An Investigation into Over the Counter Painkiller Use

Shane Cusack, Angeline D. Lagali and Andreia Stavrianos

Department of Biological Sciences, Munster Technological University, Bishopstown, Cork, Ireland.

Fourth Year BSc (Hons) Biomedical Science, Munster Technological University/ University College Cork.

ABSTRACT

This study comprises a survey to examine the use, risks, and awareness of over-the-counter (OTC) pain medication. The survey was a paper-based survey extended to the general public in Cork, Ireland from February 24th 2020 to March 14th 2020. A Microsoft Excel template (16.34 2020) was used to analyse the results of the 106 valid responses that were received. Responses showed that 105/106 individuals had taken an OTC painkiller in their lifetime. Paracetamol was the most used OTC painkiller with 98.1% of people having taken it in the past. The overall majority of individuals were aware of the risks associated with OTC painkiller use. However, there were a large number of people that were unaware of the serious risks and dangers. A higher proportion of individuals were willing to take a second dose sooner than recommended (41.9%), rather than a higher dose (36.2%), if they were in significant pain. In terms of taking a dose sooner than recommended; 43.7% of ibuprofen users and 35% of paracetamol users were unaware of the adverse health consequences. Regular users of OTC painkillers were generally more aware of the risks when compared to irregular users. This study supports the need for further education on the risks of OTC painkiller use as there was a large proportion of individuals willing to take higher doses than recommended, and many were unaware of the drug's associated risks.

INTRODUCTION

Analgesics, also known as painkillers, are drugs that are used to treat pain. Over-the-counter (OTC) painkillers can be bought without a prescription in stores or pharmacies. They are generally used to provide temporary relief from pain associated with inflammation. Painkillers have an estimated worldwide usage of more than 30 million per day (Singh, 1999). In Ireland, 23% of the Irish pharmaceutical market consist of analgesics (IPHA, 2009). OTC painkillers give consumers great freedom to self-medicate and have control over their health. However, there are risks associated with their use and thus users should adhere to the accompanying instructions. OTC painkillers should not be used for more than a few days in a row, and the specified maximum daily dose should not be exceeded (IQWIG, 2006).

Common OTC pain medications can be divided into nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen (Paracetamol, Panadol). NSAIDs include aspirin (Disprin, Excedrin), naproxen (Aleve), and ibuprofen (Nurofen, Buplex). According to the Health Products Regulatory Authority's (HPRA), many aspirin and paracetamol containing products are classified as a general sales medicine, which means they can be sold by both non-pharmacy and pharmacy retailers (HPRA, 2021). However, ibuprofen-containing products can only be sold by pharmacy retailers.

As NSAIDs, both aspirin and ibuprofen have an anti-inflammatory, analgesic, and antipyretic effect. They inhibit the production of prostaglandins (PGs), which are typically released in response to illness or injury, through the inhibition of two cyclooxygenase enzymes (COX-1 and COX-2) (Gunaydin and Bilge, 2018). Anti-platelet effect is also observed through the reduction of thromboxane A2 production

(Al-Saeed, 2011). Most common unwanted effects of NSAIDs involve the gastrointestinal tract (GI bleeding, symptomatic ulcer disease, perforation of the GI tract) due to the inhibition of gastric COX-1(Al-Saeed, 2011). COX-1 is responsible for the production of prostaglandins that inhibit acid secretion and protect the mucosa (Al-Saeed, 2011). While therapeutic doses are normally well tolerated in healthy individuals, they can cause renal insufficiency in susceptible individuals due to the inhibition of prostaglandin E2 and prostaglandin I2 which are involved in the maintenance of renal blood flow. Failure to excrete these drugs may exacerbate toxicity in other organs such as the liver (Hörl, 2010).

NSAIDs can also contribute to disturbances in platelet function. Inappropriate use of ibuprofen can result in serious cardiovascular events such as myocardial infarction, angina, stroke, and death (Al-Saeed, 2011). A British study involving two NHS hospitals in Merseyside in England showed that NSAIDs are responsible for 30% of hospital admissions for adverse drug reactions due to bleeding, heart attacks, strokes and renal damage (Davis & Robson, 2016).

