CHAPTER 8

Web-based Medical Informatics: A study†

8.1. Introduction

Fever is one of the most common health problems we face throughout the total span of our life. It is a familiar childhood crisis faced by medical practitioners, nurses and parents in both hospital and community settings. Fever means that the body temperature is higher than normal. The average normal body temperature is 98.6^0 F. Children's fever may be one of the most alarming and at the same time most beneficial health matters that parents face. Fever itself is not an illness but is a sign that the body is fighting an infection. In fact fever is a natural reaction by the body to defend itself when infected by bacteria or viruses. Fever develops when the brain instructs the muscles to work harder to produce heat; the blood vessels near the skin restrict to help retain the heat, and the result is a temperature too high for many harmful bacteria or viruses to survive [1].

Despite its frequently benign nature, the presence of fever in children continues to spark fear in the hearts of parents and health care practitioners alike. In fact, fever is one of the most common paediatric problems, accounting for 25%-30% of emergency department and clinic visits each year [2-4].

Usually parents in most situations try to manage the problems during the fever of their children. Concerns about childhood fever arise, in part, from the belief that fever is a disease rather than a sign of illness. Viewing fever in this way leads to misconceptions on the part of parents regarding its role in illness, which may foster anxiety about its potential harmful effects. Ultimately, concern about fever can lead to excessive monitoring and treatment by parents/home-care providers. Although it is one of the most common problems relatively harmful [5] but, however, parents' fear and misconceptions about fever lead them take unnecessary aggressive steps and inappropriate call to doctors [6]. Educational programmes on pediatric fever management for parents

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have been shown to decrease the misuse of antipyretic drugs and inappropriate call to doctors for visit the child [7-9].

It's important to remember that by itself fever is not an illness - it's usually a symptom of an underlying problem. Fever has several potential causes:

(a) Infection: Most fevers are caused by infection or other illness. Fever helps the body fight infections by stimulating natural defense mechanisms.

(b) Overdressing: Infants, especially newborns, may get fevers if they're over bundled or in a hot environment because they can't regulate their body temperature.

(c) Immunizations: Babies and children sometimes get a low-grade fever after getting vaccinated.

Fever remains one of the most common reasons why parents seek medical attention for their child. It is the primary complaint of 30% of patients seen by pediatricians in practice and the cause of as many as 50% of after-hours calls [10-11]. In the recent years, with the advent of Internet and World-Wide-Web (WWW), parents can have more information on the management of pediatric fever at home. There is no doubt that the parent oriented medical information disseminated through WWW is useful. But, however, it might not be possible for a parent to go through all the relevant web-sites for dealing a particular problem of his/her children. Not only that, as it is a question of 'life and death', the quality of information should be, at least, 'do not harm'. The amount of information about fever that is available to parents is tremendous. In light of the huge amount of available information, parents need to have a firm understanding of fever, its role in illness and to equip themselves with up-to-date advice.

Three aspects of management can be addressed: (i) accurate measurement of temperature (ii) proper identification of associated sign & symptom, and (iii) acquainted with practice to follow for treating the child at home.

The prime objectives of our approach are (i) mitigating the lack of inadequate human experts in the domain, (ii) elimination of fever phobia among parents and (iii) educate parents to manage the febrile child.

In this work, we intend to present a comprehensive study of the web-sources on the basis of published guidelines to parents for managing fever at home supplied by El-Radhi and Carroll [12]. It is also intended to explore how far a site is equipped with the required information for the management of fever of children. In section 8.2, the physiology of fever, as contrasted with heat illness or hyperthermia is discussed. Section 8.3 presents the concept of fever phobia. Section 8.4 statistically describes arguments for and against the web-sites advocating child fever management at home. Section 8.5 describes the outcome of the study and lastly, in section 8.6 conclusions are summarized.

