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Special Editorial:
Addressing Health Care Needs of Communities?
A call for Revamping Medical Education Curriculum

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From the Editor

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This issue starts with a special editorial from Dr. Waris Qidwai, Professor and Chairman, Department of Family Medicine, Aga Khan University, Pakistan. Professor Qidwai asks have we been able to transfer benefit of advances in science and technology to the masses as we should have? We still have children dying from diarrhea and dehydration in large numbers(2). Diseases such as Malaria, Tuberculosis and HIV are rampant in different parts of the world. Mental health related disease burden is on the rise and non-communicable diseases are taking a big toll on the lives of our communities. Smoking and drug addiction is still a major problem in several parts of the world. It's time that we as health care providers and policy makers, seriously look at the reasons as to why we have failed to address health needs of the populations. He suggests this will require substantial changes in our medical education curriculum. He puts out an empathetic call to revamp medical education curriculum that can help shape health care delivery to truly address health care needs of our populations.

In this issue a descriptive cross-sectional study from Erbil assessed the influence of androgens on acne severity in adult women. Hundred fifty female patients with acne vulgaris over 18 years were involved. A full history was taken from all patients with specific emphasis on menstrual history. Out of the total 150 patients, 28% were hirsute. The level of free testosterone was elevated in 14.6% patients, menstrual cycle irregularity was present in 40.6% patients, and 36.6% patients had polycystic ovaries. No significant association was found between acne severity and the serum androgens. Hirsutism score and the level of free testosterone were significantly lower in the group with moderate acne compared with the groups with mild and minor acne. The authors conclude that serum androgens does not influence the severity of acne in adult female patients with acne.

A cross sectional study, in primary care clinics in King Khalid University Hospital, looked at the Relationship between patients understanding of treatment plan and medication compliance. The survey was composed of a validated questionnaire which consisted of three parts: personal information, treatment plan, and patient compliance to treatment. Predictive Analytics Software was used for data analysis..

A total of 80 patients participated, of which 71 completed questionnaire. There was a significant correlation between acknowledgement and total compliance. The authors concluded that the results stress on the importance of an effective communication between the patients and physicians, not only enhance medication compliance, but to improve overall healthcare outcome.

A paper from Nepal asks What do patients value in their interactions with doctors? It explored what Nepali patients value in their interactions with health care services.

Medical students were assigned in pairs to visit a chronically sick patient over 6 months. One author extracted initial themes for coding and portfolios were then reviewed independently by the other researchers, extracting data that matched the themes. The daya showed that Nepali patients highly value doctors who listen to them, show empathy, treat them with respect and clearly explain their condition and its treatment. They value continuity of care and easy access to care.

A study from Sri Lanka looked at Referral letters from General Practitioners to Hospitals. This descriptive cross sectional study was conducted in four hospitals of different levels of care provision in Sri Lanka. Referral letters received by the OPDs during a period of 2 weeks were analyzed. It concluded that most of the letters did not have the required information and legibility was also poor. Expected benefits of a referral letter to the patient, recipient and the referring doctor will not be achieved due to these short comings. Form letters were comparatively better.

Special Editorial

Original Contribution / Clinical Investigation

International Health Affairs

Clinical Research and Methods

Review article

CME case

Special Editorial: Addressing Health Care Needs of Communities? A call for Revamping Medical Education Curriculum

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Technological Advances in medicine in the last century have improved health of populations globally. There are numerous examples that have made tremendous impact on health of families and communities, from eradication of communicable diseases such as small pox(1), to the discovery of life sustaining therapies such as development of insulin for Diabetes Mellitus are some of the well-known examples, which have positively impacted health of populations.

Have we been able to transfer benefit of advances in science and technology to the masses as we should have? We still have children dying from diarrhea and dehydration in large numbers(2). Diseases such as Malaria, Tuberculosis and HIV are rampant in different parts of the world. Mental health related disease burden is on the rise and non-communicable diseases are taking a big toll on the lives of our communities. Smoking and drug addiction is still a major problem in several parts of the world. It's time that we as health care providers and policy makers, seriously look at the reasons as to why we have failed to address health needs of the populations.

One of the major issues confronting us is the need to address deficiencies in our medical education curriculum(3). It has to be in line with community needs. Community needs are multidimensional and therefore our medical education curriculum should prepare health care providers who can address community health care needs in a holistic manner. Our trained human resource is not in line with community needs. We have serious shortages of primary care physicians in several parts of the world. Our health care delivery system clearly lacks primary health care focus and thus primary health care needs are not being addressed under the current health care delivery system. This is despite the evidence that primary care improves health of the masses(4, 5).

Our medical education curriculum should be targeted to produce health care providers who can address primary care related health care needs, which form the majority of the health care needs of communities. They should be trained in addressing health care needs of populations in a holistic manner and with a heavy focus on health maintenance and disease prevention. They should be skilled communicators and have people management skills to positively impact health seeking behavior of communities. They should be trained in working in a cost effective manner and in resource constraint situations(6). It is surprising that there is no exposure to principles of doing business in medical education curriculum. Inclusion of such courses in medical curriculum will assist Health Care Providers to better control finances while managing health care related issues.

Our medical education curriculum should train health care providers to be not only well versed with the principles of evidence based medicine(7) but should at the same time be skilled in being flexible in addressing patient needs in a safe and efficient manner. They should be trained to not only critically appraise available evidence for their practice

but should be knowledgeable and skilled to look for answers for research questions that arise during their clinical practice(8).
The current stalemate in health profession and health care can be traced back to lack of effective leadership and managerial skills among Health Care providers. It is very surprising that current medical curriculum does not offer any courses or instructions in the vital area of leadership skills, despite the fact the leadership in health care is assumed to be provided by Health Care providers, considered community leaders and role models(9). Current medical education curriculum substantially lacks in producing leadership and managerial qualities that are critically needed by Health Care providers to bring about change in medical education, health care delivery systems, policy makers decisions, academic leadership and communities health seeking behavior and health.

Professionalism and ethics are components that require further integration into medical education curriculum. This will ensure professional and ethical requirements are met by Health Care Providers while delivering care to patients(10).

Medical education curriculum has changed its focus around community based learning and experience for students(11) but with less than desired meaningful results. Health Care Providers coming out of our medical schools prefer to have hospital based work, over community based practice for various reasons that include more prestige and financial benefits associated with hospital based work. Unless and until substantial changes are made in the health care delivery system and remuneration given to various categories of Health Care Providers, a truly community based focus for our health care delivery system will not materialize. A medical education curriculum truly addressing genuine community health care needs will not materialize unless and until health care delivery system changes take place that place focus on community based health care delivery. This will require leadership and managerial skills that our Health Care Providers don't have because of lack of emphasis in current medical education curriculum.

Our current health care delivery system has clearly failed to pass on the benefits of advances in science and technology to full extent resulting in compromised health of our populations and communities. The need of the hour is to align our health care delivery system with the true health care needs of communities. This will require substantial changes in our medical education curriculum. We put up an empathetic call to revamp medical education curriculum that can help shape health care delivery to truly address health care needs of our populations.

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The influence of hormones on acne in females

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Abstract

Background and objectives: Androgen hormones play a crucial role in the pathogenesis of acne, however their role in determining the severity of the disease is not well established. The aim of our study is to assess the influence of androgens on acne severity in adult women.

Methods: A hundred and fifty female patients with acne vulgaris over 18 years were involved in this descriptive cross-sectional study. A full history was taken from all patients with specific emphasis on menstrual history. Hirsutism score and acne severity were assessed on clinical examination. Hormonal assay was done including the levels of luteinizing hormone, follicle-stimulating hormone, free testosterone, dehydroepiandrosterone sulphate and prolactin and ultrasound evaluation of the ovaries was done.

Results: Out of the total 150 patients, 28% were hirsute. The level of free testosterone was elevated in 14.6% of patients, menstrual cycle irregularity was present in 40.6% patients, and 36.6% patients had polycystic ovaries. Acne severity was assessed and we found minor acne in 26% of patients, mild in 28.7% and moderate in 45.3%. No significant association was found between acne severity and the serum androgens. Hirsutism score and the level of free testosterone were significantly lower in the group with moderate acne compared with the groups with mild and minor acne.

Conclusions: Serum androgens do not influence the severity of acne in adult female patients with acne.

Key words: Acne, androgens, hirsutism, polycystic ovary syndrome

Introduction

Acne vulgaris is a chronic inflammatory disease of the pilosebaceous follicles, characterized by comedones, papules, pustules, nodules, and often scars (1). Androgen hormones play a crucial role in the pathogenesis of acne. In general, acne vulgaris does not develop unless androgens are present. Although the permissive role of androgens is essential, the process is complex. Variations in clinical responses to androgens by some patients suggest that circulating and local factors, other than androgens, also influence acne development. In addition, there are 'post androgen' events that are required for the full development of inflammatory acne lesions. These include factors that affect keratinocyte adhesion, bacterial overgrowth of Proprionibacterium acnes, and inflammatory mediators (2, 3, 4). Androgens are known to regulate the development of the sebaceous gland and sebum production. In addition, androgens may play a role in the follicular hyperkeratinization seen in acne (5).

Acne is also a cardinal component of many systemic diseases or syndromes. Their association illustrates the nature of these diseases and is indicative of the pathogenesis of acne. Congenital adrenal hyperplasia and seborrhoea-acne-hirsutism-androgenetic alopecia syndrome highlight the role of androgen steroids, while polycystic ovary and hyperandrogenism-insulin resistance acanthosis nigricans syndromes indicate insulin resistance in acne (6). An endocrine evaluation may be indicated for adult females, with a sudden onset of severe acne; with relapse shortly after isotretinoin therapy; with acne that has been proven to be resistant to conventional therapy especially in the presence of hirsutism; and with very irregular menstrual periods or signs of hyperandrogenism (7). Acne vulgaris is a very common dermatological problem encountered in our dermatology clinic and females make up the majority of acne patients and in our locality no similar study has been conducted.

Therefore we undertook this descriptive cross- sectional study to evaluate the relationship between acne severity and hyperandrogenism including circulating androgens and other features of androgenicity such as hirsutism, menstrual irregularity and amenorrhea.

Methods

A hundred and fifty female patients with acne vulgaris were drawn consecutively from patients attending the dermatology and venereology department of Rizgary teaching hospital in Erbil. All patients were over 18 years and none of them were on systemic antibiotics or isotretinoin. A questionnaire was prepared and a thorough history was taken from all patients including age, menstrual cycle history, fertility history and the use of contraceptive pills or any other hormonal products. All patients were examined to assess acne severity and patients with severe acne were excluded as most of them have been on systemic therapy. The Leeds technique (8) was used as scoring systems and the patients were divided into three groups according to acne severity: group I minor acne (total grade <1); group II, mild acne (total grade 1-2.4); and group III, moderate acne (total grade 2.5-3.9).

All patients were assessed for hirsutism and the method of Ferriman and Gallwey (FG) (9) was used for grading. According to the FG, hirsutism in women is measured by the degree of hair growth in nine body regions.

Hair score= (grade for upper lip) + (grade for chin) + (grade for chest) + (grade for upper back) + (grade for lower back) + (grade for upper abdomen) + (grade for lower abdomen) + (grade for upper arm) + (grade for thigh). A score more than 8 indicates hirsutism.

The weight and height of all the women were measured to calculate the body mass index (BMI). Ultrasound examination was done for all patients to assess ovarian morphology.

Laboratory investigations

A blood sample was taken from all women in the early follicular phase, i.e. between the second and sixth day of the menstrual cycle. The levels of luteinizing hormone (LH), follicle-stimulating hormone (FSH), prolactin, free testosterone and dehydroepiandrosterone sulphate (DHEAS) were measured.

Statistical analysis

Data were entered to the statistical package for social sciences (SPSS) data base, version 20; Pearson chi- square test was used to test the significance of association between variables. P-value equal or less than 0.05 was considered statistically significant.

Ethical consideration

An informed verbal consent was obtained from all patients. The study was approved by the Research Ethics Committee of the College of Medicine, Hawler medical university, Erbil, Iraq.

