

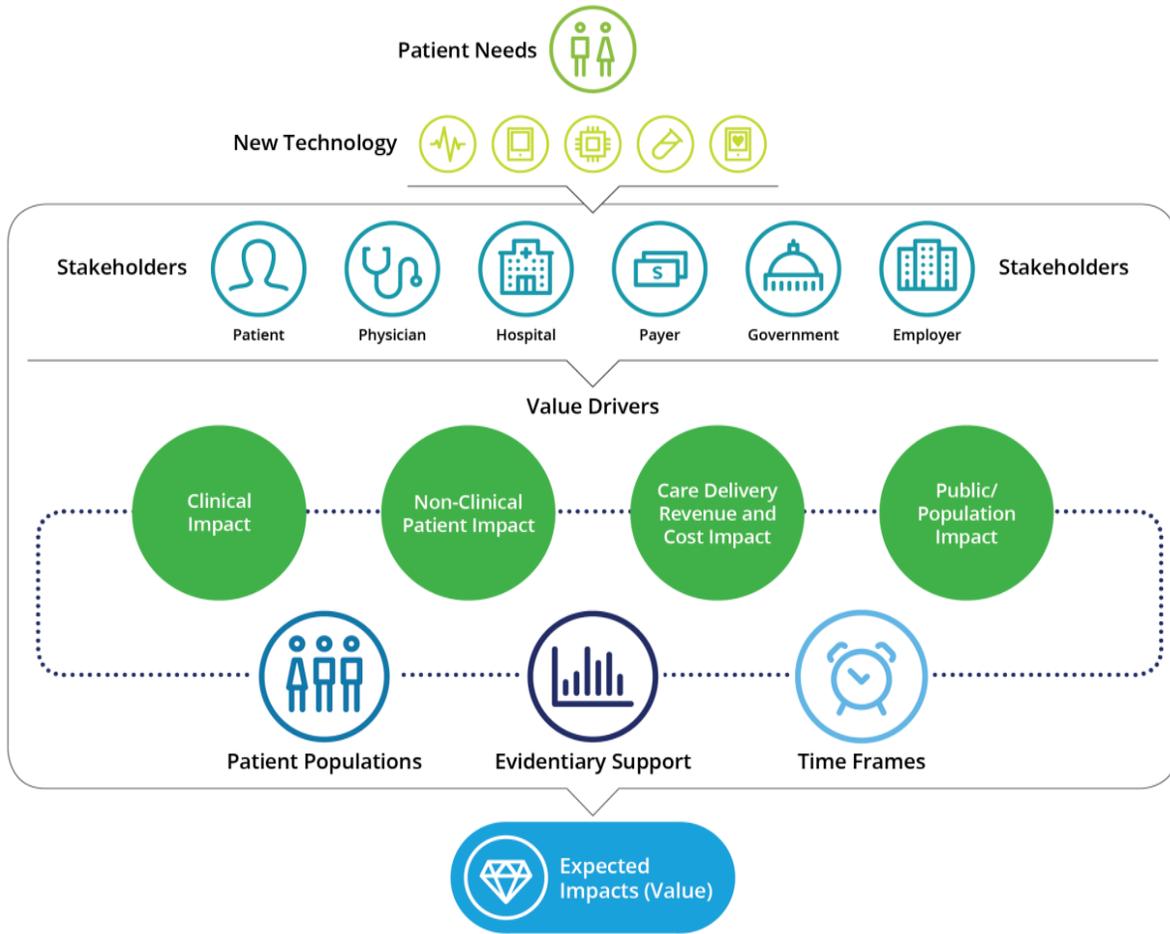
Value Framework Overview

In response to the growing need to demonstrate how medical technologies fit into the emerging value-based paradigm for providers, payers, and patients, AdvaMed launched a Strategic Value Initiative to develop an approach to value assessment for medical technologies that can be used by medical technology companies as well as by health systems, payers, and other stakeholders.¹

AdvaMed's Value Assessment goes beyond traditional health-economics-outcomes research and clinical-efficacy metrics to assess the value that medical technologies may contribute to improving patient care and experience, economic outcomes, and the overall health of populations. This approach uses four broad "value drivers" to describe the value of medical technologies: (1) clinical impact; (2) nonclinical patient impact; (3) care delivery revenue and cost impact; and (4) public/population impact relevant to stakeholders who may evaluate and measure value differently.

