Impact of Health Information Technology in Public Health

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Abstract

Public Health as a domain is a massive complex mixture of professionals and organizations that work together to achieve the mission of ensuring the nation's health. The mission can only be achieved when the population based information is made available at the fingertips of healthcare professionals, administrators, managers, governmental, non-governmental agencies and other contributing to improve the health of the community.

Population based information includes a wide range of community and health facility based information such as socio-demographic, health status, resources, infrastructure, financing, healthcare utilization, coverage and many more. Collecting, transmitting, processing, analyzing and presenting these information is always challenging for the healthcare managers and administrators.

Health information technology (HIT) provides the umbrella framework to describe the comprehensive management of health information and its secure exchange between consumers, providers, government and quality entities, and insurers. Its role in public health is unmatchable because it plays a vital role in early detection of infectious disease outbreaks around the country, improved tracking of chronic disease management, monitoring healthcare programs and coverage, evaluation of health care utilization, and in making transparent and evidence-based decisions for health system interventions.

In addition, HIT also reduces the paper work by eliminating the needs of paper based record and improve the administrative efficiency. It improves the healthcare by decreasing medical errors with an assurance that all the healthcare providers have accurate and timely information. Health information technology in general is increasingly viewed as the most promising tool for improving the overall quality, safety and efficiency of the health delivery system.

Keywords: Public Health; Health Information; Population Based Information

Introduction

Public health is the science and art of preventing disease, prolonging life and promoting health through the organized efforts and informed choices of society, organizations, public and private, communities and individuals. The focus is to prevent rather than treat a disease through surveillance of cases and the promotion of healthy behaviors [1].

This could only be achieved when the information related to the health of the community reaches to the healthcare professionals, planner, policy makers and managers at right time where and when required.

Over the last few decades, the implementation of Health Information Technology (HIT) has become increasingly common in healthcare settings [2], [3], [4]. Initially, they were used mostly for administrative and financial purposes, but in today's ambitious and challenging healthcare scenario the healthcare providers completely depend on Health Information Technology (HIT) for timely and instant access to health information. At any given point of time during patient encounter or afterwards, HIT allows the provider to collect, store, retrieve and transfer information in and across healthcare settings. The health sector has always relied on technologies. According to WHO (2004), they form the backbone of the services to prevent, diagnose, and treat illness and disease [5].

Health Information Technology has the potential to make a major contribution in improving access and quality of healthcare services while containing costs. HIT contribution in public health is countless in terms of providing elective, emergency, and long-term clinical care; educating community; improving nutrition and hygiene; and providing more sanitary living conditions. These in turn ultimately involve massive social and economic changes, as many health challenges go well beyond the health sector,[6]

Public Health Information

Figure 1 depicts the types of public health information required by the healthcare professionals, managers and policy makers at each level of healthcare system. The information is required not only to understand the health status of the population but also to know the need of the population resides in a defined geographical area. To identify the utilization of healthcare service provided at primary, secondary and tertiary level, health care managers require the information in relation to healthcare utilization, healthcare coverage etc.