Results

(Tables can be found on page 8)

The mean age of the patients was 25.78 years (± 6.76 SD) and their mean BMI was 21.8 kg/m2 (± 3.72 SD). Table (1) shows the maximum and minimum age of patients and their BMI distribution. Sixty one (40.6%) patients had menstrual cycle irregularity. Hirsutism was detected in 42 (28%) patients while 108 (72%) patients were non-hirsute, (Table 2). Minor acne was found in 39 (26%), mild in 43 (28.7%) and moderate in 68 (45.3%) patients as shown in Table 3. Blood test examination showed high free testosterone (FT) in 22 (14.6%), high DHEAS in 19 (12.6%) patients and LH/FSH ratio more than one in 48 (32%) of the patients. On ultrasound examination, polycystic ovaries were found in 55 (36.6%) patients. Significant negative correlations were demonstrated between acne severity and hirsutism score and between acne severity and FT level. Hirsutism score and FT were significantly lower in the group with moderate acne compared with the groups with mild and minor acne as shown in Table 4.

No significant differences were found between the group with mild and moderate and the group with minor acne in regard to the frequency of polycystic ovary, LH/FSH >1 and DHEAS levels. Significant positive correlations were found between BMI and hirsutism score.

Discussion

Acne development has an absolute dependence upon androgens, although numerous steps are required before and after androgens exert their action. The sebaceous gland must have undergone normal embryological development involving gene expression and the effects of numerous co-factors. Androgens then act on a pre-pubertal pilosebaceous unit through a hormone/ receptor complex to stimulate sebaceous gland proliferation and sebum secretion. Serum levels of circulating androgens do not accurately predict acne severity, suggesting end-organ differences in androgen receptor activity or peripheral metabolism of androgen precursors to active agonists. Finally, in order for clinical acne to develop, several 'postandrogen' events influence comedo formation and subsequent inflammation (10).

Assuming that androgen levels are a key factor in the aetiology of acne, then logically there should be an association between acne severity and the degree of enhanced androgen production (11). However, studies of both ovarian and adrenal androgenic hormone levels have shown no clear pattern of abnormality, most women with acne have normal serum androgen concentrations (12). The role of circulating androgens in adult acne has been extensively investigated with different results some demonstrating no relationship between clinical markers of androgenicity (excessive body hair, irregular menstrual bleeding and alopecia) and acne severity (13) while other investigators have demonstrated a positive correlation between levels of androstenedione and DHEAS, and acne grading, and a negative correlation between SHBG levels and acne grading (14).

	Minimum	Maximum	Mean
Age (years)	18	39	25.78
BMI (kg/m2)	18.1	29.6	21.8

Table 1: The maximum and minimum age and BMI distribution

	Frequency	%
Hirsute	42	28
Non hirsute	108	72
Total	150	100

Table 2: The frequency of hirsutism

	Frequency	%
Minor	39	26
Mild	43	28.7
Moderate	68	45.3
Total	150	100

Table 3: Acne severity grading

	Degree of Acne Severity				
	Minor	Mild	Moderate	Total	P value
Hirsutism	14%	9%	5%	28%	0.044
Free testosterone	7.4%	5%	2.2%	14.6%	0.001

Table 4: The relation between hirsutism, free testosterone and acne severity

the excessive growth of terminal hairs in women in a male-like pattern of distribution. It may result from various causes of androgen excess (in approximately 90% of the women, the underlying disorder is PCOS with its intrinsic hyperandrogenism) or it may be idiopathic (19). Hirsutism was found in 28% of our patients. Another Iraqi study done in Al-Najaf found the incidence of hirsutism in women with resistant acne to be 45.5% (20) which is higher than in our study. This could be due to racial factors. The number of hairs per unit area is determined by genetic factors. Mediterranean men and women have more body hairs per unit area than Asians (12), further research is needed. In the same study total testosterone was elevated in 65.1% of acne patients with PCOS. Clinical risk factors such as acne and hirsutism are common manifestations of androgen excess. Therefore, they may not only cause cosmetic concern but may also be a sign of some underlying disease like congenital adrenal hyperplasia, polycystic ovary syndrome, hyperandrogenism-insulin resistance-acanthosis nigricans (HAIR-AN) syndrome and Apert syndrome (6). Over all we found 27.2 % hyperandrogenic women among our patients. However, no positive correlation was demonstrated between acne severity and hyperandrogenism. Low values of free testosterone were found in patients with severe acne and a negative correlation was found between hirsutism score and acne severity. A similar Iranian study showed elevated androgenic parameter in 57.1% of patients with acne and hirsutism but no correlation between hormonal levels and acne severity was found (21) which is consistent with our study.

In conclusion, although androgen is essential for acne development, in this study a positive correlation was not found between the levels of serum androgens and acne severity. As acne is a multifactorial disorder further research is needed about the pathological factors of severe acne.

The limitation of this study is the shortage of laboratory facilities in our hospital therefore further studies are recommended including more hormones.

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What do patients value in their interactions with doctors?

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Abstract

Background: The needs of patients with chronic disease should be met in a culturally appropriate way. We explore what Nepali patients value in their interactions with health care services.

Methodology: Medical students were assigned in pairs to visit a chronically sick patient over 6 months. One author extracted initial themes for coding and portfolios were then reviewed independently by the other researchers, extracting data that matched the themes.

Result: Fifty-eight students interviewed twenty-nine patients. Patients identified doctor communication skills as their most important issue. 10/29 (33%) patients expressed dissatisfaction with some aspect of communication. Particular areas of comment were the importance of medical personnel giving time and empathy (12/29, 41%), a clear explanation of their illness (18/29, 62%) and simple respect (12/29, 41%). Patients valued continuity of care (8/29, 28%). They noticed teamwork (7/29, 24%) with other health professionals and wanted better supervision of junior doctors (5/29, 17%). They also wanted better process of care, particularly punctuality of doctors, reduced waiting times and ease of access.

Conclusion: Nepali patients highly value doctors who listen to them, show empathy, treat them with respect and clearly explain their condition and its treatment. They value continuity of care and easy access to care.

Key words: doctor-patient relation, satisfaction

Introduction

Non-communicable diseases are currently responsible for 60% of all deaths. The WHO predicts that global mortality from non-communicable diseases will increase by 17.6% during 2006 to 2015.(1) In Nepal, as in the rest of South Asia, there is increasing urbanization of the population with a corresponding rise in non-communicable diseases. Chronic disease is the new epidemic in developing countries such as Nepal. It requires a much different approach to the management of acute illness, which is the current focus of health care in Nepal. The traditional approach to patients in Asia is very paternalistic, which is not conducive to the patient-centered holistic care thought to be important for chronic illness.

Studies done mainly in the West suggest that the way in which physician and patient interact is important because of demonstrated effect on patient satisfaction(2,3,4) patient understanding and adherence to directions. (4) There have been very few studies done in Asia exploring what patients expect from their doctors. Our null hypothesis was that in fact Nepali patients with chronic illness may not have the same desire for a partnership with their doctor that has been found in developed nations, We hypothesized that Nepali patients did not expect to have their disease explained to them and were happy to follow instructions regarding medication without any involvement in decision making.

This qualitative study was conducted to explore what Nepali patients with chronic illness truly value in their interactions with health care services.

We involved Nepali medical students in the collection of this data, as part of our commitment in Patan Academy of Health Sciences to develop socially accountable physicians. An exploration of what students learnt as part of this project is discussed in a separate research paper.

Methodology

Fifty eight medical students were assigned in pairs to a patient with a chronic medical condition. The students were given a portfolio to complete with guidelines on the type of questions to ask and the areas they needed to explore with the patients. They were instructed to visit the patients both in the hospital and once they returned to their own home on a regular basis (once or twice per month) over a 6 month period.

Informed, written consent was taken from all patients participating in the project.

Students were asked to tape patient responses and transcribe at a later point, or to make verbatim notes while the patient was talking. All history taking was done in Nepali language and later translated by the students into English. Students entered the information they had gathered into the appropriate section of their guided portfolio.

One researcher reviewed a random sample of portfolios to begin initial coding using questions shown in Box 1.

Box 1:

1. What factors in the health care system of Nepal help or hinder patients in how they deal with chronic illness?

2. What are the experiences of patient with health care providers?

3. What is their expectation from the health care provider?

Portfolios were then divided between researchers and each portfolio was reviewed independently by two members of the research team looking for key themes arising from the patient interviews. Themes arising were coded and then analyzed for core concepts. Results were discussed between all six authors and then compiled with a definition for each concept. Thematic codes were discussed and rearranged. After finalizing of coding, researchers went back to manually count the number of times a particular theme appeared within the portfolios.

Results

Fifty-eight students interviewed twenty-nine patients with a variety of chronic conditions including COPD, hypertension, diabetes, heart failure, renal failure, connective tissue disease and rheumatoid arthritis.

Patients identified doctor communication skills as their most important issue. 10/29 (33%) patients expressed dissatisfaction with some aspect of communication. Particular areas of comment were the importance of medical personnel giving time and empathy (12/29, 41%). Many patients commented on the manner in which health professionals spoke to them. Satisfied patients described how the doctor was friendly and smiling, “helping him with the utmost love and care” or how the nurses “talked sweetly.” Patients appreciated it when doctors asked questions about their life as well as their illness, providing emotional support to both them and their family. They wanted doctors who really listened to them.

Unsatisfied patients complained that the doctor only asked lots of questions and didn’t behave in a friendly way, The doctor “didn’t show enough concern or sympathy”, or the nurses used “harsh words”. One patient shared how she felt she didn’t get enough time to tell the doctor all her symptoms and problems properly. She felt the doctor was not interested in her, and also that he “should be”. Another lady complained that the doctor “replied very harshly to some of her queries and thus she didn’t dare to ask anything else”.

In a related issue, patients expected simple respect (12/29, 41%). Sometimes this respect was expressed in quite a paternalistic way, for example a patient commented on how much they appreciated the doctor in emergency calling them “aamaa” (mother). In contrast several patients complained about the way the doctor had

scolded them and was rude to them. One woman expressed her "bitter experience" when the doctor scolded her for not taking her medications properly.

One of the chief effects of these doctor attitudes and interactions was the patients' belief in the diagnosis or treatment they were then offered. One patient who felt the doctors did not show enough empathy, later said that "they gave unconvincing reasons" which made her upset. When doctors were rude, the patient felt the doctor didn't actually know what the underlying problem was.

The majority of patients expressed the wish for a clear explanation of their illness (18/29, 62%). Satisfied patients told how the health professionals counseled them well about their disease and the medicines they should take. As a result they said that they "believed in the treatment." Patients wanted to understand their illness, the facts about their disease and the future complications. As one patient said, "Tell me the facts about what has happened to me and if I will get better or not in a clear and concise manner. Don't give me false hope."

Some patients were not satisfied with the explanation given them by health care workers. They said that because the doctors had not explained well, they didn't have a clear idea of what their disease was or the reasons they needed to take the medicines they were given. One happy customer expressed her surprise when the doctor "didn't get angry or frustrated" with her, "explaining all the doses and time of drugs even when I asked two or more times for clarification."

Patients valued continuity of care (8/29, 28%). Patients described how following the same doctor from the beginning of their illness enabled them to feel comfortable sharing their problems. Patients liked it when the doctor was familiar with their problem so that they didn't have to "tell every single thing right from the beginning." Several patients complained about finding a new doctor in front of them at every visit.

They noticed teamwork (7/29, 24%) with other health professionals. Where teamwork was good, patients commented on the good communication between departments. Where teamwork was poor, patients noticed that staff were always "in a hurry and seem angry".

Some patients commented that they wanted better supervision of junior doctors (5/29, 17%). They were not confident in the clinical skills of the younger physicians, and were also not so satisfied with their behavior.

Patients also wanted better process of care, particularly punctuality of doctors, reduced waiting times and ease of access. One old lady with COPD told how she often "turned blue or had difficulty in breathing" while waiting to see her doctor. She felt that priority should be given to the elderly suffering from chronic diseases.

Discussion

The results of this qualitative analysis of student longitudinal interviews with patients suffering from a chronic illness strongly suggest that patients in Nepal have the same expectations regarding the ideal doctor-patient relationship as those in developed countries. Nepali patients did want doctors who listened to them, demonstrated empathy and showed them respect. They wanted a clear explanation of their illness, even if the prognosis was poor.