Paracetamol (acetaminophen) is marketed as an analgesic-antipyretic agent that blocks the production of PG (Jozwiak-Bebenista *et al.*, 2014). They are weak anti-inflammatory agents (Jozwiak-Bebenista *et al.*, 2014). Increasing paracetamol dose above its therapeutic range mainly results in hepatotoxicity (Jozwiak-Bebenista *et al.*, 2014). As the drug is metabolised to a toxic metabolite (N-acetyl-p-benzoquinoneimine), long-term use may result in renal function disorder, higher blood pressure and increased prevalence of heart infarction (Jozwiak-Bebenista et al, 2014). Unfortunately, paracetamol overdoses can happen. In Ireland, there were 7933 recorded cases of drug overdose in 2004, of which 31% involved paracetamol (Mhaolain *et al*, 2007) It is estimated that in the United States nearly one in four adults consume a drug containing acetaminophen each week (Kaufman *et al*, 2002).

The study carried out specifically examined aspirin, ibuprofen, and paracetamol, as well as areas such as drug labelling, dose frequency and duration of use. The purpose of this survey was to note the general public's awareness of OTC painkillers in Ireland and to detect any patterns of misuse and negligence.

MATERIALS AND METHODS

The survey was a paper-based survey extended to third-level students and the authors' family, friends, and workplaces. The sample population studied were all over 18 years old in age. Upon analysing the survey, the individuals who have taken OTC painkillers were segregated into regular and irregular users for a particular drug to effectively analyse potential risks associated while taking that drug.

The survey was distributed from the 24th of February 2020 until the 14th of March 2020. Initially, the paper-based survey was tested on a control population to identify unnecessary question. These responses were not used in the data analysis. Paper surveys were and distributed over the course of two weeks (see appendix 1). A Microsoft Excel (Version 16.34, 2020) template was used to analyse the results.

RESULTS

The study consisted of 106 responses. All responses were deemed valid. Males represented 58% of respondents and females represented 42% of responses. The pharmacy was the most common place of obtaining an over-the-counter (OTC) painkiller, compared with retail shops, supermarkets or online.

Paracetamol was the most common OTC painkiller purchased among the Irish population (72.1%), with 23.1% and 4.8% most commonly purchasing Ibuprofen and aspirin respectively.. The data showed that 98.1% of the participants had previously taken paracetamol, 82.9% of participants had previously taken ibuprofen and 68.6% of participants had previously taken aspirin. The survey data also showed that

42.5% of the participants were determined to be regular OTC painkiller users and 57.5% were irregular users. A regular user was defined as someone who had consumed a painkiller more than once in the last 3 or 6 months. The data also shows that approximately half of respondents (51%) have purchased over-the-counter painkillers abroad for future use at home. Only 18.1% of respondents stated they did not think it was important to read the label on an over-the-counter medicine prior to use, while 81.9% of participants deemed it to be important. If using a drug for the very first time, 14.3% of participants were not likely to read the accompanying information compared to 85.7% of participants who would. Older survey participants were more likely to read the information when using an OTC for the first time. 52% of 26-39 year-olds, 59% of 40-59 year-olds and 56% of those 60+ years stated they would read the accompanying information when using the drug for the first time compared to 38% of those aged 18-25 years old. One participant out of the 106 had never taken an over-the-counter painkiller. Hence, figures 2-5 concern 105 of the 106 participants.

