

The Case for Investing in Assistive Technology

The dramatic economic, health, and social benefits of assisting a billion people to live fulfilling and dignified lives



CONTRIBUTING ORGANISATIONS



FOREWORD

We write this at a time of the severe crisis caused by the COVID-19 pandemic. It may be difficult to focus attention on anything other than the most urgent, overwhelming consequences of the epidemic.

Yet, two revelations are emerging from this global crisis, and this report speaks to both of them: This global pandemic is taking an extraordinary toll on older persons and persons with disabilities – including people who need assistive technology (AT) – as they face this crisis with an extra set of challenges. But also, hidden within a devastating global crisis, is an opportunity to ‘build back better’ – to use the time of unprecedented change as a time of unique opportunity to end old wrongs, challenge preconceptions, and prioritise the right thing to do according to science and rational calculations, rather than what has been fixed through years of unquestioning practice, precedence, and habit.

This report presents new analysis strengthening the case for prioritising the provision of assistive technology to those in need—including the first full economic impact and cost-effectiveness analysis.

It shows the unequivocal benefits – in health improvements, in social inclusion, and in economic return – of investing in AT. The nine-times economic return on investment alone – nine dollars in return for every dollar spent – provides a strong incentive for societies to act and to provide AT to those who need it. The report also shows the considerable health and social benefits that come with the provision of assistive products. Most important, but impossible to put numbers on, is the transformative power of giving hundreds of millions of people the chance to live their life to its full potential, facilitating their ability to walk, communicate, and see better than before. In short, the case shows the broad potential for AT to impact the lives of users, their families, their communities, and their countries.

Assistive technology presents one of those instances where we may ask ourselves why something so clearly beneficial has such a hard time winning recognition. Yet, we know that the seemingly simple task of providing eyeglasses, hearing aids, or wheelchairs and prostheses to all those who need them, is actually the result of thousands of decisions – in policies, supply chains and investment risk – often taken amongst other competing needs and priorities. This is among the reasons why, so far, we have made nowhere near enough progress in making AT available to all who need it.

This report has been led by ATscale, a new global partnership that works across a broad group of organisations and stakeholders to scale up access to AT where it is needed most. As champions and users of AT, it is our imperative to call for investments to increase access to AT, which so clearly has the power to overcome barriers and transform lives. In doing so, we can come through on the commitments in the large number of charters, international declarations, and agreements that state the rights of people with disabilities to get the assistance they need to lead dignified and fulfilling lives.

If we are to realise the benefits and release the potential we describe in this report, we need to act now. We are at the start of a 'decade of action' to achieve the Sustainable Development Goals. This, and the once-in-a-lifetime opportunity to break old patterns and do things differently as we re-build our societies in the wake of the COVID-19 pandemic, provide a strong incentive to act. The user stories in this report illustrate how even a single wheelchair or pair of eyeglasses can transform lives. We call on governments, the private sector, civil society, and everyone who reads this, to do their part to make AT for all who need it a reality.

November 2020



Dr. Cheri Blauwet
Physician and Professor of
Rehabilitation at Harvard Medical
School, Paralympic Gold Medalist

Caroline Casey
Founder, The Valuable 500



Helen Clark
Former Prime Minister of
New Zealand and former
Administrator of the United
Nations Development Programme

Catalina Devandas Aguilar
Former UN Special Rapporteur
on the Rights of Persons
with Disabilities



Eddie Ndopu
UN Secretary-General's SDG
Advocate

Senator Lizzie Nkosi
Minister of Health, Eswatini



Olusegun Obasanjo
Former President of Nigeria

Andrew Parsons
President, International
Paralympic Committee



Dr. Timothy Shriver
Chairman of Special Olympics

EXECUTIVE SUMMARY

Well over one billion people around the world require the use of at least one assistive technology (AT); by 2050, the need is expected to double due to ageing global populations, increased prevalence of non-communicable diseases, and other factors. AT is an umbrella term for devices and associated services—from eyeglasses to wheelchairs—that help users¹ live with greater autonomy and choice by improving their functioning in daily activities. Global commitments recognise AT as a human right, yet only 5-15% of the population that needs AT have access to it. This injustice reduces the economic opportunities of individuals, families, and entire nations; not to mention that it comes at a great cost to the quality of life of people who need AT.

Access to four products - hearing aids, prostheses, eyeglasses, and wheelchairs - can have enormous positive effects in promoting more equitable outcomes for hundreds of millions of people living in low- and middle-income countries (LMICs).

The case for investing in increased access to AT is built on three key benefits – economic, health, and social. In tandem with other critical efforts to expand the rights and participation of people with disabilities and impairments, AT can help unlock the full potential of hundreds of millions of people and promote more equitable outcomes for all. The benefits of AT, focusing on four products (hearing aids, prostheses, eyeglasses, and wheelchairs), are:



ECONOMIC RETURNS. AT has a significant effect on lifetime earning potential. Sustained provision of the four products in LMICs can yield about USD 100,000 in average increased income over the life of a child who receives AT. These benefits accrue through improved educational outcomes among younger users, better paid employment and higher productivity among adult users, and the reduction of challenges caused by ageing, helping users to work longer. Together, these factors can drive significant increases in lifetime income for AT users and their families with ripple effects that accelerate national-level economic growth. **Altogether, providing AT to all who need it would yield more than USD 10 trillion in economic benefits over the next 55 years.**



HEALTH IMPROVEMENTS. AT improves users' health and wellbeing. The health benefits of increased access to the four products and related services are equivalent to an average 1.3 additional years of 'perfect health'² (quality-adjusted life years or QALYs) over the life cycle of each user. Over the course of users' lives, AT can facilitate their ability to move, communicate, and see better than before. This directly contributes to improving users' physical and mental health, while also increasing access to broader health services for ongoing care. **Across LMICs, this adds up to over one billion QALYs for those in need today.**



SOCIAL INCLUSION. Increased access to AT facilitates greater inclusion of users of all ages in society. AT facilitates the engagement of younger AT users in meaningful play with their peers, supporting the development of friendships, independence, and lifelong learning skills. Greater societal inclusion and easier interpersonal interaction facilitated by AT also help to lower otherwise elevated risk of chronic loneliness and foster a sense of belonging for AT users including older people.



9:1 RETURN ON INVESTMENT

Investment to realise these benefits will result in a return on

investment (ROI) of 9:1. Our analysis traces the ripple effects of AT's impact in LMICs to show how these three benefits for an individual can have a strong, positive impact on the families of people in need of AT—and consequently how these effects flow outward to impact communities and entire nations. The investments required to strengthen and improve product / service delivery systems and provide the assistive products while significant are small relative to these benefits. In fact, investing in increased AT access will generate a ROI of 9:1.

Countries have begun taking important steps to expand access to AT and realise these benefits, but significant challenges remain.

Through growing advocacy efforts, policy changes, and supply chain strengthening, some countries have begun expanding access to AT. The efforts of these countries offer insight to others looking to increase AT provision and realise this ROI. However, persistent shortcomings in supportive systems and policies, market failures, and inadequate user awareness hamper progress. Overcoming these challenges will require coordinated action by global and local stakeholders.

With this report, ATscale, the Global Partnership for Assistive Technology, aims to provide compelling arguments to stakeholders around the world for increasing access to AT.

ATscale was launched in 2018 with the goal of catalysing action to reach 500 million more people with assistive technology by 2030 to enable a lifetime of potential. As a cross-sector partnership to amplify existing work and coordinate and mobilise global stakeholders, ATscale aims to increase the availability of and access to affordable and appropriate AT. We hope this report makes the case for stakeholders to join in this mission and work with us towards achieving these ambitious goals.

Given the benefits and 9:1 ROI for investments in AT, the case for

action is clear. As a sector, AT has too long remained fragmented, under-resourced, and neglected in global discussions of economics and health. Yet, investment in AT is essential to the implementation of the 2030 Agenda for Sustainable Development and its global commitment to 'leave no one behind'. It is both the right thing and the smart thing to do.

Figure 1: Key economic, health and social benefits of AT provision

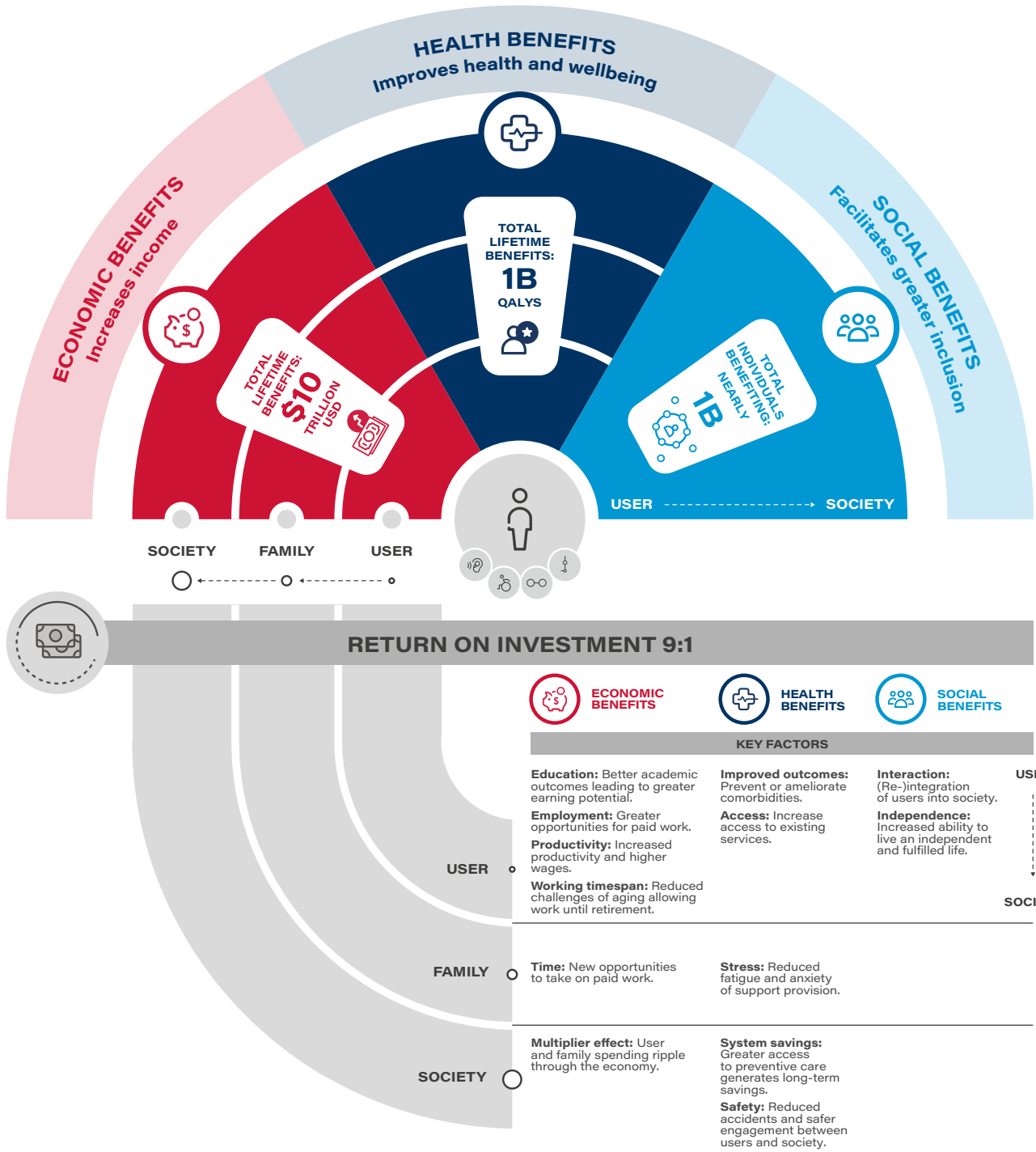


Table of contents

1. Introduction	10
2. Benefits of assistive technology	16
Economic benefits	18
Health benefits	28
Social benefits	36
3. Return on investing in assistive technology	40
4. Progress to date and the path ahead	42
5. The role of ATscale, the Global Partnership for Assistive Technology	50
6. A call to action	54
Annex A – modelling methodology	58
Annex B – acronyms	73
References	74

Chapter 1

Introduction



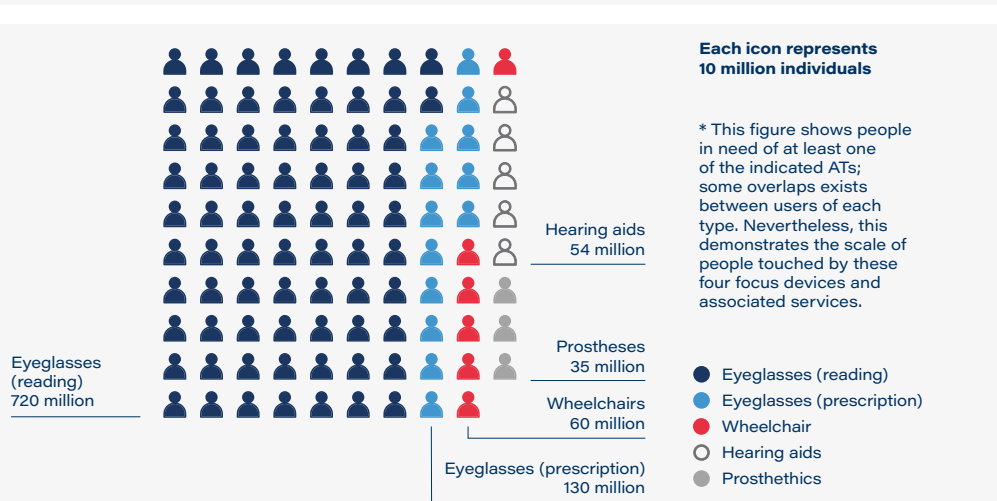


Photo credit: ©CDPF

Assistive technology (AT) can improve the daily lives of hundreds of millions of people around the world. AT is an umbrella-term for devices and associated services that help users live with greater autonomy and choice by facilitating daily activities they would otherwise be unable to do well, or at all. Assistive devices include a range of products, from wheelchairs, walkers, and crutches, to hearing aids, electronic reading devices, and braille displays. There are many groups who can benefit from AT. These include people with chronic health conditions or physical impairments, temporary injuries and diseases, older people, and people with disabilities.

The world so far has failed to meet the global need for AT. Well over one billion people today would benefit from at least one form of AT. This need is estimated to double by 2050 due to ageing global populations, increased prevalence of non-communicable diseases, and other factors.³ Much of this need falls across four products and related services: hearing aids, prostheses, eyeglasses, and wheelchairs. Based on current estimates, nearly one billion people living in low- and middle-income countries (LMICs) require one or more of just these four devices, although the overall need could potentially be significantly greater. Yet only 5–15% of this population have access to AT.⁴ This gap is a product of insufficient political will, lack of investment, and numerous systemic supply- and demand-side barriers. Despite efforts to overcome these challenges, access to AT continues to fall short of what is needed—and these essential technologies continue to receive little attention on the global agenda.