In this respect Nepali patients are the same as American patients studied in Ohio [5]. In Ohio they found that being open to the patient's agenda, and willing to negotiate options lead to better communication and understanding of patient preferences and values. Such physicians are termed "person focused" and this style was associated with the highest level of patient satisfaction. Where the doctor dominated the agenda, patients felt they could not ask questions and that the doctor was not listening to them. This "high control" style lead to the lowest level of patient satisfaction.

Review of the patient portfolios suggested that a "person focused style" was the most common approach experienced. This may be because the majority of patients participating in this study were known to either the General Practitioners or the specialists in our hospital and were chosen because they were under our care for their chronic illness. However, it may be that our data reflects a trend away from the traditional paternalistic style and toward an increased patient participatory style. This is encouraging, when we see the benefits in the literature of providing a person focused(6) patient centered(7-11) and relationship centered approach.(12)

In their examination of 129 systematic reviews of patient centered interventions Coulte and Ellins(13-14) conclude well designed measures that actively engage patients in their health care decision making can facilitate improved health literacy, better use of health care resources, better health behavior and improved health.

A review of the literature showed that a healthy doctor-patient relationship is based on patients' trust in and empathy from prescribers. Studies have found that compliance is good when doctors are emotionally supportive, giving reassurance or respect, and treating patients as an equal partner(15-16) Poor communication with the health care provider was likely to have a negative effect on patients compliance.(17-18) Rubin's study on compliance amongst type II diabetics(19) found that patients didn't trust and struggled to deal with physicians who ask few questions and demonstrate poor eye contact. Others found that too little time spent with patients was likely to threaten patients' motivation for maintaining therapy.(20)

Many patients with chronic illness experience difficulties in accessing health care services. Studies looking at the barriers to providing good care to patients with congestive heart failure found that patients reported their physicians were often hard to contact, rushed or uninformative,

inattentive to their needs and problems. Examples of good care practice included; showing concern and providing consistent advice to both patient and family members, offering practical strategies for self care, and allowing consistent access to the same care providers over time.(21-24)

The practice of having multiple physicians or health care providers prescribing medications may decrease patients' confidence in the prescribed treatment.(25) This desire for continuity of care is particularly important for patients with chronic illness and was clearly reflected in our Nepali data.

Conclusion

Nepali patients with chronic illness value doctors who listen to them, show empathy, treat them with respect and clearly explain their condition and its treatment. They value continuity of care and easy access to health care services. In this regard, Nepali patients demonstrate the same hopes and expectations as patients in developed countries, despite significant socio-cultural differences and health care experiences. In the context of a global increase in non-communicable illness, this study confirms that a holistic patient-centered approach is both culturally appropriate and important for effective patient care in Asia.

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Referral letters from General Practitioners to Hospitals in Sri Lanka; Lack information and clarity

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Abstract

Background: Referral of patients to hospitals, specialists and other institutions is an essential part of primary health care. In many instances the referral letter is the sole means of communication between general practitioners (GPs) and specialists/hospital doctors. This study was planned to assess the quality of referral letters sent by general practitioners to out patient departments (OPD) of hospitals.

Methodology: This descriptive cross sectional study was conducted in four hospitals of different levels of care provision in Sri Lanka. Referral letters received by the OPDs during a period of 2 weeks were analyzed. A check list to extract data was developed based on the items of information expected in a referral letter and legibility. Each item was assigned a score. This scoring system was validated using a panel of experts by means of Delphi method. Maximum score possible for a letter was 30.

Results: A total of 461 letters were analyzed. Items of information most often present were; to whom referred (96.7%), symptoms (91.5%), reason for referral (90.2%) and date (88.9%). The least often present items were; family history (0.2%), history of allergy (1.1%) and social history (1.7%). Most of the words were not legible in 42.3% of the letters.

Median score of the sample was 16 (mean=15.69)

Mean score of structured form letters was 18.61 (n=33) and in conventional letters it was 15.53 (n=428). The observed difference was statistically significant ($z=-3.544$, $p<0.01$).

Discussion: Most of the letters did not have the required information and legibility was also poor. Expected benefits of a referral letter to the patient, recipient and the referring doctor will not be achieved due to these short comings. Form letters were comparatively better. Measures should be taken to improve the content and clarity of referral letters.

Key words: Quality, Referral letters, General practice

Background

Referral of patients from primary care institutions to hospitals and specialists is an essential and inevitable aspect in patient management. Primary care doctors refer patients when therapeutic or investigation options are exhausted or when opinion or advice is necessary from specialists(1). Indication for referral could be routine (thyroid goiter), urgent (carcinoma of thyroid) or emergency (hyperthyroid crisis).

In the process of referral, written communication in the form of referral letters are the standard and in many instances the sole means of communication between general practitioners and their hospital colleagues and specialists(2,3,4). A referral letter reflects the diagnostic skills, communication skills, professionalism and courtesy of a doctor(5). It is also important as a medico legal document(5).

Advantages of referral letters are that they save time for clinicians as well as patients; reduce unnecessary repetition of investigations and decrease poly pharmacy(3,6). They help avoid patient dissatisfaction and loss of confidence in general practitioners(3). More importantly referral letters reduce health care costs for the patient and the state(2). Clarity and easy retrieval of information are also essential features of a good referral letter. Therefore a good command of the language and letter writing skills are vital in order to produce a quality referral letter.

Studies worldwide have demonstrated a paucity of relevant information in referral letters and therefore dissatisfaction among specialists(4,6). Time constraints(6) and lack of secretarial support(4) have been presented by primary care doctors as reasons for incomplete and badly written referral letters.

All details that are pertinent for patient management need to be included in the referral letter. This includes details regarding the presenting problem, examination findings, investigation results as well as the management up to the point of referral. Similarly the family doctor who has provided continuity of care to his patients will be privy to such details as past medical and surgical conditions, family history, social history, allergies, co morbidities and the treatment the patient is on.

The Sri Lankan setting is such that a referral letter from a primary care doctor is not a requirement to consult a specialist neither it is necessary for hospitalization. The frequently encountered scenario is that the patient had been instructed verbally to either get admitted to hospital or consult a specialist. Despite the relatively widespread availability of quality health care and good health care indicators, Sri Lanka lacks a referral/back referral system.

It must be stressed that referral letter writing skills have been included in the undergraduate curricula of most medical schools in Sri Lanka and is a frequently examined skill. Also all postgraduate curricula in family medicine recognize the importance of writing an appropriate referral letter. But in practice, there are no guidelines available as to the standard expected and what items of information to include in the referral letter. Thus the variables included in referral letters vary widely without adherence to any particular format making them operator dependent. Also most of the referral letters are written by hand and there hasn't been much emphasis on structured referral letters.

This study was planned to assess the quality (information content and legibility) of the referral letters issued by general practitioners to out patients departments of government hospitals in Sri Lanka.

Methodology

This descriptive cross sectional study was conducted in the outpatient departments (OPD) of four hospitals in the western province of Sri Lanka. These hospitals belonged to different levels of care provision, namely the National Hospital of Sri Lanka, a Teaching Hospital, a District General Hospital and a Base Hospital. Referral letters sent by primary care doctors to the OPDs during a period of two weeks were included in the study.

A check list was developed to extract data from referral letters. To ensure face validity, the content items of the check list were generated from extensive review of literature and guidelines(2,3,7,8,9,10,11). Only the items of information essential to ensure high quality patient information transfer were included. Advice was sought from written communication experts also. Legibility of the letters was also included in the check list. Initially each individual item in the check list was assigned a score. The sum of these individual scores represented the overall value of the letter. Next, this scoring method was validated by a multidisciplinary panel of medical experts (comprising family physicians, a general physician, a paediatrician, a general surgeon and a community physician) by means of Delphi method. They were invited to provide comments and suggestions as how important was each item and an individual score. According to the suggestions of the panel scoring method was finalized. The highest possible score for a letter was 30 (Table 1). The significance of the observed differences was determined using Wilcoxon Signed Ranks test.

Results

A total of 464 letters were systematically assessed in the study. Of these 33 (7.2%) were structured form letters and 52 (11.3%) letters were written by doctors with post graduate qualifications in family medicine.

Legibility of letters

All words were legible in 11% of the sample and most words were legible in 47%. Most words were illegible in 42% of the letters

Score

The score for each individual item in each referral letter was totaled to provide the total score for each referral letter and this value ranged from 6/30 to 24/30. The mean score

Item of information	Score
Presenting problem/ History	2
Examination findings	2
Probable diagnosis	2
Investigation for current condition	2
Treatment for current condition	2
Reason for referral	2
Patients name	2
Address of GP	1
Email/Tel No of GP	1
Date	1
To whom Referred	1
Allergy History	1
Patient's age	1
Co- morbidities/PMH	1
Treatment for co-morbidities	1
Social history	1
Family history	1
Name of GP	1
Signature	1
Qualifications of GP	1
Legibility 3- all words legible 2- most words legible 1- most words illegible	3
Total score(maximum)	**30**

Table 1

of the referral letters was 15.97, whilst the median score was 16. The following graph shows the frequency distribution of the referral letters according to the total score.

There was no significant difference (p=0.968) between letters written by doctors with post graduate qualifications in family medicine and those who have the basic degree.

Discussion

The focus of this study was the content and the legibility of referral letters issued by primary care doctors and it did not evaluate the appropriateness or accuracy of the content presented in the referral letters.

This sample was collected from 4 hospitals of different levels which included the National Hospital of Sri Lanka which is the premier tertiary care hospital in the country and another tertiary care hospital (provincial general hospital) and two secondary care hospitals (District general hospital and a base hospital). These four categories of hospitals represent the main referral destinations in the government health care system.

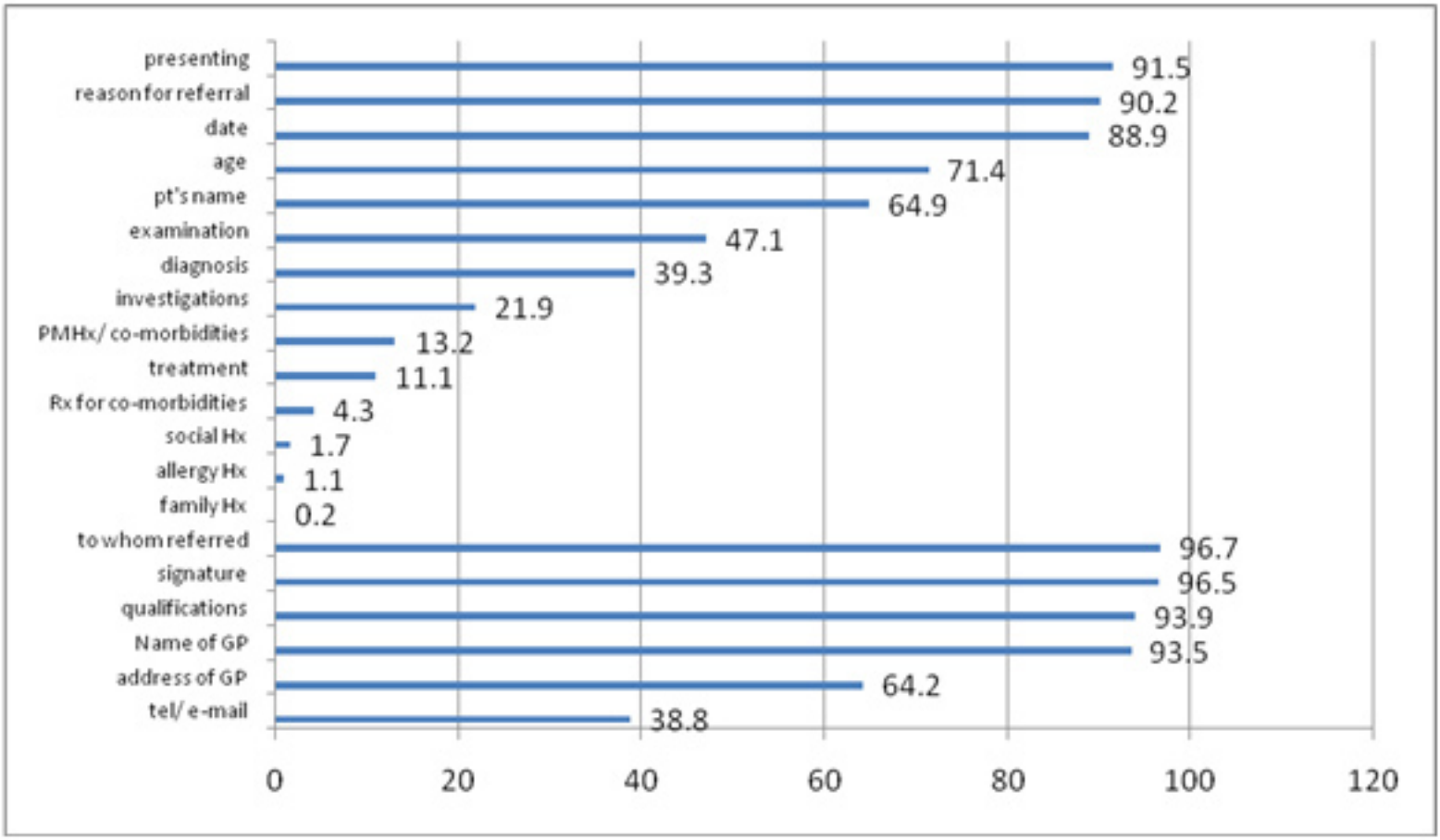
The small number (7.2%) of referral letters as structured (form) letters show that such formats are not widely used by general practitioners. In Sri Lanka post graduate qualification in family medicine is not a requirement to commence a general practice and the majority of the primary care doctors do not have such a qualification. This explains the fact that only 11.3% of the letters were written by doctors with a post graduate qualification in Family Medicine.

