Utilizing Technology for Dermatology Care in Tajikistan

A Health Systems Perspective

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KEYWORDS

• Teledermatology • Health systems • Tajikistan • Governance • Technology • Service delivery

KEY POINTS

- In Tajikistan, where distances can be long and a large proportion of the population lives outside of major cities, teledermatology can serve as an effective method of skin care delivery.
- The authors designed a store-and-forward teledermatology program to allow dermatologists in smaller cities to consult with their most experienced colleagues in the capital city of Dushanbe on complex patient cases.
- Thus far, 228 consultations have taken place through the teledermatology platform, although several challenges to implementation exist.
- The application of a health systems framework by the World Health Organization, comprising various health systems building blocks, helped define the aims of the program and enabled putting in place needed elements to maximize program success.

INTRODUCTION

Tajikistan is a land-locked former Soviet country in Central Asia, with a population of 9 million.[1] More than 90% of the country comprises mountainous terrain[2] and a majority of the population lives in rural regions.[3] Following the collapse of the Soviet Union in 1991, Tajikistan became an independent country.[4] Although the official language is Persian, until recently, medical education was conducted almost entirely in Russian. The bulk of resources used by medical professionals also are in Russian.

Health care in Tajikistan is delivered predominantly through the public sector, constituting more than 98% of outpatient services.[5] This applies to dermatologic care as well, which is delivered through national, provincial, and city-level skin hospitals as well as city and township health facilities.[6] Patients with skin conditions are treated on outpatient and inpatient bases through dermatology services. The reason for hospitalization usually is to increase adherence with treatment regimens or to accommodate patients who have traveled long distances.

There are a total of 230 dermatologists in Tajikistan, all of whom work in the public sector.[6] Postgraduate training in dermatology involves a

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minimum of 1 year of dermatology internship, which is required to practice as a dermatologist. Some dermatologists, who seek academic or leadership positions, opt for an additional 2 years of clinical and/or research training. Dermatology residents are placed at the National Republic Center for Dermatology and Venereology (NRCDV), the Dushanbe City Dermatology Hospital, or the Sughd Oblast Dermatology Hospital in the northern city of Khujand.

NRCDV provides tertiary care for patients with skin conditions from all over the country. Many of the dermatologists at this center are highly respected as they collaborate with colleagues from Russia, other former Soviet countries, Western Europe, and South Asia. As a result, patients frequently self-refer to this hospital, traveling long distances to seek medical care at this center. This can be both costly and difficult for patients, however, especially in the winter months, when road and weather conditions are not optimal.

The authors' objective was to design a telemedicine program to achieve the following primary aims: (1) improve quality of care by enabling local dermatologists to consult with experts at NRCDV, (2) reduce patient self-referral to NRCDV, and (3) improve knowledge among dermatologists outside of Dushanbe and trainee dermatologists by putting in place a reliable mechanism for teledermatology consultations. These efforts are in keeping with the Ministry of Health and Social Protection of the Population (MOHSP) goal of ensuring that all individuals receive high-quality equitable dermatologic care.

METHODS

Approach

The authors applied the World Health Organization (WHO) health systems conceptual framework to design a teledermatology program with the overarching goal of ensuring high quality, equitable, dermatologic care. This conceptual framework proposes 6 key building blocks as essential to the functioning of a health system: (1) health service delivery, (2) human resources for health, (3) health governance, (4) health information, (5) technologies and medical products, and (6) health financing (**Fig. 1**).[7]

By applying this framework, the authors were able to consider the minimum elements needed within each building block for successful implementation of the teledermatology program. The framework also enabled designing the program in a way that would, in turn, further strengthen the various building blocks as they relate to the delivery of dermatologic care.

