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**Quality of life and pain management of patients with hip and  
knee osteoarthritis**

Summary of PhD Thesis

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## INTRODUCTION

Osteoarthritis (OA) is a complex disease defined by the American College of Rheumatology (ACR) as “A heterogeneous group of conditions that lead to joint symptoms and signs which are associated with defective integrity of articular cartilage, in addition to related changes in the underlying bone at the joint margins”. Articular cartilage is the smooth cartilage at the end of long bones, which provides a low friction surface for articulation. Clinically, OA is characterized by joint pain, joint stiffness, functional impairment and local inflammation.

In 2020, 7.6% of the global population had OA, and cases are projected to increase 74.9% for knee and 78.6% for hip OA by 2050. It is expected to become a major healthcare concern as the population ages and obesity rates rise.

Certain factors have been shown to be associated with a greater risk of developing OA, some of which are modifiable or preventable, such as obesity, certain occupations, endocrine disorders, and, to a certain extent, bone deformities. Potentially modifiable risk factors for OA include joint trauma, joint malalignment and quadriceps weakness. Major risk factors such as age, gender and genetics are non-modifiable. Critical risk factors for OA are age, as the risk of developing most types of arthritis increases with it, and gender, as 60% of all people with arthritis are women.

The ACR separates patients with OA into 2 categories: 1) those with no known prior disease related to the OA (idiopathic); and 2) those with known events or disease associated with OA (secondary). Idiopathic OA has a major genetic component, also environmental factors play a significant role in disease expression. Regarding secondary OA, hip dysplasia has been identified as a potential risk factor for hip OA. In order to delay the onset of OA for patients born with hip dysplasia, early treatment is required to stimulate normal joint development.

Joint replacement surgery is a surgical procedure, when certain parts of a damaged joint are removed and replaced with artificial implants in order to relieve pain and improve function. The most common surgeries are the total hip (THA) and total knee arthroplasty (TKA). Many countries' healthcare systems had been reorganised in response to the pandemic, which meant a significant decrease in elective surgeries and consequently increased waiting list.

The World Health Organization (WHO) explains quality of life (QOL) as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. Health is regarded as an important aspect of QOL. Health-related QOL aims to measure QOL components impacted by certain diseases and effectiveness of treatment. Patients with chronic pain associated with musculoskeletal disorders have some of the poorest HRQOL with severe restrictions in their work and ordinary activities of daily living.

The WHO has developed a generic measure of QOL (WHOQOL-100) and its abbreviated version (WHOQOL-BREF) that encompasses physical, psychological, social, and environmental questions, thus giving a more complete picture of the individual's wellbeing. THA and TKA are regarded as one of the most successful operations in medicine, leading to statistically significant improvement in QOL by 4% after 6 weeks and 13% after 6 months. Post-surgical improvements in pain and function have been shown to extend over years.

While the measuring of generic QOL is advantageous when assessing overall burden, disease-specific measures of QOL are more responsive and clinically useful. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) has become a popular patient reported outcome measure used for evaluation of hip and knee OA.

OA remains a relatively unaddressed public health concern compared to such chronic diseases as cancer, diabetes, and heart disease. By many, joint pains are an inevitable part of aging. Consequently, many people do not consult a health professional, but treat it with over-the-counter (OTC) pain medications, similarly to a headache. The ACR deems non-pharmacological therapies as the "cornerstone of OA management", and stresses that pharmacological therapies should function as add-on therapy.

Regarding oral analgesics, both non-steroidal anti-inflammatory drugs (NSAIDs) and paracetamol are considered to be appropriate for treatment. It is widely accepted that regular use of NSAIDs increases the risk of severe gastrointestinal (GI) complications, by 2 to 4 times. A study investigating Hungarian patients' habit of buying OTC medications found that 58.2% of patients buying OTC medications are usually self-reliant, but have little knowledge about these drugs. Similar studies found that more than 20% of participants ignored potential side effects, and that almost a third of ibuprofen users couldn't correctly identify the maximum daily dose. A national study in the United States, showed that 11% of participants exceeded the maximum daily dose of ibuprofen.