Figure 2: Number of people in need of the priority assistive devices*



The significant unmet global need for AT is concentrated in LMICs. While access to AT is limited globally, the unmet AT need is disproportionately high in LMICs. For example:

- Only 3% of the LMIC need for hearing aids is being met.⁵
- Only 5% of individuals in need in LMICs have a wheelchair compared to 90% of those in high-income countries.⁶

Assistive technology can contribute to achieving global development targets

In order to meet the goals outlined in the 2030 Agenda for Sustainable Development—and live up to our commitment to ‘leave no one behind’—the global community needs to accelerate access to high-quality, affordable, appropriate AT. Guided by human rights instruments—including the UN Convention on the Rights of Persons with Disabilities (CRPD)—the 2030 Agenda for Sustainable Development heralds a global commitment to reducing inequality in the pursuit of sustainable development worldwide. The 2030 Agenda and its 17 Sustainable Development Goals (SDGs) pledge to ‘reach the furthest behind first,’ including people with disabilities and other disadvantaged groups. While disability is recognised as a cross-cutting issue for the implementation of all the goals, eight SDG targets and 11 indicators explicitly reference disability.

‘As we embark on this great collective journey, we pledge that no one will be left behind... Recognizing that the dignity of the human person is fundamental, we wish to see the Goals and targets met for all nations and peoples and for all segments of society. And we will endeavour to reach the furthest behind first.’

2030 Agenda for Sustainable Development



Greater access to AT has a direct link to accelerating progress on SDG 1 (No Poverty), SDG 3 (Good Health and Well-being), SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 10 (Reduced Inequality), and SDG 17 (Partnerships to achieve the Goal).

A host of other global agreements have also recognised commitments to the rights and inclusion of people with disabilities—these include The Sendai Framework for Disaster Risk Reduction (2015); The Addis Ababa Action Agenda (2015); Habitat III and the commitment to a disability-inclusive New Urban Agenda (2016); and, within the World Humanitarian Summit 2016, the resulting Charter and Interagency Standing Committee Guidelines on the Inclusion of Persons with Disabilities in Humanitarian Action (2016, 2019).

SPOTLIGHT:

The Convention on the Rights of Persons with Disabilities

The Convention on the Rights of Persons with Disabilities (CRPD) is the highest international standard that articulates the right to AT for people with disabilities. The CRPD reinforces that all people with disabilities should enjoy all human rights and clarifies and qualifies how all categories of human rights apply to people with disabilities. It outlines where adaptations should be made for people with disabilities to exercise their rights, where violations often occur, and where protections should be reinforced.

AT can mitigate institutional and physical barriers and help people contribute to, and benefit from, society on an equal basis with others. People with disabilities make up a large user group of AT. Within the global disability community, AT is recognised as a basic right, and is specifically referenced within the Convention on the Rights of Persons with Disabilities. The Convention states that people with disabilities ‘include those who have long-term physical, mental, intellectual, or sensory impairments, which in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others.’⁷ The importance of AT in helping to overcome some physical, communication, and information barriers is specifically noted and referenced throughout the Convention. It is a critical component of support, which, alongside non-discrimination and accessibility, is a precondition for inclusion and participation in society.

International legal obligations for AT have thus far not been translated into sufficient action and investment. While international pledges to these agendas and movements are an important step, action and investments will be required to ensure that commitments are met. For example, the UN Flagship ‘Disability and Development Report’ (2018) showed that despite recent progress, people with disabilities, among other AT users, continue to be at a considerable disadvantage regarding the implementation of the SDGs. This disadvantage stems from numerous barriers that limit people with disabilities from participating fully in their communities, including lack of access to AT, essential services and support; stigma and discrimination; and inaccessible physical and virtual environments. Significant progress in funding and implementing AT-supportive programmes will be critical to the full and inclusive achievement of the SDG Agenda.



Photo credit: ©David Constantine, Motivation

This report presents the case for investing in AT and an assessment of the rate of Return on Investment (ROI). It is meant to inform those who have not previously considered its role in transforming the lives of users. As this report will demonstrate, investing in AT both has a transformative impact on people's wellbeing and makes sound economic sense for funders and governments. It is both the right thing to do and a smart thing to do.

Chapter 2

Benefits of Assistive Technology





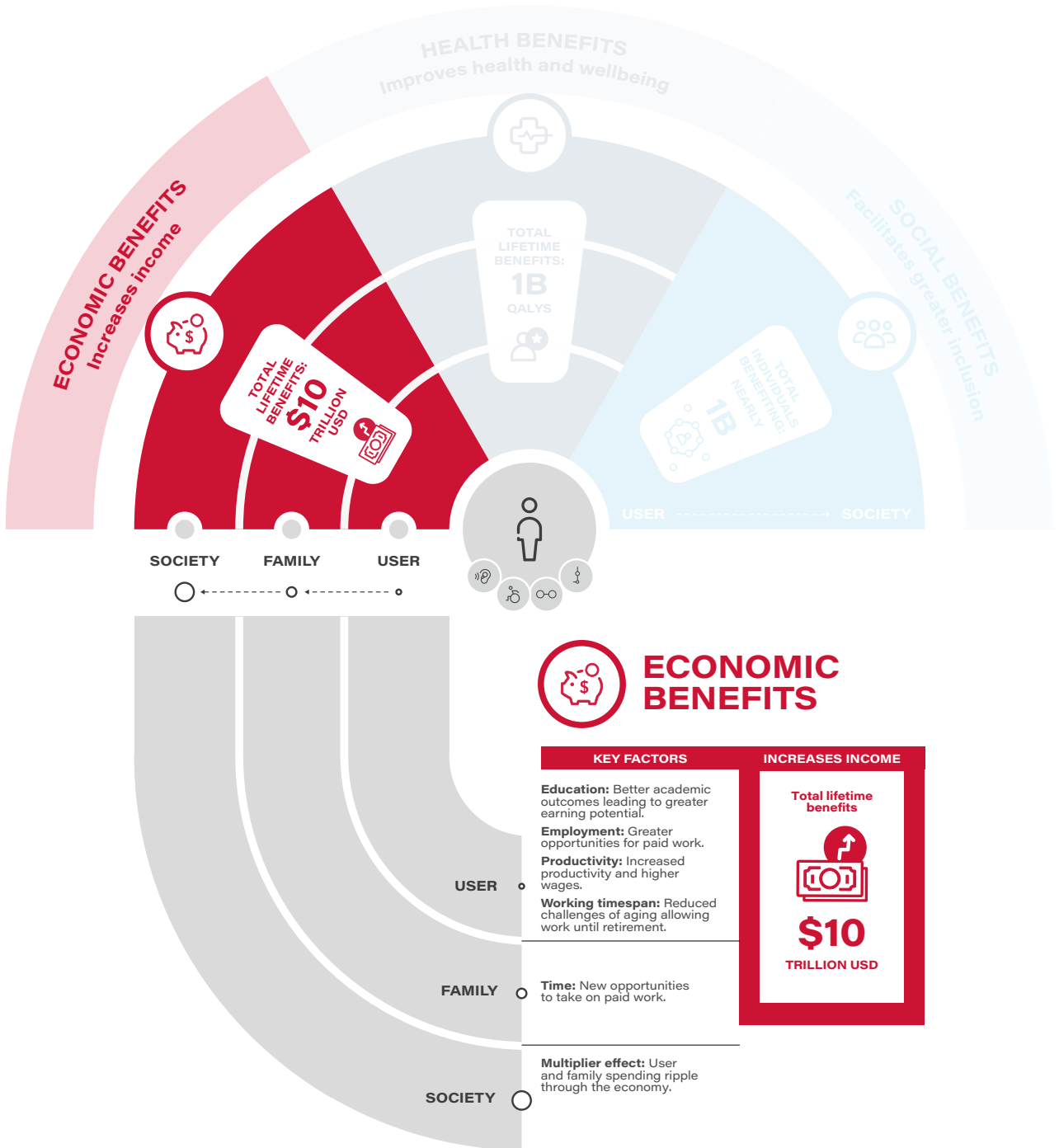
Modelling the impact of full access to assistive technology

Our analysis relies on a model developed specifically for this report that incorporates the best-available current data on AT need and the impacts of AT on users' lives. Because there is insufficient research on disability and AT, data are limited on the potential health and economic benefits of AT, as well as the return on investment in AT provision. Therefore, for our model, we have taken the available data to draw further conclusions based on a set of assumptions (detailed in Annex A). For example, to date, most data relevant to the availability and effects of AT have focused on people with disabilities. Much of what we know about other groups of AT users (including older people, people with chronic health conditions, temporary injuries and diseases) is an extrapolation from this subset of the population.⁸

We ground our analysis in three basic parameters: geographical coverage; selection of AT products; and timeframe. Our model focuses specifically on **LMICs**. The products included in the analysis are a subset of WHO's 'Priority Assistive Devices List' and represent four of the five priority products to which ATscale aims to increase access: **hearing aids, prostheses, eyeglasses, and wheelchairs**. We analyse AT needs and benefits **over the remaining lifetimes of the individuals in need of these four products today** (the current cohort). (Please see Annex A for a more complete discussion).

Our modelling looks at the three benefits—economic, health, and social—of AT for the individual user, their families, and the societies in which they live. These benefits to users and those around them are distinct, but complementary, and mutually reinforcing. Our analysis traces the ripple effects of increasing access to AT to show how the benefits of AT access for an individual can have a positive impact on their families, communities, and entire societies.

Figure 3: Economic benefits of AT provision



Economic benefits

Assistive technology has a powerful impact on the lifetime earning potential of individual users and their families. **The total economic gains** from meeting the unmet need for the four ATs across LMICs amount to over USD 10 trillion in real terms over the next 55 years—**equivalent to over 1% of total LMIC gross domestic product (GDP) over that period.**⁹

Table 1: Breakdown of economic benefits from AT access

	 HEARING AIDS		 PROSTHESES		 EYEGLASSES		 WHEELCHAIRS	
	CHILDREN	ADULTS	CHILDREN	ADULTS	CHILDREN	ADULTS	CHILDREN	ADULTS
Cohort size	4 million	50 million	5 million	30 million	20 million	830 million	10 million	50 million
Avg. lifetime gains per user	~USD 59,500	~USD 2,800	~USD 246,300	~USD 8,400	~USD 76,800	~USD 4,200	~USD 106,200	~USD 8,100
Total lifetime user gains	~USD 200 billion	~USD 100 billion	~USD 1,200 billion	~USD 300 billion	~USD 1,700 billion	~USD 3,600 billion	~USD 1,000 billion	~USD 400 billion
Total lifetime user gains across products	~USD 8,500 billion							
Total family supporter gains	~USD 70 billion	~USD 110 billion	~USD 180 billion	~USD 150 billion	~USD 160 billion	~USD 740 billion	~USD 330 billion	~USD 140 billion
Sum of family supporter gains across products¹⁰	~USD 1,900 billion							
Total economic gains⁹	~USD 10 trillion							

User

Expanding use of the four products among children today in LMICs leads to improved educational outcomes, contributing to over USD 4 trillion in increased lifetime earnings. Improving access to AT for today's adult users leads to a further USD 4 trillion in increased earnings through greater employment and productivity. This means that investments made over the coming decade will yield significant benefits over the subsequent decades, constituting a major investment in the well-being of our children and grandchildren.

I. Education

Better education has lifelong impact on users' employment and earnings. Each year of additional schooling a child receives increases future earnings by an estimated 10%.¹¹ Today, without access to AT, children who need it commonly do not receive the education they require to be successful in the workforce. Providing AT to children in LMICs who need it to attend school—and, once there, to learn to their full potential—would result in average estimated additional lifetime earnings of over USD 100,000 per child today.¹² This is equivalent to an annual average of USD 1,900 per person, or just over 25% of average per-capita income across LMICs.

AT enables children to overcome numerous obstacles to attend school. Children with disabilities, in particular, are between 10 and 60% less likely to attend school than their peers without a disability.¹³ The enhanced mobility provided by wheelchairs and prostheses, for example, can help children with disabilities overcome many of the transportation barriers that previously prevented them from attending school.¹⁴

AT also helps children perform better while in class. Challenges within the classroom for children requiring AT are often multi-fold — including inaccessible learning materials, unaccommodating teachers, and attitudinal, physical, and communication barriers—often keeping them from learning to their full potential.¹⁵ Devices such as hearing aids and eyeglasses allow for better engagement with teachers and fuller participation in classroom activities, thus overcoming some of these barriers.¹⁶

Finally, young users of AT are more likely to finish school than those without access to it. Although data are not available across all AT users, we do know that children with disabilities, many of whom require AT, are approximately one-third less likely to have completed primary school than those without disabilities.¹⁷ With greater academic access, engagement, and chance for academic success, children who need AT are less likely to experience bullying and discouragement and are more likely to complete their schooling.

Barriers to employment



Attitudinal barriers

Individuals with disabilities, and those that require AT, are often incorrectly viewed as lacking capacity or being unable to work, and therefore may be discriminated against when applying for jobs.¹¹



Institutional barriers

Discriminatory government and/or organisational policies may either prohibit employment or indirectly discriminate, for example by not including provisions for reasonable accommodation¹¹ to support employment (including use of AT). Barriers to access to quality education earlier in life also present barriers to employment later in life.¹³



Communication barriers

Inaccessible information about employment opportunities and inaccessible information and communication processes during recruitment and during employment can adversely affect both the recruitment process and job performance and satisfaction.



Physical barriers

Inaccessible transport and workplaces, which may be exacerbated by a lack of AT, can also prevent people with disabilities /those who require AT from obtaining employment.

SPOTLIGHT:**Impact of AT access on child learning**

Shakira is a 13-year-old girl from Malawi who developed hearing loss following meningitis at the age of five. Her parents realised she was having difficulty hearing when she stopped regularly speaking. She could lip read and speak a bit, but only her parents could fully understand her.

Shakira's mother, Famely, observed that Shakira was growing increasingly isolated due to her hearing loss. She was struggling to fit in with her peers and her confidence and self-esteem were diminishing. Following information provided at school, Famely brought her to a local hearing screening outreach in January 2017.

Shakira was assessed and diagnosed with bilateral hearing loss. She was measured and fitted with hearing aids in February 2017, and both her mother and she were overwhelmed by the marked change in her hearing. Only after the hearing aid fitting did she realise that some people were actually shouting when speaking with her—she now asks them to speak more softly.

