

## Epidemiology and Management outcome of Burn Injury in Jordanian Hospitals

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### Abstract

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**Background:** The WHO reported there were more than 7.1 millions fires globally, which classified as unplanned burns in 2004, giving an overall occurrences rate of 110 percent or **100,000** per year. Burns are ranked fourth in all injuries, and are accountable for more than 265,000 deaths worldwide. **Purpose:** this study aims to determine the basic epidemiological characteristics of burn injuries at the patients in northern and central Jordanian districts, and the burn management outcomes. **Techniques:** A general sectional study was done over a period of four months, between the 1<sup>st</sup> of December, 2016 and 31 of March, 2017, to analyze 200 consecutive patients admitted to two governmental and two university hospitals in the northern and central districts of Jordan .Cases were tracked to evaluate patients' medical management outcomes; until the end of June 2017, with a total sample size of (193) patients. **Results:** The study reveals that more than half of burn patients (52. 8%) were males, the largest age group (35.2%) affected was age (1-10 year), the majority (89.1%) of the burns were accidental, and (71.0%) reached hospitals less than 24 hours. Half of the burns (50.5%) were due to scalds, (58.0%) had second degree burns, (88.6%) of burns occurred at the household of patients, and the most common Arabian first aid medication used for burns, was red ointment with (82.6%). There is a significant relationship between socio-demographics (age, marital status, educational level) and burns extent. The study also reveals that children are the most common groups of burn injuries, and the majority of patients used improper myths as a first aid cure for burns. The study recommended that pouring water directly on burn injuries of the victims to bump it off, should be communicated publicly using multi-media, such as radio and TV, and also recommended that professionals in the burn injuries should be united to develop and implement burn prevention programs, mainly targeting the high risk groups, such as children.

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**Keywords:** Epidemiology, Burn, injuries, management, outcome, Jordanian hospitals

### Background

The WHO reported that there were more than 7.1 million fires globally, which classified as accidental burns in 2004, giving an overall occurrences rate of 100,000 per year<sup>1</sup>. Burns are ranked fourth in all injuries, and are accountable for more than 265,000 deaths worldwide.<sup>2</sup> Globally, there are close to (90%) of the burn injuries occurs at the low and middle income classes of undeveloped countries, such as Jordan, and this burden is a result of the terrible financial situations and the work demands, as well as significant devastating effects, not only for the patients themselves, but also their families. Medical advances in burn care didn't prevent the fact that burn injuries frequently cause deaths, long hospitalization, multiple surgeries, long term physical and psychological trauma, lifelong deformity, and poor quality of life. That is why burn is often tagged as a major public health problem<sup>4, 5</sup>.

### Significance of Problem:

The severity of burns trauma and its devastating consequences were the motive to conduct this study. Despite the many advancements in Jordanian medical fields, burn injuries remains a challenging problem, due to lack of infrastructure and trained professionals; largely in the peripheral districts, as well as the increased cost of treatment, where all of them have an impact on the outcomes.

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There isn't any available information related to the epidemiological characteristics and injury outcomes among the burned patients, as part of the medical aspects of Jordan. There are only few dependable published studies were done on the characteristics of burned patients and the proper methods used to cure their injuries<sup>6,7,8</sup>, where the studies that used dependable data from hospital records goes under the typical limitations of accurateness and completeness, therefore the occurrence rates based on hospital data are more likely to be different from the actual rate of medically treated burn injuries. The present study was undertaken in the major hospitals in the northern and middle Jordanian districts to determine specific epidemiological variables and burn management outcome. The demographics, environmental and risk factors for burns vary in different societies; therefore there is a need for adequate epidemiological knowledge of burns in Jordan<sup>9</sup>. In addition, The study found that whenever the cold season begin, households are more likely to use kerosene, diesel, or clean gas heaters for heating and cooking, instead of electric heaters because its expensive, and that family members; more likely will spend most of their times inside during the winter, and that will explain the increase in burn injuries; mainly among children. This study aims to determine the basic epidemiological characteristics of patient burn injuries in the northern and central Jordanian districts and burn management outcomes. The results of this study can be useful for the prevention of burn occurrences, and to aid the planning of educational programs and burn care facilities.