8.2. Physiology of fever

Fever is a complex physiologic response to disease mediated by pyrogenic cytokines and characterized by a rise in core temperature, generation of acute phase reactants, and activation of immune systems [13]. Fever is not a haphazard response but a well-designed weapon that the body uses to fight infection. Most pediatric specialists define fever as a rectal temperature greater than 38.0°C (100.4 F) or an oral temperature above 37.8°C (100 F) [14]. Fever can have a multitude of causes, including infections, vasculitic syndromes, central nervous system disorders, neoplasms, poisonings, immunization or drug reactions, dehydration, and heat stroke [14]. Fever is typically defined as follows: [15-16]

- Rectal temperature greater than 38° C (100.4° F)
- Tympanic temperature greater than 38° C (100.4° F)
- Oral temperature greater than 37.8° C (100° F)
- Axillary temperature greater than 37.2° C (99° F)

It is important to remember that diurnal variation may allow temperature to change as much as 1°C (1.8°F) over 24 hours, typically peaking in the early evening [17]. Browne et al [18] propose three pathophysiological mechanisms that are important to consider in the management of children with fever (table 8.1).

Table 8.1. Three key pathophysiological mechanisms related to fever [18].

The thermoregulatory set-point is elevated above the normal set-point. This most commonly occurs as a result of bacterial and viral infection which induces the action of cytokines (endogenous pyrogens); which through the action of prostaglandins turns up the thermostat. The body responds to this by producing physiological changes (including metabolic, endocrine, behavioural and autonomic processes) aimed at elevating body temperature. This produces the signs and symptoms associated with fever.	For a fever resulting from an elevated set-point the use of antipyretics and other controlled measures such as cooling may be appropriate
Heat production exceeds heat loss. This can occur in salicylate overdose, malignant hyperthermia, hyperthyroidism and excessive environmental temperatures.	For fever resulting from either excessive heat production or defective heat loss, antipyretics are not effective.
Heat loss mechanisms are defective This can occur in heat stroke, anticholinergic drug toxicity and ectodermal dysplasia.	For fever resulting from either excessive heat production or defective heat loss, antipyretics are not effective.

Casey [19] identifies the four phases of fever. Understanding these phases gives paediatrician insight into what is happening and this means they can provide an explanation to the child's parents depicted in figure 8.1.

