

## **Appendix A: Suffolk Cycle Strategy: Medical and Public Health Evidence**

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# EXECUTIVE SUMMARY

- There is compelling evidence for health benefits of regular physical activity in reducing disability and premature death from a range of health conditions including cardiovascular diseases, diabetes, and mental health conditions to name a few.
- There are recommendations for minimum quantity and quality of physical activity to achieve the health benefits for all age groups and across the whole spectrum of baseline health status and level of physical activity from beginners with increased risk to highly conditioned healthy individuals.
- There is strong evidence for effectiveness of cycling in providing many health benefits of physical activity.
- Despite its popularity and recent relative increase in participation, cycling levels are in long-term decline due to a number of perceived and real barriers such as risk of injuries, road safety, environmental factors and infrastructural issues.
- Sport related injuries are more common in elite or occupational cyclists and the majority of injuries in recreational and commuting cyclists are minor and easily preventable with simple measures.
- Health benefits and potential life years gained as a result of regular cycling outweigh risks of accidents and collisions. However, there are a number of contributory factors that if addressed can potentially reduce the risk of any serious injury or fatality.
- Despite higher injury rates in cycling in darkness or adverse weather conditions, the majority of cycling accidents are of lower injury rate and happen in daylight and good weather conditions when most cycling happens.
- There is some evidence on detrimental effect of air pollution on health benefits of exercise. Nonetheless, the beneficial effects outweigh the risks.
- Despite few discrepancies there appears to be a good correlation between perceived and actual safety and there is evidence on effectiveness of certain infrastructural measures in improving cycling safety as well as participation levels and racial inclusion.
- There is good evidence that use of conspicuity aids and measures such as cycle helmets and high-visibility clothing can reduce both the rate and severity of cycling injuries.
- Whilst educational and skills programmes can increase knowledge, participation and confidence, in practice this may not necessarily reduce risk of injury.
- Minimum annual health cost of physical inactivity in Suffolk is more than £14,000,000.

- Suffolk cyclist casualty rate is below Great Britain and more than 70% of cyclist casualties in Suffolk happen at or near a junction.

## HEALTH BENEFITS OF REGULAR PHYSICAL ACTIVITY

Reduce All-cause mortality and risk of chronic diseases:

- **Cardiovascular conditions:** reduce Coronary Heart Disease mortality; Congestive Heart Failure; Hypertension (high blood pressure)
- **General health:** Reduce the risk of falls and accidents, improving bone health and maintaining strength, co-ordination, cognitive functioning and balance, Body weight, and (type 2) diabetes
- **Cancers:** Reduce the risk of colon and other forms of cancer, enhance the immune system.
- **Mental health:** Compelling evidence; reduce the risk of depression, dementia, and anxiety, and enhancing mood and self-esteem
- **Musculoskeletal conditions:** Chronic low back pain; Osteoporosis, knee osteoarthritis
- **During pregnancy:** Reduce maternal Hypertension, gestational diabetes, and depression during pregnancy
- Cardiovascular diseases are the leading causes of death in the world and at least 80% of premature deaths from cardiovascular diseases could be prevented by a healthy diet, regular physical activity and avoiding tobacco.
- Physical inactivity is second only to tobacco as a behavioural risk factor contributing to the global burden of disease

### References:

- Department of Health (2011) Start active, Stay active: a report on physical activity from the four home countries' Chief Medical Officers
- Annual Public Health Report for Suffolk 2013: Moving forward?
- The ABC of Physical Activity for Health: A consensus statement from the British Association of Sport and Exercise Sciences
- Senter C, Appelle N, Behera SK. Prescribing exercise for women. *Curr Rev Musculoskelet Med.* 2013 June; 6(2): 164–172
- WHO, Fact file, 10 facts on the state of global health

- WHO, Global Burden of Disease

## RECOMMENDATIONS AND GUIDELINES FOR PHYSICAL ACTIVITY

For Developing and Maintaining Cardio-respiratory and Muscular Fitness, and Flexibility:

- **Most adults:** moderate-intensity cardio-respiratory exercise  $\geq 30$  min/d on  $\geq 5$  d/wk for a total of  $\geq 150$  min/wk, or vigorous-intensity cardio-respiratory exercise training for  $\geq 20$  min/d on  $\geq 3$  d/wk ( $\geq 75$  min/wk), or a combination. Resistance and muscle strength exercises and exercises involving balance, agility, and coordination 2-3 d/wk.
- **Conditioned individuals:** additional health benefits by  $\geq 300$  min/wk of moderate-intensity aerobic activity, or  $\geq 150$  min/wk of vigorous-intensity aerobic activity, or equivalent combinations.
- **Children and adolescents:** 5–16 years: at least 60 min/d of moderate to vigorous intensity activity
- **Beginners:** steadily work towards levels recommended for all healthy adults.
- **Adults with increased risk** (CVD, DM 2, weight control): may benefit from going beyond the healthy adult levels gradually progressing towards conditioned individuals.
- **All individuals:** minimise the amount of time spent being sedentary for extended periods of time

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- Annual Public Health Report for Suffolk 2013: Moving forward?

## CYCLING AS PHYSICAL ACTIVITY

- A clear positive relationship between cycling and cardio-respiratory fitness in youths.
- A reduction of all-cause mortality, cancer mortality, and cancer morbidity among middle-aged to elderly commuter cyclists.
- Consistent improvements in cardiovascular fitness and some improvements in cardiovascular risk factors due to commuting cycling.
- A consistent positive dose-response gradient between the amount of cycling and the health benefits.
- Reduction in cardiac risk factors in active travelling to work.
- Evidence for effectiveness of cycling in treating depression
- Evidence that cycling as part of normal daily activity can provide the same improvements in physical performance as specific training programmes.

### References:

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## ATTITUDES AND BARRIERS TO CYCLING

- Cycling the third most popular recreational activity in the UK
- Despite a relative increase in recent years in the number of participants doing at least 30 min of moderate intensity cycling once a week, Cycling levels in terms of total kilometres cycled in a year is in long-term decline

- Overall satisfaction with the quality of sporting experience for cycling has increased from 2009 to 2012. In general participant population the key satisfaction domains are “Exertion and fitness” and “Release and diversion”.
- General participants of the sport felt cycling contributed to their overall health by improving their fitness and physical activity levels.
- This group also found cycling an effective way of relief from stresses of daily routine life and an opportunity to be challenged with improved self-esteem.
- 3 in 10 car users would reduce car use and half of cyclists would cycle more with better provision.
- Fitness / health, and recreation / enjoyment are the main motivators
- Men more likely than women to cycle for recreation and commuting
- Women less likely than men to cycle on-road with both genders preferring off-road cycling
- General concerns and barriers to cycling from different surveys and studies / real and perceived:
  - Safety: 56% fear urban roads unsafe to cycle, fear of traffic, cars, and injuries
  - Environmental factors: dedicated cycle routes and separation of cycling from other traffic, trip distance, terrain and inclines, cycling at night or in bad weather, air pollution and inhaling vehicle exhaust emission
  - Harassment and motorists aggression: driving too close, shouting abuse, obscene gestures
  - Security: theft, bicycle parking

## References:

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- Sustrans press release Feb 2012
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- Implementing sustainable transport policies moving ahead. National Policies to Promote Cycling. European Conference of Ministers of Transport 2004

## **BARRIERS TO CYCLING: EVIDENCE & FACTS**

### Sport-related injuries

- Commonly in competitive and endurance athletes or occupational cyclists doing extensive cycling often more than 3 hours per day, but occasionally in novice recreational cyclists due to errors and lack of skills
- Usually classified into overuse, bicycle contact and traumatic injuries.
- 94% of elite cyclists report at least one overuse injury per year.
- Examples include: knee pain, back pain, ulnar nerve compression with numbness and weakness in hands, saddle sores, genital anaesthesia (numbness) in men and genital irritation in women.
- The majority of injuries in commuting or recreational cyclists are minor requiring little or no medical treatment with limited time off bike.
- The majority of overuse and bicycle contact injuries can be addressed by simple adjustments to saddle height, saddle design, handlebar, and gear, as well as use of padded cycling gloves or padded handlebar.