Primary care doctor's name, signature and qualifications were present in more than 90% of the letters while the address and telephone number/email were available in 64.2% and 38.2% letters respectively. A similar study conducted in South Africa revealed that demographic data of the doctor were present in more than 90% letters(11) The relatively high representation of the GPs demographic data compared to the data pertaining to the patients can be ascribed to the fact that most of referral letters were on printed letterheads and the fact that the rubber stamps bear the demographic details of the GP.

The name of the patient featured only in 64.9% and this is a cause for concern because on a referral letter, there should be the link between the patient's identity and the ensuing details. It helps to avoid medical errors and ensure patient safety(12).

The date and time of a referral letter is a useful indicator of the time duration from the referring to the receiving doctor, enabling proper evaluation of the patient's clinical condition and its progression. In this study date was present in 88.9% of the letters. Failure to reflect the date on which the referral was written could make it difficult for the receiving doctor to obtain an insight into the patient's condition at the time the referral letter was written.

The presenting problem featured in more than 90% of the letters, but findings of the clinical examination which forms a vital part of a consultation was present only in 47.1%. A referral letter without physical examination deprives the recipient of the patient's clinical picture at the time of the referral. Investigation for the current condition was mentioned only in 21.9% the letters. Non inclusion of investigation details could lead to unnecessary repetition of the same investigations, delay in diagnosis and treatment. The diagnosis was not mentioned in more than 60% of the letters. Paucity of information on the diagnosis could be an indication of the undifferentiated nature of the



Graph 1: Presence of Information in referral letters

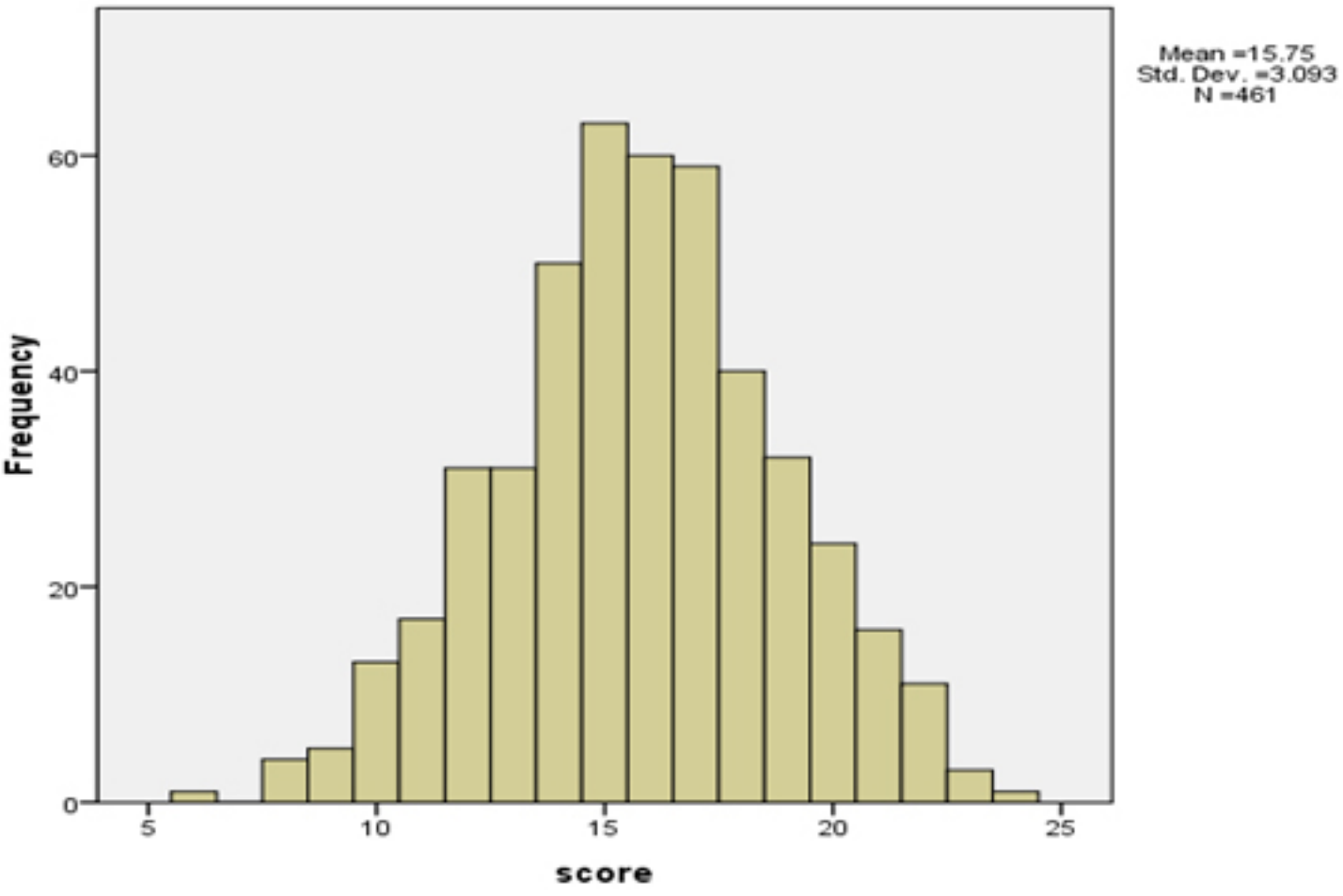
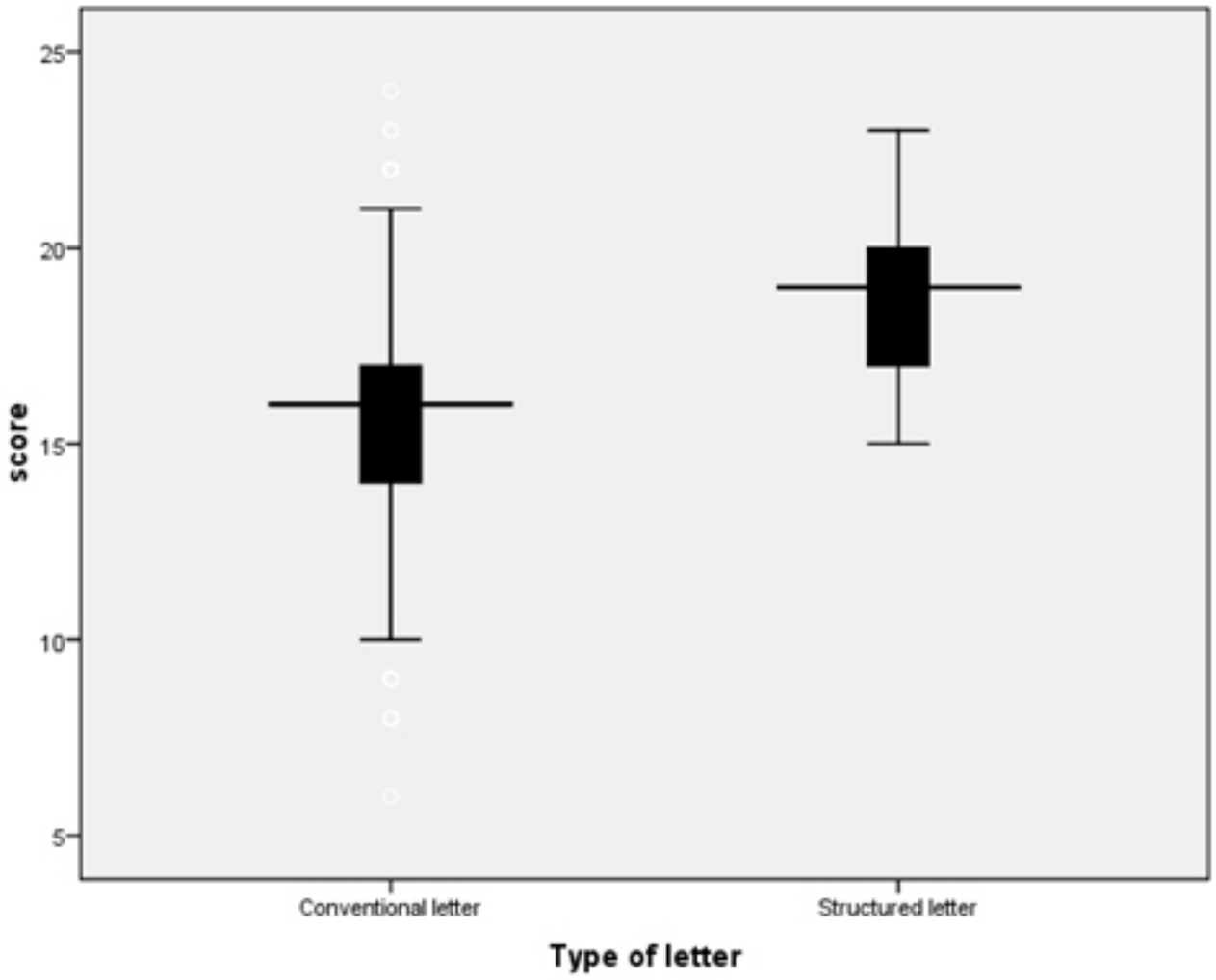


Figure 1

Structured letters vs conventional letters



P<0.01 Based on Wilcoxon signed rank test
Figure 2

patients encountered in a primary care setting. But if the GP can include probable diagnosis/ses it would have been useful for the recipient since it guides him/her as to the idea of the referring doctor.

There is a paucity of information regarding treatment received for the current condition (11.1%), treatment for co morbidities (4.3%) and allergies (0.7%) which could compromise patient care. Patients may not know details of management given to them prior to the referral. Lack of records in this regard could lead to a patient receiving an over-dosage as a result of receiving the same medication at the receiving healthcare institution. It is important to document the treatment modalities that have already been tried, but failed in the patient who is being referred. This will prevent repetition of useless medication/procedures incurring cost and losing time.

Family history and social history were reported in referral letters very rarely. Reluctance to spend time on writing these details and underestimation of the importance of this information are possible reasons for these omissions.

This study found that the reason for referral was reflected in 90.2% of the letters. Stating the specific reason for referral creates an impression in the receiving doctor as to what should be done for the patient.

The finding that only 11% of the letters were fully legible and 42% mostly illegible, is of grave concern. This is a much higher rate than that described in studies conducted in the western world(11,12). However much detail the referral letter contains, the secondary level carers will not be able to retrieve any of that information if the referral letter is illegible and will get frustrated. Winslow et al stated that illegible hand writing is an important cause of waste and hazard in medical care(12).

