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PROVISION OF WHEELCHAIRS IN TAJIKISTAN

Economic assessment of alternative options





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Abstract

This publication presents the results of a study on the economic aspects of various models for the provision of wheelchairs in Tajikistan. The study was conducted under the leadership of the Ministry of Health and Social Protection, Republic of Tajikistan and with technical support from the WHO Country Office, Tajikistan. The study was finalized in consultation with Tajik users of wheelchairs, the Ministry of Health and Social Protection and international experts on wheelchair production and provision, and made use of national and international evidence on the provision of wheelchairs to inform the analysis and develop evidence-based policy options. While the study focuses on the Tajik context and its aspirations to expand in-country production of wheelchairs, its approach and findings will also be of interest to other countries in a similar situation and to other interested stakeholders.

Keywords

WHEELCHAIRS – economics
WHEELCHAIRS – policy and services
WHEELCHAIRS – supply and distribution
WHEELCHAIRS – standards
PERSON WITH DISABILITIES – wheelchairs
LOW-RESOURCED SETTINGS

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Abbreviations

COG	centre of gravity
GDI	gross domestic income
GDP	gross domestic product
ISO	International Organization for Standardization
SEOP	State Enterprise Orthopaedic Plant

Executive summary

Since 2014, Tajikistan has adopted a number of policies and national strategies to strengthen the rights of people with disabilities and improve the provision of assistive devices. Among other initiatives, the Government has adopted the multisectoral National Programme on Rehabilitation of Persons with Disabilities 2017–2020. It has signed the Convention on the Rights of Persons with Disabilities and developed a national priority assistive products list. The present study on the economic aspects of wheelchair provision represents an additional contribution to this process. As regards wheelchairs, in the capital city of Dushanbe and in Khujand Province, Tajikistan has moved from a predominantly distribution-oriented model to a service-provision model consistent with the WHO *Guidelines on the provision of manual wheelchairs in less-resourced settings* and improved access to quality wheelchairs in Tajikistan.

Notwithstanding these initiatives, a number of challenges remain, including improving the evidence base relating to the prevalence and nature of the need for wheelchairs, strengthening the system of wheelchair provision more generally, especially outside Dushanbe and Khujand, and ensuring sustainable funding for the provision of wheelchairs in the medium and long term. The present report will provide the Government and its development partners with feasible policy options to these ends. In particular, the report presents the results of a study on the economic aspects of various models for the provision of wheelchairs in Tajikistan.

The study draws on several sources of data and information. Key cost data have been collected from various sources in Tajikistan. This ensures that all calculations are based on national evidence. Consultations have been held both with Tajik users of wheelchairs and with international experts on wheelchair production and provision. Finally, national and international evidence on the provision of wheelchairs has been reviewed to inform the analysis and develop evidence-based policy options.

Currently, Tajikistan imports around 800 wheelchairs per year. A small number of wheelchairs are assembled or produced by local manufacturers. The number of

wheelchairs currently supplied is insufficient, as the need for wheelchairs exceeds 58 000. In addition, the quality of the wheelchairs currently procured is not consistent with international quality standards. The recipients of the wheelchairs also testify to the low quality of the products, reporting that the working life of the wheelchairs is sometimes less than one year. In the short term, the Government of Tajikistan needs to import a larger number of wheelchairs of higher quality. Over the next 3–5 years, the Government may wish to import 10 000 wheelchairs annually to reach universal coverage of wheelchairs by 2023. The unit cost of procuring wheelchairs that meet international quality standards would increase from US\$ 110 to US\$ 210 (including transportation costs) with a total budget of around US\$ 167 000 per year over this period. Increasing the number of wheelchairs imported to this level would also require investments in the Government's procurement capacities and in the distribution and provision system. However, a continued failure to meet the need for wheelchairs would be costly, both to individuals and to households, as well as to the broader Tajik society.

In the medium-to-long term (5–10 years) the Government may wish to invest in national capacities either to assemble wheelchairs locally or to manufacture wheelchairs using locally sourced material. These options would also provide additional economic opportunities, including employment and the acquisition of broader manufacturing and production skills. The report presents the results from estimates of these costs and benefits to assess the implications of various policy options. However, to realize such opportunities while maintaining adequate quality, the Government needs to invest in a number of areas, including training of human resources, business development skills and infrastructure and equipment.

Whichever approach the Government adopts, it will need to continue implementing strategies and initiatives to strengthen the system of wheelchair provision to ensure that all Tajiks who need one have access to a wheelchair of adequate quality and suitable design without the risk of financial hardship.

1. Introduction

This report presents the findings from a study on the advantages and disadvantages of in-country wheelchair production with a specific focus on Tajikistan. In particular, the study assesses the economic implications of various approaches to the production of wheelchairs. It forms part of WHO support for the Ministry of Health and Social Protection in Tajikistan, as the country seeks to enhance its capacity to supply high-quality wheelchairs to those who need such assistive technologies. The study contributes to action 2.2.13 of the National Programme on Rehabilitation of Persons with Disabilities 2017–2020, namely “to assess the possibility to locally produce assistive devices”.

While the study focuses on the Tajik context and its aspirations to expand in-country production of wheelchairs, the approach and the findings of the study will also be of interest to other countries in a similar situation and to other interested stakeholders.

1.1 Background and purpose

Over the past few years, Tajikistan has adopted a number of policies and national strategies to strengthen the rights of people with disabilities and improve the provision of assistive devices. The Government signed the Convention on the Rights of Persons with Disabilities in March 2018 and is thereby committed to the provision of assistive devices. In 2016, the multisectoral National Programme on Rehabilitation of Persons with Disabilities 2017–2020 was adopted (resolution No. 455, dated 28 October 2016); this lays out a comprehensive plan for developing the assistive technology sector.

With regards to assistive products, a key achievement of the Ministry of Health and Social Protection was the procurement of a variety of assistive products (such as wheelchairs, white canes and hearing aids) in 2015 and 2016. This process has been formalized by the development of a national priority assistive products list, comprising 30 priority assistive products

that are essential for the well-being of, among others, people with disabilities, older people and people with noncommunicable diseases (7). Wheelchairs, hearing aids and prosthetics are on the list, along with other assistive products that maintain or improve individual functioning. The National Assistive Products List is a key component of the aforementioned National Programme on Rehabilitation of Persons with Disabilities 2017–2020. The Programme is an important step towards improving access to assistive products in the country. Technical specifications for the products on the assistive products list are currently being drafted, and these will strengthen procurement practices and ensure the quality of devices entering the country. The budget for assistive technologies has increased over the years and is forecast to continue to grow; the budget for 2019 will be in excess of US\$ 200 000. The Government of Tajikistan played an important role in the adoption in May 2018 of World Health Assembly resolution WHA71.8 on improving access to assistive technology and the related side event. It is evident that there is real political will to develop the assistive technology sector in the country and that a path has been set for this process.

A situational analysis of wheelchair provision was completed in 2015 with the participation of assistive technology stakeholders: the Ministry of Health and Social Protection, international and national nongovernmental organizations, disabled people’s organizations, United Nations agencies and other international development partners (2). Following the situational analysis, stakeholders worked closely with the Ministry of Health and Social Protection to improve the quality of wheelchair service provision in Tajikistan. This included training for Ministry staff and other wheelchair stakeholders on the WHO wheelchair service training package and the establishment of wheelchair service provision units in Dushanbe and Khujand Province.

While Tajikistan shares many of the fundamental aspects related to the needs and provision of wheelchairs that are seen in other low-resource settings, it also has several context-specific features

to consider. Following the outbreak of poliomyelitis in 2010, WHO provided the Ministry of Health and Social Protection with technical support in disability and rehabilitation, with the financial support of the United States Agency for International Development and the United Nations Partnership to Promote the Rights of Persons with Disabilities. This support was used for rehabilitation services, the introduction of a national community-based rehabilitation programme and the development of the National Programme on Rehabilitation of Persons with Disabilities 2017–2020 (2, 3). Among other things, the programme raised awareness among policy-makers about the importance of high-quality assistive products. The technical support thus helped to create the necessary policy environment and demonstrate the benefits of providing rehabilitation services in line with international standards.

Notwithstanding these recent efforts, the existing rehabilitation services in Tajikistan remain inadequate to meet the needs of the population, in terms of both quantity and quality. One of the reasons for the low quality of rehabilitation services is the absence of clear data and evidence on the scope and nature of the actual need for wheelchairs in the country. Over the past five years or so, many people affected by poliomyelitis have developed impairments and a subsequent need for long-term rehabilitation care. In addition, there is a significant number of children with multiple impairments, including cerebral palsy and congenital anomalies, who need rehabilitation services. There are also a number of people who acquire a disability as a result of accidents and injuries, not least from workplace incidents and road traffic crashes (4).

Furthermore, a number of people are affected by noncommunicable diseases, especially stroke and diabetes, and require rehabilitation services and assistive technologies. Disability related to noncommunicable diseases (e.g. that arising from amputation, blindness or paralysis) places significant demands on social welfare and health systems in Tajikistan, and these diseases are the leading cause of disability and death. According to the WHO publication *World health statistics 2014*, noncommunicable diseases accounted for about 59% of all deaths in the country; cardiovascular disease alone is responsible for 47% of overall mortality. Finally, many older people with reduced functioning or mobility are in need of

assistive services and products, including wheelchairs. There is thus a need to continue the development of rehabilitation guidelines and standards for effective provision of assistive devices in Tajikistan.

With its objective of optimizing functioning, rehabilitation supports those with health conditions to remain as independent as possible, participate in education, be economically productive and fulfil meaningful life roles. The availability of accessible and affordable rehabilitation services therefore plays a fundamental role in achieving Sustainable Development Goal 3, “[ensure] healthy lives and promote well-being for all at all ages” (4, 5). Over the past few years, the Government of Tajikistan has enhanced its efforts to achieve the Goals, including those related to health and well-being.

The development of technical guidelines and protocols on rehabilitation is thus an integral part of the approved National Programme on Rehabilitation of Persons with Disabilities 2017–2020. In particular, WHO is providing technical support to the Ministry of Health and Social Protection for the strengthening and extension of rehabilitation through a disability rehabilitation programme (2016–2019). The goal of the three-year programme is to improve access to high-quality rehabilitation services for persons with disabilities in Tajikistan. A key component of the programme is to support the Ministry in strengthening the assistive technology sector. The present study is a key component of this technical support programme; in addition, it addresses the specific action of the national programme on rehabilitation related to the feasibility of in-country wheelchair production.