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## Cycling accidents & collisions: Facts and figures

- Health benefits of cycling outweigh the risk of injury by 20:1 or more.
- Risk of cycling death is small. 21,000 average cyclists have to cycle for a year before one is killed.
- There is not a direct relationship between levels of cycling to work and collision risk.
- Nonetheless, over the years there has been an under-reporting of cycling injuries to the Police and occasionally Police assessment of severity of injuries is less accurate than hospital assessment.
- In 2011 a total of 107 fatalities and 3,085 serious injuries were reported to the Police in the UK on-road cyclists.
- 20% of reported cycling accidents were in children with 10-15 year olds more at risk.
- Collisions involving cyclists aged 50 or over tend to be more serious.
- Since 2000 there has been a sharp increase in the number of killed or seriously injured 30-49 year old cyclists.
- 80% of reported cycling casualties were male.
- 16% of reported cyclist fatalities or serious injuries do not involve collision with another vehicle and are caused by rider losing control of their bicycle.
- In 43% of serious collisions at junctions the contributory factor recorded by the police is "cyclist failing to look properly".
- In 20% of total serious collisions and more than 30% of serious collisions involving a child the contributory factor recorded is "cyclist entering the road from pavement".
- About 20% of cyclist fatalities in London involved an HGV, often turning left at a junction.
- Cyclist injury severity in vehicle collisions tend to be higher if any of the following driver attributed contributing factors: "impaired by alcohol", "exceeding the speed limit", "travelling too fast for conditions" and "vehicle blind spot" for HGVs.
- Common injuries: 40% arm, 25% leg, chest and abdomen 5% but often serious and accompanied by head injury, 75% of total reported cyclist fatalities and 80% of rural cyclist fatalities were because of major head injury.

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## Environmental factors

### a) Time and season

- Higher injury rates in cycling in late evening darkness than cycling in daylight
- Much higher relative injury rates in early morning darkness than late evening darkness
- Potential role of poor conspicuity and impaired perception
- However, approximately 80% of cycling accidents occur in daylight
- The most dangerous hours for cyclists are 3.00 to 6.00 p.m. and 8.00 to 9.00 a.m. on weekdays.
- Cycling accidents in the dark are more likely to be fatal
- More cycle accidents May to September, however, higher casualty rate over the Autumn and Winter (October to April) period.

## References:

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## b) Exposure to air pollution

- Evidence that exercising in air pollution increases cardiovascular morbidity and mortality probably due to an exercise-induced increase in respiratory uptake, lung deposition and toxicity of inhaled fine and ultra fine particulate matter pollutants.
- Commuting to work by bicycle in London is shown to be associated with increased long-term inhaled dose of fossil fuel-derived black carbon
- Short-term exposures to pollution while cycling in traffic may affect heart rate modulation and function in the hours immediately after cycling.
- Enhanced cognition and memory performance achieved through exercise may be negatively influenced by exercising in an environment with high concentrations of particulate matter.
- Levels of the more noxious air pollutants have been controlled in the UK. Ozone is particularly damaging to athletes and reaches its highest concentrations on hot bright days in rural areas
- Nonetheless, beneficial effects of increased physical activity are estimated to be significantly larger (3-14 months gained) than the potential mortality effect of increased inhaled air pollution doses (0.8-40 days lost)

