Exploring driving behaviour from the perspectives of individuals with chronic pain and health professionals

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Abstract

Chronic pain affects one in five Australians, and this could impact daily activities such as driving. Driving is a complex task, which requires the cognitive and physical ability to predict, identify, and respond to hazards to avoid crashing. However, research exploring the factors that influence safe driving behaviour for chronic pain individuals is limited. A qualitative study was conducted which involved semi-structured interviews with 23 people who had experienced persistent pain for at least three months and 17 health professionals who had experience working with individuals with chronic pain. The aim of this study was to obtain a deeper understanding of the experiences and challenges that people with chronic pain may have in their day-to-day driving. Participants were also asked about currently available driving assessments and strategies for individuals with chronic pain in the Australian healthcare system. The themes emerging from the interviews highlighted the need for clearer guidelines and educational materials regarding the impact of chronic pain on an individual's ability to drive. These themes included the physical and cognitive challenges resulting from chronic pain, as well as the potential side effects of pain medications. In addition, participants identified a number of self-regulation strategies and driving assessments currently available for monitoring safe driving behaviour in Australia. This study improves our understanding of how chronic pain affects driving behaviour, as reported by individuals experiencing the pain and relevant health professionals. Recommendations for improving the safety of drivers with chronic pain are discussed, including possible technological interventions and better public education.

Keywords: Chronic pain; self-management; driving behaviour, self-regulation strategies; driving assessment

1. Introduction

Driving is an instrumental activity of daily living, associated with increased independence, community engagement and social participation [4]. While driving can positively impact quality of life, reliance on motor vehicles can have adverse consequences, with approximately 1.3 million road fatalities and 50 million road traffic injuries occurring globally each year [26]. Road safety is considered both a human right and a global priority [21].

Chronic pain may increase crash risk. A recently published systematic review indicated that drivers experiencing chronic pain often report difficulties at each level of the driving task, including using operating systems within the vehicle, performing driving manoeuvres and executing the high-level planning and decision-making needed to complete a journey [23]. These findings highlighted that driving should be considered an intervention target and routinely assessed for those experiencing chronic pain. However, the authors concluded that there was an insufficiently detailed understanding of this issue for informing policy and guideline development for supporting the safe vehicle mobility of drivers with chronic pain.

In most countries, people who have a health condition that may adversely affect their ability to drive safely require clearance from a licensing jurisdiction to either commence driving or continue to drive. This process may require the individual to undertake an assessment of one's off-road and on-road driving skills to determine their fitness-to-drive. Individuals can either pass or fail this assessment or be referred for driver rehabilitation. Driver rehabilitation is recommended when there is sufficient evidence to indicate that individuals have the potential to pass a subsequent assessment after receiving appropriate treatment [REF].

While driving rehabilitation is primarily delivered by specialist occupational therapists, it is also common practice globally for individuals to receive multidisciplinary input from practitioners who have expertise in driver education, traffic safety and rehabilitation counselling [9; 25]. Driving rehabilitation can encompass treatment approaches such as car adaptations/modifications, lessons with a driving instructor, computer-based driving simulator training, off-road skill-specific training, and off-road education programmes [22].

Even though driving rehabilitation has the potential to improve driving performance and safety for individuals with chronic pain, little is known about how specific pain-related driving difficulties can be effectively addressed. Previous studies have mainly focused on self-regulation strategies such as driving avoidance or self-restriction [23]. For other populations of drivers with potential impairments, such as older adults and individuals with an acquired brain injury, off-road skill-specific training and computer-based driving simulator training have been shown to be effective [22].

This study aimed to obtain a deeper understanding of the experiences and challenges individuals with chronic pain may have in their day-to-day driving in order to identify avenues for research and more effective treatment. Two studies using a qualitative research design and interpretative phenomenological analysis (IPA) were conducted to provide insight into (1) driving difficulties experienced by individuals with chronic pain, (2) the current model of care for driving rehabilitation in Australia, (3) the driving-related treatment or adaptation strategies that individuals with chronic pain have found useful and (4) the barriers and enablers associated with adequately addressing the driving challenges experienced by the chronic pain population.

2. Study 1: Perspective of Individuals with Chronic Pain

In study 1, a group of individuals with chronic pain were identified and interviewed to (1) enhance the understanding of the needs and challenges associated with the lived experience of driving in adults experiencing chronic pain, (2) identify barriers to safe driving, (3) gain an understanding of the current assessments and treatments offered for safe driving in this population and (4) identify the driving-related treatment or adaptation strategies that are perceived as being valuable.

2.1. Methods

2.1.1 Participants

Participants initially were recruited from two chronic pain clinics, one located in Queensland and one in Victoria, Australia. Clinicians at each site explained the study verbally and provided an information sheet

to potential participants. Permission to be contacted by a research officer via phone/email was obtained to further discuss participation in the study. In addition, participants were also recruited using snowball sampling via social media (Twitter and Facebook) advertisements which included a brief description of the study in order to recruit a more representative sample of the pain population across Australia. Interested individuals were invited to contact the research team by email/phone to assess their eligibility to participate.

Eligibility criteria were that participants (1) had experienced chronic non-cancer pain for at least three months, (2) were over the age of 18 years and held a valid Australian Driver's licence, (3) had not been diagnosed with a condition affecting their vestibular or central nervous systems, or their visual acuity. Eligible participants were invited to take part in a semi-structured interview following a conversation with a member of the research team via email/phone. They were given a week to consider their participation, and informed consent was obtained prior to the scheduled interview. Participation was voluntary, and participants could choose to withdraw at any point.