Figure 1. Types of public health information required by the healthcare professionals, managers and policy makers at each level of healthcare system.
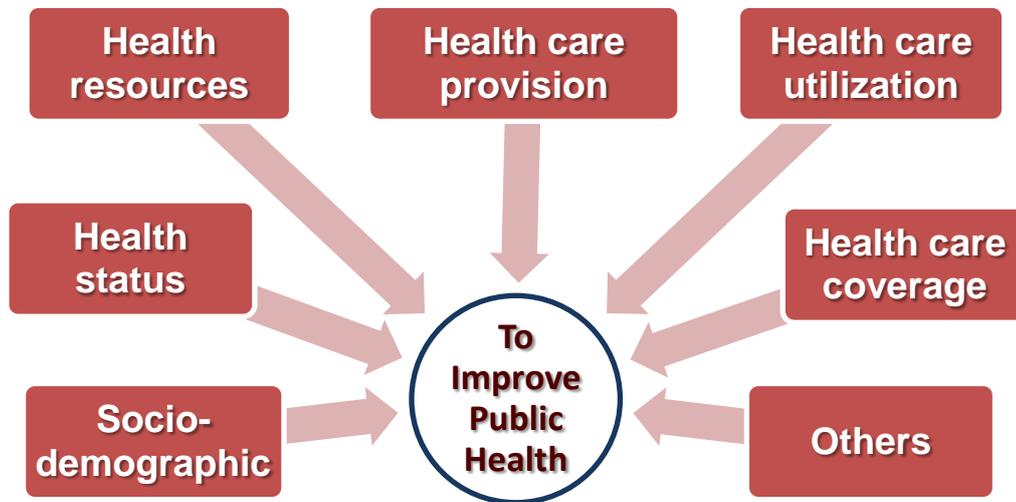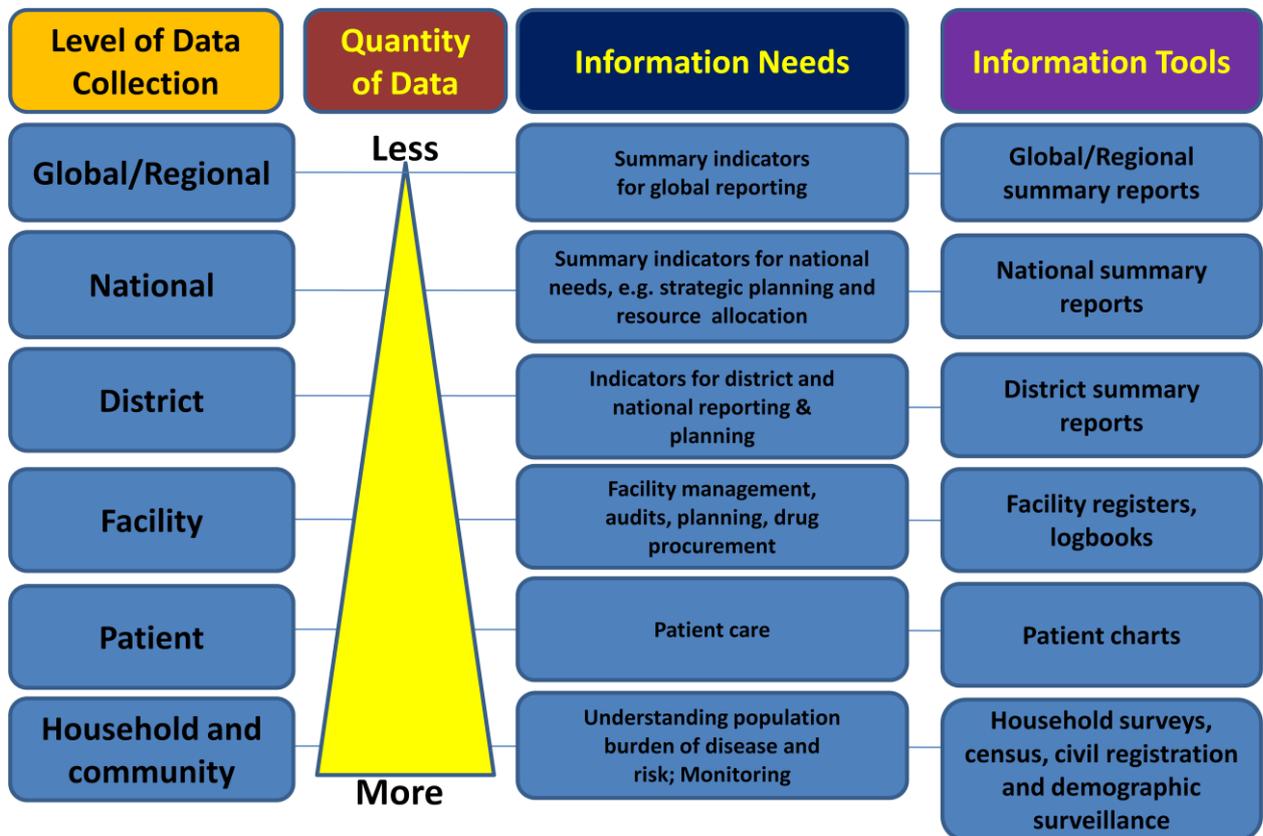

Health Information Needs and Levels of Information Generation

A key element to implement Health Information Technology (HIT) is to understand what to collect, where to collect, whom to report and how these information will be used and by whom because these are used to provide curative, preventive, rehabilitative and palliative care to the population. Considering this, it is required to determine the information needs, tools for data collection and levels of data generation. Once these are defined and determined, it is easy for the managers and providers to proceed with the implementation process in a better way.