### **Methodology:**

An approval from the Institutional Ethics Committee was obtained, and a general sectional study was done over a period of four months, between the 1<sup>st</sup> of December, 2016 and 31 of March, 2017, to analyze 200 consecutive patients admitted to two governmental and two university hospitals in the northern and central districts of Jordan. Cases were tracked to evaluate patients' medical management outcomes until the end of June 2017, with seven patients refused to participate in the study, and they were excluded from the total sample size of (193) patients. Epidemiological data of this study were selected based on previous literatures that investigated the same problem<sup>10,11,12</sup>. The socio-demographic data includes: Sex, age, marital statuses, educational levels, socio-economic statuses, medical insurance, and residence, and the injury circumstances includes: cause of injury, mode of injury, place of burn incident, facility level, and duration before hospital arrival. The clinical assessment of burn surfaces were done in the form of degree/depth for the total body surface area (TBSA) of the burn site, and depth of burns were divided into first, second, and third degree burns. Moreover, Wallace's rule of nine in adult and Lund & Browder chart in pediatrics ages were used to define the extent of burns<sup>13</sup>. Medical management of burns was determined by: pre-hospital remedy, fluid given, dressing type, skin graft surgery, and physiotherapy. Data were obtained through the distributed questionnaire, by conducting interviews, either with the patient themselves or the patient's attendants, and collecting data from the patients' files themselves. The inter-relationships of socio-demographic data with burn depth and burn extent were investigated, and the Statistical Package for the Social Science (SPSS) was used for data entry, data management, and analyses, with significance level of ( $p < 0.05$ ).

### **Results:**

#### **1. Socio-demographic Data:**

The study sample consisted of 193 patients. More than half (52.8%) were males. The predominant age group of patients was for young ages (55.4%) between one to twenty years. The majority (64.2%) were single and from urban district (79.7%). Nearly half of patients (41.6%) were unable to read and write. Table (1) shows the descriptive statistics of the entire socio-demographics:

**Table (1): Frequencies of Socio-demographic Status**

Variable	Group	Frequency	Percentage %
Sex	Male	102	52.8
	Female	91	47.2
	Total	193	100.0
Age	0-1 year	18	9.3
	1-10 years	68	35.2
	11-20 year	21	10.9
	21-30 year	37	19.2
	31-40 year	26	13.5
	41-50 year	6	3.1
	>50 year	17	8.8
	Total	193	100.0
	Marital Status	Married	63
Single		124	64.2
Divorced		2	1.1
Widowed		4	2.1
Total		193	100.0
Educational Level	Graduate school	10	5.2
	Baccalaureate (BA)	21	10.7
	High School	12	6.2
	Preparatory school	32	16.6
	Elementary school	38	19.7
	Unable to read or write	80	41.6
	Total	193	100.0
Family Income/month	501 $\geq$	117	60.6
	< 500	76	39.4
	Total	193	100.0
Medical Insurance	No	103	53.4
	Yes	90	46.6
	Total	193	100.0
Residence	Urban	153	79.7
	Rural	40	20.3
	Total	193	100.0

## 2. Burn Circumstances:

The majority (89.1%) of burns were accidental, while reached lowest percentage (5.2%) for the burns were homicidal. Regarding the mode of injury the half (50.3%) for scald, then followed by the percentage (41.5%) for flame burn, while reached lowest percentage (1.0%) for chimney. The highest percentage of sample study answers about the place of burn incident (88.6%) at home, while reached lowest percentage (5.2%) for others. Most of burn cases (143) by percentage (74.1%) were admitted in governmental burn units, while the rest in university hospital units (25.9%). Finally the majority of burned cases (71.0%) reached hospitals less than 24 hours, while the lowest percentage (11.9%) for those reached more than 72 hours (Table 2).