2.1.2 Procedure

This study was conducted in accordance with the guidelines of the National Statement on Ethical Conduct in Human Research. The method is reported using the COnsolidated criteria for REporting Qualitative research (COREQ) [2; 20]. Participants completed a short survey (see Section 2.1.3) prior to commencing their interview. Participants were interviewed via phone for between 45 and 60 minutes. An interview guide was developed by AV, NA and OO and reviewed by other members of the research team (MH, VJ, PD). Interviews were semi-structured and involved open-ended questions covering broad topics related to participants' experience and difficulties with driving, self-regulation strategies utilised while driving and any barriers to addressing their driving challenges by their healthcare providers. The interview guide is included in Appendix A.

Participants were interviewed by a female research officer (FA), with experience as a final year pre-registration occupational therapy student, employing established principles for conducting qualitative research interviews [12]. The interviewer did not have a prior relationship with participants. All interviews

were audio-recorded and transcribed verbatim by the research officer who conducted the interviews. The number of participants recruited for this study was determined by the point at which data saturation was reached (i.e., when there was limited, new information obtained from additional interviews). To reduce the participant's time commitment, transcripts were not returned to the participant for review. However, participants were encouraged to contact the research team if they wished to share any additional information after the interview. On completion of the interview, all participants received a $50 AUD digital gift card to acknowledge their contributions to this research.

2.1.3 Demographic and Pain Questionnaire

Demographic information was collected on participants' gender, age, highest education, and employment status. The pain characteristics of the sample including pain location, duration of the pain, pain severity and pain interference were collected using *Brief Pain Inventory* (BPI) [REF1]. High-to-moderate quality evidence supports the internal consistency, criterion-convergent validity and, structural validity of the BPI [see review: [REF2].

In addition, participants were asked to self-report the occurrence of motor vehicle crashes before and since the onset of their pain and if they perceived their pain condition contributed to their motor vehicle crash. A motor vehicle crash was defined as any incident involving a vehicle that resulted in a personal injury, damage to a vehicle or other property.

2.1.4 Data analysis and trustworthiness

All the transcribed interviews were imported into the Nvivo 11 software program for qualitative analysis by AV. An Interpretative Phenomenological Analysis (IPA) [17] was used to analyse the individual interview data. This qualitative analysis approach provides an in-depth and detailed analysis of a person's lived experience and is widely used in the pain field [1; 10; 11]. Transcripts were analysed by two researchers (AV, NA) with experience in qualitative data analysis. The process involved familiarisation with interview transcripts, independently identifying meaningful text, and formulating emergent themes from exploratory notes. AV and NA regularly discussed the emergent themes from each transcript data, and

the coding evolved from these discussions. Following analysis of individual transcriptions, a cross-case analysis was conducted, identifying shared themes across all transcripts.

The trustworthiness of the coding was established through the use of reflexive discussions between the researchers (AV, NA) throughout the analysis [24]. In addition, an independent review of emerging themes and subthemes were conducted by three additional members of the research team (FA, OO, VJ) with diverse backgrounds in occupational therapy, driving behaviour, physiotherapy, and occupational health and safety. A reflexive statement about the research team involved in data collection and analysis is included in Appendix D.

2.2. Results

A total of 23 participants were consented to participate in the study consisting of 14 females and nine males (aged 24-68 years, *M* = 51.5, *SD* = 12.7). All participants held an open Australian driver's licence, with a mean of 30.9 years of driving experience (*SD* = 12.9, range 5-50 years). Participants reported driving an estimated 10,916 kilometres (*SD* = 12,920, range 960-15000 kilometres) and 388.3 hours (*SD* = 485, range 26-2495 hours) on average per year. The details of the individual participants' demographics, pain characteristics and history of traffic crashes are included in Table 1. The general pain characteristics of the chronic pain sample included in Appendix B. Participants' names have been replaced with an identifier to protect their anonymity (i.e., P1, P2, ...).

[Table 1: Demographics, pain characteristics and history of traffic crashes of participants in Study 1]

The analysis below explores the perspectives of chronic pain patients on the following three main themes (1) driving difficulties experienced by individuals with chronic pain, (2) the barriers to adequately addressing driving challenges for this population, and (3) strategies utilised by individuals with chronic pain to overcome difficulties experienced while driving. Tables 2-4 show a detailed analysis of themes and subthemes that emerged during the interviews across each individual participant.

[Tables 2-4 about here- Study 1 themes and subthemes]

2.2.1 Driving difficulties experienced by individuals with chronic pain

All participants reported that driving-related prolonged and repetitive movements were pain-provoking and had an impact on their driving. In particular, twenty participants (86%) reported that prolonged sitting associated with driving exacerbated their pain. P8 stated, "Sitting for long periods of time in the car becomes an issue…. and then you're in so much pain. I think that's when accidents are likely to happen because you're not concentrating because the pain just overwhelms you."

Participants also reported that experiencing pain resulted in changes to their driving behaviour, such as increased difficulty monitoring the road environment, slower reaction times, occurrences of distracted mental states, and poorer vehicle control. Regarding monitoring the road environment, fourteen participants (61%) reported that engaging in repetitive twisting of the neck and back to perform regular safety checks provoked their pain. P5 stated, "…shoulder checking to look right is probably the biggest problem I have noticed. To give way, to change lanes...I do remember…many times when my neck has been sore, I'm like, oh that hurt." In addition, eight participants (35%) also commented on physical and cognitive limitations impacting their response time while driving. P4 reported on her knee pain affecting her reaction when required to brake abruptly, "Knee pain affects my reaction times because my knee is really swollen. If I drive and my knee is bent for a long time, then it gets swollen, so it affects my ability to brake quickly." Participants also reflected on pain influencing their perceptual-cognitive skills, which affected their attention and reaction time. P23 reported on difficulties with concentration: "I have to concentrate a lot harder. My reaction time is a lot slower than it used to be" and P15 was apprehensive about responding quickly in the event of an emergency "Look, it hasn't happened, but if I have to jump on the brake, then I am not sure I would be able to if a car just cut in front of me." Ability to control the vehicle was also impaired, for example, P23 reported increased energy expenditure and altered sensation when gripping the steering wheel "Well I don't think that impacts on my ability to drive the car, it's just a sensation that I feel, and other times it's not there. I think other times I have to hold on harder, every now and then." P14 also commented on the impact of altered sensation on the ability to use pedals: "When I drive long distances, my pain flares up. I have this sensation in my feet that can be an issue with feeling them, knowing how hard I am pushing [the pedals]."