Details of the Teledermatology Platform and Infrastructure

This program was planned as a collaboration between PASHA, a United States nonprofit organization, and the MOHSP, with funding support from an American Academy of Dermatology Skin Care for Developing Countries grant. Local dermatologists and ministry officials provided extensive feedback on the program at all stages of implementation. One aim of this program was to enable dermatologists from smaller cities to consult with their more experienced colleagues at the NRCDV on patients with complex skin conditions. The public dermatology clinic or hospital in the cities of Kulob, Qurghonteppa, Khujand, and Vahdat (hereafter referred to referring sites) were selected as facilities that would consult with NRCDV on complex cases using teledermatology (**Fig. 2**). These 4 sites were chosen because they are among the most populous cities in Tajikistan and serve large rural populations within their vicinity. At each of the referring sites and at the NRCDV, PASHA provided and installed computers. Google Drive was used to transmit patient information. A Google account was created for each referring site as well as the NRCDV. PASHA staff, along with a local dermatologist from the NRCDV and a Tajik medical student, provided training on the use of Google Drive. The training and installation of the hardware and software occurred between January and July of 2017.

Dermatologists at referring sites were trained to use the software to consult with dermatologists at the NRCDV on cases where they felt a second opinion would improve management. For patients where a teledermatology consultation was deemed appropriate, the dermatologist at the referring site entered the patient's name, date of birth, chief complaint, history of present illness, past medical history, medications, and any relevant laboratory test results into corresponding cells of a Google Sheet. The referring physicians used their personal smartphones to take photos of skin. These photos then were transferred to the computer with a cable and subsequently uploaded into a cell in the same Google Sheet. Two dermatologists at NRCDV regularly checked the Google Drive folders, reviewed the sheets, and took turns providing a diagnosis and treatment plan, which then was implemented by the dermatologist at referring sites at patient follow-up. All providers purchased their own data plans to connect to the Internet using USB modems.

Data from the teledermatology portal were collected and organized in Microsoft Excel. In

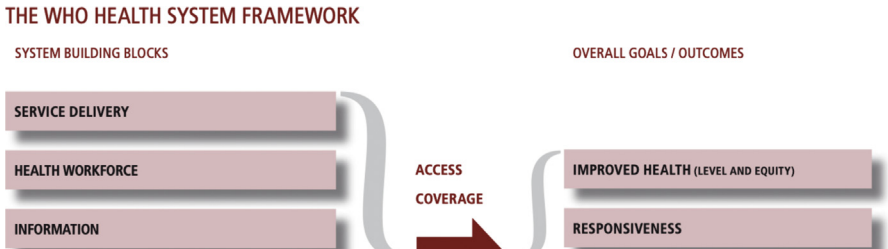

Fig. 1. WHO building blocks—the 6 building blocks of the WHO health systems framework work together to achieve the goal of improved health, responsiveness to patient needs, protection from financial and social risk, and increased efficiency. (*From* Everybody's Business - Strengthening health systems to improve health outcomes: WHO's framework for action. Geneva 2007.)

instances where the dermatologist at NRCDV provided a diagnosis, the authors translated that diagnosis into English and classified the diagnoses into different skin disease categories according to the *International Classification of Diseases, Tenth Revision*.[8] Unstructured open-ended interviews were conducted with individual dermatologists at NRCDV and the referring sites, along with roundtable discussions, to identify barriers to consultation and determine ways to enhance the teledermatology program.

RESULTS

A total of 228 patients have been referred through the portal thus far. Of the total referrals, 103 were from the city of Khujand, 32 were from Kulob, 20 were from Qurghonteppa, and 73 were from

Fig. 2. The 4 cities of Kulob, Vahdat, Qurghonteppa, and Khujand used the teledermatology platform to consult with experts in Dushanbe on patients with complex skin conditions.

Vahdat. Among the referred cases, 201 were reviewed by 1 of 2 consulting dermatologists at the NRCDV, who responded with a management plan in 168 of the referrals. In 122 cases, the consulting physician provided a diagnosis and, in another 12, a differential diagnosis. There were 11 instances where the consulting physician only provided a diagnosis but no treatment plan. The referring dermatologists did not provide their suspected diagnosis or treatment plan in the majority of cases. Therefore, it was difficult to determine concordance rates in diagnosis or management. In cases of the consulting physicians not providing a diagnosis or management plan, they reported that they either did not have Internet access at the time or they found it easier to call the referring physician and discuss the case by phone.

