

Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy



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Summary

Background Strong evidence shows that physical inactivity increases the risk of many adverse health conditions, including major non-communicable diseases such as coronary heart disease, type 2 diabetes, and breast and colon cancers, and shortens life expectancy. Because much of the world's population is inactive, this link presents a major public health issue. We aimed to quantify the effect of physical inactivity on these major non-communicable diseases by estimating how much disease could be averted if inactive people were to become active and to estimate gain in life expectancy at the population level.

Methods For our analysis of burden of disease, we calculated population attributable fractions (PAFs) associated with physical inactivity using conservative assumptions for each of the major non-communicable diseases, by country, to estimate how much disease could be averted if physical inactivity were eliminated. We used life-table analysis to estimate gains in life expectancy of the population.

Findings Worldwide, we estimate that physical inactivity causes 6% (ranging from 3·2% in southeast Asia to 7·8% in the eastern Mediterranean region) of the burden of disease from coronary heart disease, 7% (3·9–9·6) of type 2 diabetes, 10% (5·6–14·1) of breast cancer, and 10% (5·7–13·8) of colon cancer. Inactivity causes 9% (range 5·1–12·5) of premature mortality, or more than 5·3 million of the 57 million deaths that occurred worldwide in 2008. If inactivity were not eliminated, but decreased instead by 10% or 25%, more than 533 000 and more than 1·3 million deaths, respectively, could be averted every year. We estimated that elimination of physical inactivity would increase the life expectancy of the world's population by 0·68 (range 0·41–0·95) years.

Interpretation Physical inactivity has a major health effect worldwide. Decrease in or removal of this unhealthy behaviour could improve health substantially.

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Sport in Western countries (2011)

- Sedentary people: 30%
- About 40% practice physical activity (2.8 billions)
- About 30% practice sports (2.1 billions)
 - 70% regularly
 - 30% not regularly
- About 70% of children or adolescents practice sports (1 billion)



PWE

- Positive aspects in general
 - Regular physical exercise provide both physiological and psychological benefits for PWE (Nakken et al., 1999; Arida et al., 2009, Pimentel et al, 2015)
 - Among the psychological benefits, better psychosocial adjustment and self-esteem, improvement in mental state and decreased comorbidities related to epilepsy such as depression and anxiety (Nakken et al., 1999; Roth et al., 1994; Eriksen et al. 1994, Arida et al., 2012).



Positive aspects specific to E

- Animal studies demonstrate that aerobic exercise training is able to retard the epileptogenesis process (Arida et al., 1998), reduce seizure frequency (Arida et al., 1999) and promote positive plastic changes in the hippocampus (Arida et al., 2004 and 2007)
- Exercise usually decreases the number of seizures during the physical effort period (Eriksen et al., 1994; McAuley et al., 2001)
- From clinical studies, physical exercise can reduce epileptiform discharges on the EEG and increase the threshold to seizure manifestation (Gotze et al., 1967; Esquivel et al., 1991; Nakken et al., 1997)
- Reduction of epileptiform discharges during both physical effort and recovery (Vancini et al., 2010; de Lima et al., 2011)



Exercise as seizure-inducing factors

- Well-defined events precipitate seizures in a small number of cases with reflex attacks. (Ogunyemi et al., 1998; Schmitt et al., 1994; Sturm et al., 2002)
- Activating factors for seizures can be excessive mental work, nervous tension, anxiety and physical fatigue (McLaurin, 1983; Cordova, 1993).
- Sports at high altitude such as climbing may induce hypoxia
- Prolonged physical exercise, such as marathon running, may lead to occurrence of seizures in patients with and without a prior epilepsy diagnosis (Bennett and Wagner, 1983; Noakes et al., 1984)
- It is important to realize that causative links at this point are merely speculative and have been suggested in isolated cases.