The AdvaMed Value Assessment guides the development of a value proposition that communicates the breadth of expected impacts offered by medical technologies while accounting for the demands of the changing healthcare ecosystem. The collection of information associated with the value drivers reflects quantitative and qualitative metrics and gives and accounts for the consideration of evidence collected through various methods. An illustration highlighting the value drivers and components of AdvaMed's approach is on the following page.

To demonstrate the application of this framework across different technology types, AdvaMed has partnered with member companies to develop use cases. These use cases address the clinical need for the technology, alternative and existing technologies on the market, the expected impacts of the technology, and the evidence to support the value assessment.



Source: "A Framework for Comprehensive Assessment of Medical Technologies: Defining Value in the New Health Care Ecosystem", co-developed with Deloitte Consulting LLP



Use Case Highlights: Myopia

- **Uncorrected myopia is the leading cause of distance vision impairment globally.**
- **Myopia is predicted to impact half the world’s population by 2050.² Treatment of myopia principally involves eye glasses, contact lenses, and refractive surgery. Myopia has no known cures.**
- **Many medical devices used for treatment address the refractive error of myopia.**
- **Elongation of the eye as myopia progresses is associated with ocular diseases that can threaten vision (e.g., retinal detachment and macular degeneration).**
- **More research is needed into ways to control the progression of myopia.**

Summary

Myopia is the leading cause of impaired distance vision and it is predicted to impact half of the world population by 2050. As myopia progresses during childhood and adolescence, the eyeball elongates. This elongation predisposes the eye to visually-threatening eye diseases such as retinal detachment, glaucoma and macular degeneration. There is no degree of myopia that is totally safe from complications. As the world population ages and these complications become more widespread, the public health burden will grow. Consequently, more research and development regarding this condition is needed to control the progression of myopia. Eyeglasses, contact lenses, and refractive surgery are medical responses that correct the refractive error of myopia to improve distance vision.

Use Case

AdvaMed's Value Framework uses "value drivers" to assist device developers in determining the value of their products to healthcare stakeholders including clinicians, patients, payers, and others. Information from the framework is critical in determining the value that a product may bring to its intended audience. It likewise identifies evidence gaps and determines what additional evidence development to pursue.

AdvaMed's Ophthalmic Sector is evaluating the value of devices used in the management, including correction and control, of myopia. Myopia is a common reason for impaired vision. It is caused by uncorrected refractive error that can lead to distance vision impairment low enough to be classified as refractive blindness. High Myopia is associated with the development of conditions that can lead to severe or complete vision loss including cataract, glaucoma, retinal detachment, and myopic macular degeneration.³⁻⁵ With increasing prevalence worldwide, myopia is likely to become a leading cause of permanent sight-loss.⁵⁻⁹

Myopia affects stakeholders including patients who face adverse health consequences; clinicians who seek treatments to control disease progression; payers who bear the cost of treatment; and caregivers who live with persons suffering from irreversible vision impairment.¹⁰ In fact, the annual cost of treating uncorrected distance refractive error, a large percentage of which is caused by myopia, is estimated at \$202 billion per year globally.¹¹ In the United States, the current estimated cost of myopia care and loss of productivity is US \$88 billion, making it the 11th most costly health condition, ahead of congestive heart failure, lung cancer, breast cancer, and colorectal cancer, and 8th in terms of direct costs.^{12,13} The cost is projected to rise to \$222 billion in the United States and \$1.2 trillion globally by 2050.¹²

With proper management, myopia treatment can result in improved clinical and societal outcomes such as improved visual function, quality of life, comfort, improved driver safety, and improved economic productivity.¹⁴

This use case will look at the value of treating myopia with the technologies frequently used to correct it: eyeglasses, contact lenses, and refractive surgery. While myopia is common, the technologies to correct it vary in their suitability. This use case will discuss utilization of these technologies in managing myopia, including correction of myopic refractive error and controlling the progression of myopia across patient populations.

