oxycodone for 24% (157/660), fentanyl for 15% (97), morphine for 9% (60), oxymorphone for 9% (60), hydrocodone for 7% (48 primary, 103 additive cause), and heroin for 6% (37) of deaths. Oxycodone was the additive cause for 64 additional deaths. Out of the 221 deaths with oxycodone as a primary or additive cause, 32 had OxyContin prescriptions in the preceding 60 days, ie, 3.9% (32/824) of all opioid deaths and 14.5% (32/221) of oxycodone-related deaths. 43.7% (360/824) had an ER/LA opioid (20.5% had an ER opioid) prescription in the 60 days preceding the death.

Conclusions: The attributable risk of all unintentional opioid overdose deaths associated with opioids involved in two interventions, the ER/LA Opioid REMS and reformulation of OxyContin, was 43.7% for ER/LA opioids and 3.9% for OxyContin in North Carolina in 2010.

1055. Pain and Painkiller Use Among Multiple Sclerosis Patients in Sweden

Sarah M. Burkill[1], Scott Montgomery[2], Lukas Löfling[1], Ingrid Kockum[1], Fredrik Piehl[1], Pernilla Strid[1], Tomas Olsson[1], Jan Hillert[1], Lars Alfredsson[1] and Shahram Bahmanyar[1]

[1]*Karolinska Institutet, Stockholm, Sweden;* [2]*Clinical Epidemiology and Biostatistics, Örebro University, Örebro, Sweden*

Background: Multiple sclerosis is an autoimmune disease which leads to demyelination and subsequent damage of axons and neurons. Pain is known to commonly affect MS patients, however the clinical characteristics of this pain are not fully described. Prescribed pain medication identifies more severe and chronic pain and different drug types can be used to identify other pain characteristics.

Objectives: To assess whether MS patients in Sweden are at increased risk of receiving medication for pain relative to non-MS comparators. We aim to study overall pain, neuropathic pain, musculoskeletal pain and migraine.

Methods: This cohort study using data on 5,555 MS patients in Sweden individually matched to 5,555 non-MS Swedish residents on sex, year of birth and place of residence at the time of MS diagnosis. We used Cox PH models using date of entry or 1st July 2006 as the beginning of follow up, whichever occurred later, and end of study was date of death, date of prescription of a painkiller or December 31st 2014, whichever occurred first. Painkillers were identified through relevant ATC codes. For neuropathic pain, pregabalin, gabapentin, amitriptyline, capsaicin or nortriptyline were used for identification, and for migraine prescriptions of anti-migraine preparations were included in the outcome. Musculoskeletal pain was identified primarily through topical products for joint and muscular pain.

Results: Cox PH models showed MS patients to be at a 2.43 (CI 2.31–2.55) times increased risk of being prescribed any painkiller. The risk increased to 5.63 (CI 5.03–6.31) for neuropathic painkillers, however there was no significant difference for musculoskeletal painkillers (RR = 0.92 (CI 0.79–1.07)). MS patients were at a 1.28 (CI 1.10-1.50) times increased risk of being prescribed anti-migraine preparations. Restricting the data to MS patients showed that exposure to neuropathic painkillers was present in 32.8% of MS patients, and is associated with lower educational attainment and female sex.

Conclusions: MS patients are at significantly increased risk of pain overall, with a particularly elevated risk for neuropathic pain. It seems that lower educational attainment and female sex are risk factors of neuropathic pain. However, the reason for this is not fully understood.

*We would like to acknowledge the funding from the Science for Life - Astra Zeneca collaborative grant that supported this research

1056. Case Review of Opioid-Induced Thrombotic Thrombocytopenic Purpura (TTP) from Pharmacovigilance & Poison Centers

Nabarun Dasgupta, John Schwarz and Rick C. Dart

RADARS System, Denver, CO

Background: In 2012 US FDA warned about drug-induced TTP resulting from tampering and injection of Opana ER (extended-release oxymorphone). TTP was also reported with OxyContin (ER oxycodone) in Australia.

Objectives: The objective of this study was to investigate if TTP has been implicated with other opioids.