The economic and social benefits of assistive technologies and associated services, both to the individual and to society at large, are beyond dispute (6). Access to assistive technologies, including wheelchairs, helps to transform a person with a disability from a potential burden on the family to a productive citizen on equal terms with the general population. This has both intrinsic and economic value. However, it is not clear how countries should go about ensuring the safe, sustainable and efficient provision of wheelchairs of sufficient quality. This depends on existing evidence and policy guidelines and needs to be evaluated on a country-by-country basis.

The purpose of this study is to assess the viability of various options Tajikistan might choose to develop its capacity to supply wheelchairs for people who need such assistive technologies, in an effective, cost-effective and equitable manner. In principle, there are **three main models** (or approaches) that countries may follow in order to achieve this objective (for an overview of the models, see (7)): importation of complete wheelchairs (henceforth referred to as Model 1); importation of components for local assembly (Model 2); or local manufacture (Model 3).

Each model has advantages and disadvantages, as well as opportunities that go beyond the narrow confines of the regular provision of a certain number of wheelchairs. For example, Models 2 and 3 would, under certain conditions and assuming that quality can be upheld, generate employment opportunities that may be of significant wider social and economic value. Furthermore, each model of wheelchair provision needs to be complemented with a system for supplying spare parts (including service and maintenance support), fitting and training services and end-distribution of the completed wheelchairs to clients. In order to present a comprehensive review of wheelchair provision, these complementary additional services are also discussed in the report.

1.2 Methods and approaches

As noted above, the overall aim of the study is to assess the costs (disadvantages) and benefits (advantages or opportunities) of each of the identified models of wheelchair provision in Tajikistan. As such, the study can be seen as a type of cost-benefit analysis if the analysis would compare the total costs of producing wheelchairs with the total (social) benefits of providing wheelchairs. In particular, the study compares three alternative models of wheelchair provision with the current situation (called Model 0 below) to investigate the incremental costs and benefits of adopting one of the models.

However, for several reasons, the present study is not a true cost-benefit analysis in the strict sense. First, a true cost-benefit analysis would not be appropriate in

this case, since the effect (or “outcome”) of the various alternatives – the provision of wheelchairs for those who need them – is known and identical across the alternatives. And second, a cost-benefit analysis would require very detailed data on a wide range of costs and benefits, many of which are not available in the current case (8).

Given the broad scope of the analysis, the study applied several different methods to achieve its objectives. First, the study attempts to adopt a life-cycle perspective on the provision of wheelchairs. Among other things this means that, to the extent possible, costs and benefits are assessed across the entire working life of the wheelchair. For example, the analysis looks at both the purchase price of wheelchairs and the subsequent costs of service, maintenance, and replacement to understand which model of provision is the most beneficial (or cost-effective). That said, the study does not implement a strict life-cycle cost analysis to assess the resources used to ensure the long-term provision of wheelchairs as that would require access to highly detailed data that are not currently available in Tajikistan.

Second, to inform the discussion around the current situation in Tajikistan, a number of national policy-makers and experts in the sector were interviewed, and a review of key policy documents was conducted. In addition, the study consulted a large group of global experts on wheelchair provision. Annex 1, provides a synthesis of the interviews with key national and international experts on a set of general policy questions. A separate consultation exercise was conducted to interview a sample of wheelchair users in Tajikistan. The purpose of the interviews was to learn more about their use and perceptions of the wheelchairs. These findings are summarized in Annex 2.

Finally, a literature review of published research articles, policy reports and key WHO publications on the topic of wheelchair provision was done to inform the overall discussion. The review drew on a large body of existing literature and evidence on the provision of wheelchairs, in high- and in low- and middle-income countries. In particular, it builds and draws on existing global policy reports on the subject of wheelchair provision, including the *Situational analysis: state of rehabilitation in Tajikistan* (2015) (2), the WHO *Guidelines on the provision of manual wheelchairs in less-resourced*

settings (2008) (6) and the *Situational analysis on wheelchair and mobility devices in Tajikistan* (2014) (3).

As the purpose of this report is to look more specifically at the economic factors of wheelchair provision in the particular case of Tajikistan, the study does not provide an alternative to any existing policy document or guidelines. Rather, the report complements these documents by providing concrete policy support based on the best available data and evidence for Tajikistan. The data and calculations on which the analysis is based are available from WHO upon request.

1.3 Structure of the report

The report has the following structure. Chapter 2 describes the main general models of wheelchair

provision in terms of the advantages and disadvantages of each model. It therefore provides an overall framework for the assessment. Chapter 3 provides a general background to the social and economic situation of Tajikistan. In particular, it attempts to estimate the demand for wheelchairs of various types in the country over the coming 5–10 years. On the basis of the general framework and the specific context analysis for Tajikistan provided in the previous two chapters, Chapter 4 goes through the various options using the best available data and information for each parameter of interest. The aim of the analysis is to arrive at the estimated unit cost of a wheelchair for each of the models. Chapter 5 concludes the report with a discussion of policy options.

2 Models of wheelchair provision

This section reviews the three main models of wheelchair production practiced in Tajikistan to provide an overall framework for effective policy development. It is important to stress that any model of wheelchair production needs to consider the key policy challenge of ensuring a supply of wheelchairs of suitable design and adequate quality. Any wheelchair provided, whether imported or locally manufactured, needs to meet nationally agreed and guided by international quality standards.

While there are several key aspects to any model of wheelchair provision, the main approaches can be summarized as falling into one of the three main models: importation of complete wheelchairs; importation of components for local assembly; and, finally, local manufacturing of complete wheelchairs. Each model is associated with particular advantages and disadvantages (or missed opportunities) that need to be taken into consideration as policy decisions are made.

In addition, it is not only possible, but most likely beneficial, to combine different approaches to wheelchair provision in order to achieve an optimal policy mix. The combination of approaches is particularly important when considering the timing with which a certain model can be implemented to achieve identified targets for wheelchair supply. For example, it is unlikely that a low-income, or even a middle-income, country can go from importing most of its wheelchairs to satisfying national demand by means of local production in the short term.

2.1 Importation of complete wheelchairs

One model of wheelchair supply (and assistive technologies more generally) is the importation of complete products for national distribution. Globally, this is the most common approach to wheelchair provision. The main advantage of this model is that it is relatively low-cost as far as investment and prerequisites are concerned, and a country may be

able to satisfy national demand in a comparatively short period of time. This model may also enable a country to satisfy a broad range of demands for wheelchairs because it can purchase a specific number of a particular wheelchair.

However, this model also has specific drawbacks. First, the final unit cost may not be as low as first thought if transportation and customs duties are high and are not waived for assistive devices. Such costs can add 25% or more to the final unit cost. Second, supplies may be disrupted, because importation is not entirely under the control of the national purchaser. More generally, this model does not bring many employment opportunities compared with the other two main approaches. Nor are there any spin-off effects in terms of skills development, management capacity development or industry development in general. The value of these benefits is difficult to measure, although they may be considerable over the long term.

Model 1. Importation of complete wheelchairs

Advantages

- Cost-effective/low-cost
- Broad range of wheelchairs for selection
- Short-term supply opportunities
- Likely to be of high quality and compliant with quality standards

Disadvantages (risks)

- Inflexible – risk that a suitable wheelchair cannot be procured for the required context and that design adjustments cannot be made
- Supply disruption
- No or limited employment opportunities
- No spin-off effects on the development capacity of local industry
- Less access to spare parts and increased costs

Most, although not all, of the identified risks can be managed by means of suitable planning and measures. For example, the risk of supply disruption can be reduced by importing wheelchairs from multiple sellers.

2.2 Importation of components for local assembly

The second model of wheelchair provision is to import the components of wheelchairs and have national operators assemble the wheelchairs for subsequent distribution. The main advantages and disadvantages of this model are similar to those of Model 1, with the additional benefits of creating employment and some industry development opportunities.

These risks can likewise be managed to varying degrees by means of proactive planning and due diligence of supplier networks.

Model 2. Importation of components for local assembly

Advantages

- Cost-effective in medium term
- Some spin-off effects in terms of capacity development
- Some employment opportunities

Disadvantages (risks)

- Inflexible: it may not be possible to obtain suitable wheelchairs
- Supply disruption
- Relatively high up-front investment costs
- High transaction costs if it is necessary to import from several different suppliers

2.3 Local manufacture

Finally, countries can opt to set up local production of wheelchairs. Some parts of the wheelchairs may need to be imported, but all main components are produced by local producers. The model of local manufacture of wheelchairs is the most complicated and high-risk model. There are several important potential advantages with this model, including creating employment opportunities, allowing for flexibility in design and developing a range of skills in manufacturing, management and industry development.

However, these benefits do not come at zero cost, and most countries with little or no prior experience in manufacturing and design will have to make costly investments in skills development. Additional challenges include lack of skilled personnel and difficulties in retaining trained staff, dependence on public subsidies for part of the investments and inputs and, importantly, the presence (or absence) of a quality control system. The actual net benefits from this model may consequently be considerably lower than the initial assessment.

Compared with the disadvantages and risks noted for Models 1 and 2, the risks can be managed by various actions, although they will most likely require substantially more planning and preparation.

Table 1 summarizes the various models across key parameters.

Model 3. Local manufacturing

Advantages

- Complete flexibility in terms of design and local adaptation
- Relatively low risk of supply disruption when material is locally sourced
- Labour market/employment opportunities; particularly for people with disabilities
- Industry development and capacity-building across various sectors
- Enhanced capacity for provision, design, repairs, maintenance and quality control
- Export opportunities

Disadvantages (risks)

- Relatively costly (cost-ineffective)
- Long time lags before achieving full capacity
- Requires management and industry development skills and capacities
- Requires relatively large capital, infrastructure and human resource investment
- Risk of difficulty in retaining trained personnel
- Limited flexibility and restricted range in short- to medium term

Table 1. Summary of main models of wheelchair production and supply

Model	Timing of implementation ¹	Effects on:		Broader economic and social impacts ²	Remarks
		control over quality and design	employment opportunities		
Importation of complete wheelchairs	Short term	Potentially some quality control; some indirect design control	Small or no effect on local employment opportunities; some effect on distribution	Small	Cost-effective provided that quality and design standards can be met
Importation of parts for local assembly of wheelchairs	Medium to long term	Some indirect and direct quality control	Some effects on local employment opportunities	Some	Ditto; additional benefits for local development
Local production of complete wheelchairs	Long term	Potentially large quality control ability	Large potential for local employment	Large potential	Ditto; requires quality control systems and regulatory measures

¹ The immediacy with which the model can be implemented; ² direct and indirect impacts on broader industry, business and community development.