Three different questions

- Advice for physical activity
- Issuance of the certificate for competitive sports



Physical activities

- Before giving advice regarding appropriate physical activities, the epileptologist shall
 - remember the medical history of PWE
 - have a good judgment into the different types of physical activities and sport
 - be able to evaluate the function of sport or physical exercise for the particular PWE



Recommendations for issuance of the certificate of fitness for sport for PWE

- Certificates of competitive fitness for sports in Italy in 2011: about 2 millions!
- No scientific and population-based studies
- The proposal is to refer to the driving license rules





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Western driving regulations for unprovoked first seizures and epilepsy[☆]

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ABSTRACT

Purpose: To review the legislation for non-commercial driving licenses in the Western world for unprovoked first seizures (UFS) and recurrence of established epilepsy, and to examine available evidence on the road traffic accident (RTA) risk in people with seizures.

Methods: Regulations for non-commercial driving licenses were sought from appropriate national or state authorities and epilepsy societies. The literature was searched for consensus guidelines and data relevant to risk analysis, including an appropriate seizure-free period (SFP).

Results: The SFP varied widely from 3 to 24 months and in most countries no distinction was made between UFS and recurrence of established epilepsy. In the European Union (EU), harmonisation is underway but implementation of the relevant directive has been slow. The excess risk of RTA in epilepsy is minimal, especially compared to other factors such as alcohol, and few accidents result from seizures at the wheel. Risk analysis supports the shortened SFPs that are being enacted in the EU.

Conclusion: Regulations across the world continue to vary widely, and the available data support rules which are less stringent than those currently in force in many parts of the Western world. The ongoing European harmonisation is encouraging but much work remains to be done in revising legislation elsewhere, and in strengthening the theoretical foundations underpinning driving regulations.

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A North America

Canada (see text)

Washington, Oregon, Nevada, California, Alaska, Hawaii, Montana, Idaho, Wyoming, Colorado, Arizona, New Mexico, Texas, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Arkansas, Louisiana, Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Kentucky, Tennessee, Mississippi, Alabama, Georgia, Florida, New Hampshire, Vermont, Massachusetts, Maine, New York, Pennsylvania, Delaware, Maryland, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida, New Jersey, Connecticut, Rhode Island, Washington, DC (12m)