The sum of scores ranged from 6 -24 out of 30 and the mean score was 16. A significant proportion of the letters scored less than 15 which shows the inadequacy of the information provided by the primary care doctors. It is worthwhile to explore the reasons for not providing adequate information and poor legibility.

It is understood that all the items of information included in the check list cannot be expected in all the referral letters. But even the items of information which should be present (date, name and age of the patient, presenting problem, reason for referral and details pertaining to the referring doctor) were absent in many letters. Information most often present was pertaining to the referring doctor.

Structured form letters were of better quality. Literature shows that structured letters are better compared to conventional letters in several aspects(14-18). A structured letter forces and reminds the writer to attend to all identified and listed items which improves the quality of contents. It helps retrieval of information and saves time of both the writer and the reader. According to Jenkins and colleagues(16) they are shorter but contain more information than non structured letters. Couper and Henbest reported an improvement in the quality of referral letters after the introduction of a form referral letter(19). Therefore general practitioners should be encouraged to use structured form letters for patient referral.

It is a concern that letters written by doctors with post graduate training in family medicine were not significantly better than those without a postgraduate qualification. It is worthwhile to look at the curricula of these training programmes and revise those to strengthen letter writing skills.

Transferring adequate patient information accurately on the referral letter is essential for provision of high quality of care. Improving the contents and legibility of referral letters offers the opportunity to improve continuity of care, conservation of resources and prevent delays in diagnosis and treatment. It is also an opportunity to prevent communication and coordination problems between the referring GPs and the hospital doctors and specialists.

Conclusions

1. This study shows the deficits in communication and information transfer between primary care doctors and hospitals.
2. It demonstrated that referral letters lacked information and clarity
3. Structured form letters were of better quality
4. There was no difference in letters written by doctors with and without a post graduate training in family medicine.

Recommendations

1. Reasons for not providing adequate information should be explored.
2. Post graduate training programmes should be designed to enhance the capability of referral letter writing skills.
3. More emphasis should be given for both undergraduate and post graduate training programmes on information transfer.
4. Doctors should be encouraged to use structured referral letters and computer generated letters.

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Relationship between Patients' Understanding of Treatment Plan and Medication Compliance

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Abstract

Objective: The patients' understanding of treatment plan and patient education in general are very important factors in compliance especially in those patients with a chronic illness. There are no existing studies understanding the treatment plan and compliance in Saudi Arabia. Therefore the present study was to examine the relationship between patients' understanding of treatment plan and their compliance to it.

Subjects and Methods: A cross sectional study, in primary care clinics in King Khalid University Hospital, Riyadh, Saudi Arabia. The survey was composed of a validated questionnaire which consisted of three parts: personal information, treatment plan, and patient compliance to treatment. Predictive Analytics Software was used for data analysis.

Results: A total of 80 patients participated, of whom 71 completed the questionnaire. The study response rate was 88.7%. There was a significant correlation between acknowledgement and total compliance (r=.25, p-value=0.05). More than half of respondents (66.2%) committed to a treatment plan from their view point. The result revealed a significant correlation (r=.63, p-value=0.01) between compliance of patients from their view point and total compliance. A third of respondents (32.9%) rely on physicians as a source of information. 46.5% and 53.5% depended on trust and non-trust resources of information respectively. 80.3% agreed to be more adherent to compliance if treatment plans are explained to them.

Conclusion: The results stress on the importance of effective communication between the patients and physicians, not only to enhance medication compliance, but to improve overall healthcare outcome.
.
Key words: Compliance, Treatment plan, Medication

Introduction

Patient compliance with medication is recognized to have a critical influence on outcomes of medical interventions. Patients' noncompliance has been increasingly acknowledged as a major problem in healthcare environment and considered to be a main reason for low therapeutic response [1,2]. In addition, lack of compliance is associated with poor clinical outcomes, increased hospitalizations and physician visits, lower quality of life, higher overall healthcare costs and a source of ongoing frustration to physicians [2-6].

Non-compliance is defined as any aberration by a patient from the physician's treatment plan. None or low compliance is an ever present and complex problem that has an effect on the failure of treatment plans and their consequences, namely: deterioration of the patient's health, the need for further consultation and hospitalization, and direct and indirect increase in the cost of case management especially for patients with a chronic illness. The non-compliance of the patient to the physician's treatment plan can be a result of many factors; non understanding of the treatment plan is an important factor [4, 7, 8]. Patients' non-compliance to their treatment plan could create serious health problems which cause important economic repercussions. Lack of compliance to medical advice is also a source of ongoing frustration to doctors. Compliance to treatment is a key link between process and outcome in medical care [9, 10]. Relevant studies were retrieved and analyzed through comprehensive searches of different database systems to enable a thorough assessment of the major issues in compliance to prescribed medical interventions [11]. Giving importance to medication noncompliance, the WHO has published an evidence-based action for clinicians, scientists, policy-makers and health managers to improve worldwide rates of adherence [3].

Although, there are enormous amounts of quantitative research undertaken of variable methodological quality to assess patient's compliance, however, no gold standard for the measurement of compliance was defined. In fact noncompliance remains a major concern of health problem; more research is needed to address this issue. Therefore the purpose of the current study was to examine the relationship between patients' understanding of treatment plan and their compliance to medication.

Subjects and Methods

A total of 80 patients who participated were in primary care clinics. This study was cross sectional, carried out in May 2010 and was approved by the ethical committee of King Saud University. All patients provided consent and patient confidentiality was assured. Patients were excluded if they were not oriented to person, place, and time and were unaware of the circumstances surrounding their visit/admission to the hospital.

Data collection

A self-developed questionnaire was designed based on literature review to assess patients' compliance to medications and then examine the relationship between patients understanding of treatment plan and their compliance to medication [1, 10, 12-14]. The questionnaire was validated by a panel of expert professors of King Saud University.

The questionnaire consisted of three parts. The first part included questions about patients' personal information: gender, age, education level, occupation, socioeconomic status. The second part was regarding treatment plan, patient understanding and acknowledgement, and consisted of questions about patient's knowledge and acknowledgement of name of the physician, suffering any chronic disease, complications of the chronic disease, using medications for the chronic disease, name of medications, benefits of the medications, side effects of medications, frequency of dosages, improvement with medications and sources of information about the side effects and benefits of the medications.

The third part was about patient compliance to the treatment plan and included questions about the patient's compliance to the treatment plan from the patient's point of view, what the patient will do if he/she misses a dose at certain time while he/she is outside home, is there anyone who reminds the patient regarding the time of the medications, skipping some doses will affect the healing process, if the patient feels some improvement before the end of the medications course will he/she stop continuing the course. In addition the questionnaire included asking the participant, will he/she become more committed to the medication if the physician or pharmacists explained the treatment plan, will he/she become more committed to the medication if the physician explained the treatment of patient disease, have he/she made a follow up to hospital due to this disease, the number of times they ignore ing the drug dose time during the last week, when he/she takes medication , when he/she takes the drug and if the dose time is during sleeping time what will you do.

Statistical analysis

Data was analyzed using Predictive Analytics Software (PASW). Questions related to understanding of treatment plan dimension were calculated into acknowledgment index and the questions related to compliance dimension were calculated into compliance index not including patient direct question of compliance from their view point. Pearson correlation was used to measure correlation between different variables. P value at 0.05 and less was considered as statistically significant.

Results

A total of 80 patients participated; only 71 participants filled the complete questionnaire (the remaining 9 were excluded due to incomplete information), yielding a response rate of 88.75%. Most of

Patient characteristics	n (%)
Age (years)	
10-20	7(9.9)
21-30	20(28.2)
31-40	22(31.0)
41-50	12(16.9)
51≤	10(14.1)
Gender	
Male	25(35.2)
Female	46(64.8)
Education Level	
Illiterate	13(18.3)
Elementary	7(9.9)
Secondary	12(16.9)
High school	15(21.1)
College	24(33.8)
Occupation	
Unemployed	4(5.6)
Housewife	28(39.4)
Student	11(15.5)
Employee	23(32.4)
Retired	5(7.0)
Social Status	
Single	21(29.6)
Married	42(59.2)
Divorced	5(7.0)
Widow	3(4.2)

Table 1: Patient Characteristics

the patients were female (female 46, male 25) and relatively young, with mean age 35.63 years (SD ± 12.57). Only one third (33.8%) of the respondents had college and higher education level. Patients' characteristics variables are listed in Table 1.

There was a significant correlation between acknowledgement index and compliance index (r=0.25, p-value=0.05). When respondents were asked about how they see their compliance to the treatment from their view point, 66.2% were committed and 31.3% were poorly committed (Figure 1 - next page).

Furthermore, the result showed a strong significant correlation (r=0.63, p-value=0.01) between compliance of patient from their view point and compliance index. This indicates a sort of validity for the compliance index and further evidence that it can be relied on as patient's view point of compliance to the treatment as a measure of compliance. In addition, most of the respondents agreed (80.3%) that they become more compliant if the physician explains to them the treatment plan (Figure 2). The result revealed that 32.9% of respondents depend on physicians as a source of information, only 3.3% obtain their information from a health education center and 10.3% of respondents take information from the hospital. Sources of information were grouped during analysis into trusted sources and non-trusted sources. More than half of respondents (53.5%) depend on the non-trusted sources and only 46.5% depend on the trusted source of information (Figure 3).

Discussion

The purpose of the present study was to assess patient compliance and its relationship to patient understanding of treatment plan and prescribed medications. Although several studies have investigated and reported relationship between knowledge and education with level of compliance [15], however few or no studies have investigated the relationship between patient compliance with patient understanding of treatment plan and prescribed medication. The patient who decides how to use the therapy, and his or her involvement in the process of explaining and understanding is the key to improved compliance [15].

Indeed, there are numerous social, psychological, and physical factors that account for variations in patients' compliance with physician advice and there are ample studies that have addressed these factors. The range of factors that may account for variations in patients' compliance is enormous and includes personal characteristics, the nature of the regimen prescribed for each patient, paramedical and other influential persons and the doctor-patient relationship [16]. A study aimed at identifying important factors that can influence patient compliance with prescribed medication found that