Medical Technologies for Myopia Correction

People with myopia are able to see near objects clearly but experience blurred vision at a distance. Myopia is the most common type of refractive error, which occurs when rays of light entering the eye focus anterior to the retina, resulting in blurred vision.¹⁵

Myopia is a common and serious eye condition that affects more than 2 billion people worldwide.² The prevalence of myopia is increasing and it is projected to affect 5 billion people by 2050, meaning that almost half of the world's projected population will need medical intervention.^{2,15}

Though not commonly considered a public health threat, eye elongation in myopia cases can lead to retinal degeneration or detachment, cataract, glaucoma, or other serious conditions that may lead to complete vision loss.¹⁶⁻¹⁹ The risk of developing irreversible vision complications (such as myopic macular degeneration) increases exponentially with increased levels of myopia.¹⁰ Untreated high myopia severely reduces quality of life and productivity **and** may lead to complications that require additional treatment and increased healthcare costs.^{2,20}

The three commonly-used medical technologies that correct the refractive error of myopia follow. This use case does not review the benefit-risk profiles of these technologies.

Eyeglasses: Eyeglasses are the simplest method to correct myopia. They can be worn to correct myopia at any age. A patient's refractive correction can be evaluated, and new eyeglasses produced whenever changes occur or new visual symptoms develop. Eyeglasses are minimally invasive and easily tolerated by most patients with myopia.

Eyeglasses require minimal care and carry no risk of ocular infection. Further, materials such as polycarbonate plastic provide vision correction without the potential risk of eye injury from shattering glass.

Contact Lenses: Contact lenses work by acting as the initial refractive surface of the eye. The most commonly-used contact lens types are soft hydrogel, silicone hydrogel, and rigid gas permeable lenses. Newer materials increase oxygen transmissibility which can reduce the risk of some ocular complications.

Contact lenses allow for a wider field of vision, greater comfort and, in some cases, better vision correction than eyeglasses. They are also essentially "invisible" and provide vision correction without affecting a patient's cosmetic appearance and are ideal for those with occupational reasons to not wear eyeglasses.

Contact lenses are typically indicated for daytime use with removal and cleaning every night. Some lenses are approved for overnight wear.

***Orthokeratology:** Rigid, gas-permeable contact lenses can also be prescribed for use during sleep to temporarily reshape the cornea, reversing myopia during the day when the lens is not worn. Lenses must be worn every one-to-two nights to be effective.*

Refractive Surgery: Myopia may be corrected through surgical procedures that, in some cases, alter the refractive surface of the eye.

Laser-assisted technologies can be used to reshape the cornea. Lens-based refractive surgery involves the implantation of refractive lenses. Both technologies offer vision correction.

Laser-assisted refractive surgery may suit patients – without other medical or eye contraindications – who want improved vision with a reduced need for eyeglasses or contact lenses. It is best-suited for patients with steady mild-to-moderate refractive error that is not changing (a state that is typical in adulthood). The risks and benefits of refractive surgery should be discussed between the patient and a licensed healthcare provider.

Laser-assisted in-situ keratomileusis (LASIK): LASIK permanently changes the shape of the cornea using a mechanical blade device or laser to cut a flap in the cornea to expose the stroma (the middle layer of the cornea). An excimer laser is used to reshape the stroma to correct the patient's refractive error. The corneal flap is then replaced and allowed to heal.

Small Incision Lenticule Extraction (SMILE): Similar to LASIK, SMILE changes the shape of the cornea by removing intrastromal corneal tissue without cutting a flap. The SMILE procedure utilizes a single femtosecond laser referenced to the corneal surface to cleave a thin lenticule from the corneal stroma for manual extraction. The lenticule to be extracted is accurately cut to the correction prescription required by the patient using a photo disruption laser-tissue interaction. The method of extraction is via a flapless technique making a small tunnel incision in the corneal periphery.

Photorefractive keratectomy (PRK): PRK differs from LASIK in that no flap is created. Instead, the epithelium (outer layer of the cornea) is removed before an excimer laser reshapes the cornea. The epithelium then regenerates over the corneal surface. PRK has longer recovery times, but it is better-suited to some patients with thinner corneas because, unlike LASIK, it does not cut into the cornea to create a flap.

Laser-assisted subepithelial keratomileusis (LASEK): LASEK is similar to LASIK, but the procedure uses a laser to make a shallower cut into the cornea than LASIK. LASEK typically involves a longer initial recovery period than LASIK, but has less post-operative discomfort. LASEK may be ideal for refractive surgery candidates who are at increased risk of post-operative dry eye.

