

# The role of hyperbaric oxygen therapy in the management of autism

Summary

AGENCE D'ÉVALUATION DES TECHNOLOGIES  
ET DES MODES D'INTERVENTION EN SANTÉ





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## Summary

Report prepared for AETMIS by

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November 2007

*Agence d'évaluation  
des technologies  
et des modes  
d'intervention en santé*

**Québec** 

The content of this summary was translated from an official French publication released by the Agence d'évaluation des technologies et des modes d'intervention en santé (AETMIS). Both the original report, titled *Place de l'oxygénothérapie hyperbare dans la prise en charge de l'autisme*, and the English summary are available in PDF format on the Agency's Web site.

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How to cite this document:

Agence d'évaluation des technologies et des modes d'intervention en santé (AETMIS). The role of hyperbaric oxygen therapy in the management of autism: Summary. Report prepared for AETMIS by Khalil Moqadem and Gilles Pineau. Montréal: AETMIS, 2007 (AETMIS 07-11).

Legal deposit

Bibliothèque et Archives nationales du Québec, 2007  
Library and Archives Canada, 2007  
ISBN 978-2-550-51398-8 (PDF summary), (PDF French summary ISBN 978-2-550-51394-0)  
(Print French edition ISBN 978-2-550-51397-1)  
(PDF French edition ISBN 978-2-550-51396-4)

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The mission of the Agence d'évaluation des technologies et des modes d'intervention en santé (AETMIS) is to help improve the Québec health-care system. To this end, it advises and supports the Minister of Health and Social Services and decision-makers in the health-care system with regard to the assessment of health services and technologies. The Agency makes recommendations based on scientific reports assessing the introduction, diffusion and use of health technologies, including technical aids for the disabled, as well as the methods of providing and organizing services. The assessments examine many different factors, such as efficacy, safety and efficiency, as well as ethical, social, organizational and economic issues.

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# PREFACE



Since the first hyperbaric chambers were built more than two centuries ago, the therapeutic use of hyperbaric oxygen (HBO) therapy has gradually expanded to several diseases and conditions. This expansion is due mainly to advances in knowledge from diving medicine and basic research. Presently, 13 indications are recognized by the Undersea and Hyperbaric Medicine Society (UHMS), an international learned society with more than 2,500 members in about 50 countries. These indications are usually included on the list of covered services of public and private organizations.

Over the years, several researchers have continued to explore the therapeutic potential of HBO for an increasing number of other conditions, but no scientific evidence of its efficacy has been established. These conditions include certain neurological problems or disorders, such as head trauma, stroke and cerebral palsy. More recently, autism was added to this list, after a first attempt to use HBO was made in a 3-year-old autistic child in 1994. Since then, other researchers have continued this experimentation and have observed that HBO may improve the condition of children with autistic disorders. They explain this by the physiological effects that pressurized oxygen has on the brain.

The question about the efficacy of HBO in managing autism is part of the broader mandate given to AETMIS by the Minister of Health and Social Services, i.e., to provide an update of a previous report outlining the indications for which the efficacy of HBO is supported by scientific data. In his request, the Minister specifically asked AETMIS to pay special attention to cerebral palsy and autism. The first of these topics was already the subject of an assessment report, which was submitted to the Minister in January 2007.

Managing autism is demanding for parents and is based on the concerted efforts of a large number of health and social services workers. The available treatment modalities yield good results, but to varying degrees. It is therefore not surprising that clinicians and parents looking for other modalities have pinned their hopes on hyperbaric oxygen therapy.

After defining the problem of autism, this report presents the published scientific data and the current studies on the putative efficacy of hyperbaric oxygen therapy for addressing the symptoms of autism.

In submitting this report, AETMIS hopes to help improve knowledge in order to promote better guidance for decisions concerning autism management.