Of the 122 diagnoses provided by the consulting physician, 30 (24.6%) were dermatitis and eczema, 15 (12.3%) were disorders of skin appendages, 13 (10.6%) were papulosquamous disorders, 12 (9.8%) were infections of the skin and subcutaneous tissue, 4 (3.3%) were bullous disorders, 2 (1.6%) were urticaria and erythema, and 46 (37.7%) were other disorders of the skin and subcutaneous tissue. The 5 most common diagnoses were drug eruption (6 cases), contact dermatitis (6 cases), congenital melanocytic nevus (6 cases), dermatitis due to substances taken internally (5 cases), and onychogryphosis (5 cases) (**Table 1**).

Both consulting and referring dermatologists from each of the 4 sites participated in unstructured interviews and a roundtable discussion after program implementation. The dermatologists reported overall satisfaction with the program. There was general agreement that such a program was needed in Tajikistan and effective in enhancing patient care. Consulting dermatologists from NRCDV stated that the program helped with their understanding of the types of dermatologic conditions being encountered by their colleagues outside of the capital. They reported that this information could inform future ministry-level decisions about areas of need with regard to dermatologic care. Dermatologists from the referring sites stated that the teledermatology program was helpful because it enabled them to seek the expertise of their colleagues in Dushanbe. They also reported an increase in their knowledge level as a result of the input provided by dermatologists at NRCDV through the program. Physicians at the 4 referring sites also stated that patients who were informed that an expert from the NRCDV was providing input on their skin condition expressed satisfaction with this additional input on their care. Both consulting and referring physicians stated that the program had a positive impact on their e-health literacy.

Several challenges also were reported. Four key barriers presented by both referring and consulting dermatologists were (1) a lack of remuneration for providing teledermatology care, (2) lack of time to participate, (3) an inability to effectively incorporate teledermatology into the current workflow of daily activities as a clinician, and (4) formatting problems with the software. Referring dermatologists participating in this program reported that the process of transferring photos from their mobile device to the computer was time-consuming. They also stated that when photos were dragged into the Google Sheet, there were formatting problems with the sheet. Consulting dermatologists expressed frustration with the fact that they were unable to see the post-treatment outcomes of patients for whom they had provided a teleconsultation. Both consulting dermatologists stated that they would be more motivated to participate if they could see that their teledermatology consultations led to a positive outcome for patients.

DISCUSSION

This article describes a model of store-and-forward teledermatology between general dermatologists across different parts of Tajikistan and their counterparts at a tertiary referral skin hospital in the capital city of Dushanbe. This is the first use of teledermatology in Tajikistan and, to the best of the authors' knowledge, the first report on teledermatology across all of Central Asia. Teledermatology between dermatologists in the community and their counterparts at specialized care centers has previously been described in several other settings, including the United States and Germany, but reports on its use are limited in the literature.[9]

In designing this program, the authors employed a health systems approach utilizing the 6 health systems building blocks defined by the WHO as they relate to skin care delivery. The authors review each of these building blocks, outlining how the success of this teledermatology program depended on each, and conversely examining the potential impact of this program on each building block. Some of the challenges faced and propose potential solutions also are considered.

Health Service Delivery

A key challenge in the delivery of dermatologic care for patients residing in rural areas and smaller towns is the long distance of travel to the NRCDV in the capital city of Dushanbe, where many patients prefer to seek care because of the presence of physicians with greater expertise. One aim of

Table 1
Diagnoses provided by consulting physicians according to skin disease categories from the *International Classification of Diseases, Tenth Revision*