Lens-based refractive surgery: Lens-based refractive surgery is ideal for patients who do not have other medical or eye conditions and want improved vision with reduced need for eyeglasses or contact lenses. Lens-based refractive surgery is best suited for patients with steady moderate to-high refractive error that is not changing.

Phakic Intraocular Lenses (pIOL): Phakic IOLs are lenses that are implanted without removing the natural crystalline lens or reshaping the cornea. The pIOL is surgically positioned through a small incision either in the anterior chamber, between the cornea and the iris, or in the posterior chamber just behind the iris. Phakic IOLs allow light to focus properly on the retina for clearer, sharper vision without eyeglasses. The phakic IOL focuses light on the back surface of the eye (retina).

LASIK, SMILE, PRK, LASEK, and pIOLs all correct myopic refractive error. Which procedure to choose is based on the patients' consultation with their healthcare provider to assess the benefit-risk ratio.²¹ The risk/benefit of refractive surgery itself should be discussed with a licensed ophthalmic physician.

Although these devices and procedures correct the refractive error of myopia, they do not reduce the risk of developing myopia-related complications due to elongation of the eye.

Development of medical technologies to control myopia progression

Several optical and pharmacological interventions²²⁻⁴⁴ have been investigated for their effectiveness in controlling the progression of myopia. Among optical interventions, orthokeratology,³⁰⁻³⁴ bifocal and multifocal soft contact lenses,^{35-42,47} and spectacle lenses^{43,44,46} have been observed and some approved) to control myopia progression. Recently approved by the US Food and Drug Administration (FDA), daily wear single use Soft Contact Lenses are indicated for the correction of myopic ametropia and for slowing the progression of myopia in children ages 8-12 years-- with non-diseased eyes within a certain refraction and astigmatism diopter range at the initiation of treatment. Among pharmacological treatments, atropine is found to be effective; however, the treatment efficacy and rebound effect is highly dose-dependent. Combined therapies (i.e., orthokeratology and low-concentration atropine) have also been investigated showing early, promising results.



Unmet Need

AdvaMed's assessment process begins with understanding and addressing the unmet need and value imparted through the new technology.

Unmet patient need can be framed in terms of clinical efficacy, safety, patient preferences, costs, quality of care, ease of use, etc.

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Myopia affects a substantial portion of adults and children and it is most prevalent in middle-age adults. In the United States, studies estimate the prevalence of myopia to be 35%-50% in persons aged 20 to 40 years, and 15%-20% in those over the age of 60.⁴⁸⁻⁵¹

Patients' ages, lifestyles, assessments of benefit-risk, and personal preferences create the need for multiple technologies to correct myopia. Eyeglasses, contact lenses, and refractive surgery are distinctly different interventions that achieve the common goal of correcting the refractive error of myopia. Patients may find that different technologies are ideal at different times in the course of their lives.

Myopia associated complications are due to excessive elongation of the eye. As such, correcting myopia by itself (e.g., refractive surgery) does not "treat" or reduce the risk of myopia related complication. Preventing myopia and controlling myopia progression are significant unmet needs. Multiple technologies are being investigated and some new technologies have been approved.



Patient Populations

Assessments should consider the extent to which the populations where the technology is most effective aligns with the population focus for the stakeholder evaluating the technology.

This section demonstrates the value of the technology to patients through addressing the need for the technology in the context of the affected patient sub-population and the available alternatives to treat their condition.

Patient Populations

The three most common modalities for myopia refractive correction – eyeglasses, contact lenses, and refractive surgery – provide patients with options depending on their age, lifestyle, and personal preferences:

Pediatric (0 – 17 years of age): Eyeglasses are currently standard of care for young children, as they require minimal care and hygiene. They can also easily be replaced when refractive changes occur, which is common as children age. Children as young as 8 may be good candidates for contact lenses if they are able to follow the care and cleaning guidelines to prevent ocular infection and other complications.^{52,53} Contact lenses are ideal for older children involved in contact sports and for those who dislike the cosmetic appearance of wearing eyeglasses.^{54,55}

Older Pediatric and Adult (18 – 65 years of age): Persons in this age group may use any of the major technologies for correcting myopia. The choice among technologies is largely based on patient preference and input from their eyecare professional. Persons with stable refractive error may be good candidates for refractive surgery to reduce the need for eyeglasses or contact lenses. Those who are not candidates for surgery still have the option of using eyeglasses, contact lenses, or both to correct myopic refractive error.