The combination of OA patients' needs for analgesics and their tendency for self-medication practices emphasizes the need for healthcare professionals to understand OA patients' health behaviour. Many times, physicians have no data on how their patients alleviate their pain, a problem we wish to solve.

## OBJECTIVES

The overall aim of the study is to give a detailed analysis of the QOL and pain management of OA patients of the Southern Great Plain Region of Hungary.

Three primary objectives were:

- I. To measure OA's effects on the general and disease-specific QOL of the patients. Joint replacement surgeries are expected to significantly increase the QOL, and so a repeated assessment was carried out in the postoperative study.
  - a. A secondary objective was to explore factors that might alter the surgery's effects on QOL.
  - b. Another secondary objective was to investigate hip dysplasia patients' experiences, if they could be considered a vulnerable sub-group among OA patients.
- II. To investigate OA patients' habits of pain management and the explanatory factors.
  - a. A secondary objective was to estimate the risk drug-related GI complication.
- III. To identify the modifiable factors on which preventive recommendations can be made.

## MATERIALS AND METHODS

A longitudinal study was performed by the Department of Public Health, University of Szeged, based on data collected from August 2019 to September 2020 (preoperative data collection), and from March 2021 to November 2021 (postoperative data collection). The preoperative study population consisted of the group of OA patients undergoing THA or TKA surgery at the Department of Orthopaedics, Albert Szent-Györgyi Clinical Centre, University of Szeged (Szeged, Hungary) (n=100) and at the Orthopaedic Ward of Réthy Pál Hospital of Békés County Central Hospital (Békéscsaba, Hungary) (n=89), who filled out our questionnaire 24 hours prior to surgery in their hospital room. Our control group from the Maros region General Practice Partnership (n=93) filled out the questionnaire at the general practitioners' office. Postoperative data collection was carried out one year after surgery, when 120 patients returned the questionnaires that had been sent out by post.

The questionnaire comprised three basic sections: 1, sociodemographic data (age, gender, level of education, job profile, etc.); 2, QOL measuring tools (WHOQOL-BREF, WOMAC); 3, pain management (pharmacological and non-pharmacological).

### *Quality of life measures*

General QOL was measured by the validated Hungarian version of WHOQOL-BREF, which measures QOL with 26 questions through 4 domains: 1, *physical health* (activities of daily living, dependence on medicinal substances and medical aids, energy and fatigue, mobility, pain and discomfort, sleep and rest, work capacity); 2, *psychological health* (bodily image and appearance, negative feelings, positive feelings, self-esteem, spirituality/religion/personal beliefs, thinking, learning, memory and concentration); 3, *social relationships* (personal relationships, social support, sexual activity); 4, *environment* (financial resources, freedom, physical safety and security, health and social care: accessibility and quality, home environment, opportunities for acquiring new information and skills, participation in and opportunities for recreation/leisure activities, physical environment, transport). There are also two separate introductory questions which ask specifically about 1, the individual's overall perception of their health and 2, the individual's overall perception of their QOL. The answers were measured by a 5-point Likert scale. The higher score represented better QOL.

Disease-specific QOL was measured by the validated Hungarian version of WOMAC, which covers 3 dimensions through 24 items: *pain* (5 items) during walking, going up/down the stairs, lying in bed, sitting, and standing upright; *stiffness* (2 items) after waking up and later in the day; and *function* (17 items) going up/down the stairs, rising from sitting, standing, bending, walking, getting in/out of a car, shopping, putting on/taking off socks, rising from bed, lying in bed, getting in/out of the bathtub, sitting, getting on/off toilet, performing heavy domestic duties or light domestic duties. All items were assessed by using a 1-10 numeric rating scale (NRS), (1=no pain/stiffness/difficulty to 10=extreme pain/stiffness/difficulty), where higher scores indicated increased pain and decrease function.

### *Pain management and related risk*

Name, dose, and frequency of use of OTC and prescription-only medications were recorded. We only took into account regular medication use (used at least once a week). Based on these data, the following categories were made: regular use of total painkillers, OTC oral NSAID, topical NSAID, oral prescription medication, oral opioid-containing medication, and regular use of non-pharmacological methods. We also enquired about steroid and hyaluronic acid intra-articular injections and the corresponding patient satisfaction.