**Table (2): Frequencies of Burn Circumstances**

Question	Answer	Frequency	Percentage %
Cause of Burn	Accidental	172	89.1
	Homicidal	10	5.2
	Suicidal	11	5.7
	Total	193	100.0
Mode of Burn Injury	Flame burn	80	41.5
	Stove bursting	3	1.5
	Chimney	2	1.0
	Liquid Petroleum Gas (LPG)	4	2.1
	Scald	97	50.3
	Chemical	4	2.1
	Electrical	3	1.5
	Total	193	100.0
Place of Burn Incident	At home	171	88.6
	At work	12	6.2
	Others	10	5.2
	Total	193	100.0
Facility Level	Governmental Burn Unite	143	74.1
	Academic Burn Unite	50	25.9
	Total	193	100.0
Duration before Arrival	<24 hour	137	71.0
	24-72 hour	33	17.1
	>72 hour	23	11.9
	Total	193	100.0

### 3. Clinical Assessment of Burn Surface:

Regarding depth of burn injuries, more than half of the burn cases (58.0%) were classified as second degree, and then followed by third degree (34.7%), while the lowest (0.5%) for the unspecified degree, and in relation to the extent of burn, a majority of burn cases (73.6%) for the extent (0-20%), and finally for the burn site, (28.5%) for the upper limbs site, then followed by (26.4%) for the lower limbs, while lowest percentage reached (0.5%) for internal organs, as it shows in table (3).

**Table (3): Clinical Assessment of Burn Surface**

Question	Answer	Frequency	Percentage %
Depth of burn	Unspecified Degree	1	0.5
	First degree	13	6.7
	Second degree	112	58.0
	Third Degree	67	34.7
	Total	193	100.0
Extent of Burn	0-20%	142	73.6
	21-40%	32	16.6
	41-60%	9	4.7
	> 60%	10	5.2
	Total	193	100.0
Burn Site	Head	25	13.0
	Trunk	22	11.4
	Upper limbs	55	28.5
	Lower limbs	51	26.4
	Multiple sites	39	20.2
	Internal organs	1	0.5
	Total	193	100.0

**4. Medical Management of Burn Injury:**

Majority of patients (82.9%) used red ointment (Arabic Medicine) made at home by some people as a treatment for burn. Followed by the percentage (6.7%) for the pre-hospital remedy water, while lowest percentage reached (0.5%) for eggs. Regarding adequacy of fluid given, most of patients (78.8%) received adequate fluid, while lowest percentage reached (4.7%) for those received inadequate fluid. Majorities (85.5%) of patients were managed by close dressing, while the remaining (14.5%) for open dressing, and majority (79.3%) didn't develop wound sepsis. In addition only (10.4%) developed skin contracture, where nearly half (46.6%) of the patients need no skin graft while the lowest percentage of (7.8%) for those who didn't indicated skin graft. Skin grafts were done early for (8.3%) of patients while (37.3%) had late skin graft. More than half (53.3%) of patients received physiotherapy, while the lowest percentage reached (5.2%) for assigned physiotherapy, but not done.

**Table (4): Medical Management of Burn Injury**

Question	Answer	Frequency	Percentage %
Pre-hospital Remedy	Honey	3	1.6
	Water	13	6.7
	Oil	2	1.0
	Oil and honey	12	6.2
	Eggs	1	0.5
	Honey and eggs	2	1.1
	Red Ointment	160	82.9
	Total	193	100.0
Fluid Given	Adequate	152	78.8
	Inadequate	9	4.6
	Not Applicable	32	16.6
	Total	193	100.0
Dressing Type	Open	28	14.5
	Closed	165	85.5
	Total	193	100.0
Wound Sepsis	Yes	40	20.7
	No	153	79.3
	Total	193	100.0
Skin Contracture	Yes	20	10.4
	No	173	89.6
	Total	193	100.0
Skin Graft	Done early	16	8.3
	Late	72	37.3
	Indicated not done	15	7.8
	Not indicated	90	46.6
	Total	193	100.0
Physiotherapy	Done	80	41.5
	Indicated but not done	10	5.2
	Not indicated	103	53.3
	Total	193	100.0

**5. Association of Burn Depth With Socio-demographics:**

Chi-Square test was used to figure out the association of socio-demographics with burn depth. The values of Chi-Square for (Sex, age, marital status and educational level) is (2.318, 15.871, 4.084, 21.645) respectively, and these values weren't significant at the significance level ( $\alpha \leq 0.05$ ), this shows that there were no relation between these socio-demographics variables and burn depth. On other hand the value of Chi-Square for place of burn incident was (21.728). This value was significant at the significance level ( $\alpha \leq 0.05$ ), this show that there is relation between the place of burn incident and burn depth (Table5).