Older Adult (65+ years of age): Eyeglasses or contact lenses are an ideal choice for older adults who may not be good candidates for refractive surgery. Refractive error tends to change in mature adults as they experience decreased near vision (*presbyopia*). This makes it necessary for older patients to increase the frequency of checking their refractive error and assessing which technology fits their needs and lifestyle. Options for correcting presbyopia include bifocal or multifocal spectacles, contact lenses, and reading glasses.



Timeframes

The assessment should identify patient populations and time frames that are important in understanding the value of the technology.

Time Frames

The onset of myopia most often occurs around school age. Newborn infants are born with some degree of hyperopic refractive error that often resolves within the first years of life.⁵⁶ After the initial natural emmetropization, the process of developing myopia slowly begins. In a study of refractive error in nearly 5000 children without myopia at the time of study initiation, 16% developed myopia during their school years, with most new diagnoses occurring around age 11.⁵⁷ In the NHANES Study conducted between 1999 and 2004, over 50% of the US population between the ages of 20 and 59 years were found to have myopia.⁴⁸

Children who develop myopia at a very young age are at risk for axial elongation that is associated with complications in adulthood. Myopia worsens more quickly in people whose myopia became apparent at a young age, indicating that intervention in early childhood, as soon as myopia is detected, is critical to reducing the risk of long-term issues.^{16,58,59}



Stakeholders

The intended audience for a value assessment affects the framing of the assessment and the drivers and metrics that could be highlighted.

Both the intended audience/stakeholders and the purpose of the assessment should dictate which types of value are considered and emphasized via the assessment process, as well as the types and quality of evidence needed to support that this early assessment can help determine evidence development needs and point to the appropriate strategies for collecting annual performance information.

Stakeholders

The chart on the following page highlights potential value for stakeholders based on use of medical technologies in correcting the refractive error of myopia and developing treatments to help control the progression of myopia:

	Clinical Impact	Non-Clinical Impact	Care Delivery Revenue and Cost Impact	Public/Population Impact
Patient	<ul style="list-style-type: none"> Improved visual acuity Potential of lowered risk of developing myopia-related complications Non-surgically invasive (EG and CL) Lower risk of ocular infection (EG and RS, post-op) compared to CL Suitable for patients with dry eye (EG) 	<ul style="list-style-type: none"> Improved quality of life as a result of improved vision; better able to perform daily tasks Minimal training required to care for EG, CL, and RS For many people, option to choose technology that best suits personal preferences/lifestyle 	<ul style="list-style-type: none"> Potential for reduced risk of myopia associated complications (e.g., cataract, RD, MMD) Reduced long-term spending on treatment (e.g. RS upfront costs compared to long-term costs of CL) 	<ul style="list-style-type: none"> Reduced accidents as a result of impaired vision (e.g., traffic accidents) Reduced depression resulting from poor vision Increased productivity
Physician	<ul style="list-style-type: none"> Easy to fit EG and CL Low risk of ocular infection (EG and RS, post-op) compared to CL Few interventions to address the complications from the axial elongation of myopia 	<ul style="list-style-type: none"> Minimal time required to train patient on care and cleaning Few follow-up appointments needed after initial fittings Able to provide options to patients that best suit personal preferences/lifestyle 	<ul style="list-style-type: none"> Technologies available at different price points to fit patient needs 	
Hospital/Clinic		<ul style="list-style-type: none"> Few follow-up appointments needed after initial fittings 	<ul style="list-style-type: none"> Potential for reduced risk of myopia associated complications (e.g., cataract, RD, MMD) 	
Insurer			<ul style="list-style-type: none"> Potential for reduced risk of myopia associated complications (e.g., cataract, RD, MMD) Reduced long-term spending on treatment (e.g. RS upfront costs compared to long-term costs of CL) 	

EG = eyeglasses
CL = contact lenses
RS = refractive surgery
RD = retinal detachment
MMD = myopic macular degeneration



Evidence Across the Value Drivers

Medical technology innovators must determine the best way to show value with evidence.