2.4 Conclusions

There are three broad models of wheelchair production: importing complete wheelchairs; importing the components of wheelchairs for local assembly; and local manufacture of complete wheelchairs. Each model comes with particular advantages and disadvantages (risks) and provides opportunities

that may be relevant to policy-makers. While the most common approach globally is to import all the wheelchairs needed to satisfy local demand, it would be sensible to combine approaches to meet both immediate needs and longer-term policy goals, including issues related to the quality and design of wheelchairs.

3 Tajikistan – situational analysis of wheelchair use and provision

To the extent possible and data permitting, this study takes a life-cycle perspective on the use of and demand for wheelchairs. Among other things, this means that all factors and components that go into using a wheelchair over the chair's lifetime are taken into consideration. For example, while it may be less costly up-front to import a complete wheelchair than to purchase a locally produced one, the total lifetime cost of the imported wheelchair may be several times higher when total service, maintenance and replacement costs are considered. Understanding these life-cycle factors requires a careful assessment of the country's current socioeconomic and institutional situation.

3.1 Socioeconomic situation

3.1.1 Overall macroeconomic situation

The overall macroeconomic performance of Tajikistan over the past years has been relatively favourable (9, 10). Economic growth has remained at around 6–7% per year since 2010, resulting in a fairly high per capita growth rate during this period. Remittances constitute a relatively large share of the Tajik economy, making up around 45% of gross domestic product (GDP). While the Government retains a fiscal surplus of around 1% of GDP, the fiscal space for health is limited. At around 2.2% of GDP, public spending on health is the lowest in the Europe and Central Asia region, and low compared with other low-income countries. As wages constitute a large share of the Government's overall spending and the provision of assistive devices is a relatively human-resource-intensive activity, the scope for significant change in the fiscal space for assistive devices over the coming period is limited.

Furthermore, Tajikistan has relatively weak social targeting programmes (11). This is despite the existence of formal programmes designed to provide financial

and practical support for various vulnerable population groups. The benefit programme is set out in the State Guarantee Benefits Package of 2014. The programme identifies a total of 14 separate groups that are entitled to medical and health benefits, including five separate disability-related groups.

3.1.2 Poverty and socioeconomic status

Tajikistan is a low-income country with a total population of around 9 million and an average annual per capita income of around US\$ 812 (12). Despite relatively strong economic growth over the past decade or so, poverty is still widespread in Tajikistan. It is estimated that around 30% of households live below the official national poverty line (13). The high level of extreme poverty (17%) is a particular concern. There are also regional differences in poverty and socioeconomic status, since poverty is concentrated in rural areas where the overall poverty rate was 36.1% in 2014 (down from 37.4% the previous year).

Tajikistan has a relatively young population. Recent census estimates suggest that around half the population is made up of children and adolescents (11). Life expectancy is comparatively low, standing at 69 years and 73 years, respectively, for men and women. Many people in Tajikistan have moved abroad, in particular to the Russian Federation, in order to find employment. Consequently, remittances constitute a fairly large share of national income and many households depend on them for their subsistence.

The educational status of most people is relatively favourable, with high rates of literacy, school enrolment and school completion. Access to clean water and sanitation has improved over the past decade. Concerns remain, however, about access to nutrition, since malnutrition is relatively prevalent, particularly in rural areas. Immunization rates against most diseases are high, although not perfect (14).

There is currently little or no evidence on poverty among people with disabilities in Tajikistan. It is, however, well known from international studies that people with disabilities are particularly vulnerable, and there is little reason to believe the situation to be very different in Tajikistan (2). Hence, it may be generally assumed that people with disabilities have little financial capacity to purchase assistive devices, including wheelchairs, without risking financial hardship in the form of impoverishment or indebtedness.

3.1.3 Disability and the need for wheelchairs

There are currently very little data or evidence on the prevalence and nature of disability in Tajikistan (2). The absence of reliable data and information pose significant obstacles to the development of effective policies. One common approach to estimating the demand for wheelchairs is that 1% of the total population of any country is in need of a wheelchair (6). In Tajikistan, this would translate into 90 000 children, adolescents and adults.

Alternatively, assuming that, as a broad rule-of-thumb, 10% of all people with a disability need a wheelchair, the total demand for wheelchairs in Tajikistan would be around 15 000 people (2). This calculation is based on the Government's own assessment of the total number of people with disabilities in the country. However, many people with disabilities in Tajikistan are not registered with the Government. In addition, elderly people, individuals affected by certain chronic diseases and others may also need wheelchairs. Recent estimates suggest that in total, over 58 500 people are in need of a wheelchair in Tajikistan (15).

The large differences between these estimates, and the lack of more reliable data, suggest that more research on the true need for wheelchairs in Tajikistan is required before the development of policies on the provision of wheelchairs.

3.2 Current provision and supply of wheelchairs in Tajikistan (Model 0)

This section describes the current situation with respect to the provision of wheelchairs in Tajikistan. The purpose of the discussion is to provide a baseline model (**Model 0**) for wheelchair provision, against which alternative models may be compared in the key dimensions of cost-effectiveness, quality and design and larger economic and societal impacts.

Public provision of assistive products in Tajikistan is centralized under the State Enterprise Orthopaedic Plant (SEOP), which is responsible for the procurement, production and distribution of all publicly funded assistive products. The capacity of SEOP to provide assistive technology services has also made significant progress in the past few years. The Khujand branch has extended its services to include provision of a greater variety of assistive products and prosthetics and orthotics services. The Government is currently working towards expanding the capacity of the Kulob branch to provide a variety of assistive products and also plans to increase the capacity of the Khorog branch by 2019. In addition, since 2015, SEOP has started to look beyond mobility products and provide hearing aids and white canes, thus assuming the role of a true national assistive technology centre.

3.2.1 Design and production of wheelchairs

Currently there is one dominant model of wheelchair provision in Tajikistan, that of importation by the Government of complete wheelchairs for subsequent distribution as described in the 2014 WHO publication *Situational analysis on wheelchairs and mobility devices in Tajikistan* (3). The Government orders approximately 800 wheelchairs per year. They are procured on an annual basis by means of a Government tender, with

price being the main selection criterion. Consequently, there is little consideration of either quality or design.

The current Government-provided wheelchairs are imported from China at a retail price of US\$ 77 (see Table 2). In addition, the cost of transportation from the seller in China to the central warehouse in Dushanbe is US\$ 32.5 per unit (or 40% of the total unit cost). Most of this cost applies to transport from the Tajik border to Dushanbe. Importantly, the current model is wholly budget-driven, in that the number of wheelchairs imported is determined by the fiscal appropriations granted by the Ministry of Finance, not by the real demand.

Table 2. Model 0: current cost of wheelchair supply in Tajikistan, 800 units/year

	Cost item	Cost per unit (US \$)	Total cost/year
A	Direct costs, comprising:		
A.1	Purchase price	77	61 600
A.2	Transportation costs	33	26 400
	Total	110	88 000

Sources: Authors' own field research; Ministry of Health and Social Protection; national expert consultations; 2017 data.

In addition, a limited number of wheelchairs are supplied by donation: between 2015 and 2018, Operation Mercy donated 569 wheelchairs of different models to Tajikistan. Finally, there are two small-scale producers of wheelchairs in the country, Dilshod in the south (Vakhsh Region) and BODOM in the north (Khujand Region). Between them they have produced fewer than 150 wheelchairs since 2015. Because of these small numbers, both producers are effectively out of business. According to information from interviews, the main reasons why they are failing include their location far from Dushanbe; uncompetitive prices (between US\$ 160 and US\$ 240) compared with Chinese imports (US\$ 77 before transportation costs); inadequate quality and outdated designs; and a limited production capacity of fewer than 300 wheelchairs per year.

As noted, the wheelchairs imported by the Government are not appropriate for active users, especially in the rugged terrain of Tajikistan. Users have various complaints about them, saying that parts break easily and the wheelchairs have low manoeuvrability, and they are thought to be difficult to transport. From recent interviews with users in the second quarter of 2018, it is estimated that the maximum working life of the Government wheelchair is one year, assuming it receives adequate maintenance. The waiting list for a Government wheelchair is relatively long; as at July 2018, more than 1000 people are on the waiting list and the last person on the current list is scheduled to receive a wheelchair in December 2019.

3.2.2 Service delivery

One critical shortcoming in the current Tajik model of wheelchair provision is the lack of funds for the additional services needed for effective and sustainable provision of wheelchairs. WHO and partners have set out the eight-step model of effective wheelchair provision in a set of international guidelines (6). The steps are as follows:

1. referral and appointment
2. assessment
3. prescription
4. funding and ordering
5. product preparation
6. fitting
7. user training
8. follow-up, maintenance and repairs.

While measures to improve the situation have been introduced in the past few years, these additional services are not currently fully funded in Tajikistan (15). The absence of proper service provision and reliable maintenance and repair services throughout the country means that wheelchairs cannot be used safely and that the stock of wheelchairs is used inefficiently, with a shorter-than-necessary working life. It also puts a financial strain on wheelchair users and their families, who have to fund the repairs themselves out of their own pockets.

In respect of service delivery – i.e. referral and prescription for a wheelchair, funding, ordering and fitting and training and maintenance – the current

situation in Tajikistan exhibits various shortcomings (3). Many wheelchairs are still handed out by local social protection departments, with no related services provided. The main issues are ones of fitting, user training and maintenance of the wheelchairs. Neglecting these crucial aspects of service provision means that many people are given the wrong size of wheelchair, and maintenance and repairs are at the user's expense. This limits the usefulness of the device and contributes to abandonment or underutilization. Too few users receive adequate training to ensure sufficient confidence in using their wheelchairs without an assistant (usually a relative). This lack of training also increases the risk of injuries. Pressure-relief cushions are not provided, so that the wheelchairs place users at risk of developing pressure sores. These shortages are of particular challenge in regions away from urban areas. It is also a concern that public awareness of ways to obtain a Government wheelchair appears to be very low.

It is difficult to obtain estimates of the costs incurred by users for ongoing maintenance and repairs. However, these costs would be higher for low-quality wheelchairs that break more frequently. It is also difficult to determine the extent to which the lack of service provision contributes to discontinuation of use of wheelchairs (or use only for transfers) and the associated cost implications.