Figure 2 depicts that data collection starts for the house hold visit to the patient, facility, districts, national and global level where the amount of data generated are more at the lower level as compare to higher [7].

To make an evidence based decision healthcare providers, managers and policy maker need to understand the population health status, burden of disease, type of healthcare services required to each level, and the progress of the activities/programs at each level of healthcare system. Unless this complete, accurate and adequate health information reaches to the users in a timely fashion, the goal of achieving **"health for all"** will be impossible.

Figure 2. Levels of Data Collection

| Level of Data Collection	Quantity of Data	Information Needs	Information Tools
Global/Regional	Less	Summary indicators for global reporting	Global/Regional summary reports
National		Summary indicators for national needs, e.g. strategic planning and resource allocation	National summary reports
District		Indicators for district and national reporting & planning	District summary reports
Facility		Facility management, audits, planning, drug procurement	Facility registers, logbooks
Patient		Patient care	Patient charts
Household and community	More	Understanding population burden of disease and risk; Monitoring	Household surveys, census, civil registration and demographic surveillance

(Source: HMN-Framework and Standards for Country Health Information System)

Standard Health Information System Model

Figure.3. portray the Health Information System (HIS) Model[7] and its component in a public healthcare setup. This model needs to be developed before the actual implementation of health information technology because it will act as a roadmap for the same. It describes that the healthcare units and population are the vital source of information where the data collection have to be completed using a standard compliant data collection activity. The information's are then stored and later use for the analysis and reporting to the immediate and central level of healthcare system. Health information system actors at the local and central level utilize these for the provision of quality healthcare to the population and also to resolve many issues in relation to healthcare service and health information system.

While implementing Health Information Technology; the healthcare system of the country should consider the model to achieve better acceptability and sustainability of the system. The managers and policy maker should formulate the important policies, allocate adequate resource and design processes where the end user down the line can get maximum benefit from the system.

Figure 3. Health Information System Model
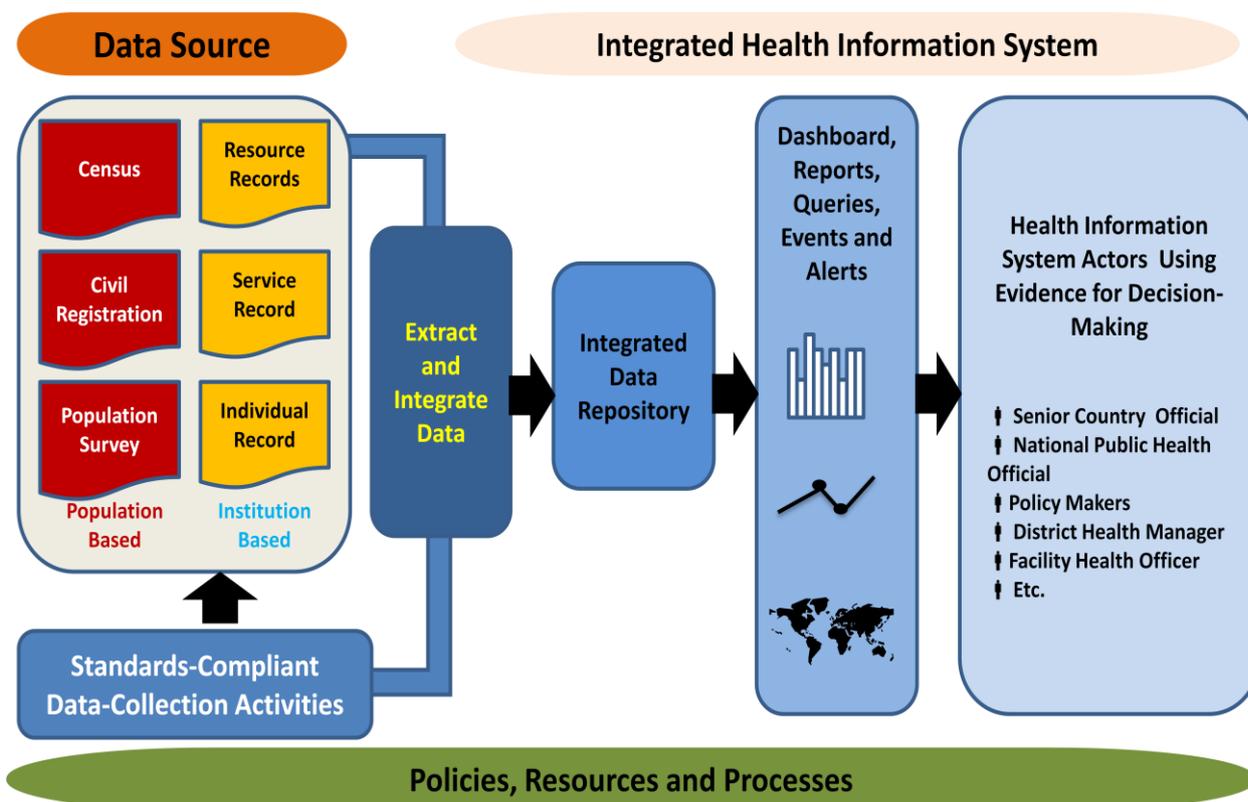
(Source: HMN-Framework and Standards for Country Health Information System)

