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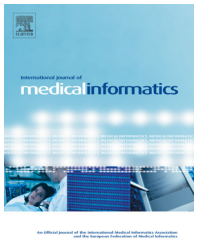

Electronic diagnostic algorithms to assist mid-level health care workers in Nepal: A mixed-method exploratory study

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ABSTRACT

Introduction: The use of mobile health applications for data collection and disease management by rural health care workers in developing countries has been shown to be accepted by patients and health care workers. However, the acceptances of diagnostic decision applications have not been studied. Moreover, verbal acceptance of these tools has not been shown to equate with actual usage by the health care workers when use is not compulsory.

Objective: To measure the acceptance, usage and reasons for use or non-use of electronic diagnostic applications by health care workers to aid in clinical diagnosis.

Methods: Eleven health care workers (HCW) from rural facilities were asked to use the e-algo application on an electronic tablet with patients over the age of five presenting with acute complaints. Use was compulsory for the first 30 working days and after that optional. Patients were asked by questionnaire about their preference and confidence between the traditional approach and that of the e-algo. HCW acceptance was measured by focus group discussions after the compulsory period. The HCW was then told to use the application as they desired. After two months of non-compulsory usage, reasons were explored for use or non-use through a focus group discussion and interviews.

Results: A total of 1410 out-patient encounters occurred in the first phase. Of this, the e-algo was used with 1177 encounters (83%). 496 patients were asked about their preference and confidence in the use of the e-algo. 325 preferred the e-algo over the traditional visit 65.8–25.1%. Patient confidence was higher in the e-algo 72.2–17.4%.

In the second phase, three of the nine HCWs did not use the e-algo at all, the remaining six HCWs reported e-algo use dropped to approximately 15% of total OPD visits. E-algos were reported to be used primarily with more complicated or confusing cases. Reasons for non-use was primarily time related.

Conclusions: We concluded that patients had confidence in and preferred the HCW using the e-algo in their patient care. The HCW users were also positive about the e-algo application, seeing its primary benefit as assisting them in more difficult cases through the use of a differential diagnosis and focused questions. HCWs also reported that the e-algo functioned as a learning tool as well as a diagnostic tool. However, actual usage of the application dropped off significantly when its use was not mandatory. The primary reason was that they

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did not feel the time required to use the application was warranted in the vast majority of their cases which they perceived as being simple and easily diagnose without the assistance of the application. Unless the HCW perceives the decision-support application to be valid, time-saving and easy to use, they will not use them.

1. Introduction

Mid-level health care workers (MLHCW) compose the backbone of the rural health care system in Nepal, often taking the place of a doctor due to a lack of doctors in rural areas. This author showed significant performance gaps of these health care workers (HCW) in diagnostic and clinical decision-making skills [1]. Studies in India found gaps in quality of care by non-physician providers [2]. In response to these findings, NSI developed diagnostic algorithms which were used in a problem and skill-based training called the Mid-Level Practicum (MLP). These diagnostic algorithms have been shown to be effective in improving the HCW clinical decision making in a classroom setting [3]. However, training follow-up revealed a reluctance by HCWs to use the paper algorithms in front of patients for fear of being seen as less than competent.

NSI funded and this author developed an electronic mobile version of its paper-based diagnostic algorithms for use in rural health posts by rural HCW's. The electronic algorithm ("e-algo") is an Android OS application that operates on any Android OS mobile platform, including smart phones and tablets. These diagnostic algorithms cover more than 35 acute complaints. The decision trees lead to more than 260 different diseases endpoints, which also provide diagnostic criteria, management and patient education. This open-source application can be used or modified for use in other countries.

The application requires the HCW to input patient data and answer specific questions. The steps in the application of a patient encounter are as follows:

1. Patient age and gender is entered.
2. A list of common chief complaints is displayed of which the HCW chooses one (Fig. 1).
3. Vital signs are required to be entered.
4. A list of Warning Signs are displayed to which the HCW enters "Yes" or "No". A positive response results in direction to emergency management (Fig. 2).
5. If there are no warning signs, a series of questions based on the chief complaint are asked. The HCW answers based on his history and examination (Fig. 3).
6. A provisional diagnosis is given and the HCW is asked whether they agree with this. If yes, they are referred to the disease management section. If they disagree, they are referred to a differential diagnosis list from which they can pick.

Mobile electronic devices have been used in various developing countries to improve data collection and improve treatment. DeRenzi [4] and Bogan [5] found both patients and HCWs were accepting electronic decision making tools in the

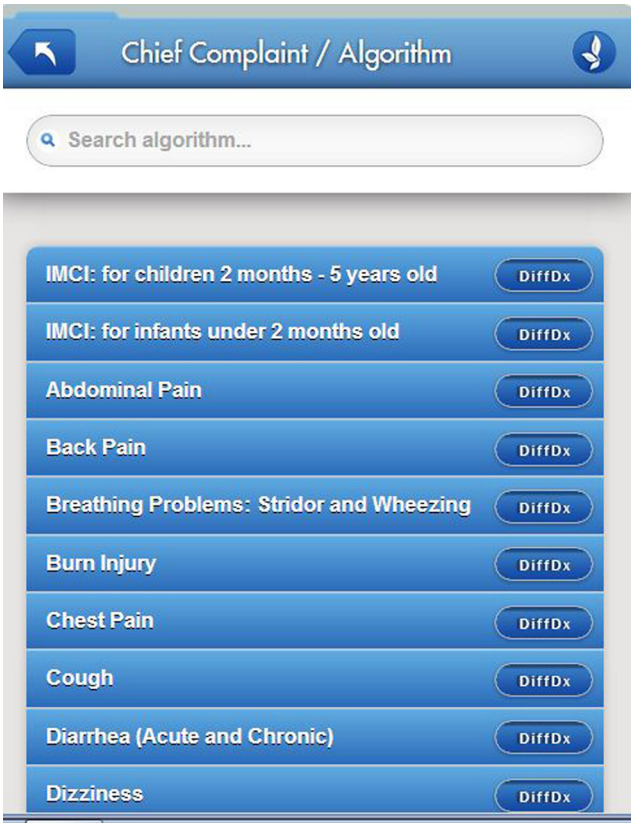

Fig. 1 – Screenshot of algorithms.

care of pediatric patients using the Integrated Management of Childhood Illnesses (IMCI). Using electronic applications to guide HCWs in treatment protocols showed that their use improved the adherence to accepted protocols and was then assumed to improve treatment and patient outcomes [6].

Curry and Reed found that the use of electronic clinical decision support in ordering diagnostic tests did improve the quality of the physicians' clinical care, however, physicians were reluctant to change their clinical habits because they believed that it interrupted their routine work flow [7]. A study of Ghanian midwives showed an acceptance of the mobile application's usefulness but a lack of usability resulted in reduced usage [8].

The vast majority of studies looking at electronic devices however are for the purpose of improving data collection, patient record keeping or specific disease management. Electronic applications that assist the HCW in primary clinical diagnosis have not been studied [9].

In studies exploring patients' attitudes, they generally have been positive about HCWs using mobile devices in their care. Cheng, however, found that HIV patients were reluctant to give