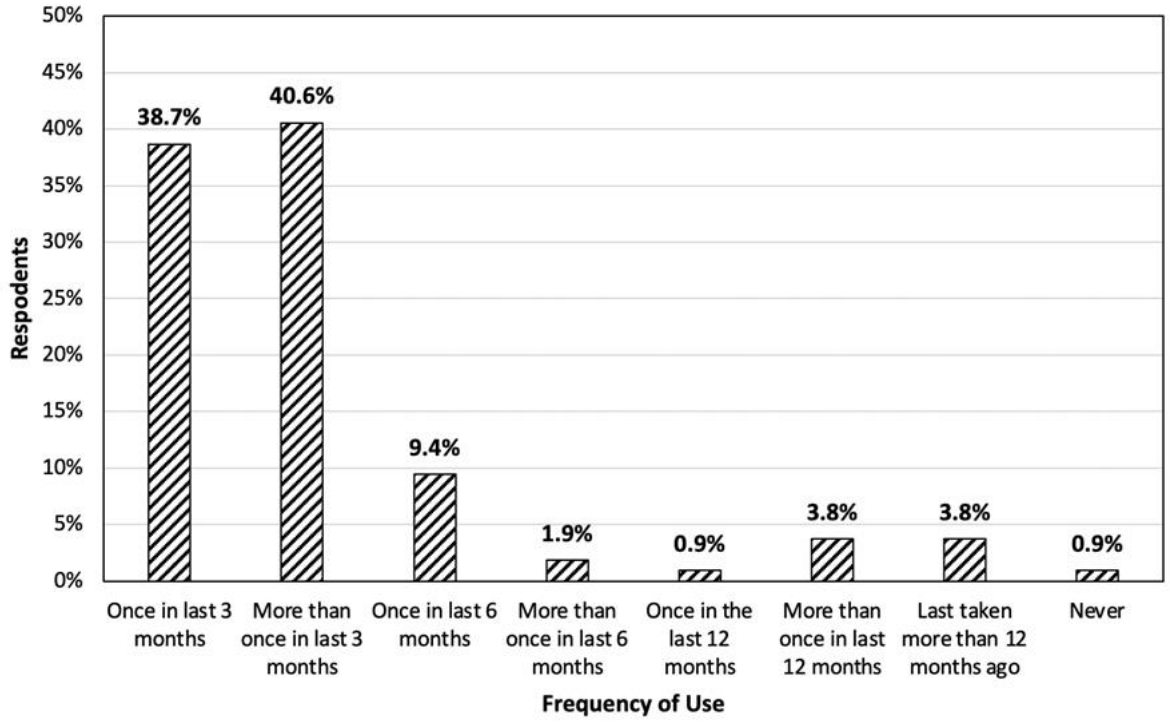

Figure 1: Frequency of over-the-counter painkiller intake among the Irish population in three-month period. The majority of the participants (79.3%) took an over-the-counter painkiller in the last three months as shown in figure 1.

A significant proportion of people were willing to take a higher dose than recommended for each drug and even more participants were willing to take a second dose sooner than recommended.

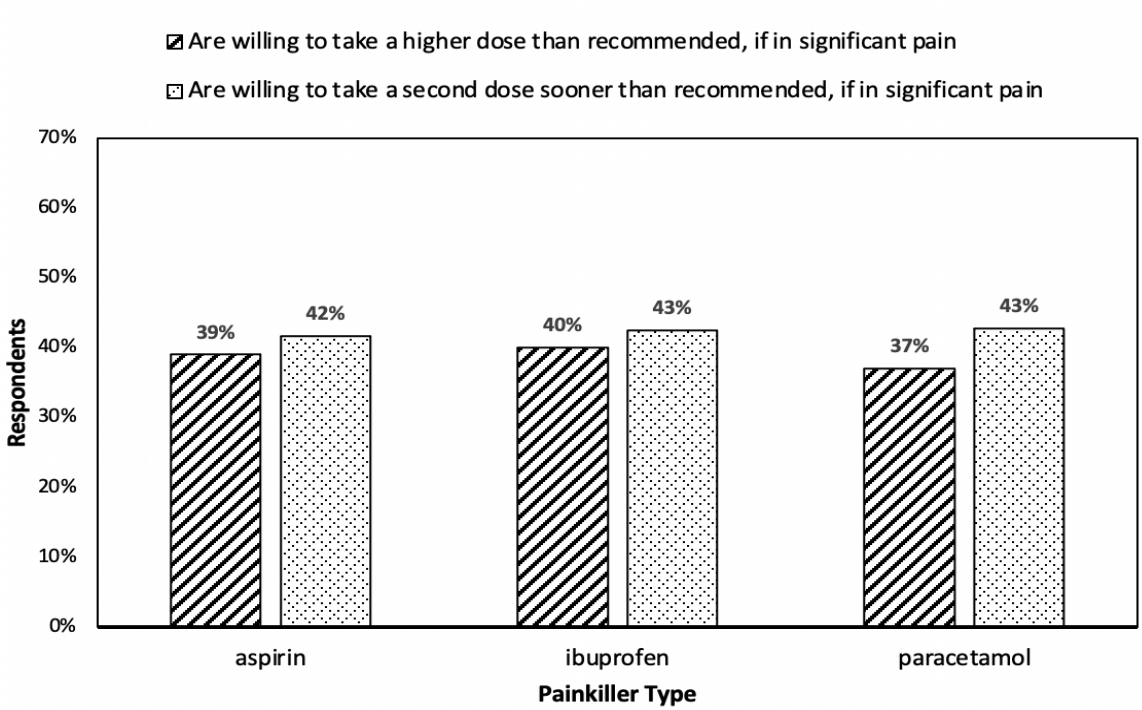

Figure 2: Percentage of participants who are willing to take a sooner subsequent dose or more than the recommended dose of aspirin, ibuprofen or paracetamol if they were experiencing significant pain

