



Mary Ward Essay Submission Form 2021

Please include this submission form, along with your essay, to DirectorTrafficMedicine@RCPI.IE

Title of Essay:	Driving: A Vague Future for Parkinson's		
Word Count:	2646		
Name:	Frederick Lee Xin Yang		
Email:	frederickleexin21@rcsi.com		
Telephone/mobile:	+353852121819		
Date of submission:	24/01/2022		
College/Institution:	Royal College of Surgeons in Ireland (RCSI)		
School:	School of Medicine		
Specialty (if any):	Nil		
Level of study (tick the relevant box below):			
<u>Undergraduate</u>		<u>Postgraduate</u>	
Year 1	<input checked="" type="checkbox"/>	Year 1	<input type="checkbox"/>
Year 2	<input type="checkbox"/>	Year 2	<input type="checkbox"/>
Year 3	<input type="checkbox"/>	Year 3	<input type="checkbox"/>
Year 4	<input type="checkbox"/>	Year 4	<input type="checkbox"/>

Driving: A Vague Future for Parkinson's

Introduction

Independence describes the state of freedom from others' influences. Collectively, it is characterised by many skillsets and the ability to drive plays a crucial aspect of it. Undoubtedly, driving is a complex task, requiring much attention and response to the dynamic environment which often possess difficulties for many, especially those with chronic illnesses.

Automobile accidents and fatalities have come a long way, since 1869^[1], but traffic medicine itself receives very little attention even at present. The term – traffic medicine – was coined along with the formation of International Traffic Medicine Association (ITMA), formerly known as the International Association for Accident and Traffic Medicine (IAATM)^[2], altogether to minimise the number road accidents as well as its harm on human beings through a multi-disciplinary approach. This relatively new speciality utilises strengths from a variety of professional workers from all disciplines like engineers, educators, researchers, and medical workers, to render an optimised safe mobility for the public. Traffic medicine also aims to enable and rehabilitate people with health conditions in ensuring transport mobility. Although traffic medicine includes injuries from all vehicles travelling over land, sea, air, under-water and even in space, it mostly focuses thoroughly on harm results from road vehicles as it comprises a vast percentile^[3]. Hitherto, many preventative measures and legislation have been implemented around people with chronic illnesses thanks to the emerging interest on this field of study. Howbeit, a perfect approach that truly covers people with the wide array of chronic conditions to enable driving remains incomplete.

A truthful representation of chronic illness that stands out in presenting challenges for driving, is Parkinson's disease (PD). PD is a chronic, multisystem, and progressive neurodegenerative condition which involves the gradual breakdown of dopamine-producing neurons in the brain. Dopamine is a local chemical messenger between parts of the brain and nervous system that is responsible in controlling and coordinating body movements. The reduced dopamine levels in the brain causes a series of movement-related symptoms like tremor, limb rigidity and bradykinesia. Frequently overlooked by the public are the non-motor manifestations of PD which affects speech, balance, and ambulatory functions.^[4] These symptoms make activities of daily living as simple as walking or eating a strenuous task; to say nothing of driving. Yet

in many parts of the world, Ireland inclusive, little is known about the daunting lived experiences of these persons with PD as they try to navigate a motor vehicle smoothly while keeping up with the flow of the traffic on the road. It is also worthwhile noting, the concerns because of illness trajectory or the potential diverse driving concerns from diagnosis to cessation not only influences the patient him or herself, but also their respective family members.

Parkinson's Disease

Parkinson's disease is the second most prevalent neurodegenerative condition after Alzheimer's disease with an incidence rate of 1-2:1000 within the general population and 1:100 among those who are over 80 according to the Parkinson's Association of Ireland (PAI).^[5] Studies have also suggested a significantly higher prevalence of PD amongst men, who are 1.5 times more at risk than their counterparts.^[6]

The pathophysiology hallmark of Parkinson's disease is predominantly characterised by the progressive degeneration of dopaminergic neurons in the brain particularly the substantia nigra and locus coeruleus. The symptoms usually develop slowly over years and generally only occurs when around 80% of the neurons in the substantia nigra are lost. Despite the fact that its cause is still unknown, it is thought that genetic and environmental factors appear to play a role. An interesting find is the association between ambient air pollution from traffic sources and PD where participants with higher exposure to certain toxins have a higher risk of PD.^[7] It is also well accepted that presence of microscopic markers, Lewy bodies and the content in them, α -synuclein do hold an important clue to the cause of PD.^[8]