3.2.3 Training

Regarding the training component of wheelchair provision, the current situation in Tajikistan needs improvement; few or no coherent training strategies are being implemented in a sustained manner (3). There is a lack of staff trained in wheelchair provision, and the skills of the existing workforce are lacking or outdated. A limited number of basic-level training events on wheelchair provision, supported by WHO, have been conducted over the past few years, but no training took place before that.

3.2.4 Policy and planning

Access to and provision of assistive devices, including wheelchairs, are covered by formal legislation. The

regulations specify the provision of wheelchairs free of charge for persons who have been identified as being in need of a wheelchair.

Specifically, the Government has adopted the National Programme on Rehabilitation of Persons with Disabilities 2017–2020. This programme sets out an action plan to strengthen the assistive device sector more broadly. Among other things, an assessment of the feasibility of wheelchair production in the country is one of the activities in the programme.

3.3 Conclusions

The current model of wheelchair provision in Tajikistan relies predominantly on the importation of complete wheelchairs (low-price). While this is a reasonable approach given the situation in Tajikistan, this model arouses both quantity and quality concerns. Too few wheelchairs are imported to meet the real demand, and they are too low in quality to meet users' needs.

Tajikistan has introduced various policies and strategies to address and improve the provision of wheelchairs for those who need them. In addition, several studies over the past few years have increased knowledge about the need for wheelchairs and the current supply models.

Tajikistan currently experiences challenges in the provision of wheelchairs. First, the current number of wheelchairs imported is too low and does not meet the actual demand. Second, the wheelchairs do not meet adequate quality requirements. And third, additional services, such as fitting, training and maintenance and repairs, are either not provided or are underfunded (see (6) for details of the additional services required for effective and equitable provision of wheelchairs).

This suggests that Tajikistan needs to look at alternative approaches for the effective provision of wheelchairs. The next chapter outlines these approaches and discusses the implications of moving towards any of these models of wheelchair production.

4 Economic assessment of the main models of wheelchair provision

From the analysis of the available data and evidence on the provision of wheelchairs in Tajikistan and the consultations with national policy-makers and international experts, this review has found several challenges. First, even controlling for the absence of accurate estimates of need, there is currently a significant undersupply of wheelchairs. Judging by the best estimates of needs, Tajikistan would need to supply around 10 000 people with wheelchairs annually over the next five years or so to close the existing demand gap. Currently, Tajikistan imports around 800 wheelchairs per year and assembles or produces only a very small number.

Second, the quality of the current supply of wheelchairs is not consistent with international quality standards. For example, the working life of some of the imported wheelchairs is estimated at less than one year, while it is commonly accepted that a wheelchair should last for at least five years of normal use, even under challenging conditions such as those found in many areas of Tajikistan. Third, Tajikistan exhibits a range of shortcomings in the effective provision of wheelchairs according to current global guidelines. These shortcomings range from institutional and technical weaknesses, a shortage of trained personnel and gaps in implementation of policy strategies. In addition, Tajikistan has limited experience in the manufacturing and development of business capacities (16). These would be needed for effective, efficient and sustainable local production of wheelchairs of adequate quality.

Following on from these observations, the following sections (4.1–4.3) assesses the main models of wheelchair production and provision with a view to arriving at a feasible approach for the country over the next 5–10 years. Subsequently, section 4.4 reviews the benefits of each model. On the basis of the available data and information in Tajikistan and a set of working assumptions, the analysis attempts to quantify the benefits in terms of employment and economic opportunities and any additional benefits that can be assumed to arise from each of the models.

It is important, however, to emphasize that, while these benefits may potentially be substantial, they will not materialize without additional investment by the Government. For example, realizing the potential employment opportunities offered by local manufacture would require significant investment in, among other things, training, distribution and logistical systems and regulation capacities. For these and possibly other reasons, the net benefits will most likely be substantially smaller than they may initially appear. It cannot be ruled out that the net benefits of any model would turn out to be negative, even in the medium term. This shows the importance of the analysis and the need to agree on suitable funding sources for future investment in this area.

4.1 Model 1: importation of complete wheelchairs

Importing complete wheelchairs of sufficient quality for distribution may constitute a relatively cost-effective way to provide wheelchairs for immediate impact. However, compared with the current situation, this option would require a change of approach to the purchase of wheelchairs. Key procurement staff at central agencies would need to upgrade their skills considerably in order to identify sellers that can provide wheelchairs of acceptable quality and design standards. The suggested standards and specifications for wheelchairs are appended to the present report; they are based on the ongoing WHO work in Tajikistan on standards and specifications for each of the products in the assistive products list. More generally, it would require a change in procurement practices from a budget-driven to a quality-driven approach.

A wheelchair of an acceptable standard would cost upward of US\$ 175 (ranging between US\$ 120 and US\$ 200; figures from consultations by the authors with international experts) suggesting that the total cost of

importation would be around US\$ 170 000 per year, including transportation costs and customs charges (see Table 3).

Table 3. Model 1: cost of importing wheelchairs of adequate quality, 800 units/year

	Cost item	Cost/unit (US \$)	Total cost/year
A	Direct costs, comprising:		
A.1	Purchase price	175	140 000
A.2	Transportation costs	33	26 400
	Total	208	166 400

Source: International expert consultations, August–September 2018; see Annex 1.

In addition, compared with the existing situation, Tajikistan would need to import considerably more wheelchairs to meet actual demand. By 2023, Tajikistan may be aiming to supply 10 000 wheelchairs by means of some model, or combination of models, of wheelchair production, which will push the annual total budget costs towards US\$ 1 750 000. This is a substantial increase compared with today's situation, and would still not meet the total need. In addition, Model 1 would most likely also require some level of upgrading of international purchasing and procurement skills and management capacities for quality assurance, the costs of which need to be added to these estimates.

4.2 Model 2: importation of parts for local assembly

Alternatively, Tajikistan could opt to import all, or certain, parts of a wheelchair for local assembly. This option would take more time to implement owing to the need for additional investment in, for instance, skills development, infrastructure and facilities for workshops. The model would, however, come with several potential benefits in terms of local employment

opportunities; see section 4.5 for details and estimates of these benefits.

Based on field research for this report, it is estimated that parts for the assembly of a wheelchair could be obtained for a cost of around US\$ 175 per wheelchair. The cost of assembly would then need to be added to these costs, making the final unit cost around US\$ 225 (see Table 4). The total budget cost for supplying 800 units per year would be around US\$ 185 000.

Table 4. Model 2: cost of local assembly of wheelchairs, 800 units/year

	Assembly costs	Cost/ unit (US \$)	Total cost
A	Cost items		
A.1	Purchase price of components	175	140 000
A.2	Assembly labour cost	1	800
A.3	Plant/utilities	9	7 200
A.4	Transportation costs	33	26 400
A.5	Support staff	7	10 560
	Total	225	184 960

Source: International expert consultations; field research by authors; data for 2017.

Again, under these assumptions, the number of wheelchairs would not meet the real demand. It should be noted that the transportation costs per wheelchair are lower for parts than for complete wheelchairs. However, empirical evidence from Tajikistan suggests that US\$ 33 per unit is the expected average transportation cost.

4.3 Model 3: local manufacturing of complete wheelchairs

The third option that Tajikistan may consider is to produce complete wheelchairs locally. As the country is currently only producing a very small number of

wheelchairs, this option would represent a major undertaking in the development of infrastructure, logistical systems and management capacities if such a venture is to work. Therefore, this option may rather provide a long-term model for the wheelchair provision system in Tajikistan.

From the data and information collected in Tajikistan on the costs of the main production inputs, the total unit cost would be around US\$ 158 (or US\$ 126 000 in annual budget costs for 800 units; see Table 5).

Table 5. Model 3: cost of local manufacture of wheelchairs, 800 units/year

	Manufacturing costs	Cost/unit (US \$)	Total cost/year
A	Cost items, comprising:		
A.1	Materials	80	64 000
A.2	Plant/facility/infrastructure	32	25 600
A.3	Labour	29	23 440
A.4	Utilities	3	2 560
A.5	Support staff	13	10 560
	Total	158	126 160

Source: International expert consultations; field research by authors; estimates; data for 2017.

The total budget required to meet the real demand for 10 000 wheelchairs would be around US\$ 1 260 000 per year until 2023. Empirical evidence from Tajikistan suggests that most parts can be sourced locally (with the possible exception of castor wheels). However, there may be an additional need to import some parts.

Many lessons can be learned from the experiences of local wheelchair producers in low- and middle-income countries. From our review of the literature on wheelchair production and provision and the expert consultations, a number of key prerequisites can be identified that need to be in place for the model of local manufacturing to be effective. These factors are described below.

4.3.1 Quality control

Adequate quality control systems require an institutionalized business culture that prioritizes quality over quantity. Adopting and enforcing minimum standards (such as the ISO 7176 standard of the International Organization for Standardization (ISO)) is essential to ensure that locally produced wheelchairs are of sufficient quality. The manufacturing facility must develop a testing protocol for performance and durability to demonstrate compliance with these standards. Wheelchairs should be periodically subjected to both laboratory and human testing. This will require a testing laboratory to be established in Tajikistan, or arrangements need to be made for wheelchairs to be tested in laboratories outside the country. The wheelchairs should meet the standards described in Annex 3 of the present report. As early prototypes may not meet the minimum quality standards, the facility need to be prepared for iterative rounds of testing, with several modifications of the design and manufacturing process, before appropriate quality is achieved. Maintaining quality over time is a key component of effective quality control systems.

4.3.2 Government financial commitment

Establishing a manufacturing facility will require a significant financial investment, including some up-front investment in, for instance, machinery and tooling, training and preproduction labour requirements. To become competitive against foreign imports, the local producer must be able to produce a wheelchair of comparable quality at similar or lower unit cost. It may take years before the facility becomes cost-effective, but during this time it will need steady revenue to reinvest in its operations. Given the nature of wheelchairs and other assistive products (mainly products that are not traded on normal competitive markets), the role of the State in guaranteeing funding during a sufficiently long start-up period is vital. In Tajikistan, where the Government is the main provider of wheelchairs, winning the tender to supply the Government every year will be critical to the long-term financial viability of the facility. Therefore, the Government needs to commit to purchasing a set number of wheelchairs from the local producer, whether or not imported wheelchairs are more

cost-effective. The feasibility of this commitment depends partly on whether sufficient budgetary (or fiscal) space can be created. Such a privileged relationship should be conditional on the local manufacturer's reaching yearly targets that aim to ensure quality while enhancing productivity.