To explore drug-related GI risks, the following risk factors were taken into account: age >60, anticoagulant use, ulcer, dyspepsia or gastroesophageal reflux disease (GERD), use of two NSAIDs, a high dose of one NSAID or the concomitant use of NSAIDs and anticoagulant. The dose of a medication was considered high if it reached or passed the recommended daily intake.

Then patients were classified into three GI categories: 1) low risk: no risk factors, 2) moderate risk: at least one risk factor, 3) high risk: GI bleeding history, concomitant use of NSAIDs and anticoagulants or the presence of three risk factors mentioned above.

We also examined non-pharmacological methods such as physiotherapy, exercise, therapeutic massage, cold wraps, and supplements for bone and cartilage health.

### *Supplementary questions and data*

The questionnaire was expanded with supplementary questions regarding: for how long their hip/knee had been hurting, what patients think caused their illness, if their job and weight played a part in their condition, congenital abnormalities, previous joint injury, sporting habits, use of walking aid, previous administration of intra-articular hyaluronic acid and/or steroid injections and their satisfaction with the injections (1-10 scale), previous joint replacement surgeries, satisfaction with the outcome of current surgery (1-10 scale).

Patients' documentations were checked for: pre- and postoperative range of motion (ROM), extension deficit after surgery, subjective limb shortening after surgery, pre- and postoperative muscle strength and pain scale (Visual analogue scale: 1-10), design of the prosthesis (conventional or high-flexion), use of cement, complications, start of rehabilitation.

### *Statistical analyses*

Data analysis was carried out with IBM SPSS. Descriptive statistics, Mann-Whitney U test was conducted to compare the baseline scores of patients and the control group, while Wilcoxon tests were carried out to assess the difference of the preoperative and postoperative QOL outcome measures. Sub-group analyses were carried out using mixed-design two-way repeated measures ANOVA. Pain management measures were evaluated with a Chi-square test, one-way ANOVA, McNemar test and multivariable binary logistic regression. Joint kinetics and pain measures were analysed by paired-sample T-test and repeated measure ANOVA. Statistical significance was set at  $p < 0.05$ .

### *Ethical approval*

The study was approved by the Human Investigations Review Board of University of Szeged, Albert Szent-Györgyi Clinical Centre, Hungary (ID: 4059). All subjects were informed about the aim and attributes of the study and provided written informed consent.

## RESULTS

### 1. Preoperative study

189 OA patients and 93 control individuals participated in the preoperative study, with a median age of 68 years and 64 years respectively. The majority of participants (70.4% and 74.2%) were women. 48.7% of patients had hip OA, and 57.1% were obese, a slightly higher percentage compared to the control group (42.2%). 58% of patients used walking aids. 51.3% of patients and 60% of control participants had physically taxing jobs.

Majority of patients (58.7%) came for their first operation, while 1-1 patient for their sixth and seventh one. Regarding waiting times, 29.8% waited less than a year, 36.2% between 1-5 years, while 17.6% for more than 10 years. When asked about the reason of this time, 54 patients reported the waiting list as a cause, seven were delayed by their workplace and three waited for their retirement. When asked about their illness, only 49.5% of patients listed arthritis as a current health problem, and 24.2% said that they are not suffering from any type of disease.

Regarding the cause of the OA, the majority (19%) wrote their job, while 6.9% wrote congenital problem, 3.2% sports, 2.1% injury, 1.6% other musculoskeletal disease and 1.1% wrote their age. 16.8% said that their weight played a significant role in their disease.

#### *General QOL (WHOQOL-BREF) assessment*

Compared to the control group, OA patients reported a significantly lower QOL only in the *physical health domain* ( $p<0.001$ ). Patients with manual jobs reported a significantly lower QOL in the *physical health* and *psychological domain* ( $p=0.002$ ). Hip OA patients also reported a decrease in the *physical health domain* ( $p=0.002$ ) compared to knee OA patients. In case of older patients, the decrease in QOL appeared in the *social relationships domain* ( $p<0.001$ ), while BMI had no association with the perceived QOL.