Methods: Design: Case review of reports received in the FDA Adverse Event Reporting System (FAERS)

and RADARS System Poison Centers (PC). Setting: Spontaneous reports involving TTP from FAERS and selected US PCs, received Jan 2010-Sep 2016. Outcomes: TTP was identified in public FAERS using MedDRA preferred terms, where an opioid was primary suspect drug. TTP was identified from intentional exposure PC call notes by lexical match. Analysis: Multiplicate FAERS reports were consolidated and described. PC call notes will be reviewed by medical specialists to assess causality in final presentation. Published US drug labels were reviewed for TTP warnings.

Results: There were 100 unique case records of TTP mentioning opioid analgesics over 81 months; 49 indicated an opioid was the primary suspect cause of TTP. Of these, 46 reports involved oxymorphone, 2 oxycodone, and 1 tramadol (including 1 death). Only 2 FAERS cases & 3 PC cases preceded the FDA warning; case volume peaked in early 2013, followed by steady decline in both sources. There were 53 unique cases of PC case notes mentioning TTP, though some involved more than 1 opioid or were informational. Opioids involved: oxymorphone (34), oxycodone (9), morphine (10), buprenorphine (2), fentanyl (1), hydrocodone (1). PC call notes consistently described abdominal purpura. Many PC cases involved patients with multiple TTP episodes and polydrug use.

Conclusions: Although spontaneous reports are declining, TTP may be of concern with opioids beyond oxymorphone, including oxycodone, and morphine, but were not present on most opioid labels. Solid oral controlled substances that are likely to be injected may warrant pre-clinical testing and active monitoring for injection sequelae from excipients.

1057. A Systematic Review of Interventions and Programs Targeting Appropriate Prescribing of Opioids

Yola Moride[1], Genaro Castillon[1], Danae Lemieux Uresandi[1], Sarah Gabrielle Beland[1], Cristiano Moura[2], Georges Wells[3], Louise Pilote[2] and Sasha Bernartsky[2]

[1] *Universite de Montreal, Montreal, QC, Canada;* [2] *McGill University, Montreal, QC, Canada;* [3] *University of Ottawa, Ottawa, ON, Canada*

Background: Canada and the US have one of the highest levels of prescription opioid consumption in the world. This project was conducted to review interventions to support appropriate prescribing.

Objectives: 1) To identify and assess the effectiveness of interventions to support appropriate prescribing of opioids; 2) To compare the interventions on various outcome measures; 3) To determine the methodological quality of studies evaluating effectiveness of interventions.

Methods: Systematic review. MEDLINE, Embase and LILACS were searched from 1st Jan. 2005 to 23rd Sept. 2016. Grey literature was also searched. Target population included all prescribers or users of opioids with no restriction on indication. Outcomes considered were those related to Process (implementation), Outcomes (effectiveness) or Impact evaluation. Sources were screened independently by two reviewers using pre-defined eligibility criteria.

Results: A total of 12,278 sources were screened. Of these, 142 were retained out of which 75 were further excluded during full-text review. Search of the grey literature yielded 49 other sources. A total of 95 distinct interventions were identified. Over half consisted of prescription monitoring programs (PMPs) and mainly targeted health care providers. The majority of studies evaluating effectiveness addressed opioid prescription rate (44%), opioid use (19.4%), response to doctor shopping or diversion (9.7%). Fewer studies considered overdose (11.4%), abuse (9.7%), misuse (4.2%), diversion (5.6%). Study designs consisted of cross-sectional surveys (23.3%), pre-post intervention or time series without a comparison group (26.7% and 13.3%, respectively), which greatly limits the robustness of the evidence. Over 80% of studies reported positive benefits of opioid prescription and use but studies on abuse and overdose-death appear conflicting.

Conclusions: Although PMPs have been shown to be associated with a reduction in prescription rates of opioids, their impact on abuse and overdose is inconsistent. A global approach that would include guideline implementation, timely treatment of addiction and overdose, and community involvement should be supported.

1058. Comparison of a Doctor/Pharmacy Shopping Measure for Opioid Analgesics Using Claims Data with Medical Chart Review to Identify Misuse, Diversion, Abuse and/or Addiction