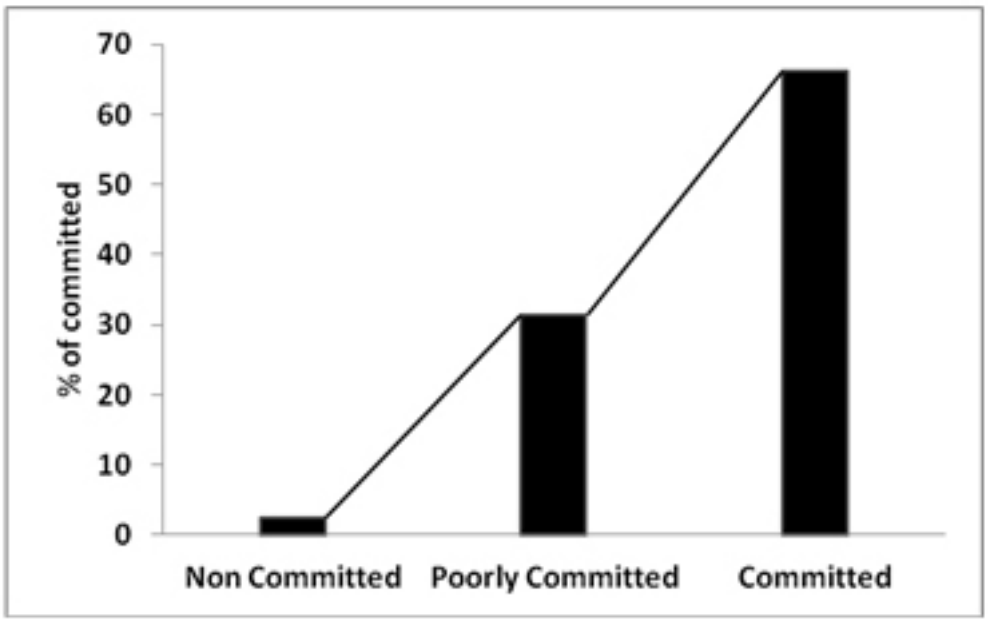

Figure 1: Patients' point of view in compliance to treatment plan

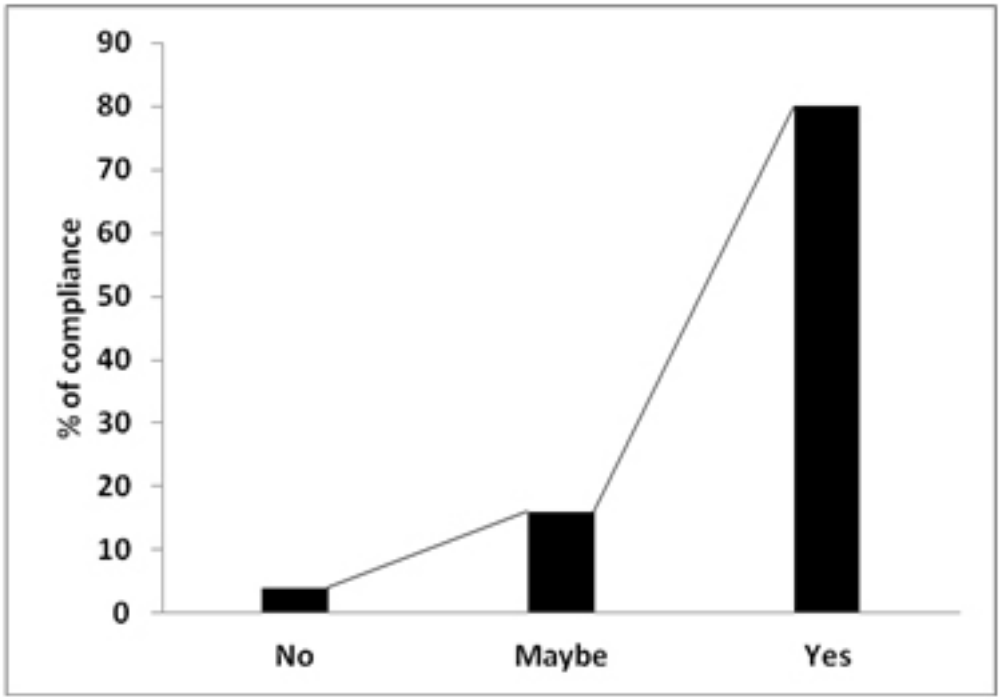

Figure 2: Patients' self-reported compliance if the physician explains to them the proper treatment plan

age, gender, duration of disease, the attitude of staff and information/ education about disease were factors of importance for self reported compliance [17]. Another study that evaluated factors affecting medication adherence in geriatric diabetic patients treated at private clinics and tertiary hospitals showed that drug storage and self-efficacy were factors affecting adherence to medication in tertiary hospital patients and the significant variables in private clinic cases were financial level, severity of diabetes complications, and self-efficacy [18].

The results of the current study indicated that there is significant correlation between acknowledgement and patient understanding of treatment plan with compliance index to medication plan ($r = 0.25$, p-value = 0.05). Furthermore, most of the respondents (80.3%) reported that they become more compliant if physician explains to them the treatment plan (Figure 2). In a study of non-compliance and knowledge of prescribed medication in elderly patients with heart failure, Cline et al, [19] found that non-compliance in elderly heart failure patients is due to shortcomings in patients' knowledge regarding prescribed medications. According to a study that assessed the effect of patient education on antiobstructive medication dispensed from pharmacies, it was found that educated asthmatics showed improved steroid inhaler compliance compared with the uneducated patients [20]. Additionally a study by Bhushan B, and Gaude G[21] demonstrated that after employing the various strategies of patient education, the compliance increased in one third of the subjects (34.3%)

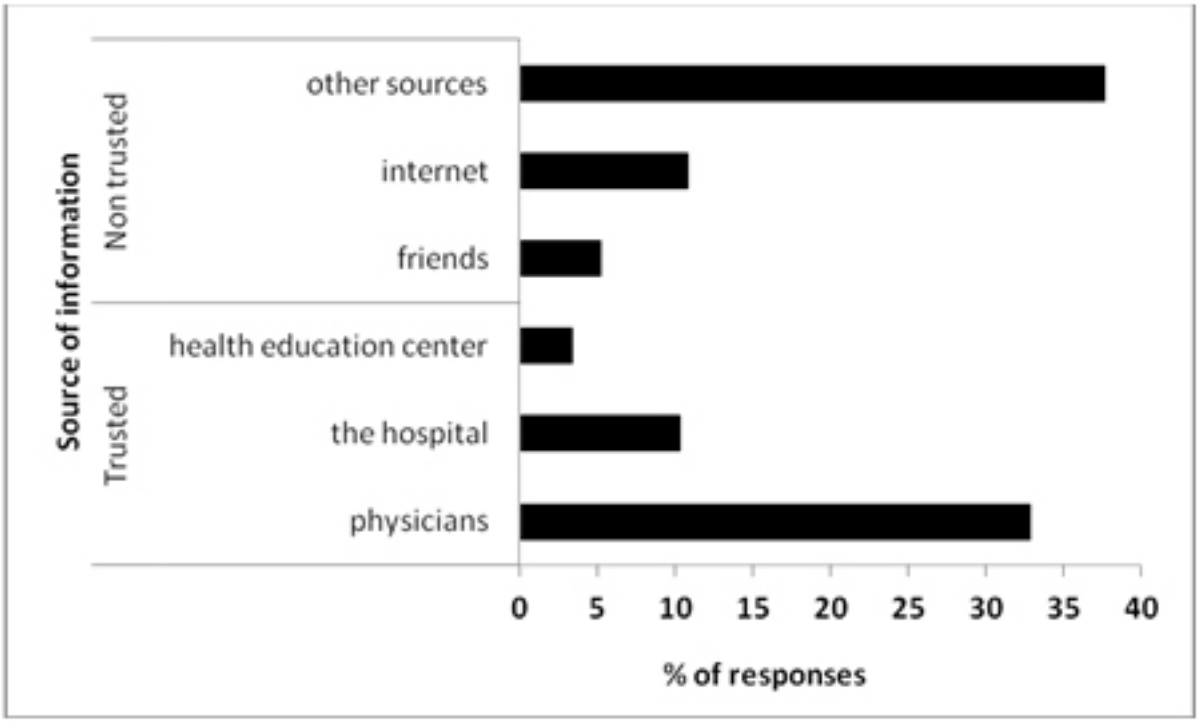

Figure 3: Patients' trusted sources of information

among the earlier defaulting patients. Based on the earlier mentioned study about asthmatic patients, the staff listened and took patients' views about their asthma into account, and having received information and education about asthma tended to increase the odds of taking medication as prescribed [17].

In the present study, most respondents (66.2%) reported they were committed to the treatment plan from their view point (Figure 1). In addition, the results revealed a significant correlation between compliance of patient from their view point and total compliance (calculated compliance) ($r = 0.63$, p-value = 0.01). Regardless of the difference between subjects in both studies, self reported compliance in the present study was near to a study which aimed to determine physician- and patient-rated treatment compliance with osteoporosis treatments which found 65.5% of women considered themselves to be fully compliant [22]. In addition it was adjacent to 57.8% reported by respondents in a study of asthmatic patients [17].

The validity of self-reported adherence is a topic of current debate. Murri et al, [23] found that patient report may be a valid method for detecting non-adherence, but may be an insensitive measure of adherence. Conversely, a study carried out to construct validity comparisons of three methods for measuring patient compliance stated that the patient-report method yielded validities of about (0.4) compared to the nurse rating method of measuring patient compliance (0.7) and the physiological assessments (0.5) [24]. According to a study that evaluated self-report and microelectronic monitoring, the adherence rates for all dosing errors between self-report and the Medication Event Monitoring System was significantly different and it considered patient self report alone is not a reliable measure of adherence [25]. Another study compared patient self report with pill-count as a measure of drug compliance; patient self report was poorly predictive of non compliance and only 65% of patients were correctly classified using self-report [26].

As previously indicated, most of the respondents (80.3%) reported that they become more compliant if the physician explains to them the treatment plan (Figure 2). Moreover, a third of respondents of the current study reported that they depend on physicians as a source of medical information in the complications of the chronic disease(s), side effects of the medication(s) and benefits of the medication(s). This finding indicates the importance of communications, physician- patient relationship, and patient education in general to enhance compliance. This has been noted by Hulka et al, [27] in a study of the impact of medication regimen and doctor-patient communication in affecting patient medication-taking behavior. They found that for patients with congestive heart failure, good communication of instructions and information from physician to patient was associated with low levels of all types of medication errors. A literature review study of how do you improve compliance presented the issue in the context of its incidence of and barriers to compliance and provided general principles to improve compliance in pediatrics stated that a one- on- one relationship between physician and patient is needed for communication and improved compliance. In addition, improved communication between physician and patient and/or family is one of the general principles to enhance medication compliance[28].

The present study categorized sources of medical information into trusted sources and non-trust sources. The trusted sources included: physicians, the hospital, and health education center and the non-trusted sources included: friends, internet and other sources (Figure 3). Only 46.5% of respondents reported that they depend on the trusted sources of information. In a study by Impicciatore P et al, [29] it was reported that only a few web sites provided complete and accurate information for managing fever in children. The study aimed to assess the reliability of healthcare information on the World Wide Web and how it may help lay people cope with common health problems. Standardized review to assess medical information provided in a medically oriented Internet discussion group suggested that medical information available on the Internet discussion groups may come from nonprofessionals and may be unconventional, based on limited evidence, and/or inappropriate [30].

Limitations

A limitation of the present study could be that, the result cannot be generalized because compliance or non-compliance was patient self- reported which possibly has the results easily distorted by the patient. Although results revealed a significant correlation (r=0.63, p-value=0.01) between compliance of patient from their view point and total compliance calculated by the study instrument which indicates a kind of validity for the compliance index and provides evidence that patient's view point of compliance to the treatment can be relied on as a measure of compliance. However the instrument to measure compliance in the current study was a self-designed questionnaire based on literature review and the validity of the instrument was not fully assessed. In addition, there is not yet a gold standard method to measure patient compliance and methods to assess adherence are multiple, even in the single field [1]. With these different methods, each method has advantages, limitations, and disadvantages [14].

Another limitation of the present study is sample size. It is suggested a study be conducted with a wider sample to include different disease conditions which can lead to compare compliance across several diseases, ages, social, and other sub groups, to be more able to identify the factors which effect on compliance and adherence to treatment plan and develop strategies to improve medication compliance.

Conclusions

The current study results stress on the importance of effective patient-physicians communications, not only to enhance medication compliance, but to improve overall healthcare outcome. Physicians are considered to be a very important source of information for patients, and this study findings stress on the importance of utilization of physician educational role. It is clear that patient education in general and treatment plan acknowledgement and understanding have a significant positive impact on patient compliance. Non-compliance remains a major health problem; more scientific research is greatly needed to assess its related aspects.

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The Accuracy of Clinical Signs in Detecting Dehydration in Children

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Abstract

Background and Objectives: Dehydration is a state of negative fluid balance. The objective of this review was to establish the accuracy of the clinical signs in detecting dehydration in children.

Methods: Searching was conducted in nine databases, and ended with 1,974 studies. Two types of studies were included; prospective and cross-sectional. Participants were children up to 18 years. Outcomes were sensitivity, specificity, predictive values and likelihood ratio for clinical signs of dehydration. Included research was evaluated using a quality checklist and analyzed using two developed templates. The first template examined individual signs of dehydration, and the second one examined scales.

Results: Decreased urine output was found to be the most sensitive sign (85 percent). However, decreased skin elasticity is the most specific clinical sign. To detect moderate dehydration, the CDS was the most sensitive scale (68 percent) and the Ten-point Gorelick Scale was the most specific (64 percent). To detect severe dehydration, the Ten-point Gorelick Scale was found to be the most sensitive scale (82 percent) and the WHO scale was the most specific (43 percent).

Conclusion: To detect dehydration in pediatrics, the most useful sign was dry mucus membrane. Accuracy of the current scales was questionable and data did not support its use as an accurate tool.