Overall, 36.2% of participants were willing to take higher than the recommended dose if they were in significant pain and 41.9% said they would be willing to take another dose sooner than recommended (not shown in figure).

Survey data also showed that 28.2% of respondents would not tell their dentist if they were taking aspirin prior to an appointment including 7% of regular aspirin users, 15.5% of respondents were unsure and 56.3% of respondents would tell their dentist prior to an appointment. Of respondents 12.5% believed high blood pressure could be treated with aspirin and 15.3% of respondents thought aspirin could be used to treat stomach pain both of which are not recommended.

A significant proportion of respondents were willing to take over-the-counter drugs, for multiple days. 25.35% of respondents were willing to take aspirin for more than 4 days, which is longer than recommended, 16.9% stated they would take it until the pain was gone. 21.84% of respondents stated they would take ibuprofen until the pain was gone as did 24.27% of respondents for paracetamol. Paracetamol should not be taken for over 10 days and 7.77% of participants stated they were willing to take the drug for more than 10 days.

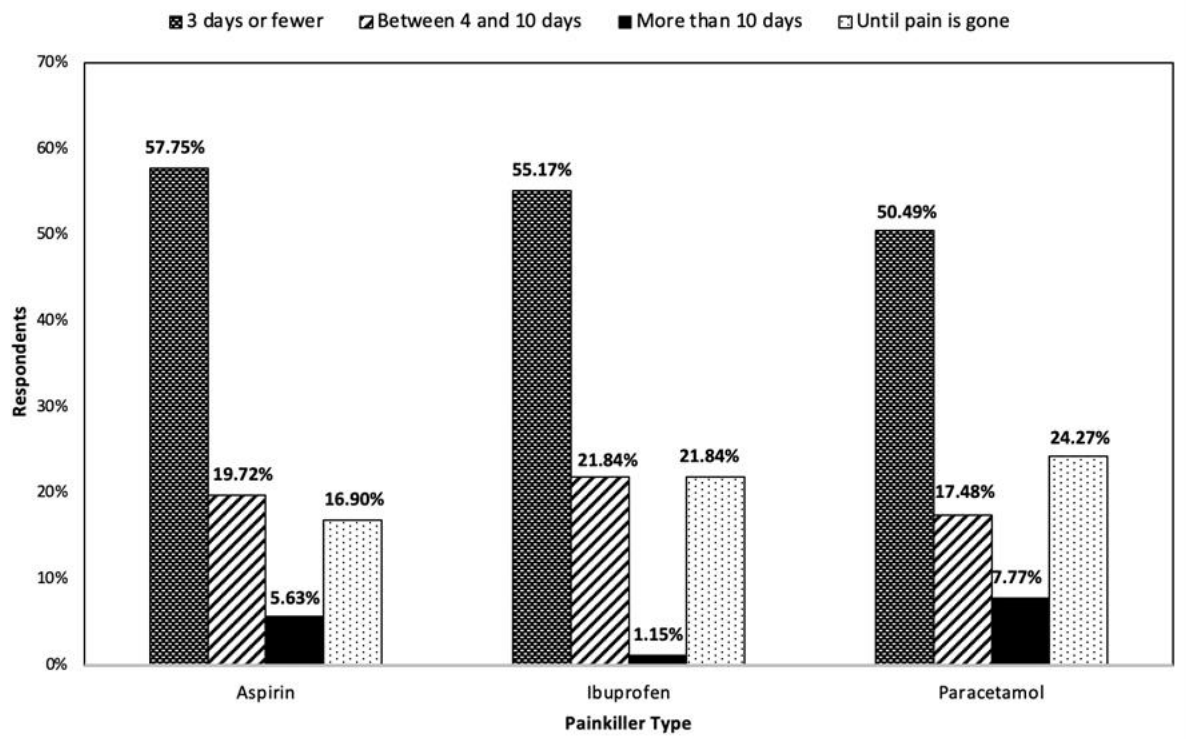

Figure 3: Percentage of individuals who were willing to take a specific drug for a certain period of time before seeking medical attention.