Parkinson's disease mainly affects movements, producing motor symptoms but it may also affect anatomical areas ranging from the brainstem to neocortex and neurotransmitter systems, rendering non-motor symptoms. The spectrum of these non-motor disturbances is very broad; composed of autonomic dysfunction and neuropsychiatric problems involving cognition, behaviour, mood or thought alterations which have an impact on one's day-to-day lives, inflicting their quality of life and autonomy in tasks such as driving. The Movement Disorder Society-sponsored Unified Parkinson's Disease Rating Scale (MDS-UPDRS) is used by clinicians to gauge the symptom progression of PD.^[9] It incorporates elements from several

scales to create a comprehensive tool to evaluate both the motor and non-motor experiences of daily living with PD. The MDS-UPDRS is also used with two other Parkinson's rating scales: a modified Hoehn and Yahr Scale ^[10], and the Schwab and England Activities of Daily Living (ADL) Scale. ^[11]

To date, all treatments for Parkinson's disease are symptomatic which shows no attempt in slowing or halting the disease progression while extensive research into developing new treatments for Parkinson's continues; in hopes of finding a cure. Medications like Levodopa and dopamine agonists are the mainstay of treatment to help relieve the symptoms for PD patients while some may require supportive therapies, and possibly surgical procedures to mediate symptoms that do not improve with medication adjustments. ^[12] As research progresses, there are likely to be better treatments available over time which will enhance the quality of life of people with PD.

Parkinson's Disease and Driving

Driving as a multitasking activity is a demanding task for people with Parkinson's disease. The declining motor skills like bradykinesias makes it difficult for them to react rapidly and accordingly to the ever-changing road conditions. An analytic study by D. Holmes et al. discussed the impact of PD on participants' driving skills, one of which included the modified driving behaviours by PD drivers. ^[13] Participants highlighted how they avoided various driving environments such as the downtown and adapted compensatory behaviours or strategies. Some would plan route rest stops and avoid switching lanes while driving. Participants also expressed their struggles in getting in and out of the car as well as donning seatbelts. Vision issues on the other hand has kept many drivers off the road in the dark, or in winter weather. Aside from these motor, cognitive, and visual impairments that can affect driving, somnolence is also common in advanced stages of PD or as a result from the dopaminergic medications. ^[14] This includes excessive daytime sleepiness (EDS) and sudden onset of sleep (SOS) which attributes to the fact that PD patients are unfit to drive. Findings uncovered that up to 50% of patients with PD have reported inappropriate sleepiness during waking hours. ^[15]

There are three main driving assessments for doctors to refer to when making decisions on fitness to drive for their patients with Parkinson's disease. Namely, questionnaires and structured interview, off-road tests, and on-road tests. ^[16] For example, naturalistic driving tests on the road expose tactical errors made and gives insight into everyday driver behaviour. These examinations provide a personalised assessment of the individual's driving skills whereby recommendations on adjustments to driving habits or the vehicle itself could be given thereafter. It obviously makes sense that these clinician assessments form the basis of licence issuance for people with PD, but one questions its accuracy and adequacy. Some of these tests do not produce a pass/fail result which makes it hard to justify driving competency. As a matter of fact, there are no well-established epidemiological findings on the crash risks in PD. ^[17] Two existing studies on accident rates revealed PD patients are not more prone to cause auto accidents than ordinary people. ^[18, 19] It was suggested that the most PD groups implemented strategic compensation or executed early driving cessation. To this end, while the assessments and severity of parkinsonism can inform about the potential risks for undesired driving outcomes, the evaluation of patients' driving ability is very difficult to carry out and very much dependent on empirical observations of performance. In response, physicians often feel uncomfortable in providing advice and suggestions due to a lack of established practice parameters or uniform guidelines.

Nevertheless, these existing tests imposed by driving authorities explore the linkages between motor, visual, and cognitive abilities and driving behaviour have formed a part of the formal assessment of fitness-to-drive. At present, rating scales like the aforementioned Hoehn and Yahr Scale somewhat elucidates a means of measuring one's ability to perform daily activities like driving; with stages 1 through 5. ^[10] Dr. Comella stated "*There is clearly a difference in Parkinson's disease when going from stage 2 to stage 3, one would have anticipated worsening in driving skills with the increasing disability.*" ^[20] PD drivers who are at the marginal of their driving capacity should be offered help from driving rehabilitation specialists (DRS) for driving rehabilitation or retraining to refine those skills needed for safety driving before their reassessment for driver recertification.