Common Health Service and Health Information Issues

There are many health related issue arises due to the lack of health information support and prompt reporting (Table 1). These issues need to be addressed before the implementation of Health Information Technology [8].

Table 1. Common Health Services and Related Health Information System Issues

Common Health Service Issue	Corresponding HIS Issue
Problems in providing critical supply continuously.	Lack of accurate and timely stock inventory report.
Inadequate detection and control of communicable diseases.	Failure to receive reports of notifiable communicable diseases from Govt. services.
Inadequate planning and scheduling of critical activities and services at facility and district level.	Certain facility types or service levels not regularly submitting routine operation plans and monitoring reports.

Common Health Service Issue	Corresponding HIS Issue
Inadequate attention is given to finding and serving high risk and underserved populations	Patient and clinic records fail to identify high-risk patients, families and communities.
Inadequate health protection and service provided to poor populations	Lack of up-to-date population data which identifies less advantaged population groups.
Inadequate action by health staff at facility and district level to monitor and correct deficiencies in service coverage and quality.	Staff at facility and district level do not maintain records and present data in a manner which enable monitoring of coverage and quality
High staff turnover	Lack of clear job descriptions and career development opportunities

Health Information Technology has all potentials to resolve the issues encountered by the healthcare providers in managing health information of the population. Healthcare system of the country should look forward in implementing this technology in providing quality healthcare to the individual and the community but before that it is required to understand the health information technology, its application, reason to use and its impact.

Health Information Technology

Health information technology (HIT) provides the umbrella framework to describe the comprehensive management of health information and its secure exchange between consumers, providers, government and quality entities, and insurers. Health information technology (HIT) is in general increasingly viewed as the most promising tool for improving the overall quality, safety and efficiency of the health delivery system [9].

Reason to Use Health Information Technology

Wilson & Smith Suggested that the creative use of computer technology is one of the most promising means of improving quality, timeliness, clarity, presentation and use of relevant information for public healthcare management.

The ultimate aim of health information technology in healthcare is to provide optimal information support to the healthcare professionals, managers and policy makers for quality decision making, care and treatment. The HIT provide highly-secure, economical, easy-to-use, always available, point-of-care application in[8] [10]:

- Improving program efficiency by collecting, processing and analyzing a large amount of data quickly. As the manual systems are by nature paper-heavy, managers are often buried under the mountain of data result in which they are unable to navigate the information for quality decision making.

- Producing a wide variety of output and feedback reports targeted for many level of the health system from a single data set or by combining data sets.

- Reducing the duplication of work where the data can be entered once and will be available to at any point of to the care providers, mangers and policymakers.

- Automatic validation helps the care providers to improving the quality of data collection through automatic validation during data entry and automatic preparation of immediate feedback reports on error for individual health facilities.

- Improving analysis and information presentation to facilities data interpretation and use for decision making.

- Decentralization data analysis and use to reduce the data entry bottleneck at the central level and provide management information to district manager in a timely manner.

- Training health personnel through computer based interactive tutorial for self instruction and continuing education.

- Managing the data for monitoring the attainment of health program targets and objectives.