**Juan Roberto Iglesias, M.D., M.Sc.**  
President and Chief Executive Officer



# EXECUTIVE SUMMARY

Autism is a neurological disorder characterized by early impairments in the overall development of cognitive, speech and relational functions. It affects 3 or 4 times as many boys as girls. The prevalence of autism has increased in the past three decades, although this is due, in large part, to better recognition of autistic disorders by parents, educators and clinicians, to changes in the diagnostic criteria, and to better access to the available services. Presently, the prevalence is estimated at 1 in 500 children.

The management of autism involves behavioural and educational therapies, which yield fairly good results when used properly. In the 1990s, the search for new therapeutic approaches led clinicians to experiment with hyperbaric oxygen therapy in light of the potential neurophysiological effects of compressed oxygen on the brain.

Despite a thorough literature search in the scientific databases and textbooks and on websites dealing with autism or HBO, it must be concluded that there is a lack of evidence, for apart from two descriptions of anecdotal cases, the only results available are from three case series studies, two of which are described very briefly, and from a randomized, controlled trial. These studies seem to indicate a reduction in autism symptoms, but their validity cannot be demonstrated because of the small patient samples and the methodological weaknesses.

Five current studies on this subject were identified as well. Upon examining their designs, it was found that the oxygen and pressure parameters vary from study to study and that the number of subjects enrolled is small, ranging from 10 to 60. When these studies are published, these two factors will influence the analysis and interpretation of the results.

In light of its assessment, AETMIS concludes that there is insufficient evidence to build a strong case for the efficacy of hyperbaric oxygen therapy in the management of autistic disorders. In these circumstances, a literature watch should be conducted to evaluate the results of the current and future studies.

In short, for the management of autism, hyperbaric oxygen therapy should, for now, be considered an experimental treatment modality. Consequently, this treatment should be limited to formal research projects.

# ACKNOWLEDGEMENTS

This report was prepared at the request of the Agence d'évaluation des technologies et des modes d'intervention en santé (AETMIS) by Dr. **Khalil Moqadem**, C. Adm., M.B.A., and a doctoral candidate in public health, and Dr. **Gilles Pineau**, who also holds a degree in engineering physics, both consulting researchers at AETMIS and the lead authors of this report.

The Agency wishes to thank the external reviewers, whose many comments helped improve the quality and contents of this report:

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## CONFLICT OF INTEREST

None declared.



# SUMMARY

## Context

Autism is a neurological disorder characterized by early impairments in the overall development of cognitive, speech and relational functions. It is one of a family of pervasive developmental disorders (PDDs). The clinical picture of autistic disorder is highly variable, and its management requires multiple resources and various intervention methods. Language therapies and socialization and behavioural interventions can change the course of autistic disorder but cannot cure it. Since none of these numerous therapeutic approaches stands out as being the most effective, the modalities for optimal management have not yet been determined, and research continues.

This situation has prompted researchers to try new management and therapeutic approaches, including hyperbaric oxygen (HBO) therapy. Experiments with this modality are based on the physiological effects that pressurized oxygen can have on the brain. However, autism is not on the list of indications officially recognized by the Undersea and Hyperbaric Medical Society (UHMS), an international learned society with more than 2,500 members in about 50 countries. The question of the role of hyperbaric oxygen therapy in managing autistic disorder is, therefore, still unresolved.

This is why the Minister of Health and Social Services asked AETMIS to examine this matter in the broader context of an update of the report published in 2000 by the Conseil d'évaluation des technologies de la santé (CETS), AETMIS's predecessor, on the conditions for the treatment of which the efficacy of HBO is supported by evidence. In his request, the Minister also singled out cerebral palsy, on which AETMIS has already published a report, dated January 2007. The present assessment, which is based on an exhaustive literature review, focuses on the efficacy of HBO in managing autistic disorder.

## Hyperbaric oxygen therapy

The UHMS defines hyperbaric oxygen therapy as the inhalation of pure oxygen (100%) by an individual placed in a chamber at a pressure greater than one atmosphere absolute (ATA). There are other definitions in the literature, but they are not the product of a consensus. The basis of this treatment modality is that oxygen compressed to pressures up to 2 or 3 ATA reduces symptoms, helps cure or simply does cure certain illnesses, such as refractory wounds.