**Table (5): Association of Socio-demographics With Burn Depth**

Variable	Group	Depths				Total N (%)	Chi-square	P-value
		Unspecified Degree N (%)	1 <sup>st</sup> Degree N (%)	2 <sup>st</sup> Degree N (%)	3 <sup>st</sup> Degree N (%)			
Sex	Male	1(0.5%)	8(4.1%)	55(28.5%)	38(19.7%)	102 (52.8%)	2.318	0.509
	Female	0(0.0%)	5(2.6%)	57(29.5%)	29(15.0%)	91 (47.2%)		
Age	0-1 year	0(0.0%)	1(0.5%)	14(7.3%)	3(1.6%)	18 (9.3%)	15.871	0.602
	1-10 years	1(0.5%)	4(2.1%)	40(20.7%)	23(11.9%)	68(35.2%)		
	11-20 year	0(0.0%)	1(0.5%)	8(4.1%)	12(6.2%)	21(10.9%)		
	21-30 year	0(0.0%)	4(2.1%)	19(9.8%)	14(7.3%)	37(19.2%)		
	31-40 year	0(0.0%)	2(1.0%)	18(9.3%)	6(3.1%)	26(13.5%)		
	41-50 year	0(0.0%)	1(0.5%)	4(2.1%)	1(0.5%)	6(3.1%)		
	>50 year	0(0.0%)	0(0.0%)	9(4.7%)	8(4.1%)	17(8.8%)		
Marital Status	Married	0(0.0%)	4(2.1%)	35(18.1%)	24(12.4%)	63(32.6%)	4.084	0.906
	Single	1(0.5%)	9(4.7%)	72(37.3%)	42(21.8%)	124(64.2%)		
	Divorced	0(0.0%)	0(0.0%)	1(0.5%)	1(0.5%)	2(1.0%)		
	Widowed	0(0.0%)	0(0.0%)	4(2.1%)	0(0.0%)	4(2.1%)		
Education Level	Graduate school	0(0.0%)	0(0.0%)	6(3.1%)	4(2.1%)	10(5.2%)	21.645	0.117
	Baccalaureate (BA)	0(0.0%)	6(3%)	11(5.6%)	4(2.1%)	21(10.7%)		
	High School	0(0.0%)	1(0.5%)	10(5.2%)	1(0.5%)	12(6.2%)		
	Preparatory school	0(0.0%)	0(0.0%)	17(8.8%)	15(7.8%)	32(16.6%)		
	Elementary school	0(0.0%)	2(1.0%)	20(10.4%)	16(8.3%)	38(19.7%)		
	Unable to read or write	1(0.5%)	5(2.6%)	47(24.4%)	27(14.1%)	80(41.6%)		
Place of burn incident	At home	1(0.5%)	8(4.1%)	100(51.8%)	62(32.1%)	171(88.6%)	25.728	0.00*
	At work	0(0.0%)	5(2.6%)	5(2.6%)	2(1.0%)	12(6.2%)		
	Others	0(0.0%)	0(0.0%)	7(3.6%)	3(1.6%)	10(5.2%)		

\*significant at significant level ( $\alpha \leq 0.05$ )

#### 6. Association of socio-demographics with burn extent:

Chi-Square test was used to discover the association of socio-demographics with burn extent. The values of Chi-Square for (Sex and place of burn incident) were (0.976, 6.864) respectively, these values were not significant at the significance level ( $\alpha \leq 0.05$ ). On other hand, the value of Chi-Square for (age, marital status, educational level) (41.094, 19.121, 25.215) respectively, this values significant at the significance level ( $\alpha \leq 0.05$ ) as shown in (Table 6)