Since receiving hearing aids, Shakira's interaction and communication with her friends has vastly improved. Now her friends come around to the house to spend time with her and she goes over to her friends' houses. Just as importantly, Shakira's teacher says that she is completely different in class: she is much better able to communicate with the teacher and her fellow students.



Credit: SoundSeekers
Photo credit: @SoundSeekers

II. Employment

Lack of AT limits the employment prospects of many of those who need it and represents a profound barrier particularly for those with disabilities. The last available data across 51 countries from the World Report on Disabilities showed that on average only about half of men with disabilities were employed, compared with two-thirds of men without disabilities.¹⁸ And while specific data in LMICs are limited, WHO highlights that people with disabilities who work are more likely to do so in the informal sector or to hold part-time jobs.^{11,19}

Adults with access to AT are better able to overcome barriers to learning about available jobs and traveling to and from workplaces. Communication aids such as eyeglasses and hearing aids help eliminate barriers to discovering and understanding information about job opportunities. Mobility technologies such as wheelchairs and prostheses in combination with advances in accessibility help people address or eliminate barriers to getting to the job or interview site.

SPOTLIGHT:

Impact of AT access on a user's employment opportunities

In 1991, Mohammad lost both his legs to a landmine in Myanmar. At the time, he was able to receive a pair of prosthetic legs. In August 2017, he had to flee Myanmar with his family, and was forced to abandon his prosthetic legs and crutches. He is now 50 years old and living in Cox's Bazar, Bangladesh. Back in Myanmar, Mohammad was a tailor and the only breadwinner for his family. To continue earning a living and supporting his family in their new home, he improvised by attaching plastic bottles to his amputated legs in order to be able to pedal the sewing machine.

After accessing a new pair of fitted prostheses from a local health centre, Mohammad can now walk independently again. He has managed to comfortably resume his fulltime job as a tailor and is earning enough to support his wife and three children.



Credit: Ovijit Baidya, Humanity and Inclusion
Photo Credit: ©Humanity & Inclusion/HI

III. Productivity

AT can boost productivity, allowing users to earn more on the job.

When people who need AT gain access to it, they are better able to perform daily tasks, communicate with colleagues, and engage with equipment, processes, and systems within the workplace. Inaccessible locations, communication barriers (such as poor lighting or group conversation for someone who lip reads), and structural challenges (e.g. limited promotion opportunities) hinder workers from being as productive as their peers. AT helps overcome only some of these barriers directly, yet our economic model estimates that the four focus products improve a user's productivity on average by 16%. Research, though scarce, supports this. For example, correcting presbyopia with eyeglasses increased productivity of tea-pickers by 22%, and up to 32% for those aged over 50 years old.²⁰

IV. Working timespan

Access to AT extends the working life of AT users. With AT, users are physically able to work for a longer span of years as better health outcomes enable them to better cope with the challenges of ageing. Particularly in places with weaker social safety nets, this can protect older workers and ensure they maintain a source of income for as long as possible.

In each of these ways, AT can help users increase and prolong their incomes, generating over USD 8 trillion in additional earnings for the AT users themselves.

Family

Meeting the unmet need for AT can enable family supporters to increase their time spent at work, resulting in nearly USD 2 trillion of additional income for families over the users' lifetimes.

Some people in need of AT require regular in-person support to complete tasks in their daily lives. This may include support with mobility, toileting and self-care, accessing water, preparing and consuming food, moving around their homes and communities, and more. Having access to AT helps many users independently complete these tasks. In high-income countries supplementary assistance is often provided by state-funded support services, such as personal assistant schemes, sign

language interpreter services, and (compensated) support from family members. The limited availability of such services in LMICs forces some people to rely more heavily on unpaid support from close relatives for their daily needs.

Increased AT uptake enables family supporters to pursue new opportunities for paid work. AT facilitates greater independence and autonomy for users, reducing their reliance on family members for support. This allows support providers—disproportionately women and girls—to use time previously spent supporting the needs of people lacking AT to regain opportunities for education and paid work. Those previously not employed at all may take on new work responsibilities, while those working part-time may be able to further increase their time spent at work.

Society

The individual and familial economic benefits create a powerful multiplier effect that can contribute to lifting AT users out of poverty while rippling out to impact entire countries.

The cumulative value of the economic benefits accrued by today's AT users would be worth 1% of total LMIC GDP over the next 55 years. And with the spreading of this increased income and spending flowing through the economy, the multiplier effect suggests that the total benefit to local economies could be many times larger. Greater income for AT users translates into greater income for others in their communities and increased tax revenue. As household incomes increase due to higher levels of employment and greater productivity, AT users and their families have more resources to spend in their communities, pay taxes, and otherwise contribute to a virtuous cycle that drives accelerated national-level economic growth.

Earning more income also helps AT users and their families become more resilient to economic shocks, reducing their risk of experiencing poverty and relying on social safety nets. Although the research is limited, available data on workers with disabilities in LMICs have shown them to have lower average incomes than workers

without disabilities.^{11,21} At the same time, people with disabilities and other AT users often must cover high healthcare and other costs (e.g. taxi fare where public transportation is inaccessible). An estimated one in three people with disabilities faces 'catastrophic health expenditures'²², compared with one in five people without disabilities.¹¹ Depressed wages and additional cost burdens are clear contributors to elevated poverty rates among those in need of AT.^{11,23} To varying degrees, these findings can be extrapolated to other AT user groups.

Expanding the availability of AT can also create new work opportunities, such as jobs in assessment, fitting, and training on the use of assistive devices, as well as service and maintenance of devices through follow-up processes. These are jobs that often employ AT users themselves, creating opportunities for more inclusive employment.

SPOTLIGHT: AT and gender

Women and girls routinely face systemic and cultural challenges, resulting in negative consequences for their economic wellbeing

In much of the world, girls are prevented from achieving the same level of educational outcomes as their male counterparts. Women account for an estimated two-thirds (520 million) of illiterate adults around the world today—the vast majority of whom live in LMICs.²⁴ There are an estimated 5.5 million more out-of-school girls than boys, and out-of-school girls are more likely than boys never to have enrolled in school in the first place.²⁵

Already at a gender-based disadvantage in the classroom, girls in need of AT face even greater challenges, resulting in even poorer educational outcomes. For example, survey data found that girls with disability—a large AT user group—are an additional 20% less likely to complete primary school than girls without disability.¹⁸ UNICEF has also found that girls with disabilities are particularly at risk of experiencing discrimination and abuse.³¹ In the classroom, this manifests as bullying, which may result in poorer mental health or self-esteem and contribute to elevated drop-out rates.

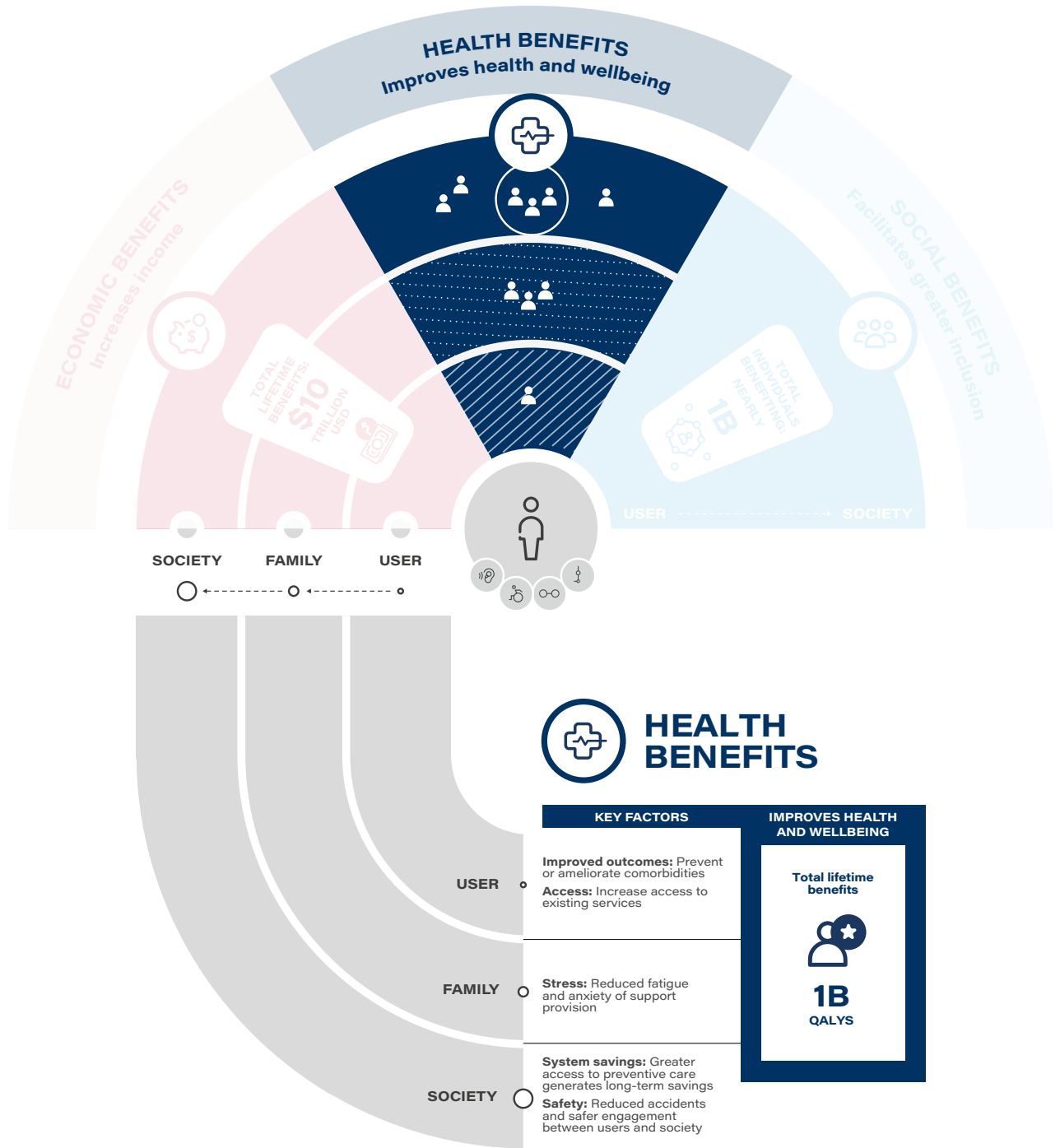
Adult women face cultural and institutional barriers that present significant barriers **to employment and work productivity**. Women are traditionally burdened by outsized responsibilities for unpaid care and domestic work. This 'time poverty' limits their ability to pursue paid work outside the home. On average, women do three times more unpaid work than men and spend seven more years performing unpaid work over the course of their lifetimes.^{26, 27, 28} Even when women are empowered to work for pay, numerous barriers limit their productivity and earning potential. For example, in most of Sub-Saharan Africa, women are not awarded with the same land rights as men and often must access land through male relatives. Furthermore, women often face challenges accessing key inputs, such as fertiliser and mechanical equipment, because they are unable to get the credit / financial support they need to purchase these items.²⁹ This results in a 20–30% productivity gap between men and women working in agriculture in Sub-Saharan Africa.³⁰

Adult women are further disempowered by a lack of AT. Women in need of AT are even more likely than other women to be left out of the workforce. The same survey data found that just under 20% of women with disability are employed compared with about 30% of women without disability.²⁵ In addition, women who live in households in which someone else needs AT are disproportionately likely to take on any required support responsibilities. In other words, a lack of access to AT restricts women's potential even when they are not the prospective users.

Ensuring access to AT will play a key role in improving outcomes for women and girls and accelerating progress towards achieving the gender-related SDGs.

A major pillar of the 2030 Agenda for Sustainable Development is to 'leave no one behind'—and to ensure that efforts reach the furthest behind first. Women are among the most broadly marginalised groups in the world, and those in need of AT are at even further disadvantage. Increasing access to AT offers a powerful opportunity to overcome poverty. By increasing mobility and the ability to engage with others, AT improves the opportunities for women with disabilities to achieve better economic outcomes. Not only does this help the global community realise the SDGs for quality education and decent work, but it is also critical to achieving SDGs 5 (gender equality) and 10 (reduced inequalities)—targeting empowerment for women and girls and reducing inequalities within and among countries.





Figure 4: Health benefits of AT provision



Health benefits

Access to assistive technology increases the wellbeing of people who need it. Providing the four focus assistive devices and services to people in need across LMICs will lead to over one billion additional quality-adjusted life years (QALYs) over the lifetime of the people in need today.

Table 2: Breakdown of health benefits from AT access

	 HEARING AIDS		 PROSTHESES		 EYEGLASSES		 WHEELCHAIRS	
	CHILDREN	ADULTS	CHILDREN	ADULTS	CHILDREN	ADULTS	CHILDREN	ADULTS
Total QALYs	~3 million	~20 million	~40 million	~170 million	~40 million	~950 million	~30 million	~90 million
Total QALYs across products	~ 1.3 billion							
Cohort size	4 million	50 million	5 million	30 million	20 million	830 million	10 million	50 million
Avg. QALYs / user	~0.6	~0.4	~8.9	~5.2	~1.8	~1.1	~2.7	~1.8
Avg. QALYs / user across products	~1.3							

User

Filling the unmet need for AT leads to improved health outcomes and greater access to health care for users, resulting in over one billion additional QALYs over the users' lifetimes.

Based on the experiences of AT users, providing the four products to those who need them in LMICs would produce an average of 1.3 'quality-adjusted life years' per person. A quality-adjusted life year (QALYs) provides a 'common currency' to assess the benefits of health-related interventions on a person's quality of life. They measure 'lives improved' One QALY represents a year of life with 'perfect health'. It expresses how much an individual's ability to, for example, conduct day-to-day activities free of pain and mental distress, incorporating such factors as mobility restrictions, ability to independently self-care, and engagement with work and leisure, changes before and after the intervention.²⁸ For example, a child who continues to receive the prosthetic device needed over their lifetime will on average see an improvement worth 8.9 QALYs – the equivalent of 8.9 years of 'perfect health'. Providing the four products to the 900 million people in LMICs who need them would collectively produce the equivalent of over one billion years of perfect health.³²

These benefits come from a combination of improved physical and mental health and increasing access to existing health services. Although AT alone does not constitute a complete solution and systems and societies still need to become more inclusive and accessible,³³ WHO has noted improved health outcomes among users after receiving AT.³¹ The primary driver of these gains is greater access to, and utilisation of, health services. While current evidence is inconsistent, lived experience speaks to reductions in secondary conditions, such as pressure sores amongst wheelchair users, and increased ability to engage in healthy personal habits following uptake of properly fitted AT. Many users are also better able to avoid accidents and identify and respond to threats to personal safety.