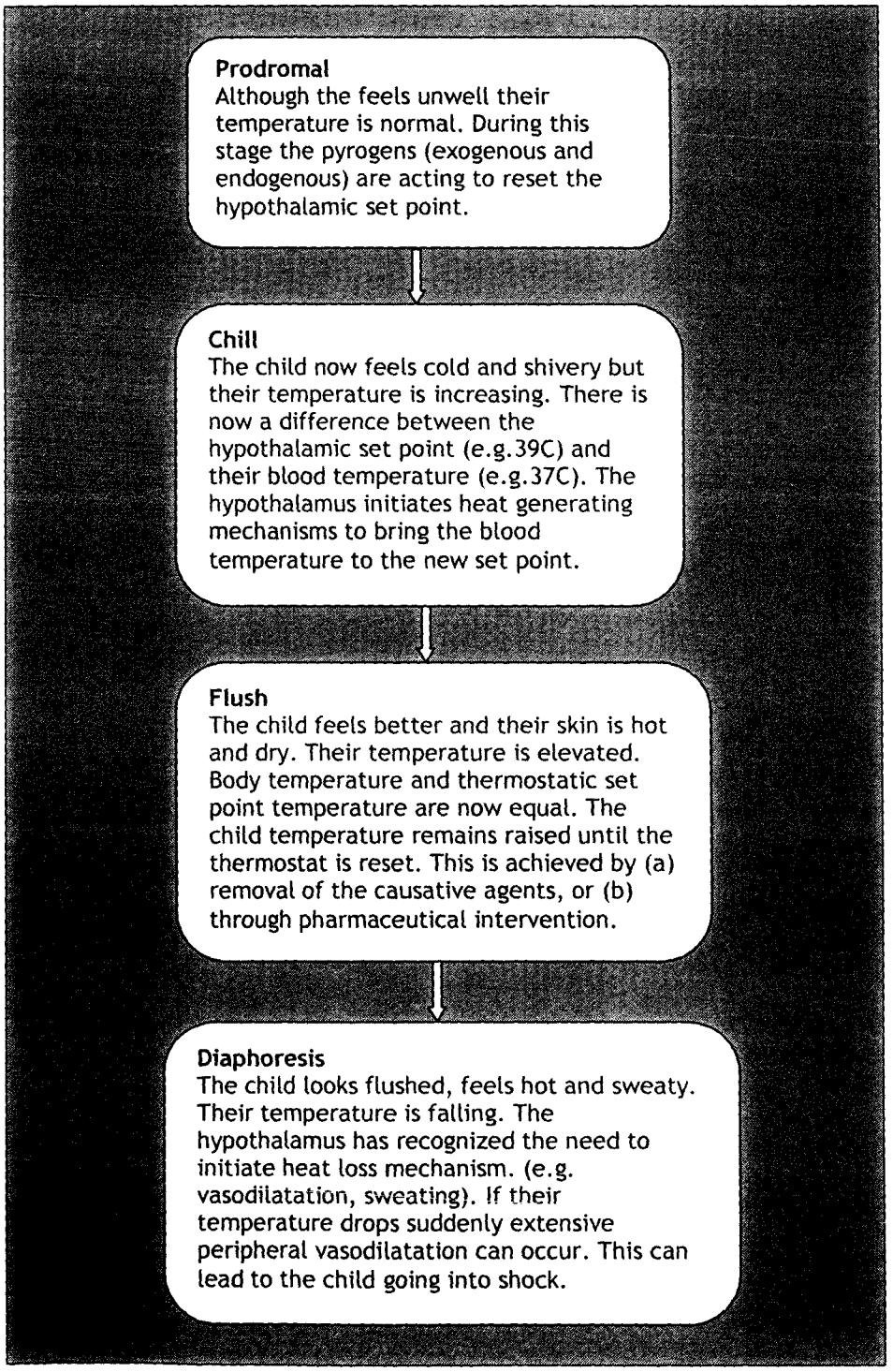

Fig.8.1. The four stages of fever.

8.2.1. Recommendation for Infant

The following steps are recommended [20] for management of previously healthy, nontoxic infant or child (3 months to 3 years of age) with fever without source and having temperature < 39°C.

- Careful physical examination to identify potential focal infection (e.g., pneumonia, abscess, cellulitis, sinusitis, otitis media, osteomyelitis, impetigo, lymphadenitis, scarlet fever, streptococcal pharyngitis).

- No tests or antibiotics if infant or young child looks well and no possible bacterial source is identified.

- Antipyretic as needed.

- Follow-up: Re-evaluation if fever persists more than 48 hours or condition deteriorates.

8.3 Fever phobia

Studies of parental knowledge of fever have exposed unfounded fears and misconceptions leading in many cases to unnecessary or inappropriate treatments and/or visits to hospital or medical practitioners. Although not addressed in the literature, the issue of cost-effectiveness of intervention is also a concern in this era of limited resources. In 1980, Schmitt found that parents had numerous misconceptions about fever in children [21]. His study found that 94% of parents believed that fever could cause side effects; 63% stated that they worried a great deal about serious harm resulting from a fever; 18% believed that brain damage and other serious consequences could be caused by a fever of 38.9°C (102°F) or higher; and 16% believed that body temperatures could rise above 43.3°C (110°F) if not treated with an antipyretic. These concerns were termed 'fever phobia.'

Twenty years later, Crocetti et. al., were conducted a similar study of parental attitudes toward fever [22]. They found that fever phobia persists, and that parents share many of the concerns identified by Schmitt in 1980. Ninety-one percent believed that fever could cause harmful effects, such as seizures, brain damage, coma, delirium, blindness, and death; 56% were very worried about fever and it's potential to cause harm; and 7% believed that temperatures could rise above 43.3°C (110°F) if left untreated. These effects are summarized in the following table 8.2.

Table 8.2. Harmful effects of fever.

Type	Schmitt (n = 81)	Crocetti et al (n = 340)
Seizure	15%	32%
Brain damage	45%	21%
Death	8%	14%
Dehydration	4%	4%
Really sick	1%	2%
Coma	4%	2%
Delirium	12%	1%
Blindness	3%	1%
No response	6%	9%
Other	-	14%
Total	100%	100%

8.3.1. Parents' versus physicians' Preferences

Because of current uncertainty about the evaluation and treatment of infants and young children with fever, some studies have recommended that increased consideration be given to parental input.