Diagnosis	Number of Cases (% of Total Cases); N = 122
Bullous disorders	4 (3.3)
Epidermolysis bullosa	2 (1.6)
Linear IgA bullous dermatosis	1 (0.8)
Pemphigus vulgaris	1 (0.8)
Dermatitis and eczema	30 (24.6)
Drug eruption	6 (4.9)
Contact dermatitis	6 (4.9)
Dermatitis due to substances taken internally[a]	5 (4.1)
Prurigo	4 (3.3)
Atopic dermatitis	3 (2.5)
Eczema	2 (1.6)
Eczema herpeticum	1 (0.8)
Posttraumatic eczema	1 (0.8)
Dyshidrosis	1 (0.8)
Lichen simplex chronicus	1 (0.8)
Disorders of skin appendages	15 (12.3)
Onychogryphosis	5 (4.1)
Alopecia	2 (1.6)
Rosacea	2 (1.6)
Sycosis	2 (1.6)
Acne vulgaris	1 (0.8)
Hirsutism	1 (0.8)
Hyperhidrosis	1 (0.8)
Onychomycosis	1 (0.8)
Infections of the skin and subcutaneous tissue	12 (9.8)
Dermatophytosis	4 (3.3)
Pyoderma	2 (1.6)
Cutaneous leishmaniasis	2 (1.6)
Demodicosis	1 (0.8)
Erysipelas	1 (0.8)
Staphylococcal scalded skin syndrome	1 (0.8)
Tinea cruris	1 (0.8)
Papulosquamous disorders	13 (10.6)
Lichen planus	4 (3.3)
Plaque psoriasis	3 (2.5)
Pityriasis rosea	2 (1.6)
Psoriasis	2 (1.6)
Palmoplantar nonpustular psoriasis	1 (0.8)
Pustular psoriasis	1 (0.8)
Urticaria and erythema	2 (1.6)
Behçet disease	1 (0.8)
Erythema multiforme	1 (0.8)
Other disorders of the skin and subcutaneous tissue	46 (37.7)
Congenital melanocytic nevus	6 (4.9)

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Table 1
(continued)

Diagnosis	Number of Cases (% of Total Cases); N = 122
Pellagra	4 (3.3)
Plantar wart	3 (2.5)
Pigmented nevus	3 (2.5)
Ichthyosis	3 (2.5)
Herpes zoster	2 (1.6)
Stasis dermatitis of lower legs	2 (1.6)
Necrobiosis lipoidica	2 (1.6)
Systemic sclerosis	2 (1.6)
Venous stasis ulcer of lower extremity	2 (1.6)
Plantar hyperkeratosis	2 (1.6)
Ichthyosis vulgaris	2 (1.6)
Systemic lupus erythematosus with skin involvement	1 (0.8)
Xanthelasma	1 (0.8)
Keratoderma	1 (0.8)
Basal cell carcinoma	1 (0.8)
Nonpigmented nevus	1 (0.8)
Flat warts	1 (0.8)
Kaposi sarcoma	1 (0.8)
Lipoma	1 (0.8)
Neurofibromatoses	1 (0.8)
Palmoplantar hyperkeratosis	1 (0.8)
Lichen sclerosis	1 (0.8)
Verruca vulgaris	1 (0.8)
Oral mucosal warts	1 (0.8)
Total	122 (100)

[a] Consultant did not specify whether this was due to ingestion of food or drugs.

this teledermatology program was to enhance health service delivery by enabling patients to seek dermatologic care at their local health facility and receive a second opinion from dermatologists in the capital when warranted, thereby obviating the need to travel long distances.

Physicians reported that time and lack of integration of teledermatology into their work flow were challenges to participating in teledermatology. Specifically, the process of transferring photos from the mobile device to the computer and formatting the images was cumbersome. To address this, the authors are in the process of moving the teledermatology platform to a software designed specifically for telemedicine and providing iPads to participating providers. With the new software and iPads, high-quality photos can be taken and uploaded onto the dermatology portal using the same device, eliminating the need for the manual transfer of photos from the mobile device to the computer. It also is expected that formatting problems will be resolved with the use of the new software. Along with these efforts, in order to increase uptake, local providers are working to raise awareness about the program within the patient community to encourage patients to seek care at the local facility in the nearest town instead of traveling to the NRCDV in Dushanbe.

Human Resources for Health

One of the 6 building blocks of the WHO health systems framework is human resources. As with all teledermatology services, this program relies on the physician workforce for its success, but it also was designed with the aim of strengthening the dermatology workforce. The teledermatology portal has the potential to increase availability of human resources for the delivery of health care services at the NRCDV by reducing the number

of unnecessary in-person visits, thus freeing up time for visits with more complex patients. In the United States, the use of teledermatology at a public county hospital has had this type of positive effect, leading to increases in total volume of patients treated and reductions in patient waiting times.[10]

The portal has allowed dermatologists at referring sites to share complex cases with more experienced colleagues in Dushanbe and seek their opinion. This process also has the potential to lead to increases in the knowledge level for referring dermatologists. Although the authors did not systematically measure this, the referring dermatologists reported that the program enhanced their knowledge level. There is evidence that store-and-forward teledermatology can improve knowledge of skin disease and its treatments among primary care providers in the United States.[11] In the long term, as referring dermatologists learn the approaches used by their colleagues at the NRCDV, they may adopt similar practices and share these practices with colleagues in their region, which could, in turn, enhance the standards of dermatologic care across Tajikistan.