Ten participants (43%) reported lower distress tolerance and anxiety because of being in constant pain "just having the pain all the time you lose your patience." (P2). P2 also reported unsafe driving as a result of increased pain affecting their temperament while driving "Sometimes my pain is bad, I will become more irritable and might not be the safest driver, I could probably become a bit pushy." and feeling anxious about having to react suddenly "Merging into traffic makes me a little anxious because I don't want to have to turn suddenly." (P8).

Participants also reported that their chronic pain interferes with some driving tasks. For example, driving during adverse weather conditions; "Heavy rain or fog, where the car is misting up, you tend to lean toward the steering wheel more so that puts more stress on the back." (P22), getting in and out of the car, "Getting in and out of the car has changed for me." (P11), and loading the vehicle, "I have to be careful to put stuff in the car, how much lift, getting things in and out of the car is difficult." (P2).

2.2.2 Strategies utilised by individuals with chronic pain to overcome difficulties experienced while driving

All participants reported that chronic pain impeded their driving ability to a degree. However, to mitigate these challenges, participants utilised a number of strategies to safely manage driving demands and pain-related difficulties. These strategies can be broadly considered as a form of "self-regulation" of driving behaviour. Most participants used one or multiple self-regulation strategies to cope with their pain while driving.

Some of the strategies included planning their journey by avoiding driving in certain contexts to minimise pain interference. Fifteen participants (65%) reported avoiding driving during peak traffic hours and on unfamiliar roads. P8 reported, "I avoid peak hours at all costs because that means that I am sitting for longer, which then impacts my back, and I find that hard. So, I definitely pick the time of the day that I drive." P2 also added, "If I've got pain and I'm supposed to go somewhere that I haven't been before, I might feel less confident about going there and might decide not to go." Thirteen participants (57%) noted refraining from driving when experiencing high pain levels to ensure safety. P3 reported, "If my pain is too high, then I won't drive because it is just not safe."

Participants also discussed varying driving tasks by breaking up the drive (i.e., activity pacing), reducing the frequency of trips, decreasing the distance of the drive, or asking others to share the drive. Regarding pacing the driving task, P6 reported planning for timed rest breaks to alter positions, "When I'm driving long distances, I still stop and get up and move around a bit and then get back in the car". P16 talked about adjusting his driving pattern to better cope with the pain, "I just drive shorter trips now. I cannot be in the car longer than 20 to 30 minutes; I need to take breaks".

Participants also discussed medication management, including adjusting the timing of medication intake. P5 said, "A few of the medications have drowsy tags on them. If I do need to drive early in the morning, then I don't take my morning tablets and take my night tablets 3 hours earlier than I would. I just adjust really and only drive at certain times of the day." P3 spoke about avoiding driving under the influence of strong medications, "When I take the stronger medication, I can't concentrate, so I don't drive". However, two participants also highlighted fatigue and drowsiness as unavoidable side effects of some of the pain medications, "Part of the side effects [of medications] are being tired, I sleep every lunchtime." (P21). Other side effects reported by P16 were "Tiredness, lack of concentration, forgetfulness and overall slower reaction time."

In addition, participants mentioned vehicle modifications and the use of advanced driver assistance systems (ADAS) to reduce the impact of chronic pain. P6 reported using a combination of adaptations to reduce the physical load when seated, as well as timed rest breaks to alter positions. "The first change is my physio recommended wedged cushion to make sure that my knees are below my hips. I use this when driving". Regarding the use of ADAS, P7 and P13 discussed the use of cruise control to avoid static body positions while driving at a constant speed: "For long distances, I use cruise control so that I can move my foot around more often, and I don't have to have it stuck to the accelerator, and I can maintain the speed limit." (P13). P17 reported using blind-spot warning to compensate for neck pain while driving: "Looking over my shoulder is sometimes hard, so the blind spot detector would help." P20 also added that an automatic vehicle reduced the physical demands of driving: "I drive an automatic car most of the time, so I just straighten it, and I don't really need it", and P8 said a higher vehicle increased the ease of transfers in and out of the car "I bought a car that was a little bit higher to make getting into easier."