- Collaborating the networks of providers and researchers in analyzing, discussing and interpreting the care process and outcomes for its continuous improvement.

- Integrating service statistics data with already computerized data on demography, health infrastructure, and/or financial management.

- Accessing the internet to search for information about new products and approaches to service delivery, and exchanging information with other health care workers around the globe.

- Improving data dissemination by providing online public access o data through internet World Wide Web pages.

- Developing decision support tools for planning increased service coverage and logistics (e.g. target cost from future group)

- Modeling and stimulation to facilitate planning by analyzing projected outcome for given input and condition.

- Helping the primary health centers, district and national health team in healthcare resource determinations.

- Enables consumers, purchasers and payers to get information they need to support their decisions

- Provides alerts and reminders to help prevent errors and omissions

- Manages plan of care execution to assure orders are carried out with minimal disruption

- Coordinates care across the entire healthcare continuum

- Speeds workflows by streamlining tasks, such as scheduling, ordering, data entry, and generating forms and reports

As the above represent the reason to use HIT in healthcare setup but it is also required to understand the types of application required at each level of healthcare setting for various clinical and administrative activities.

Common HIT Application and Their Role in Achieving Quality Healthcare

There are many applications exist in relation to the management of health information as well as in provision of healthcare services. The most common are:

Health Management Information System

Health Management Information System is an information system specially designed to assist in the management and planning of health programs, as opposed to delivery of care [11]. Health Management Information System incorporate all the data needed by the policy makers, clinicians and health service users to improve and protect population health.

As per World Health Organization (WHO) investment in health management information systems (HMIS) now could reap multiple benefits, including:
- ✓ helping decision makers to detect and control emerging and endemic health problems, monitor progress towards health goals, and promote equity;
- ✓ empowering individuals and communities with timely and understandable health-related information, and drive improvements in quality of services;
- ✓ strengthening the evidence base for effective health policies, permitting evaluation of scale-up efforts, and enabling innovation through research;
- ✓ Improving governance, mobilizing new resources, and ensuring accountability in the way they are used [12].

Electronic Health Records

The Electronic Health Record (EHR) is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting [13]. It supports healthcare providers with optimal information in continue, efficient, and quality integrated

healthcare. It contains the problem list that clearly delineates the patient clinical problems and current status of each problem. It addresses patient data confidentiality extensively and can be linked local and remote knowledge, literature, bibliographic or administrative database. It is flexible and expandable to support not only today's basic information needs but also the evolving needs of each clinical specialty and sub-specialty.

Decision Support System

A Decision Support System (DSS) is an interactive, flexible and adoptable computer based information system developed for supporting decision making related to the solution of particular management functions. It assists the clinicians in finding health information of the patient required to diagnose the patient condition and provide the continuity of care. Though a wide variety of patient's information stored in the computer, it helps healthcare providers to get the patient data without any extra effort. As patient care involved professionals like physicians, nurses, pharmacists, and other supportive staff and each one wants patient's information at their fingertip as and when required. Decision Support System provides easy flow of information among these professionals to provide best care. Being a paperless system, the DSS provides legibility of data, which helps the health care professionals to avoid the complexity in finding various results

Hospital Information System

Hospital Information System (HIS) is as open system, which attempt to integrate and communicate the outside and inside flow of information within a hospital and provide the functions common for all application. It support the healthcare providers in real time access of patients information, preparation of operation document, keeping track of movement history of the patient across locations, Multiple accesses to information, Reduction in transcription work, compilation of data in multiple forms etc. A well designed, integrated hospital information system, tailored to the specific needs of a particular hospital, can improve the productivity of a hospital staff, allow each department and service center to control its own information processing and contribute to the quality of patient care.

Computerized Physician Order Entry

Computerized physician order entry (CPOE), is a process of electronic entry of medical practitioner instructions for the treatment of patients under his or her care. These orders are communicated over a computer network to the medical staff or to the departments (pharmacy, laboratory or radiology) responsible for fulfilling the order. CPOE decreases delay in order completion, reduces errors related to handwriting or transcription, allows order entry at point-of-care or off-site, provides error-checking for duplicate or incorrect doses or tests, and simplifies inventory and posting of charges. Order Entry is in the domain of the pharmacist because it is the pharmacist responsibility to verify any entry into the system concerning the use of medications within the hospital or health care system. Order clarification requests will be enhanced by improved communication of collaboration amongst the health care team [14].

