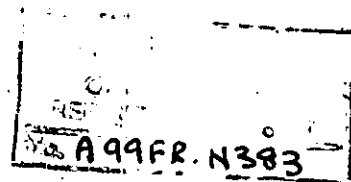


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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH AND FIRE OFFICES' COMMITTEE
JOINT FIRE RESEARCH ORGANIZATION

IMPORTANCE OF DOORS AND WINDOWS IN FIRES IN DOMESTIC DWELLINGS

by

R. E. Lustig

Summary

An examination has been made of over 250 research reports on fires in domestic premises in order to ascertain whether or not they provide support for the belief that doors and windows should be closed as a fire spread precaution. Unfortunately only some thirty of these reports indicated the state of doors and windows at the time of the fire, but from these it appears that, in general, doors and windows should be left closed in order to diminish the risk of fire spread. The major exception to this rule is in the case of rooms occupied by children, invalids or old people, where early discovery is of primary importance.

December, 1958.

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It is often suggested that closed doors and windows will retard the spread of a fire, or even cause its extinction through oxygen starvation. A study has therefore been made of research reports on fires in dwellings over a period of five years in order to see whether they give any indication of the validity of this suggestion. Unfortunately, although over 250 reports were examined, only some thirty made any mention of whether doors or windows were opened or closed; consequently it was not possible to make a statistical analysis, particularly in view of the fact that the research reports themselves represented such a small sample of all domestic fires, and probably one heavily biased towards the unusual. None the less it is felt that the analysis threw up some interesting data in the form of case histories.

2. OXYGEN STARVATION

It has been found, both in accidental fires and in experiments, that fires can occur in closed rooms and burn for considerable periods without spreading. Occasionally these fires burn themselves out as is shown by the following report summaries:-

- A. Couple retired to bed about midnight closing the windows and door of the living room which was directly under their bedroom. Between 0300 and 0400 the husband was out on the landing and noticed no smoke. At 0630 he went downstairs and found a fire had occurred during the night, completely consuming the settee, leaving only ash and springs; paint-work was badly blistered and other furniture was damaged by heat. The room had returned to normal temperature. (Plate I)
- B. Fire in living room severely damaging an armchair, carpet, lino, floor boards and fibre board partition. Doors and windows were closed and family had no intimation of what had happened during the night. The fire was out when discovered.

On other occasions fires burn undetected for some time but remain quite small:-

- C. Family retired to bed about 2300, leaving the living room door closed. On waking next morning the lino of the bedroom, which was directly above the living room, felt warm, though the fire was not discovered till the living room door was opened at about 0605 hours. By this time the fire had destroyed a three piece suite and caused severe damage by heat and smoke to other furniture and decorations, but it was still small enough to be extinguished with buckets of water without resort to the Fire Brigade.

3. DANGERS OF CLOSED DOORS

(a) Asphyxiation and impeded escape

There are some dangers in closed windows and doors which are exemplified by other reports. A confined space by its very nature provides a hazard, particularly to occupants of a room in which fire occurs, by increasing the risk of asphyxiation and impeding escape:-

D. Three children were left unattended in a living room while the mother went shopping. When she returned after a period of about half an hour she found the room smoke-logged, and the children, aged 2, 3 and 4, lying on the carpet. The fire was confined to the room of origin and several items of contents, including a Christmas tree, were unburned, BUT on arrival at hospital the children were found to have been asphyxiated.

(b) Delayed discovery

The closing of doors and windows will tend to postpone the discovery of a fire and this again may increase the danger of asphyxiation.

E. A fire occurred in an unventilated, ground floor living room, probably at about 0200 hours, and was not discovered until about 1130 hours by a laundry man. The fire had reduced to ash all combustible furniture within a six foot radius of the corner in which it originated and heat had cracked the stone floor and blistered the remaining furniture. The fire was confined to room of origin BUT a woman of 76 was found asphyxiated on the first floor. She was fully dressed and had probably been dead for some hours.

Delay in discovery may also increase danger to persons, in particular babies who cannot fend for themselves, by prolonging the period during which they are exposed to risk:-

F. Fire in a baby's room caused by hot ember falling down a disused fireplace which had a common flue with an anthracite boiler. Everything was normal at 2200 hours with door and windows closed, and nothing unusual was noticed when father left the house at 0600 the following morning, nor when mother got up about 0700 and proceeded with normal chores. At 0820 a neighbour pointed out that windows and curtains were blackened. A fire was then discovered, which had severely damaged about 25% of the room and contents, and damaged the rest by heat and smoke. The fire had evidently burnt slowly for some hours and was confined to the room of origin, BUT a child aged two was found in his collapsed cot so severely burnt that cause of death was unestablished.

4. FLASH-OVER AND SPREAD

Perhaps the most alarming danger associated with delay in discovering a confined fire is the rapid spread that is possible should the discovery cause a flash-over to occur. Some ten of the reports examined record such events, but as research reports are called for mainly in cases of serious fires, they cannot be regarded as an unbiased sample. Typical examples are:-

G. Wife awakened in the early hours of the morning by smoke and the smell of burning. She went to the living room where she discovered a fire; she then rushed out through the living room and kitchen to the back door, shouted for help and ran back upstairs leaving all the doors open. When the brigade arrived some three minutes later they found the downstairs well alight with the front windows out and flames coming through, and the stairs impassable. The mother had jumped out of a bedroom window and sustained a severe back injury; the father was found unconscious upstairs and suffered severe burns; the nine year old daughter was also rescued from a bedroom but died shortly after admission to hospital.