Key words: Dehydration, children, clinical signs.

Introduction

Dehydration is a state of negative fluid balance that is most commonly caused by diarrheal illnesses.(1)

Many factors contribute in dehydrating young children including the higher incidence of gastroenteritis if compared with adults, the higher surface area-to-volume ratio,(2) their large body water content, renal immaturity and inability to meet their own needs independently.(1)

Diarrheal illnesses with subsequent dehydration accounts for four million deaths per year in infants and children worldwide,(1) with an incidence of approximately one and a half billion and an estimated death rate between one and a half to two and a half million in children younger than five years. In the United States, it is estimated that 200,000 hospitalizations and 300 deaths are attributed to gastroenteritis among children.(3)

Dehydration is graded into mild (three to five percent volume loss), moderate (six to nine percent volume loss) and severe dehydration (equal to or more than ten percent volume loss).(2)

Although weight change is the gold standard tool to detect dehydration in children; the pre-illness weight is not always available in acute sittings.(4) Hence, having accurate dehydration clinical signs is essential to detect dehydration and to manage the patient appropriately.

Objectives

This review was undertaken to establish the accuracy of the clinical signs in detecting dehydration in children

Methods

Criteria for Considering Studies for This Review

Types of studies:
• Prospective studies;
• Cross sectional studies.

Types of participants:
• Infants and children up to 18 years.

Types of outcome measures
• Accuracy of clinical signs as a diagnostic tool in detecting dehydration; sensitivity, specificity, predictive values and likelihood ratios (LRs).

Search Methods for Identification of Studies
The following databases were used for searching:

• EbscoHost was used to search for "TI dehydration AND TI children". Results were narrowed by selecting full text. This search ended with 34 results (to March 2013);

• Google Scholar was used to search for "allintitle: dehydration children clinical", this search ended with 39 results (to March 2013);

• JAMA was used to search for "dehydration children". Results were narrowed by selecting child. This search ended with 28 results (to March 2013);

• ProQuest was used to search for "(clinical signs) AND ti(dehydration) AND ti(children)". Results were narrowed by selecting full text. This search ended with 11 results (to March 2013);

• Springer Link was used to search for "dehydration AND children AND clinical AND signs". Results were narrowed by searching within English, medicine, paediatrics, article and (2000- 2013). This search ended with 382 results (to March 2013);

• The Cochrane Library was used to search for "dehydration children", this search ended with 304 results (to March 2013);

• TRIP was used to search for "dehydration children clinical signs ", this search ended with 1018 results (to March 2013);

• UpToDate was used to search for " dehydration in children", this search ended with 150 results (to March 2013);

• Wiley Online library was used to search for " dehydration in article titles AND children clinical signs in all fields", this search ended with 36 results (to March 2013).

Search methods for identification of grey literature studies and informational papers

• Google was used to search for "Dehydration children", this search ended with 7,420,000 results (to March 2013).

Data Collection and Analysis
Selection of Studies:
Subsequent to the selection of the ten potentially relevant non-duplicated studies, the full text of these studies was retrieved and assessed according to the inclusion criteria. Four of the ten potentially relevant non-duplicated studies met the inclusion criteria. The other six studies did not meet the inclusion criteria outcome measures.

Methodological quality of included studies
Table 1 shows the methodological quality of included studies. All selected studies were assessed using a quality check list.(5) Accordingly, the included research was graded as follows(6):

• **Level 1:** The highest-quality evidence: independent, blind comparisons of test with a valid gold standard; large number of consecutive patients enrolled;

• **Level 2:** High-quality study with independent, blind comparison of test with a valid gold standard; small number of consecutive patients enrolled;

• **Level 3:** Independent, blind comparison of test with a valid gold standard; patients enrolled in a nonconsecutive fashion, using a subset or smaller group who may have had the condition and generated definitive results on both test and gold standard;

• **Level 4:** Non-independent comparison of a test with a valid gold standard among a "grab" sample of patients believed to have the condition in question;

• **Level 5:** Non-independent comparison of test with a standard of uncertain validity; this standard may incorporate the test result into the gold standard.

Data extraction and analysis
The author developed two templates in analyzing the objectives and the results of the included studies. These two templates are highly relevant to the objectives of this review and aim to measure and discuss the accuracy of clinical signs of dehydration. The first template explores the accuracy of a single clinical sign of dehydration in children, independently of other signs. However, the second template explores scales rather than individual signs.

Results

Description of the Studies

The full text of ten potentially relevant studies was retrieved, four of which met the inclusion criteria. Three studies (Pringle et al 2011(7) and Parkin et al 2010(8) and Koves et al 2004(9)) explored the accuracy of scales in detecting dehydration among pediatrics. On the other hand, only one study (Gorelick et al 1997(4)) looked into the accuracy of individual signs. The description of the included studies is presented in Table 2 (pages 31, 32 and 33).

All the six excluded studies failed to meet the inclusion criteria for outcome measures (Bailey et al 2010(10), Hayajneh et al 2010(11), Bar-David et al 2009(12), Goldman et al 2008(13), Friedman et al 2004(14), and Alam et al 2001(15)). Figure 1 (page 34) explains the characteristics of the excluded studies.

	Pringle et al (2011)[7]	Parkin et al (2010)[8]	Koves et al (2004)[9]	Gorelick et al (1997)[4]
Were the study methods appropriate and adequate to answer the research question?	Yes	Yes	Yes	Yes
Was the study well designed?	Yes	Yes	Yes	Yes
Was the study setting relevant?	Yes	Yes	Yes	Yes
Were the participants appropriately defined, selected representatively and followed up without significant loss?	Yes	Representativeness might be affected by the following exclusion criteria: neonates and children above 3 years; cases with malnutrition, significant sodium disturbance, and/or chronic diseases;	Yes	Yes
Was the intervention appropriate?	Not applicable	Not applicable	Not applicable	Not applicable
Were endpoint(s) relevant to the health of patients or populations, well defined and measured?	Yes	Yes	Tools to measure the outcome are not precise	Yes
Were the study findings important from a public health or clinical perspective	Yes	Yes	Yes	Yes
Had the study sufficient power (was large and long enough to detect effects)?	Sample size is relatively small	Yes	Sample size is relatively small	Yes
Quality level	4	4	4	4

Table 1: Methodological Quality of Included Studies

Table 2: Characteristics of Included Studies

Part A

	Study design	Samples	Methods	Outcome	Results
Pringle et al (2011)[7]	Prospective study	- N= 23 children - Relevant - Representative	• Clinical signs of dehydration shown on children presented with diarrhea and/or vomiting were recorded. Patients were then weighted and directly started on rehydration therapy. On discharge, patients were weighted again. • For analysis, patients were evaluated using the World Health Organization (WHO) (look at condition, eyes, thirst and skin pinch), Gorelick (general appearance, capillary refill, tears, mucus membranes, eyes, breathing, quality of pulses, skin elasticity, heart rate and urine output) and the Clinical dehydration Scale (CDS) (general appearance, tears, mucus membranes and eyes) scales.	Sensitivity, specificity and likelihood ratios of the scales.	WHO: • Moderate dehydration (5-10%): Sensitivity 50%, specificity 61%, +LR 1.28, -LR .82. • Severe dehydration (>10%): Sensitivity 79%, specificity 43%, +LR 1.38, -LR .50. Gorelick: • Moderate dehydration (5-10%): 4-point scale: Sensitivity 64%, specificity 69%, +LR 1.15, -LR .78. 10-point scale: Sensitivity 21%, specificity 82%, +LR 1.25, -LR .53. • Severe dehydration (≥10%): 4-point scale: Sensitivity 68%, specificity 41%, +LR 1.09, -LR .52. 10-point scale Sensitivity 82%, specificity 35%, +LR 2.04, -LR .88. CDS • Moderate dehydration (≥ 6%): Sensitivity 68%, specificity 45%, +LR 1.24, -LR .70.

Table 2: Characteristics of Included Studies

Part B

Parkin et al (2010)[8]	Cross sectional	- N=93 children - relevant - representativeness is questionable	Clinical dehydration scale (CDS) was developed. It consists of four items: general appearance, eyes, mucous membranes and tears. Each item can be scored from 0 to 2. Accordingly, dehydration was classified into three classes; none, some and moderate to severe. This scale was compared to weight change following rehydration.	Likelihood ratios.	CDS: • Total CDS score 0 (none): o % dehydration <3; o +LR =2.2 (95% CI: .9-5.3), -LR .79 (.64-.99). • Total CDS score 1-4 (some): o % dehydration ≥3 to <6; o +LR =1.3 (95% CI: .9- 1.74), -LR .67 (.34-1.32). • Total CDS score 5-8 (moderate to severe): o % dehydration ≥6; +LR =5.2 (95% CI: 2.1- 12.8), .55 (.3-1.03).
Koves et al (2004)[9]	Prospective study	- n= 37 - Relevant - Representative	▪ Demographic data and clinical signs of dehydration were evaluated by two physicians independently in children presented with diabetic ketoacidosis. Clinical evaluation was compared to weight change. ▪ Following admission, daily weights were recorded till discharge.	Accuracy of assessment of clinical dehydration.	• Good agreement between the two physicians on the level of dehydration (k=.5). • No agreement between assessed (clinical) and measured dehydration in 70% of patients (k=.05). o Patient who were <6% dehydrated (measured), trend was to overestimate dehydration (in 24% of patients); Patients who were >6% dehydrated (measured), trend was to underestimate dehydration (in 46% of patients).

Gorelick et al (1997)[4]	Prospective study	- n= 225 - Relevant - Representative	• Children presented with chief complain of vomiting, diarrhea or poor oral fluid intake were evaluated for ten clinical signs of dehydration by two assessors independently. • Patients were weighted at presentation and then twice daily until discharge.	Sensitivity, specificity and positive predictive value (PPV)	• Decreased skin elasticity: Sensitivity .35 (95% CI .23-.49), specificity .97 (95% CI .92-.99), PPV .57; • Capillary refill > 2 sec: Sensitivity .48 (95% CI .35-.61), specificity .96 (95% CI .90-.99), PPV .57; • General appearance: Sensitivity .59 (95% CI .46-.71), specificity .91 (95% CI .84-.95), PPV .42; • absent tears: Sensitivity .67 (95% CI .53-.78), specificity .89 (95% CI .82-.94), PPV .40; • Abnormal respiration: Sensitivity .43 (95% CI .30-.56), specificity .86 (95% CI .78-.91), PPV .37; • Dry mucus membranes: Sensitivity .80 (95% CI .67-.89), specificity .78 (95% CI .7-85), PPV .29; • Sunken eyes: Sensitivity .60 (95% CI .47-.72), specificity .84 (95% CI .76-90), PPV .29; • Abnormal radial pulse: Sensitivity .43 (95% CI .30-.56), specificity .86 (95% CI .78-.91), PPV .25; • Tachycardia: Sensitivity .46 (95% CI .32-.61), specificity .79 (95% CI .72-87), PPV.2; • Decreased urinary output: Sensitivity .85 (95% CI .73-.93), specificity .53 (95% CI .44-.62), PPV.17.