In addition, in the United States, there has been a move toward greater use of teledermatology in residency curricula.[12] This is a new element that the authors plan to combine with the teledermatology portal in Tajikistan. Modeled on American residency programs, the educational component will provide an opportunity for dermatology residents in Dushanbe to meet at a predefined time on a weekly basis to discuss teledermatology cases with their attending physicians at the NRCDV. The residents will review cases, come up with a differential diagnosis and treatment plan, present their assessment and plan to the attending physician, and together provide a final recommendation to referring physicians. By defining teledermatology as a component of resident education, the authors hope that the provision of teledermatology services will be integrated more effectively into the daily clinical workflow in the years to come.

Another factor related to the human resources building block is health workforce motivation. The consulting dermatologists in the authors' program reported that the inability to see final outcome of their teleconsultation made them less engaged in teledermatology. In addition to financial remuneration, intrinsic motivators, such as a desire to do good, are thought to play an important role in driving health care provider behavior.[13] With the new teledermatology software that the authors currently are introducing, the progress of a patient can be followed over time. This, in turn, may serve as an intrinsic motivator for consulting dermatologist leading them to further engage in teledermatology consultations.

Health Governance

There is consensus within the health systems literature that good governance is a key element of achieving successful health outcomes and improving access.[14] Recognizing this principle, the authors worked from the early stages of the design of this program to identify a local champion who could lead these efforts. They found this was imperative to motivating the workforce to become engaged in this program. Because the implementation of this program, the authors have also worked closely with the MOHSP to ensure there is ministry-level support for their activities. Currently, the authors are working with the MOHSP to better define the role that teledermatology can play in service delivery. This involves formally including the provision of dermatologic care through telemedicine as one of the defined responsibilities of dermatologists.

Health Information

This program has led to a collection of data and images, which provides useful information about the types of skin conditions that are deemed complex and being referred to the tertiary center for further evaluation. Although this information does not supplant epidemiologic surveys or disease registries, it has helped local providers gain a better picture of some of the complex skin conditions that may be prevalent or problematic in different regions. Information from this portal also may provide insights on the extent to which evidence-based approaches are being employed to treat skin conditions and shed light on the availability of various therapeutics in the country, because drugs that are not available presumably will not be recommended by the consulting dermatologists.

Data on the current practices and recommended therapies gleaned from the teledermatology portal currently are being used to develop clinical guidelines for the treatment of dermatologic conditions adapted to Tajikistan in collaboration with colleagues from several institutions in the United States. Additionally, according to physicians in Dushanbe, information collected from the teledermatology portal has, in part, contributed to a realization among providers that there is heterogeneity in the use of terms to describe medical or dermatologic concepts. Some physicians use Tajik-Persian terms, others use the Iranian-Persian terms, whereas others still use the Russian terms.

This has prompted the Tajik Association of Dermatologists to create a dictionary to standardize the terminology.

A key part of this program has involved training of local dermatologists in the use of computer technology to enter and review patient information. Although the authors never measured this in a structural fashion, they observed that physicians using this portal are more confident and capable in using the computer software now than they were before the program was implemented. In interviews and roundtable discussions, the physicians corroborated the authors' observations by stating that the program increased their ability to use computer technology. The use of this teledermatology program also has drawn the attention of the MOHSP and providers from other specialties, who have expressed interest in developing electronic databases where they can collect information on patients with a variety of conditions. In December of 2019, PASHA provided technical assistance to endocrinologists from the MOHSP to establish an electronic database that could be piloted at 4 different endocrinology clinics across Dushanbe to collect information about patients with type 1 diabetes mellitus and type 2 diabetes mellitus. Ophthalmologists in Tajikistan also have expressed interest in using a similar approach to collect information on patients with ocular trauma.