**Table (6): The Association of Socio-demographics With Burn Extent**

Variable	Group	Extent				Total N (%)	Chi-square	P-value
		0-20% N (%)	21-40% N (%)	41-60% N (%)	>60% N (%)			
Sex	Male	76(39.6%)	15(7.8%)	4(2.1%)	6(3.1%)	101(52.6%)	0.976	0.807
	Female	65(33.9%)	17(8.9%)	5(2.6%)	4(2.1%)	91(47.4%)		
Age	0-1 year	18(9.4%)	0(0.0%)	0(0.0%)	0(0.0%)	18(9.4%)	41.094	0.001*
	1-10 years	56(29.2%)	9(4.7%)	1(0.5%)	1(0.5%)	67(34.9%)		
	11-20 year	14(7.3%)	4(2.1%)	1(0.5%)	2(1.0%)	21(10.9%)		
	21-30 year	18(9.4%)	12(6.2%)	2(1.0%)	5(2.6%)	37(19.3%)		
	31-40 year	18(9.4%)	4(2.1%)	3(1.6%)	1(0.5%)	26(13.5%)		
	41-50 year	4(2.1%)	0(0.0%)	2(1.0%)	0(0.0%)	6(3.1%)		
	>50 year	13(6.8%)	3(1.6%)	0(0.0%)	1(0.5%)	17(8.9%)		
Marital Status	Married	39(20.3%)	16(8.3%)	5(2.6%)	3(1.6%)	63(32.8%)	19.121	0.024*
	Single	97(50.5%)	16(8.3%)	3(1.6%)	7(3.6%)	123(64.1%)		
	Divorced	1(0.5%)	0(0.0%)	1(0.5%)	0(0.0%)	2(1.0%)		
	Widowed	4(2.1%)	0(0.0%)	0(0.0%)	0(0.0%)	4(2.1%)		
Education Level	Graduate school	7(3.7%)	2(1.0%)	0(0.0%)	1(0.5%)	10(5.2%)	25.215	0.047*
	Baccalaureate (BA)	14(7.3%)	5(2.4%)	2(1.0%)	0(0.0%)	21(10.7%)		
	High School	11(5.8%)	1(0.4%)	0(0.0%)	0(0.0%)	12(6.2%)		
	Preparatory school	19(9.9%)	9(4.6%)	1(0.5%)	3(1.5%)	32(16.6%)		
	Elementary school	22(11.4%)	8(4.1%)	5(2.6%)	3(1.6%)	38(19.7%)		
	Unable to read or write	68(35.2%)	8(4.1%)	1(0.5%)	3(1.6%)	80(41.6%)		
Place of burn incident	At home	125(65.1%)	28(14.6%)	9(4.7%)	8(4.2%)	170(88.5%)	6.864	0.334
	At work	9(4.7%)	3(1.6%)	0(0.0%)	0(0.0%)	12(6.2%)		
	Others	7(3.6%)	1(0.5%)	0(0.0%)	2(1.0%)	10(5.2%)		

\*significant at significant level ( $\alpha \leq 0.05$ )

**Discussion:**

This is the first prospective study conducted among Jordanian burned population, moreover the first study that tracked medical management outcomes. The male–female ratio shows slight prevalence of male patients, which correlates with the findings of other studies<sup>10,12,15,16</sup>. This result contrasted with other study<sup>14</sup>. Regarding age group, burn injury incidence was predominant in children, similar to other studies<sup>5,12</sup>. This result could be explained that in Jordan, middle and low socio-economic status families usually uses kerosene stoves in winter for heating, boiling water and sometimes for cooking in sitting rooms were children usually play. Like other studies, socio-economic statuses leading to burn injury were reported, especially from low-and middle-income<sup>10,18</sup>. In addition, developing this age group characterized by rapid motor development, which isn't proportional to their cognitive development<sup>17,18</sup>.

This result agree with the fact that children play regularly around their mothers, especially when they use stoves for cooking or boiling water, and that's risky, and this finding is similar to other studies, where illiteracy increases the risk of burn injuries <sup>10,12,17</sup>, but other studies showed that maternity and parenting education raises mother awareness and understanding about childhood burns. <sup>19</sup>

Regarding burn circumstances, the majority of burn injuries were accidental and occurs at the residence of those patients, and this finding is similar to most of the studies reviewed <sup>10,12,15,16</sup>, where women found themselves involved in multiple tasks, such as preparing meals while caring for their children. The study found that whenever the cold season begin, households are more likely to use kerosene, diesel, or clean gas heaters for heating and cooking, instead of electric heaters because its expensive, and that family members; more likely will spend most of their times inside during the winter, and that will explain the increase in burn injuries, mainly among children. The injuries, causalities, and deaths related to chemicals and electricity were uncommon, but the greater part of burn injuries were caused by scalds, and followed by flame. This results were similar to the previous studies <sup>20,21</sup>, but other studies found that flame burns were more common<sup>10,11</sup>, and found that most patients who treated at governmental burn units were of middle and low socio-economic status, who can't afford university burn units. The majority (71%) of patients arrived less than 24hr after injury, while (11.9%0) arrived more than 72 hr after burn injury.