Participants also discussed particular behaviours while driving. Four participants (17%) mentioned avoiding or adapting how they performed certain driving manoeuvres. P22 preferred to stay in the same lane for the duration of his journey: "So, I just stick to the one lane as well as much as I can, so I don't really swap lanes like I used to because one is moving faster you know, so then I have to be stuck in that slower flow." When changing lanes or merging, the participants reported more frequent use of mirrors to avoid shoulder checks, "I check my mirrors a lot more if I'm going to change lanes so that I'm not having to turn around and check my blind spot as much again" (P8). Another participant discussed needing more time reversing, "I usually just wait till there aren't many cars at all [before reversing]. I tend to avoid car parks where there is something behind me, or some sort of blind turn." (P22)

Finally, participants reported behavioural changes when controlling their vehicle, such as reducing their speed, purposefully being more attentive, and engaging in activities that distract them from the pain. Three participants (13%) reported generally adopting driving at a lower speed to reduce their risk of adverse events while driving, "I have been a lot more aware, and I have had to slow down. Like I always drive 10 km under the speed limit." (P23). P7 discussed being more attentive, "I really concentrate a lot more on driving. I am more attentive as there is a risk of an accident. I think I am more attentive than others on the road...as I feel if there were an accident people would likely blame me as I have chronic pain. I am on medications, regardless of whose fault it is." P1 shared how engaging in a secondary task could distract him from the pain while driving, "I guess I would play music really loudly because I'm distracted by singing the song. "

2.2.3 Barriers to adequately addressing driving challenges for this population

Participants experiencing chronic pain discussed their perception of the barriers related to adequately addressing driving difficulties. Eighteen participants (78%) reported that health professionals had not broached the topic of driving during the course of their assessments or treatments. Additionally, thirteen participants (57%) stated that the effects of medications on their driving ability was seldomly raised during consultations or at pain rehabilitation programs. P18 stated that the onus was upon the individual to self-assess their own ability and refrain from driving if required: "It's up to the individual. There's not a lot of monitoring there I found, and if I had been a negligent person, I probably could have done a bit of damage

in my own private vehicle, things that I probably shouldn't have done. " P17 recalled a general discussion about driving when being prescribed medications, however, he added that the conversation did not prompt any self-reflection, "They don't mention it other than medications. They might say do you drive. I say yes. If I say I drive or I drive here, I get a surprised look. But no one has sat down and asked me these kinds of questions. This is the first time I have had to analyse and think about my driving history in such detail. And that could be something that health professionals could do is ask questions like these."

Driving is the main mode of transport for many Australians; therefore, self-initiating a conversation regarding concerns about driving was perceived as confronting for three of the participants (13%). P5 reported, "Umm... it's hard, you don't want to be restricted from driving. I guess [pause] like I have said to you, I have had times where my medication affected me, and I had to pull over. Whether it was my pain meds or other medications, I can't be sure. But I can't be the only one". Similarly, P9 reported more generally that the risks would outweigh the benefits of self-reporting, "No one's ever asked me. Most people with disabilities aren't likely to bring it up because we don't want to be told we can't drive because that would severely impact our actual freedom to get around in the world. So, obviously, we want to keep driving. So, I wouldn't be likely to mention it unless I thought I was a danger on the road."

3. Study 2 - Perspective of Health Professionals

In study 2, a group of health professionals with experience working with individuals with chronic pain was identified and interviewed to (1) enhance the understanding of the driving difficulties experienced by individuals with chronic pain, (2) establish current driving assessments, treatments, and barriers to adequately addressing driving and, (3) identify the potential risks associated with chronic pain experienced while driving from the perspective of health professionals.

3.1. Methods

3.1.1. Participants

Participants were recruited via the RECOVER Injury Research Centre team and through snowballing (where health professionals forwarded an invitation email to potential participants). In addition, an

advertisement was shared via social media to recruit a larger sample of health professionals across Australia. Participant eligibility was based on their occupation and experience working with individuals with chronic pain. The sample included health professionals from chronic pain clinics, general practitioners, and community-based occupational therapy driving assessors.

3.1.2. Procedure

This study was conducted in accordance with the guidelines of the National Statement on Ethical Conduct in Human Research. Participants were interviewed via the phone or face-to-face, depending on participants preference and availability. Participants were interviewed by two research officers with experience as final year pre-registration occupational therapy students, who used established principles for conducting qualitative research interviews [12]. Interviews were semi-structured and lasted approximately 40-60 minutes. Questions covered broad topics related to health professionals' perspectives on driving difficulties experienced by individuals with chronic pain, barriers to adequately assess driving, and the current model of care in Australia concerning available assessments and treatments of safe driving for a chronic pain cohort (Interview guide included in Appendix C). All interviews were audio-recorded and transcribed verbatim by the same researcher who conducted the interviews. Transcripts were emailed to participants, who were asked to confirm their accuracy.

3.1.3. Data analysis, and trustworthiness

The same data analysis procedures used in study 1 were followed in study 2. All the transcribed interviews were imported into the Nvivo 11 software program for qualitative analysis by AV. An Interpretative Phenomenological Analysis (IPA) [17] was used to analyse the individual interview data where two of the authors (AV, NA) independently analysed each transcript and then reached an agreement regarding any differences. The trustworthiness of the coding was established using reflexive discussions between the researchers and via the verification of the transcript interviews by participants.

3.2. Results

A total of 17 individuals participated in this study, consisting of ten females and seven males (aged 31-72 years, *M* = 44.6, *SD* = 11.9). Twelve participants (70.6%) held full-time employment; five (29.4%) were part-time employees. The professions of the sample consisted of eight occupational therapists (47.1%), four pain specialists (23.5%), three general practitioners (17.6%), one clinical psychologist, and one research fellow. Twelve participants reported working in regional Queensland, two from rural Queensland, two from Victoria and one from Australian Capital Territory. Their average number of years of professional experience was 19.4 years (*SD* = 12.1, range 4-46 years), and experience with chronic pain clients was 11.5 years (*SD* = 6.6, range 4-27 years). Finally, the sample reported consulting with a mean number of 14.7 chronic pain clients per week (*SD* = 11.8, range 4-40 per week). Table 2 summarises the demographic and occupation characteristics of the individual participants in Study 2. Participants' names were replaced with a unique identifier to protect their anonymity (i.e., HP1, HP2, ...)