#### *Disease-specific QOL (WOMAC) assessment*

Compared to the control group, OA patients reported a significantly lower disease specific QOL in all domains ( $p<0.001$ ). Those with manual job reported a significantly higher level of *pain* ( $p=0.004$ ) and decreased *physical function* ( $p=0.021$ ) compared those with non-manual jobs. Patients of the 65+ age group reported worse joint *stiffness* ( $p<0.05$ ); while BMI had no effect on the disease specific QOL. Hip OA patient reported a generally worse QOL compared to knee OA patients, significantly so in *physical function* and overall score ( $p<0.05$ ).

#### *Assessment of pain management*

Diclofenac was the most frequently used drug, followed by ibuprofen and tramadol. Medications with paracetamol and selective cyclooxygenase-2 (COX-2)

blockers were taken by 4.8% and 0.5% of patients, respectively. 12.7% of participants took 2 different types of oral analgesic, while 4.8% and 1.1% took 3 or 4 different types. 18% of patients took high doses of painkillers and 38.1% used prescription medication regularly. 29.1% of patients used topical analgesics, all of which had diclofenac as an active ingredient.

Even though hip OA patients reported worse QOL in the WOMAC total score ( $p = 0.038$ ), they were less likely to regularly use NSAIDs. Knee OA patients were more likely to use topical analgesics ( $p = 0.013$ ) and non-pharmacological methods of pain management.

The majority of patients (65.1%) practiced a non-pharmacological method to mitigate their pain, with 7.4% using these methods exclusively. Exercise, massages, cold packs and topical herbal cream were the most favoured. Only seven patients took part in physiotherapy. Awaiting surgery, 26.5% of patients were administered intra-articular hyaluronic acid and 14.3% were administered intra-articular steroid injections.

#### *Assessment of influencing factors*

Manual labour showed the most connections to painkiller use both with oral ( $p=0.011$ ) and topical ( $p=0.030$ ) NSAIDs and overall analgesic use ( $p=0.016$ ). Knee OA suggested an even stronger association with total ( $p=0.007$ ) and topical ( $p=0.013$ ) NSAID use.

Female patients were more likely to use non-pharmacological methods. Variables associated with stress on the joint such as manual labour and higher WOMAC score, showed a greater likelihood of medication use, however, patients with higher BMIs were less likely to take OTC NSAIDs, compared to participants with normal BMI. WOMAC Score results showed that patients with poorer physical function and/or higher pain level were more likely to take prescription medications, each point increases the chance of taking medicine by 1.3%.

#### *Assessment of drug-related GI risks*

OA patients were significantly more likely to be in a higher GI risk category compared to the control participants ( $p=0.002$ ). However, we found that a significant number of participants was considered at moderate risk solely because of their age. After the exclusion of age, this difference was even more significant ( $p=0.0004$ ). Only 34.2% of responders reported taking either proton pump inhibitors or histamine H<sub>2</sub>-receptor antagonist.

#### *Surgery descriptives and preoperative joint status*

Of the 189 surgeries, 92 were performed on hip joint, of which 22% were cemented and 78% uncemented. ROM of a given joint is suitable indicator of the probability of disability. Only half of knee OA patients had the necessary ROM for going up



and down the stairs and standing up from a sitting position, a task that only 11% of hip OA patient had the needed ROM for.

### *Patients with hip dysplasia*

All 14 hip dysplasia patients were women with an average of 59.5 years. When comparing to the other hip OA patients, they were significantly younger (on average 10 years,  $p < 0.01$ ), half of them waited more, then 10 years for surgery, and yet needed more surgery done.

Only one patient reported a follow up with an orthopaedic surgeon. When asked how QOL of people with dysplasia could be improved, continuous and personalised physiotherapy, regular follow-up visits and patient education were mentioned.