I. Improved user outcomes

Increased use of AT is directly linked to improved physical and mental health by preventing or reducing the impact of secondary conditions. Both the US Center for Disease Control and Prevention (CDC) and WHO report that people with disabilities, as a subset of AT users, are often at a higher risk of experiencing secondary conditions related and unrelated to their disability, such as obesity, diabetes, and chronic fatigue.^{11,34} Research on AT and the reduction of pressure sores has so far been mixed, but hearing aids have been shown to reduce incidence and severity of dementia as well as improving balance and reducing falls.^{35, 36, 37} At a basic level, access to AT is likely to improve health outcomes simply through facilitating increased mobility and physical activity.

No less critically, AT can have a profound effect on the mental health of users. Dealing with barriers (including stigma) and feelings of isolation, among other daily challenges for those in need of AT, can increase stress and contribute to negative mental health outcomes. Data show that people with physical disabilities, among other AT users, are three times more likely than the general population to experience depression.^{38, 39} AT can be an important tool for helping users overcome some of these barriers and better engage with those around them.

II. Greater access to care services

AT can help people overcome widespread barriers to accessing healthcare services. Many people in need of AT must overcome physical barriers—such as lack of accessible and affordable transportation—in order to access health services. For example, across lower-income countries, a reported 30% of people with disabilities (compared with less than 20% of those without disabilities) could not access healthcare due to transportation costs—such as the added expense of taxis or ride-shares when public transit is inaccessible.¹¹ People who need AT often also contend with communication barriers, attitudinal barriers within health facilities, lack of services, and inappropriate treatment options—all of which contribute to the fact that individuals with disabilities in lower-income countries are three times more likely to be denied treatment than those without disabilities.¹¹ While AT cannot address all of these barriers, it plays an important role in helping users overcome some of them.

For women, in particular, greater access to health facilities and better communication with health staff allow users greater access to sexual and reproductive health services and with support in addressing violence and abuse. For example, increased access to care has shown to improve rates of cervical cancer screening. Women can also better communicate with their care providers, which improves understanding and uptake of offerings such as family planning tools.

Family

Meeting the unmet need for AT not only improves users' health outcomes; it also provides increased economic opportunities for those supporting users.

Access to AT can improve the mental and physical health of supporting family members by reducing their fatigue and anxiety and freeing up more time for other activities. Family members of those needing AT have been shown to face significantly greater risk of mental distress, including elevated rates of depression, anxiety, and suicide.⁴⁰ Further, data have shown that the leading reason parents of people with disabilities fail to seek out mental health services is a lack of time amidst existing support-giving responsibilities.⁴⁰ Just as AT use alleviates users' needs for some forms of support and can free up time for family members to engage in paid work, it can also mitigate the levels of stress and fear that family supporters experience and enable them to seek out formal health services. Thus, the family and community members who support AT users often see improvements in their own wellbeing.

SPOTLIGHT:

How a wheelchair benefits a whole family

Renu lives in New Delhi with six members of her family, including her 11-year-old daughter Jiya. When Jiya was born, the doctors told Renu that she had cerebral palsy, which would cause some delay in her development. The family believed it could manage.

Jiya started in a special school with the help of her mother and grandmother. The school provides physiotherapy with special education and teaches Jiya about supporting herself.

But the school is 40 minutes by train from home. Before she had a wheelchair, Renu and Jiya's grandmother had to transport Jiya in a child's pram. Renu suffers from back pain, which made the journey even more difficult.

Now, the family has a wheelchair that is comfortable for Jiya to sit in. Jiya has better posture in the chair, improved neck control, and can sit for a much longer time. In fact, she often chooses to remain in it after she has come home from school.

For Renu and her mother, the new wheelchair is manageable on the trains and can be carried up and down steps with two people. Now it is possible for Jiya's grandmother to stay with Jiya at school on her own—two people are not needed. Renu can receive treatment on her back while Jiya is in class.



Credit: Motivation
Photo credit: ©Motivation

Society

Meeting the unmet need for AT not only improves users' health and economic outcomes; it also provides increased economic opportunities for those supporting users.

I. Health system savings

Greater access to preventive care can reduce total longer-term health system expenditures. Primary and preventive healthcare is significantly cheaper and more cost-effective than curative tertiary and referral-based care.⁴¹ By facilitating greater utilisation of preventive services, and thereby preventing the development of more serious comorbidities, AT can contribute to savings across national-level health systems. At the same time, data also suggest that in some cases these savings may be offset by the significant increase in total healthcare consumption among AT users as they overcome some of the barriers they currently face to accessing all care. However, even if overall health spending may go up, improved access to health services for more people is fundamentally a good thing, contributing to a healthier workforce, which is a more productive workforce. This further contributes to the economic gains discussed above and more than offsets any increase in health expenditure.

II. Universal health coverage

Investing in increased AT provision ultimately represents an important step for countries towards the achievement of universal health coverage. One of the targets of the SDGs, universal health coverage (UHC), is a commitment to ensuring that 'all individuals and communities receive the health services they need without suffering financial hardship.' UHC includes 'the full spectrum of essential, quality health services, from health promotion to prevention, treatment, rehabilitation, and palliative care.'⁴² Given the range of health and other benefits AT facilitates for users, AT must be a critical part of UHC packages.

Furthermore, AT's potential to expand users' access to other health services makes it an even more important part of guaranteeing affordable and effective care and promoting more equitable outcomes for all.

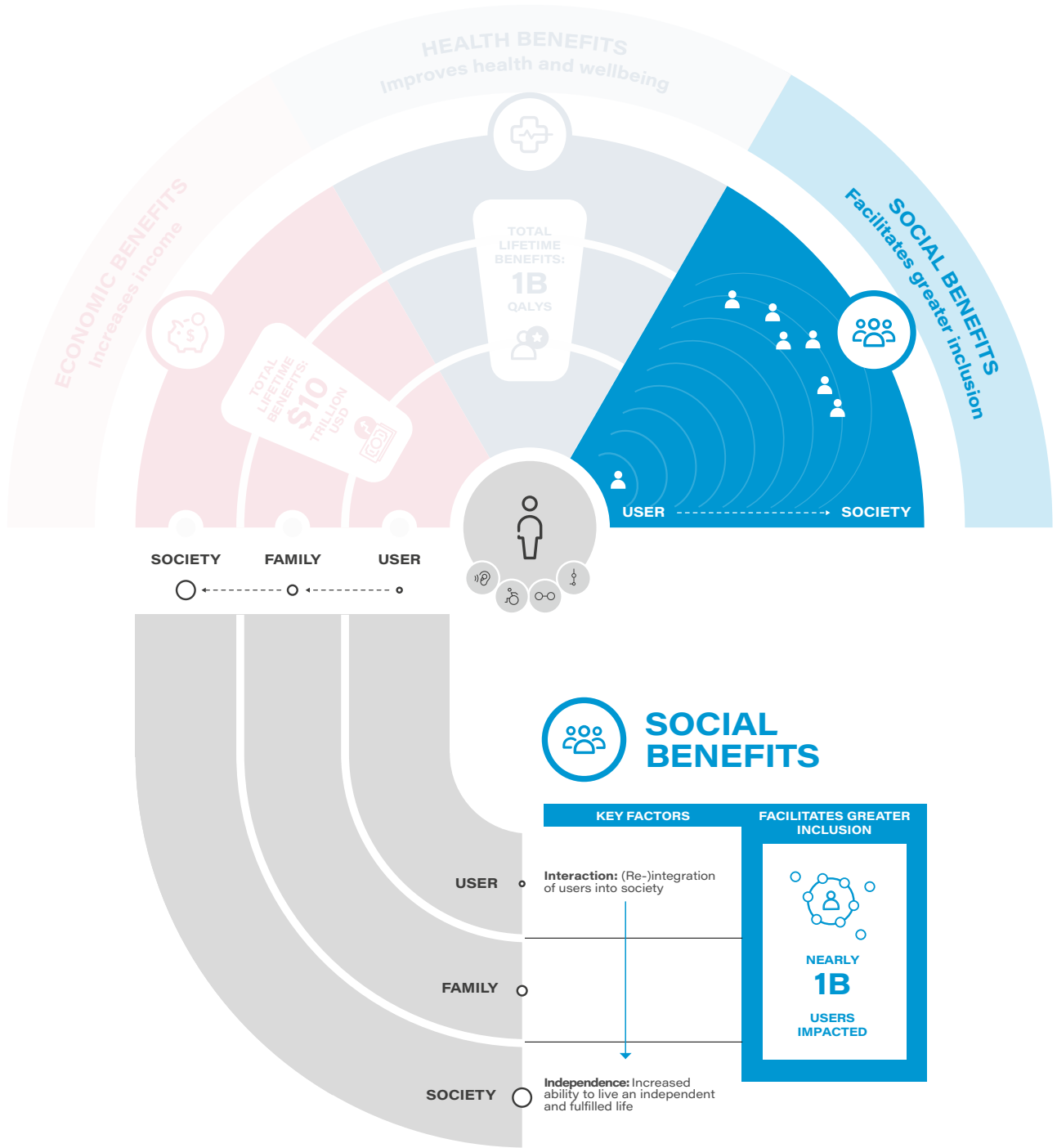


Photo credit: ©UNICEF-UN0155936-Danang

III. Safety

AT can help users more safely navigate their environment and engage with one another. Hearing aids, wheelchairs, prostheses, and eyeglasses improve users' safety when navigating outside the home by helping them avoid accidents and identify and respond to threats to personal safety. Eyeglasses, for example, contribute to greatly reducing traffic fatalities for drivers.⁴³

Figure 5: Social benefits of AT provision



Social benefits

Increased access to assistive technology promotes the integration of users into society and increases users' sense of independence, both of which are felt particularly by marginalised populations and contribute to building resilient communities.

I. (Re)integration of users into society

Fulfilling individuals' right to AT promotes greater inclusion and sense of independence contributes to the strengthening of societies.

AT is an important tool for helping adults and children meaningfully engage in their communities and build and maintain social relationships. Older people and adults with disabilities may become socially isolated because they are unable to attend social gatherings or even regularly leave the home. Likewise, children unable to attend school miss out on interacting with their peers and establishing social relationships. Lack of widespread awareness and misconceptions of these issues also often lead to social stigma and further exclusion, which severely detracts from people's quality of life. AT can facilitate increased interpersonal interaction, which ultimately promotes a sense of belonging, elevates users' self-esteem,⁴⁴ and helps build more resilient and effective communities.

Increased access to AT has also been shown to increase children with disabilities' engagement in meaningful group play with their peers.

This can benefit child development in areas such as confidence, resilience, self-awareness, and independent thought.⁴⁵

Access to AT ultimately increases the effectiveness and resilience of a society by increasing the diversity of its engaged members. When more people are able to achieve their full potential, they contribute to the overall wellbeing and diversity of their communities, bring a wider range of perspectives to bear on social issues, and enrich society as a whole.^{46,47}

II. Living a more independent and fulfilled life

Improved access to AT provides users with an increased sense of independence and control, which is particularly impactful for vulnerable populations.

Access to AT may provide users with more opportunities, choice, and control over their daily lives. With greater mobility and increased ability to communicate with others, new opportunities can emerge that require less support from others, present more individual choice, and afford greater independence. Increased access to AT can have a particularly marked impact on marginalised populations, contributing to more equitable opportunities and outcomes.

SPOTLIGHT:

Impact of AT access on girls in vulnerable circumstances

Nirmala and Khendo were seven when the earthquake struck Nepal in April 2015. Nirmala was trapped under a collapsed wall and Khendo was buried under the ruins of her house.

The two girls were sent to the Bir Trauma Center hospital in Kathmandu, and both had a leg amputated. The girls were there for almost three months and then moved to a rehabilitation centre. With the support of Humanity and Inclusion, an NGO, the girls received prostheses six months after the earthquake and re-learned to walk. 'They have made tremendous progress. They support each other. Their friendship is their strength' says Sudan Rimal, a physiotherapist for HI.

'We adapt their prosthesis every six months, according to how much they grow,' explains Rimal. 'They become more aware of their bodies and the importance of rehabilitation exercises. They tell me when they are hurting, and where. [...] They challenge each other to do the exercises, to progress. They are impressive.'

Nirmala and Khendo are now back in school. They love English, badminton, and playing hide and seek. And when they talk about the future, Nirmala says that she dreams of becoming an actress. As for Khendo, she wants to be a teacher, 'to help people become good people.'



Credit: Humanity and Inclusion
Photo credit: © L. Veuve / Handicap International

Chapter 3

Return on investing in assistive technology

Delivering these benefits will require an investment of approximately USD 700 billion. This reflects a sustained investment over the lifetime of people currently in need of assistive technology. While substantial, this investment is cost-effective and will earn a return of 9:1.

There are two major components of the cost of delivering AT to those in need—upfront investments in systems strengthening and user-incurred costs (both one-off and recurring). Foundational investments to strengthen systems for effective AT delivery include building sustainable supply chains, establishing and supporting healthy markets, enactment of supporting policies, and more. User-incurred costs include a one-off case-finding and diagnosis cost and recurring costs for product procurement, fitting and training, and maintenance for as long as the individual uses AT.

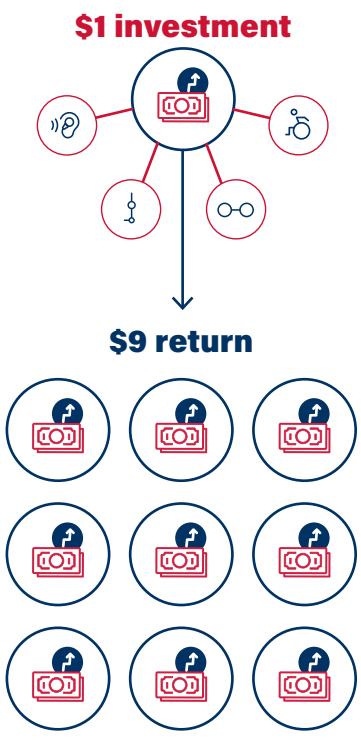


Credit: Motivation
Photo credit: ©David Constantine, Motivation

Ensuring lifetime access to appropriate AT for all people needing at least one of the four focus products in LMICs today would cost approximately USD 700 billion over 55 years. This figure is based on meeting the needs of nearly 1 billion people over their lifetimes. It also includes high-level estimates of the cost of strengthening systems for AT delivery across LMICs. However, a significant scale-up should create efficiencies and reduce unit costs, bringing substantial savings to the estimated overall investment needs.

While the investment required is substantial, realising the vastly greater economic benefits from increased AT access would lead to a return on investment of 9:1. In other words, for each dollar invested in AT, there is nine dollars in return to users, families and the national economy.⁴⁸ As this estimate does not account for the non-financial health and social benefits that AT delivers to users and their communities, the overall benefits of these investments are significantly higher.