Of all Ibuprofen users, 49.4% were unaware of the health consequences or risks associated with the drug. This was reported as 50% for regular users and 48.8% for irregular users.

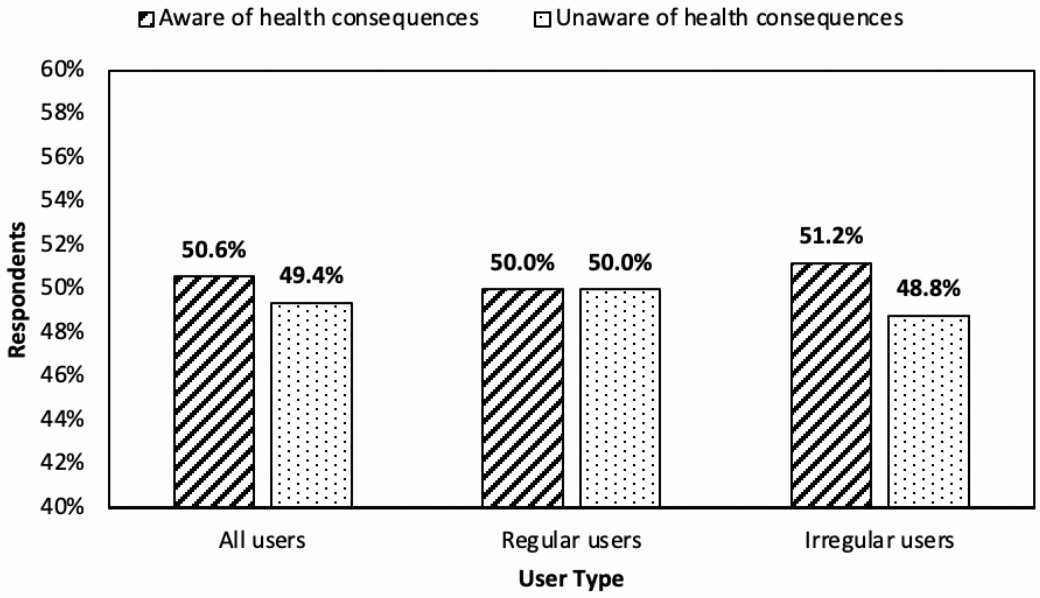

Figure 4: Analysis of the study population to determine their awareness of the health consequences associated with repeat doses of ibuprofen-containing product sooner than directed.

Survey data also shows that 34% of regular users of ibuprofen were unaware of their blood pressure status while 66% of users were aware (data not shown). The survey data also showed that 5.7% of ibuprofen users believed that it could treat hypertension.

Regular users of paracetamol were much more aware of the risks and health consequences than those who only used it occasionally, however 38% of regular users did not know the health consequences and risks associated with the drug. More awareness was seen in older age groups with 71% of those over 70 years old, 78% of those aged 60-70 and 66% of those 40-59 years old being aware of the health consequences compared to 33% of 18-25 year olds.