- H. Parents were awakened at about 0710. Mother ran downstairs and opened the living room door, whereupon a flash-over occurred. She ran out of the front door leaving both doors open. Fire and heat swept up the well-type staircase, making it impassable. Father and four children escaped from one bedroom window but two other children aged 20 and 7 were burnt to death.

It seems from the research reports that the danger of rapid spread is particularly severe if the room in which fire occurs is downstairs, so that stairs can act as a chimney.

5. LARGE FIRES CONFINED BY CLOSED DOORS

Unfortunately there was no instance reported of a door being closed after a fire had been discovered, so it is impossible to give an example of what would happen under such circumstances. However, it seems reasonable to assume that even if flash-over occurs as a door is opened, it is still possible to contain the fire, at least for some time, by closing the door again. This is supported by the following reports:-

- I. Fire in the kitchen of a tenement building originated between 0100 and 0200. Discovered about 0520 when occupier was awakened by heat and smoke. On opening the kitchen door he discovered a "raging inferno." The fire had already flashed-over and vented itself through the window, but was still confined to the room of origin, until the occupier ran out leaving both kitchen and main door open. In this instance the wife, who slept in the kitchen, was asphyxiated in her sleep.
- J. Fire originated in back room on first floor (lower floor of maisonette) and spread rapidly through the open doorway, up the stairs and through open doorways to two bedrooms, where four people died. It did not, however, spread to two rooms with closed doors on the first floor, from one of which two persons were rescued, though both rooms were affected by heat and smoke.

6. SPREAD DUE TO OPEN DOORS OR WINDOWS

(a) Internal

Rapid fire spread when doors and windows were left open was described in a number of reports. Again stairs seem to have provided a dangerous flue:-

- K. Fire originated in front ground floor room at night. By the time the occupants in the rear upstairs room were awakened by heat, the fire had spread through the open door and the stairs were impassable. A couple had to be rescued.
- L. Another night fire in a living room with its door open spread extremely rapidly. At 0455 there was no outward sign of fire, but by 0500 the stairs were well alight, and by 0519 when the brigade arrived (delayed by fog) intense flame was issuing from all windows with the exception of scullery and bathroom. Parents and six children aged between 4 and 21 had to escape from upstairs windows, whilst four others aged 2½ to 13 were burnt to death.

(b) External

Whilst the main danger would appear to be from internal doors being left open and facilitating the spread of fire, it is evident that the leaving open of external doors can also have serious repercussions, particularly if the wind fans the flames:-

M. Fire occurred in the living room of a prefabricated house. A neighbour evacuated two children, but left back door to kitchen and communicating door to living room open. "A gale force wind encouraged what at this time was a comparatively small fire to spread rapidly through the two rooms, so much so that on returning with assistance only minutes after having left the building the neighbour was unable to enter the kitchenette." All timber fittings including doors in the rooms were completely destroyed.

Though no report makes mention of it, it seems fair to assume that similar results would be achieved by leaving a window open. It is interesting to note that doors were completely consumed by fire, which tends to suggest that in a traditional dwelling the fire could have spread through the door and upstairs.

On the other hand, experiments have shown that it is possible for even a moderate wind to blow out an incipient fire, such as a fire in a wastepaper basket.

7. DIRECTION OF SPREAD

Draught may have an effect on the direction of a fire. One excellent example of this is provided in the following report:-

N. Fire in lobby common to a pair of flats in a tenement building. The lobby opened onto a landing and this door was open. Immediately at right angles to this opening was the closed door to the front flat, while the door to the rear flat was some six feet away at the other end of the lobby. The fire started near the opening onto the landing. The occupier of the rear flat discovered the fire, and as he opened his door the fire burnt towards him. One child aged 2 died and three others received burns in the rear flat, which was slightly damaged by fire, while the front flat, which although nearer the origin of the fire remained cut off from it throughout by a closed door, received only heat and smoke damage.

8. CONCLUSIONS

Although this Note does not provide statistical proof, it does show that open doors and windows may assist the spread of fire, and that in general, closed doors and windows prevent the fire developing. The increased generation of noxious gases with badly ventilated fires increases the risk to the occupants of the room in which they start.

It has been shown that in some circumstances fire can be starved of oxygen in rooms with closed doors and windows to such an extent that they may even burn out, or at least remain relatively small. Even in cases where fires have reached considerable magnitude, and flashed-over, closed doors may prove to be satisfactory fire breaks, either confining the fire to the room of origin, or excluding it from occupied rooms. This is particularly important at night when sleepers might be overtaken by the spread of fire before awakening. On the other hand, open doors may encourage the spread of fire by providing a through draught, particularly in the case of downstairs rooms opening onto halls and stairs.

In deciding that, generally, it is advisable to close doors and windows, it is necessary to bear in mind that such a procedure is liable to delay discovery of fires and hence possibly to increase the financial loss, but it is felt that safety of human life takes an overriding precedence. In the case of rooms in which there is a fire hazard and which are occupied by children, elderly persons or invalids, it is probably desirable for doors to be left open, the prevention of fire spread taking second place to providing the occupants with a means of escape, and facilitating early discovery.

Early discovery might also be facilitated by the installation of simple fire alarms, particularly in living rooms and kitchens where fires often occur after the occupiers have retired for the night and may burn for considerable periods undetected.



PLATE 1. LIVING ROOM WITH CLOSED DOORS AND WINDOWS, IN WHICH FIRE BURNT ITSELF OUT. LEFT FOREGROUND REMAINS OF SETTEE. CENTRE WALL, MARKS SHOWING POSITION OF CHAIR AND CHINA CABINET WHICH WERE ONLY BLISTERED.

**Photo by permission of the Chief Officer of
Liecestershire and Rutland Fire Brigade.**

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