[Table 5 Demographics and occupation characteristics of participants in Study 2]

Driving is a dynamic task requiring the integration of physical, cognitive and visual abilities. Undoubtedly, chronic pain can variably impact an individuals' motor, motivational, cognitive and sensory capabilities. The analysis below explores the health professionals' perspectives on the following four main themes: (1) perceived impact of chronic pain on driving, (2) perceived impact of medication on driving, (3) the barriers to address driving challenges for this population adequately, and (4) strategies recommended by health professionals to individuals experiencing chronic pain concerning available assessment and treatment of safe driving. Tables 6-9 show a detailed analysis of themes and subthemes that emerged during the interviews with health professionals.

[Tables 6-9 about here- Study 2 themes and subthemes]

3.2.1 Perceived impact of chronic pain on driving

Health professionals with experience in working with individuals with chronic pain discussed the perceived impact of chronic pain on physical, cognitive and mental health required for safe driving among their cohort. Nine health professionals (53%) raised concern about the unpredictability and variability of how chronic pain could impact individuals. HP5 reported, "There's a lot of individual variability around this. Like some

people, that will have a significant impact, and some people will have very little impact." HP15 also added, "I think there are many ways people experience chronic pain, so that's just another aspect of no one size fitting all, that chronic pain is very much an individual experience. Because some people don't end up being very affected by the pain when they're driving, and others do."

All health professionals discussed that driving could be a physical challenge for individuals with chronic pain as it can exacerbate pain symptoms. Ten health professionals (59%) noted prolonged sitting in a vehicle to be problematic for most chronic pain sufferers who experience lower back pain. HP7 stated, "we know people with chronic pain usually have lower back pain, and for most people sustained sitting flares up [pain]. Therefore, driving has potential implications with the worsening of their pain." Ten health professionals (59%) discussed the impacts of chronic pain on everyday movements associated with driving, which require sufficient range of movement, astute cognition and sensorimotor abilities to ensure safe driving. HP9 stated, "Certain types of chronic pain will have a significant impact on driving, for instance, chronic spinal pain would impair a patient's ability to be able to turn their head in a manner that is required for safe driving". HP1 further added certain vehicle control capabilities, i.e., steering wheel and pedal control could be impaired, for example, "... their sensory ability to brake and accelerator, their range of movements in their ankle and knee and hip, their ability to hold the steering wheel with two hands and turn the steering wheel if required or if they're driving a manual their ability to use the clutch and change gear which is hand function." Other physical challenges that participants mentioned were difficulties accessing and exiting the car, "It's not just the actual driving, it can actually be difficult with getting into the car as well as getting out of the car." (HP4).

Over half of the health professionals considered driving to be a cognitively demanding task which could be directly or indirectly compromised secondary to chronic pain, "Pain will interrupt attention; that means that they can be distracted by their pain. And so, then they're not maintaining attention on the road. " (HP3). In addition, the direct effects of pain on cognition and impaired cognition secondary to poor sleep quality in the chronic pain cohort was noted. HP1 stated, "pain itself is quite distracting and is designed to be an all-consuming sensation. So, it is challenging to maintain focus. Also, there is fairly good research about the impact of poor sleep on the general population and how it relates to response time, so most of our pain

patients do not sleep very well. So, it makes sense that they're probably driving under the lack of sleep which is a big issue. Pain plays a similar role in terms of it's got a ripple effect on sleep and energy levels and attention."

Health professionals also highlighted that individuals with chronic pain often present with other mental health concerns that could influence driving behaviour. In particular, seven health professionals (41%) discussed the prevalence of mental health issues, such as trauma and motor vehicle incident-related trauma. HP16 reported, "If there has been a motor vehicle accident, and their pain has been associated with that, there can be an anxiety component with returning to drive and hypervigilance and things around driving, and that's something I see with some patients...and the hypervigilance can also be distracting to an extent; sometimes patients are quite internally distracted by not only pain but other things, such as anxiety, so that could also have an effect." HP1 also added: "some of their emotional kind of irritability may well mean that they're much more emotionally reactive when driving."

3.2.2 Perceived impact of medication on driving

Management of chronic pain when driving should also consider the effects of medication. All health professionals reported on commonly prescribed analgesics for pain modulation and their alleged side effects which could impact driving. These included drowsiness, slower reaction time and decreased concentration. HP3 argued that side effects of some medications could affect individuals' capacity to maintain attention: "Some of the pain medications that patients take can affect their attention and concentration...." HP17 further raised concern: "Many of the strong pain killers can knock people down easily, make them sleepy during driving. This doesn't seem like a good idea, for example, oxycodone and Endone are quite strong and actually quite a common drug for pain relief that can definitely affect the ability to drive." However, participants reported the effects of medication vary from patient to patient based on individual tolerances to the medication(s): "Medication is such an interesting topic because they are couple medications for pain and some of them quite strong, depends on the individual level of tolerance of medication, it can improvise different effects" (HP17).

There was also discussion that some patients could suffer from the effect of polypharmacy due to multiple drug interactions, as patients with chronic pain often have multiple comorbidities. Moreover, this could

have a multiplier effect if combined with a substance use disorder. HP7 reported, "What we often see is this issue of polypharmacy, there are multiple drugs, which is just creating a multiplication of the sedation, or impairment." HP8 also added that pain could affect innate inhibition control mechanisms, as well as cognition which could further be influenced by treatments such as medication, "Depending on the location of the pain, it can be an inhibition to a quick and forceful reaction, and then the treatment for the pain can affect people's driving as well, by changing their perception, their response time and their judgment."