## **2. Postoperative study**

### *General QOL (WHOQOL-BREF) results*

Patients reported a significant increase of the perceived QOL ( $p = 0.002$ ) and satisfaction with their health ( $p = 0.001$ ) after surgery. They had significantly better QOL compared to their previous state in the *physical health* ( $p < 0.001$ ) and *social relationship domain* (0.012).

Sub-group analysis showed that younger patients (<65 years) reported significantly better outcomes ( $p = 0.022$ ). Patients in the manual job group reported significantly greater increase in the *physical* ( $p = 0.008$ ), and *psychological domains* ( $p = 0.003$ ) compared to the non-manual group. Regardless of the patients' gender, age, level of education, job profile, BMI, affected joint, or the presence of other diseases, a significantly better QOL scores were achieved in the *physical health* ( $p < 0.001$ ) and *social relationships domains* ( $p = 0.010$ ) after the surgery.

### *Disease-specific QOL (WOMAC) results*

Patients gained significantly better QOL in all domains of the WOMAC score ( $p < 0.001$ ).

In the sub-group analysis, participants under 65 years of age reported significant decrease in joint *stiffness* ( $p = 0.005$ ), and overall, a better QOL ( $p = 0.05$ ). Manual workers had a greater increase in *physical function* ( $p = 0.037$ ) and overall score ( $p = 0.024$ ) compared to the non-manual workers. Patients with hip OA seemed to gain the most out of their operation as they reported better outcome in the WOMAC *pain* ( $p = 0.019$ ), *stiffness* ( $p = 0.010$ ), *physical function domains* ( $p = 0.011$ ). compared to knee OA patients. Normal weight and overweight patients reported a significant decrease in their *pain* compared to obese patients ( $p = 0.017$ ). Among knee OA patients, the model of the prosthesis (high-flexion or conventional) had no effect on the HRQOL. Total WOMAC score indicated significantly better disease-specific QOL after the surgery in all subgroups ( $p < 0.001$ ).

### *Changes in pain management*

After the surgery, patients reported a significant decrease in their total painkiller use ( $p < 0.001$ ) and topical herbal cream use ( $p = 0.009$ ). Regarding GI risk, nine patients could be considered at moderate risk and one at high risk when age was considered a risk factor, however, excluding age, five patients were regarded as low and five as a moderate chance for GI complication.

### *Surgical outcomes*

Patients rated their satisfaction with their surgery an average of 8 points ( $SD = 3$ ). Patients reported a significant decrease in their pain, increase in flexion muscle strength, active flexion angle and ROM.

## **DISCUSSION**

### *QOL outcomes*

One of our major aims was to investigate the general and disease-specific QOL of OA patients before and after surgery, and whether surgery would result in significant improvement.

In case of general QOL, OA patients reported a significantly lower QOL in the *physical health domain* compared to the control group, and a borderline significance was detected in the *social relationships domain*, which can be associated with a decrease of social interactions that stems from difficulty moving. After surgery, patients' perceived QOL improved significantly, as well as their satisfaction with their health. Our results indicated a significant improvement in all domains concerning physical functions as well as in the domain of *social relationships*, indicating a restored social connectedness. The improvement in the *psychological domain* was only notable for patients with a manual job, which can be attributed to the known beneficial health effects of returning to work. All patients reported a significant increase of QOL in the *physical health domain*, but younger patients and manual workers reported the most gains.

Patients with hip OA seemed to gain the most out of their operation, as they reported better outcome in all WOMAC domains. A similarly improvement was measured among patients of the working age group ( $< 65$  years) and with manual jobs. The success of the surgery among the working age population indicates that many of them may be able to return to their job actively, thus decreasing the economic burden of OA. We saw no difference in improvement by BMI category either in the generic or in the disease specific QOL.

Even though the success of joint replacement surgery is indisputable, additional therapies have been shown to boost its efficacy. Prehabilitation programme not only can alter the physical decline, but also can help participants to improve their

level of function before surgery as well, which is a major determinant of postoperative physical function.

Although we did not detect a significant difference of QOL outcomes between patients with hip dysplasia and other hip OA patients, that fact that dysplasia patients were significantly younger and went under more surgeries indicates the risk this joint abnormality represents.