This indicates high level of knowledge among patients and their guardians about seriousness of burn injury. On other hand, delayed patients may indicate financial constraints and depending on home traditional healers<sup>10,19</sup>. In terms of burn depth and extent, most of patients were categorized as second and third degree burns. This result could be explained as burn units are specialized in treating deep burns while managing the external burns in out-patients clinic, or emergency rooms. The study results were consistent with other studies<sup>10,11</sup>, and found that most parts affected by the burns were at the upper limbs, followed by the lower limbs. These findings were similar to some studies<sup>10,19</sup>, but differed from other studies, which found that place most frequently burnt was the trunk with (39%)<sup>14</sup>. In addition, the common burn sites, at the upper limbs in children could be due to their low awareness, slow responsiveness, and development phases which represented in the crawling, climbing, or standing position<sup>19,22</sup>.

In regards to medical management the majority (82.9%) of patients applied the "red ointment" as a pre-hospital first aid. It is an Arabic Medicine made at home by some people as a treatment for burn. The exact elements and amounts unknown, as this is the secrets of who made this ointment "the secret of workmanship". Many patients in Jordanian population convinced in using this ointment as an effective medicine for all degrees of burn, with only (6.7%) used water, which is a reflection to the lack of our knowledge about the proper first aid for burn injuries. In one study, cool water was applied to the burned areas<sup>19</sup>, while other study confirmed that honey is the most common used agent, as first aid<sup>10,21</sup>. The Majority (78.8%) in this study received sufficient amount of fluids, with the early arrival of patients contributed to this finding, and most patients were managed with close dressing. Wound sepsis made (20.7%) of the burn injuries, and the use of inappropriate first aids and wound contamination may led to this percentage of wound sepsis<sup>10,19</sup>, while (10.4%) of patients developed skin contractures, which may be the result of delayed physiotherapy treatment, due to late arrival, and as a result physiotherapy was often done in patients who had already developed contractures. In addition patients who didn't receive adequate fluids and early skin grafting may contribute to develop these complications<sup>10</sup>.

Most burn cases involve a process of rebuilding, grafting, and connecting the skin, which increase with the size and depth of burns, but this grafting was performed for (46.6%) of the cases, and this could be explained with the majority of burned patients who received treatment within 24 hrs, giving the chance for proper healing process without any difficulties, such as joint contractures, unstable scars, visible deformities, and impaired sensations<sup>10,23</sup>. In addition, making decisions on whether to perform a surgery or not; for burn injuries requires further clinical examinations and confirmations, and this leads to late skin grafting at only (37.8%), with more complication in the healing process, and physiotherapy was performed for (41.5%) of those patients who were vulnerable to develop contracture, or already developed it, due to delayed arrival, lack of fluid, or wound sepsis. These results were consistent with other studies<sup>10,19,23</sup>

To investigate the relationships between socio-demographics and burn depth and extent, the value of Chi-Square for place of burn incident was(21.728), and its significant at level ( $\alpha \leq 0.05$ ), which shows a relationship between the place of burn incident and burn depth, while age, marital status, and educational level were significantly associated to extent of burn injury. These results indicate the importance of further investigation for the influence of these variables on burns depth and extent.

### **Conclusion:**

Recent studies revealed that children are the frequent targeted group of burn injuries, which considers one of the primary causes for diseases and deaths. Majority of the participants uses improper traditional first aids to treat burns, and the significance of pouring water directly on burn injuries of the victims to bump it off, should be communicated publicly using multi-media, such as radio and TV. In addition, professionals in the burn injuries should unite to develop and implement burn prevention programs, mainly targeting the high risk groups, such as children.

The study strength lies in its feasible nature and actual assessment of burn cases, by the researcher, but its weaknesses are related to the proportions and numbers of accidents, casualties, and deaths, that weren't estimated accurately, because it didn't include patients who died at the scene, who visited private hospitals, who used the alternative medicine, or who treated themselves, without visiting a hospital or a doctor.

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