The ROI shows that this is a 'smart buy' for donors and governments alike. A 9:1 ROI ratio puts investments in expanded access to AT on a par with other important and impactful global initiatives, such as WHO's 'Best Buys for NCD Prevention'⁴⁹ and improved childhood education⁵⁰.



Chapter 4

Progress to date and the path ahead



Some countries have already begun making investments and progress in scaling up access to AT, with promising early results.

Access to AT is gaining global momentum as a policy issue. While more common in higher-income countries, policies supporting AT provision are emerging in LMICs.⁵¹ Through international advocacy efforts, strengthening markets, and national-level policy changes, a number of LMICs have successfully increased their support for the rights of people with disabilities and others in need of AT.

This chapter highlights recent progress in AT provision within three countries: Rwanda, Pakistan, and the Philippines. Efforts made by these countries offer insight to others looking to increase AT provision within their own borders. Countries need to ensure that their disability-specific and mainstream policies and programmes are developed with an AT-specific lens. Through multi-stakeholder partnerships, public and private actors can support each other in sharing resources to enhance AT delivery capacities and guarantee AT as a core part of the effort to achieve universal health coverage. With proper leveraging of resources and strategic planning, sustainable delivery of appropriate AT is achievable in LMICs.



Credit: SoundSeekers
Photo credit: ©SoundSeekers

RWANDA

Rapid scale-up of delivery has allowed the Government of Rwanda to make dramatic strides in providing vision care to individuals in need.

THE CHALLENGE

Rwanda's capacity limitations have restricted its ability to establish effective service delivery models for eye care services. The number of vision specialists in Rwanda was for a long time inadequate to meet the nation's treatment need: as of 2013, only four optometrists and ten ophthalmologists served ~1.1 million people requiring vision care.^{43,52} Moreover, most eye care services were concentrated in the capital of Kigali, making access to care difficult for people in rural areas.⁵³

THE APPROACH

Rwanda has created partnerships with key actors to support the scale-up of eye care services. To solve barriers to service delivery, the Government of Rwanda in 2010 partnered with Vision for a Nation, a UK-based NGO, to develop a comprehensive primary eyecare programme that would be incorporated into the national health system. Through three phases, the programme aimed to screen and provide eyeglasses to all Rwandans eight years and older who needed them by 2015.⁵²

As a result of these efforts, Rwanda became the first low-income country to provide universal eye care for its population.⁵⁴ The programme's success can be attributed to rapidly scaling up health personnel capacity. Two thousand Rwandan nurses had been trained in primary eye care by 2016.⁵⁰ By 2018, the partnership had sent specialist nurses to all 15,000 communities in Rwanda.⁵⁴ The impacts of the programme can be seen across both treatment and eyeglasses delivery. During the first 27 months of the programme, 500,000 screenings were completed, 225,000 individuals received necessary prescription medication, and 65,000 eyeglasses were delivered.⁴³ While there remains much to do to ensure full access to services for people in need of other assistive devices, this represents an important milestone in delivering AT on a national scale.

LESSONS LEARNED

Rwanda's innovative efforts in scaling up eye care delivery offer lessons to others.⁴³ Through this project, the Ministry of Health institutionalised a central fund that allocated revenue from eyeglasses sales solely to the primary eye care programme's operations.

Rwandan ophthalmologists created a training curriculum for government-employed nurses that is now taught in all eight of the nation's nursing schools. Furthermore, the programme effectively linked all 42 district hospitals in order to more efficiently serve people with severe visual impairment. These various efforts allowed Rwanda to rapidly scale up supply and delivery chain capacities and effectively provide eyeglasses and medication at all 502 health centres in the country.

PAKISTAN

The Government of Pakistan has led numerous international- and national-level efforts to highlight the importance of increased access to AT.

THE CHALLENGE

Social stigma has excluded people in need of AT from many aspects of Pakistani society and they were overlooked in national plans.^{16,55} A lack of data and partnerships on a transnational level made it harder to successfully advocate for their rights

THE APPROACH

To address the lack of knowledge and regional will to act, Pakistan has become a global advocate and international leader in revising policy to address the needs of people with disabilities and others requiring AT. Pakistan sponsored the 2018 World Health Assembly (WHA) resolution on AT, the first ever,⁵⁶ and it hosted the first WHO regional meeting on the importance of AT in May 2018.⁵⁷ Dr. Sana Hafeez, a physician in Lahore who uses a wheelchair, was named the first-ever WHO Global Champion for AT.⁵⁸

Nationally, steps are also underway to help people in need of AT realise their right to an independent life. Pakistan was the first country to pilot a Rapid Assistive Technology Assessment, surveying a sample of over 9,000 households. While this showed a demand of 13.1% who needed at least one assistive product, it also showed that of those who used an assistive device, 90% had paid for it out-of-pocket and of those who did not have the product they needed, two-thirds said it was because they could not afford it. The data will inform a National Strategic Action Plan with the aim to have universal

access to AT by 2030. In the meantime, the government has developed a strategic AT action framework due to be launched soon.⁵⁶ In March 2019, Prime Minister Khan launched the Ehsaas Kifalat programme with the goal of reducing inequality and investing in vulnerable groups.^{56,59} In support of the programme's efforts to provide universal access to AT, the government will provide Sehat Insaf (health identification) cards to people with disabilities to ensure free medical treatment and AT. The government plans to create centres for individuals needing prostheses in 20 under-privileged districts. Further, to continue to expand the availability and uptake of AT, the Government of Pakistan forged a partnership with the Chinese Disabled People's Federation.⁵⁵

LESSONS LEARNED

Pakistan has been effective in building an advocacy platform both globally and within its own borders. By leveraging the influence of multi-stakeholder efforts, Pakistan has been able to mobilise countries around the world to support the rights of people with disabilities. This, together with data collection, has also contributed to initial progress in generating domestic political support for the provision of AT.

THE PHILIPPINES

Increased clarity on the unmet need in the Philippines led to radical reform and incorporation of AT in the national health system.

THE CHALLENGE

Lack of data on the extent of unmet AT need in the Philippines has historically prevented effective policymaking. UNICEF has highlighted the degree to which minimal recognition or diagnosis of health conditions and impairments has long hampered effective data collection in the Philippines.⁶⁰ This was driven in large part by stigma and barriers to accessing quality services for those with disability or impairment.⁶¹ For example, while parents may have been aware that their child had a health condition/impairment or disability, they were often unsure of the implications of this or what support might be available. Without an accurate understanding of the gaps in provision, the government struggled to make the necessary policy changes and develop more effective national plans.

THE APPROACH

Localised data collection efforts contributed to fundamental changes in the coverage and incorporation of AT in the national health system.

Amputee Screening via Cellphone Networking (ASCENT), a mobile application that provides amputees with doctors' real-time diagnoses and advice on prostheses use, was instrumental in reaching underserved communities.⁶² Data gathered from this initiative contributed to the Philippine Health Insurance Corporation (PhilHealth) creating a new benefits package, called Z-MORPH, that targeted people in need of prostheses.^{63,64} The package was originally limited to providing PHP 15,000 (approximately USD 300) for a lower limb prosthesis but was later expanded to also cover PHP 75,000 (approximately USD 1,500) for above-the-knee prostheses.⁶⁵

Building on initial reforms, PhilHealth continued to expand coverage to other groups, amplifying the benefit package's effects. In 2016, PhilHealth announced that it would be creating benefit packages that would cover children with hearing, visual, mobility, and neurodevelopmental disabilities.⁶⁶ In 2018, the company rolled out two packages: the Z Benefit Package for children with developmental disabilities and the Z Benefit Package for children with physical disabilities.⁶⁷ The mobility package includes assessment, rehabilitation, and fitting of a prosthesis or wheelchair. In 2019, the government supported a mandate for PhilHealth to expand on these packages to provide coverage for all people with disabilities.⁶⁸

LESSONS LEARNED

Effective data collection and needs assessment efforts have been central to effective AT policymaking at the country level. While national-level surveys provide a wider view of the needs gap in a country, local efforts can target specific gaps in data and contribute to policy improvements. Furthermore, governments should aim not only to mainstream disability in all systems and efforts but also to create disability-specific policies—for instance, within a national health insurance scheme—to support individuals in need.

Systemic barriers to accessing assistive technology must be addressed in order to see the return on investment (ROI)

Despite the progress so far, much work remains to be done and investments are required. While countries such as Rwanda, Pakistan, and the Philippines have taken steps towards meeting the needs of all citizens and promoting their full participation in society, there is a long way to go to guarantee all people access to AT and ensuring their rights. Difficult barriers remain, and it is critical that the world take coordinated action.

Effective AT delivery relies on a supportive policy environment and reliable information; in LMICs, both require strengthening.⁵⁴ Inconsistent political will and lack of prioritisation for AT can contribute both to obstructive policies (such as exclusion of AT from national health schemes) and unintended consequences (such as stifling import tariffs). At the same time, lack of supporting evidence and inconsistent data make it difficult for policymakers to effectively identify areas where interventions would be most impactful and cost-effective.

Meanwhile, the supply of assistive products does not meet the specific needs of those in LMICs. Few products exist today that are designed specifically for use in LMICs. For example, products may not appropriately fit individual users, prove durable enough for the terrain, or be supported by available maintenance services in the country.⁷ These challenges stem from a lack of user-centric innovation and inconsistent or inadequate product and service delivery standards. In addition, the lack of participation in LMIC markets on the part of AT manufacturers and suppliers contributes to keeping product availability low and prices high. Products are also unaffordable for users due to inadequate funding for AT and the exclusion of AT from insurance schemes. Finally, a shortage of trained personnel for diagnosis and fitting of AT limits the effectiveness of those products that do reach people in need.

To ensure that all people can access and use the AT they require, new and existing stakeholders will need to coordinate their actions.

Effective AT delivery includes a variety of procurement systems and accompanying services including referral, assessment, prescription, ordering, product preparation, fitting and adjusting the product to the user, training the user or family members, follow-up, and maintenance and repairs. Creating these systems cannot happen without prioritisation at the political level, increased resource allocation, a coordinated and collaborative expansion of service offerings in emerging markets, and a commitment from all to overcoming these challenges to support those in need.

Chapter 5

The role of ATscale, the Global Partnership for Assistive Technology



©David Constantine - Motivation

ATscale, the Global Partnership for Assistive Technology, is a cross-sector partnership established in 2018 to build a cohesive strategy addressing the lack of global prioritisation, coordination, and investment in AT, as well as to tackle market challenges. ATscale's vision is to enable a lifetime of potential where every person can access and afford the life-changing AT they need. ATscale's goal is to catalyse action to ensure that 500 million more people globally are reached with life-changing AT by 2030.

ATscale works to:

- **Inspire and influence stakeholders to act on AT** by raising political will and mobilising resources from current and new actors
- **Catalyse leading partners across sectors to act collaboratively** within unified strategies at global, regional, and country levels
- **Make targeted investments across the AT space** to ensure rapid scale-up of sustainable systems for AT access

ATscale has two primary strategic objectives shaping its work.

The first focuses on developing an 'enabling ecosystem' for increasing access to AT. This includes galvanising political will, mobilising investment, driving policy reform, and strengthening targeted cross-product systems—particularly at the country level. The second objective is to identify and implement interventions to overcome supply- and demand-side market barriers to build and shape markets for assistive products and their related services.

Through an assessment of the WHO's Top 50 Priority Assistive Product List, level of unmet need, and the potential for impact through new market-shaping approaches, ATscale selected five priority products for initial focus: wheelchairs, hearing aids, prostheses, eyeglasses, and assistive digital devices and software.

ATscale will progressively build on its successes and expand its scope of impact. Initial investments will address some of the foundational components that are lacking in the sector including global product standards and profiles and will pilot new tools for innovative service delivery approaches. ATscale will learn from its initial investments and move towards supporting larger-scale programmes that bring together both demand and supply-side interventions to strengthen AT provision in-country and to shape global markets.



Photo credit: ©CDPF

ATscale was founded by China Disabled Persons' Federation, Clinton Health Access Initiative, Global Disability Innovation Hub, Government of Kenya, International Disability Alliance, Norwegian Agency for Development Cooperation, the then Office of the United Nations Secretary-General's Special Envoy for Health in Agenda 2030, UK Department for International Development, UNICEF, United States Agency for International Development, and World Health Organization.

Chapter 6

A call to action



Providing access to assistive technology can improve the lives of hundreds of millions of people

Governments and donors have a responsibility to prioritise action and investment in AT. In 2015, all countries agreed to the Sustainable Development Goals, which include a commitment to achieve Universal Health Coverage (UHC) by 2030. UHC is about ensuring that people have access to the health care they need without suffering financial hardship. Countries will not achieve UHC unless they strengthen their health systems to include equitable provision of quality AT. The need for AT will only continue to grow in coming years as the global population ages.⁶⁹ Total need is projected to increase to two billion individuals by 2050.³ Countries will need to explore innovative approaches to creating supportive systems and healthy markets in order to ensure successful AT provision on the required scale. These actions are critical to ensure the human rights of people in need and create more inclusive societies.

As this report describes, meeting the need for AT represents an impactful and cost-effective investment. It contributes to increasing incomes for users and their families, generating economic benefits worth nine times the required investment as well as significant health and social benefits.

Therefore, ATscale puts forth a call to action to increase access to assistive technology for the 90% of those in need around the world who have been left behind. In order to reach all people in need with appropriate products and services and to strengthen systems to support the sustainable and equitable provision of AT:

ATscale calls on LMIC governments to recognise the significant economic, health and social benefits outlined in this case for investment in AT, and to comply with their commitments to existing international agreements by:

- Allocating resources to facilitate access to appropriate AT products and services integrated with national health plans
- Enacting supportive and inclusive policies that establish AT as core parts of national health systems/services, insurance schemes, social protection programmes, education initiatives, and others

Credit: SoundSeekers
Photo credit: ©SoundSeekers

- Leading and supporting efforts to raise awareness of the need for and benefits of AT, reduce stigma in communities and the workplace, and foster respect for the rights and dignity of all users
- Consulting and working with AT users and organisations of persons with disabilities on various aspects of programme delivery

ATscale calls on donor organisations to incorporate this new evidence on the value-for-money of AT investments into plans for achieving the 2030 Agenda by:

- Considering the inclusion of AT-focused grants and initiatives into their funding strategies in ways that support sustainable service delivery systems, improve data and evidence, and expand user access to appropriate assistive devices
- Advocating for and incentivising LMIC governments to prioritise access to AT as an important part of their commitments to achieving existing health and development targets
- Consulting and working with AT users and organisations of persons with disabilities on various aspects of programme delivery

ATscale calls on the private sector to contribute to the effort to expand access to affordable and high-quality AT to those in need in all parts of the world by:

- Working with ATscale and others to review their product portfolios and identify business models and approaches that create win-win situations for business and those in need of AT

ATscale calls on the disability rights movement to leverage this new case for investment to ensure the rights of persons with disabilities by:

- Advocating for local and national governments to introduce national policies on AT and increase investments in the sector
- Advocating for improvements in access to appropriate AT products
- Advocating for more engagement with AT users and organisations representing persons with disabilities in setting policies and plans

ATscale calls on the global development community to recognise that increasing access to AT is a critical challenge; finding solutions can bring tremendous benefit, but requires collaborative action by:

- Participating in coordinated programmes through ATscale and other organisations to build economies of scale and accelerate progress in bringing AT to under-represented and marginalised communities



Photo credit: ©earAccess

- Consulting and working with AT users and organisations of persons with disabilities on various aspects of programme delivery, including the delivery of campaigns or technical assistance programmes at all levels

ANNEX A

Modelling methodology

INTRODUCTION

Our analysis relies on original modelling that incorporates the best-available current data on AT need and the impacts of AT on users' lives. Because disability and AT have long been low priorities on the international research agenda, there is limited empirical evidence on the potential health and economic benefits of AT, as well as the return on investment in AT provision. Given the data-poor environment, this model necessarily relies on simplifying and generalising assumptions.