There are two types of hyperbaric chambers: multiplace and monoplace. The choice of type of chamber depends on the need and the disease to be treated. HBO is recognized as a generally safe modality, and it has few contraindications. It does, however, carry certain risks, which should be taken into consideration when using it, namely, the risks involved in handling oxygen, such as fire and explosion, and those associated with pressure, such as traumatic injury to the middle ear, sinuses, lungs and teeth.

## Autism

Epidemiological studies since the 1960s point to a rise in the prevalence of autism. This increase can be explained by different factors, such as increased awareness of autistic disorder, changes to the diagnostic criteria, and better access to the available services. Presently, the rate of 1 affected child in 500 is the one used most in the literature. On the

basis of the patient's history, and with standardized diagnostic tools, autistic disorder can now be diagnosed as early as the second year of life, and recent research shows that if it is also managed early, by a multidisciplinary team, the long-term outcomes are better.

The uncertainty as to which management modalities are optimal is due, in large part, to the unknowns that remain with regard to the etiology and pathophysiology of autism. Presently, a combination of genetic causes and environmental factors is the most convincing explanation for its expression. Research is underway to improve knowledge in this area. A number of explanatory models have been proposed to elucidate the pathophysiological mechanisms of autism or to better understand its symptoms, but they are still much debated. Lastly, new imaging technologies exploring the morphology and functioning of the brain are showing promise.

## **Results of the literature review**

Information on hyperbaric oxygen therapy and autism can be divided into two main categories: a large body of gray literature, including anecdotal cases, which is available on different websites, and a very small body of scientific literature. The paucity of published studies prompted us to expand the inclusion criteria to ensure that the greatest possible number of information sources would be identified.

Two descriptions of isolated cases were published in non-peer-reviewed journals or in conference abstracts, the first description dating back to 1994. HBO reportedly had positive effects, but the validity of this result cannot be established. The three case series studies identified involved small numbers of subjects: 6, 14 and 18 children. In the first one, the three standardized evaluation instruments used seem to have shown a reduction in symptoms, but the authors acknowledge that their study has substantial limitations and conclude that this research needs to continue. The second study, which is briefly described in a conference abstract, shows, according to the author, improvements in a number of areas (measured by a single instrument), but their validity cannot be demonstrated. The third case series study, which was also presented at a conference, reports improvements in different areas measured with five standardized instruments, but the authors point out that these results observed in 15 children must be validated by further and better-structured studies.

The only randomized, controlled trial that has been carried out was published only as a doctoral thesis. Furthermore, its contribution to the evidence is very small. This is because its primary objective was to develop a measuring instrument for assessing the effect of HBO on autism symptoms. The study did not compare HBO with another treatment modality but instead compared two pressure protocols: 1.75 ATA versus 1.3 ATA (control group). Lastly, the sample consisted of only 10 patients. The higher pressure reportedly yielded better results in terms of symptom reduction, but the author herself mentions the substantial limitations of her study.

In addition, we identified five ongoing or recently completed studies in the United States, but their results have not yet been published. There are significant differences between these studies' designs.

## **Official positions of organizations and third-party payers**

Information gleaned from the websites of public bodies or private third-party payers in the United States shows that none of them presently covers the cost of hyperbaric oxygen therapy sessions for autism. The same is true for the Canadian public health insurance plans that were consulted.

## Conclusion

Upon the completion of this systematic literature review, we observe that this is a topic of recent interest. The scientific data available at this time are of low quality, and the level of evidence does not enable one to build a strong case for the efficacy of this treatment modality in managing autistic disorder.

The five ongoing studies identified are examining this matter from different perspectives. However, the differences in the HBO protocols and the small patient samples raise questions and foreshadow mixed results, which could compromise these studies' validity. In these circumstances, a literature watch should be conducted to evaluate the results of these studies as soon as they are published.

In short, for the management of autism, hyperbaric oxygen therapy should, for now, be considered an experimental treatment modality. Consequently, in Québec, it should be limited to formal research projects.

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