4.3.3 International cooperation

Low- and middle-income countries that want to produce wheelchairs domestically to satisfy local demand, and possibly export to other countries, will likely need to work with international partners, at least during the initial start-up period of 5–7 years. These partners have the technical and business know-how and experience to provide effective technical assistance during this period. Currently, Tajikistan does not have the requisite technical know-how and skilled labour for local wheelchair manufacture to adequate quality standards, so working with a foreign partner for technology transfer and training of staff would be critical if Model 3 is to work.

4.3.4 Effective management

While the overall macroeconomic and regulatory environment needs to be conducive to local manufacturing, effective management at the facility level is critical for the long-term sustainability of the manufacturing unit. Negotiating favourable conditions with materials suppliers, organizing the production line, expanding the client base, anticipating potential disruptions in product output and taking measures to mitigate these risks are some of the areas that require highly skilled management; to a considerable degree, this will determine the success of the manufacturing centre.

4.3.5 Viable business plan

Before any facility can be set up and be operationalized, a rigorous business plan must be developed. The plan needs to include all relevant technical, operational, financial and other factors that will determine the effectiveness of the facility. A business plan also needs to include a global context analysis that provides actionable alternatives for various market scenarios.

A detailed investigation should be conducted of the potential suppliers and overall costs. In the case of Tajikistan, a viable business plan could be the responsibility of a specially appointed committee, made up of relevant stakeholders and high-level decision-makers to provide broad support and the necessary political commitment. The committee should explore potential partnerships with local steel and aluminium producers. Importantly, the possibility of producing other tubular mobility aids should also be explored, as these products may be manufactured in the facility using similar methods.

4.4 Incremental cost implications of reform of wheelchair provision

Tables 2–5 above show, respectively, the cost estimates for wheelchair supply in Tajikistan in the current situation and in the alternative models of production. The cost estimates are based on the best available data and evidence on the cost of the various models. A key issue is then what the cost implications would be from moving away from the current situation to any of the alternative models. Table 6 presents the incremental cost implications of these reform options.

Table 6. Incremental cost implications of moving from Model 0 to an alternative model

	Model 1	Model 2	Model 3
Total unit costs/year (US \$)	98	115	48
Total budget costs/year (US \$)	78 400	96 960	38 160

Source: authors' calculations.

The lowest cost increase per unit would be from moving from Model 0 (the current situation) to Model 3 (local manufacture). This would imply an incremental cost increase of US\$ 48 per wheelchair, or US\$ 38 160 in total budget requirements. The largest incremental cost increase would result from changing from Model 0 to Model 2 (local assembly). Remaining with the current

approach of importing wheelchairs, but choosing ones of higher quality, would imply an incremental cost increase of US\$ 98 per unit, or US\$ 78 000 in total budget impact.

4.5 Estimating the net benefits of the various models

Estimating the benefits of investments is done across a range of areas and industries, in both the public and the private sectors. The accuracy of such estimates, however, vary by area and type of investment. Estimating the benefits of the investments discussed here presents varying levels of complication. Some benefits can be foreseen with reasonable confidence and only require relatively simple assumptions. For example, it is fairly clear how many employment opportunities may arise from local manufacturing. Based on existing data and evidence, one well trained person is able to manufacture one wheelchair in about 32 hours (or four working days). Depending on the level of production, this would generate a certain number of employment opportunities, each valued at around US\$ 1000 per year (equivalent to the current gross domestic income (GDI) per capita per year in Tajikistan); see Table 6 and the discussion below for further details (12).

However, the value of additional benefits, such as the development of management skills and manufacturing and industry development more broadly, are difficult to gauge with any level of accuracy. For example, the productivity in this sector is largely unknown. Using, for example, GDI per capita or the average wage as an estimate of that value may require some largely arbitrary adjustments. Moreover, there may be additional benefits associated with a particular model of wheelchair supply that can only be hypothesized. For example, the change in value resulting in improved flexibility and local control over wheelchair design and quality in moving from Model 1 (importation of complete wheelchairs) to Model 3 (local manufacture) is very difficult to estimate.

An additional complication in these types of analysis is that the benefits do not necessarily accrue to those who fund the investment. As noted above, this requires

a careful discussion and consensus around the broader social values of these types of investment.

The benefits assessment analysis identifies the following main benefits of wheelchair supply models (Table 7).

Table 7. Main sources of benefits of wheelchair supply models

Source of benefit	Expected value
Employment opportunities	Varies across models; largest in Models 3 and 2
Export proceeds	Largest in Models 3 and 2
Industry and manufacturing development skills	Largest in Models 3 and 2
Flexibility and local control of design and quality	Largest in Models 3 and 2
Management and regulation capacity development	Varies across models; largest in Models 3 and 2

Source: authors.

4.5.1 Employment opportunities

All models involve some amount of labour inputs, of various kinds and amounts. To estimate the value of any employment opportunity, the study uses the Tajik gross national income per capital as estimated by the World Bank – US\$ 1000 in 2017.

Model 1 (importing complete wheelchairs) mainly involves administrative staff charged with procurement of the products. Compared with Model 0 (the current situation), Model 1 would, in particular, most likely require an upgrade of their skill set. This would suggest that the net effect on employment would be modest or even negligible.

Model 2 (importing parts for local assembly) would bring a range of employment opportunities, both in administration and management and in assembly of the wheelchairs. From the review of existing assembly activities and the input of key informants, it is estimated that, to assemble 500 wheelchairs per year, approximately five technical staff would be needed.

The total estimated value of those opportunities would then be around US\$ 5000 per year. The net benefits might, however, be many times smaller, owing to the investment required.

Model 3 (local manufacture of complete wheelchairs) would also require a broad range of human resources, most of which would need to be trained and developed before these employment opportunities could be realized. From the existing evidence base and the expert consultations undertaken during the study, it is estimated that approximately 20 staff would be needed for this model to function at any reasonable level. The total annual value of such opportunities would be equal to around US\$ 20 000 in the medium-to-long term.

4.5.2 Export proceeds

On the assumption that Tajikistan makes the requisite investments and successfully develops either a wheelchair assembly plant or a manufacturing operation which is able to deliver the required number of wheelchairs that satisfy local demands and that meet quality standards, any excess production could be exported to other countries, bringing in some amount of revenue. This could be invested in further development. The present study assumes that any wheelchair assembled or manufactured would comply with existing quality standards, such as ISO 7176. It is unlikely that the country will be able to develop such a supply of wheelchairs, even in the medium term. A conservative cost estimate of around US\$ 200–350 has therefore been assumed for any exported wheelchair, in order to derive some value for this source of potential benefits. If Tajikistan is able to export 250 wheelchairs, the total value will equal US\$ 87 500 per year in export proceeds. The net value is, however, most likely significantly less, given the relatively substantial investments the country would have to make; the value would possibly even be negative in the medium term.

4.5.3 Additional benefits

Table 7 also identifies additional potential benefits associated with the various supply models. There is most likely some value in being able to obtain some level

of local control over the design and quality aspects of wheelchair provision. Likewise, Model 2 and Model 3 would involve significant value in developing national management and regulation skills, as well as general industry and manufacturing development skills. However, estimating the monetary value of these benefits is very difficult and would require a set of unreasonable assumptions. The present report therefore refrains from estimating the monetary value of these benefits, but we emphasize that they could be significant, given the country's current challenges in these areas (12).

4.6 Net benefits comparing Model 0 and Model 3

Based on the calculations of the total unit costs and the benefits of each of the models, the net benefits can be estimated. Table 8 shows the net benefits of each of the models.

Table 8. Net benefits of Models 0–3

Model	Total costs	Total benefits	Net benefits
Model 0	88 000	10 000	- 78 000
Model 1	166 400	20 000	- 146 400
Model 2	184 960	50 000	- 134 960
Model 3	126 160	187 500	61 340

Source: authors' calculations.

The calculations show that only Model 3, national manufacturing of wheelchairs, produces a positive net benefit. It is the need for local labour that generates the relatively large benefits of this model compared with the other models. Model 1, importing wheelchairs, produces the largest negative net benefit. This is because there are no significant employment opportunities associated with this model. It should be emphasized that a key assumption in these calculations is that the quality of the wheelchairs will be meet the required standards (e.g. ISO 7176).

5 Conclusions – policy considerations for the provision of wheelchairs in Tajikistan

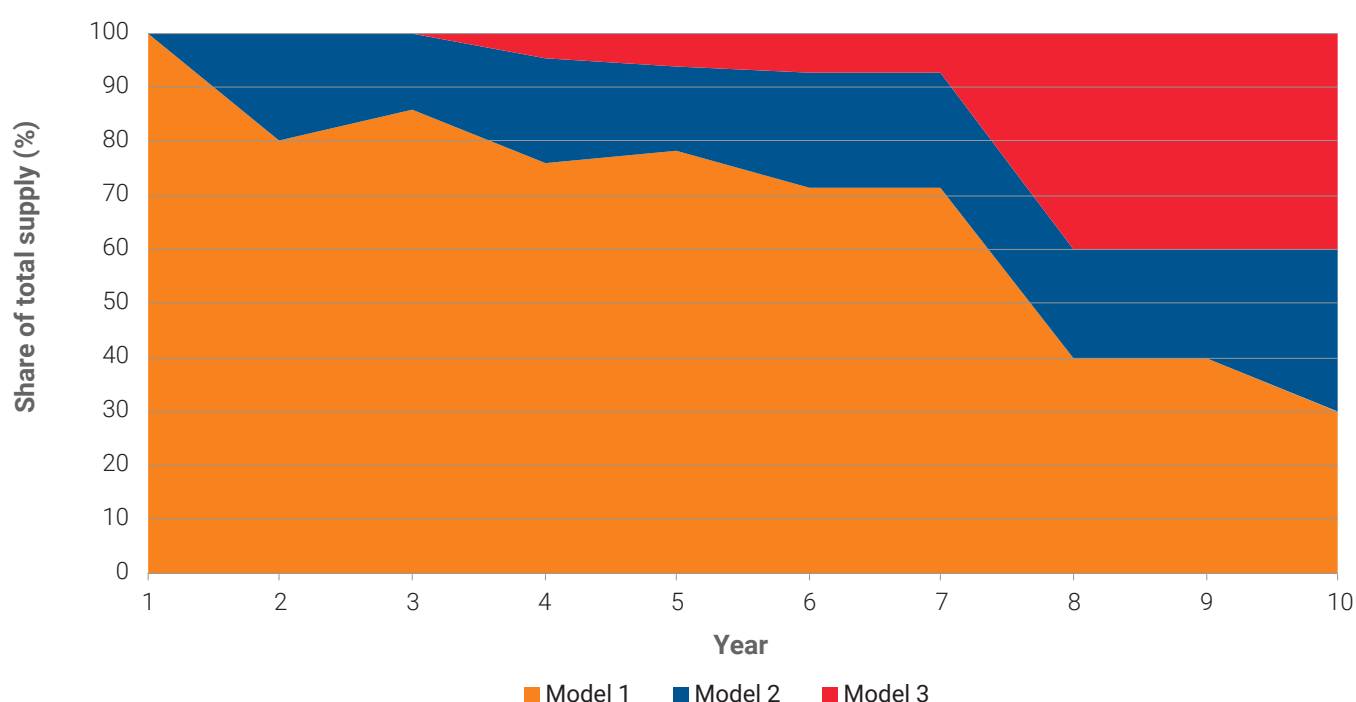
Over the past few years, the Tajik Government has implemented a number of interventions and adopted various policies to strengthen the provision of assistive devices, including wheelchairs. Among other things, the Government adopted a multisectoral programme on rehabilitation of persons with disabilities over the period 2017–2020. It signed the Convention on the Rights of Persons with Disabilities in March 2018, and has developed a national priority assistive products list that will facilitate and clarify the implementation of the policies.