This work aims to complement ongoing efforts in the AT space and to spur increased data collection and additional analysis. This analysis aims to expand the literature and provide new perspective to ministries of health, finance, and social protection, as well as global donors, on the need to broaden their efforts to provide AT. These results should be viewed as a strategic guide to decision makers.

The fundamental objective of the model is to estimate and bring increased specificity to the costs and associated benefits of delivering high-priority AT products in LMICs. The model assessed both the 'critical path' investments needed to strengthen systems for AT delivery and costs associated with AT usage, including end-to-end product delivery costs and the ongoing lifetime cost of AT for users. Though increased access to AT leads to social, economic, and health benefits—as described throughout the report—the model specifically calculates the benefits of economic and health improvements for users in quantitative terms.

APPROACH

Three parameters defined the scope of this work:

- **Products:** Eyeglasses, hearing aids, prostheses, and wheelchairs
- **Geographical coverage:** All lower- and middle- income countries (LMICs)
- **Time:** Remaining lifetime of all individuals in need of the four priority products alive today (55 years)⁷⁰

The products included in the analysis are a subset of WHO's 'Priority Assistive Devices List' and represent four of ATscale's five selected

priority products for increased utilisation. We selected these four for two reasons: a majority of people in need of AT require at least one of these four products, and the research into their potential benefits is relatively extensive.⁷¹

A set of underlying global assumptions support the model. These include:

1. The lifetime costs of AT delivery (including initial procurement and ongoing servicing and upkeep) are based on today's prices and do not change over time⁷²
2. The products delivered are suitable for users in the local context—this implies negligible abandonment of devices
3. Ideal implementation of supportive systems and policies prior to product delivery—these programme costs are accounted for, but uptake estimates do not include lag time in systems strengthening, demand generation, or similar efforts
4. Global averages of demand and impact will provide reasonable estimates of cost-effectiveness and ROI in specific country-level environments
5. Distribution across age brackets is flat in all LMICs

METHODOLOGY

COHORT SIZING

The model is based on product-specific estimates of unmet need in LMICs. These figures are based on existing literature and account for total global need, the respective share of need in LMICs, and the relative rates of product delivery to date.

The model makes a simple adjustment to address potential double-counting across the four products. It roughly estimates the percentage of the adult population that would have received one product as a child and then a second later in life—for example, due to ageing. The economic and health gains portion of the model treat each AT received as its own case and therefore may overestimate the income gains for 'multiple AT' users. To find the number of adults needing more than one AT today, we first used the childhood need rate to estimate the share of the adult population that first needed AT as

a child. We then applied the rate of 'novel' adult AT need to the same population to get a rough estimate of the overlap in populations for all product combinations. This gave an estimate of approximately 2.5% of the total cohort requiring two products. While this same approach could be applied again to find those needing >2 products, we assumed that this population would be negligible relative to the total cohort.

For any individual using more than one AT, we assumed that the model would overstate their marginal income gains from AT by approximately 10%. Applying this 10% to 2.5% of users requiring two ATs suggests that without an adjustment for double counting, the model would overestimate the total benefits by approximately 0.25%. In order to make a conservative adjustment and avoid overstating the potential benefits of AT, we rounded this up and applied a flat 1% reduction to all economic and health benefit estimates. We also incorporated the 1% adjustment into the estimation of case-finding costs (assuming fewer individuals to identify).

The cohort sizes used are shown in Table 3.

Table 3: Estimated cohort sizes, by product and age group⁷³

	CHILDREN	ADULTS
HEARING AIDS	4 million	50 million
PROSTHESES	5 million	30 million
EYEGLASSES (prescription)	20 million	110 million
EYEGLASSES (readers)	-	720 million
WHEELCHAIRS	10 million	50 million

DISCOUNT FOR TIME TO STRENGTHEN AT DELIVERY SYSTEMS

One of ATscale's primary areas of work focuses on improving the enabling ecosystem to support sustainable and effective delivery of AT products and services to those in need. While this work, along with more targeted market shaping efforts, is ongoing, we assumed for the purposes of modelling the economic and health benefits that it would take some time for full implementation. Therefore, we first modelled the maximum possible benefits that each AT user (across both children and adults) could accrue in a given year. Then, we assumed that they would accrue 35% of this maximum benefit in the Year 1 (2020), and that the share of the maximum accrued in each subsequent year would increase linearly up to 100% in Year 15. The benefits then continue to accrue at 100% of the maximum in each following year, assuming full development of the AT delivery system.

BENEFITS

ECONOMIC IMPACT

The economic impact of AT is threefold: i) increased rates of employment and productivity (affecting adult users as well as children once they reach working age); ii) improved educational outcomes (affecting child users); and iii) unpaid family support providers taking up more paid work. We modelled each of these components separately and then aggregated them across the three groups. In all cases, we use GDP per capita as a benchmark for average LMIC earnings and adjust it to account for economic growth and inflation.

These factors are all influenced by 'disability severity'; the model uses QALY weights as proxies. The severity of their disability in large part dictates the extent to which AT users are better able to access jobs, attend and succeed at school, or reduce their reliance on family support providers. The model uses the product-specific QALY weightings (see 'Health impact' below for more on QALYs) as quantitative proxies of disability severity throughout the economic estimates.

We based the estimate of increase in employment and productivity on previous work by the ILO. The approach accounts for changes in both willingness / capacity to work (workforce participation) and ability to obtain a job (employment and unemployment rates) based on disability severity and the impact of AT. The model estimates the total earnings gains based on the following formula:^{74,75}

$$\Delta\$_p \text{ (per year)} = \sum_{i=1}^4 V N_i \gamma_i, \text{ where}$$

$$\gamma_i = (\beta_i^* - \beta_i) e_i + \beta_i^* (u_i - u) + \beta_i^* (d_i - d)$$

where N = # AT users, V = GDP per capita, y = income adjustment factor, β = disability severity, e = employment rate, u = unemployment rate, d = inactivity rate, i = AT product, * = post-intervention

Note: This assumes i) average employment statistics can be applied to estimate LMIC-wide shifts, and ii) working life spans from the ages of 18 to 64.

The educational component is based on the impact of increased schooling on lifetime earning potential. Research has shown that each additional year of schooling is linked to a 10% increase in personal earnings.¹¹ The model scaled each year of school for which a child had AT by the relative increase in ability to attend and perform to estimate the effective number of increased school-years gained. Due to the limited available data regarding the impact of AT on education attendance and performance, the model again used QALY weight values as proxies for increased ability to attend and learn. We then multiplied the result in order to estimate lifetime earnings gains. The following formula describes this calculation:⁷⁶

$$\Delta\$_p \text{ (per year)} = \sum_{i=1}^4 N_i V_i [r * T_i (Q_i^* - Q_i)]$$

where N = # children using AT, V = GDP / capita, r = percent earnings increase per year of schooling, T = total years of schooling while using AT, Q = QALY weight, i = AT product, * = post-intervention

Finally, the model estimates the economic gains of family supporters who take on additional paid work outside the home. We assume that the increase in quality of life and independence (assessed by proxy according to QALY weightings) leads to a proportional reduction in need for dedicated support from family members. In turn, those previously providing support may then be able to pursue part-time or full-time employment. Because data on support providers in

LMICs are limited, largely due to the difficulty in estimating the informal family supporter population, the model uses U.S. benchmarks scaled up to the level of AT need in LMICs.

Supporters' income increases derive from their pre- and post-intervention employment statuses. The model differentiates between those working part-time ('high' = 25 hours per week; 'low' = 15 hours per week) or not working (zero hours per week) pre-intervention and then accounts for changes between groups post-intervention. Only three of these transitions produce employment gains: i) no work to low part-time work, ii) no work to high part-time work, and iii) low part-time work to high part-time work. We determined the allocation to each category based on average employment statistics for the AT users and the severity of the user's disability (again using QALY weights as a proxy).⁷⁷





The following formula captures the estimated annual income gains from this increase in paid work:

$$\Delta\$_{CG} (per\ year) = \sum_{i=1}^4 \sum_{j=1}^3 N_i V_i * p_{ij} \Delta h_{ij}$$

where CG = caregiver, N = # support providers, V = GDP / capita / hour, p = share of support providers in category, Δh = change in hours worked per week, i = AT product, j = support provider employment group

The combined economic gains due to adult, children, and family supporters having the opportunity to perform additional paid work come to nearly USD 10.5 trillion. Table 4 below breaks down economic benefits by product and population group.

Table 4: Breakdown of modelled economic benefits

	 HEARING AIDS		 PROSTHESES		 EYEGLASSES		 WHEELCHAIRS	
	CHILDREN	ADULTS	CHILDREN	ADULTS	CHILDREN	ADULTS	CHILDREN	ADULTS
Cohort size	4 million	50 million	5 million	30 million	20 million	830 million	10 million	50 million
Avg. lifetime gains per user	~USD 59,500	~USD 2,800	~USD 246,300	~USD 8,400	~USD 76,800	~USD 4,200	~USD 106,200	~USD 8,100
Total lifetime user gains	~USD 200 billion	~USD 100 billion	~USD 1,200 billion	~USD 300 billion	~USD 1,700 billion	~USD 3,600 billion	~USD 1,000 billion	~USD 400 billion
Total lifetime user gains across products	~USD 8,500 billion							
Total family supporter gains	~USD 70 billion	~USD 110 billion	~USD 180 billion	~USD 150 billion	~USD 160 billion	~USD 740 billion	~USD 330 billion	~USD 140 billion
Sum of family supporter gains across products⁷⁸	~USD 1,900 billion							
Total economic gains¹⁵	~USD 10 trillion							

HEALTH IMPACT

The health impact assessment is based on the quality-adjusted life year (QALY). This is a standard metric used to capture changes in AT users' reported quality of life, despite a lack of direct change to their underlying physical condition as a result of receiving AT.⁷⁹ Existing literature provides data on users' reported quality of life before and after receiving either of the four assistive products. These data tracked changes in quality of life over the residual life expectancy, beginning with the average age of receiving each AT product (addressing adults and children separately), in order to estimate the total gain in QALY.

The QALY weightings are based on pre- and post-intervention EQ-5D values (a standardised instrument used to measure health status) available in the existing literature.^{80,81,82,83} Given the data-poor environment, some of these estimates came from small-scale or localised studies. The QALY weighting values used in the model are shown in Table 5 below.

Table 5: QALY weightings by product (EQ-5D)

	Pre-Intervention	Post-Intervention	Difference
HEARING AIDS	0.830	0.853	0.023
PROSTHESES	0.398	0.724	0.326
EYEGLASSES (prescription)	0.895	0.961	0.066
EYEGLASSES (readers)	0.915	0.961	0.046
WHEELCHAIRS	0.537	0.638	0.101

The health model does not account for changes to mortality or health system expenditure. Desk research and expert interviews indicated that there is insufficient empirical evidence directly linking AT uptake to reductions in mortality. Similarly, evidence examining the impact of increased access to AT on health care expenditures was inconclusive. This may be due to difficulty in assessing the effects of two opposing and uncertain forces: i) increased access to AT helps users overcome some barriers to accessing health services, thereby increasing utilisation of services, and ii) increased use of preventive services reduces incidence of serious complications, which are associated with more costly reactive emergency treatments.

We estimate the gain in QALYs using the following equation:⁸⁴

$$QALYs\ gained = \sum_{i=1}^4 N_i \left[Q_i^* \frac{(1-e^{-rl_i^*})}{r} - Q_i \frac{(1-e^{-rl_i})}{r} \right]$$





For the case of AT, in which there is no change in life expectancy post-intervention, the equation reduces to:

$$QALYs\ gained = \sum_{i=1}^4 N_i \left[(Q_i^* - Q_i) * \frac{(1-e^{-rl_i})}{r} \right]$$

where N = # users, Q = QALY weight,
l = residual life expectancy, r = discount rate, i = AT product, * = post-intervention

This approach yields a final estimated gain of 1.3 billion QALYs. Table 6 below breaks down the change in QALYs by age group and product.

Table 6: Breakdown of modelled health benefits

	 HEARING AIDS		 PROSTHESES		 EYEGLASSES		 WHEELCHAIRS	
	CHILDREN	ADULTS	CHILDREN	ADULTS	CHILDREN	ADULTS	CHILDREN	ADULTS
Total QALYs	~3 million	~20 million	~40 million	~170 million	~40 million	~950 million	~30 million	~90 million
Total QALYs across products	~1.3 billion							
Cohort size	4 million	50 million	5 million	30 million	20 million	830 million	10 million	50 million
Avg. QALYs / user	~0.6	~0.4	~8.9	~5.2	~1.8	~1.1	~2.7	~1.8
Avg. QALYs / user across products	~1.3							

COSTS

As described above, the costing analysis consists of two components: initial investments critical to ensuring that systems are fully supportive and structured to effectively deliver appropriate AT and the user-incurred costs of accessing and receiving assistance.

Estimating the fixed investment costs to strengthen AT delivery systems is important in order to capture the full and realistic requirements for sustainable AT delivery. However, cost estimates for these activities (which may include policy change, advocacy, public awareness raising, and stigma reduction) are subject to significant uncertainty as needs may be highly country-dependent and / or vary with regard to cost and efficacy (e.g. stigma reduction, demand

generation, etc.). Meanwhile, these costs are likely very small relative to those for ongoing service delivery. Therefore, the model takes a single line-item estimate for the total cost of activities to strengthen systems for AT delivery. We fixed this value at USD 10 billion—a conservatively high estimate of the total required costs for most core activities.