A study [23] by Oppenheim et. al. shows that 71 percent of parents of children with fever preferred options with less testing and treatment, accepting the very small but real risk associated with failure to identify and treat hidden infection. These parents reported a variety of reasons for their preference, including a desire for fewer painful tests, less waiting time, smaller chance of unnecessary antibiotic therapy and a belief that they could return to the emergency department if their child's condition deteriorated. In contrast, the 29 percent who preferred the more aggressive option universally cited desire for lower risk as the reason for their selection.

In general, parents tend to emphasize the short-term pain, discomfort and inconvenience of tests. Physicians are more likely to discount these considerations and focus on minimizing the risk of adverse outcomes [24].

Among physicians, widespread differences regarding the management of febrile children have been repeatedly documented. Not surprisingly, physicians in private office settings tend to adopt strategies involving less diagnostic testing or empiric treatment, whereas hospital-based physicians are most likely to test and treat [25, 26].

8.4. Materials and Methods

8.4.1. Searching the Web

It is intended to present here a case study, web-based home management of pediatric fever, to explore the variability in both content and quality of web-based information. As on 20th January, 2000, we searched the World Wide Web with the browser MSN Network and using the Infoseek search engine. It gave Web search results as 5,088,970. We considered 33 such sites having relevance >= 60%. [Table 8.3] The phrase that was used as a search string is 'child fever management'. Here we concentrated to English language only.

8.4.2. Assessing the sites

We think that we have to consider two prime issues in respect of assessment of medical web-sites: (i) quality and reliability, and (ii) completeness of information for a particular problem, say fever management. For such assessment of explored web-sites, the guidelines to present for managing fever at home supplied by El-Radhi and Carroll [12] were considered. The highlighting recommendations from them [12] are:

(a) Taking the child's temperature in the armpit;

(b) Giving paracetamol in a dose of 10-15 mg/kg every four hours;

(c) Sponging: use tepid water that feels neutral to the touch and to always give paracetamol before sponging;

(d) Keeping the child lightly dressed, offer fluids frequently, and discourage excessive activity.

(e) Calling a doctor if the child is less than 6 months old; looks very seek; suspecting a disease like measles, chicken pox etc.; feeling very uneasy; or has one or more associated symptoms like stiff neck, confusion, vomiting, seizure, breathing problem, severe headache etc., or has had a temperature above 106^0F.

Here a list of 33 web-sites having relevance >= 60% is presented in table 8.3.

Table 8.3. A comparison between 33 web sites offering child fever management at home and the published guidelines [12].

Web sites	Measurement of temperature	Drug treatment	Sponging procedure	Other physical remedies	When to call a doctor?
American Institute of Preventive Medicine	Yes	Yes	No*	Yes	Yes
Mayo Clinic	No	Yes	No*	Yes	Yes
Dr. Reddy's Pediatric Office on the Web	Yes	Yes	Yes	No	Yes
DRS4KIDS	Yes	Yes	No*	No	Yes
KID'S Health	Yes	Yes	No*	Yes	Yes
KIDS Doctor	No	Yes	No*	Yes	No
Kidshealth.org	Yes	Yes	No*	No	No
the Doctor's Office	No	Yes	No*	Yes	Yes
C.A.L.M.	Yes	Yes	No	Yes	Yes
Lifeline	Yes	Yes	No*	Yes	Yes
Framinhham Pediatrics	Yes	Yes	No*	Yes	Yes
Mead Johnson	No	No	No*	Yes	Yes
MCARE	Yes	Yes	No*	Yes	Yes
Medicine Net.com	Yes	Yes	No	No	Yes
Los Altos Town Crier	No	Yes	No*	No	No
Health World Integrative Medicine	No	Yes	No	Yes	Yes
American College of Emergency Physicians	No	Yes	No	No	Yes
Doctors Hospital, Ohio Health	No	Yes	No	No	Yes
Health Education Associates	No	Yes	No	Yes	Yes
Len Leshin	Yes	Yes	No*	No	Yes
AHS-Pediatrics-Ask the Doctor	No	Yes	Yes	Yes	No
UCSD Healthcare	No	No	No	Yes	No
Healthfront.com	Yes	Yes	No*	Yes	Yes
OMRON Health Care	Yes	Yes	No*	Yes	Yes
San Jose Medical Group	No	Yes	No	No	Yes
Brookline Town Online	No	Yes	No*	Yes	Yes
Healthvilleusa.com	No	Yes	No	No	Yes
Dr. Greene's House Calls	No	Yes	Yes	Yes	Yes
Palo Alto Medical Foundation	Yes	Yes	No*	No	Yes
Generalhealth.org	No	Yes	No*	No	Yes
drreddy's.com	Yes	Yes	No*	Yes	Yes
Group Health Cooperative	Yes	Yes	No*	Yes	Yes
Tiny Pediatric Topics II	No	Yes	No	No	No