3.2.3 Strategies recommended by health professionals to chronic pain individuals

Health professionals with experience in working with individuals with chronic pain provided recommendations for strategies to address driving-related concerns and difficulties experienced among chronic pain sufferers. These suggestions included self-management strategies, ergonomic modifications for seating and the use of alternative modes of transportation. Additionally, discussing the impact of commonly prescribed pharmaceuticals, developing appropriate referral criteria to refer onto community-based practitioners and implementing a communication framework to support patient and family decision-making around driving safety was recommended.

Six HPs (35%) reported on the provision of self-management strategies either focused on driving or within the context of one's day-to-day activities (e.g., pacing or fatigue management). HP10 reported, "I guess just give advice, just general advice about staying alert and taking care of themselves. So, staying hydrated and keeping/staying fit is important as well." and HP16 reported, "It’s more of broad fatigue management. So, when I talk to patients, I use a fuel gauge kind of analogy and speak to them about monitoring for early warning signs of fatigue. And how I can sort of manage that and look at strategies that can re-energise and pace out activities that are quite draining. We talk about cognitive fatigue versus physical fatigue and managing that. That, I guess, translates to driving sometimes."

Three health professionals (18%) reported suggesting ergonomic vehicle modifications for patients to improve their driving experience. HP14 stated, "So obviously, the first thing, we'd get someone to sit in the vehicle, set themselves up how they'd normally seat themselves. And then we'd go through, you know, whether there's any better way to set themselves up based on the reason they've been referred. So obviously, if they've got lower back pain, I might be looking at how they set the seat in terms of whether [they] incline

or decline the seat, how close they're sitting to the steering wheel, that sort of thing. So, you know, positions. Are the hands on the wheel? Whether they're supported in the seat, that sort of thing." Ten health professionals (59%) discussed vehicle modification options with their patients, however, the cost of these modifications limited access for patients. HP8 reported that there are modifications available to address numerous physical limitations but chronic pain patients frequently experienced difficulties accessing subsidy schemes; "They could change their automatic to the left for control, for example, if they had problems with their right foot. If I had problems with one of their arms or something like that, they could maybe put a spinner knob on the steering wheel. So those kinds of modifications... I used to access things like that through the National Disability Insurance Scheme, but a lot of chronic pain patients won't be participants."

Nine health professionals (53%) were aware of the referral pathways if required. HP6 reported, "I think occupational therapy driving assessors would be the main referral", and HP8 also noted, "I guess as a rehabilitation doctor, more often than as a pain doctor, I would recommend things like consideration of occupational therapy, driving assessment." Six non-medical clinicians (35%) discussed providing recommendations to patients to liaise with their general practitioner regarding pain management medications and capacity to drive. HP16 stated, "I guess it's also talking to the general practitioner just about exploring, you know, whether that medication is the right fit for them, or do they have a discussion with the general practitioner or with the doctor here, around that…. That's out of my scope of practice. Still, I will find out what the issues are and bring them to the doctor." Conversely, medical professionals also discussed the impact of commonly prescribed pharmaceuticals on an individuals' ability to drive. HP10 reported, "When someone is taking the medication, my usual norm is to discuss the effects of meditation on driving and driving ability. Usually, I clearly explained the intended effects of meditation on driving abilities, focus and concentration to them and asked them not to drive on the defects of these medications or change the timing of taking the medications. For example, if they have to drive to work in the morning, I explained to them that they could skip the morning dose and then take it later during the day when they no longer need to drive. These are the norms I usually follow." Nine health professionals (53%) recommended alternative forms of transport or having a support person to drive. HP15 stated, "If I thought

there was a risk either to themselves or to other people on the road, then I would definitely be encouraging to look at alternative transport options." and similarly, HP9 reported, "I usually suggest family members as a first line and then public transport, taxis. Some people can't really afford taxis, so I kind of leave those options and then depending on their age and comfort with technology, ride-sharing services and such. "

Three health professionals (18%) had familiarity with addressing driving and were confident to equip patients with the knowledge about the cognitive, physical and emotional demands of driving to support safe decision-making. HP3 reported, "Ideally, I look at a specific range of movement and break it down into the different components of driving. The different cognitive, physical, emotional, capacity to drive and work through that with the patient. So, they are helping me to make the decision and also the decision to go and have a driving assessment." HP7 expanded on this notion and reported on a graduated approach to support decision-making among patients: "Basically, have an open conversation, explain the risk… There is a graduated way to increase the level of seriousness, where at first you talk about the risks and invite people to identify themselves. But after that, you will explicitly state the risks and look for some acknowledgement or buy-in from them. And finally, if they continue to be in a pre-contemplative stage or have resistance, or whatever it may be, you then have more heavy-handed messages for saying this person should no longer have their license. So, you kind of workaround that continuum." HP6 also stated that retaining one's driving ability could be used as a motivator to improve patient compliance with self-management treatment options. "In terms of strategies, I would say for the patients who want to maintain that driving capacity that can sometimes be used as leverage for treatment options. For example, if a patient says it is essential for me to drive, then that is an opportunity for me to say, well, we need to look at your medication use. We need to try and cut that there. We need to try to do these things so that you can continue to drive safely. So that sometimes can be used to guide the conversation if they want to maintain it."

3.2.4 Barriers to adequately address driving

Health professionals identified a number of barriers to addressing driving within their practice. These included the lack of guidelines, clinician capacity building and standardised protocols for assessment. Driving not being a criteria of routine assessments nor included as part of the current pain management model of care were also put forward as barriers. Overall, all health professionals identified a gap in practice

concerning addressing driving-related concerns. Eleven health professionals (65%) commented on the absence of standardised practice guidelines to address driving and medications. HP9, a general practitioner working in a public pain clinic, commented, "I don't know if there were any specific guidelines that would indicate that [medication] side effects are present and that can impair function when driving. But I think there are maybe local guidelines and certain hospitals in certain departments that would guide practitioners about the effect of drugs on driving". HP7, a pain medicine consultant, working within a similar setting, reported, "To my knowledge the faculty of pain medicine hasn't released one…". Furthermore, HP12 a community general practitioner, discussed a gap in the guidelines, which otherwise discuss most common chronic medical conditions affecting driving, "Chronic pain is a topic less highlighted in our context…and there are no step-by-step guidelines for us and never have been. For example, for a seizure, we can quickly assess it. We know what is required. However, for chronic pain, there is nothing of this sort."