Parkinson's Disease and Road Safety Authority (RSA) Guidelines

Standards in assessing fitness to drive from a medical standpoint have been adapted internationally to assist doctors and healthcare professionals in advising patients on their fitness to drive. In Ireland, the *Sláinte agus Tiomáint* Medical Fitness To Drive (MFTD) Guidelines developed by the National Office for Traffic Medicine (NOTM), is updated annually to warrant representation of necessary medical conditions like sleep apnoea, alcohol problems, stroke, and of course, Parkinson's disease.

The guidelines are categorised into two subgroups – Group 1 and Group 2 – based on the type of vehicle, where Group 1 represents cars, motorcycles, and work vehicles whilst Group 2 vehicles being buses and trucks. Per the 2021 edition ^[21], Group 1 drivers are permitted to drive provided the condition does not impair safe driving as well as considering medications, especially those that causes tendency to drowsiness or sleepiness like pramipexole and ropinirole ^[22]. The MFTD guidelines also discussed the need to assess rehabilitation, specialist on-road assessment, and adaptations where licence will be granted if subjected to satisfactory reports. Individuals of Group 2 vehicles which are regarded as higher-risk vehicles are not permitted to drive if their condition is disabling or when there is clinically significant variability in motor function unless subjected to an individual consultant assessment with annual review. Both group drivers must however notify the National Driver Licence Service (NDLS) about their diagnosis with or without regards to automobile modifications when applying for or renewing driving licences. The individual's driving licence will then be coded to reflect the modifications where appropriate.

Sláinte agus Tiomáint also illustrates and guides medical doctors in completing the medical report form (D501) ^[21], which includes the assessment of the overall health of the driver and incorporating the specialist opinion, deeming patients' fitness to drive. This etches an important recognition and acknowledgement of the driving challenges faced by drivers with PD which could ultimately strike a balance between the public safety and the promotion of opportunities and optimal quality of life for them.

While the enactment of MFTD guidelines have been associated with a 45 per cent reduction in crash accidents among drivers with certain conditions, the literature is only perfect insomuch

as a physician's judgement and conviction may not provide an adequate assessment to determine driving competence in these drivers. Not to mention, the ethical obligation certainly has put rising pressure on healthcare providers to come up with favourable assessments for their patients where it emerges a dilemma between encouraging them in keeping an active and engaged life versus imposing driving cessations for them to follow. A meta-analysis by Trevor Thompson et al. concluded that, even though PD patients were no more likely to be involved in a crash accident than healthy control drivers, they were however more likely to fail on-road driving assessments, simulator driving test or other equivalent assessments. ^[23] While it is understandable the initiation of mandatory reporting and retesting for people with significant cognitive impairment – PD patients included – may seem like the strategy to diminish automobile accidents, it definitely does not provide all answers.

Directions for the Future

With the primary aim of the Irish State Government to reduce the number of deaths and serious injuries by 50 per cent in the coming 10 years ^[24], revision of the fitness-to-drive assessment guidelines must be continued yearly to address a holistic discussion on the topic of driving competency in people with chronic illnesses. The idea of a restricted licence which would permit a person to drive only within a fixed distance of their home for instance, or only during daylight hours could be constructed for not all PD patients might be in favour of the proposition of complete driving cessation. Medical fitness-to-drive assessments could also be improved by compiling a battery of suitable tests by related professionals such as psychiatrist, psychologist, neurologist, therapist along with driving instructors to put together a good evaluation for driving safety in PD. There is surely a need to review the current health system by directing it to a greater and harder assessment of the psychological dysfunctions of all types of drivers – not just Parkinson's disease. The extent of public transport options in Ireland in lieu of driving also needs refinement. Albeit there has been an increase in the use of public transport in recent years but the way to travel around Ireland continues to rely heavily on private cars. ^[25] Case in point, the lack of public transport as well as the high number of one-off houses and supermarkets in suburbs and rural areas only further encourages the use of private vehicles. On hindsight this leaves many PD drivers hesitant on giving up their licence.