### *Pain management*

Our second major aim was to investigate OA patients' habits of pain management and to examine the explanatory factors of various ways of self-treatment. The majority of patients practiced a non-pharmacological method, with women in particular favouring it, while pharmacological methods were frequently chosen by patients doing manual labour. Despite the bigger strain put on the joint, patients with higher BMI were less likely to take OTC NSAIDs.

A total of 23.3% of patients took OTC NSAIDs regularly. This is in line with the results (26.5%) from the 2011 Five European Countries National Health and Wellness Survey. Our results for prescription medication use (38.1%) and paracetamol (1.0%) were comfortably within the range of the survey's result. Results showing that diclofenac and ibuprofen were the most-used active ingredients also correspond with results from European and Asian countries. Medicines preferred by patients are a cause for concern, with diclofenac being the most popular but COX-2 inhibitors being neglected, as a study published in 2010 showed that the relative risk of upper GI bleeding/perforation was 4.50 for traditional NSAIDs, and 3.98 for diclofenac specifically, but only 1.88 for coxibs.

Knee OA patients were more likely to use topical analgesics, which can be attributed to the fact that the knee joint is easier to reach and the active ingredients absorbed through the skin reach the site of pain more efficiently. Only 29.1% of patients used topical analgesics even though professional guidelines favour topical drugs over oral medication as a way to decrease harmful GI side-effects. It would be worth paying particular attention to hip OA patients who seem to prefer oral painkillers.

The importance of using topical analgesics cannot be overemphasised, given the advanced age of our patients and the amount of medication they use. With diclofenac being the most favoured OTC painkiller, the possibility of adverse cardiovascular events must not be over-looked. A study found that people taking diclofenac had a 20% increased rate for a major adverse cardiovascular event, compared to patients taking paracetamol. Fortunately, we detected high prevalence of the use of non-pharmacological techniques. As obesity is suggested to be the main modifiable risk factor of OA and 57.1% of patients were over-weight, we wish to emphasise the integration of weight management into the OA therapy.

For both hip and knee OA, the core treatments are exercise, education, mechanical interventions, and weight loss. We would like to encourage both

general practitioners and specialists to recommend the following techniques: manual therapy, transcutaneous electrical nerve stimulation, knee braces, resistance and neuromuscular exercise and Nordic walking.

With the increased waiting time due to the COVID-19 pandemic, a further increase in self-medication can be expected; thus, the responsibility of general practitioners in pain management and monitoring has increased. Regarding the surgeries, our data showed a high satisfaction rate and decrease in painkiller consumption, followed by reduced GI risk.

### *Prevention*

Although, many patients and even some health-care providers tend to treat OA in a very passive way by waiting till the affected joint necessitates replacement surgery, all levels of prevention can be utilized to a certain degree.

As OA has various modifiable risk factors, takes a long period of time to manifest and its symptoms worsens gradually, there are ample opportunities for prevention. Based on our results and literature data, the most important risk factors that should be managed are: 1) obesity, 2) physically taxing jobs and 3) impaired muscle function.

While addressing obesity in osteoarthritis, healthy diet and physical activity is paramount. Patients working physically demanding jobs are more likely to suffer from OA, but occupation should be considered as a semi-modifiable risk factor, as not all jobs can be automated. Despite this, through occupational health services, workers should receive education on prevention. The problem of impaired muscle function can be managed by regular exercise in general and with prehabilitation when the patients are preparing for surgery, although prehabilitative physiotherapy is not available at every hospital. Screening and treatment of hip dysplasia is critical in reducing the risk of the later development of OA. Based on our results concerning patients' habit of self-medication, OA patients need guidance on safe pain management methods, which presents an opportunity to improve patient education. A series of patient information material will be developed, which hopefully will benefit the Hungarian OA patients.