Health professionals also reported insufficient professional development and subject knowledge to inform evidence-based practice on driving assessments for chronic pain individuals. Seven health professionals (41%) reported on the gap in specialised knowledge and the absence of validated driving assessment tools as a barrier to addressing driving within their work context. HP10 reported, "Our guidelines are very specific when it comes to chronic conditions, such as diabetes, epilepsy, heart disease, stroke but for chronic back pain, we don't have any specific guidelines that I am aware of that includes driving, but for all major chronic conditions we have guidelines to follow", and HP6 added, "As a clinician, I would try to make an assessment of their driving capacity or refer the patient on for a driving assessment. I do not have the capacity to provide an accurate driving assessment, as I do not have those skills. So, it would be the matter of referring the patient to somebody who does". Additionally, five health professionals (29%) reported on the lack of research on chronic pain and driving. HP5 stated, "I'm across a lot of pain literature, and I haven't come across [driving in individuals with chronic pain] in the literature. Probably if there is more out there about this topic, then it'd probably be more at the forefront of my mind, and I would think I should be doing more." HP16 also added: "I think we need the research behind it to know what things to be aware of and what is the appropriate tool that would translate to something that is going to be useful."

Eight health professionals (47%) reported that driving was rarely part of their routine assessment battery unless the patient report triggered concern. HP16 reported, "I think if an issue was raised, then just exploring that, and asking them more questions, but no nothing in particular." When discussions about driving occurred, eleven health professionals (65%) reported that the patients' subjective report guided their assessment choices, and those patients were unlikely to self-report driving-related concerns either to avoid associated repercussions or limited insight into their own challenges. HP10 explained, "It's extremely rare. I haven't come across anyone who has intentionally identified driving as an issue. In my opinion, people prefer to keep driving and lose their capacity to drive as the last option. So, they keep driving and driving, even with some major medical conditions. We do have a struggle identifying and informing those individuals and reporting them to the authorities as to whether they are safe drivers or not. And I don't think chronic pain would be on the list for someone to self-identify. So far, I haven't come across anyone." HP14 further added, "So obviously, we aren't getting a true picture. It's a lot of subjective information. So sometimes, if they don't have the insight, then we won't get a true subjective assessment about that. I'd say the biggest one is the insight."

Health professionals stated that the current Australian Medicare policies, time constraints and insufficient financial resources made it challenging to discuss driving with individuals experiencing chronic pain during consultations. Ten health professionals (59%) believed that being time-poor limited the capacity to address driving within a single consultation. HP9 reported, "The time is a barrier in terms of the time during the consultation, because of other things and challenges to try to discuss". Practitioners noted that the billing schedule within the Medicare scheme was an added barrier; HP10 stated, "The barriers for GP's are far more profound because of the way Medicare works… there is only so much you can discuss in an hour", and HP8 reported, "The GP's bear the main burden of saying whether someone can drive or not. The general practitioners are the ones who have the most responsibility … to pick that up, but unfortunately, they are the people who have the shortest appointments as well." Seven health professionals (41%) noted that driving assessors provide a specialised service within the Australian healthcare system. However, chronic pain patients often did not have access to this service due to a reduced number of publicly funded driving assessors. HP2 stated: "We don't do driving assessments within Queensland Health... we can write a letter

to the GP about that, and then the general practitioner can decide based on our observations of that person", and HP5 also added "Getting access to driving assessors has been a barrier, for a while now. Patients who I work with usually have limited resources and wouldn't be able to get a private driving assessment, and there are not enough public driving assessors."

Lastly, participants discussed the complexity of driving and individual differences in approaches to treatments for the chronic pain cohort, being a challenge to adequately assess driving safety. HP14 stated, "Everyone's experience is very different and different treatment strategies work for different people. It's not like one approach essentially." HP12 also agreed, "The nature of chronic pain makes it harder as every individual reacts differently."

4. Discussion

A qualitative research design and interpretative phenomenological analysis were used to understand the impact of chronic pain on driving from the lived experiences of twenty-three individuals with chronic pain and the clinical experiences of seventeen health professionals working with people with chronic pain. In this study, participants who experience chronic pain reported that the pain changes their driving performance, including increased difficulty monitoring the road environment, slower reaction times, occurrence of distracting mental states, and poor vehicle control. Chronic pain drivers also reported experiencing difficulties with safety-critical manoeuvres, such as shoulder checking for blind spots, merging with traffic, turning corners, and reversing the vehicle. Health professionals also discussed how chronic pain interferes with the physical, cognitive, and mental health resources required for safe driving among chronic pain cohorts. Health professionals considered driving a cognitively demanding task that may be directly or indirectly be compromised due to chronic pain. Effects included impaired cognition due to distraction caused by pain and poor quality of sleep before driving, both common occurrences among chronic pain cohorts [16]. Health professionals in this study also raised concerns about the unpredictability and variability of how chronic pain impacts individuals' driving behaviour. These results are consistent with a comprehensive systematic review that found that drivers experiencing chronic pain have difficulties with vehicle manoeuvres and maintaining attentional resources required for driving, which may increase their crash risk [23]. This indicates that the increased vulnerabilities of individuals experiencing chronic pain

should be considered in a coordinated approach by transport authorities and healthcare policymakers, particularly in car-centric jurisdictions such as Australia [REF].