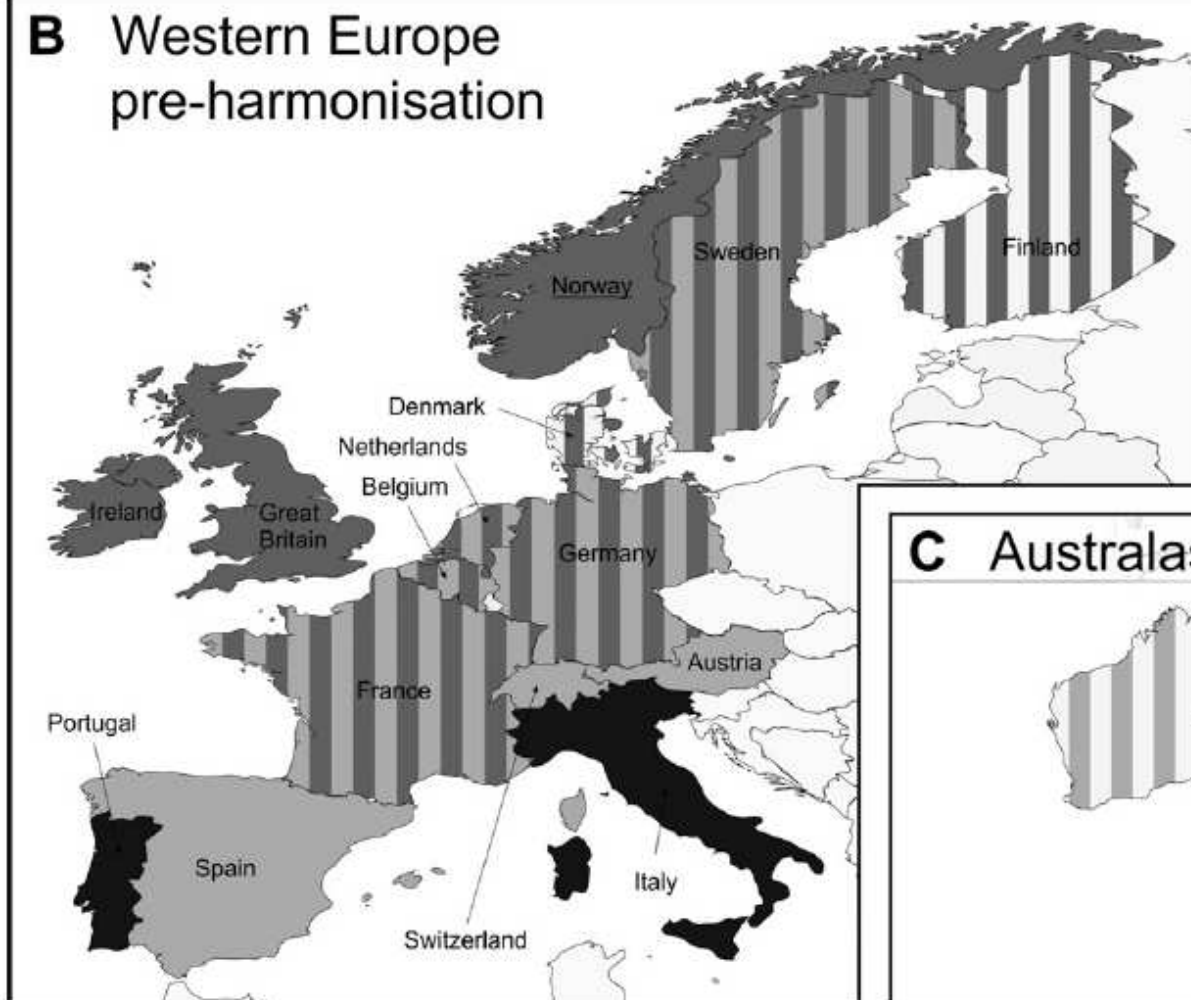
Typical seizure-free period

3 months
6 months

3 months
6 months
12 months
24 months
No fixed period

Underlined countries/states require statutory physician reporting

B Western Europe pre-harmonisation

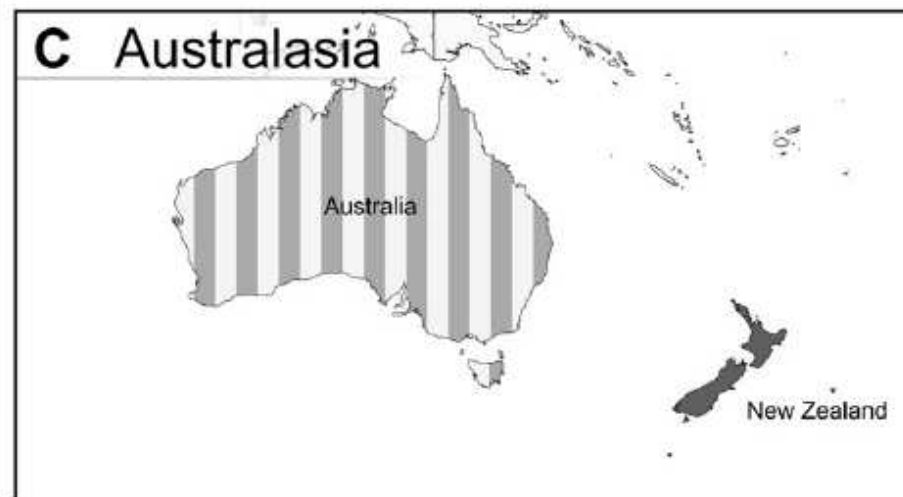


Typical seizure-free period

3 months
6 months
12 months
24 months
No fixed period

Underlined countries/states require statutory physician reporting

C Australasia



(A–C) Typical seizure-free periods (SFPs) required after an unprovoked first seizure (UFS) or recurrence of established epilepsy. For many countries/states the SFPs were equal in both cases (uniform shading). In several countries, the SFP was longer for recurrence of epilepsy than for UFS; the opposite situation applied in Denmark and Austria (striped shading indicating both SFPs). Several US states use case-by-case decisions rather than fixed SFPs (black shading). Underlined countries/states required statutory physician reporting.