At an international level with the rapid advances in the technology of autonomous vehicle that uses Adaptive Driver Assistance Systems (ADAS), the future of self-driving cars may be imminent. The National Highway Traffic Safety Administration (NHTSA) has defined vehicle automation in 6 levels, ranging from no driving automation (level 0) to full driving automation (level 6). [26] Dotzauer M et al. proved ADAS boosted driving outcomes in PD groups. [27] When equipped with ADAS, drivers appear to cross more often with a critical time-to-collision (TTC) value and crossed intersections in a shorter time span. Presently, only few studies have investigated the highest level of automation, level 3 where the driver still needs to take-over manoeuvring of the vehicle. Future research should include PD drivers and target on higher levels of automation. Prof O'Neill, the Director of the National Programme Office for Traffic Medicine (NOTM) cites that they are in fact keeping in touch with the International Transport Research Board to be informed on the progress of vehicular automation. [28]

Conclusion

As motorisation continues to grow which brings about the development of driverless vehicles, the number of traffic deaths at the same time multiplies indefinitely. This underlines the urgency for an expanding and cohesive traffic medicine. I believe if all agencies work hand-in-hand with the healthcare system, it is possible to better inform and raise drivers' awareness on the risk of driving while suffering from chronic illnesses like Parkinson's disease. Geriatrics which is closely related to Parkinson's disease should also be given attention to, could potentially accelerate the search for a cure for PD.

A study carried out by a team in Tallaght Hospital underlined that the number of Irish people with Parkinson's disease is predicted to triple by 2046, accounting for an increasing proportion of health expenditure over the next 20 years. [29] This goes without saying, much research studies are needed to be done to meet those demands in preserving the patient's mobility and independence while maintaining traffic security and preventing road accidents. Unfortunately, Parkinson's charity gets no core funding from the Irish government. [30] Regardless, by acknowledging driving as an indispensable activity that symbolises autonomy and the ubiquity of Parkinson's disease, we must not ignore the impact of driving on Parkinson's disease but more importantly come together to build a silver lining – an egalitarian and safe society.

Bibliography

1. Fallon I, O'Neill D. *The world's first automobile fatality*. *Accid Anal Prev* 2005 Jul;37(4):601-3.
2. Evans, L. *A short history of the International Traffic Medicine Association (ITMA)*. July 2010. Available from: <https://www.trafficmedicine.org/wp-content/uploads/2017/11/ITMAhistory.pdf>.
3. Savage, Ian. *Comparing the fatality risks in United States transportation across modes and over time*. *Research in Transportation Economics*. 2013;43. 9–22. 10.1016/j.retrec.2012.12.011.
4. Bodis-Wollner I. *Neuropsychological and perceptual defects in Parkinson's disease*. *Parkinsonism Relat Disord*. 2003 Aug;9 Suppl 2:S83-9.
5. Parkinson's Association of Ireland. *What is Parkinson's Disease*. Available from: <https://www.parkinsons.ie/what-is-parkinsons-disease/>.
6. Wooten GF, Currie LJ, Bovbjerg VE, et al. *Are men at greater risk for Parkinson's disease than women?*. *Journal of Neurology, Neurosurgery & Psychiatry*. 2004;75:637-639.
7. Beate Ritz, Pei-Chen Lee, Johnni Hansen, Christina Funch Lassen, Matthias Ketzel, Mette Sørensen, and Ole Raaschou-Nielsen. *Traffic-Related Air Pollution and Parkinson's Disease in Denmark: A Case–Control Study*. *Environmental Health Perspectives*. 2016;124:3
8. Xu L, Pu J. *Alpha-Synuclein in Parkinson's Disease: From Pathogenetic Dysfunction to Potential Clinical Application*. *Parkinsons Dis*. 2016;2016:1720621.
9. Goetz CG, Fahn S, Martinez-Martin P, Poewe W, Sampaio C, Stebbins GT, Stern MB, Tilley BC, Dodel R, Dubois B, Holloway R, Jankovic J, Kulisevsky J, Lang AE, Lees A, Leurgans S, LeWitt PA, Nyenhuis D, Olanow CW, Rascol O, Schrag A, Teresi JA, Van Hilten JJ, LaPelle N. *Movement Disorder Society-sponsored revision of the Unified Parkinson's Disease Rating Scale (MDS-UPDRS): Process, format, and clinimetric testing plan*. *Mov Disord*. 2007 Jan;22(1):41-7.
10. Goetz CG, Poewe W, Rascol O, et al. *Movement Disorder Society Task Force report on the Hoehn and Yahr staging scale: status and recommendations*. *Mov Disord*. 2004 Sep. 19(9):1020-8.
11. Siderowf, A.. *Schwab and England Activities of Daily Living Scale*. 2010;10.1016/B978-0-12-374105-9.00070-8.