District Health Information System

A District Health Information System (DHIS) is a high flexible open source health management information system and data warehouse. The work of it is to cover aggregate routine data, case base patient information, disease surveillance, survey or audit data etc. The system is used to transmit the valuable information from lower level to the higher for reporting and planning of healthcare services [15].

Overall Impact of Health Information Technology

Health information Technology has a greater impact on healthcare services as well as research and education. The below mentioned point discuss the impact of health information technology on patient, providers, administration, researcher and academician.

Patient Perspective

Health information technologies (HIT) are an enabling component to the delivery of health services over distances, providing fundamental tools and systems [16]. Evolution and adoption of electronic health records and computerized health information system has also improved the sharing and real time access of patient information at a given point of time. It also provides support for continuous home based geriatric care and the patient with chronic illness. The technology can integrate to the telemedicine in getting the patient information situated in outreach areas.

Clinicians Perspective

HIT provides reliable, relevant, up-to-date, adequate, timely and reasonably complete information for health manager at all level (e.g. central, intermediate and local) to improve the health care delivery and to achieve national goal. The applications such as EHR, DSS, CPOE, HIS helps the clinicians for instant access of patient information as well as support for quality decision making. Clinicians can also evaluate their performance using these applications and also track their patient health status under care. It is not only helps the clinicians in treatment plan process but also support for their continuing education when these applications get integrated with online education systems. HIT also helps the clinicians in reducing and avoiding medical error by prompting alerts and reminder about patient health status.

Administrator's Perspective

HIT provides health administrators a mean for the data collection (both routine and non-routine), processing, analysis and timely reporting of the information to their immediate level and others. The information generated can be used to understand the healthcare needs of the community and also for conducting various community health programs. At the district level HIS provide information to improve various community programs. In case of any endemic

outbreak and disaster, HIT integrates with other applications such as Tele-medicine and TeleHealth to assist healthcare providers in delivering quality services to a large group of patient within and outside the coverage area.

It equipped the healthcare managers and administrator with a mean to monitor and evaluate the healthcare activities and also the health status of the community. At the primary level and secondary level, HIT provides information related to the family planning, immunization and various other programs to decide whether it is necessary to organize out-reach programs into the community. It also Provide information about the health indicators and trends which can be used to identify inequities in health service provision and to inform strategies to achieve equitable resource allocation

Research and Education

Success of any healthcare research is largely depends on the availability of health information and medical knowledge. Health Information Technology with its versatile features provides information related to the demographic, clinical, administrative, and health status of the population. The above information assists the healthcare researcher in improving the population health, pharmaceutical surveillance, comparative effectiveness research, clinical trial etc.

To impart Medical, Dental, Nursing, Paramedical and Public Health Education and also the refresher in-service training, academician should have the access to complete, accurate, adequate and timely reporting of information related to the population of a defined geographical location. As EHR, DSS, HIS and may other application provide easy access of patient information to the healthcare academician which can be used to improve teaching-learning method. Students will also have access to the actual patient records to learn the clinical findings, interpretation and outcome. The above not only improve their clinical efficiency but also equipped them with the large domain knowledge.

Several benefits of HIT have been well documented in a number of clinical studies. While the advantages of HIT on administrative functions are readily discernible, such as decreasing paperwork and workload of health care professionals, increasing administrative efficiencies, and expanding access to affordable care [17],[18].

It is also evident from the studies of Choudhary et.al[19] that HIT has improved the efficacy in improving quality of healthcare service. A study conducted by Hunt et al[20], Steele[21] evident that the implementation of HIT had remarkably improved the performance of the physician where in Delipierre et.al[22] implementation of EHR has reported maximum satisfaction among physician in terms of care. Kucher et al[23] reported the reduction in medical error cases after the implementation of HIT application whereas it has shown a remarkable impact on medical education [24].

Conclusions

Health Information technology is always considered to be a promising tool for the improvement of healthcare of individuals as well as the population. The applications such as EHR, CPOE, HMIS, HIS and others provide easy and instant access of health information and domain specific knowledge to the healthcare professionals, planner, managers, policy maker, and national health agencies for the provision of quality healthcare as well as informed decision making.

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