Driving

- Driving regulations aim to maximize public safety whilst preserving individual freedom as much as possible
- The action of revoking a license is primarily taken to protect passengers and other road users, rather than to safeguard the driver
- Excessive restriction carries the risk of non-compliance or under-reporting of seizures by PWE

Road accidents

- The majority are due to driver error, the same major cause as in the general population
- In a large study, a relative risk for road accidents of 1.33 (1.00-1.73) was reported, which was comparable to the RR in people with diabetes or medical conditions which do not carry driving restrictions, such as cardiovascular disease
- between 0.02% and 0.25% of accidents are seizure-related, whilst 31% of accidents are related to alcohol

Europe

- In Europe, an harmonization about the issuance of driving license has been reached
- The directive is active in almost all country

Driving

- Group 1

A 6-month SFP for an UFS and 12 months for recurrence of established epilepsy

Special categories have been introduced

- Without LOC

- During sleep only

- Group 2

10 years freedom from further seizures without the use of anti-epileptic drugs.

National authorities may allow drivers with recognized good prognostic indicators to drive sooner

Epilepsy, seizures, physical exercise, and sports: A report from the ILAE Task Force on Sports and Epilepsy

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SUMMARY

People with epilepsy (PWEs) are often advised against participating in sports and exercise, mostly because of fear, overprotection, and ignorance about the specific benefits and risks associated with such activities. Available evidence suggests that physical exercise and active participation in sports may favorably affect seizure control, in addition to producing broader health and psychosocial benefits. This consensus paper prepared by the International League Against Epilepsy (ILAE) Task Force on Sports and Epilepsy offers general guidance concerning participation of PWEs in sport activities, and provides suggestions on the issuance of medical fitness certificates related to involvement in different sports. Sports are divided into three categories based on potential risk of injury or death should a seizure occur: group 1, sports with no significant additional risk; group 2, sports with moderate risk to PWEs, but no risk to bystanders; and group 3, sports with major risk. Factors to be considered when advising whether a PWE can participate in specific activities include the type of sport, the probability of a seizure occurring, the type and severity of the seizures, seizure precipitating factors, the usual timing of seizure occurrence, and the person's attitude in accepting some level of risk. The Task Force on Sports and Epilepsy considers this document as a work in progress to be updated as additional data become available.

KEY WORDS: Epilepsy, Seizures, Physical exercise, Sports, Fitness certificates.

Categories of sport risks

Three groups

- **Group 1: No risks**
 - If there are not reasonable risks both for the athlete (compared to the general population) and bystanders
- **Group 2: Moderate risks**
 - If the sport has a moderate risk to create a physical injury to the athlete with epilepsy and there are no real risks for bystanders
- **Group 3: Major risks**
 - If the sport is considered to be highly dangerous in the presence of seizures to the athlete with epilepsy or to bystanders



Table 1. Categorization of sports by level of risk of injury or death for PWEs, or for bystanders, should a seizure occur during the event