It is critical to identify and evaluate the quantity and quality of available types of evidence for the technology early in product development to determine how each can be used across the relevant drivers to offer robust evidentiary support.

Evidence on the value of correcting refractive error and the potential benefits of staving off the progression of myopia is clear. Manufacturers and users of these technologies have conducted multiple clinical studies that demonstrate the benefits of correcting refractive error. There is reason to believe that prevention of the escalation of myopia into high-myopia may reduce the risk of developing myopia-related conditions including vision loss and other serious ocular impairments.

The chart on the following page highlights evidence that shows the risks associated with not addressing myopia and allowing the condition to escalate over time, further demonstrating the value of early myopia correction and treatment and comprehensive eye care services:

Evidence	Type of Evidence	Clinical Impact	Non-Clinical Patient Impact	Care Delivery Revenue and Cost Impact	Public/ Population Impact
Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000-2050 (Published)²	Systematic Review and Meta-analysis	<ul style="list-style-type: none"> Comprehensive eye care services will help reduce the severity of myopic-related ocular complications and high myopia vision loss 	<ul style="list-style-type: none"> Greater risk of permanent vision loss or myopia related disease/complications if uncontrolled 	If uncontrolled: <ul style="list-style-type: none"> Increased vision loss Increased complications (including myopic macular degeneration, cataract, retinal detachment, and glaucoma) 	If uncontrolled: <ul style="list-style-type: none"> More older patients suffering from pathologic effects of myopia More myopia related vision loss
Myopia, an underrated global challenge to vision where the current data takes us on myopia control (Published)²⁰	Incidence Study	<ul style="list-style-type: none"> Untreated myopia is the most common cause of distance visual impairment Optical interventions, combined with temporary reduction in myopia, show promise to slow myopia-related diseases and the prevalence of developing high myopia 	<ul style="list-style-type: none"> Reduced quality of life 	<ul style="list-style-type: none"> Debilitating eye conditions High costs to provide devices for correcting visual acuity 	<ul style="list-style-type: none"> Increased lifetime economic burden related to lost productivity and independence Health and socio-economic burdens for society
Potential lost productivity resulting from the global burden of uncorrected refractive error (Published)¹⁰	Prevalence Study	<ul style="list-style-type: none"> Uncorrected refractive error is a leading cause of low vision and the second leading cause of blindness after cataract 	<ul style="list-style-type: none"> Absent correction may limit function 	<ul style="list-style-type: none"> Net economic gain associated with providing appropriate eyeglasses Eyeglasses are a low-cost intervention Uncorrected refractive error has a potentially greater impact on the global economy than all other preventable vision disorders. 	<ul style="list-style-type: none"> Global economic productivity loss
Refractive Errors & Refractive Surgery Preferred Practice Pattern (Published)¹⁵	Systematic Review	<ul style="list-style-type: none"> Uncorrected peripheral hyperopic defocus, may lead to worsened axial myopia in children who would otherwise only have URE 	<ul style="list-style-type: none"> Correcting improves visual acuity, function, and comfort 	<ul style="list-style-type: none"> Correction reduces economic productivity loss 	<ul style="list-style-type: none"> Correcting improves economic productivity loss



Expected Impacts (Value)

The value assessment should clearly demonstrate the impact of the technology across select value drivers including clinical impact, non-clinical patient impact, care delivery revenue and cost impact, and societal impact.

Clinical Impact Value – Controlling the progression of myopia and the progression of refractive error using comprehensive eye care services and interventions will reduce progression to high-myopia and potentially the resultant vision impairments including vision loss, macular degeneration, retinal detachment, cataracts, and glaucoma.

Non-Clinical Impact Value – Patients whose refractive error and myopia are treated have better outcomes regarding their visual health and have better long-term outcomes regarding their ability to retain their independence and to be economically productive thereby improving their quality of life.

Care Delivery Revenue and Cost Impact Value – The economic burden of untreated myopia is expected to increase over time. Treatments which reduce refractive error and address the progression of myopia can reduce the societal economic burden through reduction in the burden of disease, including the potential for vision loss.

Societal Impact Value – Treatment designed to address and correct refractive error and myopia allow persons suffering with these vision impairments to remain active in society and the economy. This reduces the need for society to accommodate persons who are suffering from the more serious vision impairments that can result from inadequate or no treatment.

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