The user-incurred costs begin with one-off case-finding activities.

These costs are based on benchmark estimates from comparable health interventions, scaled to the prevalence of unmet need for each AT product.^{85,86} These benchmarks considered health worker wages, transportation, field training, and screening and diagnostic tests.

Users then experience additional recurring costs over the rest of their lifetimes. Across the support provision pathway, individuals typically require appointments for initial referral to a specialist, detailed assessment, AT fitting and training, and subsequent regular follow-up and servicing.⁸⁷ Meanwhile, equipment needs typically include the device itself and ongoing replacement parts (depending upon equipment type and usage patterns). To estimate procurement costs, the model uses estimated LMIC market prices for each product.⁸⁸ To approximate the cost of delivery, fitting, and training we used WHO estimates of outpatient costs for primary-level hospitals in selected LMICs.⁸⁹ Given the lack of data on AT-specific delivery channels, this estimation aimed to reflect the cost of health worker time and any tests necessary to accurately diagnose and prescribe appropriate AT to individuals who need it. These costs, as well as servicing and maintenance, recur over the lifetime of the equipment, starting at an estimated 'midpoint age' of receiving AT.⁹⁰

The model addresses the recurrent costs for adult and child users separately. The model weights total unmet need between adult and child populations, and accounts for the difference in lifetime needs between the two groups. It then sums across the two cases to find the total cost of meeting today's unmet need.





Combining these elements, the model follows this formula:

$$\begin{aligned}
 &\text{Cost per individuals} = \\
 &\text{One-time costs} \longrightarrow (\text{case finding}) + (\text{diagnosis}) + \\
 &\text{Recurrent costs} \longrightarrow \left[[(\text{procurement}) + (\text{fitting \& training}) + (\text{total servicing})] * \left(\frac{\text{user life expectancy}}{\text{product lifetime}} \right) \right] \\
 &\text{\# of repetitions} \longrightarrow \uparrow
 \end{aligned}$$

The model does not account for other potential secondary costs of accessing AT. These may include potential time missed from work for health appointments, travel to and from the health centre, and more. However, these costs are expected to be small relative to the others described above, and data estimating these costs are limited. Therefore, secondary costs have not been included in the analysis.

The formula yields an estimated total required investment of approximately USD 730 billion over the cohort's lifetime. Table 7 below breaks down these costs.

Table 7: Breakdown of modelled cost⁹¹

	 HEARING AIDS		 PROSTHESES		 EYEGLASSES		 WHEELCHAIRS	
	CHILDREN	ADULTS	CHILDREN	ADULTS	CHILDREN	ADULTS	CHILDREN	ADULTS
	Lifetime cost per person (USD)	~7,200	~2,400	~14,300	~5,200	~1,200	~100	~5,300
Cohort size	4 million	50 million	5 million	30 million	20 million	830 million	10 million	50 million
Total user costs (USD)	~30 billion	~130 billion	~70 billion	~170 billion	~30 billion	~130 billion	~50 billion	~120 billion
System strengthening costs	~USD 10 billion							
Total costs across products and system strengthening	~USD 730 billion							

ROI

We estimated the final ROI using the following equation:

$$\text{ROI} = \frac{(\text{economic benefits} - \text{costs})}{\text{costs}}$$

This includes a summation of the economic benefits across all three drivers. It excludes the health and social benefits also described above, meaning the true ROI (including both financial and nonfinancial benefits) could be even higher than the value estimated here implies. The dollar values of both the benefit and cost components are also discounted according to their net present value⁹² with a discount rate of 5% over the AT users' remaining lifetimes (55 years from start). Given total discounted costs of USD 400 billion, yielding total discounted benefits of USD 4.1 trillion, the model gives a final ROI of approximately 9:1.

SENSITIVITY ANALYSIS

Following completion of the modelling as described above, we conducted a sensitivity analysis to understand the impact of variation in key input parameters on the final ROI output value (using ROI as a composite measure of multiple other intermediate outputs in the model).

We conducted a basic one-at-a-time sensitivity analysis on a set of 18 key parameters, covering components of cohort sizing, costing, benefit accrual, and others. We independently varied each parameter to upper and lower bounds and recorded the impact on the output ROI value. To normalise the findings across parameters, we measured results as the ratio of the percentage-change in ROI over the percentage-change in the parameter value. The formula for this calculation was as follows:

$$\text{Sensitivity} = \frac{(dR / R)}{(dP / P)}$$

where R = baseline ROI value, dR = change in ROI, P = baseline parameter value, dP = change in parameter value

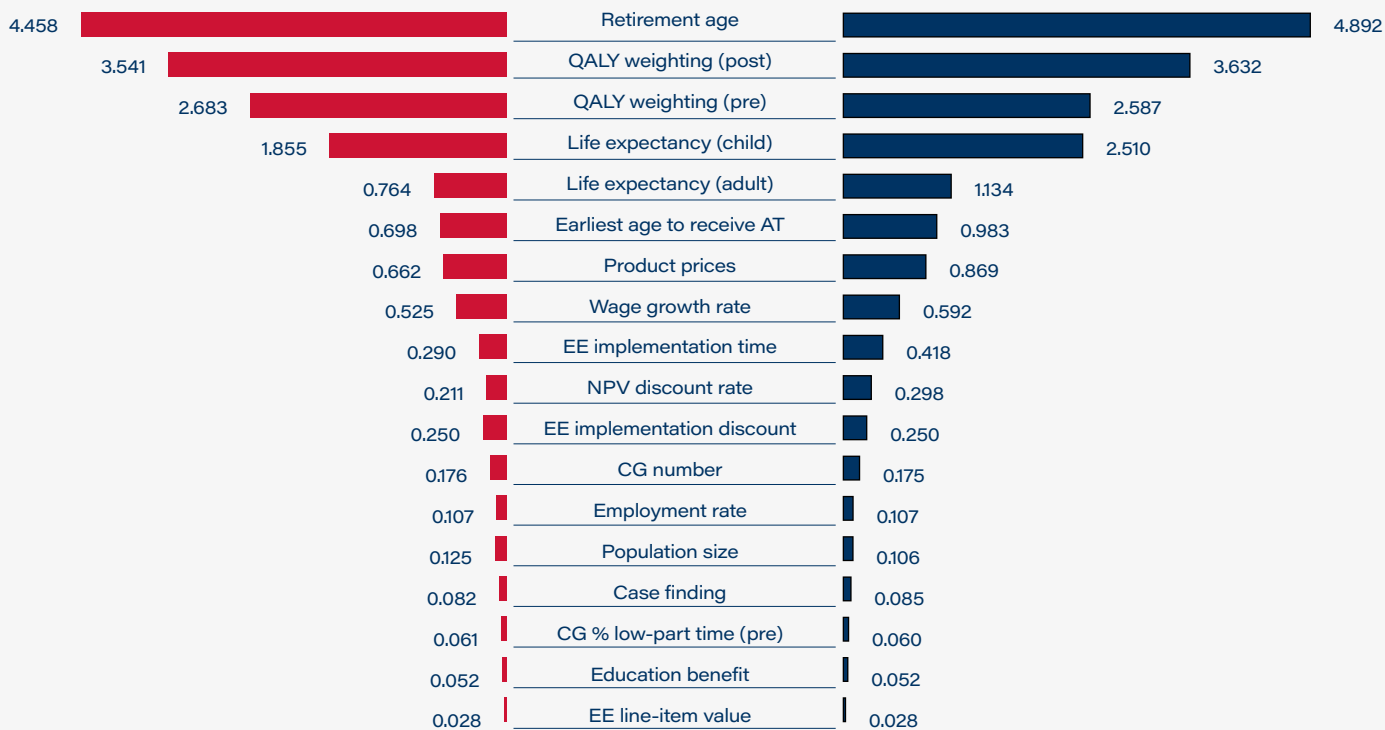
The analysis showed that four variables have significant impact on the ROI outcome: retirement age of AT users, the pre- and post-intervention QALY weighting values, and life expectancy at birth for users that receive AT during childhood. For example, a one-percent change in retirement age leads to a nearly-five-percent shift in the overall ROI. This affirms that the model outputs are most strongly determined by the total time over which users accrue benefits (with each additional year of work and life contributing heavily to total economic gains, and outweighing the additional cost of maintaining the AT over that time) and the degree of benefit derived from receiving AT (with greater QALY differentials leading to greater impact in school and in the workplace).

Figure 6 below shows the percentage change in the economic output figure per one-percent change in the input parameter.

Figure 6: Sensitivity analysis findings

Sensitivity of ROI output based on input parameter variation

Ratio of percent-change in ROI to percent-change in input parameter value



EE – Enabling Ecosystem, NPV - Net present value, CG - caregiver

ANNEX B

Acronyms

ABBREVIATION	DEFINITION
ASCENT	Amputee Screening via Cellphone Networking
AT	Assistive Technology
CDC	United States Centers for Disease Control and Prevention
CRPD	United Nations Convention on the Rights of Persons with Disabilities
GDP	Gross domestic product
HI	Humanity and Inclusion
LMIC	Low- and middle-income country
NGO	Non-governmental organisation
PhilHealth	Philippine Health Insurance Corporation
PHP	Philippine peso
QALY	Quality-adjusted life year
ROI	Return on investment
SDG	Sustainable Development Goals
UHC	Universal health coverage
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICEF	United Nations Children's Fund
USD	United States Dollar
WHA	World Health Assembly
WHO	World Health Organization

REFERENCES

1. All AT users, with emphasis on two of the larger populations comprising this group: persons with disabilities and older AT users
2. This is estimated in terms of quality-adjusted life years (QALYs)—a measure of an individual's ability to conduct day-to-day activities free of pain and mental distress, incorporating such factors as mobility restrictions, ability to independently self-care, and engagement with work and leisure.
3. World Health Organization. Assistive technology. Available from: <https://www.who.int/news-room/fact-sheets/detail/assistive-technology> [Accessed 29th October 2019].
4. Rohwerder B. Assistive technologies in developing countries. Institute of Development Studies, 2018.
5. Humphreys G. Technology transfer aids hearing. Bulletin of the World Health Organization. 2013;91(7): 471-472. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3699802/> [Accessed 12th January 2020].
6. AT2030 and ATscale. *Increasing access to wheelchairs and related services in low and middle income countries*, 2019. <https://atscale2030.org/>
7. UN General Assembly, Convention on the Rights of Persons with Disabilities. 2007. Available from: <https://www.un.org/disabilities/documents/convention/convoptprot-e.pdf> [Accessed 10th January 2020].
8. This report draws on existing literature to estimate the unmet need for AT and its potential impact on users lives. This literature has to date been heavily focused on people with disabilities; these limitations are noted where relevant, though the insights from such studies are also applied to model and predict the impact of AT on other types of users.
9. This estimate is based on pre-COVID19 data and projections of LMIC GDP growth. We do not expect COVID19-related disruptions to have a significant effect on the aggregate outcomes given the 55-year timeframe.
10. Note that value may not equal sum of components due to rounding
11. Banks LM, Polack S. *The economic costs of exclusion and gains of inclusion of people with disabilities*. International Centre for Evidence in Disability, 2014.
12. This global estimate is in real dollars and accounts for projected inflation over the lifetime of a child today. We also assume that education is otherwise available to those receiving AT, and that there exists a broader array of employment opportunities for users in adulthood (with the benefit of AT).
13. Filmer D. Disability, poverty, and schooling in developing countries: Results from 14 household surveys. The World Bank Economic Review, 2008;22(1): 141-63. Available from: <http://documents.worldbank.org/curated/en/279081468333856724/pdf/775610JRN02008000PUBLIC00Disability.pdf> [Accessed 10th January 2020].
14. Greenstone M, Looney A. Education is the key to better jobs. Available from: <https://www.brookings.edu/blog/up-front/2012/09/17/education-is-the-key-to-better-jobs/>. [Accessed 14th February 2020]; Dalberg analysis.
15. UNICEF. *Do children with disabilities attend school?* New findings from Sierra Leone. Available from: <https://blogs.unicef.org/evidence-for-action/children-disabilities-attend-school-new-findings-sierra-leone/> [Accessed 15th January 2020].
16. Saleem S, Sajjad S. The scope of assistive technology in learning process of students with blindness. International Journal of Special Education. 2016;31(1): 46-54. Available from: <https://files.eric.ed.gov/fulltext/EJ1099969.pdf> [Accessed 14th February 2020].
17. UNESCO. Disabilities and education. Available from: <http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/pdf/Facts-Figures-gmr.pdf>
18. World Health Organization. *World Report on Disability*, 2011.
19. United Nations. Disability and Development Report: *Realizing the sustainable development goals by, for and with persons with disabilities*, 2018.
20. Reddy, PA, Congdon, N, Mackenzie, G, Gogate, P, Wen, Q, Jan, C, Clarke, M, Kassalow, J, Gudwin, E, O'Neill, C, Jin, L, Tang, J, Bassett, K, Cherwek, DH and Ali, R. Effect of providing near glasses on productivity among rural Indian tea workers with presbyopia (PROSPER): a randomised trial. Lancet Glob Health. 2018;6(9):e1019-e1027.
21. Handicap International. *Situation of wage employment of people with disabilities*, 2016.
22. WHO defines 'catastrophic expenditure' as 'out-of-pocket spending for health care that exceeds a certain proportion of a household's income with the consequence that households suffer the burden of disease.' While thresholds for catastrophic spending vary, WHO has proposed that 'health expenditure be viewed as catastrophic whenever it is greater than or equal to 40% of a household's non-subsistence income, i.e., income available after basic needs have been met.