Group 1 sports (no significant additional risk)	Group 2 sports (moderate risks to the PWEs but not to bystanders)	Group 3 sports (high risk for PWEs, and, for some sports, also for bystanders)
Athletics (except for sports listed under group 2)	Alpine skiing	Aviation
Bowling	Archery	Climbing
Most collective contact sports (judo, wrestling, etc.)	Athletics (pole vault)	Diving (platform, springboard)
Collective sports on the ground (baseball, basketball, cricket, field hockey, football, rugby, volleyball, etc.)	Biathlon, triathlon, modern pentathlon	Horse racing (competitive)
Cross-country skiing	Canoeing	Motor sports
Curling	Collective contact sports involving potentially serious injury (e.g., boxing, karate, etc)	Parachuting (and similar sports)
Dancing	Cycling	Rodeo
Golf	Fencing	Scuba diving
Racquet sports (squash, table tennis, tennis, etc.)	Gymnastics	Ski jumping
	Horse riding (e.g., Olympic equestrian events—dressage, eventing, show jumping)	Solitary sailing
	Ice hockey	Surfing, wind-surfing
	Shooting	
	Skateboarding	
	Skating	
	Snowboarding	
	Swimming	
	Water skiing	
	Weightlifting	

The categorization was done by consensus, taking into account the most common conditions that are likely to apply when PWEs practice these sports. We recognize that some sports fall in a gray zone, and that there are specific individual characteristics or circumstances for which a different categorization would be indicated, based on the judgment of the physician.

Table 2. Suggestions of physical activities/sports participation for PWEs or with other seizure disorders

	One or more symptomatic seizures	Single unprovoked seizure	Seizure-free (12 months or longer)	Sleep-related seizures only	Seizures without impaired awareness	Seizures with impaired awareness	Epilepsy resolved (no seizures >10 years and off AED > 5 years)	Medication withdrawal
Group 1 sports	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted at neurologist's discretion applies when seizures are precipitated by specific activities	Permitted	Permitted at neurologist's discretion applies when seizures are precipitated by specific activities
Group 2 sports	Permitted at neurologist's discretion, with restrictions (see text)	Permitted after 12 months of seizure freedom ^a	Permitted	Permitted at neurologist's discretion, with restrictions (see text)	Permitted at neurologist's discretion, with restrictions (see text)	Permitted at neurologist's discretion, with restrictions (see text)	Permitted	Permitted after appropriate periods following AED cessation (see text) ^a
Group 3 sports	Permitted at neurologist's discretion, with restrictions (see text)	Permitted after 12 months of seizure freedom ^a	Permitted	Generally barred, but may be considered, with restrictions, at neurologist's discretion, for sports posing no risk to bystanders (see text)	Generally barred, but may be considered, with restrictions, at neurologist's discretion, for sports posing no risk to bystanders (see text)	Generally barred, but may be considered, with restrictions, at neurologist's discretion for sports posing no risk to bystanders (see text)	Permitted	Permitted after appropriate periods following AED cessation (see text) ^a

^aSports for which earlier permission may apply based on the neurologist's discretion. The latter includes, in addition to informed consent, (1) evaluation of specific clinical aspects and risks related to the specific sport activity and (2) feasibility of medical surveillance and appropriate supervision during the activity. For more detailed information, see text.

Categories of PWE

- under remission
- seizure free
- with a first provoked seizure
- with a first unprovoked seizure
- with pure nocturnal seizure
- with seizures without loss of consciousness
- with seizures with loss of consciousness
- seizure recurrence after medical withdrawal



PWE under remission

According to the ILAE definition, the epilepsy can be considered resolved when seizure-free individuals “either had an age-dependent epilepsy syndrome but are now past the applicable age or have remained without seizures for the last 10 years and are off anti-seizure medicines for at least the last 5 years”. These people may practice and compete in all sports.



Seizure free PWE (under treatment or not)

- After 12 months of SF in all sports



PWE with a first provoked seizure

seizure(s). Once the causative condition is resolved, the risk of further seizures would be generally regarded as low, unless there is a high probability for the precipitating

event to recur. If the risk of seizure recurrence is considered low and there are no associated contraindicating conditions, these individuals should be permitted to practice and compete immediately in group 1 sports. They may also practice and compete in group 2 and group 3 sports at the neurologist's discretion after careful medical and neurologic assessment of the risks of the causative event recurring, and with informed

consent.^A Provisions may be indicated for medical follow-up as appropriate under the specific circumstances.