From the above review and analysis of the current situation with respect to wheelchair provision in Tajikistan, it is clear that the country is facing a dual challenge: too few wheelchairs are currently provided, and the majority of these wheelchairs are of unsatisfactory quality. To address these challenges,

the Government will need to reconsider its current approach to wheelchair provision. Given the inadequate number of wheelchairs currently provided, and therefore the need to increase the supply drastically, it is unlikely that the challenge can be met in the short-to-medium term by adopting either Model 2 (importation of parts for local assembly) or Model 3 (local production of complete wheelchairs). The current state of the main production facility is such that major investment would be needed in order to reach the required production levels over the next 1–3 years.

However, for the reasons discussed above, particularly increasing local production capacity, Models 2 and 3 could both be targets to which Tajikistan could aspire to in the medium-to-long term (3–6 and 5–8 years, respectively). Fig. 1 shows one possible scenario for Tajikistan to supply approximately 10 000 wheelchairs

Fig. 1. Short- to long-term scenario for wheelchair provision in Tajikistan



per year, using an approach that combines all three models to varying degrees over the next 10 years.

In the short-term (1–3 years), Tajikistan would need to continue importing complete wheelchairs to meet the actual demand. However, as emphasized earlier, the wheelchairs need to be of sufficient quality to comply with international quality standards such as ISO 7176 which is not the case under mode 0. For this reason model 0 is not been included as an alternative in scenario of Fig. 1. In the meantime, Tajikistan may want to make the necessary investment in local manufacturing capacities so that it can eventually satisfy domestic demand by means of that model.

By around 2025, Tajikistan would need to supply around 10 000 wheelchairs per year. This would represent a significant increase from the current figure of around 800. From the review of the evidence base on wheelchair production and the consultations with international experts, the present study estimates that a wheelchair of acceptable quality and consistent with international guidelines could be purchased and supplied for around US\$ 175. Below this amount, it would appear to be difficult to reach an acceptable level of quality, not least given the relatively harsh conditions of wheelchair use in Tajikistan.

Although these estimates represent a substantial increase in the costs of producing and supplying a wheelchair in Tajikistan, it should be emphasized that the current approach is most likely wasteful and does not provide value for money, either for the Government or for the users. Higher-quality wheelchairs would have a longer working life and would not have to be replaced every year or even more frequently. According to current estimates, the average working life of Government-supplied wheelchairs is only around one year. This means that the Government needs to repurchase the 800 wheelchairs every year to meet the same demand. If higher-quality wheelchairs were purchased that last five times longer (the expected working life of a wheelchair of sufficient quality even in relatively harsh conditions, as stated in the international expert consultations), the larger funding requirements would be spread out over a longer time, making the annual requirements smaller. The Government budget for assistive technologies has increased over the years

and is forecast to continue to grow in the coming years, which presents an important opportunity to supply an acceptable quality of wheelchairs.

5.1 Key recommendations

From the above analysis, including costing estimates, benefit assessments and consultations, the following key recommendations have been identified.

5.1.1 Conduct a national coverage survey to obtain more accurate estimates of the demand for wheelchairs; by type, region, adult versus child

Tajikistan needs to improve its data on the need for wheelchairs (and assistive technologies more generally). To date, there is too little information and data on the real needs of people with disabilities, older people and those with chronic diseases leading to mobility impairment. A national household survey should be conducted to provide more and updated information on these needs. Alternatively, a special disability module may be introduced into the next round of the Tajikistan Demographic and Health Survey.

5.1.2 Revise purchasing policies to meet clear quality standards

Tajikistan needs to revise its purchasing policies and guidelines related to assistive technologies to reflect its desire to provide wheelchairs that meet national and international standards and to generate an adequate range of products. Ideally, the policies should include a mandate that only wheelchairs that comply with the ISO 7176 standard should be purchased. Also, implementation of the specifications in Annex 3 of the present report would improve the quality and range of the wheelchairs available in Tajikistan. This would most likely require further training of purchasing staff and an upgrade of the quality assurance systems of the relevant Government departments.

5.1.3 Ensure sufficient budget resources to purchase quality products and additional services (Government budget/donor grants/charity grants)

Regardless of the approach that Tajikistan chooses, the country needs to conduct a costing analysis to identify the funding requirements for the provision of wheelchairs that meet the necessary standards. This would include costing the setting-up of any assembly workshop or production plant that would be needed to realize either Model 2 or Model 3. Such an analysis would clearly lay out the financing of the investment, and funders, including development partners, would be able to decide on their commitment to such an enterprise. Tajikistan also needs to explore ways of ensuring the continued introduction and development of an effective system to provide the additional services (training, fitting, maintenance and repairs) required for effective wheelchair provision. These services likewise need to be fully funded.

5.1.4 Introduce quality guidelines to ensure effective provision of quality wheelchairs outside Dushanbe and Khujand, consistent with the WHO wheelchair guidelines

More broadly, Tajikistan needs to ensure the effective introduction and application of the WHO *Guidelines on the provision of manual wheelchairs in less-resourced*

settings (6). These guidelines describe the steps that need to be taken to ensure that an effective, efficient and equitable system of wheelchair provision is in place in the country over the next 3–5 years.

5.1.5 Conduct the necessary research to prepare for investment in national manufacturing capacity

If Tajikistan wishes to pursue the option of developing the national capacity to manufacture wheelchairs of adequate quality, the country needs to conduct rigorous research to that end. This would include the development of a sound business plan, a survey of components that can be sourced locally and the procedure for putting in place a rigorous quality assurance system. These investigations need to be conducted by experts in the sector, drawing on the lessons provided by other countries, e.g. Cambodia, Georgia and India.

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Annex 1. Consultations with national and international experts

As part of the analysis, the study team conducted a series of consultations with international and country experts on the provision of wheelchairs in low-income countries. The purpose of the consultations was to obtain critical input from the experts on policy issues of a kind not readily available in published reports. The views expressed by the experts were those of the individuals themselves, and do not necessarily reflect the views of the authors of the present study, WHO or the Government of Tajikistan. Each interview lasted between 60 and 90 minutes and was conducted via Skype. The following experts who, between them, provide wheelchairs in more than 60 countries, were interviewed over a period of two weeks between 20 and 31 August 2018:

- Caden Broussard, Boston Consulting Group, United States of America (in writing);
- David Constantine, Motivation UK, United Kingdom
- Bruce Curtis, Whirlwind Wheelchair;
- Shona McDonald/Megan Giljam, Shonaquip/Uhambo Foundation, United States and South Africa;
- Gabriela Manta, Motivation, Romania;
- Soikat Ghosh Moulic, Mobility India, India;
- Jon Pearlman, University of Pittsburgh, United States;
- Perth Rosen, UCP Wheels for Humanity, United States;
- Eric Wunderlich, LDS Humanitarian Services, United States.

The experts were all asked to provide their reflections and views on the following questions:

1. Is there any consensus on how a country like Tajikistan should produce and provide wheelchairs? If so, what is that consensus built on? If not, why is there no consensus?
2. How can sufficient or adequate quality of wheelchairs be ensured? What standards should be referred to?
3. What is a reasonable expected lifespan of a wheelchair? Are there “standards” to refer to?

4. How can “normal use” of a wheelchair be assessed? Can normal use be identified or defined in any reasonable way?
5. What would be the reasonable unit cost of producing a wheelchair of sufficient quality?
6. What are the pros and cons of the various approaches of importation, local assembly and local production of wheelchairs?
7. How can we measure the benefits of the various models of wheelchair production? What are the benefits for the user, society and the State?
8. How can we assess a country’s capacity for local production?

Summary of international expert consultations

1. Is there any consensus on how a country like Tajikistan should produce and provide wheelchairs? If so, what is that consensus built on? If not, why is there no consensus?

Experts were divided on the question whether there is a consensus in the international community on the way low-income countries should best approach the issue of wheelchair provision. Some experts suggested that there is a consensus, pointing to the WHO wheelchair guidelines. Others said that there is no consensus on this issue.

2. How can sufficient or adequate quality of wheelchairs be ensured? What standards should be referred to?

Most experts referred to the ISO 7176 standards as the general standards to which countries should aspire to ensure adequate quality. Others mentioned the existence of national standards, some of which are similar or close to the international standards. Many

experts stressed the importance of ensuring quality standards and systems to maintain standards.

3. What is a reasonable expected lifespan of a wheelchair? Are there “standards” to refer to?

Most experts suggested that five years is a reasonable expected working life for a wheelchair of adequate quality. All experts stressed that there needs to be some variation and adjustment of the expected lifespan and standards to match local conditions.

4. How can “normal use” of a wheelchair be assessed? Can normal use be identified or defined in any reasonable way?

All experts agreed that it is very difficult to identify normal usage of wheelchairs, as the needs of users vary along with the prevailing conditions and other factors.