No*: Don't suggest giving paracetamol before every sponging.

In the table 8.3., we summarize the results of the comparison between the guide lines [12] chosen as standard and the contents of the selected web pages. More results from our statistical analysis are given below considering some other specific issues as:

(a) The optimal sites for measuring temperature;

(b) The exact temperature for treating as fever;

(c) Physical and Pharmacological treatments of fever; and

(d) Conditions that may warrant a visit by a doctor.

Table 8.4 shows the results of measuring temperature. Table 8.4 shows 14, 23, 11 and 25 nos. recommended for measuring temperature by axillary, oral, tympanic and rectal methods respectively. But only 7 (axillary), 12 (oral), 4 (tympanic) and 14 (rectal) nos. of web sites recommended the exact temperature considered to have fever as shown in table 8.5.

Table 8.4. Measuring temperature.

No. of web site (%)			
Methods	**Recommended**	**Discouraged**	**Not mentioned**
Forehead touch	00 (00.00)	03 (09.09)	30 (90.90)
Forehead Strip	00 (00.00)	07 (21.21)	26 (78.78)
Axillary	14 (42.42)	00 (00.00)	19 (57.57)
Oral	23 (69.69)	00 (00.00)	10 (30.30)
Tympacic	11 (33.33)	02 (06.06)	20 (60.60)
Rectal	25 (75.75)	00 (00.00)	08 (24.24)
Correct way (instruction) for taking temperature		Recommended 07(21.21)	Not Mentioned 26 (78.78)

Table 8.5. Exact temperature mentioned.

A	B	C	D	E	F
Method	Recommended for measuring temperature	Recommended for exact temperature considered fever	Range of temperature considered fever (C)	Mean of column C	Standard deviation of column C
Axillary	14	07	98.6 to 99.2	98.98	0.17
Oral	23	12	98.7 to 100.1	99.60	0.37
Tympanic	11	04	100.0 to 100.4	100.16	0.15
Rectal	25	14	99.7 to 101.1	100.41	0.30

Of the 33 documents that all mentioned drug treatment, Acetaminophen was recommended in 31, Ibuprophen in 20 and Aspirin in one as shown in table 8.6. But, however, only 6 (18.18%) sites offer the dosage for Acetaminophen and 5 (15.15%) sites offer the dosage of Ibuprophen as in table 8.7.

Table 8.6. Drug treatment.

No. of web sites (%)			
Drug	Recommended	Discouraged	Not mentioned
Only Acetaminophen	31 (93.93)	00 (00.00)	02 (06.06)
Only Ibuprophen	20 (60.60)	00 (00.00)	13 (39.39)
Acetaminophen + Ibuprophen	20 (60.60)	00 (00.00)	13 (39.39)
Aspirin	01 (03.03)	22 (66.66)	10 (30.30)

Table 8.7. Drug dosage.

Web site	Acetaminophen		Ibuprophen	
Sl. No.	mg/kg of body weight	frequency	mg/kg of body weight	frequency
4	13.3	4	16.1	6
9	11.8	4	08.3	6
10	10.0 to 15.0	4 to 6	----	----
20	10.0 to 15.0	4	10.0	6
29	11.8	4 to 6	11.11	6 to 8
33	17.7	4	27.7	6

Non-drug treatments were indicated in web sites as shown in table 8.8. Lukewarm sponging, light dressing, intake of more fluids, maximizing rest were most commonly recommended, while alcohol sponging and use of tight/warm/heavy dressing were discouraged. Table 8.9 shows the criteria for

calling a doctor. Two major recommendations were found: (i) when the baby is up to 3 months, and (ii) fever with one or more associated symptoms.