23. Mont D, Cuong NV. *Disability and poverty in Vietnam*. The World Bank Economic Review, 2011;25(2): 323-59. Available from: <http://documents.worldbank.org/curated/en/793841468320699746/pdf/812700JRN0WBEC00Box379814B00PUBLIC0.pdf> [Accessed 16th February 2020].
24. UNESCO. Better Life, Better Future Campaign.
25. UNICEF. Gender and Education. Available from: <https://data.unicef.org/topic/gender/gender-disparities-in-education/> [Accessed 31st March 2020].
26. UN Women. *Progress of the world's women 2015-2016: Transforming economies, realizing rights*, 2015.
27. Dalberg analysis; Estimated using the average unpaid work hours per day across girls and adult women compared to boys and adult men multiplied by the average life expectancy for men and women globally. Data on girls and boys time use from [UNICEF](#); data on adult time use from [UN Women](#).
28. QALYs are the accepted standard for measuring the impact of interventions on an individual's life in cases where the intervention does not change their underlying physical condition.
29. Meinzen-Dick R. *Empowering Africa's Women Farmers*. Available from: <https://www.project-syndicate.org/commentary/women-farmers-africa-gender-equality-agriculture-by-ruth-meinzen-dick-2019-10?barrier=accesspaylog> [Accessed 31st March 2020].
30. The World Bank. *Levelling the Field: Improving opportunities for women farmers in Africa*, 2011.
31. UNICEF. *Assistive technology for children with disabilities: Creating opportunities for education, inclusion and participation*, 2015.
32. The concept of gaining additional QALYs does not suggest that these individuals will necessarily live longer, but rather it captures improvements in their quality of life due to the ability to move, hear, and see better than before.
33. Users may still be forced to contend with inaccessible medical equipment, health professionals who do not fully understand their needs, and low-quality treatment services.
34. US Centers for Disease Control and Prevention. *Disability and health related conditions*. Available from: <https://www.cdc.gov/ncbddd/disabilityandhealth/relatedconditions.html> [Accessed 12th January 2020].
35. Mahmoudi E, Basu T, Langa K, McKee MM, Zazove P, Alexander N, et al. Can hearing aids delay time to diagnosis of dementia, depression, or falls in older adults? *Journal of the American Geriatrics Society*. 2019;67(11): 2632-9. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/jgs.16109> [Accessed 22nd March 2020].
36. Lin F, Ferrucci L. Hearing loss and falls among older adults in the United States. *Archives of internal medicine*. 2012;172(4): 369-71. Available from: <https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/1108740> [Accessed 22nd March 2020].
37. Rumalla K, Karim AM, Hullar TE. *The effect of hearing aids on postural stability*. *The Laryngoscope*. 2015;125(3): 720-3. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1002/lary.24974> [Accessed 22nd March 2020].
38. Noh JW, Kwon YD, Park J, Oh IH, Kim J. *Relationship between physical disability and depression by gender: A panel regression model*. *PLoS One*. 2016;11(11). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5130183/> [Accessed 12th December 2019].
39. A study in Nigeria found that 'elderly people with hearing loss have higher rates of depression, reducing their interest in daily activities, with 62% reporting depression symptoms as opposed to 17% for those without hearing loss.' (Sogebi OA et al. 2015.)
40. Gilson KM, Davis E, Johnson S, Gains J, Reddihough D, Williams K, et al. *Mental health care needs and preferences for mothers of children with a disability*. 2018;44(3): 384-91. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/cch.12556> [Accessed 8th March 2020].
41. World Health Organization. *Building the economic case for primary health care: a scoping review*, 2018.
42. World Health Organization. *Universal health coverage*. Available from: [https://www.who.int/news-room/fact-sheets/detail/universal-health-coverage-\(uhc\)](https://www.who.int/news-room/fact-sheets/detail/universal-health-coverage-(uhc)) [Accessed 14th January 2020].
43. World Economic Forum. *Eyeglasses for global development: Bridging the Visual Divide*, 2016.
44. Alquraini T, Gut D. Critical components of successful inclusion of students with severe disabilities: Literature review. *International Journal of Special Education*. 2012;27(1): 42-59. Available from: <https://files.eric.ed.gov/fulltext/EJ979712.pdf> [Accessed 14th February 2020].
45. LEGO. *Play well report*, 2018.
46. World Economic Forum. *The business case for diversity in the workplace is now overwhelming*. Available from: <https://www.weforum.org/agenda/2019/04/business-case-for-diversity-in-the-workplace/> [Accessed 8th March 2020].

47. Deloitte. *The economic benefits of improving social inclusion*, 2019.
48. This estimate includes an adjustment for the 'net present value' of all costs and benefits, discounting those that accrue over time. The discounted value of all economic benefits comes to USD 4.1 trillion, while discounted costs total USD 400 billion.
49. World Health Organization. *Saving lives, spending less: A strategic response to noncommunicable diseases*, 2018.
50. Global Partnership for Education. *Fund education, shape the future: Case for investment*, 2017.
51. This may be in the form of AT inclusion in disability policy, AT-specific policy (including but not limited to users with disability), and/or the mainstreaming of AT into other national health policies.
52. Ingber J. Vision for a nation provides access to eyeglasses for Rwandans. Available from: <https://www.afb.org/aw/14/5/15692> [Accessed 9th December 2019].
53. Binagwaho A, Scott K, Rosewall T, Mackenzie G, Rehnberg G, Hannema S, et al. Lessons from the field: Improving Eye Care in Rwanda. *Bulletin of the World Health Organization*. 2015;93: 429-34. Available from: <https://www.who.int/bulletin/volumes/93/6/14-143149/en/> [Accessed 9th December 2019].
54. Bowman V. Rwanda becomes first poor country to provide eye care for all. Available from: <https://www.theguardian.com/global-development/2018/jan/31/rwanda-becomes-rst-poor-country-to-provide-eye-care-for-all> [Accessed 9th December 2019].
55. The Economist Intelligence Unit. *Moving from the margins: Mainstreaming persons with disabilities in Pakistan*, 2014.
56. World Health Organization Pakistan Country Office. Personal Communication. 28th January 2020.
57. World Health Organization. *Pakistan hosts groundbreaking meeting to improve access to assistive technology*. Available from: <http://www.emro.who.int/pak/pakistan-news/pakistan-hosts-groundbreaking-meeting-to-improve-access-to-assistive-technology.html> [Accessed 24th January 2020].
58. World Health Organization. *Pakistani Doctor Sana Hafeez Named WHO Global Champion for Assistive Technology*. Available from: <http://www.emro.who.int/pak/pakistan-news/pakistani-doctor-sana-hafeez-named-who-global-champion-for-assistive-technology.html> [Accessed 24th January 2020].
59. Government of Pakistan. *Ehsaas Programme, Prime Minister's policy statement*. Available from: <http://www.pakistan.gov.pk/ehsaas-program.html> [Accessed 24th January 2020].
60. UNICEF. *No Child Left Behind: Study Calls for Better Care of Children with Disabilities*. Available from: <https://www.unicef.org/philippines/press-releases/no-child-left-behind-study-calls-better-care-children-disabilities> [Accessed 8th January 2020].
61. Jaucian D. *Breaking the Stigma on Filipino Children with Disabilities*. Available from: <https://cnnphilippines.com/life/culture/2017/03/03/lotta-sylwander-interview-unicef.html> [Accessed 8th January 2020].
62. Valmero. *Mobile app helps Filipino amputees in remote areas*. Available from: http://www.science.ph/full_story.php?type=News&key=5553:mobile-app-helps-filipino-amputees-in-remote-areas [Accessed 8th January 2020].
63. Professor J. Bundoc, Personal Communication. 10th March 2020.
64. PhilHealth. *President PNoy leads launch of PhilHealth's prosthesis benefit package and new provider payment mechanism*. Available at: https://www.philhealth.gov.ph/news/2013/prosthesis_benefit.html [Accessed 8th January 2020].
65. AT2030 and ATscale. *A market landscape and strategic approach to increasing access to prosthetic and related services in low and middle income countries*, 2020. <https://atscale2030.org/>
66. PhilHealth. *Improving Access to Assistive Technology and Rehabilitation for Children with Disabilities (CWD)*. Available from: https://www.philhealth.gov.ph/news/2016/assistive_tech.html [Accessed 8th January 2020].
67. Castillo. *Guide to PhilHealth's Z Benefit Packages for kids with disabilities*. Available from: <https://www.smartparenting.com.ph/parenting/kids-with-special-needs/philhealth-benefit-package-children-special-needs-disabilities-a00026-20180305> [Accessed 8th January 2020].
68. PhilHealth. *PhilHealth to Introduce Special Benefits for PWDs*. Available from: https://www.philhealth.gov.ph/news/2019/pwd_bnfts.php [Accessed 8th January 2020].
69. Special Rapporteur on the Rights of Persons with Disabilities. *Report of the Special Rapporteur on the rights of persons with disabilities* (theme: older persons with disabilities), 2019.
70. Note that residual life expectancy is based on an average across those without access to AT today. Among children in need, we assigned average ages of receiving AT by product; we estimated residual life expectancy as the difference between average life expectancy at birth across LMICs and these average ages (by product) of receiving AT.

71. We did not include ATscale's fifth priority product—assistive digital devices and software—because the range of products in this category is much broader and ATscale's scope of work in this area is not yet defined.
72. This is a conservative assumption on the costing side of the model; ATscale aims to facilitate long-term price reductions through its market shaping work, significantly reducing the costs of delivering products in LMICs and thus further improving the cost-effectiveness of future investments in this space.
73. based on estimates in the Product Narratives developed by AT2030 and ATscale (atscale2030.org/product-narratives)
74. Buckup S. The price of exclusion: The economic consequences of excluding people with disabilities from the world of work. International Labour Organisation. 2009. Available at: ilo.org/employment/Whatwedo/Publications/working-papers/WCMS_119305/lang-en/index.htm [Accessed 24th October 2019]; adapted by Dalberg for this analysis.
75. This assumes i) average employment statistics can be applied to estimate LMIC-wide shifts, and ii) working life spans from the ages of 18 to 64.
76. Although this increase in educational performance drives increased earnings while employed, the model does not explicitly account for additional changes to likelihood of employment beyond that shown in the employment and productivity formula above.
77. The allocation to pre-intervention categories assumed that the supporters of any AT user currently working or seeking work would not be providing full-time care. Among those working part time, we determined the allocation to the 'high' and 'low' categories by the users' workforce participation rate weighted by their pre-intervention QALY score. For the post-intervention distribution, the model also assumed that no support provider performed less paid work than before the intervention.
78. Note that value may not equal sum of components due to rounding.
79. While AT does not itself change a user's physical condition, some AT does contribute to subsequent changes in physical health, e.g., prostheses improving ability to exercise, wheelchairs reducing risk of some secondary conditions, etc. QALY metrics capture these impacts.
80. Davies A, Souza LD, Frank AO. *Changes in the quality of life in severely disabled people following provision of powered indoor / outdoor chairs. Disability and Rehabilitation.* 2003;25(6): 286-90. Available from: <https://bura.brunel.ac.uk/bitstream/2438/3367/1/epioc%202002.pdf> [Accessed 11th November 2019].
81. Persson J, Husberg M. *Can we rely on QALYs for assistive technologies? Technology and Disability.* 2012;24(1): 93-100. Available from: https://www.researchgate.net/publication/235641799_Can_we_rely_on_QALYs_for_assistive_technologies [Accessed 17th November 2019].
82. 59. Park Y, Shin JA, Yang SW, Yim YW, Kim HS, Park YH. *The relationship between visual impairment and health-related quality of life in Korean adults: The Korea National Health and Nutrition Examination Survey (2008-2012).* PLoS One. 2015;10(7). Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0132779> [Accessed 11th November 2019].
83. Pennington M, Grieve R, van der c JH. *Cost-effectiveness of five Commonly used prosthesis brands for total knee replacement in the UK: A study using the NJR Dataset.* PLoS One. 2016;11(3). Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0150074> [Accessed 12th November 2019].
84. Sassi F. *Calculating QALYs, comparing QALY and DALY calculations. Health Policy and Planning.* Available from: <https://www.ncbi.nlm.nih.gov/pubmed/16877455> [Accessed 24th October 2019].
85. Karki B, Kittel G, Bolokon Jr I, Duke T. *Active community-based case finding for tuberculosis with limited resources: estimating prevalence in a remote area of Papua New Guinea.* Asia Pacific Journal of Public Health. 2017;29(1): 17-27. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5349312/> [Accessed 24th January 2020].
86. Sekandi JN, Dobbin K, Oloya J, Okwera A, Whallen CC, Corso PS. *Cost-effectiveness analysis of community active case finding and household contact investigation for tuberculosis case detection in urban Africa.* PLoS One. 2015;10(2). Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25658592> [Accessed 24th January 2020].
87. World Health Organization. *Guidelines on the provision of manual wheelchairs in less resourced settings*, 2008.
88. AT2030 and ATscale. *Product Narratives*, 2019-2020. <https://atscale2030.org/>
89. Data from WHO-CHOICE Project, 2011.
90. Shepard DS. *The market for wheelchairs, innovations, and federal policy. Congress of the US, Office of Technology Assessment.* Available from: <https://www.princeton.edu/~ota/disk3/1984/8418/841808.PDF> [Accessed 24th January 2020].
91. Note that totals may not equal the sum of the components due to rounding.
92. Net present value (NPV) is a method of comparing the values of invested resources and results over time in constant (current) terms in order to determine the overall net return on investment.





ACKNOWLEDGEMENTS

We wish to thank the working group of ATscale Founding Partners who supported its development – Michael Allen (USAID), Sara Boiten (DFID), Amy Farkas Karageorgos (International Disability Alliance), Phyllis Heydt (Office of the WHO Ambassador for Global Strategy), Victoria James (DFID), Dennis Soendergaard (UNICEF) and Nikki Tyler (USAID) – as well as Alison End Fineberg and Barbara Goedde from the ATscale Secretariat and Erin Barringer, James Eustace, Ian Thornton, and Ayesha Karnik from Dalberg Advisors. We would like to thank Briana Wilson (Inclusion Advisory Group, CBM Global) for contributing a rights perspective within the report writing process.

ATscale acknowledges with deep appreciation the work of Henry Koster (Dalberg Advisors), lead author of this report.

ATscale would like to acknowledge with thanks Dorothy Boggs (London School of Hygiene and Tropical Medicine), Johan Borg (Dalarna University), Arjan Buis (Strathclyde University), Alex Cote (Center for Inclusive Policy), Jeremy A. Lauer (Strathclyde University), Andrew Mirelman (World Health Organization), Daniel Mont (Center for Inclusive Policy), Priya Morjaria (London School of Hygiene and Tropical Medicine; Peek Vision Ltd.), Stefan Tromel (International Labour Organisation), who provided their technical expertise and valued feedback.

Several colleagues graciously supplied material for the country case studies and spotlights. They are: Dr. Josephine Bundoc (UERM Medical Center, The Philippines), Dr. Francesca Celletti (WHO, The Philippines), Tanya D'Souza (SoundSeekers), Dr. Maryam Mallick (WHO Pakistan), Valentina Pomatto (Humanity & Inclusion), Anna Reeve (Motivation), Dr. Florante Trinidad (WHO, The Philippines), and Isabelle Urseau (Humanity & Inclusion).

ATscale would like to recognise with gratitude the generous funding received from the United States International Agency for Development (USAID). The views and opinions expressed within this report are those of the authors and do not necessarily reflect the official policies or position of partners /contributing organisations or funders.

Accessible versions of this report are available on the ATscale website (atscale2030.org).

This report may be freely reproduced, in whole or in part, provided the original source is acknowledged.



ATSCALE2030.ORG