5. What would be the reasonable unit cost of producing a wheelchair of sufficient quality?

Estimates of the reasonable unit cost of a wheelchair of adequate quality varied between under US\$ 100 and US\$ 300. Most experts suggested that a unit cost of around US\$ 110 would be acceptable for a high-quality wheelchair. Most of them also agreed that it would be all but impossible to produce or purchase a high-quality wheelchair for much less than US\$ 100.

6. What are the pros and cons of the various approaches of importation, local assembly and local production of wheelchairs?

Opinions on the advantages and disadvantages of the various supply models varied, but most experts

mentioned the advantages of local manufacture for creating employment opportunities. However, all experts also stressed the fact that these advantages are not easy to realize and stressed the importance of keeping the goal of providing quality wheelchairs firmly in sight.

7. How can we measure the benefits of the various models of wheelchair production? What benefits are there for the user, society and the State?

Employment opportunities, quality-of-life improvements and flexibility and control of design and production processes are some of the benefits of local manufacturing. Low price was seen as the most important benefit of importation of complete wheelchairs. It was mentioned that benefits need to be measured by means of user-reported outcome measures (comparable with patient-reported outcome measures).

8. How can we assess a country’s capacity for local production?

Experts suggested manufacturing traditions, management skills and capacity to operate medium-scale and large-scale manufacturing units as key parameters to consider.

Annex 2. Interviews with users of wheelchairs in Tajikistan

From August to September 2018, a total of five interviews was conducted with wheelchair users from various parts of Tajikistan; four women and one man, aged between 15 and 44 years. The purpose of the interviews was to learn more about wheelchairs users' perceptions and experiences of using wheelchairs in Tajikistan. In particular, open-ended questions were asked about usage, working life and quality of wheelchairs.

The main concerns from the interviews include the following.

1. Service provision is generally lacking. Wheelchairs are frequently of the wrong size, making them difficult to navigate. Users are provided with little or no training on the correct use of a wheelchair. In addition, pressure-relief cushions are rarely or never provided with the wheelchair. This increases the risk of pressure sores that may require medical treatment.
2. Low durability and strength of the wheelchairs. Interviewees consistently noted that the Government-provided wheelchairs are of low quality. The expected working life of the wheelchair is reported to be less than 12 months with frequent breakdowns and repairs throughout that time. The repairs are paid for by the user or his or her family.
3. Low knowledge and awareness of users' rights. The interviews suggested that many users are unaware of their rights to obtain support, as advocated in international guidelines for wheelchair provision. They are also unaware of the existence of various types of wheelchair that may be better suited to their particular needs.

The findings from the user consultations corroborate the concerns raised in previous investigations of the situation of wheelchair provision (see e.g. (1), (2)). The

findings generally point to the need for substantial reform in the system of wheelchair provision, with more focus on users' rights, quality and design and additional services for effective wheelchair provision.

Despite all its problems, the country has taken decisive action towards reforming the assistive technologies sector. The multisectoral National Programme on Rehabilitation of Persons with Disabilities 2017–2020 (resolution No. 455, dated 28 October 2016) identifies the major gaps and sets the country going in the right direction. Since 2016, remarkable progress has been made from a policy perspective with the signing of the Convention on the Rights of Persons with Disabilities in March 2018, the development of the national Priority Assistive Products List, ongoing work on standards and specifications for assistive products and an economic assessment of wheelchair production and procurement options.

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Annex 3. Draft wheelchair standards and specifications

ISO 9999:2016 codes	12.22/12.27/12.24/09.07/18.10
Definition and purpose of use	A wheeled mobility device with a seating support system for a person with impaired mobility, intended to provide mobility in a seated position as its primary function. User- or attendant-propelled
General features	<ul style="list-style-type: none"> • 3 or 4 wheels (2 rear wheels and 1 or 2 front swivel castors) • Seat and backrest providing sitting support for the wheelchair user • Foot supports • Armrests • Rear wheel locks (to park the wheelchair) • Push rings for user propulsion (on all variations except transporter)
Exclusion	<ul style="list-style-type: none"> • Wheelchairs, electrically powered • Wheelchairs, standing

	Variations	Typical use	Specific characteristics	Requirements for standard configuration
Functional requirements	Transporter wheelchair	Typically used intermittently for short duration or for short distance transportation. Primarily used indoors or on even surfaces outdoors.	Frame: <ul style="list-style-type: none"> • 4 wheels • folding frame • push handles • fixed backrest height (at least mid-thoracic height) • tipping lever • fixed seat/frame depth Wheels and castors: <ul style="list-style-type: none"> • rear wheels 8–26 inches (20.3–66.0 cm) in diameter • rear wheels in safe position (in line with backrest tubes or further back) 	<ul style="list-style-type: none"> • Adjustable footrest height • Two flip-up footrests or two swing-away and/or removable footrests • Flip-up and/or removable armrests • Appropriate cushion to be added according to user's needs and matching the wheelchair seat size configurations
	Active urban wheelchair	Primarily for users who self-propel. Wheelchair used in urban indoor and outdoor environments.	Frame: <ul style="list-style-type: none"> • 3 or 4 wheels • folding or rigid frame; • armrest design for minimal profile • short overall length and compact turning circle • lightweight frame (maximum weight of wheelchair – 16 kg) Wheels and castors: <ul style="list-style-type: none"> • quick-release rear wheels • zero (degrees) to minimum camber (rear wheel perpendicular to ground or 3 degrees maximum tilt) Frame adjustments for centre of gravity (COG): <ul style="list-style-type: none"> • rear wheel horizontal adjustability 	<ul style="list-style-type: none"> • Adjustable backrest height or frame back height options • Adjustable seat depth or frame seat depth options • Adjustable footrest height • Backrest contouring options • Armrests optional • Push handles optional • Appropriate cushion to be added according to user's needs and matching the wheelchair seat size configurations

	Variations	Typical use	Specific characteristics	Requirements for standard configuration
Functional requirements	Active dual-terrain wheelchair	Primarily for users who self-propel. Wheelchair used in mixed environments: indoor, urban outdoor and in fairly non-level outdoor environments.	<p>Frame:</p> <ul style="list-style-type: none"> • 3 or 4 wheels • folding or rigid frame • armrest design for minimal profile • longer wheelbase than urban active wheelchair <p>Wheels and castors:</p> <ul style="list-style-type: none"> • quick-release rear wheels for rigid frames for transportability • zero (degrees) to moderate camber • larger-diameter or wider castors than urban active wheelchair <p>COG frame adjustments:</p> <ul style="list-style-type: none"> • rear wheel horizontal adjustability/custom options 	<ul style="list-style-type: none"> • Adjustable backrest height or frame back height options • Adjustable seat depth or frame seat depth options • Adjustable footrest height • Backrest contouring options • Armrests are optional • Push handles are optional • Appropriate cushion to be added according to user's needs and matching the wheelchair seat size configurations
	Active long-wheelbase uneven-terrain wheelchair	Primarily for independent self-propulsion. Primarily used outdoors over uneven, sloped, steep or rough terrain, including unpaved tracks or roads and softer ground surfaces such as sand and grass. Designed to roll over larger obstacles.	<p>Frame:</p> <ul style="list-style-type: none"> • 3- or 4-wheel frame format • usually fixed frame • long wheelbase (longer than dual-terrain wheelchair) • large overall length and large turning circle • low centre of gravity compared to other active wheelchairs • ergonomically placed push handles for controlled assistance • integrated stability options for feet <p>Wheels and castors:</p> <ul style="list-style-type: none"> • minimum 3 degrees of camber on rear wheels • larger rear wheel size (minimum 26 inches/66.0 cm) • wider- or larger-tread tyres • wider (minimum 2 inches/5 cm) and larger-diameter (minimum 8 inches/20.3 cm) castors <p>COG frame adjustments:</p> <ul style="list-style-type: none"> • rear wheel horizontal adjustability/custom options 	<ul style="list-style-type: none"> • Adjustable backrest height or frame back height options • Adjustable seat depth or frame seat depth options • Adjustable footrest height • Backrest contouring options • Armrests are optional • Appropriate cushion to be added according to user's needs and matching the wheelchair seat size configurations

	Variations	Typical use	Specific characteristics	Requirements for standard configuration
Functional requirements	Dedicated postural-support wheelchair	For users who require extensive postural support and variable quick release, large range of tilt and/or recline adjustment. Used in indoor, urban and semiurban terrain.	<p>Frame:</p> <ul style="list-style-type: none"> • 3 or 4 wheels; • folding or rigid frame • push handles • longer wheelbase compared to temporary use wheelchair • solid seat • armrests and/or tray table • large range (minimum 20 degrees) quick-release adjustable tilt in space (seat/backrest) • integrated mechanism or adjustment options to maintain stability with tilt and/or recline engaged <p>Wheels and castors:</p> <ul style="list-style-type: none"> • rear wheel size: self-propelling - 22-28 inches (55.9–71.1 cm) attendant propelling – minimum 8 inches (20.3 cm) <p>COG frame adjustments:</p> <ul style="list-style-type: none"> • rear wheel vertical and horizontal adjustability/options 	<ul style="list-style-type: none"> • Backrest height fixed at least at shoulder height or is height-adjustable • Seat depth adjustability/frame depth options of minimum 4 inches (10.1 cm) • Height-adjustable footrests • Solid backrest system with option for contouring to optimize pelvis and trunk support • Horizontal and vertical adjustable pelvis and trunk side supports • Headrest (horizontal and vertical adjustment) • Pelvis strap, adjustable length • Knee separator (adjustable and removable) standard on child size • Calf and/or foot straps • Arm support (tray or armrest) height-adjustable, horizontally adjustable and removable • Appropriate cushion to be added according to user's needs and matching the wheelchair seat size configurations
	Add-on postural-support devices for active wheelchair	For users who require extensive posture support. To provide appropriate postural support for using active wheelchairs to support trunk and pelvis, head, arms, thighs, legs and feet.	Includes, but not limited to: <ul style="list-style-type: none"> • tension adjustable backrests (range of back height options) • solid backrests with no or low-profile side supports with option to fit trunk/trunk and pelvis side supports (range of back height options/adjustability) • solid backrests with medium or deep profile to provide appropriate level of trunk and/or pelvis support (range of back height options/adjustability) • head supports • tray tables • range of armrests and arm supports • range of footrests with hanger angle and footplate angle adjustability • range of straps/harnesses for trunk, pelvis, thighs, lower legs, feet 	Each item in appropriate range of adult and child sizes and to match wheelchair configuration Include mounting systems where appropriate