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## Infrastructure

- Route choices and decisions to cycle are affected by perceptions of safety, and there is evidence these perceptions usually correspond with observed safety. However, in one study there were discrepancies between perceived and actual safety for cycle tracks (perceived as less safe than observed) and for multiuse paths (perceived as safer than observed).
- 75% of cycling injuries in Britain happen at, or near, a road junction
- In London around 20% of cyclist fatalities involve an HGV often when an HGV is turning left at a junction
- Evidence that purpose-built bicycle-specific facilities reduce crashes and injuries among cyclists. Street lighting, paved surfaces, and low-angled grades are additional factors that help.
- Multi-lane roundabouts can significantly increase risk unless there is a separated cycle track
- It was shown that sidewalks and multi-use trails cause the highest risk, major roads are more dangerous than minor roads, and the presence of bicycle facilities (e.g. on-road bike routes, on-road marked bike lanes, and off-road bike paths) was associated with the lowest risk.
- Evidence that properly implemented bicycle boulevards are a safer alternative to riding on arterials
- Some evidence that roundabouts with cycle lanes appear to be significantly worse compared to mixed traffic, separate cycle paths, and grade-separated cycle paths
- Evidence that one-way cycle tracks are generally safer at intersections than two-way and that they reduce injury severity at intersections
- Evidence that better edge markings, especially in curves of bicycle tracks, and improved conspicuity of bollards can reduce number of single bicycle crashes
- Evidence that street lighting may prevent road traffic crashes, injuries and fatalities.
- Dedicated cycle routes or paths, separation of cycling from other traffic, and proximity of a cycle path or green space and promoting 'safe routes to school' are shown to have positive association with cycling
- The socio-demographic distribution of effect of cycle lane construction on physical activity is unclear.
- Evidence that measures to improve bicyclists' safety from cars would primarily benefit racial-ethnic groups who cycle less but have higher rates of chronic diseases, as well as those who currently feel least safe bicycling.

## References:

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## EDUCATION AND PROTECTION

- Evidence that regular use of conspicuity aids can reduce cycling injury rates.

- Cyclists regularly wearing fluorescent or high visibility clothing appear to have less severe crash-related injuries with significantly lower rate of days off work after an injury.
- Evidence that helmet users are more likely to use other protective measures.
- Evidence that introduction of helmet legislation can reduce head injuries as well as general cycling injuries particularly in children.
- Evidence that use of cycling helmet can reduce central nervous system complications of a head injury
- Improvements in cycle helmet design to account for rotational forces involved in a head injury can further reduce the risks.
- Cycling and skills programmes can increase participation by improving confidence.
- Knowledge of cycling safety can increase through educational and skills training programmes, however, there is a lack of sufficient evidence as whether this will reduce cycling injuries in practice.

#### References:

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## SUFFOLK DATA

- Annual healthcare cost of physical inactivity in Suffolk estimated more than £14,000,000 or in excess of £1,800,000 per 100,000 of raw population.
- This estimate is based on a limited number of disease categories which do not include obesity, musculoskeletal health, mental health, and functional health. The true cost is likely to be much higher.
- Excluding recreational walking and cycling, 34.1% of adults in Suffolk participate in at least 30 minutes of moderate intensity sport activity per week. This is slightly lower than the England average of 35.2%.
- In 2011/12 a total of 12.4% of adults in Suffolk met the current recommendations for 30 minutes per day, 5 days a week of moderate intensity physical activity (England 11.8%).
- In 2013 a total of 56.4% of adults in Suffolk were considered physically active i.e. achieving at least 150 min of physical activity per week.
- 20% of adults in Suffolk cycle at least once a month for any purpose or duration (England 15%).
- 4% of adults in Suffolk cycle at least five times a week for any purpose or duration (England 3%)
- 2.6% of Suffolk commuters cycle to work regularly (3.1% England and Wales, 29.9% Cambridge)
- 49.9% of adults in Suffolk want to do more sport and 7.4% want to cycle most as a sport
- Cyclist casualty rate in Suffolk is below the overall Great Britain rate
- 18% of all adult cyclist casualties in Suffolk over a 5 years period to 2012 led to fatality or serious injury. There have been no child cyclist fatalities over the same period.
- Each week approximately 4 cyclists are injured in Suffolk with almost 3 cyclists killed or seriously injured every month.

- Over a 5 year period 72% of all recorded cyclist casualties were at, or within 20 metres, of a junction with 57% of these at a t-junction followed by roundabouts.
- In 77% of cyclist casualties at or near a junction the cyclist has not been culpable, however, in 2 of the 3 recorded fatalities over this period the cyclist was at fault.
- In total driver's error has been attributed to 68% of all collisions in Suffolk.

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