of having an escape plan and following home safety advice
- the risks of cooking under the influence of alcohol or drugs
- the appropriate supervision of children, e.g. every child needs a sober caregiver.

Ways to share these and existing prevention messages:

These could be explored by the Child Death Review Programme (CDRP) team liaising with Welsh Government and with Health Improvement colleagues in Public Health Wales to determine effective mechanisms for sharing these messages.

Existing prevention activities:

- CDRP team to explore the possibility of adding families with children <5 years to qualify for a free home safety check
- CDRP team to explore pathways for preventative actions where there is a threat of arson.

Legislation:

• CDRP team to initiate discussions on legislation relating to smoke alarms.

## 9 Stakeholder engagement

The CDRP team have started to meet with stakeholders to progress the opportunities for prevention which have been identified in this review.

Public Health Wales is currently undertaking a review of the parental information it provides. Opportunities have been identified to link the key messages from the CDRP into Public Health Wales' parental information provision where it is effective and appropriate to do so. It is hoped that effective mechanisms of sharing messages can be utilised by the CDRP in the future.

A briefing meeting with Welsh Government policy leads was held, with representation from safeguarding children, injury prevention/ environmental safety and Fire and Rescue Services, and the Senior Medical Officer for women and child health. Positive discussions took place on the ways in which vulnerable families could access the home safety fire check and links were made to other stakeholders to discuss this and other opportunities for prevention which were identified.

The CDRP team is extending engagement to include additional stakeholders identified from initial discussions.

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