Chronic pain and health professional participants highlighted that driving-related prolonged sitting and repetitive movements could exacerbate chronic pain [18; 19]. This means that driving could create challenges for managing pain and/or increase consumption of pain medication affecting the quality of life and health outcomes of individuals experiencing chronic pain. Indeed, health professionals reported that commonly prescribed analgesics for pain modulation could result in pain medication dependence. As driving can increase pain, it could also result in analgesic overuse to mitigate that increased pain. The side effects of analgesics also could impact driving behaviours, such as slower reaction time and decreased concentration. This raises the possibility that individuals experiencing chronic pain may need alternatives for pain treatments and their transport requirements to facilitate better health outcomes and increase safety on the roads.

Discussions about self-regulation strategies to overcome driving difficulties by participants were in line with the Michon model of driving behaviour [13]. This driving behaviour model has been used in previous research as an important factor in the driver's safety at three levels of the strategic, tactical and operational driving tasks. Chronic pain and health professional participants reported or suggested frequent use of one or multiple self-regulation strategies to manage pain while driving. For example, some of the strategic-level adaptations reported by participants with chronic pain involved planning decisions made before driving, such as avoiding driving during high peak hours, avoiding unfamiliar roads or refraining from driving when experiencing high levels of pain to ensure safety. Another form of planning reported by both individuals with chronic pain and health professionals to cope with pain while driving included ergonomic modification of the vehicle, pacing the task of driving by breaking up, reducing the frequency or distance of driving, and managing medication in a way that does not interfere with driving. These results reflect previous research [5; 18; 19] among chronic pain cohorts but also self-regulation strategies reported by older drives [6]. The results of this study also found some of the self-regulation strategies reported by chronic pain drivers at tactical levels of driving tasks which involve considerations affecting the immediate traffic conditions and monitoring the potential hazards. These included avoiding certain driving manoeuvres when possible, such

as avoiding changing lanes, more frequent use of mirrors to avoid shoulder checks and avoiding car parks that require reversing. These self-regulation strategies adopted by chronic pain drivers seem to be compensating for difficulties performing tactical driving activities previously reported [3; 5; 8; 15; 18]. Finally, some of the self-regulation strategies reported by chronic pain drivers at the operational level, which involve vehicle controls, included adopting lower speed to reduce their risk while driving, being more attentive, and engaging in secondary activities that distract from pain (i.e., listening to music). However, the effectiveness of these strategies reported by chronic pain drivers in increasing safety and compensating for their driving difficulties are unknown.

This study broadly highlighted health professionals' views on the lack of evidence for self-regulation strategies beyond medication management. Our recent review highlighted a lack of studies demonstrating the effectiveness of any self-regulation strategy in reducing impairments and the increased risk of driving with chronic pain, which complicates the development of evidence-based clinical guidelines to support driving [23]. Chronic pain participants also reported using emerging advanced driving assistance systems in modern vehicles equipped with sensors and cameras to detect nearby obstacles and support them during driving tasks such as blind-spot monitors, reverse cameras, and cruise control mechanisms to self-regulate their chronic pain. However, caution must be applied in using such systems, and further research is required to assess the safety of relying solely on the technology to substitute tasks typically performed by the driver, such as shoulder checks or speed management. Indeed, these technologies lack standardisation and conflicting operational capabilities is a rising issue in the road safety field [14].

The results of this study indicate that management of pain and driving is challenging both from the perspective of chronic pain and health professional participants. Among the chronic pain participants, the main barrier could be the fear of losing the independence associated with driving, which prevents them from discussing their challenges with health professionals. Health professionals also confirmed that people rarely raise driving concerns, resulting in these issues being rarely addressed in a healthcare setting. A reason for this could be a high reliance of Australians on driving as a main mode of transport, in particular in rural and remote areas which lacks alternative transport options [23]. Among health professional participants, there was a common theme in relation to lack of guidelines, lack of capacity building, lack of

routine assessment and standardised protocols in the current model of care for individuals with chronic pain. Additionally, driving assessors who are more qualified to assess driving skills and safety are reported to be limited in number in public health systems and often expensive to access in private practice. In clinical settings where health professionals interact with patients, there are restricted consultation time frames which could limit the possibility to discuss driving issues with chronic pain participants. Importantly, health professionals stressed the complex nature of chronic pain and how it can be experienced in different parts of the body or often in combination with other diseases or injuries. This could further make the driving assessment during the consultation timeframes more challenging. Moving forward, these findings highlight a need to develop driver assessments that follow a user-centred approach to fitness-to-drive that could assess all potential expressions of chronic pain, considering the sufficiency of an individual's capability to safely drive a vehicle despite their condition. Simulated driving assessments of crash-related driving skills such as hazard perception [7] might be a cost-effective way to assess driving in clinical settings while minimising the use of healthcare resources.

In conclusion, these findings provide insight into how chronic pain may negatively impact driving at the strategic, tactical and operational levels, all of which are required for safe driving. Some of the issues emerging from our findings relate specifically to the variability of chronic pain, including type, location, the severity of pain and its effects on an individual's driving performance. In addition, the lack of evidence-based research and clear guidelines makes it challenging for health professionals to assess driving in short clinical timeframes. Future research could investigate the effectiveness and safety of self-regulation strategies currently adopted by drivers experiencing chronic pain, including the use of advanced driver support systems. Such research could contribute to developing clear guidelines, public education and identifying specific strategies that relate to the successful management of safe driving among chronic pain cohorts.

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