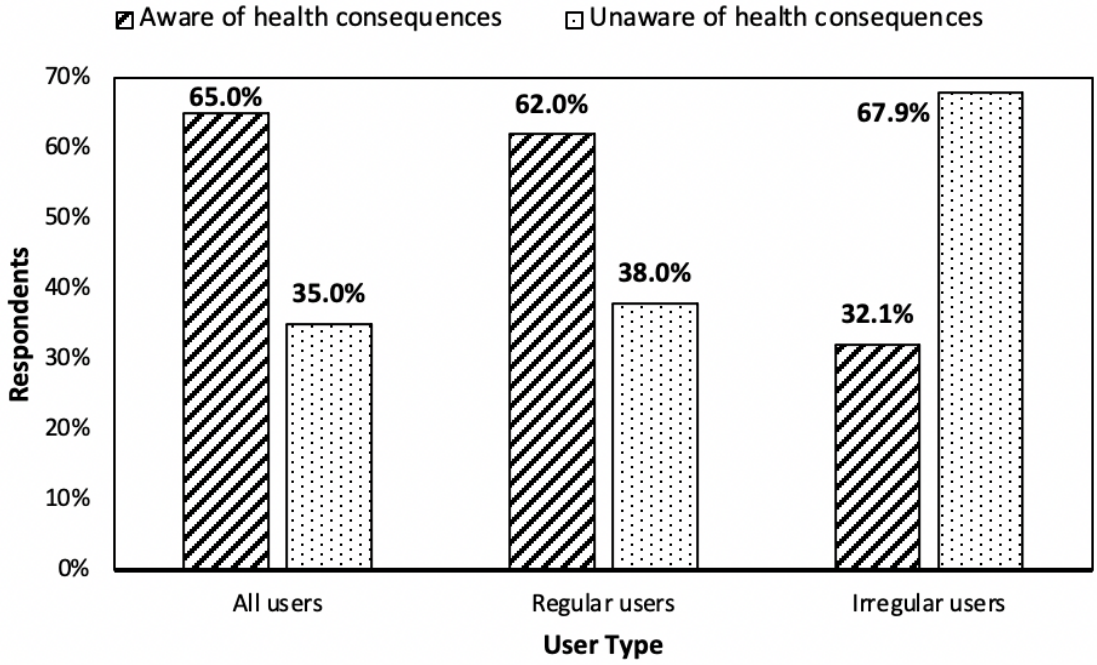

Figure 5: Analysis of the study population to determine their awareness of the health consequences associated with repeat doses of paracetamol taken sooner than directed.

DISCUSSION

As seen in Figure 1, survey data showed that 79.3 % of participants had taken non-prescription analgesics in the last three months prior to participation in the survey. Fifty-one percent of participants said they had purchased OTC painkillers, abroad for later use at home which are often of higher concentration than those available in Ireland. Up to recently, 600 mg ibuprofen tablets were available in Spain over-the-counter according to the Spanish Agency of Medicines and Medical Products (Agencia Española de Medicamentos y Productos Sanitarios, 2020). The ease of availability of these doses circumvents the strict protocols of pharmacists dispensing non-prescription products in Ireland. For instance, it is prohibited for pharmacies in Ireland to sell more than 24 paracetamol (500 mg) tablets in a single transaction (Mhaolain *et al*, 2007). Failing to adhere to regulations such as these may put consumers' health in danger.

The responses for the painkiller dosage questions in the survey revealed potentially dangerous practices within the Irish population. Almost a fifth of participants (19%) admitted to exceeding the dose of a painkiller in the past, but 36.2% of participants said they would be willing to take higher than the recommended dose if they were in significant pain. A higher percentage of people (41.9%) said they would be willing to take another dose sooner than recommended on the packaging (Figure 2). This shows that a number of participants would not be willing to take a higher dose when in significant pain and yet would take another dose sooner than recommended. The National Council on Patient Information and Education in 2002 (Harris Interactive, 2002) commissioned a survey to identify opinions that influenced self-medicating behaviours of Americans. The survey found that a third of Americans said that they take more than the recommended dose of a non-prescription medicine in order to increase the effectiveness of a product. Sixty-three percent reported taking the next dose sooner than

directed. The results from both of these surveys suggest that people are more likely to take a sooner subsequent dose rather than taking a higher dose at a given time. These results seem to suggest that there may be a belief that taking a sooner dose is not as dangerous as taking a higher dose despite the increased amount of drug in the body. Taking a dose sooner than directed can still increase the risk of overdosing (National Health Service, 2017).

The survey data showed that relatively few individuals (18.1%) believed reading the label including the dosage information to be important prior to taking the drug and 82.9% of people did not think doing this was important. It was also asked how likely participants were to read the labelling information when taking a specific brand/type of drug for the first time, to which 14.3% of participants stated they were not likely to read the information. This is concerning as these participants do not make themselves aware of the risks or dosage information prior to their first use and will likely not check the label and information routinely in the future. Overall individuals were more vigilant about checking the label when using the drug for the first time with increasing age. (38% of 18-25 years, 52% of 26-39 years, 59% of 40-59 years, 56% of 60+ years).