12. Paolini Paoletti F, Tambasco N, Parnetti L. *Levodopa treatment in Parkinson's disease: earlier or later?*. Ann Transl Med. 2019;7(Suppl 6):S189.
13. Jeffrey D. Holmes, Liliana Alvarez, Andrew M. Johnson, Amy E. Robinson, Kaylie Gilhuly, Emily Horst, Aaron Kowalchuk, Kayleigh Rathwell, Yanni Reklitis, Nolan Wheildon. *Driving with Parkinson's Disease: Exploring Lived Experience*. Parkinson's Disease. 2019.
14. Comella CL. *Sleep disorders in Parkinson's disease: an overview*. Mov Disord. 2007 Sep;22 Suppl 17:S367-73.
15. Knie B, Mitra MT, Logishetty K, Chaudhuri KR. *Excessive daytime sleepiness in patients with Parkinson's disease*. CNS Drugs. 2011 Mar;25(3):203-12.
16. Jitkriksadakul O, Bhidayasiri R. *Physicians' role in the determination of fitness to drive in patients with Parkinson's disease: systematic review of the assessment tools and a call for national guidelines*. J Clin Mov Disord. 2016;3:14.
17. Homann CN, Suppan K, Homann B, Crevenna R, Ivanic G, Ruzicka E. *Driving in Parkinson's disease - a health hazard?*. J Neurol. 2003 Dec;250(12):1439-46.
18. Sims RV, McGwin G Jr, Allman RM, Ball K, Owsley C. *Exploratory study of incident vehicle crashes among older drivers*. J Gerontol A Biol Sci Med Sci. 2000 Jan;55(1):M22-7.
19. Hu PS, Trumble DA, Foley DJ, Eberhard JW, Wallace RB. *Crash risks of older drivers: a panel data analysis*. Accid Anal Prev. 1998 Sep;30(5):569-81.
20. Susan Fitzgerald. *For your patients-Parkinson's disease to drive or not to drive? New data, points to discuss with PD patients*. NeurologyToday. Oct 2018. Available from: https://journals.lww.com/neurotodayonline/Fulltext/2018/10040/For_Your_Patients_Parkinson_s_Disease_To_Drive_or.8.aspx.
21. Údaras Um Shábháilteacht Ar Bhóithre, Road Safety Authority. *Sláinte agus Tiomáint, Medical Fitness to Drive Guidelines (Group 1 and 2 Drivers)*. April 2021. Available from: <https://rcpi-live-cdn.s3.amazonaws.com/wp-content/uploads/2021/04/NDLS-Sla%CC%81inte-Tioma%CC%81int-Final-Version-29.04.21.pdf>.
22. Yeung EYH, Cavanna AE. *Sleep Attacks in Patients With Parkinson's Disease on Dopaminergic Medications: A Systematic Review*. Mov Disord Clin Pract. 2014 Sep 1;1(4):307-316.

23. Thompson T, Poulter D, Miles C, Solmi M, Veronese N, Carvalho AF, Stubbs B, Ue EY. *Driving impairment and crash risk in Parkinson disease: A systematic review and meta-analysis*. *Neurology*. 2018 Sep 4;91(10):e906-e916.
24. Road Safety Authority. *Our Journey Towards Vision Zero, Ireland's Government Road Safety Strategy 2021-2030*. Dec 2021. Available from: https://www.rsa.ie/docs/default-source/default-document-library/government-road-safety-strategy-2021-2030-13th-dec21-final.pdf?sfvrsn=cf289e63_3.
25. Department of Transport. *Transport Trends 2020: An Overview of Ireland's Transport Sector*. Feb 2021. Available from: <https://igees.gov.ie/wp-content/uploads/2021/03/Transport-Trends-2020.pdf>.
26. National Highway Traffic Safety Administration (NHTSA). *The road to full automation*. NHTSA. 2018. Available from: <https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety>.
27. Dotzauer M, Caljouw SR, de Waard D, Brouwer WH. *Intersection assistance: a safe solution for older drivers?*. *Accid Anal Prev*. 2013 Oct;59:522-8.
28. Medical Independent (MI). *Driving developments in the field of traffic medicine*. MI. 2017. Available from: <https://www.medicalindependent.ie/driving-developments-in-the-field-of-traffic-medicine/>.
29. Tallaght University Hospital. *Tallaght hospital study highlights the needs of the rapidly growing population with Parkinson's disease in Ireland*. April 2016. Available from: <https://www.tuh.ie/News/Tallaght-Hospital-Study-Highlights-the-Needs-of-the-Rapidly-Growing-Population-with-Parkinson%E2%80%99s-Disease-in-Ireland.html>.
30. Irish Institute of Clinical Neuroscience. *Parkinson's Association of Ireland*. Jan 2022. Available from: <https://iicn.ie/parkinsons-association-of-ireland/>.