## SUMMARY AND CONCLUSION

- I. In comparison to the control group, OA patients reported a significantly decreased QOL in physical health and functions, and a considerably lower score in the *social relationships domain*, indicating how reduced mobility can affect interpersonal connections. Patients with hip OA or working manual jobs were the most affected. Postoperative QOL showed significant improvement in physical functions and social relationships.
  - a. According to our results, patients with hip OA, manual jobs and of the working age group seemed to gain the most out of their operation, suggesting that many of them may be able to return to their job actively, thus decreasing the economic burden of OA. Even though obesity is a major risk factor, BMI had no effect on the disease specific QOL in this study.
  - b. Compared to the other hip OA patients, participants with hip dysplasia were significantly younger, and had more hip surgery in their history, despite that, only one patient indicated regular follow-up with a specialist. As hip dysplasia shortens the time for OA to develop, these patients must be treated as vulnerable population, receiving regular consultancy.
- II. Patients tended to use well-known pain medications even if their side effect profiles were less desirable. While knee OA patients favoured topical analgesics, hip OA patients preferred oral painkillers. Women favoured non-pharmacological techniques, while pharmacological methods were chosen by patients doing manual labour. After the surgery, patients reported a considerable decrease in their analgesic medication consumption.
  - a. Prior to operation, OA patients were significantly more likely to be in a higher GI risk category compared to the control participants, but the decrease of analgesic consumption after surgery was followed by the decrease of risk of developing a drug-related GI complication.
- III. In order for patients to benefit from this study, series of patient information material will be developed.

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## LIST OF PUBLICATIONS

### Original publications directly related to the Ph.D. thesis:

- I. **Mezey, GA.**, Máté, Z., Paulik, E. Factors Influencing Pain Management of Patients with Osteoarthritis: A Cross-Sectional Study. *Journal of Clinical Medicine*. 11(5):1352 (2022).  
<https://doi.org/10.3390/jcm11051352>  
IF<sub>2023</sub>: 3.9, SJR Indicator - Q1
- II. **Mezey GA.**, Paulik, E., Máté, Z. Effect of osteoarthritis and its surgical treatment on patients' quality of life: a longitudinal study. *BMC Musculoskeletal Disorders* 24(1):537 (2023).  
<https://doi.org/10.1186/s12891-023-06662-w>  
IF<sub>2023</sub>: 2.2, SJR Indicator – Q2

**Total impact factor of the directly related publications: 6.1**

### Original publications not related to the Ph.D. thesis:

1. Trimmel, B., Gede, N., Hegyi, P., Szakács, Z., **Mezey, GA.**, Varga, E., Kivovics, M., Hanák, L., Rumbus, Z., & Szabó, G. Relative performance of various biomaterials used for maxillary sinus augmentation: A Bayesian network meta-analysis. *Clinical oral implants research*, 32(2), 135–153 (2021). <https://doi.org/10.1111/clr.13690>  
IF<sub>2023</sub>: 5,021, SJR Indicator – D1

### Abstracts related to the thesis:

1. **Mezey, GA.**, Máté, Z., Paulik, E. Quality of life in patients with knee or hip osteoarthritis. In: Škrbić B (Ed.) 21st Danube-Kris-Mures-Tisza (DKMT) Euroregional Conference on Environment and Health: Book of Abstracts pp 71-71, Novi Sad, Serbia 06-08 June 2019
2. **Mezey, GA.**, Máté, Z., Paulik, E. The 'wear and tear' of the public health sector: the under-recognized burden of osteoarthritis on the quality of life. International Conference on Chronic Diseases and 6<sup>th</sup> Savez Conference: Chronic Diseases and Integrated Care: Rethinking Health and Welfare Systems. Book of Abstracts p. 4. Kosice, Slovakia, 24-25 October 2019

3. **Mezey, GA.**, Máté, Z., Paulik, E. Pain management and consequential gastrointestinal risks in patients with osteoarthritis. NKE Conference XIV, Hungary. 26-27 August 2021.  
Népegészségügy, 98: 2 pp 285-285 Paper P/9. (2021)

**Abstracts not related to the thesis:**

1. **Mezey, GA.**, Paulik, E. Phone hygiene - the missing step in infection control.  
In: EUGLOH Annual Student Research Conference: Book of Abstracts pp 57-57, 28-30 September 2020 (Online)