Most participants said they take OTC painkillers for 3 days or less before seeking medical attention (Figure 3). Most of the individuals were adhering to the recommended length of use for each drug e.g. 3 days or less for aspirin and 10 days or less for ibuprofen according to the National Health Service (2018) and 3 days or less for paracetamol (Pfizer Healthcare Ireland, 2018). However, there was still a large percent of individuals (17.48%) that would wait between 4 and 10 days for paracetamol and a smaller percentage of them that would wait for more than 10 days. The results showed that the percentage of individuals who would wait until the pain was gone, and not seek any medical advice were 16.9%, 21.84% and 24.27% for aspirin, ibuprofen and paracetamol respectively. This contradicts the information given with each of the over-the-counter painkillers and shows that a large percentage of individuals may not be aware of the effects of prolonged use of these OTC painkillers.

As can be seen in Figure 2, 39% of participants were willing to exceed the recommended dosage of aspirin if they were in significant pain. The main risks and complications of aspirin use include gastrointestinal bleeding and strokes (Ittaman *et al*. 2014). Aspirin is known to help prevent clot-related strokes (National Health Service, 2018); however, it may increase the risk of a bleeding stroke which is associated with taking high doses of aspirin or taking aspirin more frequently than recommended. The survey data obtained show that 57.7% of aspirin users would only take non-prescription aspirin for 3 days or less. This data is encouraging as it decreases their risk of bleeding and complications dramatically. In 2009, the FDA issued a warning about serious stomach bleeding risks with aspirin and other NSAIDS (FDA, 2009). The warning also stressed that those over 60 years of age are at a particularly high risk of bleeding. According to the NHS, aspirin should not be used for over 2-3 days without consulting a doctor (National Health Service, 2018). Almost a fifth of participants (19.7%) stated that they would use it between 4 and 10 days and 5.6% of people stated that they would take non-prescription aspirin for more than ten days putting them at an increased risk.

The dosage of over-the-counter aspirin is formulated to be taken only on a short-term basis. OTC aspirin intended for pain relief should not be used as a preventative measure by healthy individuals. Failing to do so may lead to haemorrhaging in the body (Ittaman *et al*, 2014). A Harvard study that consisted of over 14000 healthy adults, over 40 years old, and free of cardiovascular disease in the United States of America suggested that approximately ¼ of adults who do not have cardiovascular disease take OTC aspirin daily without a doctor's recommendation, (23% in the referenced study). The study concluded that the participants were putting themselves at risk without benefits (Harvard Medical School, 2019). A concerning trend identified in the survey data was that 12.5% of aspirin users said that OTC aspirin could be used to treat high blood pressure and 15.3% of users said aspirin could be used to treat stomach upset and pain. However, it is strongly advised in drug leaflets and by the FDA that any individuals with such conditions should consult a doctor before taking aspirin due to the increased risk of bleeding. (NHS as available 2020).

In the current study, 28.2% of aspirin users did not believe it was necessary to tell their doctor or dentist if they were taking aspirin and 15.5% were not sure if it was necessary to disclose this information. Aspirin inhibits platelet aggregation and causes increased bleeding. Bleeding complications related to aspirin after minor oral surgeries such as tooth extraction is of concern to dentists who are responsible for the dental care and management of these patients (Keun Lee, 2018). The study showed that 7% of regular users did not deem it necessary to tell their doctor or dentist if they were taking aspirin. These are the individuals most at risk of an adverse reaction to aspirin among the survey participants. It is evident that more education is needed on the associated risks as 39-42% of participants were willing to take an exceeded dose of aspirin (figure 2). These individuals are at a higher risk of bleeding, particularly patients who could have underlying conditions which could be exacerbated from excessive bleeding.

Figure 4 shows the percentage of ibuprofen users that were aware that taking another dose of ibuprofen sooner than recommended is associated with an increased risk of cardiac events. Even with regular users, only 50% were aware of this risk. Having a higher amount of ibuprofen in the body than is recommended significantly increases the risk of hypertension and other cardiac events as reiterated in 2015 by the FDA. The FDA strengthened warnings that non-aspirin NSAIDS, including ibuprofen, cause an increased risk of heart attack and stroke.