A single first unprovoked seizure

According to the ILAE practical clinical definition of epilepsy,^{32,33} a single seizure considered to be associated with a $\geq 60\%$ probability of recurrence within the next 10 years qualifies for a diagnosis of epilepsy.

Individuals who had a single unprovoked seizure, whether diurnal or nocturnal in origin, may practice and compete in group 1 sports immediately after an appropriate medical/neurologic assessment. The same individuals may also practice and compete in group 2 and group 3 sports after 12 months of seizure freedom, subject to an appropriate medical/neurologic assessment. They may practice and compete in some group 2 and even some group 3 sports immediately at neurologist's discretion with informed consent and under medical surveillance, and with appropriate supervision during the activity. Neurologist's discretion in the latter situation should take into account, among other considerations, prognostic factors for seizure recurrence,³³ such as the presence or the absence of a structural brain lesion considered to be potentially causative of the seizure.



PWEs with sleep-related seizures only

PWEs whose seizures occur only during sleep may immediately practice and compete in group 1 sports. They may also be considered fit to practice and compete immediately in some group 2 sports (e.g., swimming and canoeing), at neurologist's discretion, provided informed consent is obtained and appropriate medical surveillance and supervision during the activity are ensured. They may practice and compete in all group 2 sports after 12 months of follow-up if the frequency of seizures during this period is sufficient to confirm with reasonable certainty the exclusive association of the seizures with sleep and if the sport does not involve



important alterations in the wake–sleep cycle.³¹ They should not practice or compete in group 3 sports that pose a danger to others. However, in those sports in which only the PWE would be injured, practice and competition of some group 3 sports may be considered at the neurologist’s discretion following in-depth medical/neurologic assessment after 12 months of follow-up, provided their seizure frequency is sufficient to confirm the exclusively sleep-related occurrence of seizures, informed consent is obtained, and appropriate medical surveillance and supervision during the activity are ensured.



PWEs continuing to have seizures without impaired awareness

PWEs with seizures without loss of consciousness or impaired awareness may immediately practice and compete in group 1 sports. They may also be considered fit to practice and compete immediately in some group 2 sports (e.g., swimming and canoeing), at the neurologist's discretion, provided informed consent is obtained and appropriate medical surveillance and supervision during the activity are ensured. In agreement with the 2009 EU Commission Directive for driving,³¹ they may practice and compete in all group 2 sports after 12 months of follow-up, provided their seizure frequency is sufficient to confirm the consistency of the clinical semiology. They should not practice or compete in group 3 sports that pose a danger to others. However, in those sports in which only the PWE would be injured, practice and competition of some group 3 sports may be considered at the neurologist's discretion following in-depth medical/neurologic assessments after 12 months of follow-up, provided seizure frequency is sufficient to confirm consistent ictal semiology, informed consent is obtained, and appropriate medical surveillance and supervision during the activity are ensured.



PWE continuing to have seizures with LOC

PWE with uncontrolled seizures associated with impaired awareness may practice and compete in group 1 sports unless the activity involves exposure to specific seizure precipitating factors, as in the case of some reflex epilepsies. They may also be considered fit to practice and compete in some group 2 sports at neurologist's discretion, provided informed consent is obtained and appropriate medical surveillance and supervision during the activity are ensured. They should not practice or compete in group 3 sports that pose danger to others. However,, in sports in which only the PWE would be injured, practice and competition of specific group 3 sports may be considered with informed consent and at the neurologist's discretion under exceptional circumstances, e.g. when appropriate medical surveillance and supervision during the activity can be ensured and in depth medical/neurologic assessments allow to exclude an excessive risk of seizure-related harm.