Table 8.8. Non-drug treatments.

	No. of web pages (%)		
Non-drug treatment	**Recommended (%)**	**Discouraged (%)**	**Not mentioned (%)**
Lukewarm sponging	15 (45.45)	01 (03.03)	17 (51.51)
Lukewarm bath/shower	15 (45.45)	00 (00.00)	18 (54.54)
Cold sponging	02 (06.06)	04 (12.12)	27 (81.81)
Cold bath/shower	01 (03.03)	08 (24.24)	24 (72.72)
Alcohol sponging	00 (00.00)	17 (51.51)	16 (48.48)
Setting room temperature/ Cooling room	04 (12.12)	00 (00.00)	29 (87.87)
Fanning	02 (06.06)	00 (00.00)	31 (93.93)
Light dressing	14 (42.42)	00 (00.00)	19 (57.57)
Tight/warm/heavy dressing	00 (00.00)	14 (42.42)	19 (57.57)
Intake of fluids	23 (69.69)	00 (00.00)	10 (30.30)
Maximizing rest	11 (33.33)	00 (00.00)	22 (66.66)
Minimizing activity	03 (09.09)	00 (00.00)	30 (90.90)
Antipyretic before cooling	03 (09.09)	00 (00.00)	30 (90.90)

Table 8.9. When to see/call a doctor?

	No. of web sites (%)	
Criteria	**Recommended**	**Not mentioned**
Age upto 3 months	15 (45.45)	18 (54.54)
6months < Age >3months + any temperature	08 (24.24)	25 (75.75)
Fever >=102 F	06 (18.18)	27 (81.81)
Fever >=104 F	11 (33.33)	22 (66.66)
Fever + associated symptom(s)	20 (60.60)	13 (39.39)
Not reducing by medication/ non-drug treatment	06 (18.18)	27 (81.81)
2 days<=fever persists<=1 day	08 (24.24)	25 (75.75)
fever persists >=3 days	08 (24.24)	25 (75.75)

8.5. Results

Taking the above recommendations as standard, we made our statistical analysis on the 33 web-sites. In the table 8.3, we summarize the results of the comparison between the guide lines [12] chosen as standard and the contents of the web pages. It is seen from the table 8.3 that none of the 33 web-sites closely adhered to the main recommendations listed in the guidelines. The main deviations were with the prescriptions for sponging procedures: only three sites adhere to the published guidelines. But, however, if we don't consider the use of paracetamol before every sponging, we get 9 reliable sites. Most of the sites recommended acetaminophen but not all suggested the dose. Some of the web pages also recommended treatment with ibuprofen and/or acetaminophen. All web pages except one suggested strictly not to use aspirin because of the possibility of developing Reye's Syndrome.

8.6. Conclusion

As internet based public health information is gaining swift momentum, it is warranted to use in actual practice because there is variability in both content and quality of information. This is more important specially in medical domain as it is a matter of 'life and death'. There is a fair chance to get mislead by what is obtained from the Internet, particularly searched by non-experts in the field. More importantly, this may even lead to dangerous situations. Though there is a wealth of health information available, there is often no guarantee of

its quality. Everybody should be careful of websites that are created by a commercial agency that might be trying to sell their product. From our study, it is clear that parents might easily be misguided if not the proper web page(s) has been consulted. So the public oriented health care information on the internet should be judged on the basis of accuracy, quality, completeness, and consistency before applying the same in actual practice. Additionally, if the site is created by a well-known and reputable organisation such as a government or educational agency then it may be a trustworthy. Some reliable web sites are created for health consumers and are therefore written in plain language. In this regard, such reliable web-pages should be marked and obviously, medical professionals have to come forward. Moreover, the internet can be a good source of information for us but it should not be a substitute of a family doctor.

It is our appeal to all policy-makers, bio-medical professionals, researchers and healthcare workers to involve in the process to identify more criteria for assessing credibility of Internet medical sites. Work to be done towards a general consensus on the criteria and develop criteria into a web-base knowledge acquisition toolkit so that the general public and physicians can use it. Thus it is our duty to educate others and to involve for making Internet a useful and mankind medical resource.

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