The data obtained from the survey conducted showed that 40% of ibuprofen users were willing to take a higher dose if in pain and 43% of ibuprofen users were willing to take another dose sooner than recommended on the packaging (Figure 2). In both of these scenarios the individual is exceeding the dose. Unknown underlying health conditions such as peptic ulcers may also exacerbate the effects and cause increased bleeding. (Drini, 2017). Respondents' knowledge of the conditions ibuprofen treats were relatively accurate except for a small proportion. However, 5.7% of participants believed ibuprofen could treat hypertension. This is both untrue and dangerous as ibuprofen can cause a significant increase in blood pressure. The survey data also showed that 34% of regular ibuprofen users were unaware of their blood pressure status. This puts individuals who may unknowingly have hypertension at a significant risk of cardiac events, especially if they take a higher dose of ibuprofen than recommended. All NSAIDs, including ibuprofen, may increase blood pressure and destabilise blood pressure controls in individuals (Grover *et al*, 2005). Researchers in Denmark studied 29,000 patients who suffered an out-of-hospital cardiac arrest and found a 31% increased risk of cardiac arrest when they were using ibuprofen (Sondergaard *et al*, 2016). This study suggested limiting ibuprofen to 1200 mg per day to reduce the associated risks. This is currently the limit in Ireland, however, the data shows that around 2/5 of participants are willing to exceed this (Figure 2).

Regular users of over-the-counter painkillers were more aware of the risks and dangers associated with paracetamol such as metabolic acidosis, depressed consciousness, renal toxicity, hepatotoxicity and liver failure (Tan & Sklar, 2017). As seen in Figure 5, 65% of paracetamol users, of which 62% were regular users, were aware of the risk of liver damage and hepatotoxic events when taking another dose of paracetamol sooner than is recommended. Overall, the respondents had a greater knowledge of the conditions that paracetamol can be used to treat compared to the other two drugs. While these figures were reassuring, there were still 38% of regular users who were not aware of its harmful effects on the liver. There was an interesting trend seen among the different age groups with only 33% of 18-25 year-olds were aware of paracetamol's associated risks to the liver compared to 53% of 26-39 year olds, 66% of 40-59 year olds, 78% of 60-70 year olds and 71% of those over 70 years of age. Older people seemed to have a better understanding of the risks of taking higher doses of paracetamol. Patients suffering from chronic alcohol problems are of particular concern as they are at a greater risk of hepatotoxicity at lower doses of paracetamol. (Chandok & Watt 2010).

Figure 2 shows that 37% of paracetamol users were willing to take a higher dose of the drug when in pain and 43% of users were willing to take another dose sooner than recommended. This is a significant amount of people at risk as the maximum dose within a 24 hour period of paracetamol should not be exceeded as it can lead to serious liver damage and can be fatal. Paracetamol overdose is one of the leading causes of liver failure. . In February 2017, The British Liver Trust stated in an article that

paracetamol overdoses represent approximately 20% of the required liver transplants across Europe, 52% of liver transplants in Ireland and 28% of liver transplants in the United Kingdom (British Liver Trust, 2017). Paracetamol may pose a higher risk to individuals due to the potential damage of one extra tablet over the recommended dose (British Liver Trust, 2017). For that reason, 37-43% of individuals being willing to exceed the dose is alarming (Figure 2).

It is important to emphasise that this research is a snapshot of both the use and awareness of the risks of OTC painkillers among the Irish population. Despite the study showing significant results, there are a number of factors that should be noted for further studies. Firstly, the access to, and scarcity of data on painkiller misuse and associated consequences in Ireland did pose a problem. There were also very little recent studies performed on this topic so some of the supporting studies were over 10 years old indicating a need for further research. Furthermore, a more comprehensive analysis of the awareness of the risks and dangers of OTC painkillers would have occurred if each of the age groups were represented equally in this study. The majority of the sample population was composed of 18-25 year old participants (37.7%), while the > 60 year old category consisted of 15% of the participants. Examining the understanding of package labelling could be an interesting area of future study. Factors including lifestyle habits, their effects on health, and relationship with OTC painkillers is another area that could lead to interesting results. This survey was paper based and hand-distributed, which may have resulted in less respondents when compared to digital methods. However, while the data is limited the results obtained are alarming and have not been previously reported in the Republic of Ireland.

In conclusion, a good understanding of OTC painkillers was seen among the Irish population. However, there remains a large percentage of individuals that take these drugs while being unaware of the risks and dangers associated with them. A concerning number of participants are willing to take more than the recommended dose, whilst being aware of the serious health consequences. Practices such as these show the need for further education, such as advertising campaigns, regarding dangers of OTC painkillers and warrant further studies.

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Corresponding Author: Shane Cusack shanecusack.2468@gmail.com

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