Table 2: Characteristics of Included Studies

Part C

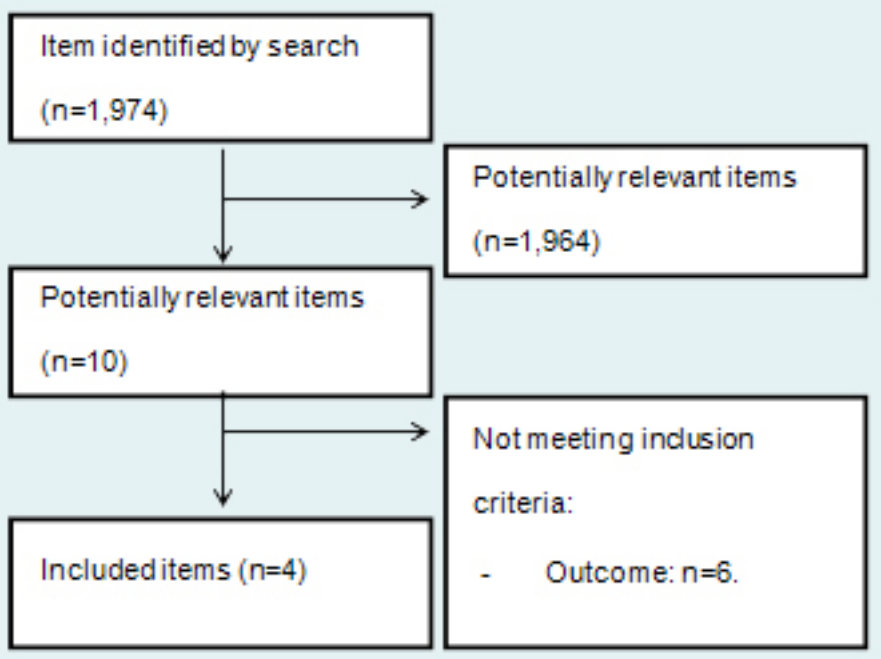

Figure 1:
Characteristics of Excluded Studies

Accuracy of Individual Signs
Gorelick et al 1997(4) was the only study that explored the accuracy of clinical signs of dehydration individually. It showed that decreased urine output was the most sensitive clinical sign (but with low specificity) in detecting dehydration (85 percent (95 percent CI .73-.93)) followed by dry mucus membranes (80 percent (95 percent CI .67-.89)). However, decreased skin elasticity was the most specific clinical sign (97 percent (95 percent CI.92- .99)), but the least sensitive, followed by increased skin turgor (96 percent (95 percent CI.90-.99)) and general appearance (91 percent (95 percent CI.84-.95)). It is important to highlight the fact that individual signs with high sensitivity can have low specificity and vice versa. Please, refer to Table 2. However, the single clinical sign with reasonable sensitivity and specificity was the dry mucus membrane.

Accuracy of scales
Three researchers explored the accuracy of specific scales:

• Pringle et al 2011(7) examined the accuracy of three popular scales;
o the World Health Organization (WHO) Scale, which consists of the following four components: general condition, eyes, thirst and skin pinch;

o Gorelick Scale:
Four-point Gorelick Scale where general appearance, capillary refill, tears and mucus membranes are its main components;

• Ten-point Gorelick Scale, which consists of general appearance, capillary refill, tears, mucus membranes, eyes, breathing, quality of pulses, skin elasticity, heart rate and urine output.

o the Clinical Dehydration Scale (CDS), which consists of the following signs: general appearance, eyes, mucus membranes and tears.

Pringle et al 2011(6) found that the CDS was the most sensitive scale (68 percent) in detecting moderate dehydration followed by the four-point Gorelick Scale (64 percent). The most specific scale was the Ten-point Gorelick scale (82 percent) followed by the Four-point Gorelick Scale (69 percent).

As for severe dehydration, the Ten-point Gorelick Scale was found to be the most sensitive (82 percent) followed by the WHO Scale (79 percent). The most specific scale was the WHO scale (43 percent).

• Parkin et al 2010(8) examined the accuracy of the Clinical dehydration scale (CDS). Results showed that the positive likelihood ratio for a total CDS score zero (which indicates no dehydration) makes small but sometimes important changes in dehydration probability (2.2). However, all other positive and negative likelihood ratios would rarely alter the probability to an important degree.

• Koves et al 2004(9) explored both; the reliability and accuracy of clinical signs. Results showed that there is a good agreement on dehydration grade when the child was physically examined by two different physicians (k=.5). However, if dehydration grade based on clinical signs was compared to the gold standard tool, clinical assessment was found to be not accurate (k=.05).

Discussion

Principle Findings
The most sensitive two clinical signs were decreased urine output followed by dry mucus membranes. To detect moderate dehydration, the CDS scale was found to be the most sensitive followed by the Ten-point Gorelick Scale. On the other hand, to detect severe dehydration, the Ten-point Gorelick Scale was the most sensitive followed by the WHO Scale.

Interestingly, and if these results are compared to other reviews, Somers 2013(2) found that the most useful clinical signs to predict five percent hypovolemia in children were delayed capillary refill time, reduced skin turgor, and deep respirations with or without an increase in absolute respiratory rate.

Steiner et al 2004(6) found that dry mucus membranes was the most sensitive clinical sign of dehydration (86 percent) followed by a poor overall appearance (80 percent) and sunken eyes (75 percent), where urine output was not examined. Prolonged capillary refill was the most specific clinical sign of dehydration (85 percent) followed by abnormal respiratory pattern (79 percent) and abnormal skin turgor (76 percent).

Limitations

The main limitations to this review were the small number of included studies which were, in addition, heterogeneous.

Implications

It is highly recommended that other dehydration scales be developed and examined, as the current ones are neither highly sensitive nor specific.

Conclusion

The most useful sign in detecting dehydration in children was dry mucus membrane. However, accuracy of the current scales was questionable and data did not support their use as an accurate tool in dehydration detection in pediatrics.

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Case presentation

Mariam, a two year old girl is brought to see you by her mother with a one-week history of diarrhoea. Mariam's illness began one week earlier. After returning home from crèche she complained of "tummy" pain, vomited once and then became progressively more ill and listless. She has passed about 6 loose, watery stools per day. During this week her weight has fallen from 16 kg. to 14.5 kg.

You order a number of tests including blood gases and urea and electrolytes and the laboratory returns the following results:

pH	7.18	(7.34 - 7.43)
pCO_2	20 mmHg	(31 - 42)
HCO_3^-	5 mmol/L	(22 - 26)
Na^+	144 mmol/L	(135-145)
K^+	5.6 mmol/L	(3.5-5.0)
Cl^-	124 mmol/L	(98-110)
Urea	10.1 mmol/L	(2.1-6.5)
Creatinine	0.06 mmol/L	(0.02-0.06)

Question 1

Which of the following is Mariam's most likely acid-base condition?

Select ONE only.

1. Metabolic acidosis
2. Metabolic alkalosis
3. Respiratory acidosis
4. Respiratory alkalosis
5. Metabolic acidosis with evidence of respiratory compensation
6. Metabolic alkalosis with evidence of renal compensation
7. Respiratory acidosis with evidence of renal compensation
8. Respiratory alkalosis with evidence of renal compensation
9. Mixed disturbance

Question 2

What is Mariam's anion gap?

Question 3

Why is the plasma chloride high? (Hint: Consider the electroneutrality of the blood implied by the anion gap equation).

Question 4

Why is the plasma potassium high?

Question 5

Why is the plasma urea high?

Question 6

In order to exclude a renal origin for the metabolic acidosis, urinary electrolytes are ordered and the following results obtained:

Na^+	84 mmol/L
K^+	5.6 mmol/L
Cl^-	124 mmol/L

Is the urine net charge positive (greater than one) or negative (less than one)?

Question 7

Does this value for urine net charge exclude a renal basis for the acidosis?
Answer YES or NO

Question 8

Feedback:
When direct measurement of ammonium is not possible, ammonium excretion is inferred by the “urine anion gap”, also known as the urine net charge. It is defined as follows: [Na+] + [K+] - [Cl-]. A linear relationship exists between the urinary net charge and ammonium excretion. When excretion of Cl- exceeds that of Na+ and K+, the urinary net charge is negative, and it can be assumed that a substantial concentration of ammonium is present in the urine, which would be the case in metabolic acidosis of non-renal origin. Conversely, in both hypokalemic and hyperkalemic renal tubular acidosis, urine concentration of ammonium is insufficient, excretion of Na+ and K+ exceed that of Cl-, and the urinary net charge is positive.

This method has potential pitfalls. A negative urine anion gap is also observed in patients whose acidosis is due to non-renal causes but who fail to acidify maximally because of decreased presentation of sodium to the distal nephron. In these cases, the urinary sodium concentration is very low. Urinary excretion of ketoanions secondary to systemic ketoacidosis can cause a positive anion gap despite adequate ammonium excretion. Thus, ketonuria also should be ruled out in

cases of metabolic acidosis where the etiology is uncertain enough to warrant calculation of the urine AG. The urine net charge also is less useful when large amounts of bicarbonate are present in the urine (pH >6).

Which of the following electrolytes should be administered?

Select ONE only.

1. Sodium only
2. Sodium and potassium only
3. Saline-Bicarbonate solution
4. Saline-Bicarbonate solution with potassium supplementation

Question 9

What volume of fluid should be administered over the following 24-48 hours?

Select ONE of the following only.

About 500 ml
About 1.5 litres
About 2.5 litres
About 5.0 litres

End of case summary:
2.5 litres of Gastrolyte ([Na+]=60 mmol/l, [K+]=25 mmol/l, [Cl-]=45 mmol/l, [Citrate]=20 mmol/l, [Glucose]=90 mmol/l) are administered over the following 48 hours. The blood and sputum cultures return negative growth and you thus suspect that a virus brought on the attack. The child recovers uneventfully over the course of the following week.

Two weeks after hospital discharge the mother returns stating that Mariam's diarrhoea has returned. You examine Mariam and find that the nappy contains a "frothy" stool and that she has red perianal excoriation. You suspect that the original diarrhoeal episode and associated acute enteritis has induced lactose intolerance in the child. You suggest that the mother uses a lactose-free milk formula for two weeks after which she can re-introduce normal milk.

Answer 1:
5. Metabolic acidosis with evidence of respiratory compensation

Answer 2:
= Na+ - Cl- - HCO3-
= 144 - 124 - 5
= 15 (elevated above normal by 3)

Feedback:
1. The anion gap (AG) represents the difference between unmeasured cations and anions. This discrepancy is due to the presence of anions in the plasma that are not routinely measured. An increased AG is associated with renal failure, ketoacidosis, lactic acidosis, and ingestion of various toxins.

2. It should be noted that the decrease in the HCO3- levels (about 20 mmol/l) far exceeds the elevation in ion gap. This indicates that there must be either a loss of HCO3- as well or the failure to regenerate HCO3-

3. Potassium is usually not included in the anion gap calculation as its levels are relatively low and normally don't vary greatly.

Answer 3:
In hyperchloremic metabolic acidosis, the lost HCO3- is "replaced" by Cl- in order to maintain a balance of charge in the plasma. Such a situation is commonly found in the following conditions:

Feedback
- Bicarbonate loss from body fluids through the gastrointestinal tract or kidney, with subsequent chloride retention
- Defective renal acidification with failure to excrete normal quantities of metabolically produced acid; the conjugate base is excreted as the sodium salt and sodium chloride is retained
- Addition of hydrochloric acid to body fluids
- Addition or generation of another acid with rapid titration of bicarbonate and rapid renal excretion of the accompanying anion and replacement by chloride
- Rapid dilution of the plasma bicarbonate by saline

Answer 4:
During acidosis, H+ ion enters the cell in exchange for K+. This causes an elevation in the plasma K+ concentration.

Answer 5:
The reduced glomerular filtration that occurs during episodes of dehydration can result in reduced excretion of nitrogenous compounds such as urea (acute pre-renal renal failure).

Answer 6:
Positive

Feedback:
Cl- = Na+ + K+ + NH4+
Therefore, NH4+ = Na+ + K+ - Cl-
Therefore, NH4+ = 84 + 5.6 - 124
Therefore, NH4+ ~ 34 (a positive value)

Answer 7:

Yes. A positive value for the NH4+ level indicates that the kidneys are able to respond to the acidosis by producing NH4+.

Answer 8:
Saline-Bicarbonate solution

Feedback: The child has lost significant amounts of sodium and bicarbonate in the diarrhea and chloride in the urine (as a counter-ion to the buffer NH4+). Thus, a saline-bicarbonate solution would usually be sufficient to restore the extracellular fluid and correct the acidosis.

Answer 9:
About 2.5 litres

Feedback: Fluid replacement therapy should aim at:
- replacing the loss already experienced (approximately 1.5 kgs).
- Replace ongoing stool losses as they occur, provide ongoing maintenance fluid (100 ml/kg/day for the first 10 kg in body weight and 50 ml/kg/day for the second 10 kg).
- This makes a total of 1.5 litres (initial loss) plus 1 litre (first 10 kg) plus 300 ml (next 6 kg) making a total of 2.8 litres.