Medical Technologies and Products

Medical products and technologies are integral elements of an effective health system. With more widespread use of telemedicine and teledermatology, computer technology both in the form of hardware and software also increasingly is recognized as a key component of this health systems building block. One way in which the authors supported this program was the provision of desktop and laptop computers at the referring centers and the NRCDV. Most of the physicians in the program used their own smartphones to take photos of the skin lesion and transferred the photos to the computer. Internet access (4G) is available across most of Tajikistan, which made it possible for referring and consulting dermatologists to use USB modems, which they personally had purchased, to access the Internet.

In conjunction with computer hardware and software, the success of this teledermatology program and dermatologic care in general is contingent on access to medicines. Progress has been made in this area in recent years. Some treatments cannot be obtained, however, within the country or at all pharmacies. One example is locally sourced Unna boots. Although the cost of production is low and the Unna boot potentially can serve as a new source of revenue for pharmacies, most pharmacies are not producing such Unna boots because the staff are not trained in their production. The authors currently are working with the Division of Pharmaceutical Services in the MOHSP to design a program that would train pharmacy staff to prepare these boots, ensuring there is enough supply to meet demands while setting prices in a way that does not make them unaffordable to patients. The authors hope that this collaboration can set the foundation for future work within the division of the MOHSP to procure other needed medications and treatments at low cost.

Health Financing

One of the major aims of this teledermatology program is to reduce the financial burden on individuals and families. As discussed previously, patients from all over Tajikistan self-refer to the NRCDV in Dushanbe to seek care from the most respected specialists in the country. Some of these individuals travel by car for 1 day to 2 days to reach the capital and incur significant transportation costs. Wages also are lost as patients and family members take time off from work. Furthermore, patients traveling from long distances often have nowhere to stay when they reach Dushanbe and, therefore, are hospitalized, which incurs additional costs to them and places a financial burden on an already stretched public health care system.[5]

Future studies examining the impact of this program would be valuable in determining if there is, in fact, a reduction in the financial burden and the extent of this reduction. Nevertheless, the current facts support the potential for reductions in expenditures. Studies from other countries also point to evidence of cost effectiveness of store-and-forward teledermatology, particularly for individuals who otherwise would have to travel long distances.[15] Recent evidence from Portugal suggests that the use of store-and-forward teledermatology in presurgical consultations for skin cancer can lead to reductions in patient out-of-pocket expenditures.[16]

Furthermore, developing a financial model for physician remuneration that would ensure sustainability of the program remains a key challenge of this program. As described previously, the absence of compensation for the time dermatologists spend on such consultations was a major barrier to participation. A clear financial scheme is needed to ensure sustainability of such a program.

SUMMARY AND FUTURE DIRECTIONS

This article highlights several lessons learned through the introduction of teledermatology in

Tajikistan as well as challenges faced. Physicians on the ground report benefits from the program, including improvements in their knowledge levels, e-health literacy, and an overall ability to better care for their patients. The data suggest that there is uptake of the program by referring physicians and participation on the part of the consulting physicians. Nevertheless, challenges, such as technical difficulties with the software, may be hindering the program from achieving its full potential. There are limitations to the methodology used to evaluate the program, because baseline evaluations were not conducted nor did was a control group used. Therefore, it is difficult to make definitive conclusions about the direct impact of the program on quality, outcomes, or costs. Furthermore, the diagnoses provided by the consulting physicians were not confirmed with histopathologic analysis. Therefore, it is difficult to know with certainty how accurately these diagnoses reflect the actual pathology causing skin disease in patients.

One key takeaway from the authors' experience, which they believe can be applied in other contexts, is that telehealth services and teledermatology, in particular, do not occur in isolation from the larger health system. The success of such programs and their scalability require identifying and ensuring that key health systems elements are in place. The authors found the WHO health systems conceptual framework (see **Fig. 1**) a useful metric to design a teledermatology program. Using this framework, they were able to ensure that key local health systems elements needed for the program to succeed were in place. The use of this framework also enabled designing the program with the goal of strengthening each of the health systems building blocks as they related to dermatologic care. In doing so, the author believe that it is more feasible to achieve the long-term goal of providing high-quality equitable dermatologic care to the population. Although all health systems building blocks are relevant, the authors found that local ownership and good governance are key elements needed for the success of this program.

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DISCLOSURE

The authors have nothing to disclose.

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