Medication withdrawal

factors. In PWEs who are undergoing (or underwent) reduction or withdrawal of AED therapy, neurologists and sports specialists need to consider the individual risks of seizure recurrence when making decisions in relation to practice and competition in specific sports. In agreement with the EU driving Directive, PWEs who are seizure-free should not engage in group 2 and group 3 sports from the commencement of the period of AED withdrawal and thereafter for a period of 6 months after cessation of treatment. PWEs who had recurrence of seizures during physician-advised treatment change or AED withdrawal should not engage in group 2 and group 3 sports for a period of 3 months after the previously effective treatment is reinstated and no further seizures occurred in this period. Some flexibility to these



Italian scenario

1.Epileptologists play an important role

2.In strict collaboration with the sport doctors



Hot questions

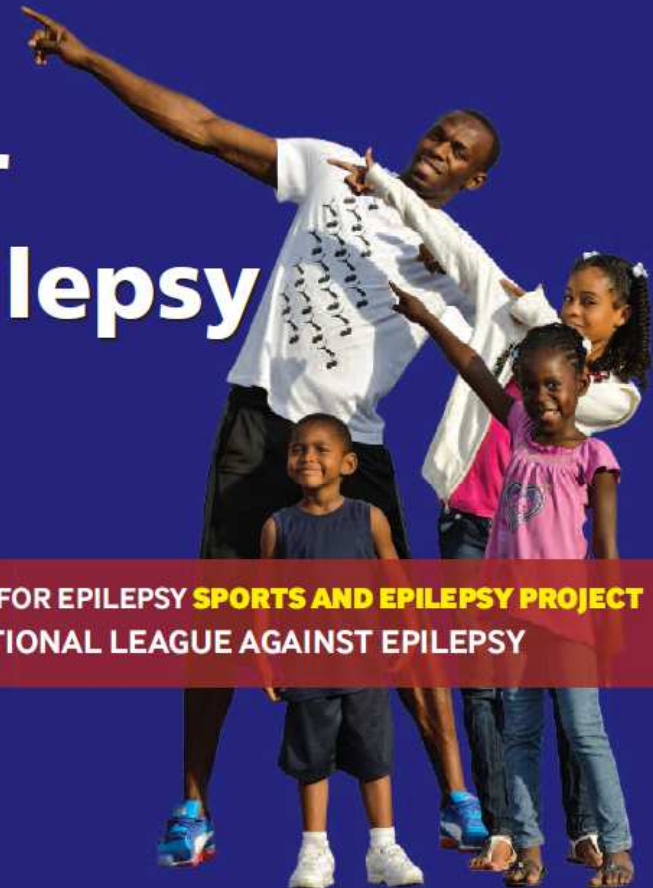
- If sport practice cannot increase the risk to have seizure recurrence, why cannot PWE practice and compete in sport?
- If sport practice have a protective effect on seizure recurrence and positive effects on physical and psychological health, why should a PWE have denied the possibility to practice and compete in sport?
- If a well controlled PWE drives, why cannot PWE compete in motor sports?
- The road users "accept" that PWE drive in the same roads. Why circuit users should not accept that well controlled PWE compete together with them?
- If "normal" people practice and compete in very dangerous sports, why should well controlled PWE not compete in more or less dangerous sports?
-?



The ILAE, through its Task Force on Sports and Epilepsy and in collaboration with IBE, have created this collection of images of famous sports persons photographed with children and teenagers from around the world. The photographs convey the message that celebrities have no prejudice against the disorder and that people with epilepsy can achieve their goals, lead a full and active life and engage in sports.



Stand Up For Epilepsy



STAND UP FOR EPILEPSY **SPORTS AND EPILEPSY PROJECT**
INTERNATIONAL LEAGUE AGAINST EPILEPSY



Stand Up For Epilepsy





The fastest man in the world, Olympic Gold medalist, **Usain Bolt**. With 'Lightning Bolt' are Amy-Marie Fraser, Kristina Dasilva, Shay-Ann Bennett, Thaenia Matthews and Jordan Russell.

COUNTRY Jamaica

PHOTOGRAPHER Marc Evans