Standards	<p>Wheelchairs must comply with and be tested according to ISO 7176 standards. Wheelchairs should meet minimum requirements of ISO 7176-8:2014 tests for static, impact and fatigue strength (including 200 000 cycle two-drum test and 6666 curb-drop test).</p> <p>The test laboratories should be accredited for the methods used in the appropriate standard(s) at the time of the testing. A summary of the results from the test laboratories that states the fulfilment of the requirements should always be provided. The summary must be dated and signed and delivered together with the offer. All documentation must be in English, Russian or Tajik.</p>
Size and weight	<p>The frame should come in different sizes. At least four sizes should be available in 25–40 mm increments. Should include paediatric and adult sizes.</p> <ol style="list-style-type: none"> 1. Information about the overall width, height and length of manual wheelchair must be provided. If applicable, dimensions in operating and folded modes must be provided. 2. The overall weight of the wheelchair and the configuration in which it is weighed must be provided. 3. Seat width and depth availability, front seat to floor height, back height range, rear wheel diameter and width, front castor diameter and width must be stated
Lifespan	<p>Given the purpose of use by typical users, the wheelchairs must be designed for a lifetime of at least 5 years.</p>

Annex 4. Production and supply of wheelchairs in low- and middle-income countries: a review of the literature

Purpose: The purpose of this literature review is to inform the present report on the provision of wheelchairs in Tajikistan. The report seeks to answer the question of how Tajikistan may ensure the provision of quality wheelchairs in an effective and equitable manner. In particular, the report looks at three main models for supplying wheelchairs: importation of complete wheelchairs; importation of wheelchair parts for local assembly; or local production of complete wheelchairs. The review looks specifically at the economic aspects of wheelchair production and provision in low- and middle-income countries and the costs and benefits associated with each approach.

Objectives: the objectives of the review are: (a) to search the published literature to identify relevant evidence to inform the report; and (b) to summarize the relevant literature to identify key lessons.

Database and search terms: the literature review searched for published studies in the main databases, including Medline, EconLit, PubMed and Web of Science. The literature was searched with a particular focus on economic evaluation of alternative models of wheelchair provision, including costing, cost-effectiveness and cost-benefit analyses. Only English-language literature was searched, from 2000 on.

Search terms: the following search terms and advanced search options were used:

- wheelchair [title/abstract] AND production [title/abstract] OR supply [title/abstract] OR provision [title/abstract] OR cost* [title/abstract];
- wheelchair [title/abstract] AND review [abstract/keywords] OR systematic review [abstract/keywords] OR meta analysis [abstract/keywords].

The searches were saved in a RIS-formatted file for later updating.

Approach: in step 1, the literature was searched, using the above search terms, on 8 and 9 July 2018. In step 2, the titles and sources of the identified references ("hits") were reviewed to identify relevant references. In step 3, the abstracts from the identified references were reviewed for relevance. In the final step, the full articles were reviewed. Complementary manual searches were also conducted to complete the literature search.

Results: The use of the above search terms and options in the database yielded around 820 hits (the number of hits varied from 820 to 142 depending on search terms and search options; many articles were found using more than one search option). After an on-screen review of the titles and sources of this list of publications, around 40 references remained for abstract and keyword review. The review resulted in seven articles for full-text review. An additional three articles were included as a result of complementary manual searches. The final list of included references is reproduced in Table A4.1.

While there is a sizeable body of literature on wheelchairs, the vast majority of the articles focus on either the technical aspects of wheelchair mechanics or on clinical aspects of the use of wheelchairs. However, the size of the evidence base of relevance for this review, i.e. the economic aspects of models for the supply of wheelchairs in low- and middle-income countries, is small. The review found only two studies that reported on a model for production and design of a wheelchair in a low- or middle-income context (1, 2). Both articles report on the same intervention in India, making the true evidence base even smaller. While both reports contain some information on the costs of the model that is described, neither contains an economic evaluation where the model is compared with an alternative. Zipfel et al. (1) describe the findings of a pilot project involving collaboration between a design laboratory based in the United States and a production facility in India. The study found several issues of

relevance to Tajikistan, including cost, lifespan and various design and manufacturing issues.

Pearlman et al. (2) review the literature on wheelchair technology transfer to low-income countries, drawing on the authors' own experiences. Based on these sources of evidence and knowledge, they discuss various models of wheelchair production and provision. In particular, they identify five models: the charitable model, the workshop model (for wheelchair assembly and small-scale manufacturing), the manufacturing model, the globalization model (where an international producer of wheelchairs initiates operations in a low-income country) and the multimodal model (which uses the first four models in some combination). The authors then discuss each model by looking at costs, sustainability and impact and identify the opportunities and challenges of each model. They conclude that the manufacturing model presents the most favourable opportunities under certain conditions, such as sufficient initial funding and the availability of technical and other capacity.

One additional article addresses the review's objectives by providing an overview of the situation of the provision of wheelchairs in low- and middle-income countries (3). The report includes some cost and price information, but does not describe any particular model of wheelchair production.

While the relatively small size of the evidence base is a concern, it should not come as a surprise. First, it is likely that the published literature available in research databases only reflects a relatively small share of all projects, investments and other activities taking place in this field. Most of these are not reported in academic research or similar outlets. Second, the questions and issues of relevance to the report are largely of empirical policy interest and are not necessarily relevant to scientific or academic research. Nonetheless, there is a dearth of evidence on how countries should approach the general questions that the report is trying to address.

The overwhelming impression from the evidence base is that it is largely descriptive, rather than analysing causal relationships. This means that the current body of evidence is weak in terms of providing knowledge and understanding of the approaches that work and why they work in particular contexts. The review did

identify a number of studies that report on issues and questions of indirect relevance to the report. These studies addressed issues such as user experiences, effects of introducing guidelines and the distribution of wheelchairs. These studies are predominantly descriptive and context-dependent. Any lessons from these kinds of studies need to be interpreted with a close knowledge of the circumstances in the particular country or region of interest.

A particular gap in the evidence base on the supply and provision of wheelchairs is the apparent lack of any study on the costs of the additional services needed for effective provision of wheelchairs. While these costs will vary depending on the country and the particular context in which production and supply are being introduced or reformed, no such costing analysis appears to have been done. This is despite the fact that the international guidelines on the provision of wheelchairs in low- and middle-income countries outline the main cost items associated with such an analysis (4).

Conclusions

From the review of the literature described above, the main conclusions are as follows.

- The current evidence base on the economic aspects of wheelchair production and supply in low- and middle-income countries is small in size.
- The available evidence is largely descriptive in nature and does not provide convincing information to show what works in particular contexts.
- Gaps remain in the evidence base as to the costs of the additional services needed for effective and sustainable production and provision of wheelchairs in low- and middle-income countries.
- Future research should focus on developing a costing protocol and field costing analyses in a variety of countries and contexts to obtain an understanding of these costs.

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Table A4.1. Review of wheelchair production and supply in low- and middle-income countries

Ref. no.	Authors	Year	Title	Available at	Design	Findings	Comments
1	Williams et al.	2017	Perspectives of basic wheelchair users on improving their access to wheelchair services in Kenya and Philippines: a qualitative study	doi: 10.1186/s12914-017-0130-6	Descriptive; qualitative content analysis	Ill-fitting wheelchairs and little formal training; four themes emerged as critical for understanding the implementation of wheelchair services (barriers in the physical environment, the need for having multiple chairs to improve access, perceived social stigma and the importance of peer support)	Does not address report's questions
2	Visagie et al.	2013	Policy implementation in wheelchair service delivery in a rural South African setting	doi: 10.4102/ajod.v2i1.63	Descriptive; qualitative content analysis	Identified gaps between the guiding documents and wheelchair service delivery regarding services, maintenance and management systems	Does not address report's questions
3	Visagie et al.	2016	Impact of structured wheelchair services on satisfaction and function of wheelchair users in Zimbabwe	doi: 10.4102/ajod.v5i1.222	Descriptive; qualitative content analysis; case study	Wheelchair service programme resulted in significant positive changes in user satisfaction with the wheelchair, wheelchair services and functioning	Does not address report's questions

Ref. no.	Authors	Year	Title	Available at	Design	Findings	Comments
4	Toro et al.	2016	The impact of the World Health Organization 8-steps in wheelchair service provision in wheelchair users in a less-resourced setting: a cohort study in Indonesia	doi: 10.1186/s12913-016-1268-y	Survey of convenience sample; follow-up interviews	Quality of life and health improved with wheelchair provision according to WHO guidelines	Does not address report's questions
5	Shore	2017	The long-term impact of wheelchair delivery on the lives of people with disabilities in three countries of the world	doi: 10.4102/ajod.v6i0.344	Survey and analysis using non-parametric analysis	Improvements in overall health and distance travelled were no longer significant after 30 months	Does not address report's questions
6	McSweeney and Gowran	2017	Wheelchair service provision education and training in low and lower-middle-income countries: a scoping review	doi: 10.1080/17483107.2017.1392621	Scoping review of literature	Education and training in low- and lower-middle-income countries appear ad hoc and limited; inconsistency exists regarding personnel responsible for wheelchair provision	Does not address report's questions
7	Armstrong et al.	2007	Evaluation of CIR-Whirlwind Wheelchair and service provision in Afghanistan	doi: 10.1080/09638280701240615	Field study to evaluate effects of wheelchair provision; follow-up and monitoring	Improved user perceptions and skills; minimal service requirements	Partly addresses report's question(s); relevant for additional service knowledge and evidence
8	Zipfel et al..	2007	New design and development of a manual wheelchair for India	doi: 10.1080/09638280701240672	Qualitative observational	Describes a feasible approach of collaboration between an external laboratory and a production facility in-country to produce wheelchairs of sufficient quality	Addresses the report's question(s). See information on lifespan and costs
9	Pearlman et al.	2006	Towards the development of an effective technology transfer model of wheelchairs to developing countries	doi: 10.1080/09638280500167563	Literature review, personal experiences and expertise	Expansion of the manufacturing and globalization model necessary to meet demand	Addresses the report's question(s); provides information on several aspects of relevance
10	Pearlman et al.	2008	Lower-limb prostheses and wheelchairs in low-income countries	doi: 10.1109/EMB.2007.907372	Overview based on literature and own experiences	A need and opportunity to conduct research in lower-income countries on most appropriate models of provision	Addresses the report's question(s); provides information on several aspects of relevance

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